

# Mighty claws: a new genus and species of lobster from the Philippine deep sea (Crustacea, Decapoda, Nephropidae)

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Ahyong S. T., Chan T.-Y. & Bouchet P. 2010. — Mighty claws: a new genus and species of lobster from the Philippine deep sea (Crustacea, Decapoda, Nephropidae). *Zoosystema* 32 (3): 525-535.

## ABSTRACT

A new genus and species of deepwater lobster of the family Nephropidae, *Dinochelus ausubeli* n. gen., n. sp., is described from the Philippine Sea off the island of Luzon. The new genus and species is most closely related to species of *Thaumastocheles* and *Thaumastochelopsis*, sharing the distinctive, strongly dimorphic chelipeds, and shares features of both genera. Most notably, *D. ausubeli* n. gen., n. sp. shares movable well-developed eyestalks with species of *Thaumastochelopsis* (versus highly reduced and fixed eyestalks in species of *Thaumastocheles*), and similar branchial formula and uropod structure with *Thaumastocheles*. *Dinochelus* n. gen. differs from species of *Thaumastocheles* and *Thaumastochelopsis* (as well as all other clawed lobsters) in having an inverted, T-shaped epistome. Phylogenetic analysis of 12S rRNA sequences indicated that *Dinochelus* n. gen. is sister to a *Thaumastocheles* + *Thaumastochelopsis* clade. The new species is named after Jesse Ausubel at the occasion of the 10-year synthesis of the *Census of Marine Life*.

## KEY WORDS

Crustacea,  
Decapoda,  
Nephropidae,  
lobster,  
deep water,  
*Census of Marine Life*,  
Philippines,  
new genus,  
new species.

## RÉSUMÉ

*Les pinces de la terreur: un nouveau genre et une nouvelle espèce de langoustine du bathyal des Philippines (Crustacea, Decapoda, Nephropidae).*

Une nouvelle espèce, *Dinochelus ausubeli* n. gen., n. sp., appartenant à un nouveau genre de langoustine de la famille des Nephropidae, est décrite des profondeurs bathyales de la Mer des Philippines au large de l'île de Luzon. La nouvelle espèce est apparentée aux espèces des genres *Thaumastocheles* et *Thaumastochelopsis*, avec lesquels elle partage, entre autres, la présence de remarquables chélipèdes très asymétriques. De plus, *D. ausubeli* n. gen., n. sp. partage avec *Thaumastochelopsis* des pédoncules oculaires mobiles bien développés (par opposition aux pédoncules oculaires très réduits et fixes chez *Thaumastocheles*), et partage avec *Thaumastocheles* une formule branchiale similaire et la structure de l'uropode. *Dinochelus* n. gen. diffère de *Thaumastocheles* et *Thaumastochelopsis* (ainsi que des autres langoustines à pinces) par la présence d'un épistome en forme de T renversé. Une analyse phylogénétique de séquences d'ARNr 12S indique que *Dinochelus* n. gen. est le groupe-frère du clade *Thaumastocheles* + *Thaumastochelopsis*. La nouvelle espèce est dédiée à Jesse Ausubel à l'occasion des 10 ans du *Census of Marine Life*.

## MOTS CLÉS

Crustacea,  
Decapoda,  
Nephropidae,  
langoustine,  
bathyal,  
*Census of Marine Life*,  
Philippines,  
genre nouveau,  
espèce nouvelle.

## INTRODUCTION

There is an abundant literature documenting the exceptional marine species richness of the Indo-Malayan region, an area extending from the Philippines and Indonesia to Papua New Guinea and the Solomon Islands (see, e.g., Hoeksema 2007; Bellwood & Meyer 2009). On the basis of various taxonomical group(s), different authors have championed the Philippines (Carpenter & Springer 2005, based on shore fishes) or West Papua (Veron et al. 2009, based on zooxanthellate corals) as “the” centre of coastal marine biodiversity. There is limited evidence that patterns of deep-sea marine biodiversity richness parallel those in shallow-water, with the highest number of azooxanthellate corals also being recorded from the Philippines (Cairns 2007). The deep benthos of the tropical seas represents one of the last frontiers for marine biodiversity exploration (Bouchet 2006), and recent deep-sea expeditions have confirmed the Indo-Pacific as a major reservoir of unknown forms of life in all taxonomic groups. However, unlike most other tropical biological communities, the deep-sea benthos of this area has remained understudied by zoologists

and oceanographers. Indeed, the work carried out by the U.S. Bureau of Fisheries research vessel *Albatross* in 1907-1910 (Smith & Williams 1999), and by the French research vessels *Vauban* and *Coriolis* in the 1970s-80s (Forest 1989) remains to this day the main source of knowledge on the deep-sea benthic fauna of the archipelago. Although both endeavours generated descriptions of numerous new species of fish and invertebrates, many parts of the Philippines, especially the Pacific seaboard, have still never been surveyed for their offshore benthic fauna. In 2007, as part of the CoMarge component of the *Census of Marine Life*, the AURORA 2007 expedition was conducted on board MV *DA-BFAR*, the research vessel of the Philippine Bureau of Fisheries and Aquatic Resources, precisely to sample benthic invertebrates and fish off the provinces of Quezon and Aurora in east Luzon. Between May 20 and June 4, 2007, 111 hauls (dredging and trawling) were conducted at depths between 100 and 2300 m. Among the many new and little-known organisms collected (see, e.g., Komai & Chan 2008; Yang et al. 2008, 2010; Ahyong & Ng 2009; Galil & Ng 2009; Richer de Forges & Ng 2009; Puillandre et al. 2010), was a specimen of a remarkable lobster with spectacular

claws that was used in outreach material for the *Census* (e.g., Anonymous 2008; Crist *et al.* 2009) but has remained undescribed and unnamed. We take pleasure in publishing the present paper at the occasion of the 10-year synthesis of the *Census of Marine Life*, and in naming the new lobster after the patron of the *Census* and *Marine Barcoding of Life* initiatives.

The new lobster bears features of both the clawed lobster genera *Thaumastocheles* Wood-Mason, 1874, and *Thaumastochelopsis* Bruce, 1988. *Thaumastocheles* (with three known species), *Thaumastochelopsis* (with two known species), and the fossil genus *Oncopareia* Bosquet, 1854 (with seven known species), form a monophyletic group that had until recently been placed in the family Thaumastochelidae Bate, 1888 (Ahyong 2006; Ahyong *et al.* 2007). Characteristic of thaumastochelids is the strongly dimorphic first pereopods in which the major chela has a short bulbous palm and long, slender, spinous fingers. Although the monophyly of the thaumastochelid clade is well accepted, recent molecular phylogenetic analyses place the thaumastochelids within a wider clade corresponding to Nephropidae rendering Thaumastochelidae a junior synonym of the former (Tshudy *et al.* 2009; De Grave *et al.* 2009). Although we recognise Nephropidae *s.l.*, for convenience, we use the term “thaumastocheliform” to refer to the genera formerly placed in Thaumastochelidae.

## MATERIAL AND METHODS

### MOLECULAR PROTOCOLS AND PHYLOGENETIC ANALYSIS

Total DNA was extracted from abdominal muscular tissue and pleopod tissue of the holotype of *D. ausubeli* n. gen., n. sp., using QIAamp DNA Mini Kit (QIAGEN, Hilden, Germany). The tissues were washed three times with double distilled water (ddH<sub>2</sub>O) prior to proteinase K digestion. After extraction, the DNA was eluted in 200 µl of ddH<sub>2</sub>O. A segment of mitochondrial 12S rRNA gene was amplified by polymerase chain reaction (PCR) with the primers 12SAI (Palumbi *et al.* 1991) and 12SH2 (Taylor *et al.* 1996). The 50 µl amplification reaction mix contained 5.0 µl of

DNA extract, 1X PCR buffer (QIAGEN), 0.4 µM of each primer, 200 µM of dNTPs, 2 units of Taq polymerase (QIAGEN), and ddH<sub>2</sub>O. The cycling profile was as follows: 2.5 min at 94°C for initial denaturation, then 32 cycles of 25 s at 94°C, 30 s at 49°C, 45 s at 72°C and the final extension for 3 min at 72°C. Prior to sequencing, PCR product was purified using QIAquick PCR purification kit (QIAGEN) according to manufacturer's instructions. 20 µl of cycle sequencing mix, containing 8 µl of ABI Prism dRhodamine terminator (Applied Biosystems, Foster City, California), 3 µl of purified PCR products, 1 µl of 3.3 µM primer, and ddH<sub>2</sub>O, was analyzed using an ABI 3100 Genetic Analyzer (Applied Biosystems). The 400 bp 12S sequence of *D. ausubeli* n. gen., n. sp. (GenBank accession number HQ010043) was aligned with 12S sequences of *Thaumastocheles dochmiodon* Chan & de Saint Laurent, 1999, *T. japonicus* Calman, 1913, *Thaumastochelopsis brucei* Ahyong, Chu & Chan, 2007, *T. wardi* Bruce, 1988 and three outgroups (*Homarus americanus* H. Milne Edwards, 1837, *Metanephrops japonicus* (Tapparone-Canefri, 1873), *Nephropsis serrata* Macpherson, 1993) (GenBank accession numbers: DQ657354, DQ657355, DQ298427, DQ298434, DQ298437, DQ298438, EU882897) using CLUSTAL X (Thompson *et al.* 1994). Phylogenetic analyses were conducted under maximum parsimony (MP) and maximum likelihood (ML) in PAUP\* 4.0b10 (Swofford 2002) (heuristic search, TBR, random addition sequence). The most appropriate model of nucleotide substitution for ML analyses was selected by Modeltest 3.7 (Posada & Crandall 1998) using the Akaike information criterion. A partial COI sequence of the holotype of *D. ausubeli* n. gen., n. sp., generated by using standard protocols is deposited in the Barcode of Life Database (Barcode ID: MDECA001-10).

### MORPHOLOGICAL PROTOCOLS

Morphological terminology generally follows Ahyong *et al.* (2007). Terminology of carapace grooves follows Holthuis (1974). Carapace length (cl) is measured along the dorsal midline and includes the rostrum; postorbital carapace length (pcl) is measured from the posterior margin of the orbit to the posterior margin of the carapace. Specimens used in this study are

deposited in the Crustacean Collection of the National Museum of the Philippines, Manila (NMCR) and Australian Museum, Sydney (AM). Specimens of four “*thaumastocheliform*” species deposited in the AM and the National Taiwan Ocean University, Keelung (NTOU), namely *Thaumastocheles zaleucus* (Thomson, 1873), *T. japonicus*, *T. dochmiodon*, *Thaumastochelopsis brucei*), were examined for comparison.

## SYSTEMATICS

### Family NEPHROPIDAE Dana, 1852

#### Genus *Dinochelus* n. gen.

TYPE SPECIES. — *Dinochelus ausubeli* n. gen., n. sp.

ETYMOLOGY. — From the Greek *dinos*, meaning terrible, fearful, and *chela*, meaning claw, alluding to the massive, spinose major claw of the new genus. Gender masculine.

DIAGNOSIS. — Rostrum with lateral spines. Carapace surface with scattered spinules or acute granules, otherwise smooth, without median groove or carina; with small supraorbital spine; orbital fossa obsolete; pterygostomial margin faintly convex, with prominent antennal spine; anterolateral angle rounded, with few small spines or denticles, meeting pterygostomial margin at acute angle; with postcervical, cervical, hepatic, antennal and branchiocardiac grooves. Pleural margins subtruncate to broadly rounded, wider than high; surfaces and margins of pleura 2-5 with laterally minute granules or spinules. Eyes well-developed, elongate, movable, corneal region rounded, unpigmented. Scaphocerite spinose. Epistome fused anteriorly with carapace; inverted T-shaped, with narrow median portion and slender, transverse posterior portion. Mandible with palp. Maxilliped 2 exopod well-developed; epipod absent. Maxilliped 3 exopod well-developed; epipod with well-developed podobranch; with 2 arthrobranches. Pereopods 1-4 each with epipod and podobranch. Pereopod 5 without epipod or podobranch. Chelipeds strongly dimorphic. Major and minor pereopod 1 palms with numerous spinules; pollex and dactylus with occlusal margins bearing 2 divergent rows of spines. Pereopod 1 minor chela fingers 3 times as long as palm. Uropodal exopod proximal segment with spinose outer margin; distal segment wider than half width of proximal segment. Telson subquadrate; margins and surfaces unarmed.

## MONOPHYLY AND RELATIONSHIPS

*Dinochelus* n. gen. is most closely related to other nephropids formerly placed in Thaumastochelidae, namely species of *Thaumastocheles* and *Thaumastochelopsis*. Phylogenetic analyses of partial 12S mitochondrial sequences under both ML and MP recovered identical topologies indicating that *Dinochelus* n. gen. is sister to the remaining thaumastocheliform nephropids, namely, a clade containing two reciprocally monophyletic clades corresponding to *Thaumastocheles* and *Thaumastochelopsis* (Fig. 1).

*Dinochelus* n. gen. variously shares diagnostic features of both *Thaumastocheles* and *Thaumastochelopsis*. With species of *Thaumastocheles*, *Dinochelus* n. gen. shares well developed rather than rudimentary exopods on maxillipeds 2 and 3, of which maxilliped 3 also has two rather than one arthrobranches and a well-developed podobranch; and the distal segment of the uropodal exopod is wider than long instead of small and semicircular. Together with species of *Thaumastochelopsis*, *Dinochelus* n. gen. shares movable, well-developed eyes, although it is noteworthy that the eyes of *Dinochelus* n. gen. are relatively larger than in species of *Thaumastochelopsis* (cf. Fig. 2B, J). In species of *Thaumastocheles*, the eyes are reduced to a fixed, rudimentary stub without a cornea. The well-developed eyes of *Dinochelus* n. gen. (in common with species of *Thaumastochelopsis*), and more complete branchial formula along with the larger uropodal exopod distal segment (in common with species of *Thaumastocheles*) is consistent with its phylogenetic position as sister to *Thaumastocheles* + *Thaumastochelopsis*. *Dinochelus* n. gen. exhibits a more “complete” morphology than either *Thaumastocheles* or *Thaumastochelopsis* in being less modified. In *Thaumastocheles* and *Thaumastochelopsis*, aspects of morphological reduction relative to *Dinochelus* n. gen. are evident in the various losses of branchiae, reduction of maxillipedal exopods, reduction of the uropodal exopod and degeneration of the eyes.

Although less modified than species of either *Thaumastocheles* or *Thaumastochelopsis*, *Dinochelus* n. gen. differs from both of these genera in having an unusual epistome form (Fig. 2G, K). In both

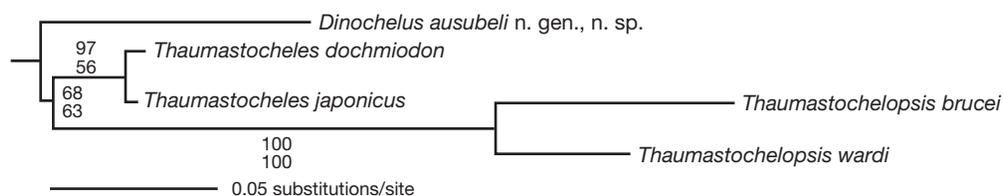


FIG. 1. — Maximum likelihood (ML) phylogram of “thaumastochelid” genera based on analysis of mitochondrial 12S rRNA sequences under best fitting model TVM + G. Numbers at nodes indicate bootstrap proportions for analyses under MP (upper) and ML (lower). Outgroups (not shown) were *Homarus americanus*, *Metanephrops japonicus* and *Nephropsis serrata*.

*Thaumastocheles* and *Thaumastochelopsis*, the median and posterior portions of the epistome are broad, with the median portion wider than one-third the overall epistome width. The basal antennal segments in members of these two genera fit snugly against the anterolateral excavations on either side of the epistome. In contrast, the epistome in *Dinochelus* n. gen. has slender median and posterior portions, forming a distinctly inverted T-shaped element. The basal antennal segments in *Dinochelus* n. gen. are proportionally larger than in species of *Thaumastocheles* and *Thaumastochelopsis*, but articulate with the anterolateral margins of the epistome via a wide margin of arthrodistal membrane. Such an epistomial arrangement as in *Dinochelus* n. gen. is unique in the Nephropidae.

*Dinochelus ausubeli* n. sp.  
(Figs 2A-I; 3; 4; Table 1)

*Thaumastochelopsis* sp. — Anonymous 2008: 4. — Crist *et al.* 2009: 44.

HOLOTYPE. — **Philippines**. AURORA stn CP2748, 15°56'N, 121°45'E, 249-247 m, 2.VI.2007, ♂, cl 31.1 mm, pcl 26.1 mm (NMCR).

ETYMOLOGY. — Named in honour of Jesse Ausubel, patron of the *Census of Marine Life*, in recognition of his vision and support for marine biodiversity exploration.

DISTRIBUTION. — Presently known only from the type locality.

DIAGNOSIS. — Eyes well developed, movable, cornea present. Surfaces and margins of pleura 2-5 with laterally minute granules or spinules. Major and minor pereopod 1 palms with numerous spinules; pollex and dactylus

TABLE 1. — *Dinochelus ausubeli* n. gen., n. sp., branchial formula. Abbreviations: **Mxp1-Mxp3**, maxillipeds 1-3; **P1-P5**, pereopods 1-5; +, present; -, absent.

|               | Mxp1 | Mxp2 | Mxp3 | P1 | P2 | P3 | P4 | P5 |
|---------------|------|------|------|----|----|----|----|----|
| Pleurobranchs | -    | -    | -    | 1  | 1  | 1  | 1  | 1  |
| Arthrobranchs | -    | -    | 2    | 2  | 2  | 2  | 2  | -  |
| Podobranchs   | -    | -    | 1    | 1  | 1  | 1  | 1  | -  |
| Epipods       | +    | -    | +    | 1  | 1  | 1  | 1  | -  |
| Exopods       | +    | +    | +    | -  | -  | -  | -  | -  |

with occlusal margins bearing 2 divergent rows of spines. Pereopod 1 minor chela fingers 3 times as long as palm. Uropodal exopod proximal segment with spinose outer margin; distal segment wider than half width of proximal segment.

DESCRIPTION

Rostrum triangular, without dorsal median groove; surface and margins setose, setae extending posteriorly onto carapace surface on either side of midline to level of cervical groove; apex acute; deflected ventrally; finely and sparsely setose; margins with 3 spines, inclined anterodorsally.

Carapace surface with scattered spinules or acute granules, otherwise smooth, without median groove or carina; with small supraorbital spine; orbital fossa obsolete; pterygostomial margin faintly convex, with prominent antennal spine; anterolateral angle rounded, with few small spines or denticles, meeting pterygostomial margin at acute angle; postcervical, cervical, hepatic and antennal grooves continuous with each other; postcervical groove deep, crossing dorsum; branchiocardiac groove faintly indicated, posterior half subparallel to midline; marginal carina distinct. Lower and posterior margins setose.

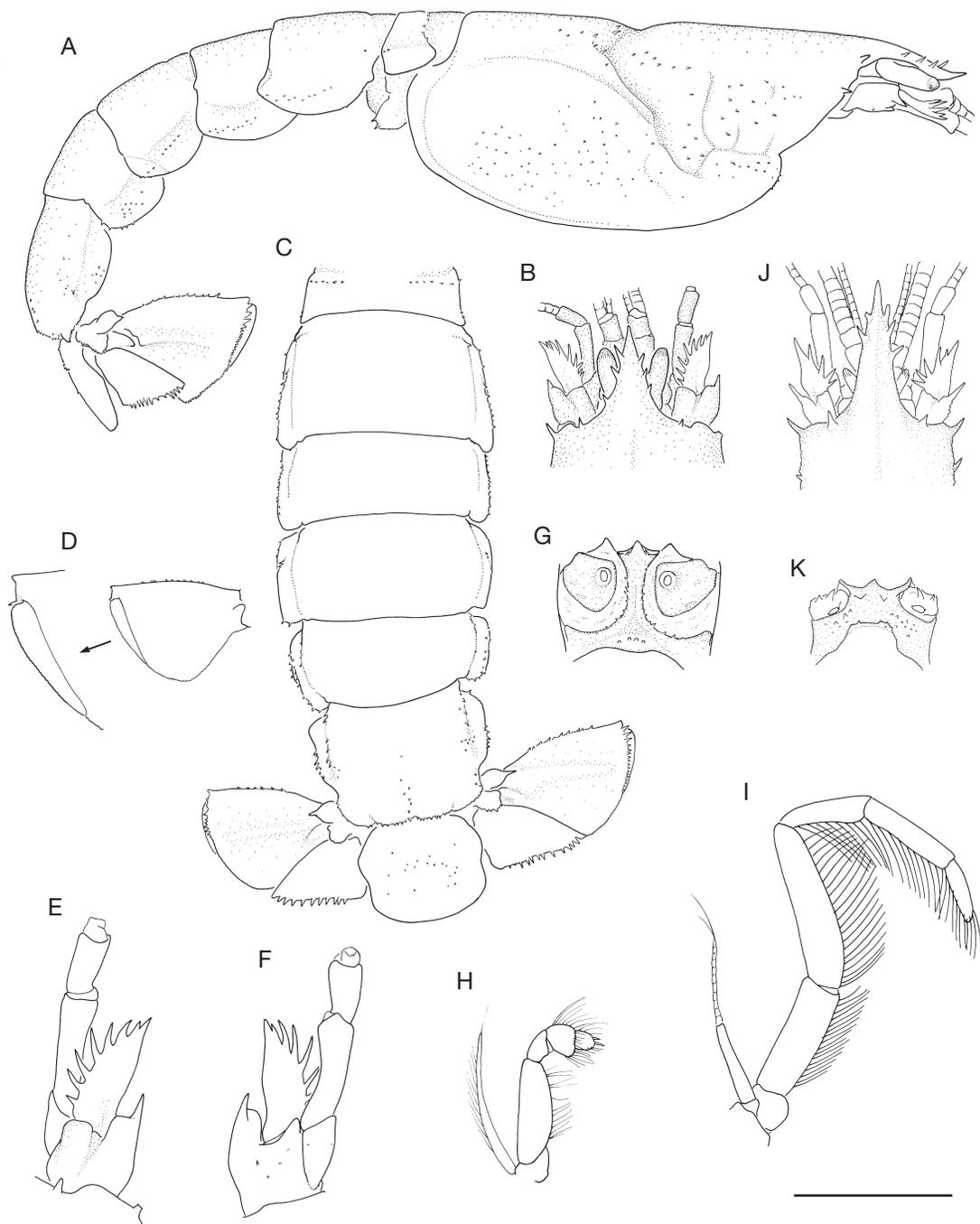


FIG. 2. — **A-I**, *Dinochelus ausubeli* n. gen., n. sp., ♂ holotype, pcl 26.1 mm (NMCR); **J, K**, *Thaumastochelopsis brucei* Ahyong, Chu & Chan, 2007, ♂ holotype, pcl 21.1 mm (AM P49083); **A**, body, right lateral view; **B, J**, anterior carapace, dorsal view; **C**, abdomen, dorsal view; **D**, right uropodal exopod, ventral view; **E**, right antenna, dorsal view; **F**, right antenna, ventral view; **G, K**, epistome, ventral view; **H**, right maxilliped 2, lateral view; **I**, right maxilliped 3, lateral view. Scale bar: A-D, G, 10.0 mm; E, F, H, I, 5.0 mm; J, K, 7.5 mm.

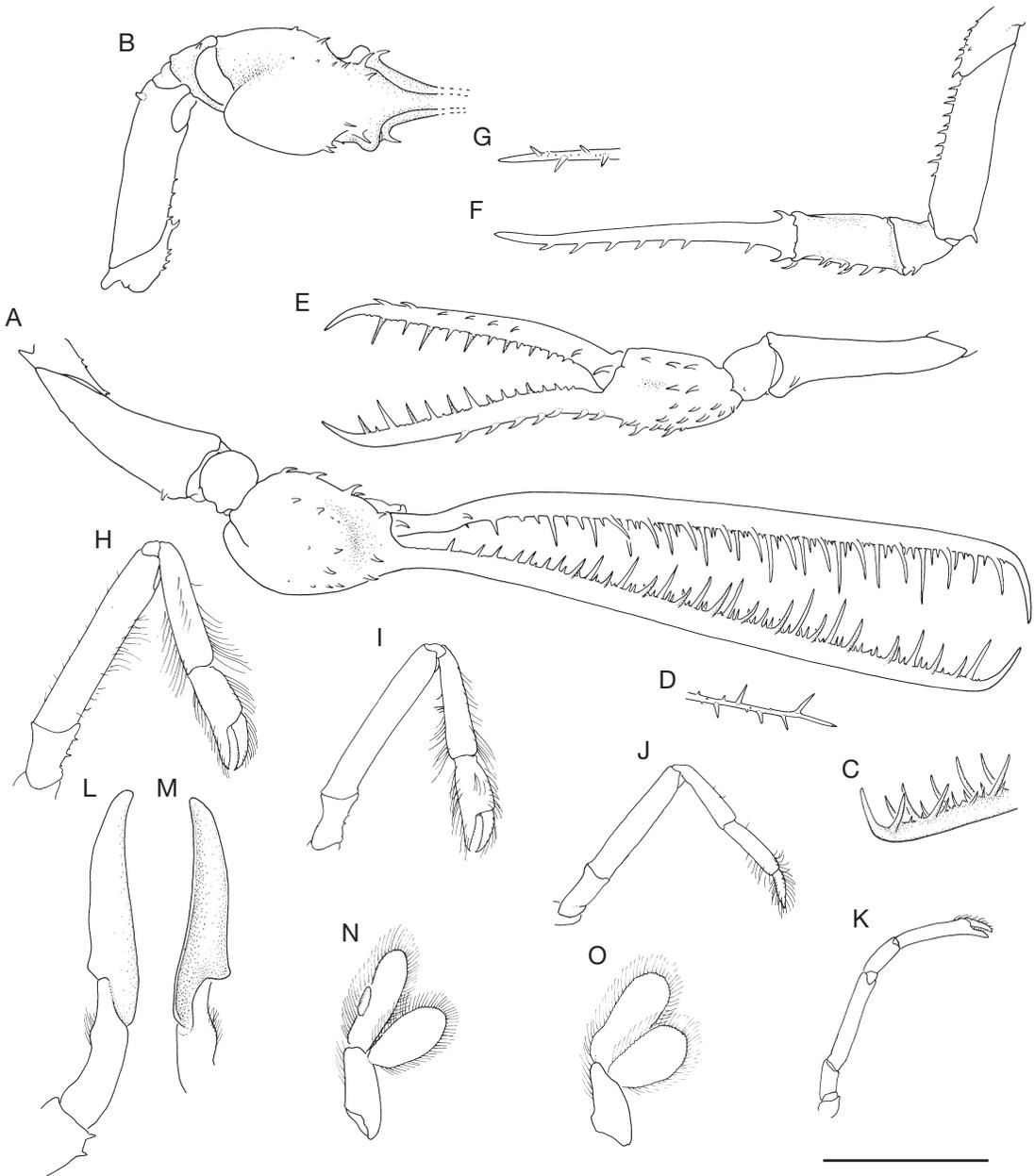


FIG. 3. — *Dinochelus ausubeli* n. gen., n. sp., ♂ holotype, pcl 26.1 mm (NMCR): **A**, right pereopod 1, lateral view; **B**, proximal portion of right pereopod 1, dorsal view; **C**, distal portion of right pereopod 1 pollex, mesial oblique view; **D**, distal portion of right pereopod 1 pollex, dorsal view; **E**, left pereopod 1, lateral view; **F**, left pereopod 1, dorsal view; **G**, distal portion of left pereopod 1 pollex, dorsal view; **H-K**, pereopods 2-5, lateral view; **L**, right pleopod 1, lateral view; **M**, right pleopod 1, mesial view; **N**, right pleopod 2, anterior view; **O**, right pleopod 3, anterior view. Scale bar: A-K, N, O, 10.0 mm; L, M, 5.0 mm.

Abdomen strongly depressed; smooth dorsally. Tergite 1 short, with transverse row of spinules on either side of midline; pleuron rudimentary, with 2 spinules on posterior surface; with 2 small, ventrally directed spines adjacent to pleopod articulation. Tergites 1-5 smooth dorsally, posterior margins unarmed, setose; lateral carinae granulate or minutely spinulate; pleural surfaces with minute spines, margins rounded to subtruncate, setose, posterolaterally with few spinules or granules. Tergite 6 smooth dorsally except for irregular row of minute spinules along midline of posterior half; posterior margin minutely spinulate, medially emarginate; lateral carina spinulate; pleural surface sparsely spinulate and granulate; lower pleural margin broadly rounded, setose, unarmed. Telson subquadrate; lateral sinuous, widest in anterior half; posterior margin broadly rounded; surface sparsely granulate or minutely spinulate.

Antennular peduncle overreaching rostrum by half length of distal peduncular article; inner flagellum longest, 0.95 pcl; outer flagellum thicker, setose ventrally. Antennal basal article wider than one-third epistome width, surrounded by wide band of arthrodial membrane; basicerite with stout distodorsal spine reaching midlength of scaphocerite, ventral surface with few scattered spinules. Scaphocerite narrowly triangular, length about 3 times width; outer margin unarmed; inner margin with 8 or 9 spines.

Epistome fused anteriorly with carapace; inverted T-shaped, with narrow median portion and slender, transverse posterior portion; margins curved, spinulate; anterior surface with 2 spinules at base of antennular articulation; posterior margin raised, with row of granules.

Eyestalk movable; corneal region rounded, unpigmented, sparsely setose dorsally; not extending beyond antennular peduncle segment 2.

Mouthparts examined *in situ*, not dissected. Mandible robust; palp 3-segmented. Maxilliped 2 exopod reaching beyond merus; flagellum absent; epipod absent. Maxilliped 3 exopod reaching midlength of ischium, flagellum multiarticulate, reaching proximal quarter of merus; epipod with well-developed podobranch; with 2 arthrobranchs.

Pereopods 1-4 with epipod and podobranch. Pereopod 5 without epipod or podobranch.

Pereopod 1 chelate, with few sparse setae; left and right markedly unequal and dissimilar; coxae with inner distal spine and 2 inner proximal spinules.

Major pereopod 1 ischium with spinulate inner margin; merus with 4 small spines on inner proximal margin and distal spine on outer margin; carpus with spine on outer ventral margin; propodus palm glabrous, dorsolateral and distomesial surface sparsely spinulose; dactylus and pollex about 4 times as long as palm; occlusal margins of pollex and dactylus lined with longer spines approximately evenly interspersed between several shorter spines, spines oriented obliquely to main axis of pollex and dactylus, alternately inclined to right and left forming two divergent rows, spines of dactylus and pollex interlocking when occluded; non-occlusal margins of pollex and dactylus smooth; dactylus with spine anterior to each articular condyle.

Minor pereopod 1 ischium with spines along inner margin; merus with row of spines along proximal three-fourths and 1 spine on outer distal margin; carpus with spine on outer distal margin; propodus palm with outer and lower surface bearing numerous spines extending onto proximal half of pollex; dactylus and pollex about 3 times as long as palm; dactylus outer margin with row of 8 well-spaced spines; spines of occlusal margins of pollex and dactylus orientation similar to that of major cheliped.

Pereopod 2 chelate, with few sparse setae; coxa with small inner distal spine and spinule on inner margin; basis flexor margin with cluster of spinules; ischium with spinose flexor margin; merus, carpus and propodus unarmed; pollex and dactylus with finely serrate occlusal margins, length about as long as palm.

Pereopod 3 chelate; coxa with 2 distal spines on inner margin; basis and ischium with few spinules on flexor margin; merus, carpus and propodus unarmed; pollex and dactylus with finely serrate occlusal margins, length almost as long as palm.

Pereopod 4 non-chelate; coxa with 1 or 2 inner distal spines; basis, ischium, merus, carpus, propodus and dactylus unarmed; dactylus densely setose.

Pereopod 5 chelate; coxa unarmed on inner margin; basis, ischium, merus, carpus and propodus

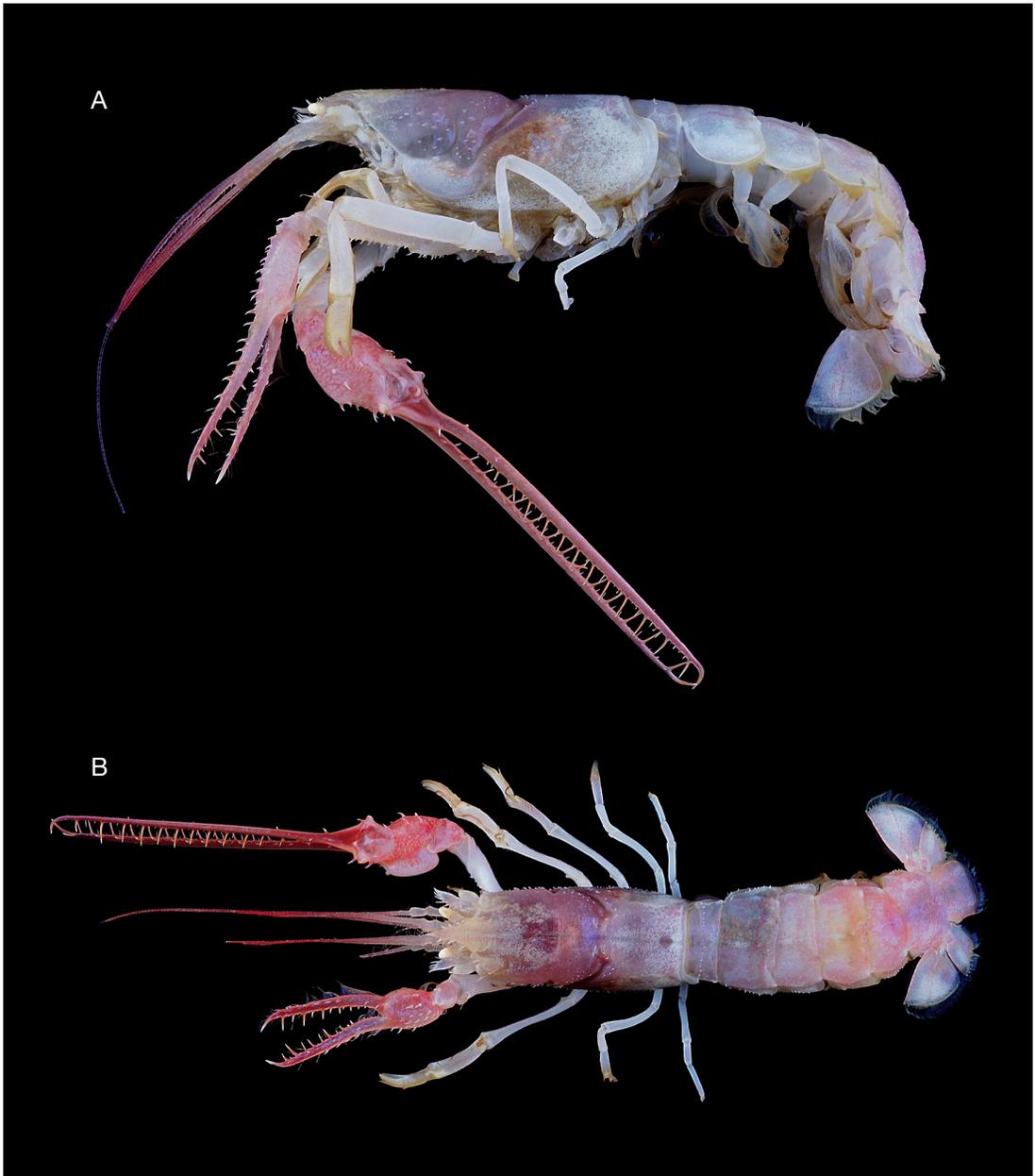


FIG. 4. — *Dinochelus ausubeli* n. gen., n. sp., ♂ holotype, pcl 26.1 mm (NMCR), abdomen slightly damaged and causing the posterior part of abdomen to bend right: **A**, left lateral view; **B**, dorsal view.

unarmed; dactylus slightly expanded distally, setose dorsally; pollex and dactylus with stiff, obliquely directed setae on occlusal margins.

Pleopod 1 with distal and proximal segments articulating, forming copulatory organ. Proximal segment sparsely setose on inner distal margin.

Distal segment slightly arcuate, tapering distally to rounded apex; slightly cannulate medially, flattened distally; glabrous.

Pleopod 2 biramous; basis inner distal margin setose; exopod and endopod elongate-ovate with setose margins; endopod longer than exopod, with appendix masculina.

Pleopods 3-5 biramous; basis inner distal margin setose; exopod and endopod elongate-ovate with setose margins; endopod longer than exopod, with slight basal swelling.

Uropodal protopod short, stout, with anterior spine overhanging exopod articulation; with denticulate lobe overhanging endopod articulation. Exopod proximal segment broadly trianguloid; outer margin irregularly spinose; distal margin curved, lined with setae and row of graded spines (largest laterally) above distal segment; distal segment wide, short, distal margin unarmed, rounded, demarcated from proximal segment by submarginal diaeresis. Endopod markedly smaller than exopod, with posterior margin lined with 11-13 spines.

#### *Colour in life (Fig. 4)*

Overall translucent white (including cornea) with central third diffusely reddish-pink. Abdominal somites and tailfan with diffuse reddish-pink patches and blotches. Antennular and antennal flagella, and pereopod 1 chelae reddish-pink. Pereopods 2-5 white.

#### REMARKS

Species of *Dinorchelus* n. gen., *Thaumastocheles* and *Thaumastochelopsis*, are superficially very similar, and apart from eye, uropod and maxilliped form, differ most prominently in major cheliped armature. Specimens collected by trawl or dredge are very often damaged, and in the case of incomplete specimens, or where only a major cheliped is collected, *D. ausubeli* n. gen., n. sp. is nevertheless identifiable. Of the known thaumastocheliform nephropids, the first chelipeds of *D. ausubeli* n. gen., n. sp. are most similar to those of *Thaumastocheles zaleucus* from the Caribbean Sea, in which the occlusal margins of the fingers are lined with two divergent rows of spines. The chelipeds of *D. ausubeli* n. gen., n. sp., however, differ from those of *T. zaleucus* in

having distinctly spinose palms (versus at most a few scattered spinules), and the fingers of the minor pereopod 1 are proportionally longer, being three times, versus less than twice the palm length. The cheliped armature of *D. ausubeli* n. gen., n. sp. differs from other species of *Thaumastocheles* and species of *Thaumastochelopsis* in having two divergent rows of slender spines on the occlusal margins of the fingers, rather than a single row of either upright spines or low, triangular serrations. It should be noted that a species recently described from Madagascar, *Thaumastochelopsis plantei* Burukovsky, 2005, is actually an axiidean of the genus *Ctenocheles* Kishinouye, 1926 (see also Tshudy & Sorhannus 2000). Thus, only two species of *Thaumastochelopsis* (i.e. *T. wardi* and *T. brucei*) are presently known.

#### Acknowledgements

The AURORA 2007 expedition, onboard MV *DA-BFAR*, was a collaboration between the Muséum national d'Histoire naturelle, Paris (principal investigator, PB); the National Museum of the Philippines, Manila (principal investigator, Marivene Manuel-Santos); the Philippine Bureau of Fisheries and Aquatic Resources, Manila (BFAR); the National Museum of Natural History, Smithsonian Institution, Washington, DC; Aurora State College of Technology, Baler; the National University of Singapore; the University of San Carlos, Cebu City; and the National Taiwan Ocean University, Keelung. The cruise was affiliated with the *Census of Margins* (CoMarge) component of the *Census of Marine Life*, and Jesse Ausubel is thanked for facilitating a grant from the Lounsbery Foundation that made the AURORA 2007 cruise possible. Malcolm Sarmiento, Director of BFAR, kindly made MV *DA-BFAR* available, and Noel Saguil (USC Associate) organized the logistics. We gratefully acknowledge K. H. Chu and C. P. Li (both Chinese University of Hong Kong) for assistance with collecting molecular data, and Peter Ng and Charles Fransen for constructive comments on the manuscript. This work was supported by grants from the National Science Council, Taiwan, R.O.C.; Academia Sinica, Taiwan, R.O.C.; and the Center for Marine Bioenvironment and Biotechnology of NTOU to TYC.

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Submitted on 28 July 2010;  
accepted on 6 August 2010.