

**A NEW SPECIES OF THE GENUS *KARSTARMA*
(CRUSTACEA: DECAPODA: BRACHYURA: SESARMIDAE)
FROM ANCHIALINE CAVES IN THE PHILIPPINES**

Daniel Edison M. Husana

*Department of Natural Environmental Studies, Graduate School of Frontier Science, the University of Tokyo,
5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8561, Japan
E-mail: stygoxene@nenv.k.u-tokyo.ac.jp*

Tohru Naruse

*Department of Biological Sciences, National University of Singapore, 14 Science Drive 4, Singapore 117543, Republic of Singapore
(Current address: Transdisciplinary Research Organization for Subtropical and Island Studies,
University of the Ryukyus, 870 Uehara, Taketomi, Okinawa 907-1541, Japan.
E-mail: naruse@lab.u-ryukyu.ac.jp)*

Tomoki Kase

*Department of Geology and Paleontology, National Museum of Nature and Science, 3-23-1 Hyakunincho, Shinjuku-ku, Tokyo, 169-0073 Japan
E-mail: kase@kahaku.go.jp*

ABSTRACT. – A new cavernicolous crab of the genus *Karstarma* is described from anchialine caves in Samal and Boracay islands, Philippines. The new species, *K. philippinarum*, is morphologically most similar to *K. ultrapes* (Ng, Guinot & Illife, 1994) from the Solomon Islands, but differs in having shorter ambulatory legs and an obtuse external orbital angle. A supraorbital convexity tends to be slightly larger in the new species. This paper increases the number of the species of the genus *Karstarma* to 15 and records the third species of the genus from the Philippines.

KEY WORDS. – Anchialine cave, *Karstarma philippinarum*, new species, Philippines, Brachyura, taxonomy.

INTRODUCTION

The sesarmid crab genus *Karstarma* Davie & Ng, 2007, is currently represented by 14 species from Indo-West Pacific (Ng et al., 2008; Wowor & Ng, 2009). Although *Karstarma* is morphologically similar to *Sesarmoides* Serène & Soh, 1970, especially in the markedly long ambulatory legs, Davie & Ng (2007) distinguished *Karstarma* from *Sesarmoides* primarily by the absences of a milled suborbital ridge of the carapace and a stridulatory crest on the merus of the cheliped. Ng (2002) and Davie & Ng (2007) also noted an interesting correlation between the stridulatory mechanism and habitat preferences. *Sesarmoides* with stridulatory mechanism inhabits tidal mangrove, estuarine and coastal caves, whereas this mechanism is absent in *Karstarma* and the species of the genus have exclusively been found in karst areas.

During stygofaunal surveys conducted in various caves in the Philippines, the first and third authors obtained several specimens assigned to *Karstarma* from two anchialine caves,

one in Boracay Island, central Philippines and the other in Samal Island, southern Philippines. Although *K. boholano* (Ng, 2002) and *K. sulu* (Ng, 2002) have been recorded from Palawan and Bohol respectively, the species from Boracay and Samal resembles *K. ultrapes* (Ng, Guinot & Illife, 1994) which is only known only from the Solomon Islands. Our detailed comparison with the type specimens of *K. ultrapes* has revealed that the species from Boracay and Samal is new to science. We here described this new species and briefly documented the habitats.

Measurements provided are the carapace length (CL) by the carapace width in mm. The terminology follows that of Davie & Ng (2007). Specimens examined are deposited in the Muséum national d'Histoire naturelle, Paris (MNHN); the National Museum of the Philippines, Manila (NMCR); the National Museum of Nature and Science (formerly National Science Museum), Tokyo (NSMT); and the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore (ZRC). The abbreviations G1 and G2 are used for male first and second gonopods, respectively.

TAXONOMY

Sesarmidae Dana, 1851

Karstarma Davie & Ng, 2007

Karstarma philippinarum, new species (Figs. 1–3)

Material examined. – Holotype: male (23.8 × 30.2 mm, NMCR 27063), Bat Cave, Boracay Island, 11°59.954'N 121°55.442'E, coll. E. Husana, 5 Dec.2004.

Paratypes: 1 male (22.1 × 27.7 mm, NSMT-Cr2007.0105), 1 female (25.2 × 31.1 mm, NMCR 27064), 1 female (18.9 × 24.0 mm, NSMT-Cr2007.0107), 1 male (19.8 × 24.6 mm, NSMT-Cr2007.0108), 1 male (20.6 × 26.0 mm, NSMT-Cr2007.0109), 1 juvenile male (13.0 × 17.0 mm, NSMT-Cr2007.0110), 1 juvenile male (11.4 × 14.4 mm), 1 male (19.2 × 24.0 mm), 1 female (20.7 × 25.7 mm) (NSMT-Cr2007.0111), Tagbaobo Cave, Samal Island, 7°00.730'N 125°46.810'E, coll. E. Husana, T. Kase & S. Kinjo, 28 & 29 Jan.2004; 1 female (22.6 × 29.2 mm, NSMT-Cr2007.0096), 1 male (28.3 × 36.1 mm, NSMT-Cr2007.0097), 1 female (29.3 × 36.8 mm, NSMT-Cr2007.0098), 1 female (24.1 × 30.6 mm, NSMT-Cr2007.0099), 1 male (25.7 × 31.8 mm, NSMT-Cr2007.0100), 1 male (25.0 × 31.2 mm, NSMT-Cr2007.0101), 1 female (30.8 × 37.5 mm, NSMT-Cr2007.0102), 1 female (28.2 × 34.7 mm, NSMT-Cr2007.0103), 1 female (29.4 × 36.9 mm, NSMT-Cr2007.0104), Bat Cave, Boracay Island, 11°59.954'N 121°55.442'E, coll. E. Husana, 5 Dec.2004.

Comparative material. – *Karstarma ultrapes* (Ng, Guinot & Iliffe, 1994). Holotype: male (22.9 × 28.9 mm, MNHN-B24796), Mbetibula Cave (station 88-083), Florida Islands, Nggela Pile Island, Solomon Islands, coll. T. M. Iliffe & S. Sarbu, 15 Aug.1988; Paratype: 1 female (32.5 × 39.4 mm, MNHN-B24797), data same as holotype.

Description. – Carapace (Figs. 2a, b, 3a) approximately trapezoidal, widest between bases of second and third ambulatory legs; dorsal surface distinctly rugose, especially on branchial regions, with scattered minute setae and short stiff black setae on entire surface. Deep longitudinal

furrow present along median epi- and protogastric regions, diverging on meso- and metagastric regions and surrounding gastro-cardiac groove, with inward-curving setae along epi- and protogastric furrow, tips of setae partly interlocked especially in dorsal part; cervical furrow distinct but shallow on anterior part whereas indistinct on posterior part; gastro-cardiac and cardio-intestinal furrows shallow; postorbital and epigastric protuberances slightly rugose. Frontal region gently granulose. Frontal margin deflexed, bilobed, medially separated by U-shaped concavity in dorsal view; downwardly inclined towards antennular septum in anterior view (Fig. 3c), ventral extensions of front embracing median tip of proepistome; supraorbital margin cristate, compressed W-shaped, submedian part gently produced; external orbital angle relatively produced, inner margin straight, base of inner margin concave; infraorbital margin medially broader, laterally reaching as far as below external orbital angle; suborbital crista present, lateral three-fifths thinly raised, forming keel, edge of keel lined with microscopical granules. Anterolateral and anterior half of posterolateral margin continuous, no clear demarcation, strongly diverging posteriorly, cristate, with 3 distinct teeth including external orbital angle, first and second teeth separated by deep, narrow fissure, third tooth separated from second tooth by shallow V-shaped notch, tip of second tooth slightly closer to that of first tooth than to third tooth, third tooth followed posteriorly by few small notches. Posterior half of posterolateral margin subcristate, converging abruptly towards gently sinuous posterior carapace margin. Epistome with posterior margin



Fig. 1. Live coloration of *Karstarma philippinarum*, new species, in its natural habitat, Bat Cave, Boracay Island, Philippines.



Fig. 2. *Karstarma philippinarum*, new species. Holotype male (23.8 × 30.2 mm, NMCR 27063). a, habitus; b, carapace, dorsal view.

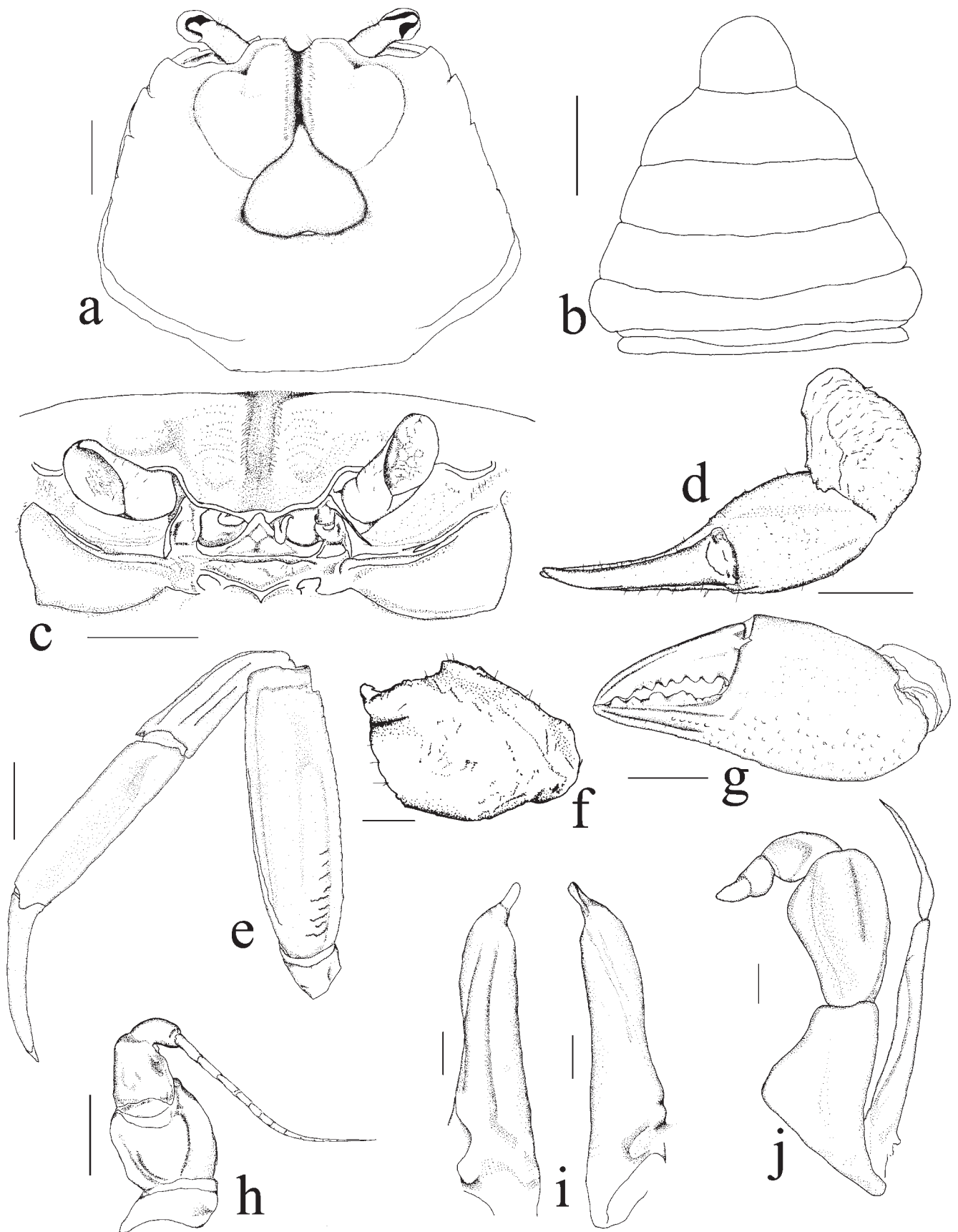


Fig. 3. *Karstarma philippinarum*, new species. Paratype male NSMT-Cr2007.0105. a, carapace; b, abdomen and telson; c, cephalothorax, frontal view; d, left cheliped, dorsal view; e, left fourth ambulatory leg, dorsal view; f, left cheliped, carpus; g, left chela, outer view; h, left antenna, ventral view; i, G1, ventral and dorsal views; j, left third maxilliped, ventral view. Scale bars: a–e, g = 5.0 mm; f = 2.0 mm; h–j = 1.0 mm.

cristate, bent anteriorly, trilobed, median projection longest, triangular.

Eyes (Fig. 3a, c) well developed, well pigmented, cornea wider than peduncle in dorsal view. Third maxilliped (Fig. 3j) elongated; ischium as long as merus, with oblique median groove; merus with crest adjacent to inner margin, lined with setae; exopod slender, with long flagellum.

Thoracic sternites 2 and 3 fused, lateral margin strongly convex outwards, suture indistinct; suture between 3 and 4 visible, concave towards the anterior part.

Chelipeds (Fig. 2a) equal, more robust in males than females, merus (Fig. 3d) triangular in cross-section, all margins granulated, inner surface with two longitudinal rows of black fine setae, subdistal part of ventral inner margin with short, longitudinal non-corneous raise; carpus (Fig. 3f) with inner angle slightly foliaceous, fringed with small teeth, outer margin with several low teeth; chela (Fig. 3d, g) with slightly inflated palm, palm sparsely granulated on lower half; movable finger slightly shorter than palm, immovable finger with 2 median longitudinal ridges along outer edge, cutting edges lined with numerous triangular teeth. Ambulatory legs (Figs. 1, 2a, 3e) very long, third pair longest, fourth pair shortest. Meri rugose on dorsal surfaces, merus of third ambulatory leg 3.83–5.12 times width (mean = 4.39, $n = 14$), 1.08–1.60 times CL (mean = 1.37, $n = 14$). Margins of propodi and dactyli lined with stiff and long black setae, inner and outer margins of dactyli of first and second ambulatory legs with mat of dense short black setae.

Abdominal somites segments, all freely segmented. Male abdomen (Fig. 3b) triangular, wide; somites 1 and 2 short; lateral margins of somites 3 strongly convex; somites 4 and 5 trapezoidal in shape, lateral margins straight or gently sinuous; lateral margins of somites 6 convex; telson rounded on distal margin. Female abdomen rounded, very wide, somites 3 trapezoidal in shape; somites 4 to 5 with convex lateral margins, almost reaching proximal half of coxa; lateral margin of somites 6 convex; telson distinctly sunken into distal margin of somites 6. G1 (Fig. 3i) very stout, almost straight, outer margin and subdistal area covered with dense long setae, covering pectinated distal part; distal part spade-like.

Colouration. – *Karstarma philippinarum*, new species, has a semi-circular bright orange pattern on the anterior half of the dorsal surface of the carapace (Fig. 1). The posterior part of the dorsal surfaces of the carapace, including the intestinal region, is brownish in male live specimen. Females, on the other hand, have whitish intestinal region. The meri and carpi of the ambulatory legs are orange, and the propodi and dactyli are white. The chelipeds are orangish, except for whitish distal ends of the fingers in males and whitish palm and fingers in females.

Etymology. – The species name, *philippinarum*, was derived from the Philippines, where the present new species was collected.

Remarks. – *Karstarma philippinarum*, new species, closely resembles *K. ultrapes*. They could easily be misidentified as the same species because of their similar body pigmentations and appearances. But obvious distinction between the two species could easily be noticed if they are compared side by side. The clear difference between them is the proportions of the ambulatory legs; *K. philippinarum* has shorter ambulatory legs than those of *K. ultrapes*. For example, the merus of the third ambulatory leg of *K. philippinarum* is 3.83–5.12 times width (mean = 4.39, $n = 14$) and 1.08–1.60 times CL (mean = 1.37, $n = 14$), while that of *K. ultrapes* is 5.45 and 5.47 times width (mean = 5.46, $n = 2$) and 1.40 and 1.66 times CL (mean = 1.53, $n = 2$) (also see Figs. 2a, 4a; Ng et al., 1994: fig. 5). In addition, *K. philippinarum* has blunter external orbital angle and larger projection on the supraorbital margin. In *K. philippinarum*, the inner margin of the external orbital angle is convex and the submedian convexity of the supraorbital margin is more produced, forming a rounded concavity between them. While in *K. ultrapes*, the inner margin of the angle is gradually confluent with the supraorbital margin, the submedian convexity of the supraorbital margin is lower (Figs. 2b, 3a, 4b; Ng et al., 1994, figs. 5–7a).

When Davie & Ng (2007) established *Karstarma*, they used two spellings, “*Karstarma*” and “*Karstama*”, for the genus name. Although Davie & Ng (2007: 229) clearly stated that the genus name is derived from an arbitrary combination



Fig. 4. *Karstarma ultrapes* (Ng, Guinot & Iliffe, 1994). Holotype male (22.9 × 28.9 mm, MNHN-B24796). a, habitus; b, carapace, dorsal view.

of “karst” and “*Sesarma*”, Ng, Guinot & Davie (2008) consistently spelled the genus as “*Karstama*” without any comment. Indeed, the authors have not been aware of the presence of the second spelling (P. J. F. Davie & P. K. L. Ng, pers. comm.). According to the ICZN Article 24.2.3, we select the spelling “*Karstarma*” as a correct original spelling (see also Wowor & Ng, 2009).

Notes on habitat. – *Karstarma philippinarum*, new species, was found in two anchialine caves that are filled with normal high saline seawater. Tagbaobo Cave is located in a remote area on the eastern side of Samal Island just south of Davao City in Mindanao. The entrance of this cave is located on a limestone sea cliff about four meters above the high tide line and inside is gloomy, with a direct underground and below sea-level connection to the sea. The animals co-occurred with *K. philippinarum* in this cave are the hyppolitid shrimp *Parhippolyte misticia* (Clark, 1989), undetermined ostracods and mysids. Bat Cave is in a limestone body and its entrance is about 100 m away from the sea. The cave extends seaward and appears to connect to the sea because dim light is visible from the water at the innermost part of the cave. Other crustaceans collected inside this cave are the gecarcinid crabs *Discoplax gracilipes* Ng, 2002 and *Gecarcoidea landanii* H. Milne Edwards, 1837. Many bats inhabit both caves. *Karstarma philippinarum* was observed in water and dry parts of the cave floors and walls, seemingly feeding on bat feces and other organic materials in both caves.

Distribution. – *Karstarma philippinarum*, new species, is currently known only from Boracay Island and Samal Island, Philippines.

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