Sundathelphusa spelaeophila, a new species of cavernicolous crab from Samar, Philippines (Decapoda: Brachyura: Gecarcinucidae)

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Abstract. A new species of Sundathelphusa Bott, 1969, from Samar Island in the Philippines, is described. The new species, collected from two caves, differs from the other species collected in Samar principally for the lack of troglobitic morphological features and for the different shapes of the carapace and G1.

Key words. Sundathelphusa, Philippines, cave fauna, freshwater crab

INTRODUCTION

A speleological expedition to the island of Samar, in the central Philippines, was conducted in 1991 by a team whose members came from the Italian National Council of Research, together with the Natural History Museum of Florence University, Verona Natural History Museum, and the French speleological club “Aven Club Valettois”. The main goal of the expedition was the mapping and description of Samar caves, following the first mission conducted in 1987 (Rossi et al., 1987), however invertebrates were noted and in some instances collected. In 1993, the French club visited the island again and collected additional material. The expeditions were planned in collaboration with relevant Philippine authorities such as the Department of Environment and Natural Resources (Piccini & Rossi, 1994) and resulted in numerous decapod crustaceans being collected from the caves there (Cai & Anker, 2004; Ng & Ng, 2009; Stasolla & Innocenti, 2014).

The expeditions were hand-collected in the municipality of San Jorge, Barangay Matalud, from Can Gortio cave (also known as Cangortillo) (11°59'00" N, 124°53'00" E) and in a cave, named by the speleologists “SNAZ 1”, as it is located near the local National School of Agriculture and Zootechnics (12°00'00" N, 124°54'00" E). Can Gortio is a complex cave with several levels, the lower partially invaded by still water, while the higher is dry and well concretionated. The entrance gallery floor is softly covered by guano, and the cave develops for nearly 300 m. The air temperature inside the cave is around 20°C. “SNAZ 1” is a well concretionated cave that develops for nearly 200 m, with the air temperature inside the cave of 23–25°C. In both cases, the crabs were collected not far from the cave entrance (A. Gobetti, pers. comm.).

Material and Methods

Samar Province is one of the three provinces on Samar Island (the others being Eastern Samar and Northern Samar), which is located in the eastern Visayas region in the central Philippines.

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Material examined are deposited in the Zoological Museum of Florence University (MZUF) and in the National Museum of the Philippines, Manila (NMCR), while the comparative material was borrowed from the Museum für Naturkunde, Berlin (ZMB). The systematic order follows Cumberlidge & Ng (2009).

G1 and G2 refer to the male first and second gonopods, respectively. Articles of the ambulatory legs are referred to as follows: 3M, 3P and 3D, for the merus, propodus and dactylus of the third ambulatory leg, respectively.
TAXONOMY

Gecarcinucidae Rathbun, 1904

*Sundathelphusa spelaeophila* n. sp.
(Figs. 1A–C, 2A–E)

Material examined. Holotype: male (15.9 × 14.1 mm) (MZUF 3920); Philippines, Samar province, San Jorge municipality, Barangay Matalud, Can Gortio Cave, coll. C. Ferron, 19 March 1991. Paratypes: 1 male (11.7 × 10.6 mm) (MZUF 4273) Samar province, San Jorge municipality, Barangay Matalud, Can Gortio Cave, coll. C. Ferron, 19 March 1991; 1 male (15.4 × 12.9 mm) (NMCR 40102) Samar province, San Jorge municipality, Barangay Matalud, Can Gortio Cave, coll. P. Marcel, 20 March 1991. Other material: 1 male (16.8 × 14.7 mm) (MZUF 3927), Samar province, San Jorge municipality, Barangay Matalud, “SNAZ 1” Cave (1 km from the local National School of Agriculture and Zootechnics), coll. C. Ferron, 26 May 1993.

Comparative material. The specimens were compared with the descriptions of *Sundathelphusa waray* Husana, Naruse & Kase, 2009 and *S. lobo* Husana, Naruse & Kase, 2009, as well as with the direct observation of the specimens of *S. philippina* (von Martens, 1868) deposited in the Museum für Naturkunde, Berlin (ZMB), a *Sundathelphusa* species collected in Samar Island. These last specimens are presently catalogued as *S. grapsoides*, possibly following Balss (1937) (O. Coleman pers. comm.). *Sundathelphusa philippina* were collected in Samar in the following localities: Calbiga river and Loquilocum (= Ulut) river (Bott, 1970). As the ZMB specimens were presently identified as *S. grapsoides* (H. Milne Edwards, 1853), the original descriptions of this latter species were also carefully compared, following A. Milne Edwards (1869) and Rathbun (1904).

Description. Carapace (Fig. 1A) subquadrate, broader than long (width-to-length ratio ca. 1.1) quite flat; dorsal surface with distinct rugosity in frontal, hepatic regions; branchial region rugose, striated; regions poorly defined, cervical, gastric grooves shallow; epigastric cristae low but distinct, continuous with postorbital cristae; postorbital cristae low but distinct, gently curving toward anterior, converging toward and connecting epibranchial teeth; frontal margin slightly convex; anterolateral margins slightly convex, granular; external orbital angle not very broad; single epibranchial tooth acutely triangular, developed, anteriorly directed, separated from exorbital tooth by V-shaped notch; posterolateral margins slightly concave before converging towards posterior carapace margin; supraorbital margin smooth, parallel with frontal margin; infraorbital margins granular, complete, congruent with anterolateral margin; suborbital region rugose, extending to sub-branchial region.

Antennules slender. Eyes well-developed, cornea pigmented.

Epistome narrow (Fig. 1C), posterior margin with one lateral cleft, median part sub-triangular, margin smooth. Third maxilliped (Figs. 1B, 2A) with slender, sinuous exopod, narrower than ischium, flagellum well developed; merus broad, antero-external margin rounded.

Male thoracic sternum (Fig. 1B) broad and generally smooth, with scattered granularities, lateral margins setose; sternites 1–4 fused, with traces of sutures between 3–4 sternites; sterno-abdominal cavity deep; press button on sternite 5, near to the suture between sternites 4 and 5.

Male chelae (Fig. 1A) distinctly unequal, relatively long, surface punctuated, with scattered rugosities, fingers shorter than palm; distal region of fingers with pointed, chitinous tooth; margin of merus irregularly granular. Carpus rounded, rugose, inner distal angle with well-developed tooth and with 1 or 2 smaller teeth in inner margin.

Ambulatory legs (Fig. 1A) sub-triangular in cross section; second, third ambulatory legs longest; anterior dorsal margin

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Fig. 1. *Sundathelphusa spelaeophila* n. sp., holotype, male (15.9 × 14.1 mm) (MZUF 3920). A, dorsal view (Scale bar = 10 mm); B, ventral view; C, anterior view.
of merus (M) smooth; propodi (P) with spines, all dactyli (D) bearing spines; 3M long (length to width ratio 3.3), 3P long (length to width ratio 2.3), 3D long (length to width ratio 6.4); 4M short (length to width ratio 2.9), 4P long (length to width ratio 2), 4D relatively short (length to width ratio 3.8).

Male abdomen (Fig. 2B) T-shaped; lateral margins covered with short setae; Telson slightly shorter than somite 6, narrow, with lateral margins converging to rounded distal margin. G1 (Fig. 2D, E) relatively stout, basal part swollen, terminally curved, subterminal segment straight with outer margin distinctly concave; proximal part evenly cylindrical, terminal part occupying about 0.2 times total length, nearly straight, conical, with fairly fluted tip. G2 (Fig. 2C) relatively long, slightly longer than G1, distal segment long, sinuous, about 0.5 times length of basal segment.

No females were collected, thus it is not possible to give any detail of female morphology.

**Etymology.** From the composition of *spelaeo* (Latin: spēlaeum, i) cavern and *philae* (Latin: -philus, -phila) lover, as it has been collected in a cave.

**Remarks.** At present, only three species of *Sundathelphusa* are known for Samar: *S. philippina*, *S. lobo* and *S. waray*. However *S. spelaeophila* clearly differs from *S. philippina* in: (a) the subquadrate shape of the carapace (versus subhexagonal, inflated and broader in *S. philippina*); (b) poorly defined regions in the carapace (versus well defined regions in *S. philippina*); and (c) G1 subterminal segment almost straight with outer margin distinctly concave (versus curved with outer margin convex in *S. philippina*).

The other two species, described from caves, *S. waray* and *S. lobo*, are both regarded as obligate cave inhabitants by Husana et al. (2009). *Sundathelphusa spelaeophila* sp. nov. can be separated from these two species by the absence of merus (M) smooth; propodi (P) with spines, all dactyli (D) bearing spines; 3M long (length to width ratio 3.3), 3P long (length to width ratio 2.3), 3D long (length to width ratio 6.4); 4M short (length to width ratio 2.9), 4P long (length to width ratio 2), 4D relatively short (length to width ratio 3.8).

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of evident troglobitic traits (e.g., reduced cornea pigment; absence of body pigment; length of legs and spines, see Husana et al., 2009) clearly present in S. waray and S. lobo.

*Sundathelphusa spelaeophila* sp. nov. can apparently resemble *S. grapsoides* (H Milne Edwards, 1853). Even if this species is reported from Luzon (Pampanga and Bulacan; Mendoza & Naruse, 2010), an island quite distant from Samar (Ng & Sket, 1996; Ng, 2010), it also shows remarkable morphological differences. *Sundathelphusa spelaeophila* differs from *S. grapsoides* descriptions reported in A. Milne Edwards (1869) and Rathbun (1904) by: (a) the subquadrate shape of the carapace (versus rounded shape of the carapace in *S. grapsoides*); (b) the anterior side of the merus of the ambulatory legs smooth (versus numerous teeth in the anterior side of the merus of the ambulatory legs in *S. grapsoides*); and (c) poorly defined regions of the carapace (versus well defined regions of the carapace in *S. grapsoides*).

**DISCUSSION**

The diagnostic characters of *Sundathelphusa spelaeophila* sp. nov. clearly show differences from the other *Sundathelphusa* species described from Samar: *S. philippina* (von Martens, 1868), *S. waray* and *S. lobo* (Husana et al., 2009) and from *S. grapsoides*, a morphologically similar species, described from Luzon (Rathbun, 1904). Even if the new species does not show any troglobitic features, such as reduced eyes or loss in eye pigmentation (as in *S. waray* and *S. lobo*, strictly troglobitic), it was collected only at the entrance of the caves, suggesting that it is perhaps a facultative cave resident or at least adapted to the epigean–hypogean transitional ecosystem (as defined by Prous et al., 2004). These findings highlight the high ecological versatilities of this genus, particularly in the Philippine islands (Klaus et al., 2013; Husana et al., 2014). Most species have very particular habitat requirements and have very localised distributions (Ng & Rodriguez, 1995; Yeo et al., 2008; Mendoza & Naruse, 2010).

The Philippine Islands comprise ca. 7,000 islands ranging up to 100,000 km$^2$ of land area. With the exception of the Palawan group, all the other islands have an oceanic origin, having emerged from a complex and well-documented set of tectonic events. During the many Pleistocene ‘ice ages’, periods of lowered sea level brought some current islands to coalesce into larger ones, but others remained separated, with channels ranging from 1 to 25 km (Hall, 1996, 1998, 2002). These geological events could have contributed to the diversification of *Sundathelphusa* genus (Husana et al., 2010; Husana & Yamamura, 2013), with its 37 species, 29 of which described only from the Philippines (Ng et al., 2008; Mendoza & Naruse, 2010; Ng, 2010; Husana et al., 2014; Peter K.L. Ng, pers. comm.; Husana et al., 2015; present paper).
For the archipelagic nature of the Philippines and their peculiar biogeography and ecology, the taxonomy of Philippine freshwater crabs, particularly that of the genus *Sundathelphusa* is quite complicated. Moreover, mismatch and the lack of accurate information from the material collected in historical times (H. Milne Edwards, 1853; von Martens, 1868; Bürger, 1894) increase the difficulties in understanding the evolution of this group (Husana et al., 2015). The discovery of more new species can be expected if one considers the number of unexplored habitats (Chia & Ng, 2006) and the cryptic diversity in certain habitats (e.g., caves) due to the selection of similar specialised morphologies or adaptations (Klaus et al., 2013). Our considerations agree with Husana et al., (2015) that draw attention to the need of an extensive field research in the Philippines archipelago, possibly joined with genetic analyses, in order to give a better comprehension of the biogeography and phylogeny of *Sundathelphusa*.

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**LITERATURE CITED**


