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The freshwater crab fauna (Crustacea: Decapoda: Brachyura) of the Philippines. IV. On a collection of Parathelphusidae from Bohol

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Abstract.—Five species of freshwater crabs of the genus *Sundathelphusa* are recognised from the island of Bohol in the Philippines: *S. cavernicola* (Takeda, 1983), and four new species, *S. boex*, *S. sottoae*, *S. urichi* and *S. vedeniki*. Specimens from Bohol previously referred to *S. philippina* (von Martens, 1868) belong to *S. boex*, and those identified as *S. cavernicola* belong to two separate species.

The freshwater crab fauna of the Philippines is one of exceptional diversity, although this is not apparent from the number of described species. In recent years, Ng & Takeda (1992a, 1992b, 1993a, 1993b) have been involved in a systematic revision of this fauna based on extensive collections made by staff of the National Science Museum (Tokyo) and the National Museum of the Philippines (Manila). The revision of the two largest genera, *Sundathelphusa* Bott, 1969, and *Archipelothelphusa* Bott, 1969, is now in progress.

In February 1995, the Slovene Caving Association launched two caving expeditions to Asia: to Guizhou, China (Trontelj 1996, Ng & Trontelj 1996), and the Philippines (Sket 1995). Altogether, the expedition team investigated about 30 caves in Pleistocene to Miocene aged limestone. The Philippine island of Bohol in particular, harbours one of the largest continuous karst areas in the Philippine archipelago (Balasz 1973), and because of this, exploration efforts were centered there. Studies of the collections made show that Bohol has a rich freshwater crab fauna.

Few cavernicolous crabs are known from the Philippines. Takeda (1983) described a new troglobitic species, *Archipelothelphusa cavernicola*, from caves in Bohol, and Ng

(1991) reported *Archipelothelphusa longipes* Balss, 1937, from Bautakay Cave in Luzon. A total of four species of freshwater crabs of the family Parathelphusidae were collected by the present expedition. All are undescribed. Of these, three are apparently troglobitic species while one epigeal species makes occasional forays into caves.

Only two true freshwater species have been reported from Bohol thus far, *Sundathelphusa philippina* (von Martens, 1868) and *Archipelothelphusa cavernicola* Takeda, 1983 (Bott 1970, Takeda 1983). Previous collections, however, are rather poor, so the discovery of new taxa is not unexpected.

In view of the good series of specimens available from Bohol, the homogeneity nature of the fauna (all the species seem to be more closely related to each other than to others in the Philippines) and the cavernicolous habits of the species, it was felt that it would be useful to document this fauna in a single paper.

The generic system used by Bott (1969, 1970) for the Southeast Asian fauna is problematic. *Sundathelphusa* Bott, 1969, and *Archipelothelphusa* Bott, 1969, are so close that there seems to be no good reason for separating them. As both *Sundathelphusa* and *Archipelothelphusa* were described

in the same paper (Bott, 1969), *Sundathelphusa* Bott, 1969, is herein regarded as having seniority over *Archipelothelphusa* Bott, 1969. In any case, the name *Sundathelphusa* Bott, 1969, appears before *Archipelothelphusa* Bott, 1969, in Bott's (1969) paper.

The abbreviations G1 and G2 are used for the male first and second pleopods respectively. All measurements are indicated as carapace width x carapace length. The terminology used follows that by Ng (1988). Specimens are deposited in the National Museum of the Philippines, Manila (NMCR); National Science Museum, Tokyo (NSMT); Department of Biology, University of Ljubljana (ULB); and Zoological Reference Collection, School of Biology, National University of Singapore (ZRC).

Systematic Account

Family Parathelphusidae Alcock, 1910

Genus *Sundathelphusa* Bott, 1969

Sundathelphusa boex, new species

Figs. 1A, 2a-f, 4a-f

? *Telphusa leschenaulti*.—Bürger, 1894:2 (part) (not *Thelphusa leschenaudii* H. Milne Edwards, 1834, misspelling by Bürger, 1894).

Material examined.—Holotype male (37.4 × 30.9 mm) (NMCR), small stream near Sierra Bulliones, about 9°42'N, 124°20'E, about 5 km northwest of Jagna, Bohol, leg. H. Morioka, 22 Jul 1985. Paratype male (34.2 × 27.8 mm), paratype female (almost mature) (26.8 × 22.4 mm) (ZRC 1996.1550–1551), Castigio Cave, Batuan, Bohol, leg. B. Sket, Feb 1995. Paratype male (41.0 × 33.0 mm) (ZRC 1996.1549), Batuan, Bohol, leg. B. Sket, Feb 1995. 1 male (NMCR), 1 male (ULB), 1 male (NMCR), brook, Pahangong Talon, Ginguyuran, Bohol, leg. B. Sket, Feb 1995. 1 male (34.6 × 28.8 mm) (NMCR), spring in Batuan, Bohol, leg. B. Sket, Feb 1995. 1 juvenile (NMCR), Capiro Spring, Batuan, Bohol, leg. B. Sket, Feb 1995. 1 young male (10.2 by 8.7 mm) (ULB), Carmulaon,

lower part, Cugon, Jagna, Bohol, leg. B. Sket, Feb 1995.

Description.—Dorsal surface of carapace gently convex; anterolateral regions rugose; posterolateral regions covered with oblique striae; cervical grooves deep; epigastric cristae low, rugose, not confluent with low postorbital cristae; postorbital cristae interrupted medially by cervical groove, not reaching epibranchial tooth. Frontal median triangle well defined, with dorsal and lateral margins cristate; dorsal ridge not fused with lateral margins. Anterolateral margin distinctly convex, smooth; epibranchial tooth low to very low, separated from external orbital angle by small notch; posterolateral margins gently converging towards posterior carapace margin. Ocular peduncle and cornea well developed; eye occupying almost entire orbit. Carpus of chelipeds with surface smooth; inner margin with 1 large sublamelliform tooth and 1 smaller tooth. Ambulatory legs relatively short; meri of third and fourth legs about 2.7 times longer than broad; dactylus of third and fourth legs subequal or shorter than propodus. Male abdomen with slender segment 6, about 1.1 times longer than broad. G1 slender, gently curved outwards; terminal segment slender, conical, about 0.4 times length of subterminal segment. G2 about 1.0 times length of G1; distal segment well developed, about 0.5 times length of basal segment.

Discussion.—Bürger (1894) reported a large 50 × 41 mm female from Bohol as *Telphusa leschenaulti*, but his specimen is most likely *S. boex* instead. *Thelphusa leschenaudii* H. Milne Edwards, 1834 (type locality Pondicherry, India) (spelling of genus name erroneous) is now regarded as a junior synonym of *Oziothelphusa senex* (Fabricius, 1798) (see Bott 1970:100). The specific epithet of *T. leschenaudii* is often spelled "leschenaulti" (changed by H. Milne Edwards, 1853) but under current rules (ICZN 1985), the original spelling must be preserved.

Sundathelphusa philippina (von Martens, 1868) somewhat resembles *S. boex*, but *S.*

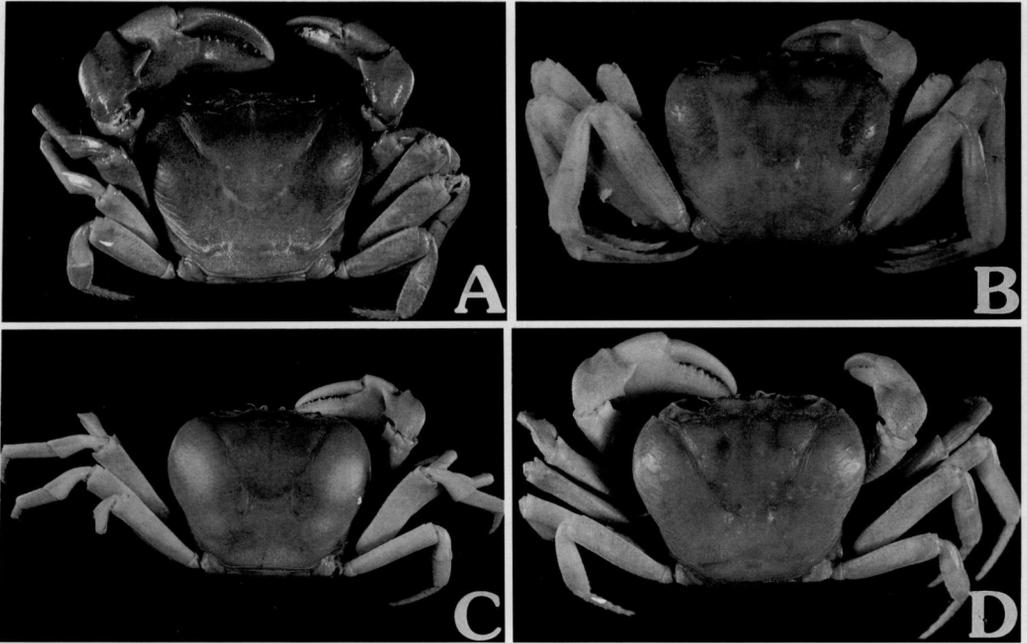


Fig. 1. Dorsal views of new *Sundathelphusa* species. A, *S. boex*, holotype male (37.4 × 30.9 mm) (NMCR); B, *S. sottoae*, holotype male (17.3 × 13.4 mm) (NSMT-Cr 8938); C, *S. urichi*, holotype male (36.6 × 27.9 mm) (NMCR); D, *S. vedeniki*, holotype male (28.2 by 22.3 mm) (NMCR).

philippina differs markedly in having a more inflated and proportionately broader carapace, as well as the differently structured anterolateral margin and G1. The first author has examined the types of *Sundathelphusa philippina* in the Berlin Museum. *Sundathelphusa philippina* is known for certain only from the islands of Leyte, Cebu and Samar (PKLN, pers. obs.).

Sundathelphusa boex was found in surface waters as well as in caves. Both caves where the crabs were found are rich in organic nutrients. Castigio Cave is inside a mogote ("chocolate hill") and has a very high amount of plant debris. Carmulaon Cave is a vertical cave receiving waters from nearby rice fields. All specimens are usually pigmented. The eyestalks of adults are subequally thick both distally and proximally, while in juveniles the distal part is proportionately broader.

Etymology.—The species name is derived from the acronym B.O.E.X. (Bohol Outdoor Explorers Club), whose members

acted as the Philippine component of the expedition. The name is used here as a noun in apposition.

Sundathelphusa cavernicola

(Takeda, 1983)

Fig. 4g

Archipelothelphusa cavernicola Takeda, 1983:169 (part).

Material examined.—Holotype female (25.7 × 21.0 mm) (NSMT-Cr 8937), muddy bottom on subterranean stream, 20–30 cm deep, about 300 m from entrance to east branch of Quinapon-an Cave, Antequera, 09°49'38"N, 123°54'10"E, Bohol, leg. S. I. Ueno, 4 Mar 1983.

Description.—Dorsal surface of carapace gently convex; anterolateral regions gently rugose; posterolateral regions covered with oblique striae; cervical grooves distinct but relatively shallow; epigastric cristae low, rugose, not confluent with low postorbital cristae; postorbital cristae interrupted me-

dially by cervical groove, not reaching epibranchial tooth. Frontal median triangle poorly defined; lateral margins cristate, dorsal margin not cristate or meeting lateral margins. Anterolateral margin distinctly convex, smooth; epibranchial tooth distinct, separated from external orbital angle by distinct notch; posterolateral margins gently converging towards posterior carapace margin. Ocular peduncle reduced, cornea strongly reduced; eye occupying about half of orbit. Surface of chelipedal carpus rugose; inner margin with one large sublamelliform tooth and one denticle. Ambulatory legs relatively long; meri of third and fourth legs about 5.2 and 3.8 times longer than broad respectively; dactylus of third and fourth legs distinctly longer than propodus. Male abdomen, G1 and G2 not known.

Discussion.—This species is here transferred to *Sundathelphusa* in line with our proposed synonymy of *Archipelothelphusa* and *Sundathelphusa*. Takeda (1983) described this species from one large female and one small male from different caves in Bohol. The holotype female possesses strongly reduced eyes, the cornea being highly degenerated. The paratype male, however, possessed a larger cornea and more developed eyes. Takeda (pers. comm.) has also expressed doubts as to the conspecificity of the two specimens. The localities where the two types were collected (Quinapon-an and Ughob Caves) are on different parts of the island.

The good series of specimens from the Batuan area (where Ughob Cave is located) confirms the suspicion that the specimens which have been previously referred to "*Archipelothelphusa cavernicola*" (fide Takeda, 1983) actually belong to two distinct species, easily separated by the degree of degeneration of the eyes and cornea, as well as proportions of the third ambulatory merus. One species, *S. cavernicola*, is represented only by a single female specimen (the holotype) whilst the others (including the paratype male of *A. cavernicola*) is re-

ferred to *S. sottoae*, new species (see *Discussion* for *S. sottoae*). Unfortunately, no males of *S. cavernicola* are known.

Sundathelphusa sottoae,

new species

Figs. 1B, 2g–k, 4h–l

Archipelothelphusa cavernicola Takeda, 1983:169 (part).

Material examined.—Holotype male (17.3 × 13.4 mm) (NSMT-Cr 8938), in shallow subterranean water, about 50 m from entrance to Ughob Cave, about 2 km southwest of Batuan, 09°46'45"N, 124°07'54"E, Bohol, leg. S. I. Ueno, 28 Feb 1983. Paratype female (26.0 × 21.0 mm) (ZRC 1996.1553), Bonugan, Batuan, Bohol, leg. B. Sket, Feb 1995. Paratype female (28.0 × 25.0 mm) (NMCR), upper part of cave, Bonugan Cave, Batuan, Bohol, leg. B. Sket, Feb 1995. 1 male (14.8 × 12.5 mm) (ULB), Kalumpan, Behind-the-Clouds, Batuan, Bohol, leg. B. Sket, Feb 1995. 1 male (17.4 × 13.8 mm) (ZRC 1996.1548), open well, Batuan, Bohol, leg. B. Sket, Feb 1995.

Description.—Dorsal surface of carapace gently convex; anterolateral regions gently rugose; posterolateral regions covered with oblique striae; cervical grooves distinct but relatively shallow; epigastric cristae low, rugose, barely confluent with low postorbital cristae; postorbital cristae interrupted medially by cervical groove, not reaching epibranchial tooth. Frontal median triangle poorly defined; lateral margins cristate, dorsal margin not cristate and not meeting lateral margins. Anterolateral margin distinctly convex, smooth; epibranchial tooth distinct, separated from external orbital angle by distinct notch; posterolateral margins gently converging towards posterior carapace margin. Ocular peduncle and cornea reduced; eye occupying about 2/3 of orbit. Surface of chelipedal carpus rugose; inner margin with 1 large sublamelliform tooth and one denticle. Ambulatory legs relatively long; meri of third and fourth legs 3.4–3.5 and 3.4–3.6 times longer than broad re-

spectively; dactylus of third and fourth legs distinctly longer than propodus. Male abdomen with segment 6 about 1.1 times longer than broad. G1 slender, gently curved outwards; terminal segment slender, distal part especially slim, about 0.3 times length of subterminal segment. G2 about 1.1 times length of G1; distal segment well developed, about 0.5 times length of basal segment.

Discussion.—*Sundathelphusa sottoae*, new species, is very similar to *S. cavernicola*, both species sharing a high carapace in which the anterolateral margins are gently convex, lateral regions have distinct striae, reduced eyes, as well as elongate ambulatory dactyli. They differ, however, markedly in the condition of the eyes, which in *S. cavernicola* are far more reduced than those in *S. sottoae*. Also distinct are the proportions of the ambulatory legs, with the meri of *S. cavernicola* relatively longer, especially that of the third ambulatory leg (length/width ratio = 5.2 and 3.4–3.5 respectively).

In his description of *S. cavernicola*, Takeda (1983: 172) stated that the paratype male of *S. cavernicola* agrees "... with the holotype female in the general formation of the carapace, chelipeds and ambulatory legs, but the cornea is not as strongly reduced and the eyestalk is slightly movable and occupies about two-thirds the longer axis of the orbit. . . ." Our specimens from the Batuan area, where the paratype male of *S. cavernicola* was collected, has allowed us to ascertain that Takeda's paratype male actually represents *S. sottoae*, and is here chosen as the holotype for this new species.

Two of the larger females from Bonugan Cave (ZRC, NMCR) agree very well with the holotype male for *S. sottoae* and confirms the usefulness of the diagnostic characters used to separate this species from *S. cavernicola*. The identities of the two smaller males (14.8 × 12.5 mm, ULB, and 17.4 × 13.8 mm, ZRC) from Kalumpan and Batuan respectively are more difficult to de-

termine. In general carapace and leg morphology, the Kalumpan and Batuan specimens agree best with the holotype male of *S. sottoae*. They nevertheless differ in having the eye occupying more of the orbit (0.74–0.75 vs. 0.63–0.66), the cornea is proportionately larger (relative to the whole eye) (0.35–0.37 vs. 0.25–0.31), the tooth on the inner angle of the chelipedal carpus proportionately shorter, the length of the last ambulatory dactylus being about 7.1 times longer than the maximum width (excluding spines) (vs. about 10 times), and the median part of the subterminal segment of the G1 being more slender, with the tip of the terminal segment gently but distinctly upturned (vs. straight). These differences suggest the possibility that these specimens represent two species. However, until larger specimens from Batuan and Kalumpan are collected, this cannot be ascertained.

Sundathelphusa sottoae was found in a number of rather diverse habitats, all in the Batuan region in the center of Bohol. Pigmented specimens originate from a surface spring pool. The specimen (male, 17.4 × 13.8 mm, ZRC) from a garden well in the middle of Batuan is pale, while those from within caves (Ughob, Bonugan and Kalumpan: NSMT-Cr 8938, ZRC, NMCR, ULB) are poorly pigmented. Bonugan Cave is one of a chain of caves along the same brook. The substrate of this stream is only moderately enriched with organic matter and the surface fauna (including Anura) is present only near the entrances. In Kalumpan, the crab was found among stones in an illuminated siphon pool which had no direct connection with any surface stream.

Etymology.—The species is named after Prof. Dr. Filipina Sotto of the Marine Biology section at the University of San Carlos, Cebu City, whose help with logistics contributed substantially to the successful expedition.

Sundathelphusa urichi, new species
Figs. 1C, 3a–f, 4m–p

Material examined.—Holotype male (36.6 × 27.9 mm) (NMCR), Quilas Cave,

Nueva Vida Norte, Batuan, Bohol, leg. B. Sket, Feb 1995. Paratype male, paratype female (ULB), 2 paratype males (28.0 × 20.0 mm [crushed], 21.6 × 15.5 mm), paratype female (32.6 × 25.0 mm) (ZRC 1996.1554–1556), same data as holotype. 1 juvenile (NMCR), Quilas Cave, Nueva Vida Norte, Batuan, Bohol, leg. B. Sket, Feb 1995.

Description.—Dorsal surface of carapace strongly convex; anterolateral regions smooth; posterolateral regions with very low oblique striae; cervical grooves deep; epigastric cristae very low, rugose, not confluent with very low postorbital cristae; postorbital cristae interrupted medially by cervical groove, not reaching epibranchial tooth. Frontal median triangle poorly defined; lateral margins cristate, dorsal margin not cristate or meeting lateral margins. Anterolateral margin strongly convex, smooth; epibranchial tooth very low, separated from external orbital angle by faint but distinct notch; posterolateral margins strongly converging towards posterior carapace margin. Ocular peduncle and cornea slightly reduced; eye occupying about 3/4 of orbit. Surface of chelipedal carpus smooth; inner margin with 1 large sublamelliform tooth and 1 denticle. Ambulatory legs relatively long; meri of third and fourth legs about 3.7 and 3.5 times longer than broad respectively; dactylus of third leg subequal to length of propodus; dactylus of fourth leg longer than propodus. Male abdomen with slender segment 6, medially constricted, about 1.2 times longer than broad. G1 slender, gently curved outwards; terminal segment slender, conical, about 0.4 times length of subterminal segment. G2 about 1.2 times length of G1; distal segment well developed, about 0.4 times length of basal segment.

Discussion.—*Sundathelphusa urichi*, new species, differs markedly from *S. sottoae*, new species (which occurs in the same area) in having distinctly proportionately shorter and more falcate ambulatory dactyli (straighter in *S. sottoae*), a distinctly more swollen carapace and more convex

anterolateral margins. In physiognomy, *S. urichi* is closer to *S. vedeniki*, but the carapace of *S. urichi* is distinctly more swollen than *S. vedeniki*.

Sundathelphusa urichi was found only in Quilas Cave, which is in the central plateau east of Batuan. The cave is part of a long chain of chambers with large pools. They do not seem to be connected directly to any permanent surface stream but rather, are fed diffusely or by periodical inputs from the surface. However, the presence of pigmented catfish (Clariidae: *Clarias* sp.) in the cave suggests that a hidden connection to surface waters might exist. The rich organic matter present, mostly detritus from the surface, supports a rich population of shrimps (Decapoda: Atyidae), with amphipods (*Eriopisa* sp.) being less numerous. Many specimens of this amphibious crab were observed.

Etymology.—The present species honours Dr. Peter Urich, a “caver” and socio-geographer, now at the Waikato University, New Zealand. An expert on Boholano society and nature, he efficiently took care of the expedition group.

Sundathelphusa vedeniki,
new species
Figs. 1D, 3g–l, 4q, r

Material examined.—Holotype male (28.2 × 22.3 mm) (NMCR), Boho sa Bikahan, Bikahan, Antequera, Bohol, leg. B. Sket, Feb 1995. Paratype male (33.9 × 26.5 mm) (ZRC 1996.1552), same data as holotype.

Description.—Dorsal surface of carapace distinctly convex; anterolateral regions rugose; posterolateral regions with distinct oblique striae; cervical grooves deep; epigastric cristae low, rugose, not confluent with low postorbital cristae; postorbital cristae interrupted medially by cervical groove, not reaching epibranchial tooth. Frontal median triangle not well defined; lateral margins cristate, dorsal margin weakly cristate and not meeting lateral mar-

gins. Anterolateral margin distinctly convex, smooth; epibranchial tooth well developed to low, separated from external orbital angle by distinct notch; posterolateral margins strongly converging towards posterior carapace margin. Ocular peduncle and cornea slightly reduced; eye occupying about $\frac{3}{4}$ of orbit. Surface of chelipedal carpus smooth; inner margin with 1 large sublamelliform tooth and 1 denticle. Ambulatory legs relatively short; meri of third and fourth legs about 3.2 and 3.0 times longer than broad respectively; dactylus of third and fourth legs subequal to length of propodus. Male abdomen with rectangular segment 6, about 1.1 times longer than broad. G1 slender, gently curved outwards; terminal segment slender, conical, distal part particularly slim, about 0.4 times length of subterminal segment. G2 about 1.0 times length of G1; distal segment well developed, about 0.5 times length of basal segment.

Discussion.—The relatively short ambulatory legs of *S. vedeniki*, new species, allies it with *S. boex*, new species. The leg proportions of *S. vedeniki*, however, are still greater than those of *S. boex*. The G1s of *S. vedeniki* are relatively stouter and the terminal segment straighter than those of *S. boex*. The posterolateral margins of *S. vedeniki* converge towards the posterior carapace margin more strongly than those of *S. boex*, giving it a less squarish appearance. In addition, the carapace of *S. vedeniki* is distinctly more inflated than that of *S. boex*.

Sundathelphusa vedeniki was found in a cave (Boho sa Bikahan) northwest of Antequera which is subjected to periodic resurgence of waters. At the end of the rainy season, the water in the cave is stagnant. There is a large amount of organic debris-like tree branches and leaves in the pools, as well as numerous mollusc shells. Live surface-dwelling gastropods are numerous, particularly a large species of *Brotia*. Also common is a normally pigmented catfish (Clariidae: *Clarias* sp.).

Etymology.—The second author takes pleasure in naming the present species after Mr. Tone Vedenik, the “moving spirit” of the Caving Club “Crni galeb” in Prebold, Slovenia, and its expeditions abroad.

Discussion

The caves where crabs had been collected are mostly of modest dimensions. Some contain sinking streams, while others are primary springs of purely hypogean brooks. The water temperature on average, was between 22.5°C (at 400 m above sea level, below high mountains) and 27–28°C (at sea level). The pH was generally 7.5–8.0. The food resources in the investigated caves are very diverse. While some of them are evidently nutrient-poor, others contain large amounts of plant debris. These are also the ones inhabited by a rich troglone fauna. The most frequently observed animals in these caves are pigmented or troglomorphic shrimps of the family Atyidae (*Caridina* spp.) while Palaemonidae (*Macrobrachium* sp.) are generally rare and never troglomorphic. The relatively large number of crabs as well as large molluscs (including *Brotia* sp. and *Corbicula* sp.) found in the Bohol caves is interesting. It contrasts somewhat with dinaric sinking rivers which are usually richer in insect larvae (Sket 1970, 1979).

With regards to the cavernicolous species discussed here, there are some interesting morphological and ecological trends. *Sundathelphusa cavernicola* is clearly a completely troglomorphic species, with very reduced pigmentation and eyes (Fig. 4g). *Sundathelphusa sottoae* on the other hand, is a less troglomorphic species, with more well developed eyes (Fig. 4h-l) and less obvious loss of pigmentation. *Sundathelphusa urichi* has also been found in one cave only, and while its body is poorly pigmented, the eyes are only slightly reduced (Fig. 4m, p). *Sundathelphusa vedeniki* has been found in nutrient rich caves only but it is probably mainly an epigean species,

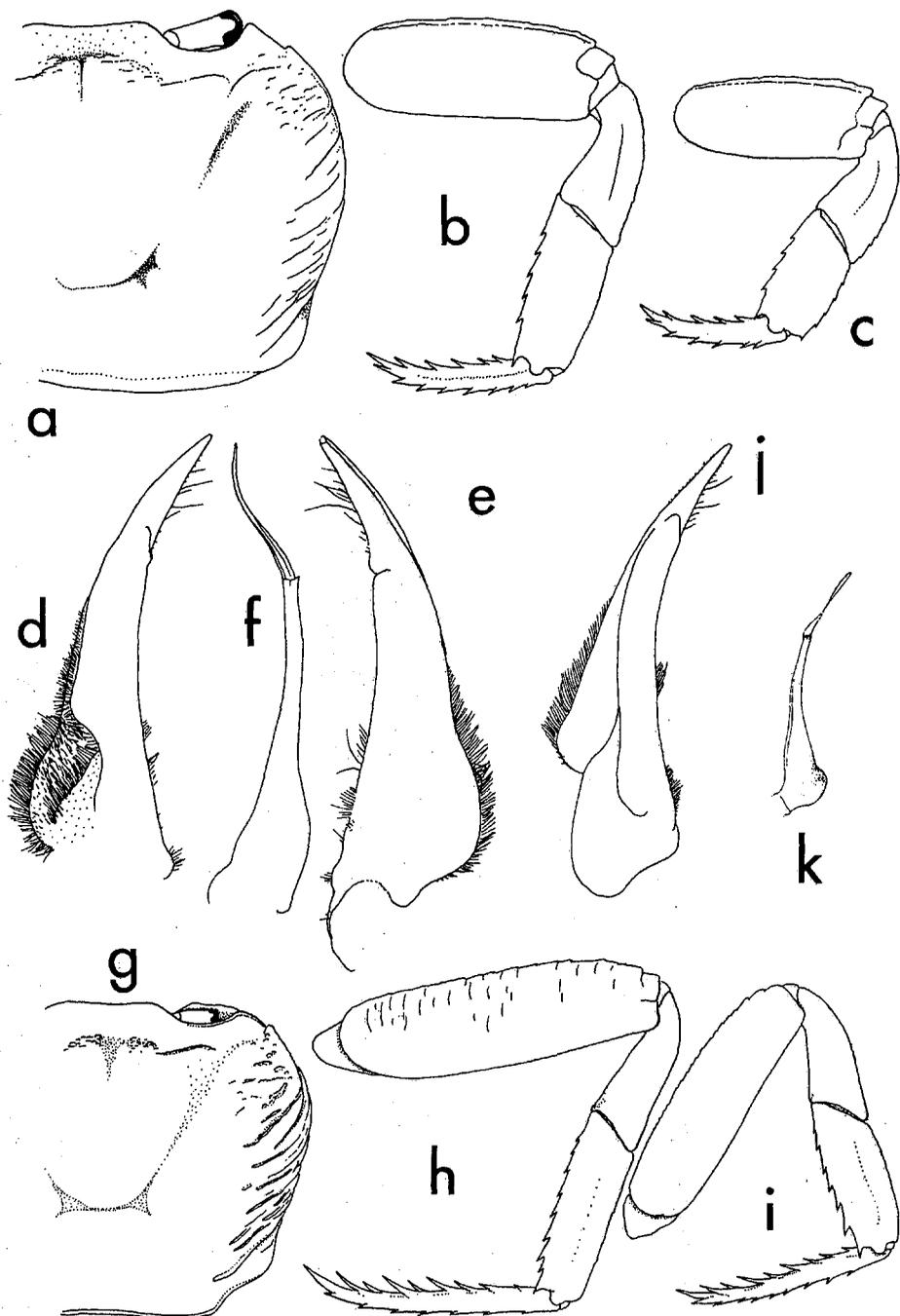


Fig. 2. a-f, *Sundathelphusa boeox*, new species, holotype male (37.4 × 30.9 mm) (NMCR); g, *S. sottoae*, new species, paratype female (26.0 × 21.0 mm) (ZRC 1996.1553); h-k, *S. sottoae*, new species, holotype male (17.3 × 13.4 mm) (NSMT-Cr 8938). a, carapace; b, right third ambulatory leg; c, right fourth ambulatory leg; d, ventral view of left G1; e, dorsal view of left G1; f, left G2; g, carapace; h, right third ambulatory leg; i, right fourth ambulatory leg; j, ventral view of left G1; k, left G2 (after Takeda, 1983) (different scale from j).

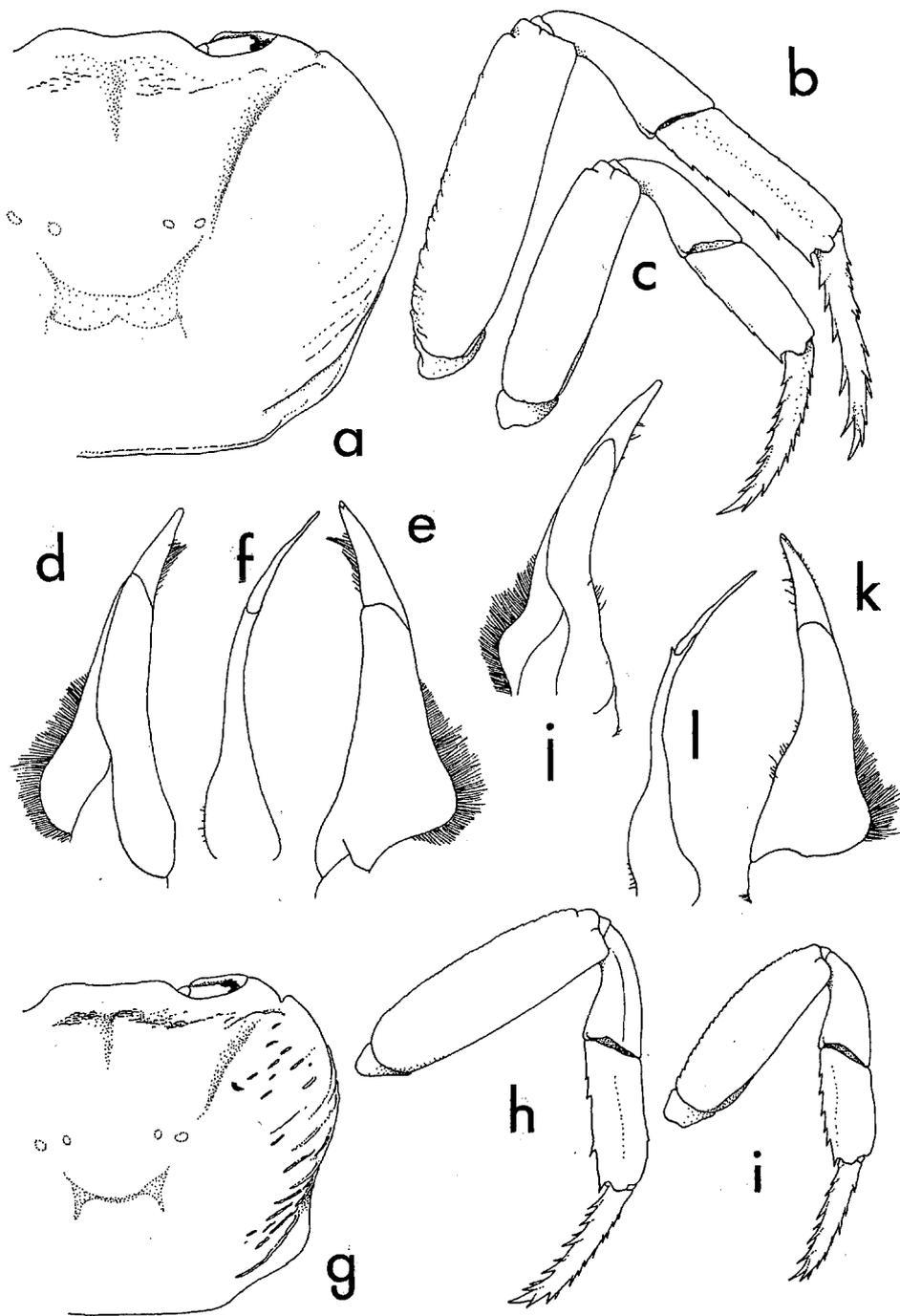


Fig. 3. a-f, *Sundathelphusa urichi*, new species, holotype male (36.6 × 27.9 mm) (NMCR); g-l, *S. vedeniki*, new species, holotype male (28.2 × 22.3 mm) (NMCR). a, carapace; b, right third ambulatory leg; c, right fourth ambulatory leg; d, ventral view of left G1; e, dorsal view of left G1; f, left G2; g, carapace; h, right third ambulatory leg; i, right fourth ambulatory leg; j, ventral view of left G1; k, dorsal view of left G1; l, left G2.

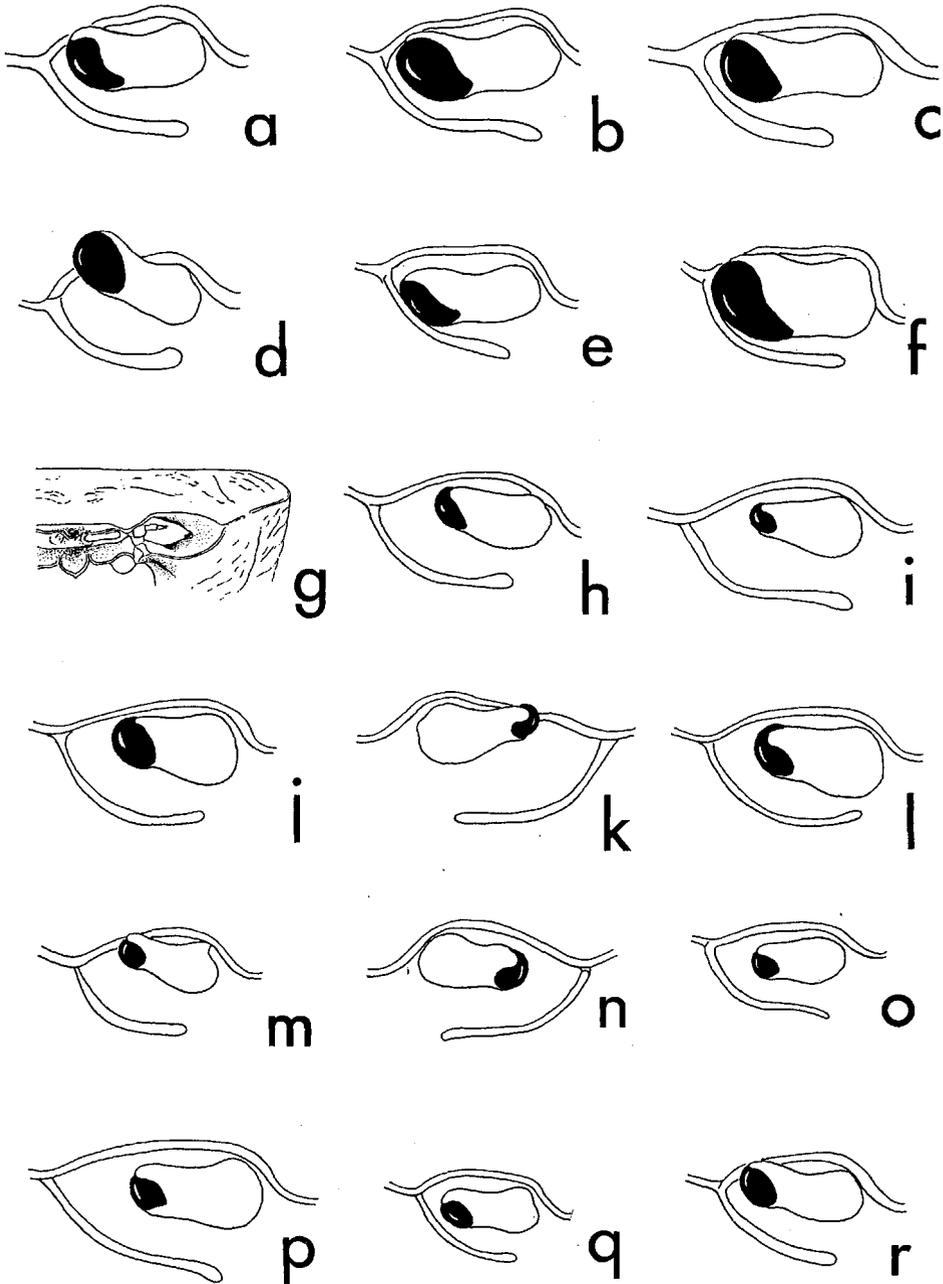


Fig. 4. Orbits and eyes of *Sundathelphusa* species from Bohol. a-f, *S. boex*: a, holotype male (37.4 × 30.9 mm, Sierra Bulliones, NMCR); b, male (24.0 × 20.1 mm, Pahangong Talon, ULB); c, paratype male (41.0 × 33.0 mm, Batuan, ZRC 1996.1549); d, paratype male (34.2 × 27.8 mm, Castigio Cave, ZRC 1996.1550); e, male (34.6 × 28.8 mm, Batuan, NMCR); f, male (10.2 × 8.7 mm, Carmulaon, ULB). g, *S. cavernicola*: holotype female (25.7 by 21.0 mm, Quinapon-an Cave, NSMT-Cr 8937) (after Takeda, 1983: Fig. 2). h-l, *S. sottoae*: h, holotype male (17.3 × 13.4 mm, Ughob Cave, NSMT-Cr 8938); i, paratype female (26.0 × 21.0 mm, Bonugan Cave, ZRC 1996.1553); j, male (17.4 × 13.8 mm, Batuan, ZRC 1996.1548); k, paratype female (28.0 × 25.0 mm, Bonugan Cave, NMCR); l, male (14.8 × 12.5 mm, Kalumpan, ULB); m-p, *S. urichi* (Quilas Cave): m, holotype male (36.6 × 27.9 mm, NMCR); n, paratype male (16.5 × 20.5 mm, ULB); o, paratype male (21.6 × 15.5 mm, ZRC 1996.1555); p, paratype female (32.6 × 25.0 mm, ZRC 1996.1556). q, r, *S. vedeniki* (Boho sa Bikahan): q, holotype male (28.2 × 22.3 mm, NMCR); r, paratype male (33.9 × 26.5 mm, ZRC 1996.1552).

with well developed pigmentation and eyes (Fig. 4g, r) as well as relatively short legs. *Sundathelphusa boex*, with normal eyes (Fig. 4a–f) and short legs, occurs in nutrient rich caves, but is also common in epigeal waters.

With regards to their distributions, *S. boex* is probably a widely distributed species in central and southeastern parts of Bohol, being found in open areas as well as occasionally in caves. The other species seem to have more restricted distributions. In the Antequera area in southern Bohol, two very different species are present, *S. cavernicola* and *S. vedeniki*, the former being troglomorphic. In the central Batuan area, two possibly troglobitic species, *S. urichi* and *S. sottoae* are present. It is important, however, to note that it is possible that with more specimens, what is now regarded as one variable species, i.e., *S. sottoae*, may actually contain two species which differ, among other characters, in their degree of troglomorphism. The presence of several cavernicolous species in one cave system is not surprising (see Holthuis 1979, Ng 1989). It is, however, difficult to ascertain if any species, whether slightly troglomorphic or not, is a true troglobite or just an occasional cave inhabitant, especially since epigeal habitats were not sampled adequately during this study.

It is also of interest to note that another cavernicolous crab of the varunine genus *Orcovita* Ng & Tomascik, 1994 (Grapsidae), has recently been reported from anchialine habitats in Bohol. *Orcovita fictilia* Ng, Guinot & Iliffe, 1996, is known only from Hinagdanan Cave, Panglao, which is southwest of Bohol.

Acknowledgments

The second author thanks all the members of the expedition for their support during the investigations. The expedition was supported by the Ministry of Science and Technology of the Republic of Slovenia, Open Society Fund for Slovenia as well as

by other sponsors, which have been gratefully acknowledged in the general expedition report. The first author thanks Dr M. Takeda (NSMT) for loan of specimens as well as the useful discussions on the identity of *S. cavernicola*.

Literature Cited

- Alcock, A. 1910. Brachyura I. Fasc. II. The Indian freshwater crabs—Potamonidae. Catalogue of the Indian Decapod Crustacea in the collection of the Indian Museum. Calcutta, pp. 1–135, pls. 1–14.
- Balasz, D. 1973. Karts types in the Philippines.—Proceedings of the 6th International Congress on Speleology 2:19–38.
- Balss, H. 1937. Potamoniden (Dekapoda Brachyura) der Philippinen und des Malayischen Archipels.—International Revue des gesellschaft Hydrobiologie und Hydrographie 34(3–5):143–187.
- Bott, R. 1969. Flússkrabben aus Asien und ihre Klassifikation. (Crustacea, Decapoda).—Senckenbergiana Biologica 50(5/6):359–366.
- . 1970. Die Süßwasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte. Eine Revision der Potamoidea und Parathelphusoidea (Crustacea, Decapoda).—Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft 526:1–338.
- Bürger, O. 1894. Beiträge zur Kenntnis der gattung *Telphusa*.—Zoologische Jahrbuchner, Systematics 8:1–7.
- Fabricius, J. C. 1798. Supplementum Entomologiae Systematicae. Hafniae, 572 pp.
- Holthuis, L. B. 1979. Cavernicolous and terrestrial decapod crustacea from northern Sarawak, Borneo.—Zoologische Verhandlungen 171:1–47.
- ICZN (International Commission of Zoological Nomenclature). 1985. International Code of Zoological Nomenclature, 1985. Third Edition. International Trust for Zoological Nomenclature, with the British Museum (Natural History), London, 338 pp.
- Martens, E., von. 1868. Ueber einige neue Crustaceen.—Monatsberichte k.-p. Akademie Wissenschaften Berlin 1868:608–615.
- Milne Edwards, H. 1834. Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et, la classification de ces animaux. 1:i–xxxv, 1–468.
- Milne Edwards, H. 1853. Mémoire sur la Famille des Ocypodiens.—Annales du Science Naturelles, Zoologie (3)20:163–228, pls. 6–11.
- Ng, P. K. L. 1988. The freshwater crabs of peninsular Malaysia and Singapore. Department of Zool-

- ogy, National University of Singapore, Shinglee Press, Singapore, pp. 1-156.
- . 1989. A new cavernicolous freshwater crab, *Thelphusula styx* spec. nov. (Crustacea: Decapoda: Brachyura: Gecarcinucidae), from Gunong Mulu, Sarawak, Borneo.—*Zoologische Mededelingen* 63(6):53-59.
- . 1991. On two species of *Archipelothelphusa* Bott, 1969 (Crustacea: Decapoda: Brachyura: Sundathelphusidae) from Luzon, Philippines, one of which is new.—*Zoologische Mededelingen* 65(2):13-24.
- , D. Guinot, & T. M. Iliffe. 1996. Revision of the anchialine varunine crabs of the genus *Orcovita* Ng & Tomascik, 1994 (Crustacea: Decapoda: Brachyura: Grapsidae), with descriptions of four new species.—*Raffles Bulletin of Zoology* 44:109-134.
- , & M. Takeda. 1992a. The freshwater crab fauna (Crustacea, Brachyura) of the Philippines. I. The family Potamidae Ortmann, 1896.—*Bulletin of the National Science Museum, Tokyo* (A)18(4):149-166.
- , & ———. 1992b. A new freshwater crab of the genus *Geosesarma* De Man, 1892 from the Philippines (Crustacea, Brachyura, Grapsidae).—*Proceedings of the Systematic Society of Japan* 47:29-32.
- , & ———. 1993a. The freshwater crab fauna (Crustacea, Brachyura) of the Philippines. II. The genus *Parathelphusa* H. Milne Edwards, 1853 (Family Parathelphusidae).—*Bulletin of the National Science Museum, Tokyo* (A)19(1): 1-19.
- , & ———. 1993b. The freshwater crab fauna (Crustacea, Brachyura) of the Philippines. III. The identity of *Telphusa cumingii* Miers, 1884, and its placement in the genus *Ovitamon* Ng et Takeda, 1992 (Family Potamidae).—*Bulletin of the National Science Museum, Tokyo* (A)19(3): 111-116.
- , & T. Tomascik. 1994. *Orcovita saltatrix*, a new genus and species of anchialine varunine crab (Crustacea: Decapoda: Brachyura: Grapsidae) from Kakaban Island, Indonesia.—*Raffles Bulletin of Zoology* 42:937-948.
- , & P. Trontelj. 1996. *Daipotamon minos*, a new genus and species of cavernicolous potamid crab (Crustacea, Decapoda, Brachyura) from China.—*Proceedings of the Biological Society of Washington* 109:476-481.
- Sket, B. 1970. Predhodno porocilo o ekoloskih raziskavah v sistemu kraske Ljubljane [Preliminary report on ecological investigations in the Pivka River system in the karts of Slovenia].—*Biologica Vestion* 18:79-87.
- . 1979. Jamska favna Notranjskega trikotnika (Cerknica-Postojna-Planina), njena ogroženost in naravovartveni pomen [The cave fauna in the triangle Cerknica-Postojna-Planina (Slovenia, Yugoslavia), its conservation importance].—*Varstvo Narave, Ljubljana* 12:45-59.
- . 1995. Aquatic hypogean fauna in Bohol (Philippines).—*Resumes du XII Colloque Internationale Biospeleologique*, p. 38.
- Takeda, M. 1983. A new cavernicolous crab from Bohol, the Philippines.—*Bulletin of the National Science Museum, Tokyo* (A)9(4):169-173.
- Trontelj, P. 1996. Speleobiological investigations in Guizho, China.—*Nase Jame, Supplement*, in press.