

REDESCRIPTION OF THE SUBTERRANEAN AMPHIPOD CRUSTACEAN *FLAGITOPISA PHILIPPENSIS* (HADZIOIDEA: MELITIDAE), WITH NOTES ON ITS UNIQUE MORPHOLOGY AND CLARIFICATION OF THE TAXONOMIC STATUS OF *PSAMMOGAMMARUS FLUVIATILIS*

Thomas R. Sawicki and John R. Holsinger

Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529, USA

Boris Sket

Oddelek za biologijo, Biotehniška fakulteta, Univerza v Ljubljani, p.p. 2995, 1001 Ljubljana, Slovenia

Abstract. – *Flagitopisa philippensis* is redescribed on the basis of recent collections from various localities in the Philippine Islands. Paratypes of *Psammogammarus fluviatilis* from a single locality in the Philippines were also examined, and this species, which is closely similar to *F. philippensis*, is reassigned to *Flagitopisa*. Both of these species possess a pair of weakly stalked, subovate “coxal-like” gills attached to the ventral surface of the first pleonal segment, just anterior to pleopod 1. Aside from these two species, pleonite gills with this morphology are unknown in hadzioid amphipods.

Key Words. – Amphipoda, *Flagitopisa*, *Psammogammarus*, Philippines, subterranean.

INTRODUCTION

Niphargus philippensis was described by Chilton (1920) on the basis of specimens collected from a well near Los Baños, on the southern shore of Laguna de Bay, Luzon Island, Philippines. The species was later reassigned to the genus *Eriopisa* (Gauthier 1936; Monod 1938; Stock & Nijssen 1965; Stock 1980). Karaman & Barnard (1979) and Barnard & Barnard (1983) placed the species in the genus *Psammogammarus*. Finally, G. Karaman (1984) placed the species into a new genus *Flagitopisa* but gave little reason for doing so except that *F. philippensis* was the only freshwater species in the *Eriopisa* complex, which otherwise consisted of the genera *Eriopisa*, *Victoriopisa*, *Tunisopisa* and *Psammogammarus*.

Stock (1987) questioned the genus *Flagitopisa* and later (Stock 1991) described a new species, *Psammogammarus fluviatilis*, the type-locality being only 25 km from the type-locality of *F. philippensis*. Stock (1991) described *P. fluviatilis* as being morphologically very similar to *F. philippensis*, differing primarily by an overall smaller body size, shorter, less spinose uropod 3, and with a coxal gill on pereopod 7.

The rich samples of *F. philippensis* from groundwater habitats on Bohol Island made us aware of a unique character, which consists of a pair of large subovate gills attached to the ventral side of pleonite 1. Further study of specimens from Luzon,

including Stock's paratypes, have shown that Chilton (1920) simply ignored these (and the other) gills, while Stock (1991) erroneously described the large gill on the first pleonite as being on the seventh pereopod. Examination of specimens from populations in different geographic locations in the Philippine archipelago resulted in our recognition and description of this highly unusual character.

SYSTEMATICS

Flagitopisa G. Karaman, 1984

Flagitopisa G. Karaman, 1984: 49-50.

Type species. – *Niphargus philippensis* Chilton, 1920 by monotypy

Diagnosis. – Corresponding to the diagnosis given by Karaman (1984) with the following addition: one pair of weakly stalked, subovate, coxal-like gills attached to the ventral surface of the first pleonal segment, just anterior to pleopod 1. Largest males 7.0 mm; largest females 6.5 mm.

Flagitopisa philippensis (Chilton, 1920)

(Figs. 1-5)

Niphargus philippensis Chilton, 1920: 515-521, Pls. 1-3.
Flagitopisa philippensis (Chilton) - G. Karaman, 1984: 50.

Psammogammarus philippensis (Chilton) - Stock, 1991: 231, 233.
Eriopisa sp.- Sket, 1995, 1997 (in part: specimens from Bohol only).

Material examined. – 20 specimens (males & females) (USNM acc. 364310), well at Tigaon, Camarines Sur Province, Luzon Island, coll. T. M. Iliffe, 4 Apr.1985; 6 specimens (males and females) (USNM acc. 364310), well, Pinet Ocampo, coll. T. M. Iliffe, 4 Apr.1985. 100 + specimens (males, females and juveniles) from Bohol Island as follows: Maitom Cave in Behind-the-Clouds, Batuan, coll. B. Sket, Feb.1995; Quilas Cave in Nueva Vida Norte, Batuan, coll. B. Sket, Feb.1995; pump wells in Tejero, coll. B. Sket, Feb.1995; open well, in Batuan, coll. B. Sket, Feb.1995; pump well in Bungamar, coll. B. Sket, Feb.1995; spring below C. Serapia, Ginjuyuran, coll. B. Sket, Feb.1995; spring below cave Serapia, coll. B. Sket, Feb.1995; spring-cave Anislag, Valencia, coll. B. Sket, Feb.1995; spring Badyang, Valencia, coll. B. Sket, Feb.1995; spring Badyang in Omhon, Valencia, coll. B. Sket, Feb.1995; spring 1, Roxas Park in Roxas, Garcia-Hernandez, coll. B. Sket, Feb.1995; spring 2, Roxas Park, coll. B. Sket, Feb.1995; cave Inambokan Boho in Villa Aurora, Antequera, coll. B. Sket, Feb.1995.

The material examined during the present study includes specimens from the National Museum of Natural History of the Smithsonian Institution (USNM), numerous specimens collected by B. Sket and deposited in the J. R. Holsinger research collection, and paratypes on loan from Amsterdam University. Largest males are 7.0 mm in length; largest females are 6.5 mm.

Diagnosis. – *Flagitopisa philippensis* is clearly distinguished from all other hadzioid amphipods except *F. fluviatilis* (see below) by presence of a pair of conspicuous subovate gills attached to ventral surface of the first pleonite.

Description of female. – Antenna 1 ca. 1.4 times longer than body and 3.2 times longer than antenna 2; primary flagellum with up to 44 segments, accessory flagellum 2 segmented (tiny second segment not shown in Fig. 1A). Antenna 2: flagellum with up to 7 segments. Mandible: right mandible molar well developed, with molar seta, lacinia mobilis 3 dentate; incisor 6 dentate, with 8 serrate accessory spines and 4 small setae; left molar prominent, with molar seta, lacinia mobilis 6 dentate, incisor 7 dentate; palp segment 3 with 4-5 D setae and 4 E setae. Lower lip with inner lobes. Maxilla 1: inner plate with up to 15 apical plumose setae; outer plate with 9 pectinate spines; palps 2-segmented, second segment bearing 8 spines and 2 long setae apically. Maxilla 2: inner plate bearing dorsal oblique row of up to 20 setae, inner and apical margins bearing numerous setae. Maxilliped: inner plate narrow, bearing 2 spines along inner apical margin and 8-9 spines along apical margin; outer plate expanded with numerous long setae along inner and apical margins; palp 4-segmented, segment 2 with numerous long setae along inner margin, segment 3 longer than wide, weakly pubescent distally.

Gnathopod 1: propodus ca. 72% length of carpus, palm transverse bearing 7-8 long setae and up to 6 small setae medially and 8 spines, 4 of which are bifurcate at the defining angle; dactyl subequal in length to palm; carpus elongate, posterior margin with numerous long setae; merus expanded distally, pubescent, with up to 10 setae along distoposterior

margin; basis with 9 long setae along posterior margin; coxa deeper than broad with 8 marginal setae. Gnathopod 2: propodus elongate and expanded, ca. 1.7 times longer than carpus, palm oblique with 5 long setae and 6 short setae and 2 stout spines medially, defining angle with 2 spines and 2 long setae; propodus posterior margin bearing numerous setae; carpus weakly subtriangular, posterior margin with 5 sets of setae; basis with 4 sets of long setae on posterior margin and few shorter setae on anterior margin; coxa only slightly deeper than broad with 10 marginal setae. Pereopod 3: subequal in length to 4, coxa about as deep as broad with 10 marginal setae; basis expanded with 7 long setae on posterior margin. Pereopod 4: coxa posterior margin not excavate, slightly broader than deep with 8 marginal setae; basis expanded with 8 long setae on posterior margin. Pereopod 5 ca. 44% length of body; basis weakly expanded, distoposterior lobe not developed; dactyl ca. 16% length of propodus. Pereopod 6 ca. 71% length of body; basis posterior margin expanded relative to pereopod 5, distoposterior lobe well developed; dactyl ca. 16% length of propodus. Pereopod 7 ca. 75% length of body; posterior margin of basis expanded greatly, distoposterior lobe well developed, its width about 50% the length of the basis; dactyl ca. 22% length of propodus. Coxal gills on pereopods 2-6, subovate, with distinct peduncles; brood plates subequal in length to gills, narrow, with small lateral and distal setae.

Pleonite 1 with pair of weakly stalked, subovate coxal-like gills attached to ventral surface, just anterior to pleopod 1. Distoposterior margin of pleonal plate 1 rounded, with 6 small spines; distoposterior margins of pleonal plates 2 and 3 less rounded, both posterior and ventral margins with many small spines. Pleopods normal, each bearing 2 coupling spines. Uropod 1: outer ramus ca. 89% length of inner, bearing 5 apical and 4 lateral spines; inner ramus ca. 79% length of peduncle with 5 apical and 4 lateral spines; peduncle with 13 spines, 1 of which is basofacial. Uropod 2: outer ramus ca. 72% length of inner ramus, bearing 3 apical and 4 lateral spines; inner ramus slightly longer than peduncle, with 6 apical and 3 lateral spines; peduncle with up to 4 spines. Uropod 3: ca. 48% length of body; inner ramus small, scale-like, with small apical seta; peduncle long, ca. 40% length of segment 1 of outer ramus; outer ramus 2-segmented, first segment armed with numerous clusters of spines, second segment ca. 48% length of segment 1, with 7 long, thin setae apically and numerous lateral spines. Telson short, cleft to base, wider than long, each half bearing 3 lateral and 2 apical spines (the second apical spine being much smaller).

Male. – Differing only slightly from the female as follows: palm of propodus of gnathopod 2 with additional spines and setae. Propodus of gnathopod 2 in mature males may be nearly twice as long as carpus. (period) Basis of pereopod 7 may be narrower, its width only only 65% of length. Uropod 3 may be 60 % as long as body length, with peduncle up to 60 % length of segment 1 of outer ramus.

Type-locality. – A well at Los Baños, Laguna Province, on the south shore of Laguna de Bay, 25 km SW of Santa Cruz and 54 km SE of Manila.

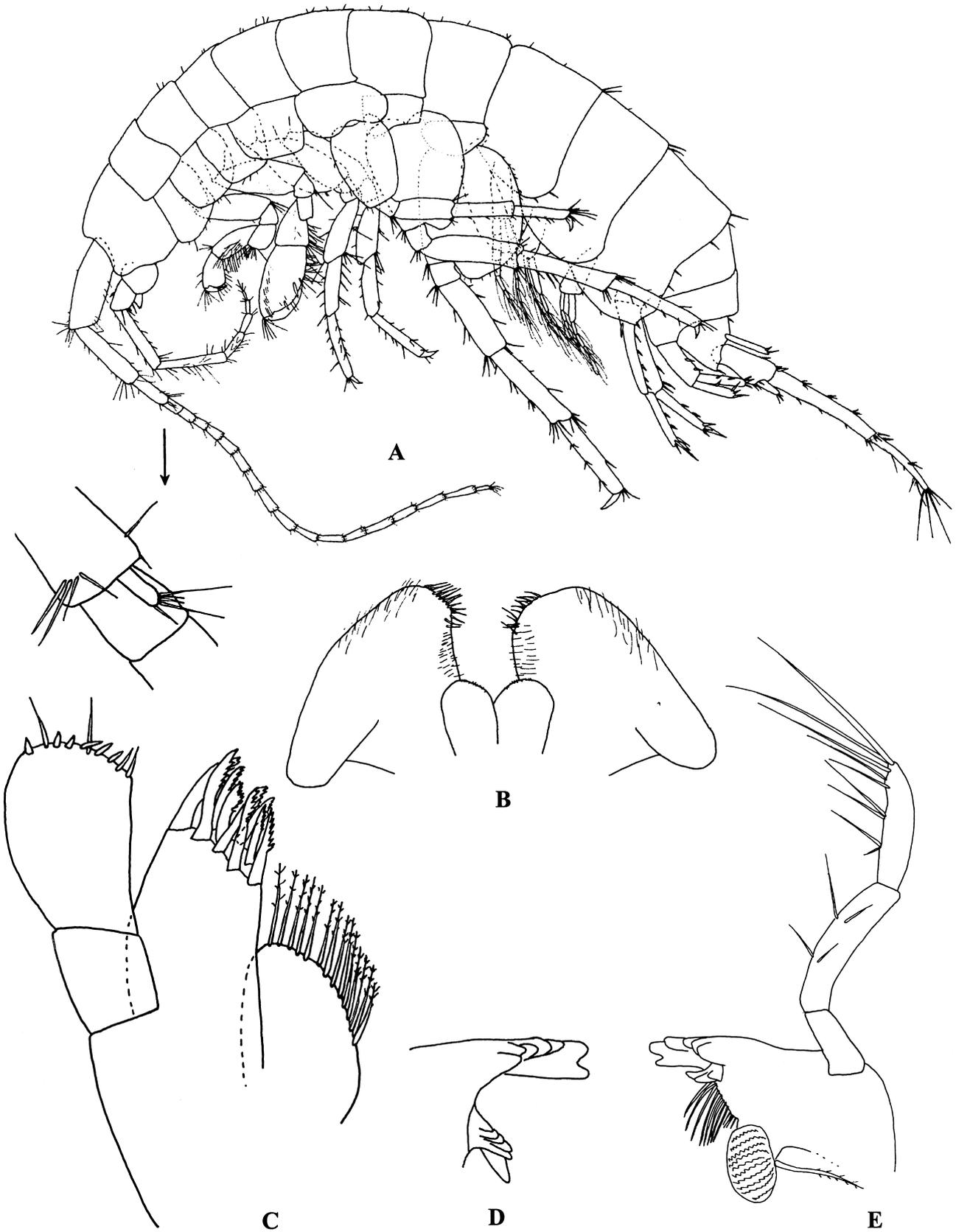


Fig. 1. *Flagitopisa philippensis*, Spring 1, Roxas Park, Bohol Island, Philippines. Male (5.0 mm): A, whole animal. Male (7.0 mm): B, lower lip; D, left mandible incisor and lacinia mobilis; E, right mandible. Female (6.0 mm): C, maxilla 1.



Fig. 2. *Flagitopisa philippensis*, Spring 1, Roxas Park, Bohol Island, Philippines. Male (7.0 mm): A, gnathopod 1; B, enlarged distal end of propodus and dactyl of gnathopod 1; C, gnathopod 2; D, enlarged distal end of propodus and dactyl of gnathopod 2.

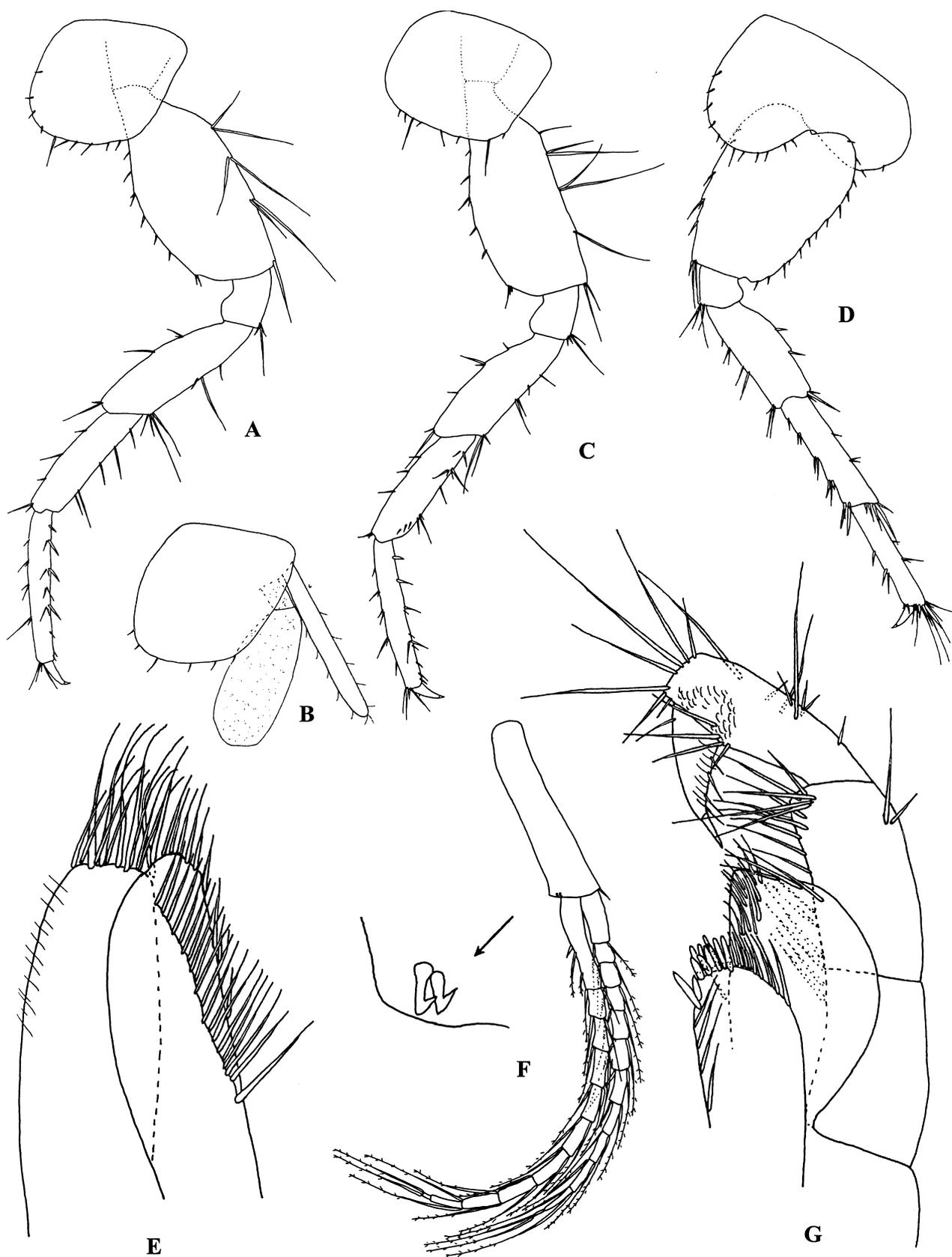


Fig. 3. *Flagitopisa philippensis*, Spring 1. Roxas Park, Bohol Island, Philippines. Male (7.0 mm): A, pereopod 3; C, pereopod 4; E, maxilla 2; F, pleopod 1 (coupling spines enlarged); G, maxilliped. Female (6.0 mm): B, pereopod 3 coxal plate with brood plate and gill; D, pereopod 5.

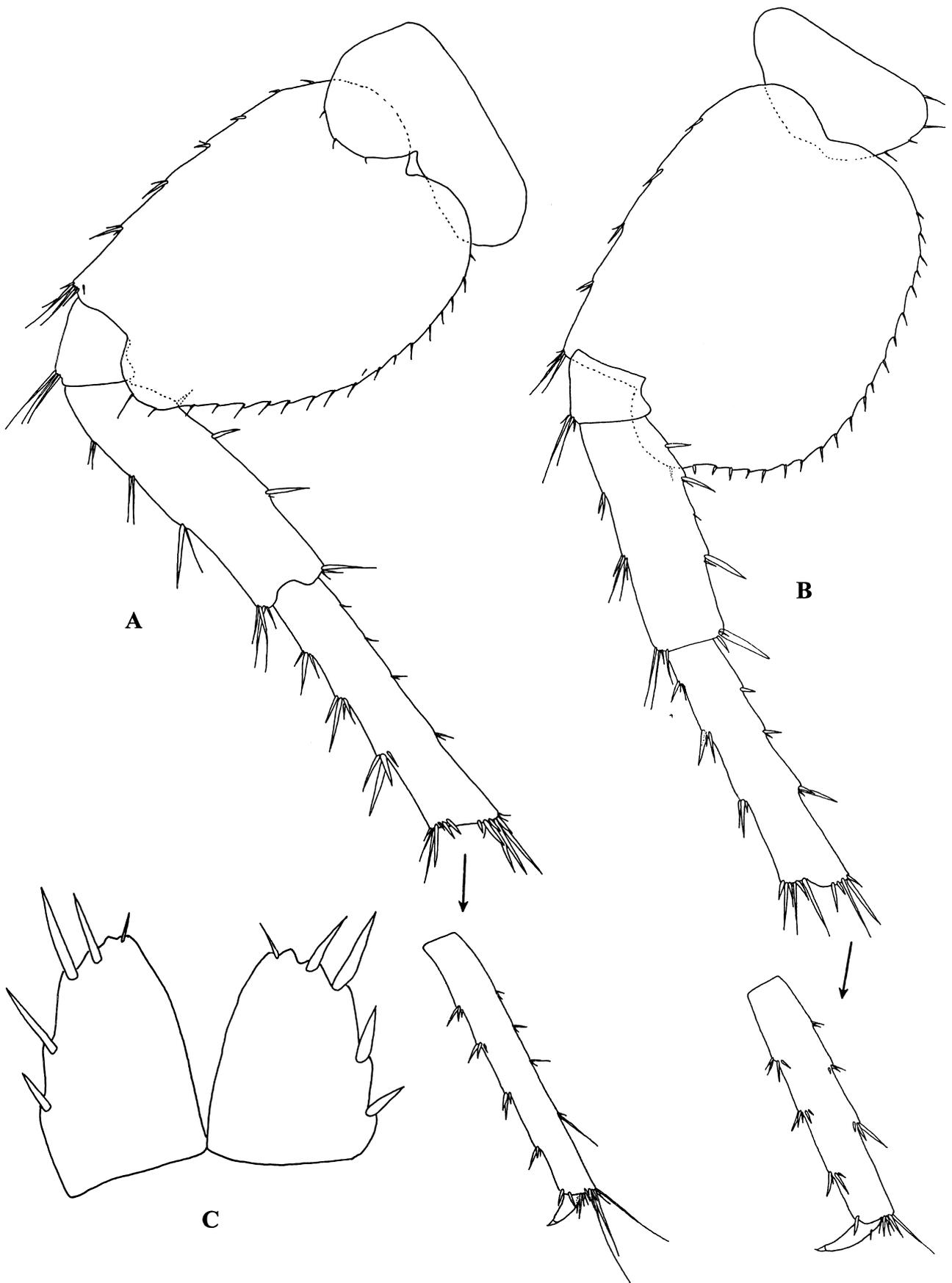


Fig. 4. *Flagitopisa philippensis*, Spring 1, Roxas Park, Bohol Island, Philippines. Male (7.0 mm): A, pereopod 6; B, pereopod 7. Female (6.0 mm): C, Telson.

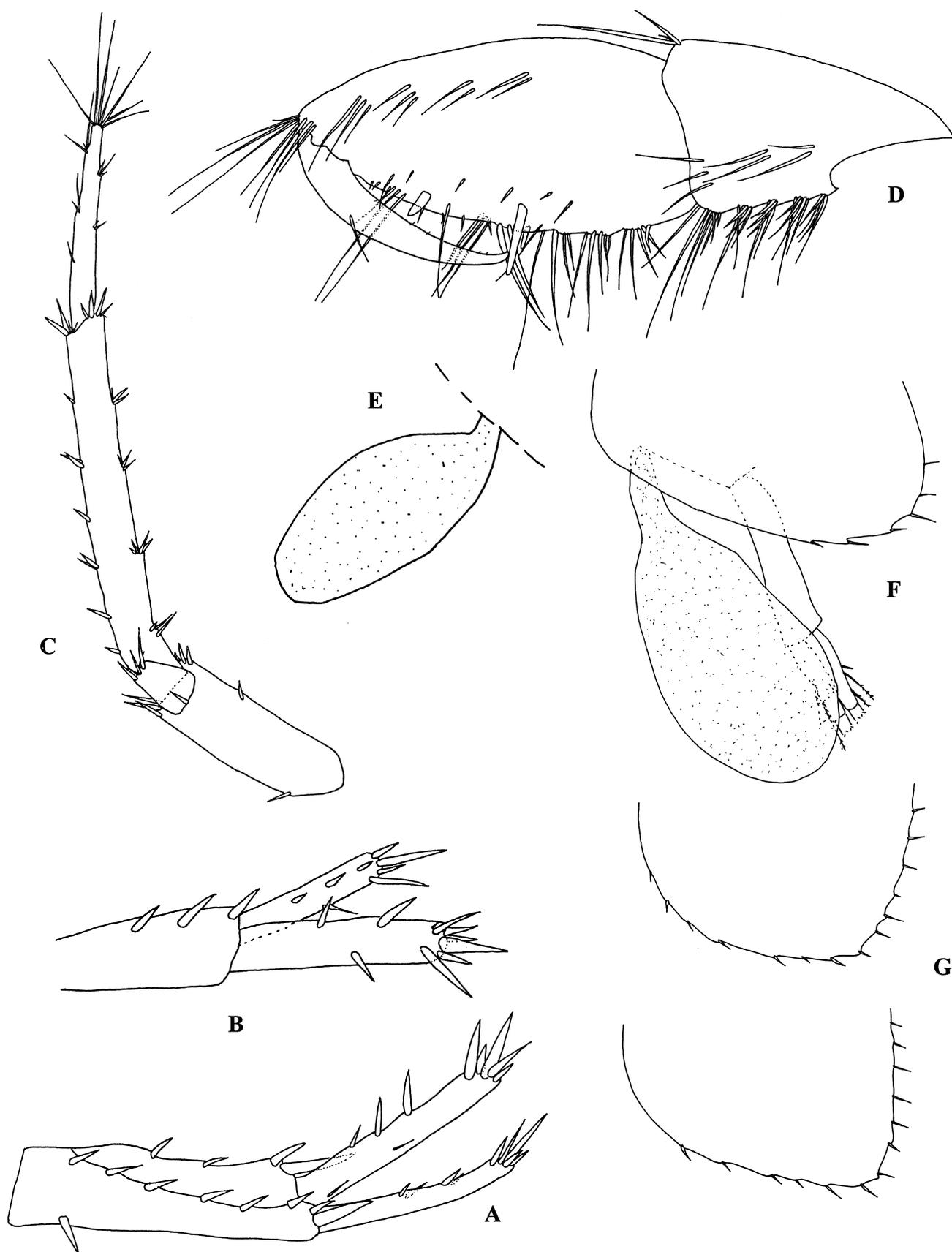


Fig. 5. *Flagitopisa philippensis*, Spring 1, Roxas Park, Bohol Island, Philippines. Male (7.0 mm): A, uropod 1; B, uropod 2; F, pleonal plate 1 with gill attached anterior to pleopod 1; G, pleonal plates 2 and 3. Female (6.0 mm): C, uropod 3; D, carpus and propodus of gnathopod 2; Spring 2, Roxas Park, Bohol Island, Philippines. Second Female (6.0 mm): E, pleonal gill drawn from opposite perspective.

Distribution and Ecology. – Until recent years, *Flagitopisa philippensis* was known only from its type locality. In April of 1985, Thomas M. Iliffe collected the species from two new, separate locations, both being wells on Luzon Island in Camarines Sur Province. In February of 1995, one of us (BS) made numerous collections of this species from wells and springs on the island of Bohol in the Philippines, marking a significant range extension for *F. philippensis*. Subsequent to collections from the above mentioned localities in 1995 (see Material Examined), new localities were established in 1999 in the Antequera region (cave Tubang in Celang; Bongcawi Cave in Villa Aurora, Camantong Cave in Quinapon-an; Kanador Cave in Canla-as) and near Jagna (Kabulihan Cave in Odiong). This species appears to be present throughout that part of Bohol Island, which was biospeleologically investigated and includes the area within the triangle formed by Jagna – Sagbayan – Antequera. It appears to be the only amphipod of this territory and is replaced by one species of *Hadzia* and two of *Tegano* in anchialine caves of tiny Panglao Island just 1 km off the southwestern corner of Bohol Island (Sawicki et al., 2004, 2005) and probably in some coastal localities of Bohol itself. *Flagitopisa* was found in caves, wells, and some springs, and it occupies subterranean waters in karst voids but apparently also inhabits fresh interstitial water in coarse sands close to the shore. Its most common cohabitants are shrimps of the genus *Caridina* (Atyidae) and quite often also crabs *Sundathelphusa* spp. (Parathelphusidae). Both of these crustacean groups are represented in Bohol by troglomorphic

and non-troglomorphic species (Sket, 1995, 1997; Ng & Sket, 1996). Given the presently known disjunct distributional pattern of *F. philippensis* (Fig. 6), it is probable that this species inhabits other, less investigated, parts of the Philippine archipelago, especially in areas between Manila in Luzon and Bohol.

Flagitopisa fluviatilis (Stock), new combination

Psammogammarus fluviatilis Stock, 1991:227-233. [type-locality: Pagsanjan Falls, Laguna Province, Luzon Island, Philippines].

Material Examined. – PHILIPPINES. 6 paratypes (Zoological Museum, Amsterdam University, ZMA AMPH. 108811) from interstices in coarse sand on bank of Pagsanjan Falls, Laguna Province, Luzon Island.

Diagnosis. – *Flagitopisa fluviatilis* is morphologically closely similar to *F. philippensis* and distinguished from the latter primarily by overall smaller body size and length and spination of uropod 3. Otherwise corresponding to the diagnosis given by Stock (1991).

Remarks. – Stock (1987) questioned the diagnosis of the monotypic genus *Flagitopisa* by Karaman (1984) on the premise that this genus was described largely on the basis of plesiomorphic characters. Stock (1991) described the new species *Psammogammarus fluviatilis* and noted the presence of a large “coxal” gill on pereopod 7. Examination of the paratypes of *P. fluviatilis* during this study indicates that the gill is attached to the ventral surface of the first pleonal segment (pleonite 1), just anterior to pleopod 1. *Psammogammarus fluviatilis* and *F. philippensis* are synapomorphic for this highly unusual character and are otherwise morphologically very similar. Based on its overall morphological similarity to *F. philippensis* and possession of this highly unusual pleonal gill, *P. fluviatilis* is reassigned to *Flagitopisa*. Despite the rejection of the genus *Flagitopisa* by Stock (1987), the name *Flagitopisa* is available according to the International Code of Zoological Nomenclature and is therefore used here for this unique genus.

DISCUSSION

Recent collections of *Flagitopisa philippensis* have extended the range of this species to Bohol, approximately 550 km SSE of the type locality (Fig. 6). This significant range extension and recognition of the large, subovate “coxal-like” gills attached to the ventral surface of the first pleonite have necessitated the redescription of the species. Chilton’s original description of this species, although relatively good for the standards of that day, lacked the mention of gills and failed to recognize the conspicuous gills on pleonite 1.

Psammogammarus fluviatilis, which we have reassigned to the genus *Flagitopisa* herein, was described by Stock (1991) from coarse sand interstices on the bank of Pagsanjan Falls in Laguna Province on Luzon Island. In his description of this species, a coxal gill was said to occur on the seventh

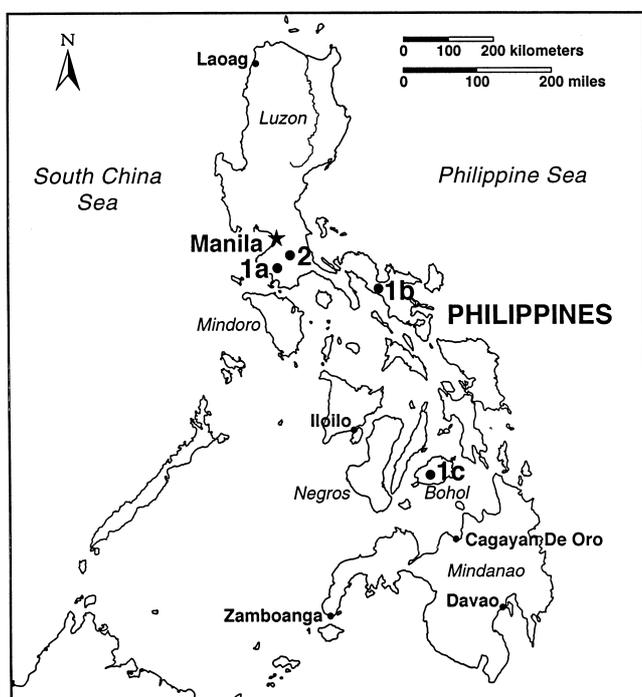


Fig. 6. Distribution of *Flagitopisa* in the Philippine archipelago. Solid circles indicate known localities as follows: 1a) *Flagitopisa philippensis*—Type-locality, Luzon Island, near Los Baños, on the southern shore of Laguna de Bay; 1b) Luzon Island, in the Camarines Sur Province, approximately 240 km SE of the type locality; 1c) the island of Bohol, approximately 550 km SSE of the type locality; 2) *Flagitopisa fluviatilis*—Luzon Island, Laguna Province, Pagsanjan Falls.

pereopod and was considered a plesiomorphic character (Stock 1991). Although *F. fluviatilis* was found in an area only 25 km from the type locality of *F. philippensis*, Stock noted that his material differed from the latter in having an overall smaller body size, and a shorter, less spinose uropod 3. As pointed out below, these small differences may well be influenced by adaptation of this species to an interstitial environment. In contrast, *F. philippensis*, which appears to reach sexual maturity at a larger size, has been collected mainly from wells and springs, where it apparently inhabits more "open" subterranean water, with larger living space. Stock (1991) also suggested that segment 3 of the maxilliped palp was elongate in *F. fluviatilis* and globular in *F. philippensis*, but our comparison of the paratypes of *F. fluviatilis* with recently collected specimens of *F. philippensis* revealed no difference in this character between the species. This mistake can be attributed to Chilton's original figure, which erroneously showed segment 3 of the maxilliped palp to be globular in shape.

Examination of the paratypes of *F. fluviatilis* clearly shows that the "coxal gill" described by Stock (1991) as being attached to the base of pereopod 7 is in fact attached to the ventral surface of pleonite 1, and is therefore identical to the pleonite "coxal-gill" of *F. philippensis*. Outside these two species, we know of no other species of hadzioid amphipods with gills or gill-like structures on the pleonites. However, pleonite gills do occur in some species of crangonyctid amphipods, but in this group they differ from the pleonite gill in *Flagitopisa* and in marked contrast are slender, "finger-like" processes lacking a stalk or peduncle. The occurrence of this unique structure in these Philippine stygobionts is apparently an unusual apomorphic character that alone clearly distinguishes *Flagitopisa* from *Psammogammarus*, *Eriopisa*, *Victoriopisa*, and *Tunisopisa*, the genera traditionally placed in the *Eriopisa* complex (Van Der Ham and Vonk 2003).

Based on a cladistic analysis of species within the *Eriopisa* complex, Van Der Ham and Vonk (2003) concluded that *Psammogammarus* and *Eriopisa* did not form separate clades and maintaining separate genera for these species could not be justified. These conclusions were based on the fact that the exclusion of *P. philippensis* and *P. fluviatilis* would make the genus *Eriopisa* paraphyletic. Although we might be persuaded to accept paraphyletic taxa under very exceptional circumstances, this is not necessary when raising the now well supported monophyletic *philippensis-fluviatilis* complex (see this text) to the generic level. For example, the cladistically well supported monophyletic *epistomata-australiensis-chilkenis-atlantica-papiae-ryukyuensis* species complex (see Van Der Ham and Vonk, 2003) could also be raised to the generic level. Karaman (1984) made two names available for this genus, with *Victoriopisa* G. Karaman and Barnard (1979) having priority. When doing so, the next most basal branch consisting of *philippensis* and *fluviatilis* is the sister clade to the rest of *Eriopisa*. Moreover, considering the significance of the synapomorphic pleonal gill of the two species of *Flagitopisa*, which was not recognized in the cladistic analysis of Van Der Ham and Vonk (2003), there is no doubt that this genus would cluster in a very different

position in a future analysis that utilized this character. It is our opinion that *Flagitopisa* is clearly a separate clade vis-a-vis both the *Eriopisa/Psammogammarus* and *Victoriopisa* clades, and that recognition of the genus *Flagitopisa* does not violate any cladistic and/or taxonomic principles.

Despite the closely similar morphology of *F. philippensis* and *F. fluviatilis*, the differences between the two are greater than between the geographically widely separated populations of the former species in the Philippine archipelago (Fig. 6). Although we attribute much of the difference between these species to size-related changes associated with *ad hoc* adaptations for living in structural different subterranean habitats, we agree with Stock (1991) that *F. fluviatilis* should remain a separate species.

ACKNOWLEDGMENTS

We are grateful to Yolanda Iliffe, Dr. Thomas Iliffe and the late Dennis Williams for their assistance with the fieldwork in the South Pacific in 1985 and our appreciation is extended to Dr. Pedro C. Gonzales and staff of the National Museum of the Philippines for assistance in the Philippine Islands. Special thanks are extended to the members and sponsors of two Solvene international caving expeditions to the Philippines in 1995 and 1999 (see Vedenik, 1997; Ulrich et al., 1997) that enabled one of us (BS) to carry out fieldwork under pleasant conditions. We thank Donald Emminger of the Graphics Office at Old Dominion University for preparation of the distribution map, and Drs. Kent E. Carpenter and Michael F. Gable for reading parts of the manuscript and making helpful suggestions for improvement. Parts of this study were supported by funding from the National Science Foundation, including a grant to T. M. Iliffe (BSR-8417494) for biological collecting in the South Pacific and a PEET grant to J. R. Holsinger (DEB-9521752) for taxonomy. In addition, grants from Slovenian authorities supported fieldwork in the Philippines in the 1990s.

LITERATURE CITED

- Barnard, J. L. & C. M. Barnard, 1983. *Freshwater Amphipoda of the World*, Parts I & II. Hayfield Associates, Mt. Vernon, Virginia. Pp. 1-830.
- Chilton, C., 1920. *Niphargus philippensis*, a new species of amphipod from the underground waters of the Philippine Islands. *The Philippine Journal of Science*, **17**: 515-523.
- Gauthier, H., 1936. *Eriopisa seurati*, nouvel amphipode du Sud-Tunisien. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord*, **27**: 133-143.
- Karaman, G. S., 1984. Revision of the *Eriopisa*-Complex of genera (Gammaridea) (Contribution to the Knowledge Contribution to the Knowledge of the Amphipoda 139). *Poljopriveda I Sumarstvo*, **30**: 39-72.
- Karaman, G. & J. L. Barnard, 1979. Classificatory revision in gammaridean Amphipoda (Crustacea), part 1. *Proceedings of the Biological Station of Washington*, **92**: 106-165.

- Monod, T., 1938. Sur un localité nouvelle d'*Eriopisa seruati* H. Gauthier, 1936. *Bulletin de la Société Zoologique de France*, **63**: 244-247.
- Ng, P. K. L. & B. Sket, 1996. The freshwater crab fauna (Crustacea: Brachyura) of the Philippines. IV. On a collection of Parathelphusidae from Bohol. *Proceedings of the Biological Society of Washington*, **109**(4): 695-706.
- Sawicki, T. R., J. R. Holsinger & T. M. Iliffe. 2004. Four new species of the subterranean amphipod genus *Hadzia* (Hadziidae) from caves in the western Pacific, with a re-evaluation of the taxonomic status of the genus. *Subterranean Biology*, **2**: 65-90.
- Sawicki, T. R., J. R. Holsinger & T. M. Iliffe, 2005. New species of amphipod crustaceans in the genera *Tegano* and *Melita* (Hadzioidea: Melitidae) from subterranean groundwaters in Guam, Palau, and the Philippines. *Journal of Crustacean Biology*, **25**(1): 49-74.
- Sket, B. 1995. Aquatic hypogean fauna in Bohol (Philippines) (abstract). Resumes du XII Colloque International De Biospeologie, p. 38.
- Sket, B., 1997. Podzemeljska vodna favna na otoku Bohol, Filipini (Hypogean aquatic fauna in Bohol Island, Philippines). *Naše jame*, **39** (Suppl.): 62-67.
- Stock, J. H., 1980. The right generic names of some Amphipoda. *Annals and Magazine of Natural History*, **5**(6): 192-194.
- Stock, J. H., 1987. *Psammogammarus initialis* n. sp., a new mediolittoral interstitial amphipod crustacean from Tenerife. *Stygologia*, **3**: 264-277.
- Stock, J. H., 1991. A new species of *Psammogammarus* (Amphipoda, Melitidae) from river alluvia in Luzon, Philippines. *Stygologia*, **6**: 227-233.
- Stock, J. H. & H. Nijssen, 1965. *Eriopisa longiramus* n. sp. a new subterranean amphipod from a Red Sea island. *Bulletin of the Sea Fisheries Research Station state of Isreal*, **38**: 28-39.
- Urich, P., G. Madronero, T. Vedenik & J. Prestor, 1997. International caving expedition Philippines 1995. *Naše jame*, **39** (Suppl.): 15-21.
- Van Der Ham, J. L. & R. Vonk, 2003. A phylogenetic analysis of the *Eriopisa* complex (Crustacea: Amphipoda: Melitidae) and a new species from beach interstitial in Venezuela. *Journal of Natural History*, **37**: 779-796.
- Vedenik, T. 1997. 1. Slovenska mednarodna jamarska odprava Filipini 1995 (1st Slovenian international caving expedition Philippines 1995). *Naše jame*, **39** (Suppl.): 7-14.