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Redescription of *Bathygyge grandis* Hansen, 1897 (Crustacea, Isopoda, Bopyridae) from Southern California with Erection of a New Subfamily, Bathygyginae

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Hansen (1897), dealing with only fragmentary material, erected the genus *Bathygyge* with *B. grandis* as its type-species as one of the earliest bopyrid species known from the eastern Pacific Ocean. *Bathygyge grandis* was first recorded as a parasite of the deep-water crangonid shrimp *Glyphocrangon spinulosa* Faxon from off the coast of Acapulco, Mexico. It has since been reported from several different localities worldwide as a parasite of other species of *Glyphocrangon*, but it has never been properly described. Material that recently became available from near the type-locality has made it possible to correct that situation.

Order Isopoda Latreille, 1817
Suborder Cymothoidea Wägele, 1989
Family Bopyridae Rafinesque-Schmaltz, 1815
Subfamily Bathygyginae, subf. n.

Genus *Bathygyge* Hansen, 1897
Type-species, by monotypy, *Bathygyge grandis* Hansen, 1897
Bathygyge grandis Hansen, 1897
Figs. 1–2

Bopyrus – Faxon, 1895: 140 [Type-material later described].

Bathygyge grandis Hansen, 1897: 122-124; pl. V, figs. 2-2c [Pacific Ocean, off Acapulco, Mexico, 21°15'N, 106°23'W, 676 fm {= 1236m}; infesting *Glyphocrangon spinulosa* Faxon, 1893].—Richardson, 1899a: 869.—Richardson, 1899b: 338.—Bonnier, 1900: 48, 221, 291-292, 381; fig. 53.—Richard, 1900: 71.—Townsend, 1901: 527.—Richardson, 1905: 537-539; fig. 581.—Stebbing, 1908: 57-59; pl. XXXIII [Off Cape Point, South Africa, 800-900 fm {= 1463-1646m}; infesting *Glyphocrangon sculpta* (S. I. Smith, 1882)].—Stebbing, 1910: 436.—Nierstrasz and Brender à Brandis, 1923: 86.—Barnard, 1940: 494, 721.—Danforth, 1963: 33, 37, 91, 92; pl. 5, figs. 1, 2.—Şadoğlu, 1969: 197.—Schultz, 1969: 312; fig. 496.—Danforth, 1970: 9, 43, 57-58, 149; fig. 5D, E.—Holthuis, 1971: 285.—Wenner, 1978: 1058-1061 [On continental slope of Middle Atlantic Bight; infesting *G. sculpta* and *G. longirostris* (S. I. Smith, 1882)].—Bourdon, 1979: 510.—Markham, 1979: 771-772.—Markham, 1985: 19, 131 [Atlantic Ocean, off coast of Virginia, USA: infesting *G. longirostris*].—Markham, 1986: 155, 156; fig. 4B.—Kaufmann et al., 1989: 1882; tab. 4 [Magellan Rise, NE Pacific, 07°05'N, 176°55'W - 176°50'W, 3100m; infesting unspecified host, probably *G. vicaria* Faxon].—Salazar-Vallejo and Leija-Tristán, 1989: 429.—Leija-Tristán and Salazar-Vallejo, 1991: 1.—Markham, 1992: 3; tab. 1.—Espinosa-Pérez and Hendrickx, 2001: 50.—Román-Contreras and Soto, 2002: 279.—An, 2006: Abstract [on unnumbered p.], 73-74, 114, 117, 123, 131; fig. 28 [East China Sea, 26°10'N, 126°00'E; infesting *Glyphocrangon* sp.].—An et al., 2007: 1002, 1003; fig. 1 [Same material as An, 2006].—Yu and An, 2008: 691.—Stebbins, 2012a: 2.—Stebbins, 2012b: 2, 6, 16; 4 unnumbered figs.

- ?*Gigantione bouvieri*.—Bourdon, 1967: 857 [Canary Islands; infesting *Glyphocrangon* sp., hyperparasitized by *Cabirops serratus* Bourdon, 1967. Probably not *Gigantione bouvieri* Bonnier, 1900].
- ?*Bathygyge* sp.—Bourdon, 1967: 857 [Same material tentatively called *Gigantione bouvieri* above].—Bourdon, 1979: 510 [Azores, 1590–1665m; infesting *Glyphocrangon longirostris*].—Lemos de Castro, 1970: 2.—Holthuis, 1971: 339.—Restivo, 1971: 71; tab. 1.—Restivo, 1975: 153; tab. 3.—Bourdon et al., 1981: 498.—Rybakov, 1990: 415.—Román-Contreras, 2008: 91.
- ?"bopyrid parasites."—Holthuis, 1971: 339 [Off Atlantic coast of Nigeria, 04°15'N, 04°27'E–04°12'N, 04°28'E, 1280–1320m; infesting *Glyphocrangon longirostris*].
- Munidion* sp.—Wicksten, 1979: 222 [San Clemente Basin, California, infesting *Glyphocrangon vicaria* Faxon, 1896: material examined herein, described below].—Wicksten, 2009: 168.
- ?"branchial bopyrid."—Chace, 1984: 11 [West of Halmahera, Indonesia, 00°16'30"N, 127°30'00"E, 497m; infesting *Glyphocrangon faxoni* de Man, 1918].
- Bathygyge* [sic] *grandis*.—Campos and Campos, 1989: 33; tab. 2.
- ?"Bopyrid isopod"—Moore et al., 2003: 368 [Bear Seamount, northwestern Atlantic, 39°55'N, 67°30'W, 1100 m; infesting "*Glyphocrangon*" {probably = *G. sculpta*}].
- ?"bopyrid isopod."—Ahyong, 2006: 68 [Tasman Sea, 32°04'S, 159°53'E, 1920–1934m; infesting *Glyphocrangon dimorpha* Komai, 2004].—Han and Li, 2007: 550 [East China Sea, 09°29'N, 123°41'E, 2000–2150m; infesting *Glyphocrangon megalophtalma* de Man, 1918]

Material Examined

Infesting *Glyphocrangon vicaria* Faxon, 1896. R/V *Agassiz* Station M-7 Sta. 3, San Clemente Basin, eastern Pacific off California, USA, 32°28'N, 118°08'W, 1792m, 16 September 1971, 40-foot otter trawl. 2♀, 2♂, SIO (Scripps Institute of Oceanography) C3100.

Redescription of Female

Length 12.7 mm, maximal width 9.3 mm, head length 1.3mm, head width 2.8 mm, pleonal length 3.9 mm. Distortion 115° sinistrally. Body outline broadly ovate, widest across pereomere 5. All body regions distinct, pereomeres distinct but pleomeres medially fused; pleon strongly torsioned (Fig 1A, B).

Head deeply embedded in pereon, its anterior margin overreached by second oostegites. No eyes. Antennae (Fig. 1C) not extending beyond margins of head, first of 3 articles, second of 6 articles, setation obscure. Barbula (Fig. 1D) with pair of unornamented slender falcate projections on each end, slightly sinuous margin medially. Maxilliped (Fig. 1E) of irregularly pentagonal anterior article bearing subterminal articulating triangular palp (Fig. 1F) densely setose along medial edge; and smaller subtriangular posterior article produced into long slender plectron (Fig. 1G) directed anteromedially.

Pereomeres separated dorsally by sinuate margins. Coxal plates well-developed on pereomeres 1–4, those of first two pairs reflexed medially over dorsal surfaces of pereomeres (Fig. 1A, J), other two pairs completely covering lateral margins of pereomeres. Pereomeres 5–7 lacking coxal plates but their lateral regions expanded and flat. Oostegite 1 (Fig. 1H, I) slightly longer than broad, with nearly parallel sides; internal ridge lacking ornamentation; posterolateral projection about 1/3 width of posterior margin of oostegite, rather short and broadly rounded, turned slightly medially. Oostegites 2–5 of both pairs large and completely enclosing vaulted brood pouch. Pereopods (Fig. 1K, M) all tiny, though slightly larger posteriorly, arrayed along lateral margins of pereon and extending little beyond those margins, pereopods 1 and 2

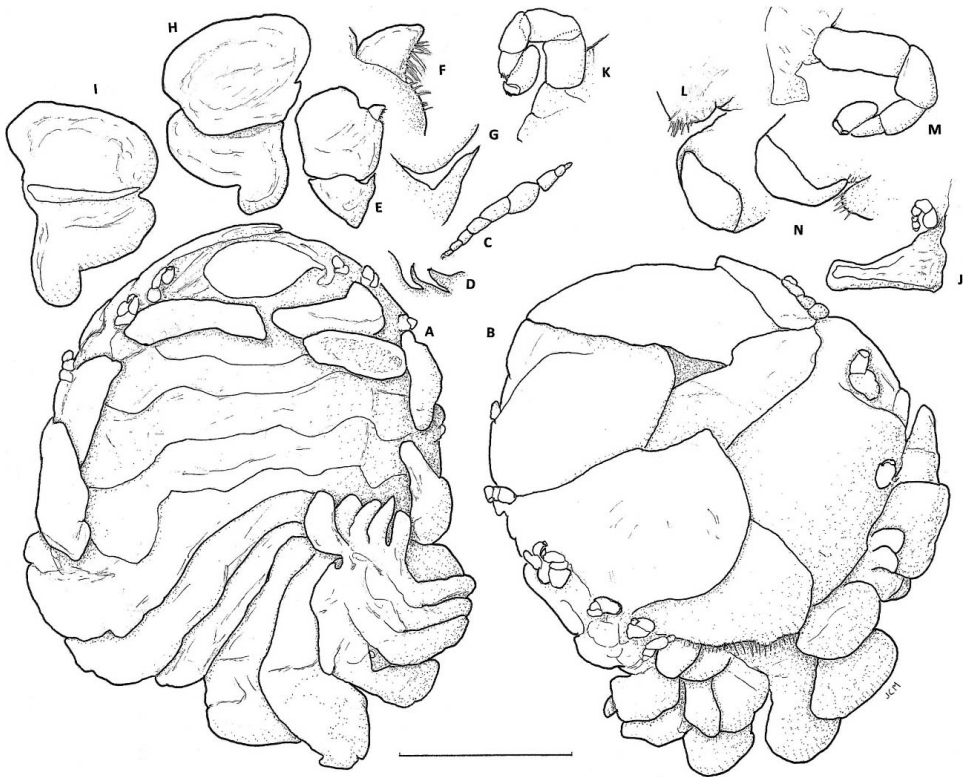


Fig. 1. *Bathygyge grandis* Hansen, 1897, reference female. A. Dorsal view. B. Ventral view. C. Right antennae. D. Barbula, right side. E. Right maxilliped, external view. F. Palp of same. G. Plectron of same. H. Oostegite 1, external view. I. Same, internal view. J. Right pereopod 1 and attached coxal plate. K. Left pereopod 1. L. Dactylus and end of carpus of same. M. Left pereopod 7. N. Dactylus and end of carpus of same. Scale: 4.00 mm for A, B, D, E, H, I, J; 1.43 mm for K, M; 1.00 mm for C, F, G; 0.29 mm for L, N.

clustered closely together, and pereopods 6 and 7 similarly clustered on both sides; all articles of all pereopods separate, dactyli reduced and blunt anteriorly (Fig. 1L), bases (Fig. 1M) longer and dactyli (Fig. 1N) longer and sharper posteriorly.

Pleon (Fig. 1A) strongly torsioned and reflexed over pereon, so right (longer) side facing forward, of 6 pleomeres, final four pleomeres incompletely separated. Pleomeres 1–3 produced into broad blunt lateral plates on longer side. Pleomeres 4 and 5 produced into slender lateral plates on both sides. Pleomere 6 bearing widely separated uniramous uropods of structure and shape similar to that of lateral plates. No pleopods on any pleomeres.

Other female quite similar. Distortion dextral, with pleon torsioned to left side. Length 10.5mm, maximal width 8.2mm. Reflexed coxal plates on left (shorter) side of pereomeres 1–3, on opposite sides of pereomeres 1–2. Pereopods 1–4 with long dactyli, those of pereopods 5–7 smaller.

Redescription of Male

Length 6.8 mm, maximal width 1.6 mm, head length 0.6 mm, head width 1.1 mm, pleon length 1.8 mm, pleon width 1.2 mm. Head, pereomeres and pleon distinct. Sides of pereon parallel from pereomere 2–6. No pigmentation (Fig. 2A).

Head roundly quadrate, abruptly narrower than first pereomere and extending forward from it; anterior and posterior margins straight across, former somewhat shorter. No eyes. Antennae (Fig. 2B) of 3 and 7 articles respectively, minutely setose distally.

Pereon narrowest across pereomeres 1 and 7, its sides nearly parallel between; all pereomeres separated by deep notches laterally, slightly ridged middorsally. No midventral tubercles. Pereopods (Fig. 2C, D) with all articles distinct, larger anteriorly; carpi sparsely setose on anteromedial corners; all propodi enlarged, each produced into proximal lobe with socket receiving tip of reflexed dactylus; long sharply pointed dactyli on pereopods 1–5, shorter and blunter dactyli on pereopods 6–7.

Pleon long and extended, markedly narrower than last pereomere, as truncated oval, its sides nearly parallel, posterior margin broadly rounded. No trace of segmentation. No appendages.

Other male very similar, its antenna 2 of 8 articles. Length 12.7mm, maximal width 3.8mm, head length 0.7mm, pleon length 1.5mm.

Bathygyginae, new subfamily

Diagnosis. Branchially-infesting bopyrid. Female: Body outline roughly circular, with no straight margins. Head oval, much broader than long, deeply embedded in first pereomere and overreached by second oostegites. Maxilliped with subterminal triangular palp and slender pointed plectron. Barbula bearing two long slender projections laterally, bare medially. All pereomeres distinct dorsally, their margins irregularly curved. Pereopods all present, reduced. Coxal plates of pereomeres 1, 2 and/or 3 extending medially over dorsal surface of body. Oostegites 2–5 on both sides well-developed and completely enclosing enlarged brood pouch. Pleon of 6 incompletely separated pleomeres, its central axis greatly rotated to one side, posterior-most point of body side of pleomeres 1 and 2, pleomeres bearing blunt lateral plates but lacking all pleopods and uropods. Male: Body about 4 times as long as broad, fusiform in outline. Head narrower than first pereomere and distinct from it. Pereomeres deeply divided. Pereopods all with enlarged propodi with sockets receiving tips of sharply pointed dactyli. Pleon separated from last pereomere, suboval, bulbous, completely lacking all traces of segmentation or appendages. Only one genus and species known, *Bathygyge grandis* Hansen, 1897.

With a complete description of *Bathygyge grandis*, it now becomes possible to assess its systematic placement. Characters unique to *B. grandis*, which indicate that it should be in a subfamily of its own are: Female: Second oostegites extending beyond anterior margin of head; coxal plates of first and second pereomeres extending medially over dorsal surface of pereon; pleon strongly torsioned and pointing forward over pereon. Male: All pereopodal propodi bearing sockets into which tips of sharply pointed dactyli retract. Unusual characters (though in rare instances known from members of other subfamilies of the Bopyridae) are: Female: Body broadly oval, almost circular; head lacking frontal lamina; pereopods proportionately tiny. Male: Body very long relative to width; pleon completely lacking all traces of segmentation and all appendages. Hosts: All known in genus *Glyphocrangon* A. Milne-Edwards, 1881 (Caridea, Crangonoidea, Glyphocrangonidae).

Hansen (1897), whose description of *Bathygyge grandis* Richardson (1905) quoted verbatim and whose illustrations she reproduced, had “[o]nly a male, and the posterior part of a female.” He did not figure the female at all but remarked on it thus: “Abdomen: It is turned to the left in a startling degree...” That extreme rotation of the pleon, figured and described herein, is unique for bopyrid females. The present male closely matches the description and figures of the type-male by Hansen (1897) (reproduced by Richardson, 1905). The only illustration prepared of *Bathygyge grandis* since the original description is that of An (2006), of Chinese material in a dissertation, which has limited accessibility because it is entirely in Chinese and unpublished;

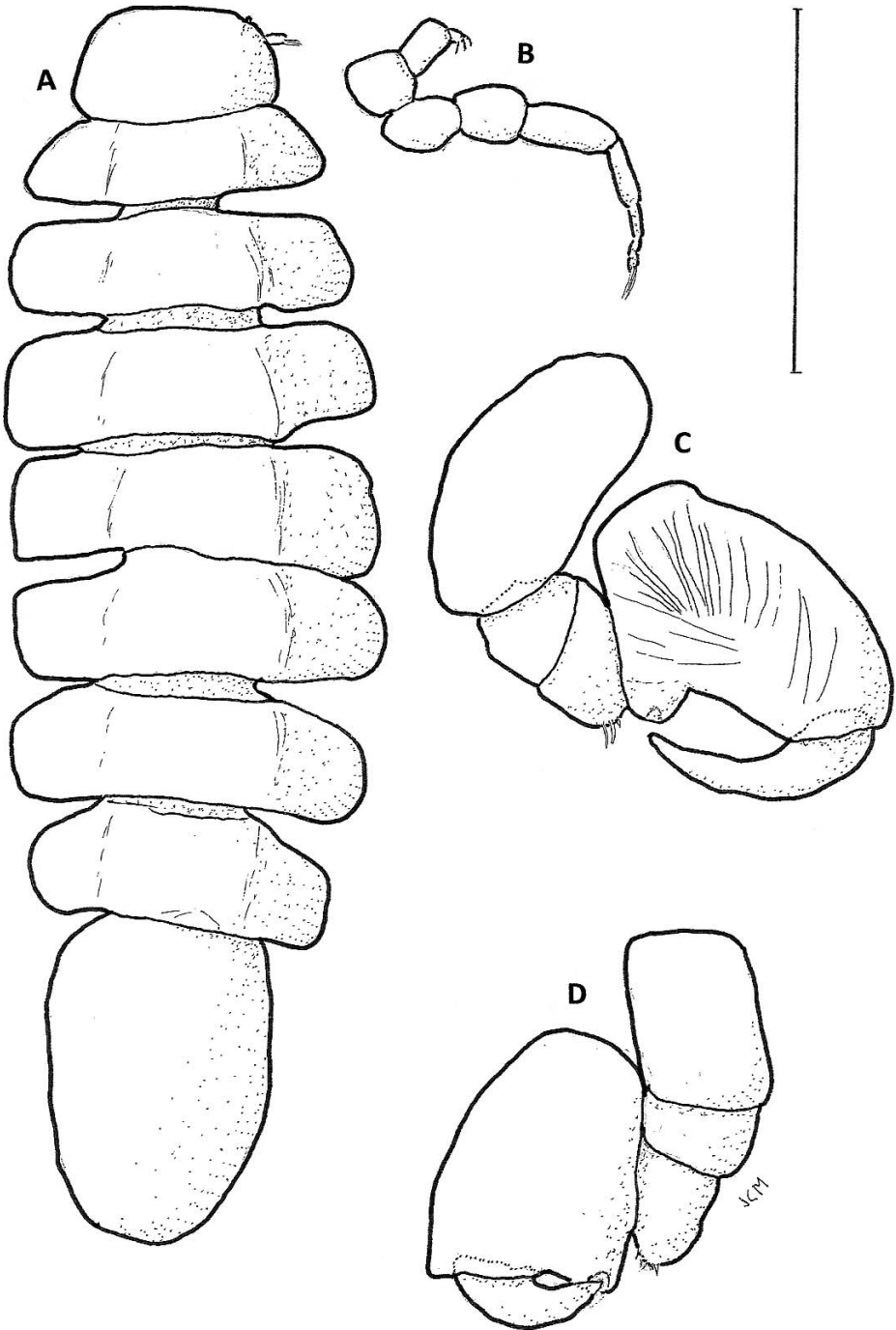


Fig. 2. *Bathygge grandis* Hansen, 1897, reference male. A. Dorsal view. B. Left antennae. C. Left pereopod 1. D. Right pereopod 7. Scale: 2.00 for A; 0.45 mm for B-D.

it only recently came to my attention. In her figure 28, she presents detailed drawings, the first known, of both sexes. Both the female and male illustrate the diagnostic characters of the species: the medially extending coxal plates of the first two pereomeres, the reduced pereopods and the strongly torsioned pleon of the female; and, in the male, the strongly separated head, pereomeres and pleon; prominent proximal lobes on the propodi of the pereopods of the first pair; and complete lack of segmentation and appendages of its pleon. There are however, several differences between the material herein described and that from China. In the Chinese female, the body is more nearly circular; the maxilliped's palp does not articulate, and its spur is much reduced; the first oostegite has a slightly more slender and longer posterolateral point, which is setose along its lateral margin; the posterior pereomeres bear tergal plates distinctly separated from the segments; and the lateral plates of the pleomeres are quite sharply pointed. In the Chinese male, the body is slightly curved; tiny colorless eyes are present next to the posterior edge of the head; and the pleon is attached to the last pereomere by a narrow peduncle. It is uncertain whether the propodi of that male's pereopods bear sockets receiving the tips of the dactyli, as in the male herein described. An et al. (2007), who published mention of the same material as An (2006), included a photograph (their fig. 1) of the parasite in place on its host but did not present drawings of the specimens themselves. Few specimens assigned to *Bathygyge grandis* have been examined in detail (only the male in the type-collection, only two females and two males in the present collection and a single one of each sex in the report from China). Thus there remains some doubt whether the distinctions cited here are consistent among the populations from opposite sides of the Pacific Ocean. If they are, the individuals from China should quite probably be considered representatives of a separate undescribed species. The status of specimens reported from elsewhere in the world is also uncertain. For now, however, I am retaining all of them in the synonymy of *B. grandis* presented above.

Branchial bopyrid parasites of caridean shrimps are most commonly members of the subfamily Bopyrinae, whose species are not known to infest any hosts but carideans. The small subfamily Argeiinae contains exclusively caridean-infesting parasites. In the large subfamily Pseudioninae, whose many species are typically parasites of anomurans, are a few species found as parasites of deep-water carideans. *Bathygyge* clearly does not belong in the Argeiinae, whose females, among other contrasting characters, have large rear-extending pleons of a very different shape. It has been dubiously assigned to the Bopyrinae (Shiino, 1965) or Pseudioninae (Markham, 1974) but does not fit well into either of those subfamilies for various reasons. Stebbins (2012a, 2012b) expressed doubt about its proper assignment to subfamily. Its unique placement, emphasized by the present erection of a new subfamily, may be a reflection of its occurrence as the only known bopyrid species infesting any member of the family Glyphocrangonidae, of which *Glyphocrangon* is the sole recognized genus.

Wicksten (1979) mentioned infestation of *Glyphocrangon vicaria* and called its parasite "*Mumidion* sp." without any descriptive notes and later (Wicksten, 2009) repeated that record. I found her label in the container with the material herein redescribed, thereby confirming that I was dealing with the same specimens.

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