PROCEEDINGS OF THE BIOLOGICAL SOCIETY OF WASHINGTON
117(2):186–198. 2004.

New species and records of Bopyridae (Crustacea: Isopoda) infesting species of the genus *Upogebia* (Crustacea: Decapoda: Upogebiidae): the genera *Orthione* Markham, 1988, and *Gyge* Cornalia & Panceri, 1861

John C. Markham

Arch Cape Marine Laboratory, Arch Cape, Oregon 97102-0105 U.S.A.

Abstract.—Two bopyrid genera whose species parasitize only *Upogebia* spp. are reviewed and revised. *Orthione* Markham, 1988, heretofore known only from its type-species, *O. furcata* (Richardson, 1904), is rediagnosed and enlarged. *Orthione griffenis,* new species, infests *Upogebia pugettensis* (Dana, 1852) in Oregon, U.S.A. *Orthione mesoamericana,* new species, infests *U. spinigera* (Smith, 1871) on the Pacific coasts of Costa Rica and Colombia. The genus *Metabopyrus* Shiino, 1939, is incorporated into *Gyge* Cornalia and Panceri, 1861, which is rediagnosed, and a key is given to the four known species. *Gyge ovalis* (Shiino, 1939), formerly *Metabopyrus ovalis* Shiino, 1939, is redescribed on the basis of new material found infesting *U. edulis* Ngoc-Ho & Chan, 1992, in Taiwan, a new host and geographical record.

In a recent compilation of the known bopyrid parasites of thalassinidean decapod crustaceans throughout the world (Markham 2001), I listed 26 species of the genus *Upogebia* known to harbor a total of 27 species of bopyrid isopods. Since then, additional material of parasites of species of *Upogebia* has become available for examination or has been reliably reported to me. It includes two new species of *Orthione* Markham, 1988, described herein, as well as new host and geographic records for *Metabopyrus ovalis* Shiino, 1939, which is redescribed and reassigned to the genus *Gyge* Cornalia & Panceri, 1861.

Materials and Methods

Host specimens bearing parasites, or parasites that had been removed from their hosts, have become available for study from various sources over a period of several years. Some were already in scientific collections, while others are being newly donated to institutions housing such collections. Those institutions are indicated thus: Museo de Zoología, Universidad de Costa Rica, MZUCR; Naturhistorisches Museum, Wien, Austria, NHMW; Naturhistoriska Rijksmuseet, Sweden, SMNH; and Natural History Museum, Smithsonian Institution, USNM.

Results

Family Bopyridae Rafinesque-Schmaltz, 1815

Subfamily Pseudioninae Codreanu, 1967

Genus *Orthione* Markham, 1988

Type-species, by original designation, *Pseudione furcata* Richardson, 1904. Number of previously known species: 1, *O. furcata* (Richardson, 1904), infesting *Upogebia affinis* (Say, 1818), Massachusetts to North Carolina, U.S.A.

Revised generic diagnosis, based on three known species.–Female. Body outline oblong, about twice as long as wide, sides nearly parallel, axis only slightly distorted, all body regions and segments distinct dorsally. Head deeply set into pereon, its an-

terior margin completely covered by frontal lamina and forming continuous curve with pereon; maxilliped lacking palp; barbula with single prominent lanceolate process on each side, rarely minute process lateral to it. Pereopods slightly to much larger posteriorly; oostegites generously enclosing brood pouch, first one with prominent but unadorned internal ridge, no posterolateral point. Pleon of six pleomeres, much broader than long, final pleomere deeply enclosed by fifth; five pairs of biramous pleopods and similar uniramous uropods completely covering lateral margins and all but center of dorsal surface of pleon, endopodites of first pair larger and medially extended.

Male. Body oblong, at least three times as long as wide; all body regions and segments distinct. Head nearly semicircular; second antennae prominently extended. Pereopods relatively small, though overall larger and with smaller dactyli posteriorly, all clustered medially. Pleon about ⅓ of total body length, of six pleomeres; pleopods absent or as low incomplete oval uniramous flaps; final pleomere largely surrounded by fifth, ending in pair of uniramous flaplike uropods.

Hosts. All in genus *Upogebia.*

Key to Three Species of *Orthione,* Based on Mature Females

1. Pereopods with propodal cups receiving tips of dactyli, bases produced into large carinae; pleopodal rami somewhat ovate *O. griffenis* new species [Oregon, U.S.A.].
–. Pereopods lacking propodal cups to receive tips of dactyli, bases lacking carinae; pleopodal rami lanceolate ..... 2.
2. Head much broader than long, with minute barbular projection lateral to main process; final pleomere visible dorsally ... *O. mesoamericana* new species [Pacific coast from Costa Rica to Colombia].
–. Head about as broad as long, only single process on each side of barbula; final pleomere more or less hidden dorsally ..... *O. furcata* (Richardson, 1904) [Atlantic coast of U.S.A.].

Orthione griffenis, new species
Figs. 1–3

"New species . . . [of] . . . *Orthione.*"—David, 2001:6.

Material examined.—Infesting *Upogebia pugettensis* (Dana, 1852). Collected and hosts det. by B. D. Griffen. Mudflats, Idaho Inlet, Yaquina Bay, Oregon, USA, 44° 35.4′N, 124°01.5′W, unspecified date, 2000: 1 ♀, holotype, USNM 1008784, 1 ♂, allotype, USNM 1008785. Same locality, 23 June 2001, 9 ♀♀, 7 ♂♂, paratypes, USNM 1008786. Collected and hosts det. by T. H. DeWitt: Riverbend, Yaquina Bay, Oregon, 12 November 1999, Sample 59MDF-U31: 1 ♀, dextral, 1 ♂, paratypes, USNM 1008787. Idaho Flat, Yaquina Bay, Oregon, 24 September 1999, Sample 59UU104M: 1 ♀, sinistral, immature, paratype, USNM 1008788.

Description.—Holotype female (Fig. 1). Length 11.0 mm, maximal width 9.2 mm, head length 2.2 mm, head width 2.1 mm, pleon length 2.9 mm; distortion 15°, dextrally. Outline oval, nowhere abruptly broader or narrower; all body regions and segments distinct. No pigmentation (Fig. 1A, B).

Head almost square, deeply set into pereon, its anterior edge continuous with pereonal margin. Distinct rather long frontal lamina extending completely across front of head but not beyond its sides. First antennae long and extended beyond margin of head, of 5 articles, distal two terminally setose; second antennae greatly reduced, of 1 to 3 articles (Fig. 1C). Barbula (Fig. 1D) with single long falcate process on each side, central region entire. Maxilliped (Fig. 1E) subtriangular, lacking palp, with plectron short and blunt; anterior article nearly rectangular, much longer than triangular posterior article.

Pereon widest across pereomeres 4–5. Pereomere 1 curved strongly around head, it and pereomere 2 markedly concave anteriorly; pereomeres 3–4 nearly straight across; pereomeres 5–7 concave posterior-

Fig. 1. *Orthione griffenis*, new species. Holotype female. A. Dorsal. B. Ventral. C. Right antennae. D. Right side of barbula. E. Right maxilliped. F. Right oostegite 1, external. G. Same, internal. H. Right pereopod 1. I. End carpus and dactylus of same. J. Right pereopod 7. K. End carpus and dactylus of same. Scale: 3.60 mm for A, B, E–G; 1.20 mm for C; 2.40 mm for D; 1.00 mm for H, J; 0.4 mm for I, K.

ly. Pereomere 1 shortest, all others about same length. Shallow elongate depression near each side of dorsal surface of pereomeres 2–5. Pereomeres 1–6 bordered by coxal plates on long side of body, those on pereomeres 5–6 with crenulate margins; smaller coxal plates on short sides of pereomeres 1 and 5. First oostegite (Fig. 1F, G) subcircular, its articles of about same size, separated by deep but narrow groove externally; internal ridge smoothly curved and lacking ornamentation. Oostegites 2–5 all long and relatively slender, each reaching about ⅔ of distance across brood pouch and together completely enclosing it. Fifth oostegite with fringe of long setae along posterior margin. Pereopods (Fig. 1H, J) with all articles distinct, more than doubling in size posteriorly; all bases produced into broadly rounded carinae; short comma-shaped dactyli (Fig. 1I, K) with sharp tips fitting into lip-like receptacles on distal corners of propodi; all carpi densely setose distally.

Pleon of 6 pleomeres, all sharply concave posteriorly, its posterior margin almost straight across sides of all pleomeres. Ventrally, sides of pleon completely covered by 5 pairs of overlapping lanceolate uniramous lateral plates and uropods, and its middle region equally covered by 5 pairs of biramous pleopods, all of their rami of size and structure similar to lateral plates, except that endopodites of first pleopods much larger than others and crossing each other in middle of pleon.

Allotype male (Fig. 2). Length 8.0 mm, maximal width 3.0 mm, head length 1.1 mm, head width 1.9 mm, pleon length 2.7 mm. Body straight on both sides, rounded

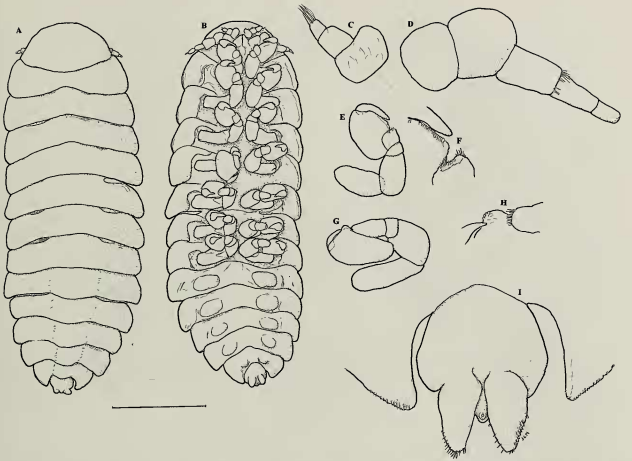

Fig. 2. *Orthione griffenis,* new species. Allotype male. A. Dorsal. B. Ventral. C. Right antenna 1. D. Left antenna 2. E. Right pereopod 1. F. End carpus and dactylus of same. G. Right pereopod 7. H. End carpus and dactylus of same. I. End of pleon, ventral. Scale: 2.00 mm for A, B; 0.84 mm for E, G; 0.24 mm for C, D, F, H, I.

at both ends. All body regions and segments distinctly separated (Fig. 2A, B). No pigmentation.

Head almost semicircular, markedly narrower than any pereomeres. Antennae (Fig. 2C, D) of 3 and 5 articles, respectively, both pairs directed laterally; first antennae distally setose; second antennae extending beyond margins of head.

Pereon broadest across pereomere 6, but only slightly so. Most pereomeres deeply separated by anterolateral notches. Low broad middorsal ridge along full length of pereon. Pereopods (Fig. 2E, G) relatively small, clustered medially under body; all of about same size, but their dactyli smaller posteriorly. All propodi bearing corneous ridges on surfaces met by folded dactyli (Fig. 2F, H); distal corner of propodus of pereopod 7 extended into receptacle for end of dactylus (Fig. 2G, H); all carpi distally setose.

Pleon of 6 distinct pleomeres, each narrower than that before it. Five pairs of distinct but sessile oval pleopods, progressively smaller posteriorly. Final pleomere (Fig. 2I) deeply set into fifth, produced into pair of stubby pointed uniramous uropods, their margins bearing many short setae.

Remarks on paratypes (Fig. 3).—Of the nine paratype females, five are dextrally distorted, as is the holotype, three are sinistral, and one is too immature for assessment. They range in length from 6.2 mm to 18.8 mm and in width from 2.7 to 13.3 mm (Fig. 3A–G). Most of the mature females have the endopodites of the first pair of pleopods prominently visible (Fig. 3A). One

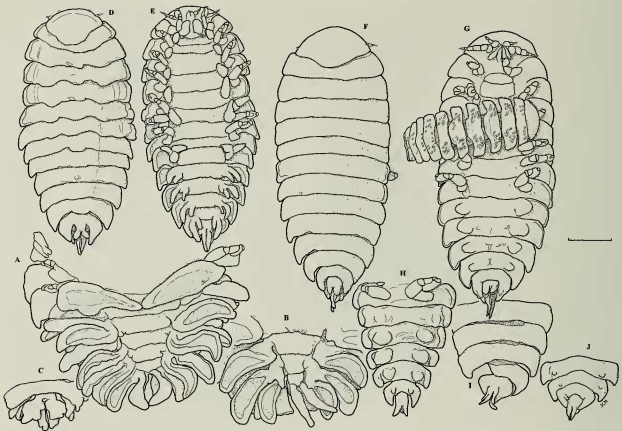

Fig. 3. *Orthione griffenis,* new species. Paratypes. A–G, females. H–J, males. A. Pleon, ventral. B. End of pleon, ventral. C. End of pleon, ventral. D. Immature, dorsal. E. Same, ventral. F. Late larva, dorsal. G. Same, with male attached, ventral. H. Pleon, ventral. I. Pleon, ventral. J. Immature, end of pleon, ventral. Scale: 4.20 mm for C; 2.10 mm for A, B, D, E; 1.00 mm for F–J.

has long slender extended uropods (Fig. 3B); one mature female has the fifth pleomere deeply separated from the preceding one (Fig. 3C), as does one immature female (Fig. 3D) In a very immature female (Fig. 3F, G), all oostegites are absent, and pleopods are only uniramous flaps. At a slightly later stage, an immature female (Fig. 3D, E) has rudimentary oostegites and small but distinctly pleopods, the endopodites of the first pair already pointing medially.

The seven paratype males (Fig. 3G–J) are 6.1 to 10.7 mm in length, and 2.0 to 3.2 mm in width. All are very similar to the allotype, but one has a more elongate pleon, its pleomeres deeply separated (Fig. 3H); one has a deformed fifth pleomere (Fig. 3I); and one has only very tiny traces of pleopods (Fig. 3J).

Etymology.—The name *griffenis,* genitive singular of a name regarded as a Latin third-declension noun, is selected to honor Blaine D. Griffen, who, in the course of an ecological study of the host, *Upogebia pugettensis,* collected most of the material, called it to my attention and furnished it and collection data for this description.

Remarks.—*Upogebia pugettensis* has been reported many times as the host of *Phyllodurus abdominalis* Stimpson, 1857, which attaches to its abdomen throughout the host's geographic range from British Columbia to central California (Williams 1986, Markham 1992), though the coast of Oregon remains a gap in the known distribution of *P. abdominalis.* This is the first record of infestation of *U. pugettensis* by a branchial bopyrid. So far this new species, *Orthione griffenis,* is known only from Yaquina Bay, Oregon, in the middle of the range of *U. pugettensis,* but there it appears to be fairly common. *Upogebia pugettensis*

Fig. 4. *Orthione mesoamericana,* new species. Holotype female. A. Dorsal. B. Ventral. C. Right antennae. D. Right maxilliped. E. Plectron of same. F. Right side of barbula. G. Right oostegite 1, external. H. Same, internal. I. Right pereopod 1. I. J. Right pereopod 7. Scale: 2.00 mm for A, B, D, F–H; 1.00 mm for E; 0.36 mm for C, I, J.

attains densities of up to 300 burrows per square meter in Yaquina Bay and occurs throughout the lower region of that estuary (Griffen 2002). For comparison of *Orthione griffenis* with other species in the genus, see the remarks on the following species.

Orthione mesoamericana, new species
Figs. 4, 5

"Bopyrid Isopod."—Holthuis, 1952:9 [Buenaventura, Colombia; infesting *Upogebia spinigera* (Smith)].

Material examined.—Infesting *Upogebia spinigera* (Smith, 1871). Puerto Jiménez, Golfo Dulce, Puntarenas, Costa Rica, 08°32′30″N, 83°18′20″W, 13 January 1977. 1 ♀, holotype, 1 ♂, allotype, MZUCR 2194-04. Lund University Chile Expedition. Buenaventura, Colombia, 03°77′N, 77°02′W, on beach, under lump of clay, 30 August 1948. H. Brattström and E. Dahl, colls., L. B. Holthuis det. of host: 1 ♂, paratype, SMNH 5325.

Description.—Holotype female (Fig. 4). Length 6.5 mm, maximal width 5.4 mm, head length 1.3 mm, head width 1.8 mm, pleon length 2.2 mm. Body axis distortion 4°, dextrally. Body nearly oval, all regions and segments distinct. No pigmentation except for dark eyespots (Fig. 4A, B).

Head slightly convex anteriorly, nearly semicircular posteriorly, deeply embedded into pereon. Frontal lamina very short but extending completely across anterior of head but not beyond. Eyes as prominent slender slashes near anterolateral corners of head. Antennae (Fig. 4C) well-developed, of 3 and 6 articles, respectively, first ones extending plainly beyond front margin of head. Barbula (Fig. 4F) with two projections on each side, outer one minute, inner

one extended and curved, both with entire margins; no decoration in middle of barbula. Maxilliped (Fig. 4D) suboval, lacking palp but with notch in anterior margin; plectron (Fig. 4E) small and slender, pointing anteriorly.

Pereon broadest across pereomere 4, all pereomeres distinctly separated laterally. Tergal plates on both sides of pereomeres 1–4, though only faint on first one. Oostegite 1 (Fig. 4G, H) with nearly parallel sides, slightly convex ends, both segments about equally wide and long, separated by deep external groove, no posterolateral projection; internal ridge unornamented, produced into long right-angled flap. Oostegites 2–5 overlapping and reaching nearly across and completely enclosing brood pouch. Pereopods (Fig. 4I) more than doubling in size posteriorly, but none extending beyond body margin; all dactyli short and fairly blunt and retracting into anterior notches of distally extended propodi; carpi all sparsely setose distally, meri and carpi of anterior pereopods fused.

Pleon of 6 distinct pleomeres, final one deeply embedded in preceding one. Five pairs of biramous pleopods, uniramous lateral plates and uniramous uropods. Endopodites of first pair of pleopods large, inflated and extending medially, touching each other and overlapping fifth oostegites anteriorly. Other pleopodal rami, lateral plates and uropods all similar to each other, all as lanceolate flaps with entire edges, completely covering margins of pleomeres.

Allotype male (Fig. 5).—Length 3.3 mm, maximal width 1.2 mm, head length 0.3 mm, head width 0.9 mm, pleon length 1.0 mm. Sides of body nearly parallel, rounded at each end. All body regions and segments distinctly separated. No pigmentation (Fig. 5A, B).

Head semicircular, lacking eyes. Antennae (Fig. 5C) prominent, first ones of 3 articles, second ones of 6 or 7 articles; second antennae extending far beyond margins of head.

Pereomeres separated by anterior notches reaching inward nearly ⅓ of body width. Pereopods (Fig. 5D, E) all of nearly same size, all their articles distinct; dactyli of pereopods 1 and 2 long and sharply pointed, others short and blunt; carpi of pereopods 5–7 much longer than others.

Pleon of 6 pleomeres, first one as wide as pereon, others tapering rapidly posteriorly. Pleopods (Fig. 5F) as sessile plates fairly conspicuous on pleomere 1, much fainter on pleomeres 2–5, absent behind. Sixth pleomere embedded in fifth, produced posteriorly into blunt clublike uropods extending rearward unequal distances, both sparsely fringed by minute setae.

Comparison of paratype male.—The other male is considerably larger, with these dimensions: length 4.2 mm, maximal width 1.4 mm, head length 0.6 mm, head width 0.9 mm, pleon length 1.7 mm. It is the same as the allotype in all respects except that both second antennae are 7-articled, and its uropods are equal in length.

Etymology.—Adjective *mesoamericana* selected to indicate the known range of the new species, along the Pacific coast of Central America.

Remarks.—The paratype male from Colombia is the unidentified bopyrid reported by Holthuis (1952). Because there was no female accompanying it, it could not be identified until the allotype was described here. The hosts are the same species in both collections.

Comparison of three known species of Orthione.—Females. One important addition to the original generic diagnosis (Markham 1988) is that the endopodites of the first pair of pleopods are markedly enlarged and medially directed in a manner highly distinctive for *Orthione.* This is the case in the type-species, *O. furcata,* as well as in the two new species, but I did not recognize its importance as a diagnostic character earlier. Of the two new species, *O. mesoamericana* is much more similar to *O. furcata* than is *O. griffenis.* Females of the first two species have heads wider than long, bearing slit-shaped eyes, and the in-

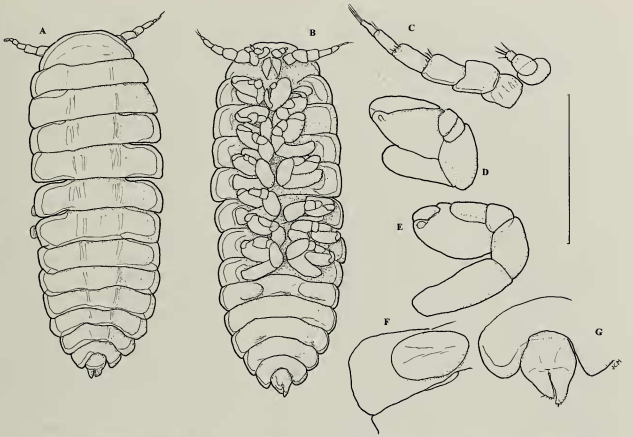

Fig. 5. *Orthione mesoamericana,* new species. Allotype male. A. Dorsal. B. Ventral. C. Right antennae. D. Right pereopod 1. E. Right pereopod 7. F. Right pleopods 1. G. Pleomeres 5, 6, ventral. Scale: 1.4 mm for A, B; 0.5 mm for C–G.

ternal ridge of the first oostegite is produced into a broad angled flap reaching far posteriorly, though that of *O. mesoamericana* is less extended. Also, females of both of those species have very slender pleopodal appendages, those of *O. mesoamericana* being relatively somewhat broader. All pereopods of *O. furcata* are about the same size, while those in the two new species more than double in size posteriorly. The minute flap lateral to the large projection on the barbula is unique to *O. mesoamericana.* Females of *O. griffenis* are distinctive in having heads longer than broad, margins of coxal plates crenulate rather than entire, pereopodal bases carinate, and pleopodal appendages ovate rather than lanceolate.

Males. All three species are very similar. Pereopods of *O. furcata* are much longer posteriorly, while those of the two new species are of nearly the same size throughout. Similarly, uropods of *O. furcata* are much smaller than in either of the other two species. In *O. mesoamericana,* second antennae are greatly extended, and pleopods are mostly absent, in contrast with the other two species. The head of *O. furcata* has a medial region extending posteriorly, that of *O. griffenis* is smoothly rounded posteriorly, and that of *O. mesoamericana* is straight posteriorly.

Genus *Gyge* Cornalia & Panceri, 1861

Type-species, by monotypy, *Gyge branchialis* Cornalia & Panceri, 1861.

Revised diagnosis.—Female. Body oval to squarish, at least ¾ as broad as long, body axis only slightly distorted either dextrally or sinistrally, angle of distortion far forward. Head deeply set into pereon, its sides diverging slightly to greatly anterior-

ly, frontal lamina completely covering anterior, its posterior end rounded to pointed. Eyes usually absent. Antennae reduced. Barbula with two lateral processes on each side, they and middle region with deeply digitate margins. Maxilliped usually nearly straight across anterior margin, lacking palp, with slender forward-pointing plectron and at most only small posterior point. Pereon broadest across pereomere 4, smoothly rounded both ways, sides of first 4 or 5 pereomeres covered by conspicuous coxal plates. Pereopods all equally small, anterior ones with meri and carpi fused, bases large and often carinate. First oostegite produced onto long slender and usually curved posterior point. Other oostegites narrowly pointed and incompletely enclosing brood pouch. Pleon of 5 pleomeres, final one usually notched posteriorly. Three or four pairs of reduced biramous (or, intraspecifically, uniramous) pleopods not extending beyond pleonal edges, their leaflike rami all of same size and generally with digitately divided margins. Uniramous uropods tiny to quite large, flaplike, extended posteriorly and with entire margins.

Male. Body long and slender, its head well-extended and separated from pereon, with or without eyes. Antennae well-developed. Pereopods uniformly small, first two with proportionately longer dactyli, all with fused meri and carpi. No midventral tubercles. Pleon of 6 pleomeres, final one embedded in fifth. Pleopods absent or as sessile oval scars. No uropods.

Hosts: In genus *Upogebia.* Four species known, from Britain through Mediterranean to Black Sea; New Zealand; Japan and Taiwan; and Thailand.

Discussion.—I am hereby incorporating *Metabopyrus* Shiino, 1939, and its two species, the type-species *M. ovalis* Shiino, 1939, and *M. irregularis* Markham, 1985, into *Gyge* Cornalia & Panceri, 1861, which contained two species, *G. branchialis* Cornalia & Panceri, 1861, and *G. angularis* Page, 1985. The new diagnosis above is based on all four species. Bourdon (1968: 151) observed that "Ce genre [*Gyge*] ressemble beaucoup, en vue dorsale, à *Metabopyrus* Shiino (1939), également parasite d'*Upogebia* ..." Similarly, Page (1985: 196) asserted that "... *Gyge* and *Metabopyrus* should be united," but he did not formally make such a combination. In addition to the four species herein included in *Gyge,* two originally in *Gyge* and two in *Metabopyrus,* four other species have been cited as members of the genus, but all of them are either synonyms of *G. branchialis* or now considered to belong to other genera.

The date of publication of the paper by Cornalia & Panceri (1861), in which they established the genus *Gyge* and described its type-species *G. branchialis,* has been subject to some confusion. Bate & Westwood (1868) and Richardson (1905) listed the date as 1861, while Bonnier (1900) and Bourdon (1968) cited it as 1858. Reference to the original publication indicates that, while the volume in which the report appeared was for the year 1858, it actually appeared in 1861. Thus I am citing the date of publication for both the genus *Gyge* and its type-species *Gyge branchialis* as 1861.

Key to Four Species of *Gyge* Cornalia & Panceri, 1861, Based on Mature Females

1. Body smoothly rounded, oval; body axis distorted more than 30°; final pleomere extending farther rearward than any other pleomeres ..... 2.
–. Body with indistinct corners, subrectangular; body axis distorted less than 15°; final pleomere at least partly embedded in fifth pleomere and exceeded by one or more of other pleomeres ..... 3.
2. Long sides of pereomeres distinctly set apart by extended posterolateral angles; posterior margin of pleon entire, large uropods not visible in dorsal view .... *G. irregularis* (Markham, 1985), n. comb. [Thailand]
–. Long sides of pereomeres continuously curved; posterior margin of pleon deeply cleft, revealing minute uropods in dorsal view ..... *G. branchialis* Cornalia & Panceri, 1861 [Europe]

3. Body segments all distinctly separated; margins of barbula projections digitately subdivided; internal ridge of oostegite 1 digitate ..... *G. ovalis* (Shiino, 1939), n. comb. [Japan, Korea, Taiwan]
–. Body segments only obscurely separated; margins of barbula projections smooth; internal ridge of oostegite 1 smooth ..... *G. angularis* Page, 1985 [New Zealand]

Gyge branchialis Cornalia & Panceri, 1861

Abbreviated synonymy. (See Bourdon, 1968, for complete synonymy to 1968.)

Gyge branchialis Cornalia & Panceri, 1861: 87–111; plates I, II [Estuary of Venice, Italy; infesting *Upogebia pusilla* (Petagna, 1792)].—Bourdon, 1968:147, 151–159, 169, 322, 410; figs. 28–32; tables 23, 24 [synonymy, summaries of previous accounts, including records from Britain and Channel Islands through France to Adriatic and Black Seas, infesting *U. deltaura* Leach, 1815, *U. pusilla* and *U. stellata* (Montagu, 1808); redescription. Arcachon, France, and Napoli, Italy; infesting *U. pusilla.* Roscoff, France, and Plymouth, England; infesting *U. deltaura.* Roscoff, France; infesting *U. stellata.* Jersey, Channel Islands; no host].—Restivo, 1968:506 [Napoli,; infesting *U. pusilla*].—Restivo, 1975:152, 153, 161–163; table 1 [Golfo di Napoli; infesting *U. pusilla*; study of hyperparasitism by *Paracabirops marsupialis* (Caroli, 1953)].—Dworschak, 1988:68 [Grado, north Adriatic Sea, Italy; near Trieste, Italy; Rovinj, Slovenia; infesting *U. pusilla*].—Astall et al., 1996:821–823; table 1 [Clyde Sea, Scotland, and Irish Sea; infesting *U. deltaura* and *U. stellata.* Arcachon Basin, France; infesting *U. pusilla*].

Gyges [sic] *branchialis.*—Grube, 1864:77 [Lussin Island, Croatia, Adriatic Sea; infesting *U. pusilla*].

Gyge galatheae Bate & Westwood, 1868: 225–229 [Guernsey, Channel Islands, infesting *Galathea squamifera* Leach, 1814 {subsequently reidentified as *Upogebia stellata* by Norman, 1905:86}].

Not *Gyge branchialis* var. *arcassonensis* Carayon, 1943:46–47 [=*Progebiophilus euxinicus* (Popov, 1929)].

Material.—All identified and reported by Peter Dworschak.—Infesting *Upogebia pusilla.* Punta Spin, Grado, Adriatic Sea, Italy, 45°40′N, 13°23′E, D. Abed-Navandi coll., August 2000. 1 ♀ (ovigerous), 1 ♂, NHMW 19521. Infesting *U. tipica* (Nardo, 1868), off Isola Rossa, Rovinj, Croatia, Adriatic Sea, 45°05′N, 13°40′E, 18 m, D. Abed-Navandi coll. 4 July 2000, P. Dworschak det., 1 ♀, NHMW 19523.

Remarks.—This is the first record of bopyrid infestation of *Upogebia tipica,* and thus a new record for *Gyge branchialis. Gyge branchialis* is already known from the Croatian coast of the Adriatic Sea, and it does not need further redescription beyond the detailed accounts presented by Bonnier (1900) and Bourdon (1968). As indicated in the synonymy above, *G. branchialis* has been reported many times from Britain through the Mediterranean to the Black Sea as a parasite of three other species of *Upogebia.*

Gyge ovalis (Shiino, 1939), new combination
Fig. 6

Metabopyrus ovalis Shiino, 1939:88–91; figs. 7, 8 [Hakata Bay, Kyûsyû, Japan; infesting *Upogebia major* (de Haan, 1839) {subsequently corrected to *U. issaeffi* Balss, 1913}].—Shiino, 1958:48–49, fig. 10 [unknown specific locality, Japan; infesting unknown host; further descriptive notes].—Codreanu, 1941: 140.—Codreanu, 1961:140; fig. 1.—Codreanu & Codreanu, 1963:283.—Shiino, 1972:7.—Markham, 1982:340.—Markham, 1985:14.—Page, 1985:196.—Kim & Kwon, 1988:199, 201–203, 220; fig. 2 [Komso, southwest Korea; infesting *U. major*].—Markham, 2001:198, 201;

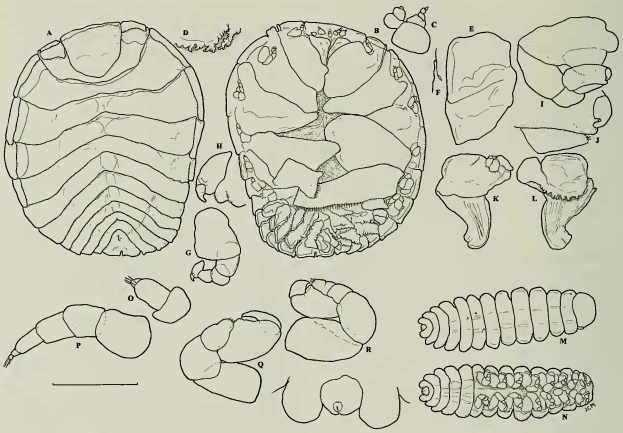

Fig. 6. *Gyge ovalis* (Shiino, 1939), new combination. A–L, female. M–S, male. A. Dorsal. B. Ventral. C. Left antennae. D. Left side of barbula. E. Left maxilliped, external. F. Plectron of same. G. Right pereopod 1. H. Distal end of same. I. Left pereopod 7. J. Distal end of same. K. Left oostegite 1, external. L. Same, internal. M. Dorsal. N. Ventral. O. Left antenna 1. P. Left antenna 2. Q. Left pereopod 1. R. Right pereopod 7. S. End of pleon, ventral. Scale: 4.00 mm for A, B, K, L; 1.93 mm for D, E, M, N; 1.00 mm for C, F; 0.88 mm for G, I; 0.35 mm for H, J, Q–S; 0.18 mm for O, P.

tables 1, 2.—Itani et al., 2002:72; fig. 1a9 [Yamaguchi Bay, Seto, Inland Sea, Japan; infesting *U. major*, study of response to host's molting].

Material examined.—Infesting *Upogebia edulis* Ngoc-Ho & Chan, 1992. Shan-kong mudflat, Chang-Hua County, southwest Taiwan, 24°06′25″N, 120°25′30″E, Tin-Yam Chan collector and det. of host: 1 ♀, 1 ♂, USNM 1008790.

Descriptive notes.—*Gyge ovalis* has now been collected five times, but no lot has been large. The original description (Shiino 1939) consisted of two pairs, the next two collections (Shiino 1958, Kim & Kwon 1988) were single females, and the present material is one pair. The size of the most recent Japanese collection (Itani et al. 2002) was not indicated; the photograph in that report, derived from a frame of a videotape which was published only to show the female's orientation on its host, lacks recognizable details. Variations among the specimens are slight, but all are noticeably different. The present female (Fig. 6A–L) most resembles the figured syntype in proportions and shapes of body parts, though it lacks the prominent tergal plates seen on the long side of pereomeres 1–3 of all previously recorded females (Fig. 6A, B). The body of one female (Shiino 1958) is proportionately shorter, and another (Kim & Kwon 1988) lacks the posterior notch on the final pleomere. The barbula (Fig. 6D) is the same as in other females. The maxilliped (Fig. 6E) is less distinctly segmented than previously seen. The propodus of the first pereopod (Fig. 6G, H) is produced into

a helmet-like shape not previously seen. The first oostegite (Fig. 6K, L) is very much like that reported by Shiino (1958), while the one from Korea (Kim & Kwon 1988) was straight posteriorly. The male (Fig. 6M–S) has a much more extended head and an embedded final pleomere (Fig. 6S), in contrast to the figured syntype (Shiino 1939), whose head was little longer than any pereomere, and whose final pleomere was extended behind the preceding one.

Remarks.—The present material represents both a new host, *Upogebia edulis,* and new locality, Taiwan, for *Gyge ovalis,* although Tin-Yam Chan (pers. comm.) reports that it is commonly collected there. Gyo Itani (pers. comm.) informs me that he has found *Gyge ovalis* infesting five different species of *Upogebia* in Japan, although so far there are published records of only two host species there.

Acknowledgments

Tin-Yam Chan, National Taiwan Ocean University, provided material of *Gyge ovalis* that he had collected and information about it. Peter C. Dworschak, NHMW, provided information about his collections of *G. branchialis* and granted me permission to report on them. Christer Erséus and Karin Sindemark, SMNH, lent the paratype male of *Orthione mesoamericana,* to which Lipke B. Holthuis, Nationaal Natuurhistorisch Museum, The Netherlands, had referred me. Blaine D. Griffen and Theodore H. DeWitt, Oregon State University, collected and furnished the type material of *O. griffenis* and provided information on its collection. Gyo Itani, Seto Marine Laboratory, Japan, sent me reprints of his papers and provided information about collections he had made. Becky S. Jordan, Iowa State University Library, confirmed the date of publication of the paper by Cornalia & Panceri (1861). Nguyen Ngoc-Ho, Muséum National d'Histoire Naturelle, Paris, confirmed the current usage of names of *Upogebia* spp. Marilyn Schotte, USNM, provided essential curatorial services and information on collections, lent much material for examination and description, furnished elusive references and information about them. Rita Vargas, MZUCR, lent type-specimens of *O. mesoamericana* and furnished details of their collection. Three anonymous reviewers provided helpful remarks.

This report is a scientific contribution of the Arch Cape Marine Laboratory (number 27) and of the College of Oceanic and Atmospheric Sciences, Oregon State University.

Literature Cited

Astall, C. M., A. C. Taylor, & R. J. A. Atkinson. 1996. Notes on some branchial isopods parasitic on upogebiid mudshrimps.—Journal of the Marine Biological Association of the United Kingdom 76:821–824.

Bate, C. S., & J. O. Westwood. 1868. A history of the British sessile-eyed Crustacea. Volume II. John van Voort, London. lvi + 536 pp.

Bonnier, J. 1900. Contribution à l'étude des épicarides. Les Bopyridae.—Travaux de l'Institut Zoologique de Lille et du Laboratoire de Zoologie Maritime de Wimereux 8:1–478.

Bourdon, R. 1968. Les *Bopyridae* des mers Européennes.—Mémoires du Muséum National d'Histoire Naturelle de Paris, Nouvelle Série (A) 50(2):77–424.

Carayon, J. 1943. Sur les épicarides du Bassin d'Arcachon (2e note).—Bulletin de la Société Zoologique de France 68:43–48.

Codreanu, R. 1941. Sur les pagures du littoral Roumain de la Mer Noire et leurs crustacés parasites.—Academia Române, Analele, Bucareşti (3)16:1095–1133.

———. 1961. Crustacei paraziţi cu afinităţi indo-pacifice în Marea Neagră.—Hidrobiologia, Academia Republicii Socialiste Romîne 3:133–146.

———, & M. Codreanu. 1963. Sur plusieurs bopyriens parasites branchiaux des anomoures de la Mer Noire, de la Méditerranée et du Viet-Nam.—Commission Internationale pour l'Exploration de la Mer Méditerranée: Rapports et Procés Verbaux, Réunion 17:283–285.

Cornalia, E., and P. Panceri. 1861. Osservazioni zoologische ed anatomische sopra un nuovo genere di isopodi sedentarii (*Gyge branchialis*).—Memorie della Reale Accademia di Scienze di Torino (2)19(1858):85–118.

David, A. 2001. Research Highlights.—Streamlines, the newsletter of Oregon State University's Col-

lege of Oceanic and Atmospheric Sciences 7(20):6.

Dworschak, P. C. 1988. The biology of *Upogebia pusilla* (Petagna) (Decapoda, Thalassinidea). III. Growth and production.—Marine Ecology 9: 51–77.

Griffen, B. D. 2002. Feeding rates of the mud shrimp *Upogebia pugettensis* and implications for estuarine phytoplankton abundance. Master of Science thesis, Oregon State University, 102 pp.

Grube, E. A. 1864. Die Insel Lussin und ihre Meeresfauna. Ferdinand Hirt, Breslau, 116 pp.

Holthuis, L. B. 1952. On two species of Crustacea Decapoda Macrura from the N. W. coast of South America. Reports of the Lund University Chile Expedition, 1948–49.—Lunds Universitets Årsskrift. N. F. (Avdeling 2), Bind 47 (Number 9):1–11.

Itani, G., M. Kato, & Y. Shirayama. 2002. Behaviour of the shrimp ectosymbionts, *Peregrinamor ohshimai* (Mollusca: Bivalvia) and *Phyllodurus* sp. (Crustacea: Isopoda) through host ecdyses.—Journal of the Marine Biological Association of the United Kingdom 82:69–78.

Kim, H. S., & D. H. Kwon. 1988. Bopyrid isopods parasitic on decapod crustaceans in Korea.—The Korean Journal of Systematic Zoology. Special Issue No. 2:199–221.

Markham, J. C. 1982. Bopyrid isopods parasitic on decapod crustaceans in Hong Kong and southern China. 1. Pp. 375–391 *in* B. S. Morton & C. K. Tseng, eds., Proceedings of the First International Marine Biological Workshop. The Marine Fauna and Flora of Hong Kong and southern China, Hong Kong, 1980. Hong Kong University Press, Hong Kong, 554 pp.

———. 1985. Additions to the bopyrid fauna of Thailand.—Zoologische Verhandelingen 224:1–63.

———. 1988. Descriptions and revisions of some species of Isopoda Bopyridae of the north western Atlantic Ocean.—Zoologische Verhandelingen 246:1–63.

———. 1992. The Isopoda Bopyridae of the eastern Pacific—missing or just hiding?—Proceedings of the San Diego Society of Natural History 17: 1–4.

———. 2001. A review of the bopyrid isopods parasitic on thalassinidean decapods. Pp. 195–204 *in* B. Kensley & R. C. Brusca, eds., Isopod systematics and evolution. Crustacean Issues 13. A. Balkema, Rotterdam.

Norman, A. M. 1905. Museum Normanianum, or a catalogue of the Invertebrata of the Arctic and North Atlantic, Temperate Ocean and Palæarctic Region, which are contained in the collection of the Rev. Canon A. M. Norman, M. A., D. C. L., L. L. D., F. R. S., F. L. S., etc. III. Crustacea (2nd edit.). Thos. Caldcleugh & Son, Durham, vi + 47 pp.

Page, R. D. M. 1985. Review of the New Zealand Bopyridae (Crustacea: Isopoda: Epicaridea).—New Zealand Journal of Zoology 12:185–212.

Restivo, F. 1968. Alcuni nuovi dati sul parassitismo da bopiridi in alcuni decapodi del Golfo di Napoli.—Pubblicazioni della Stazione Zoologica di Napoli 36:505–506.

———. 1975. Nuovi dati su *Paracabirops* (n. d. *Cabirops*) *marsupialis* Caroli, parassita di *Gyge branchialis*.—Pubblicazioni della Stazione Zoologica di Napoli 39:150–168.

Richardson, H. 1905. A monograph on the isopods of North America.—Bulletin of the United States National Museum 54:Iiii + 727 pp.

Shiino, S. M. 1939. Bopyrids from Kyûsyû and Ryûkyû.—Records of Oceanographic Works in Japan 10:79–99.

———. 1958. Note on the bopyrid fauna of Japan.—Report, Faculty of Fisheries. Prefectural University of Mie 3:29–73.

———. 1972. [The Epicaridea (list of species) from Japan].—Kansai Shizenkagaku 24:7–10. [In Japanese]

Williams, A. B. 1986. Mud shrimps, *Upogebia*, from the eastern Pacific (Thalassinoidea: Upogebiidae).—San Diego Society of Natural History, Memoir 14:1–60.