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New hosts and localities for species of *Cancricepon* Giard & Bonnier, 1887 (Isopoda: Epicaridea: Bopyridae) with description of two new species and comments on the relationship between *Cancricepon* and *Trapezicepon* Bonnier, 1900

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Abstract

The genus *Cancricepon* Giard & Bonnier, 1887 is recorded for the first time from Australia, the Maldives, Papua New Guinea and Taiwan. Four species of *Cancricepon* are reported here, and two are new to science. *Cancricepon choprae* (Nierstrasz & Brender à Brandis, 1925) is reported from the Gulf of Mexico on the Florida coast, infesting a new host, *Micropanope cf. sculptipes* Stimpson, 1871. *Cancricepon castroi n. sp.* is described from Australia, the Maldives, Japan and Papua New Guinea parasitizing coral crabs of the family Trapeziidae. *Cancricepon cf. multituberosum* An, Yu & Williams, 2012 is recorded from a specimen of *Leptodius affinis* (De Haan, 1835) from Taiwan. Specimens previously misidentified as *C. choprae* parasitizing *Scalopidia spinosipes* Stimpson, 1858, from China are described as *C. beibusinus n. sp.* All known hosts and localities of species of *Cancricepon* are summarized, and a key to the species in the genus is provided. The similarities between species of *Cancricepon* and the type species of *Trapezicepon* Bonnier, 1900, are discussed and *Trapezicepon thalamitae* Markham, 1985, is transferred to *Scyracepon* Tattersall, 1905.

Key words: Bopyridae, *Cancricepon*, Epicaridea, new locality, new species

Introduction

Giard & Bonnier (1886) mentioned *Cepon elegans* as a parasite of the crab *Pilumnus hirtellus* (Linnaeus, 1761) from France but provided no characters for the species, rendering this name a *nomen nudum*. Shortly thereafter, Giard & Bonnier (1887) erected *Cancricepon*, transferring *C. elegans* to this new genus and provided characters for the species, thereby making the name available as *Cancricepon elegans*; they also described another new species from France, *Cancricepon pilula* Giard & Bonnier, 1887. However, when erecting *Cancricepon*, Giard & Bonnier (1887) neglected to designate either of the two included species as the type species. Markham (1975) was the first to designate *Cancricepon elegans* Giard & Bonnier, 1887, as the type species of *Cancricepon*.

Nierstrasz & Brender à Brandis (1925) described *C. choprae* (originally placed in *Grapsicepon* Giard & Bonnier, 1887) infesting *Paraliomera dispar* (Stimpson, 1871) from Curaçao; this species has subsequently been recorded infesting 12 additional species of hosts from three families of xanthoid crabs and two other crab families (Table 1) (Markham 1975, 1979; Boyko & Williams 2004; An 2009). Danforth (1970) described *C. garthi* infesting *Dacryopilumnus eremita* Nobili, 1906 and *Merocepon knudseni* infesting *Eriphia sebana* (Shaw & Nodder, 1803) from the Pacific island of Eniwetok; the latter species was transferred to *Cancricepon* by An *et al.* (2012). Bourdon (1968, 1971) redescribed and provided characters to distinguish *C. elegans* and *C. pilula* from France, reviewed the genus (as well as related genera), synonymized *Merocepon* Richardson, 1910 with *Cancricepon*, transferred *Grapsicepon choprae* to *Cancricepon* and described a new species, *Cancricepon anagibbosus* Bourdon, 1971, as a parasite of *Micropanope melanodactyla* (A. Milne-Edwards, 1868) (now *Nanocassiope melanodactyla*) from Côte

d'Ivoire. Bourdon (1971) was, however, apparently unaware of Danforth's (1970) earlier paper and did not discuss the two species erected therein. An (2009) identified specimens infesting *Scalopidia spinosipes* Stimpson, 1858 from the Beibu Gulf as *C. choproae*, although they are now recognized as representing a distinct species described herein. An *et al.* (2012) described a new species, *C. multituberosum*, based on specimens parasitizing the xanthid crab *Liomera laevis* (A. Milne-Edwards, 1873). In the present paper, we describe two new species in the genus. A key to all species of *Cancricepon* is provided. We also discuss the similarities between species of *Cancricepon* and *Trapezicepon* Bonnier, 1900 and transfer *T. thalamitae* Markham, 1985, to *Scyracepon* Tattersall, 1905.

Material and methods

The isopods reported here were found infesting decapods in the collections of the Florida Museum of Natural History (UF), Gainesville, FL, USA, except for the Chinese specimens which are deposited in the Marine Biological Museum of the Chinese Academy of Sciences (MBMCAS), Qingdao, China. Specimens were viewed and drawn using a Zeiss Stemi SV Apo, Olympus XZS12 dissecting microscope, or Olympus CX31 compound microscope. Final line drawing images were created by tracing with a drawing tablet using Adobe Illustrator. For scanning electron microscopy, males were fixed in 2.5% glutaraldehyde in Millonig's phosphate buffer at pH 7.4 for 1.5h and postfixed in 1% osmium tetroxide in Millonig's buffer for 1h. The specimens were then dehydrated through a graded ethanol series, followed by critical-point drying. After sputter coating with colloidal gold, the specimens were examined with S-3400N Hitachi SEM. When measurements of hosts are provided, they are carapace width (CW) and length (CL); bopyrids were measured from the anterior of the head to the posterior of the pleon along the midline. References for authors and dates of epicaridan taxa, but not for hosts, are provided.

Results

Systematics

Order Isopoda Latreille, 1817

Suborder Epicaridea Latreille, 1825

Family Bopyridae Rafinesque-Schmaltz, 1815

Subfamily Keponinae Boyko, Moss, Williams & Shields, 2013

Genus *Cancricepon* Giard & Bonnier, 1887

Type species: *Cepon elegans* Giard & Bonnier, 1887, by subsequent designation of Markham, 1975.

Synonym: *Merocepon* Richardson, 1910

Type species: *Merocepon xanthi* Richardson, 1910, by original designation.

Remarks. The type species of *Trapezicepon* Bonnier, 1900, *T. amicorum* (Giard & Bonnier, 1888), is quite similar in many characters to species of *Cancricepon*, especially to *C. castroi* n. sp. The most obvious difference is that *T. amicorum*, which has been reported infesting *Trapezia cymodoce* (Herbst, 1801) (Trapeziidae) (Bonnier, 1900) and *Actumnus tomentosus* Dana, 1852 [= *A. setifer* (De Haan, 1835)] (Pilumnidae) (Stebbing, 1910), lacks middorsal projections on any pereomeres of the female. The barbula is similar in both species in that there are two falcate lateral projections on each side but differs in that *T. amicorum* has a broad, flat median region, whereas members of the genus *Cancricepon* have a median region with a pair of blunt triangular projections. The males of *T. amicorum* and *Cancricepon* spp. are nearly indistinguishable. It appears that these two genera are closely related and molecular data would be helpful in determining if their status as separate genera is warranted.

A second species of *Trapezicepon*, *T. domeciae* Danforth, 1972, was incompletely described and figured but appears to be congeneric with *T. amicorum* and therefore also closely related to *Cancricepon* spp. However, the

third described species in *Trapezicepon*, *T. thalamitae* Markham, 1985, is clearly not congeneric with *T. amicorum* nor closely related to any species of *Trapezicepon* or *Cancricepon*. This conclusion is based on numerous characters of the female and male of *T. thalamitae* including: female with large middorsal projections on pereomeres 6 and 7 in *T. thalamitae* vs. none in *T. amicorum*, male with head much narrower than first pereomere in *T. thalamitae* vs. subequal in width in *T. amicorum*, and male with medial dorsal fusion of pleomeres in *T. thalamitae* vs. pleomeres completely separated in *T. amicorum*. In fact, these three characters show that *T. thalamitae* belongs to *Scyracepon* Tattersall, 1905, a genus in which females of all species have large middorsal projections on at least pereomeres 6 and 7, males have a head much narrower than the first pereomere, and males have medial dorsal fusion of all pleomeres. We therefore formally transfer *T. thalamitae* to *Scyracepon*, as *S. thalamitae* (Markham, 1985) **n. comb.**

An additional juvenile female found parasitizing an unidentified species of *Lambrus* Leach 1815 (= *Parthenope* Weber, 1795) was identified as *Trapezicepon* sp. by Nierstrasz & Brender à Brandis (1931). However, due to the specimen's immaturity, its generic placement is unclear and it could belong to any one of a number of keponine genera, including *Apocepon* Nierstrasz & Brender à Brandis, 1931, whose type species, *A. sibogae* Nierstrasz & Brender à Brandis, 1931, contains the only other bopyrid specimen (also a female) known to parasitize a host in Parthenopidae.

Cancricepon choprae (Nierstrasz & Brender à Brandis, 1925)

(Fig. 1)

?*Leidya distorta*.—Hay & Shore, 1918: 440 [see Table 1] (not *Leidya distorta* (Leidy, 1855)).

Grapsicepon choprae Nierstrasz & Brender à Brandis, 1925: 4, 7, 8, figs 11–16 [see Table 1].—Shiino, 1936: 169, 171 [mention].—Shiino, 1942: 449 [mention].—Schultz, 1969: 319, fig. 508 [key].—Danforth, 1970: 10, 45 [list], 76 [translation of original description].—Danforth, 1972: 165–167 [mention; table of characters].

Ergyne rissoei Nierstrasz & Brender à Brandis, 1925: 1, 5, 7, 8, figs 17–21 [mention as host of *Danalia fraissei* Nierstrasz & Brender à Brandis, 1925 = *Cabirops fraissei* (Nierstrasz & Brender à Brandis, 1925); also see Table 1].—Nierstrasz & Brender à Brandis, 1926: 52 [mention as host of *D. fraissei* = *C. fraissei*].—Caroli, 1953: 85–86 [mention as host of *D. fraissei* = *C. fraissei*].—Markham, 1975: 55, 56, 66 [examination of type specimen].—Schultz, 1969: 315, fig. 501 [key].—Danforth, 1970: 10, 45 [list], 73–74 [translation of original description], fig. 18e, f.—Danforth, 1972: 165 [mention].—Boyko, 2013: 109 [mention].—Boyko, 2014: 75 [mention as host of *C. fraissei*].

“isopod parasites” Rathbun, 1930: 246 [identification of host of types of *G. choprae*; see Table 1].

Portunicepon rissoei.—Shiino, 1934: 276 [table of characters].

Cancricepon choprai (*sic*).—Bourdon, 1971: 387–389 [mention].

Cancricepon (*Grapsicepon*) *choprai* (*sic*).—Bourdon, 1971: 389 [mention].

Cancricepon choprae.—Markham, 1975: 56–61, figs 1–3 [see Table 1].—Markham, 1979: 523–524 [see Table 1].—Markham, 1986: 158 [mention].—Markham, 1988: 56 [list].—Kensley & Schotte, 1989: 110 [list].—Markham & Donath-Hernández, 1990: 243 [list].—Salazar-Vallejo & Leija-Tristan, 1990: 430 [list].—McDermott, 1991: 90 [mention].—Kensley, 1994: 320 [list].—Camp *et al.* 1998: 134 [list].—Boyko & Williams, 2004: 367 [see Table 1].—Schotte *et al.* 2009: 981 [list].—Boyko, 2013: 109 [mention].—Boyko, 2014: 75 [mention as host of *C. fraissei*].—Shields *et al.* 2015: 721 [mention], 728 [list].

not *Cancricepon choprae*.—An, 2009: 5–6, fig. 3.—Yu & An, 2008: 691 [list] (= *C. beibusinus* **n. sp.**).

Material examined. Infesting *Micropanope* cf. *sculptipes* Stimpson, 1871 (3.8 mm CW, 2.2 mm CL) (UF 31733); mature dextral female, 1.1 mm (UF 42205), mature male, 1.0 mm (UF 42205), USA, Gulf of Mexico, Florida, 28°26'56"N, 84°40'37"W, north-northwest of St. Petersburg, south of Big Bend area, 200 ft depth (= 60.1 m), 24 May 2012, coll. G. Paulay, N. Evans, F. Michonneau. Additional mature male, 0.8 mm (UF 42205; prepared for SEM), same locality as other specimens.

Description. *Female* (UF42205) length 1.1 mm; maximum width (across pereomere 5) 0.8 mm; head length 0.4 mm; head width 0.6 mm; pleon length 0.5 mm. All segments of body distinct (Fig. 1A).

Head subovate, frontal margin slightly bilobate medially. Frontal lamina large and extending beyond sides and frontal margin of head. Eye pigment on extreme edge of head at junction with frontal lamina. Antennules and antennae with two articles each, terminally setose. Barbula with two slender falcate pointed lateral projections on each side, outer projections larger than inner ones, middle region smooth (Fig. 1B). Maxilliped with prominent anterior segment, large palp fringed with setae, plectron triangular, short and blunt (Fig. 1C).

Pereon broadest across pereomere 5. Subcircular tergal projections prominent on pereomere 2–4, coxal plates

rudimentary. Last three pereomeres with overlapping, posteriorly directed mid-dorsal projections (Fig. 1D). Oostegites almost enclosing brood pouch, oostegite 1 (Fig. 1E, F) with subcircular anterior article, almost equal in length to posterior article, internal ridge smooth without any tubercles, posterior article triangular. Pereopods subequal in structure, first two and last two pairs smaller than pairs 3–5 (Fig. 1A). All pereopods with elongate ischia, triangular meri, and blunt dactyli.

Pleon with six segments, first five pleomeres bearing 5 pairs of biramous pleopods and uniramous lateral plates, all margins slightly undulating, surfaces smooth (Fig. 1D). Endopodites of pleopods much smaller than exopodites, globular. Terminal pleomere ending in uniramous uropods, similar to but longer than fifth pleopods, surface smooth, margins slightly undulating (Fig. 1A).

Male (UF 42205) length 1.0 mm; maximum width (across pereomere 4) 0.3 mm; head length 0.1 mm; head width 0.2 mm. All body regions and segments distinct (Fig. 1G). Head elliptical, distinctly separated from first pereomere (Fig. 1G). Large, irregular dark eyes near posterolateral corners. Antennules and antennae visible beyond margins of head in dorsal view, of three and five articles each, respectively; both bearing setae on two distalmost articles (Fig. 1H).

Pereon with mid-ventral tubercles on all segments. Pereomeres 3–5 subequal in width, patches of pigmentation on pereomeres 2–7 and pleomeres 1–2 (Fig. 1G). First two pereopods larger than other five, all with similar structure (Fig. 1H, I); all meri and carpi with setae on ventral surface. Propodi of pereopods 2–7 distally produced into comb-like surface receiving tips of dactyli (Fig. 1H)

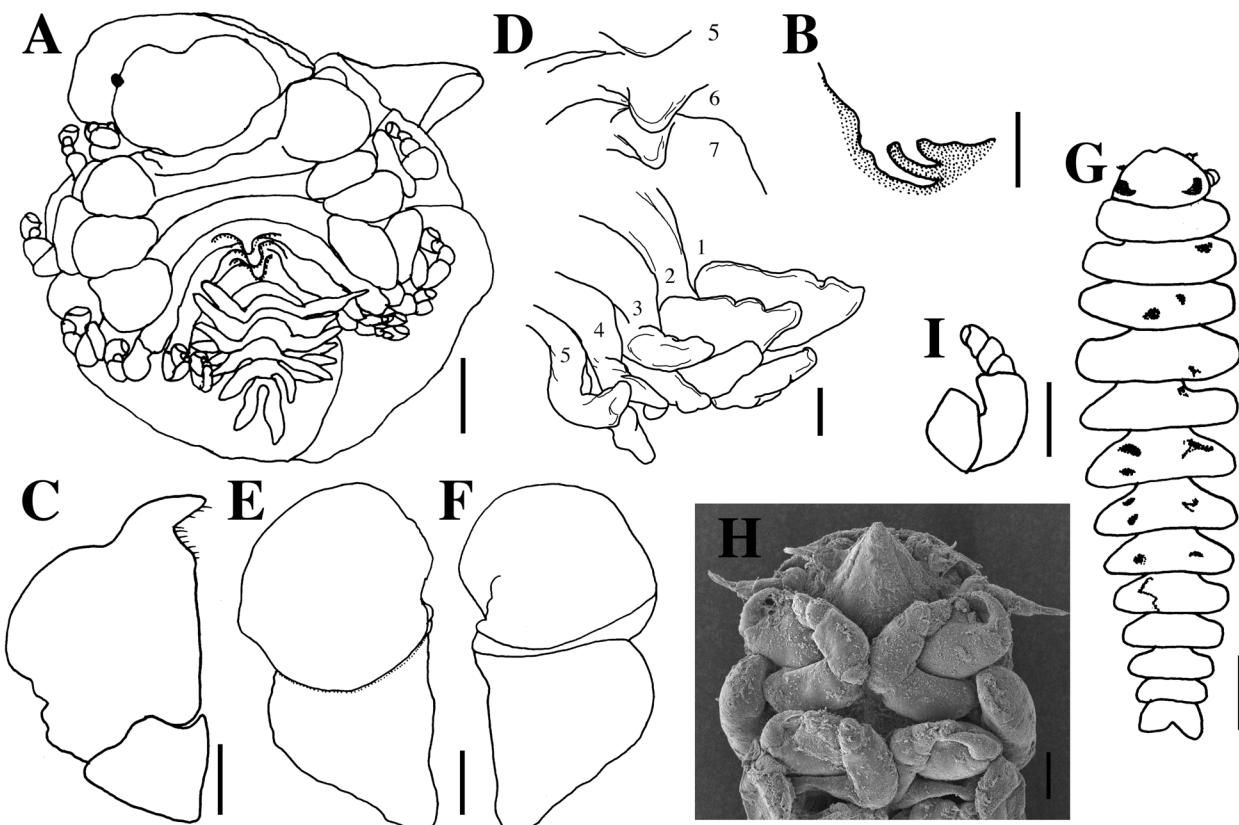


FIGURE 1. *Cancricepon choproae* (Nierstrasz & Brender à Brandis, 1925), female (UF 42205) (A–F); male (UF 42205) (G–I): A, dorsal view; B, barbula, right side; C, right maxilliped, external view; D, pleon, dorsal view (5–7 = pereomeres, 1–4 = pleomeres); E, right oostegite 1, internal view; F, right oostegite 1, external view; G, dorsal view; H, ventral view of head and pereonites 1 & 2; I, right pereopod 5. Scale bars: A = 250 µm; D = 100 µm; B, C, E–G, I = 150 µm; H = 25 µm.

Pleon with 6 pleomeres, each narrower than preceding one. First five pleomeres with low, rounded pleopods, without mid-ventral tubercles. Pleomere 6 without uropods, posterolaterally extended into two rami, each tipped with setae.

Remarks. These specimens are similar to those described by previous authors (Nierstrasz & Brender à Brandis, 1925; Markham, 1975), although smaller than those specimens for which measurements were given. Both

males in the present material were identical in all characters except size. The species was previously known from another species of *Micropanope* Stimpson, 1871, but this is the first record from *M. cf. sculptipes*, a species previously unknown to bear any bopyrid. The specimens identified as *C. choproae* by An (2009) from China do not belong to this species and are described below as *C. beibusinus* n. sp.

***Cancricepon castroi* n. sp.**

(Figs 2, 3)

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Material examined. Infesting female *Trapezia septata* Dana, 1852 (11 mm CW, 9 mm CL) (UF 22339); mature dextral holotype female (4.5 mm), mature allotype male (1.3 mm, prepared for SEM) (UF 42206), Australia, Western Australia, Ningaloo Reef, Wreck Zirv, reef front, 22°36'30"S, 113°37'30"E, in *Pocillopora* sp., 10 m, May 2009, coll. J. Cale, L. Plaisance.

Infesting female *Trapezia lutea* Castro, 1997 (8.4 mm CW, 5.9 mm CL) (UF 39611); mature sinistral paratype female (3.7 mm), mature paratype male (1.6 mm) (UF 42207), Maldives, 0.3 km south of Magoodhoo Island, 10–30 m forereef, in *Pocillopora* sp., 03°04'29"N, 72°57'59"E, 10 May 2014, coll. J. Moore.

Infesting male *T. lutea* (15.7 mm CW, 12.3 mm CL) (UF 27019); mature sinistral paratype female (7.2 mm), mature paratype male (1.9 mm) (UF 42208), Japan, Okinawa Prefecture, Okinawa Island, White Beach, 1–14 m, 26°17'44"N, 127°54'22"E, 17 July 2010, coll. N. Evans, F. Michonneau, G. Paulay, T. Naruse, Y. Ise.

Infesting male *Quadrella coronata* Dana, 1852 (6.9 mm CW, 5.4 mm CL) (UF 4821); juvenile non-type female (3.2 mm), 2 non-type cryptoniscus larvae (1.4 mm each) (UF 42209), Papua New Guinea, 02°22'06"S, 146°17'19"E, 29 June 2003, coll. L. Kirkendale.

Description. Female length 3.7 mm excluding uropods; maximum width (across pereomere 3) 3.7 mm; head length 1.1 mm, width 1.2 mm; length of uropods 1.1 mm (measurements based on holotype). All segments distinct; no pigmentation (Fig. 2A, B).

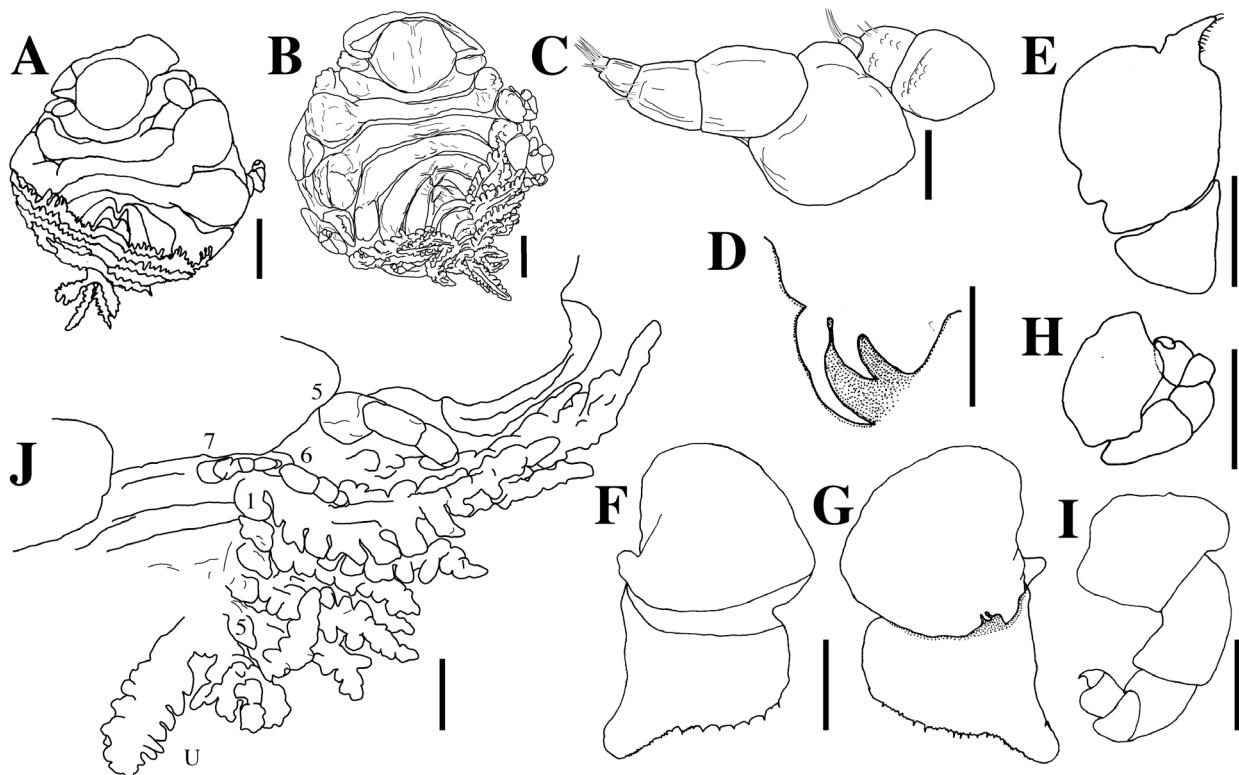


FIGURE 2. *Cancricepon castroi* n. sp., holotype female (UF 42206) (A, D–J); paratype female (UF 42207) (B, C): A, B, dorsal view; C, right antennule and antenna; D, barbula, right side; E, left maxilliped, external view; F, left oostegite 1, external view; G, left oostegite 1, internal view; H, right pereopod 1; I, left pereopod 4; J, ventral view of terminal pereomeres and pleon, left side. Scale bars: A = 1 mm; B = 500 µm; C = 50 µm; D–G = 320 µm; H, I = 170 µm; J = 250 µm.

Head ovate, frontal lamina prominent, extending beyond both sides of head and frontal margin, notched medially (Fig. 2A, B); eyes lacking. Antennules and antennae of three and five articles each, respectively, terminally setose; all articles with scales (Fig. 2C). Barbula with 2 falcate pointed lateral projections on each side, outer projections larger than inner; median region with a pair of blunt triangular projections (Fig. 2D). Maxilliped with rounded anterior segment and large tapered palp, inner margin fringed with setae, plectron triangular, short and blunt (Fig. 2E).

Pereon broadest across pereomere 3 (Fig 2A, B). Coxal plates developed in first 4 pereomeres. Large tergal projections present on pereomeres 2–4, with projections on longer side of body larger than those on shorter side. Last three pereomeres with pointed mid-dorsal projections (Fig 2A, B). Brood pouch completely covered by oostegites, highly vaulted. Oostegite 1 (Fig. 2F, G) with two segments subequal in length, anterior segment ovate; internal ridge notched near lateral margin, with small tubercle; posterior margin fringed with setae, round posterolateral point extended laterally. Pereopods 1 (Fig. 2H) and 5–7 all small, with blunt dactyli, pereopods 2–4 large, with sharp dactyli (Fig. 2I). All pereopods with stout bases.

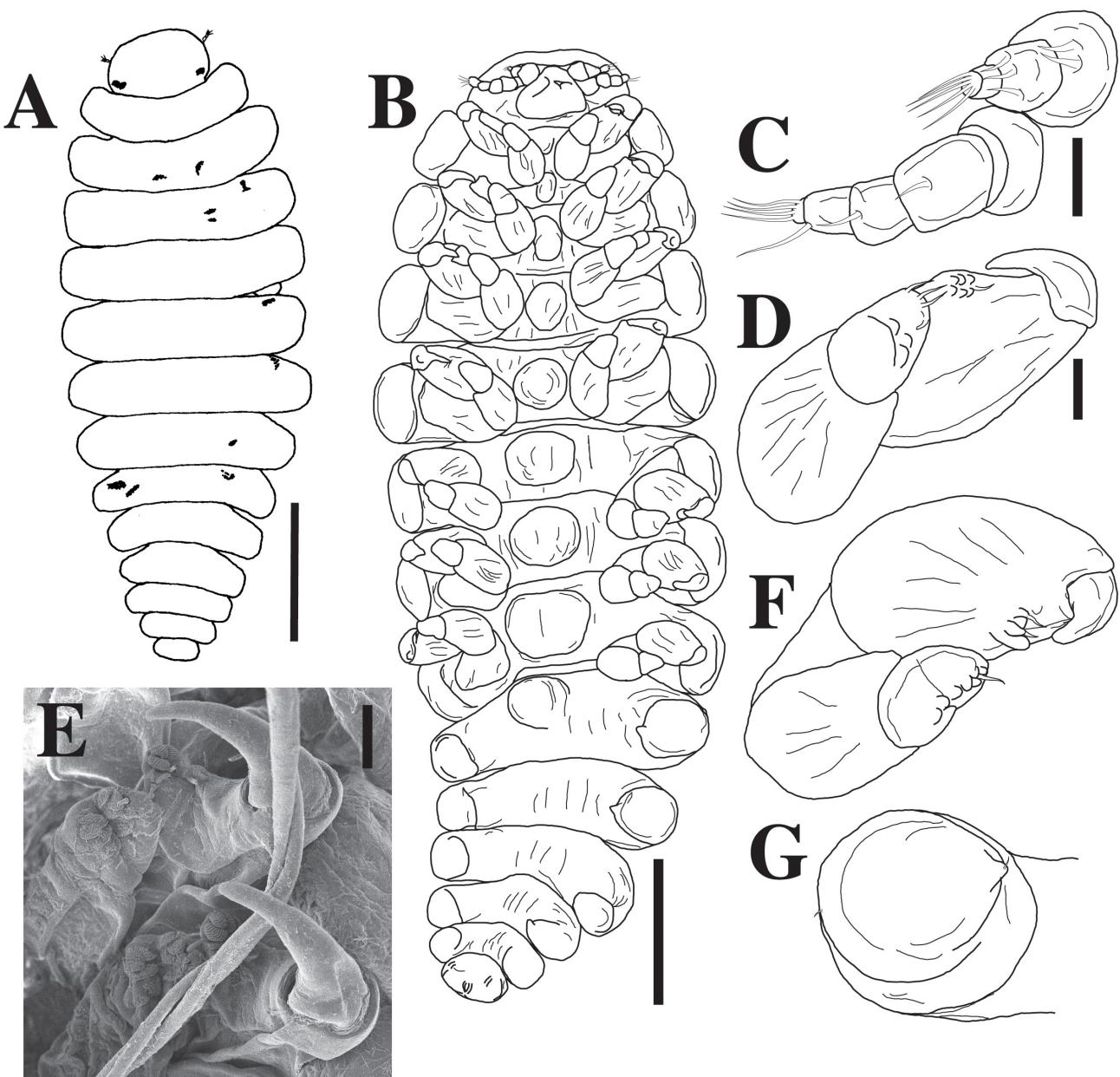


FIGURE 3. *Cancricepon castroi* n. sp., paratype male (UF 42207) (A–D, F, G); allotype male (UF 42206) (E): A, dorsal view; B, ventral view; C, left antennule and antenna; D, right pereopod 1; E, left pereopods 2 & 3; F, right pereopod 7; G, right pleopod 4. Scale bars: A = 200 µm; B = 250 µm; C, D, F, G = 50 µm; E = 10 µm.

Pleon of six segments, first five pleomeres with 5 pairs of biramous pleopods and uniramous lateral plates. All pleopods and lateral plates with digitate margins, surfaces covered with tubercles (Fig. 2J). Uropods uniramous, similar to pleopods (Fig. 2A, B, J).

Allotype male length 1.8 mm; maximum width (across pereomeres 4–6) approximately 0.7 mm; head broader than long, length 0.2 mm, width 0.3 mm. All body regions and segments distinct (Fig. 3A, B).

Head elliptical, with rounded anterior margin; small, dark eyes near posterolateral corners (Fig. 3A). Antennules with three articles each, distal margin of all articles with setae (Fig. 3C). Antennae with five articles each, second through fourth articles with single seta, distal segment with many setae (Fig. 3C).

Pereon with seven segments. Pereomeres 4–6 subequal in width, small patches of pigmentation present on some pereomeres and first pleomere (Fig. 3A). All pereomeres with rounded mid-ventral tubercles (Fig. 3B). First three pereopods larger than posterior four; dactyli of first three pereopods much larger than others (Fig. 3D–F), propodi, carpi and meri with ridged pad-like scales and tufts of setae on ventral surfaces (Fig. 3D–F).

Pleon with six pleomeres, lateral margins rounded (Fig. 3A, B). First five pleomeres with uniramous lateral digitiform pleopods, tips tapered, acute with terminal seta (Fig. 3G), first pleomere with midventral tubercle (Fig. 3B). Sixth pleomere (pleotelson) without uropods or posterolateral lobes, anal cone visible in ventral view (Fig. 3B).

Etymology. This species is named after Dr. Peter Castro (Professor Emeritus, California State Polytechnic University, Pomona) in honor of his contributions to trapeziid taxonomy.

Remarks. This new species can be distinguished from its closest relative, *C. savignyi*, by several characters of the female: all pereomeres with asymmetrical dorsolateral bosses (at least those on pereomere 2 symmetrical in *C. savignyi*), maxilliped palp elongate and tapered (maxilliped palp stout and rounded at tip in *C. savignyi*), endopods of pleopods less than 1/3 as large as exopods (endopods of pleopods 1/3 to 1/2 as long as exopods in *C. savignyi*). Additional differences between *C. castroi n. sp.* and other species of *Cancricepon* are given in the key to species below. Differences between the males of the two species are difficult to determine, as the sole male described by Stebbing (1910) had unusual pleopod structures and may not have been fully mature.

No bopyrids were previously known from either *Trapezia septata* or *T. lutea*. No species of *Quadrella* Dana, 1851, has ever previously been reported to bear bopyrids, although *Q. coronata* is the type host for *Sacculina pilosella* Van Kampen & Boschma, 1925 (Cirripedia: Rhizocephala) (Van Kampen & Boschma 1925). Australia, the Maldives, and Papua New Guinea are new localities for species of *Cancricepon*.

Cancricepon cf. multituberous An, Yu & Williams, 2012

(Fig. 4)

Material examined. Infesting *Leptodius affinis* (De Haan, 1835) (8.6 mm CW, 5.7 mm CL) (UF 29451); mature dextral female (damaged, ca. 3.0 mm excluding pleon), mature male (prepared for SEM, 0.95 mm) (UF 42216), Taiwan, Keelung area, near bridge to Chao-Jing Station, 0-2 ft (= 0–0.6 m) intertidal, 25°08'31"N, 121°48'11"E, 2 July 2011, coll. M. Bemis, M. Malay, J. Huang.

Description. *Female* total length 4.1 mm (including pleon and uropods), maximal width 2.5 mm across third pereomere, head length 0.8 mm (including frontal lamina), head width 1.0 mm. All body regions and segments distinct. No pigmentation (Fig. 4A, B).

Head subovate, wider than long, anterior margin slightly bilobate and posterior margin convex; large frontal lamina extending beyond both sides of head, anterior margin with two small notches; eyes absent (Fig. 4A). Antennules of three articles each, with stout basis and second article, distal article minute; antennae smaller than antennules, also of three articles each, all small; antennules and antennae with setae on distal two articles, all articles with scales (Fig. 4C). Barbula with two falcate projections on each side, outer projections larger than inner ones and highly curved; pair of triangular projections medially (Fig. 4D). Maxilliped with two segments, anterior segment much larger than posterior one (Fig. 4E); large and curving palp with terminal setae (Fig. 4F).

Pereon with distinct segments, broadest across pereomere 3 (Fig. 4A); all pereomeres except first with middorsal projections, but pereomeres 2–4 with small round projections, pereomeres 5–7 with posteriorly pointed projections (Fig. 4A, J). First four pereomeres with rounded dorsolateral bosses and weakly developed tergal projections (Fig. 4A, I). Brood pouch completely covered by oostegites (Fig. 4B). First oostegite (Fig. 4G, H) with two subequally long articles, posterior article with irregular margin, internal ridge almost smooth, bearing a few

small low projections near outer margin. Fifth oostegite with terminal setae and rounded tubercles on surface, covered with scales (Fig. 4L). Pereopods subequal in structure, large knob-like structure on each ischium; posterior pereopods larger (Fig. 4I, K, L)

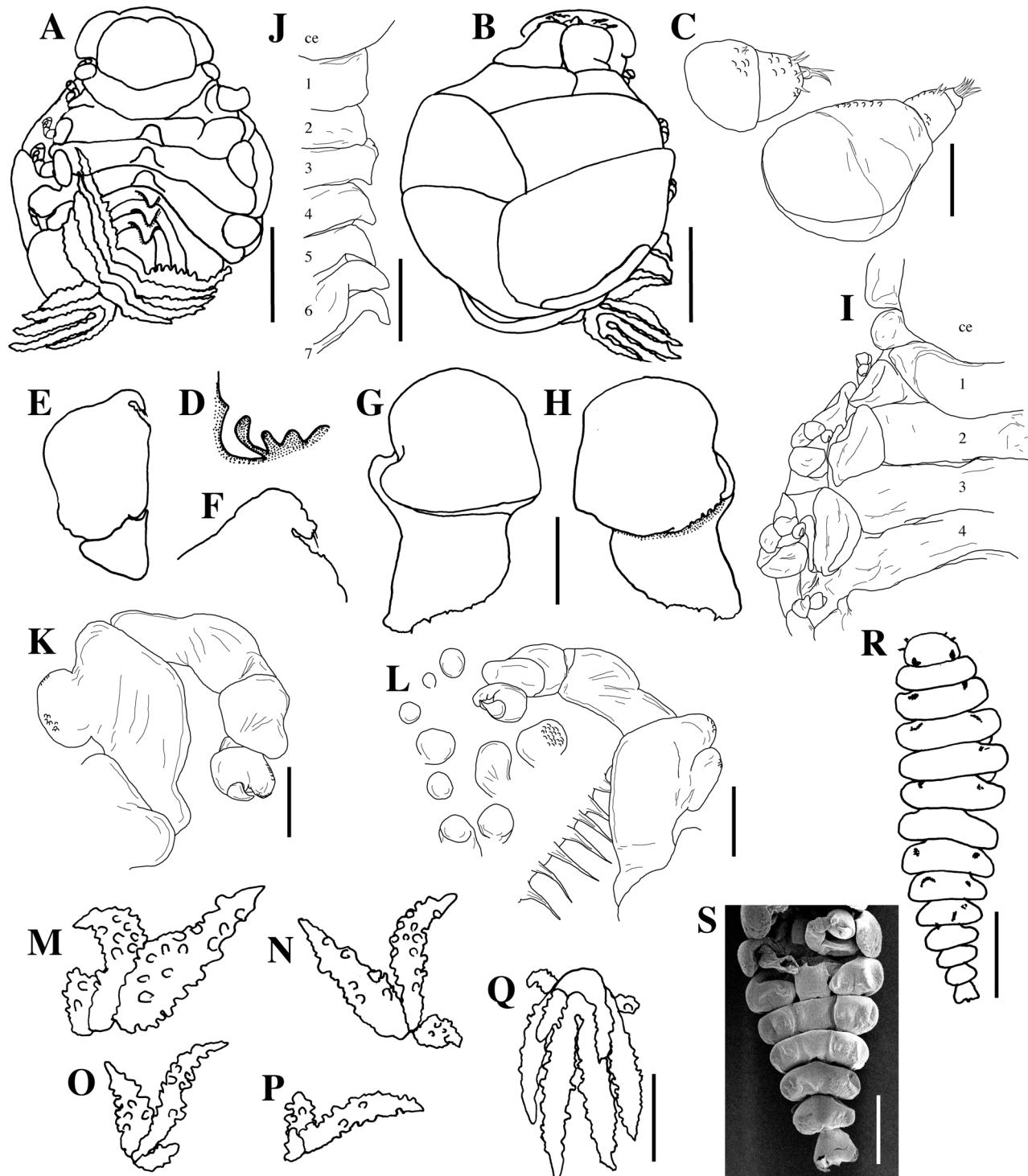


FIGURE 4. *Cancricepon* cf. *multituberousum* An, Yu & Williams, 2012, female (UF 42216) (A–Q), male (UF 42216) (R, S): A, dorsal view; B, ventral view; C, left antennule and antenna; D, right side of barbula; E, right maxilliped, external view; F, palp of maxilliped; G, right oostegite 1, external view; H, right oostegite 1, internal view; I, left side of pereomeres 1–4 (ce = cephalon), dorsal view; J, lateral view of pereomeres 1–7 (ce = cephalon) showing middorsal projections; K, left pereopod 6; L, right pereopod 7, showing tubercles on surface of fifth oostegite and terminal setae; M, right pleopod 1; N, right pleopod 2; O, right pleopod 3; P, right pleopod 4; Q, right pleopod 5 and uropods; R, dorsal view; S, ventral view of pereomere 7 and pleon. Scale bars: A, B = 1 mm; C = 50 µm; K, L, S = 100 µm; D, E, G, H, M–Q = 500 µm; F = 110 µm; I, J = 500 µm; R = 250 µm.

Pleon of six distinct pleomeres, first five with long lateral plates and biramous pleopods; lateral plates and pleopods with digitate margins, surfaces with small tubercles (Fig. 4L–P); endopodites less than half as large as associated exopodites. Sixth pleomere with uniramous uropods, margins digitate, longer than pleopod 5 (Fig. 4Q).

Male length 0.95 mm, maximal width across fourth pereomere 0.3 mm, head length 0.1 mm, head width 0.16 mm (Fig. 4R).

Head elliptical, anterior margin rounded, posterior margin truncate (Fig. 4R); conspicuous dark eyes near posterolateral margin (Fig. 4R). Head and first pereomere separated (Fig. 4R). Antennules with two articles each, first article with two setae, second article with 6–8 setae. Antennae with three articles each, first two articles with one seta, third article with 8 setae.

Pereon with pigment on pereomeres 2–7 and pleomeres 1–2 (Fig. 4R). All pereopods subequal in structure, first four pereopods larger than last three pairs. Carpi and meri of pereopods with one seta on ventral surface, propodi produced into plates covered in scales for receiving tips of dactyli. All pereomeres with midventral tubercles.

Pleon of six segments, first pleomere with midventral tubercle (Fig. 4S). First five pleomeres with low, rounded pleopods (Fig. 4S), sixth pleomere weakly produced into two rami, each terminated with tuft of setae (Fig. 4S), anal cone present medially (Fig. 4S).

Remarks. An et al. (2012) described *C. multituberousum* as having all pereomeres with middorsal triangular projections; the female from *Leptodius affinis* lacks a middorsal projection on the first pereomere. The present female specimen also differs from *C. multituberousum* in having a maxilliped with palp, whereas the maxilliped of *C. multituberousum* lacks a palp. The male of *C. multituberousum* has midventral tubercles on the first two pleomeres, whereas the present male has one only on the first pleomere. In all other aspects the present material agrees with *C. multituberousum* and, in the absence of more material from this host, we tentatively assign them to *C. multituberousum*. *Leptodius affinis*, has not previously been reported as a host for bopyrids.

Cancricepon beibusinus n. sp.

(Fig. 5)

urn:lsid:zoobank.org:act:B6E28ACF-FA65-429A-8944-076E9FA423B4

Cancricepon choprae.—An, 2009: 5–6, fig. 3.—Yu & An, 2008: 691 [list] (not *Cancricepon choprae* (Nierstrasz & Brender à Brandis, 1925)).

Material examined. Infesting female *Scalopidia spinosipes* Stimpson, 1858, mature sinistral female holotype (6.8 mm) (MBMCAS CIEO 625301), mature male allotype (2.5 mm) (MBMCAS CIEO 625302), China, Beibu Gulf, Stn. 6253, 19°00'00"N, 107°30'00"E, 67 m, 10 Feb 1960, coll. Z. Fan; infesting female *S. spinosipes*, mature sinistral female paratype (5.6 mm) (MBMCAS CIEO 625601), mature male paratype (1.9 mm) (MBMCAS CIEO 625602), China, Beibu Gulf, Stn. 6256, 17°30'00"N, 107°30'00"E, 67.7 m, 13 July 1960, coll. Z. Fan.

Description. Holotype female length 6.8 mm, maximal width 5.0 mm across third pereomere, head length 1.7 mm (include frontal lamina), head width 1.8 mm. All body regions and segments distinct; no pigmentation (Fig. 5A, B).

Head subovate, anterior margin bilobate and posteriorly curved; prominent frontal lamina extending beyond both sides of head and frontal margin; eyes lacking. Antennules and antennae of three and four articles each, respectively, distal articles small; setae on most articles (Fig. 5C). Maxilliped with large, broad palp, setae on inner margin (Fig. 5D). Barbula with two large falcate projections laterally, outer projections larger than inner ones; pair of triangular projections medially (Fig. 5E).

Pereon with seven segments, broadest across pereomere 3 (Fig. 5A); first four pereomeres with round dorsolateral bosses, pereomeres 2 and 3 with tergal projections (Fig. 5A). Brood pouch completely covered by oostegites (Fig. 5B). Last three pereomeres with middorsal projections, on fifth and sixth pereomeres rounded and directed posteriorly, on seventh pereomere acute and directed anteriorly (Fig. 5A). First oostegite (Fig. 5F, G) with two articles of approximately equal length, anterior article subovate, posterior article strongly tapered distolaterally, internal ridge with one larger thin projection nearly extending to the posterior margin of posterior article, several smaller subacute projections medially. Pereopods subequal in structure, propodus small, posterior pereopods larger (Fig. 5H, I).

Pleon of six pleomeres, first two and last two with smooth dorsal surfaces, pereomeres 3, 4 medially indented and bilobed. First five pleomeres with uniramous lateral plates and biramous pleopods; lateral plates and pleopods with densely digitate margins and surfaces with small tubercles (Fig. 5A, B, J); endopodites smaller than associated exopodites (Fig. 5J). Sixth pleomere with uniramous uropods, similar in structure to exopodite of pleopod 5 (Fig. 5A).

Allotype male length 2.5 mm, maximal width across fourth pereomere 0.9 mm, head length 0.2 mm, head width 0.4 mm (Fig. 5K, L).

Head an oblong ellipse, anterior and posterior margins rounded, minute dark eyes near posterior edge (Fig. 5K); head and first pereomere separated (Fig. 5K). Antennules with three articles each, distal two articles with setae; antennae with four articles each, distal three articles covered with setae (Fig. 5M).

Pereon of seven segments, fourth pereomere widest. All pereomeres with round midventral tubercles (Fig. 5L). Pereopods subequal in structure, median three pairs slightly larger than others. Carpi, meri and propodi of pereopods with scales on ventral surfaces (Fig. 5N).

Pleon of six segments, without midventral tubercles. First five pleomeres with lateral tuberculate pleopods (Fig. 5L), sixth pleomere (pleotelson) with truncate posterior margin, lacking uropods or posterolateral lobes (Fig. 5L).

Etymology. The species name is derived from the type locality, the Beibu Gulf, whose name in Chinese is *Bēibù Wān* or "Northern Bay" of the South China Sea.

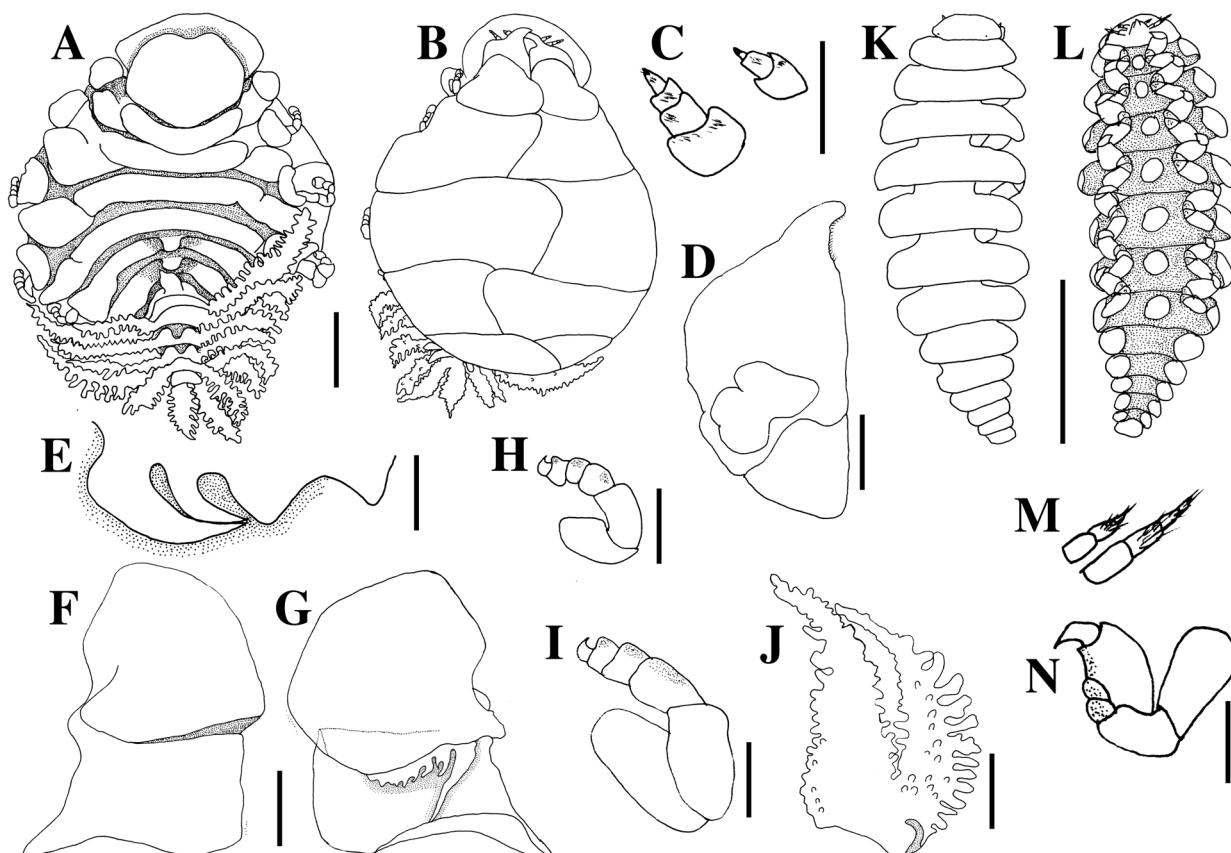


FIGURE 5. *Cancricepon beibusinus* n. sp., holotype female (MBMCAS CIEO 625301) (A–J), allotype male (MBMCAS CIEO 625302) (K–N): A, dorsal view; B, ventral view; C, right antennule and antenna; D, right maxilliped, external view; E, barbula; F, right oostegite 1, external view; G, right oostegite 1, internal view; H, right pereopod 2; I, right pereopod 7; J, right pleopod 1; K, dorsal view; L, ventral view; M, left antennule and antenna; N, left pereopod 1. Scale bars: A, B, K, L = 1 mm; C = 220 µm; D = 410 µm; E = 550 µm; F, G, J = 730 µm; H, I = 280 µm; M, N = 125 µm.

TABLE 1. Hosts and localities of species of *Cancricepon* Giard & Bonnier, 1887. Names of hosts have been updated from the references cited to reflect current classification (WoRMS Editorial Board, 2019).

Species	Hosts	Host's family	Localities	References
<i>C. anagibbosus</i> Bourdon, 1971	<i>Nanocassiope melanodactylus</i> (A. Milne-Edwards, 1868)	Xanthidae	Côte d'Ivoire ¹	Bourdon 1971
<i>C. beihuensis</i> n. sp.	<i>Scalopidia spinosipes</i> Stimpson, 1858	Scalopidiidae	Beibu Gulf, China	An 2009; Present paper
<i>C. castroi</i> n. sp.	<i>Trapezia septata</i> Dana, 1852 <i>Trapezia lutea</i> Castro, 1997 <i>Quadrella coronata</i> Dana, 1852	Trapeziidae	Australia Japan, Maldives Papua New Guinea	Present paper Present paper Present paper
<i>C. choproae</i> (Nierstrasz & Brender à Brandis, 1925)	<i>Paraliomera dispar</i> (Stimpson, 1871) <i>Domecia hispida</i> Eydoux & Souleyet, 1842 <i>Rhithropanopeus harrisi</i> (Gould, 1841) <i>Garthiopae barbadensis</i> (Rathbun, 1921) <i>Neopanope packardi</i> (Kingsley, 1879) <i>Panopeus herbstii</i> H. Milne Edwards, 1834 <i>Hexapanopeus angustifrons</i> (Benedict & Rathbun, 1891) <i>Panoplax depressa</i> Stimpson, 1871 <i>Eriphia goniagra</i> (Fabricius, 1791)? ³ <i>Dyspanopeus sayi</i> (Smith, 1869)? ⁴ <i>Domecia acanthophora</i> (Desbonne in Desbonne & Schramm, 1867) ⁴ <i>Panopeus boekei</i> Rathbun, 1915 <i>Micropanope cf. sculptipes</i> Stimpson, 1871	Xanthidae Domeciidae Panopeidae Xanthidae Panopeidae Panopeidae Panopeidae Pseudorhombidae Eriphiidae Panopeidae Domeciidae Panopeidae Pseudorhombidae	Curacao Curacao Vera Cruz, Mexico Florida (Gulf of Mexico) Florida (Atlantic) Georgia; Florida; Bermuda ² Mississippi Florida (Gulf of Mexico) North Carolina ³ ? ⁵ ? ⁵ Bahamas Florida (Gulf of Mexico)	Nierstrasz & Brender à Brandis 1925; Rathbun, 1930 Nierstrasz & Brender à Brandis 1925 Markham 1975 Markham 1975 Markham 1975 Markham 1975 Markham 1975 Markham 1975 Markham 1975 Hay & Shore 1918; Markham, 1975 Markham 1979 Markham 1979 Boyko & Williams 2004 Present paper
<i>C. elegans</i> Giard & Bonnier, 1887	<i>Pilumnus hirtellus</i> (Linnaeus, 1761)	Pilumnidae	France (Atlantic)	Giard & Bonnier 1887 Bourdon 1968
<i>C. garthi</i> Danforth, 1970 (Danforth, 1970)	<i>Dacryopilumnus eremita</i> Nobili, 1906	Dacryopilumnidae	Eniwetok	Danforth 1970
<i>C. knudseni</i> <i>Eriphia sebana</i> (Shaw & Nodder, 1803)	Eriphiidae	Eniwetok	Danforth 1970	
<i>C. multithorosum</i> An, Yu & Williams, 2012	<i>Liomeria laevis</i> (A. Milne-Edwards, 1873)	Xanthidae	China	An et al. 2012
<i>C. cf. multithorosum</i> An, Yu & Williams, 2012	<i>Leptodius affinis</i> (De Haan, 1835)	Xanthidae	Taiwan	Present paper
<i>C. phila</i> Girad & Bonnier, 1887	<i>Xantho hydrophilus</i> (Herbst, 1790)	Xanthidae	France (Atlantic)	Giard & Bonnier 1887; Bourdon 1968

....continued on the next page

TABLE I. (Continued)

Species	Hosts	Host's family	Localities	References
<i>C. savignyi</i> (Stebbing, 1910)	<i>Actaea savignyi</i> (A. Milne Edwards, 1834)	Xanthidae	Cargados Carajos (St. Brandon)	Stebbing 1910
<i>C. xanthi</i> (Richardson, 1910)	<i>Cyclodius ungulatus</i> (H. Milne Edwards, 1834) <i>Actaea</i> sp. <i>Pilodus pilumoides</i> (White, 1848) <i>Paraxanthias elegans</i> (Stimpson, 1858) <i>Cyclodius obscurus</i> (Hombron & Jacquinot, 1846)	Xanthidae Xanthidae Xanthidae Xanthidae	Philippines Japan Japan Japan Palau	Richardson 1910 Shiino 1936 Shiino 1936 Shiino 1942
<i>C. cf. xanthi</i> (Richardson, 1910)	<i>Eriphia ferox</i> Koh & Ng, 2008	Eriphiidae	Japan	Miura <i>et al.</i> 2014
<i>Cancricepon</i> sp.	<i>Piliannus longicornis</i> Hilgendorf, 1878	Piliannidae	Seychelles	Stebbing 1910
<i>Cancricepon</i> [sp.] ⁶	<i>Xantho porressa</i> (Olivier, 1792)	Xanthidae	Tunisia	Vivares 1970

¹Bourdon (1971) gave Côte d'Ivoire and Dahomey (= Benin) as the type locality for *C. anagibbosus* in different parts of the paper; Côte d'Ivoire is the correct type locality, based on the data labels associated with the type specimens (MNHN-IU-2007-3702, MNHN-IU-2007-3703).

²Markham's (1979) Bermuda record is highly speculative as he reported only a single specimen of *P. herbstii* with an empty branchial swelling.

³*Eriphia gonagra* as a host for *C. chophrae* is highly speculative; Hay & Shore identified a parasite in this host as *Leidya distorta* (Leidy, 1855), but although that identification is probably incorrect, based on other hosts known for that species, the true identity of the parasite is not known (see Hay and Short 1918; Markham 1975).

⁴The identity of this specimen is not verified as even belonging to a species of *Cancricepon*; the host has otherwise never been reported bearing bopyrids.

⁵*Dyspanopeus sapi* & *D. acanthophora* are both listed as hosts for *C. chophrae* in Markham, 1979 but without any information as to where they were collected. They were not from Bermuda, which was the locality of focus in Markham (1979) and were only included in a long list of hosts from the total range of *C. chophrae* known at that time ("Carolinas through Florida to Mississippi; Vera Cruz, Mexico; Curaçao").

⁶No morphological details or illustrations were given and it is unknown if this specimen belongs to *Cancricepon*.

Remarks. The type specimens of this species were originally identified as *C. choprae*, despite the enormous geographical distance separating them from any previously identified specimens of that species in the western Atlantic. The Chinese specimens can be separated from *C. choprae* by several characters of the females, including head with frontal lamina extending posteriorly on the sides of the head approximately half way (extending nearly to the posterior margin of the head in *C. choprae*), pereomeres 2 and 3 with completely to partly distinct median region (no regional separation in *C. choprae*), seventh pereomere middorsal projection acute (rounded in *C. choprae*), and first oostegite internal ridge with numerous tapered projections (few low rounded projections in *C. choprae*). Males of the two species can also be separated in that those of *C. beibusinus n. sp.* have a truncate pleotelson that lacks posterolateral lobes and a prominent anal cone (lobes and anal cone present in *C. choprae*); additionally, it appears that the number of pleonal midventral tubercles is different between the species, as there are none in *C. beibusinus n. sp.*, but Markham's (1975) illustration of a male *C. choprae* shows what appears to be midventral tubercles on pleomeres 1–3, although these were not mentioned in his text. This new species can also be separated from all other species in the genus by the characters given in the key below.

Discussion

At least 31 hosts of *Cancricepon* are known from 10 brachyuran families belonging to six superfamilies (Dairoidea, Eriphoidea, Ocipodoidea, Pilumnoidea, Trapezioidae and Xanthoidea). The known hosts and localities of all species of *Cancricepon* are summarized in Table 1. The present materials add a new host family, Trapeziidae, which contains species previously known to bear other bopyrids (Boyko *et al.* 2008 onwards) but not species of *Cancricepon*. Australia, the Maldives, Papua New Guinea and Taiwan are added as new localities for species of *Cancricepon*.

Key to species of *Cancricepon* Giard & Bonnier, 1887 based on mature females

1.	Mid-dorsal projections on pereomeres 1–7	<i>C. multituberous</i> An, Yu & Williams, 2012
-	Mid-dorsal projections on fewer than pereomeres 1–7	2
2.	Tergal projections on pereomeres 2–4 greatly enlarged	3
-	Tergal projections on pereomeres 2–4 small or lacking	7
3.	Large tergal projections strongly asymmetrical	<i>C. castroi n. sp.</i>
-	Large tergal projections approximately symmetrical	4
4.	Head strongly bilobed	<i>C. elegans</i> Giard & Bonnier, 1887 or <i>C. pilula</i> Giard & Bonnier, 1887 ¹
-	Head weakly bilobed or not bilobed	5
5.	Head not bilobed	<i>C. savignyi</i> (Stebbing, 1910)
-	Head weakly bilobed	6
6.	Tergal projections extremely swollen, medially indented and appearing distinct from median portion of their respective pereomeres	<i>C. xanthi</i> (Richardson, 1910)
-	Tergal projections contiguous with median of pereomeres, not medially indented	<i>C. choprae</i> (Nierstrasz & Brender à Brandis, 1925)
7.	Tergal projections lacking	<i>C. anagibbosus</i> Bourdon, 1971
-	Tergal projections on pereomeres 2–4, small	8
8.	Mid-dorsal projections on pereomeres 4–7, head not bilobed	<i>C. garthi</i> Danforth, 1970
-	Mid-dorsal projections on pereomeres 5–7, head bilobed	9
9.	Head weakly bilobed, pereomeres 1 and 2 with median region distinct from lateral	<i>C. beibusinus n. sp.</i>
-	Head strongly bilobed, pereomeres entire	<i>C. knudseni</i> (Danforth, 1970)

¹Bourdon (1968) indicated that females of *C. elegans* and *C. pilula* were indistinguishable but that males differed in three characters, of which only the presence (*C. elegans*) or absence (*C. pilula*) of midventral tubercles on the pleomeres is easily quantifiable.

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