A review of bopyrid isopods infesting crabs from China

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Synopsis
Isopod parasites of the subfamilies Ioninae and Pseudioninae infest the branchial chambers of brachyuran crabs. In total, 19 species of parasitic isopods infest crabs from China; they belong to 6 genera from the Ioninae and 1 genus from the Pseudioninae. Specifically, the following genera are represented: Allokepon Markham, 1982 (three species), Apocepon Nierstrasz and Breder à Brandis, 1930 (three species), Cancricepon Giard and Bonnier, 1887 (one species), Dactylokepon Stebbing, 1910 (four species), Gigantione Kossmann, 1881 (four species), Onkokepon, An et al. 2006 (two species) and Tylokepon Stebbing, 1906 (two species). The new species Tylokepon biturus from Menaethius monoceros (Latreille) collected in China is distinguished from other members of the genus by the striking shape of the head, two mid-dorsal projections on Pereomere 6, and entire pleopods and uropods without any tubercles on their surface. A list of all bopyrid species (19 species in seven families) along with their hosts and localities, is presented.

Introduction
The epicaridean family Bopyridae, adults of which are parasitise decapod crustacea, currently contains 595 described species in nine subfamilies (Boyko and Williams, 2009), among which the Ioninae and Pseudioninae are known to infest the branchial chambers of brachyuran crabs. Based on examination of crabs deposited in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS), 19 bopyrid species were found, including 9 species previously found only in China. In total, 25 host species belonging to the brachyuran subfamilies Xanthidae, Goneplacidae, Majidae, Ocypodidae, Portunidae, Leucosiidae were recorded, 21 of which were not previously know as hosts for parasitic isopods.

Materials and methods
Materials for this study originated from the China/Vietnam Comprehensive Oceanographic Survey of Beibu Gulf, (1959–1960, 1962) and the Chinese Academy of Sciences Nansha Islands Multi-disciplinary Investigation (1985, 1987–2000). All materials examined have been deposited in the Marine Biological Museum of the Chinese Academy of Sciences, Qingdao, China (MBM CAS). Specimens were viewed and drawn using a Zeiss Stemi SV Apo.

Systematic account
Subphylum CRUSTACEA Brünnich, 1772
Order ISOPODA Latreille, 1817
Suborder EPICARIDEA Latreille, 1831
Family BOPYRIDAE Rafinesque-Schmaltz, 1815
Subfamily Pseudioninae R. Codreanu, 1967
Genus Gigantione Kossmann, 1881
Gigantione ishigakiensis Shiino, 1941

Remarks
The genus Gigantione is known from Japan and China. Shiino (1941) based his description of the type species G. ishigakiensis on the single type-pair. An et al. (2009) redescribed this species from South China Sea and Guangdong Province. Though the Chinese specimens conform well to the original description, there were some minor differences: Chinese females lack frontal laminae, their antennae are not visible in dorsal view, the middle region of each barbula has a pair of blunt projections, and the maxillipeds have no projections in the region of the palp.

The infected crab Liagore rubromaculata (De Haan) was the first species of this genus recorded.
to bear parasitic isopods (An et al. 2009). Of six infected hosts examined, three had one chamber occupied by *G. ishigakiensis*, and the other chamber contained *Dactylokepon barbuladigitus*. Although many bopyrids infest both branchial chambers of their hosts, it is unusual for two different species to be found together in both chambers of the same host.

**Distribution and hosts**

Ishigakishima, Japan; infesting *Carpiulus convexus* (Forskål); South China Sea, Guangdong Province, China, infesting *L. rubromaculata* (De Haan).

**Gigantione hainanensis** An et al. 2009

**Remarks**

An et al. (2009) reported this species from *Atergatis floridus* (Linnaeus) and *Atergatis* sp. *Gigantione hainanensis* appears to be most closely related to *G. ishigakiensis* Shiino, 1941, which also infests xanthiid crabs. *G. hainanensis* is distinguished from *G. ishigakiensis*, however, by the absence of a frontal lamina, antennae not visible in dorsal view, a pair of blunt projections on the middle region of barbula, and the maxilliped without any projection in the palp region. The host *A. floridus* (L.) was recorded for the first time bearing parasitic isopods (An et al. 2009).

**Distribution and hosts**

Hainan, China, infesting *A. floridus* (Linnaeus) and *Atergatis* sp.

**Gigantione rhombos** An et al. 2009

**Remarks**

An et al. (2009) described this species from the South China Sea and Beibu Gulf, infesting goneplacid crabs. The female of *G. rhombos* was distinguished from those of the other 13 described species of *Gigantione* by the prominent dentate coxal margin of its coxal plates, and by a prominent rhombic projection in the middle region of the barbula of the females. *G. rhombos* appears to be most closely related to *G. petalomerae* Markham, 1999 which is known to infest *Petalomera pulchra* Miers. Females of the two species differ in that *G. rhombos* has distinct coxal plates, an asymmetrical body, and a rhombic barbular projection. According to Markham (1999), the female of *G. petalomerae* has slender and smooth coxal plates on each side, an almost symmetrical body and a barbula with a single terete projection on each side and a triangular lobe in the center. These were the first records of this host bearing parasitic isopods.

**Distribution and hosts**

South Sea, China, infesting *Eucrate alcockii* Serene and *Eucrate* sp.; Beibu Gulf, infesting *Heteroplax dentata* Stimpson.

**Gigantione tau** An et al. 2009

**Remarks**

An et al. (2009) reported that the female of this species was distinguished from the other known species of the genus by having dentate coxal plates with prominent tubercles on the long sides and a unique T-shaped pigmentation on the surface of the head. *G. tau* appears to be most closely related to *G. rhombos*, which also infests goneplacid crabs. The female of *G. tau* differs from that of *G. rhombos* in that its coxal plates bear prominent tubercles only on their long sides, by its T-shaped head pigmentation, and by its barbula having a pair of central projections. The female of *G. rhombos* is almost symmetrical, it has distinct dentate coxal plates with small tubercles on each side, it lacks pigmentation, and its barbula has a prominent central rhombic projection. The host *Carcinoplax longimanus* (De Haan) was also the first host for bearing parasitic isopods.

**Distribution and hosts**

East Sea, China, infesting *C. longimanus* (De Haan).

**Subfamily Ioninae** H. Milne Edwards, 1840

**Genus** Tylokepon Stebbing, 1906

**Tylokepon bonnieri** Stebbing, 1906. (Fig. 1)

**Material examined**

Description of reference female (CIEM710401)
Length 6.45 mm (excluding uropods), maximal width 5.65 mm across Pereomere 4, head length 1.27 mm, head width 3.17 mm. (Fig. 1A and B).

Head large, covering Pereomere 1, wider than long, bilobate, in form of two semi-spherical structures, separated by a deep median groove. Frontal lamina narrow and not extending to margin of the head. Eyes absent (Fig. 1A). Antennae very obscure, and only Antennae 2 can be seen, of 2 or 3 articles. Barbula (Fig. 1C) with two large falcate projections on each side, a pair of large blunt projections in the middle region. Anterior article of maxilliped (Fig. 1D) much larger than posterior one, with prominent palp, inwardly directed and setose, with short plectron.

Pereon broadest across Pereomere 3. Pereomere 1 encroached by swollen head, and only median parts can be seen from dorsal view. Dorsolateral bosses distinct in first four pereomeres on both sides. Coxal plates absent. Tergal projection present in Pereomeres 2–4. Middorsal projections on last two pereomeres, and three projections on Pereomere 6, one projections on Pereomere 7 (Fig. 1A and E).

Brood pouch incompletely covered by oostegites. Oostegite 1 (Fig. 1F and G) composed of two equally sized articles, internal ridge smooth. Posterolateral point of Oostegite 1 extend to lateral sides. Pereopod 1 much smaller than the others.

Pleon of six distinct pleomeres, first five pleomeres produced into tuberculate lateral plates on both sides; terminal pleomere without lateral plates. Exopodites of Pleopods 1–5 biramous, tuberculate, with digitate margin. Endopodites of Pleopods 1–5 small and smooth (Fig. 1H). Uniramous uropods similar to exopodites of Pleopod 5.

Redescription of reference male (CIEM710402)
Length 1.71 mm, maximal width across Pereomere 5, 0.50 mm, head length 0.08 mm, head width 0.18 mm, pleonal length 0.63 mm. Body gradually tapered posteriorly, all segments distinct (Fig. 1I and J).

Head semicircular, broader than long. Without eyes. Antennae of 2 and 3 articles, respectively.

Pereon broadest across Pereomere 5, all pereopods almost equally developed and about same size, with all articles distinct.
Pleon of six segments, first five pleomeres with tuberculate uniramous pleopods. Pleomere 6 is bilobed, with tuberculate projections.

Remarks
Stebbing (1906) erected the genus *Tylokepon* based on the type specimen *T. bonnieri* exhibiting middorsal projections on the last pereomeres and striking morphology of the head. Stebbing (1906) reported that *T. bonnieri* Stebbing, 1906 was found on *Tylocarcinus styx* (Herbst 1803) from the Indian Ocean. This is only the second record of this species, and Markham (1982) recorded the host *H. diacanthus* (de Haan) bearing parasitic isopods *Tylokepon naxiae* (Bonnier 1900) from Hong Kong. The present specimens conform well to Stebbing’s description (1906). However, there are some minor differences, e.g., the Chinese male specimen lacks eyes and has tuberculate projections on the ventral surface of the uropods. This is the first record of this host, *L. validus* de Haan, bearing parasitic isopods.

Distribution and hosts
Indian ocean; on *T. styx* (Herbst 1803); Beibu Gulf, on *H. diacanthus* (de Haan). South China Sea, on *L. validus* de Haan. *Tylokepon biturus* n. sp (Fig. 2).

Material examined

Description of holotype (CIEM750401)
Length 4.38 mm, maximal width 2.58 mm across Pereomere 4, head length 0.39 mm, head width 1.87 mm, pereon length 2.86 mm. All body regions and segments distinct. No pigmentation (Fig. 2A and B).

Head dumbbell shaped, much wider than long, very swollen and almost completely covering Pereomere 1, with frontal lamina equally wide as the head. Eyes absent (Fig. 2A). Antennae reduced,
cannot be seen. Barbula (Fig. 2C) with two pairs of large falcate projections on two sides, a pair of sharp projections in the middle region. Maxilliped (Fig. 2D) with a blunt, nonsetose, curved palp and a sharp plectron, anterior article much larger than posterior one.

Pereon segments distinct, broadest across Pereomere 4. Coxal plates absent. Dorsolateral bosses present on first four pereomeres on both sides, and tergal projections on Pereomeres 2, 3. Middorsal projections on last two pereomeres, two projections on Pereomere 6, and one projection on Pereomere 7. Brood pouch open. Oostegite 1 (Fig. 2E and F) has two articles that are almost equal in length, internal ridge bearing two large blunt projections on the lateral half of the ridge, posterolateral point also blunt toward posterior. Pereopods of about same size and structure.

Pleon of six segments, first five pleomeres with longer lateral plates and biramous pleopods. Lateral plates of abdomen much longer than pleopods, first pair extending to Pereomere 3, succeeding pairs gradually growing shorter and smaller. All lateral plates and pleopods almost smooth, but with slightly digitate margin (Fig. 2G). Pleomere 6 small, without lateral plates, uropods uniramous, lobose, also with smooth surface and entire margin.

Description of allotype (CIEM750402)
Length 2.20 mm, maximal width across Pleon 4, 0.58 mm, head length 0.29 mm, head width 0.39 mm. All body segments distinct, no pigment (Fig. 2H and I).

Head semicircular, black eyes on posterior edge of head (Fig. 2H). Antennae of 3 and 5 articles, respectively. Antenna 2 slightly longer than Antenna 1, without setae.

Third to sixth pereomeres almost equally wide, with truncate margins. Pereomeres 4–7 with round midventral projections (Fig. 2I). All pereopods with almost equal size and structure; round midventral projections (Fig. 2I). All pereopods with almost equal size and structure.

Pleon of six pleomeres, first three with quadrate midventral projections. Without pleopods (Fig. 2I), sixth pleomere with a pair of round tuberculate projections (possibly uropods) (Fig. 2I).

Etymology
The specific name biturus refers to only two projections on Pereomere 6 of the holotype.

Remarks
Tylokepon biturus n. sp. is placed in the genus Tylokepon on the basis of the females with a strikingly shaped head and middorsal projections on the last two pereomeres. The new species is distinguished from the other three known species of the genus Tylokepon by the peculiar shape of the head, only two middorsal projections on Pereomere 6, and smooth and entire pleopods of the female. T. biturus appears to be most closely related to T. naxiae (Bonnier 1900), which was recorded from Hong Kong on H. diacanthus (De Haan) (Markham 1982). The new species differs from T. naxiae in its female’s dumbbell head, only two middorsal projections on Pleomere 6, and smooth entire pleopods. Furthermore, the allotype has quadrate midventral projections on the first three pleomeres. The infected individual of M. monoceros (Latreille) was also host to Portunicepon tiariniae Shiino, 1937.

Distribution and hosts
China, Hainan province, on M. monoceros (Latreille).
Genus Cancricepon Giard and Bonnier, 1887
Cancricepon choprae (Nierstrasz and Brender à Brandis 1925) (Fig. 3)
Leidya distorta. Hay and Shore, 1918: 440. not L. distorta (Leidya).
Grapsicepon choprae Nierstrasz and Brender à Brandis, 1925: 4, 7, 8, Figs. 11–16; Shiino, 1936: 169–171, 1942: 449; Schultz, 1969: 319, Fig. 508; Danforth, 1972: 165, 166, 167.
Ergyne rissoi Nierstrasz and Brender à Brandis, 1925: 5, 7, 8, Figs. 17–21, 1926: 52; Caroli, 1953: 85–86; Schultz, 1969: 315, Fig. 501; Danforth, 1972: 165. “Isopod parasites,”—Rathbun, 1930: 246.
Portunicepon rissoi.—Shiino, 1934: 276.
Grapsecepon choprai.—Bourdon, 1971: 387-389.
Cancricepon (Grapsicepon) choprai.—Bourdon, 1971: 389.

Material examined

Remarks
This is the first record of this species from China and the first record of this host bearing parasitic isopods infesting crabs from China 99
isopods. *C. choprae* were recorded infesting hosts from family Xanthidae and Goneplacidae, and this is the first recorded host species within the family Ocypodidae. Markham (1975) redescribed *C. choprae* in great detail, so it is unnecessary to describe it again. The present specimens (Fig. 3) conform well to Markham’s description (1975). However, there are some minor differences, such as the internal ridge of the Oostegite 1 (Fig. 3G) of the Chinese specimens with a very long projection and some smaller ones. Markham’s specimens (1975) have two short projections on the internal ridge of Oostegite 1. Males of the present specimens (Fig. 3K) lack dark pigmentation on their surface, although Markham (1975) reported males with dark pigment spots scattered over the body.

**Distribution and hosts**

North Carolina to Florida, Mississippi; Mexico; Curaçao; Bermuda; Bahamas; on *Rbitropanopeus barrisii* (Gould); *Micropanope barbadensis* Rathbun; *Neapanope packardi* (Kingsley), *Domecia bispida* (Eydocx and Souleyet); *Panoplax depressa* (Stimpson); *Panopeus berbistii* H. Milne Edwards; *Hexapanopeus angustifrons* (Benedict and Rathbun); *Paraliomera dispar* (Stimpson); *Panopeus boekei* (Rathbun), Beibu Gulf, on *Scalopidia spinosipes* Stimpson.

**Genus Allokepon** Markham, 1982

*Allokepon hendersoni* (Giard and Bonnier 1887) *Portunicepon hendersoni* Giard and Bonnier, 1887: 186–188.

*Allokepon hendersoni* Markham, 1982: 357; Duan et al. 2008: 63.

**Remarks**

*Allokepon hendersoni* was recorded on *Thalamita callianassa* from India. Duan et al. (2008) reported this species infesting *Charybdis bimaculata* (Miers) from China. The Chinese female specimens were
very similar to the type specimens (Giard and Bonnier 1887). The females have a bilobed head, no coxal plates and a posteriorly directed posterolateral projection on the first oostegite. The males differ from the allotypic male, in having midventral tubercles on the first two pleomeres. The host was the first species of the genus *Charybdis* known to bear parasitic isopods.

**Distribution and hosts**
India, on *Thalamita callianassa*; China, on *Charybdis bimaculata* (Miers).

*Allokepon monodi* (Bourdon 1967)


*Allokepon monodi* Markham, 1982: 357.

Duan et al. 2008: 63–66, Fig. 2.

**Remarks**

Bourdon (1967) described *Portunicepon monodi* from a female specimen parasitizing *Stenorhynchus seticornis* (Herbst) from Senegal. Markham (1982) established the genus *Allokepon* and transferred *P. monodi* to *Allokepon*. China was second locality record for this species and the Chinese females are very similar to the holotype (Duan et al. 2008), although the head is distinctly bilobate in Chinese specimens. *P. trituberculatus* was recorded for the first time as a host of parasitic isopods.

**Distribution and hosts**

Senegal, on *Stenorhynchus seticornis* (Herbst 1788); China, on *Portunus pelagicus* (L.), *Portunus trituberculatus* (Miers) and *Thalamita* sp.

*Allokepon longicauda* Duan et al. 2008

*Allokepon longicauda* Duan et al. 2008: 66–68, Fig. 3.

**Remarks**

Duan et al. (2008) reported *A. longicauda* from Beibu Gulf. This species is distinguished from the other four recorded species of the genus *Allokepon* by the long slender uropods of females. *A. longicauda* appears to be most closely related to *A. tiariniae* (Shiino 1937), which also has long uropods. However, Chinese specimens differ from *A. tiariniae* in the asymmetrical body, short frontal lamina, and almost smooth margins of lateral plates and pleomeres. Furthermore, the sixth pleomere of the males has two rounded symmetrical posterior lobes, not sharp lobes as in *A. tiariniae* (Shiino 1937). This was the first record of this species as a host of parasitic isopods.

**Distribution and hosts**

Beibu Gulf, on *Portunus pulchricristatus* (Gordon).

Genus *Apocepon* Nierstrasz and Breder à Brandis, 1930

*Apocepon pulcher* Nierstrasz and Breder à Brandis, 1930


**Remarks**

Nierstrasz et al. (1930) reported this species from Chinese waters. Shiino (1934, 1936, 1939, and 1958) reported it many times from Japanese waters and Choe and Kwon (1982) and Kim and Kwon (1988) reported it from several Korean locations. An et al. (2006a) redescribed this species in great detail, and recorded two new hosts, *Philyra carinata* Bell and *Philyra heterogrammat* Ortmann.

**Distribution and hosts**

Tsingtao, other regions of Shandong province, Zhejiang, Liaoning, Jiangsu, Baohai Bay, China; Kanazawachô, Kanagawa-ken (near Tokyo), Shimoda, Koajiro, Misaki, Sioiri, Tomioka Bay, Amakusa, Kyûsyû, Amakusa Island, Japanese waters; Songapto Island, Mungapto Island, Soyado Island, Chagykto Island, and several location on Korea. On *Philyra pisum* de Haan; *Philyra carinata* Bell; *Philyra heterogrammat* Ortmann; *Philyra sp*.

*Apoecon digitatum* Stock, 1959

*Apoecon digitatum* Stock, 1959: 30–32, text-Fig. 3, pl. 1; An et al. 2006a: 8–12.

**Remarks**

An et al. (2006a) redescribed *A. digitatum* from China and added characters about the female’s last four pleopods, Oostegite 1, and the male’s ventral characters. The Chinese materials conform well to the characteristics of Singaporian type specimens. The host *Leucosia sinaica* Shen et Chen was recorded as a host of parasitic isopods for the first time.

**Distribution and hosts**

Siglap, Singapore, on *Leucosia craniolaris* (Herbst); the South China Sea, on *Leucosia sinaica* Shen et Chen

*Apoecon leucosiae* An et al. 2006

*Apoecon leucosiae* An et al. 2006a: 13–16.
Remarks
The genus *Apocepon* contains three species, and all of them are parasites of hosts with the Leucosiidae. An et al. (2006a) reported *A. leucosiae* infesting *Leucosia anatum* (Herbst) from the South China Sea. It shares defining characters with the other two species of *Apocepon* and it is most similar to *Apocepon digitum* Stock, 1959, especially the males. However, females of this species differ from *A. digitum* by having an articulated maxilliped palp, and slightly digitate frontal lamina. *Leucosia anatum* (Herbst) was recorded as the host of parasitic isopods for the first time.

Distribution and hosts
South China Sea, on *Leucosia anatum* (Herbst)
Genus *Onkokepon*, An et al. 2006b
*Onkokepon articulatus*, An et al. 2006b
*Onkokepon articulatus*, An et al. 2006b: 59–64.

Remarks
An et al. (2006b) erected this monotypic genus and indicated it was most closely related to the genera *Dactylokepon* Stebbing, 1910, *Apocepon* Nierstrasz and Brender à Brandis, 1930, and *Trapezicepon* Bonnier, 1900. Three species of *Dactylokepon* and three species of *Apocepon* are parasites of leucosiids. *Onkokepon* differs from these three genera in having well-developed tubercular frontal lamina. In addition, this genus differs from *Trapezicepon* in having deeply digitate barbula, from *Dactylokepon* in having rudimentary subcircular endopodites of pleopods, without coxal plates. Furthermore, *Onkokepon* is distinguished from *Apocepon* in having long frontal lamina and complex digitate margin of pleonal exopodites and lateral plates. The male of *Onkokepon* is more similar to the genus *Leidya* Cornalia and Panceri, 1861, but its female differs by having prominent tergal projections on Poreomere 2 and the basal segment of Antennae 2 are not as prominent as in Markham’s (1991) specimen. However, the females have tubercules on tergal projections of Pereomere 2 and the basal segment of Antennae 2 are not as prominent as in Markham’s (1991) specimen.

Distribution and hosts
Beibu Gulf; on *Leucosia longibranchia* Shen and Chen.
Genus *Dactylokepon*, Stebbing, 1910
*Dactylokepon richardsonae*, Stebbing, 1910
*Dactylokepon richardsonae*, Stebbing, 1910: 85, 113. Pl. 11C, Nierstrasz and Brender à Brandis, 1923: 83; Shiino, 1942: 444, 447; Markham, 1975: 61, 64, 66, Table 1; 1991: 289, 291, 292, 294, 296, 297. Fig. 2. An et al. 2007: 2064–2066, Fig. 1.
*Dactylokepon richardsonae*, Bourdon, 1967: 122; 1980: 243; 1983: 855–857, 859, Fig. 7.

Remarks
Bourdon (1983) and Markham (1991) described this species in great detail. An et al. (2007) first reported it on *Portunus argentatus* (White) from the Nansha islands. The Chinese specimens conform well to Markham’s description (1991). However, the females have tubercules on tergal projections of Pereomere 2 and the basal segment of Antennae 2 are not as prominent as in Markham’s (1991) specimen.

Distribution and hosts
Seychelles, Indian Ocean, on *Trapezia cymodoce* (Herbst); Bangkok, Thailand, on *Portunus tuberculosus* (A. Milne Edwards); Nansha, China on *Portunus argentatus* (White).
*Dactylokepon semipennatus*, Bourdon, 1983
*Dactylokepon semipennatus* Bourdon, 1983: 857–859, Fig. 8; An et al. 2007: 2066–2068, Fig. 2.

Remarks
An et al. (2007) recorded this species from China, extending its range from Maluku Islands (= Moluccan Islands), Indonesia to Nansha and Beibu Gulf in China. *D. semipennatus* had been found on xanthid hosts but the Chinese specimens were found on two portunid crabs. Chinese materials, especially the female, match the type specimens (Bourdon 1983) very well. Up to now, three species in the genus *Dactylokepon* were known to infest portunids; *D. catoptri*, infesting *Catoptrus nitidus* A. Milne-Edwards from Amirante; *D. palaoensis*,
infesting Thalamita spp. from Palao; and D. semipennatus, infesting Portunus haanii (Stimpson) and Lupocyclus rotundatus Adams and White from China.

**Distribution and hosts**

Selemman Bay, Maluku Islands, Indonesia, on Glabropilumnus latimanus Gordon; Nansha and BeiBu Gulf, China, on Portunus haanii (Stimpson) and Lupocyclus rotundatus Adams and White.

**Dactylokepon caribaeus** Markham, 1975

*Dactylokepon caribaeus* Markham, 1975: 61–66, Figs. 4–6; Adkison, 1982: 702–703, Fig. 1; An et al. 2007: 2072–2073, Fig. 5.

**Remarks**

Three species of the genus *Dactylokepon* are found on members of the Leucosiidae, *D. caribaeus* Markham, 1975 is found on *Iliacantha subglobosa* and *I. liodactyla* in China, *D. sulcipes* Adkison, 1982 is found on *Callidactylus asper* Stimpson, 1871 in Mexico, and *D. marchadi* Bourdon, 1967 is found on *Pseudomyra mbizi* Capart, 1951 in Senegal. The Chinese materials agree well with the original description (Markham 1975) except for some minor points. Although Markham (1975) did not mention tubercles on Pereomeres 1–4,
Adkinson (1982) noted their presence, particularly on the tergal area, as in the Chinese specimens; therefore this feature does not appear to distinguish the Caribbean and Chinese samples. Thus, the minor differences between D. caribaeus from the Caribbean and the present samples from China do not appear to warrant the erection of a new species. In light of its puzzling geographic distribution, future research should investigate the possibility that D. caribaeus represents a sibling species.

Distribution and hosts
Southeastern coast of Dominican Republic, on Illicantha subgloboisai Stimpson and Illicantha liodactyla Rathbun; South Sea, China, on Randallia trituerculata Sakai.

Dactylokepon barbuladigitus, An et al. 2007

Remarks
An et al. (2007) reported D. barbuladigitus on L. rubromaculata (De Haan) from the South China Sea. There are 11 species in the genus Dactylokepon and D. barbuladigitus can be distinguished from the other ten species by the prominent trifid frontal lamina and distinct digitate barbula. It appears to be most closely related to D. semipennatus and D. richardsonae, which are known to infest xanthid crabs, but differs from D. semipennatus in its distinct barbula, trifid frontal lamina, and curved maxilliped palp. It is distinguished from D. richardsonae by the posterolateral point of the first oostegite, shape of the frontal lamina and head, segmentation of antennae, and barbula. Males of D. barbuladigitus differ from males of D. richardsonae in the distinctly separated head and the shape of the final pleomere; and also differ from D. caribaeus and D. hunterae Wells and Wells, 1966 by the distinct midventral projections on the pereomeres.

Distribution and hosts
South Sea, China, on L. rubromaculata (De Haan).

Discussion
Markham (1986) reported all the ratios of bopyrid parasitic species to host decapod species to be about 10%, except within the Brachyura whose ratio is <2%, and he suggested this reflects the principle that parasites do not range as far as their host species. For Chinese specimens, 19 parasitic isopods have been found infesting 25 brachyuran species, this ratio is 0.76% so we can say the Chinese materials make this ratio much smaller. These 25 hosts belong to 16 genera and 6 families of crustacean (Table 1) and in total, 20 hosts were recorded for the first time as bearing parasitic isopods.

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