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FROM JAPAN. V. GENUS *CRYPTOCHIRUS*

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日本産サンゴヤドリガニ類, V. ケブカサンゴヤドリガニ属

武田正倫・田村洋一

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CORAL-INHABITING CRABS OF THE FAMILY HAPALOCARCINIDAE
FROM JAPAN. V. GENUS *CRYPTOCHIRUS*

With 2 Text-figures and 3 Plates

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Masatsune TAKEDA and Yôichi TAMURA

(Department of Zoology, National Science Museum, Tokyo)

日本産サンゴヤドリガニ類. V. ケブカサンゴヤドリガニ属

挿図 2, 図版 3

武田正倫・田村洋一

(国立科学博物館 動物研究部)

Cryptochirus coralliodytes HELLER, the pit-forming crab in massive corals and *Hapalocarcinus marsupialis* STIMPSON, the gall-forming crab on branching corals are the two well-established species in the family Hapalocarcinidae, representing two distinctive types of habits in the relations between the parasitic crabs and host corals.

Cryptochirus coralliodytes originally described from the Red Sea is now known as the common inhabitant in the Indo-West Pacific, and several related species subsequently described were revised by FIZE and SERÈNE (1955, 1957) and SERÈNE (1962). As mentioned later, the present further revision revealed that the genus *Cryptochirus* contains three valid and three questionable species.

The specimens from Japanese waters were referred to the three valid species, *C. coralliodytes* HELLER, *C. edmonsoni* FIZE et SERÈNE and *C. trii* FIZE et SERÈNE. All the specimens are preserved in the National Science Museum, Tokyo (NSMT).

Genus *Cryptochirus* HELLER, 1861

Cryptochirus HELLER, 1861a, p. 19; 1861b, p. 366; CALMAN, 1900, pp. 47-49; SHEN, 1936, p. 22 (in part); RATHBUN, 1937, p. 262 (in part); HIRO, 1937, pp. 137-154 (in part); UTINOMI, 1944, pp. 687-731 (in part); BARNARD, 1955, p. 25; FIZE and SERÈNE, 1957, p. 21; SERÈNE, 1962, pp. 30-41.

Lithoscaptus A. MILNE EDWARDS, 1862, p. 362.

Diagnosis. Carapace much longer than broad, ovate or rather quadrilateral and thickly covered with granules and short setae; dorsum weakly convex in both direc-

tions, its anterior part being bent obliquely downward. Front more or less developed and fringed with several spinules. Chelipeds rather stout in male. Meri of first to third ambulatory legs compressed. Female abdomen with three pairs of uniramous pleopods. Male abdomen elongate.

Type-species. *Cryptochirus coralliodytes* HELLER, 1861.

Remarks. The genus *Cryptochirus* erected by HELLER (1861) is, as well known, morphologically and ecologically quite distinct from *Hapalocarcinus* STIMPSON erected on the monotypical representative *H. marsupialis* STIMPSON, being distinguished from the related genus *Favicola* FIZE et SERÈNE by having three pairs of the uniramous pleopods in the female abdomen.

About a half century later since the establishment of *Cryptochirus*, HENDERSON (1906) described the second species *C. dimorphus* from the Andaman Islands, which is surprisingly different from the type-species in some features, e. g., the slender chelae of female, the absence of exopod in the third maxilliped and the subtriangular abdomen in male. These differences were considered to be of generic value by the original author, but the species was tentatively included in *Cryptochirus* which has been rather insufficiently diagnosed. The description of *C. dimorphus* is extensive and elaborate, but quite unfortunately there is no mention about the female pleopods which are important to consider the generic status in the current studies on the Hapalocarcinidae. Recently MCCAIN and COLES (1979) described *Pseudocryptochirus kahe* from several localities in Oahu Island, Hawaii. Although the authors did not compare the Hawaiian species with the Andaman Islands species hitherto known as *Cryptochirus*, after the examination of the specimens kindly provided by them it is pointed at present that both species are in all probability identical with each other and belong to *Pseudocryptochirus*. The difference is only that the male abdomen is narrowing distally, with the pointed tip, in *C. dimorphus*, and rather rounded in *Ps. kahe*. Such a shape of male abdomen in *C. dimorphus* may not be natural in the Hapalocarcinidae, and it is highly probable that the original figure is not accurate. Thus, at present, *Pseudocryptochirus kahe* MCCAIN et COLES, 1979 is reduced to a synonym of *Cryptochirus dimorphus* HENDERSON, 1906 which should be transferred to *Pseudocryptochirus*.

In 1925 Dr. C. H. EDMONDSON described *Cryptochirus crescentus* from Johnston Island, and in 1933 *C. rugosus* from Washington Island, *C. pacificus* from Palmyra and Washington Islands, *C. pyriformis* from Washington Island and *C. minutus* from some localities in Oahu Island. UTINOMI (1944) transferred *C. crescentus* to *Pseudocryptochirus* and considered the four species described in 1933 as synonyms of *C. coralliodytes*. FIZE and SERÈNE (1957), in their studies on the Viet Nam species, erected a subgenus *Favicola* in the genus *Troglocarcinus* to accommodate *C. rugosus*, *pyriformis* and *minutus* together with two new species *T. helleri* and *verrilli*. On examination of the collection sent by Dr. C. H. EDMONDSON, SERÈNE (1962) confirmed the validity of these species,

but the systematic status of *C. pacificus* was remained doubtful due to the bad conservation of the specimens. The subgenus *Favicola* is now known as a distinct genus after SERÈNE (1966).

FIZE and SERÈNE (1955) described *C. edmonsoni* and *tri* [sic] and two years later they described additional two species *C. bani* and *nami*, and three varieties *rubrolineata* [sic], *fusca* [sic] and *parvulus* in *C. coralliodytes*. Two species described in 1955 are without doubt valid, but the species and varieties defined in 1957 differ from the known species only in size, color, host corals and spinous condition of the carapace.

In reality the differences in size and host corals seem to be remarkable, but it is at present rather difficult to show the morphological differences. SERÈNE (1962) mentioned that *C. pacificus* EDMONDSON is a form of *C. coralliodytes* near *C. bani* or the variety *rubrolineatus* in consideration of its large size, and that the variety *parvulus* is identical with *T. (F.) minutus* (EDMONDSON).

As a result of the above chronological notes on the described species of *Cryptochirus*, only three species with asterisk are valid in the following list, and three species require re-examination of the topographical many specimens.

bani FIZE et SERÈNE, 1957?

coralliodytes HELLER, 1861*

coralliodytes var. *rubrolineatus* FIZE et SERÈNE, 1957?

" *fuscus* FIZE et SERÈNE, 1957?

" *parvulus* FIZE et SERÈNE, 1957=*Favicola minuta* (EDMONDSON)

crescentus EDMONDSON, 1925→*Pseudocryptochirus*

dimorphus HENDERSON, 1906→*Pseudocryptochirus*

edmonsoni FIZE et SERÈNE, 1955*

minutus EDMONDSON, 1933→*Favicola*

nami FIZE et SERÈNE, 1957?

pacificus EDMONDSON, 1933?

pyriformis EDMONDSON, 1933→*Favicola*

rugosus EDMONDSON, 1933→*Favicola*

trii FIZE et SERÈNE, 1955*

Key to the valid species of *Cryptochirus* based on adult females

- 1 Gastric region distinctly defined anteriorly by a deep \wedge -shaped furrow. Greatest breadth of carapace at anterior part. *C. edmonsoni*
- Gastric region indistinctly defined anteriorly by a shallow \wedge -shaped furrow. Greatest breadth of carapace at median part. 2
- 2 Internal orbital angle protruded beyond, or as high as, external orbital angle. Anterior part of carapace moderately bent downward and entirely covered with conical granules. *C. trii*
- Internal orbital angle not reached to level of external orbital angle. Anterior part

of carapace abruptly bent downward and covered with conical granules only on anterior part of gastric region and along lateral border of carapace.....
*C. coralliodytes*

Cryptochirus coralliodytes HELLER, 1861

[Jap. name : Kebuka-sangoyadorigani]

(Pl. II)

Cryptochirus coralliodytes [*sic*] HELLER, 1861a, p. 19.

Cryptochirus coralliodytes: HELLER, 1861b, p. 370, pl. 4 (33-39); RICHTERS, 1880, p. 159; CALMAN, 1900, pp. 47-49; BORRADAILE, 1902, p. 271; NOBILI, 1907, p. 409; EDMONDSON, 1925, p. 32; HIRO, 1937, pp. 140-143, 147, 150-153, figs. 5, 6, pls. 4 (2, 3), 6 (7-9); UTINOMI, 1944, pp. 697-729, figs. 5(B), 6(A), 7 (A, D), 9, 11 (A, B), 12 (A), 13(A), 15(A, E), 16(A, B), pls. 3 (5, 6), 4 (1, 2); BARNARD, 1955, p. 25; FIZE and SERÈNE, 1957, p. 31, figs. 4, 5 (A, E), pls. 1 (3-6), 2 (1-3), 10 (A), 14 (A-H); SERÈNE, 1962, p. 31, figs. 1(f), 2(f), 3, 4(a-c), 5(H, h, L); SAKAI, 1976, p. 684, pl. 235 (4).

Lithoscaelus paradoxus A. MILNE EDWARDS, 1862, p. 362; PAUL'SON, 1961 (1875), p. 77.

Cryptochirus coralliodytes?: CHILTON, 1911, p. 561; EDMONDSON, 1933, p. 14, fig. 5, pls. 4(A, B).

? *Cryptochirus coralliodytes* var. *rubrolineata* and *fusca* FIZE and SERÈNE, 1957, p. 40, fig. 5 (B, D).

? *Cryptochirus bani* FIZE and SERÈNE, 1957, p. 44, figs. 5(F), 6, pl. 1(7).

? *Cryptochirus nami* FIZE and SERÈNE, 1957, p. 46, figs. 5(G), 7, pls. 1(8, 9), 2(4-6).

Remarks. As already pointed out by FIZE and SERÈNE (1957) and SERÈNE (1962), the carapacial ornamentation and sculpture and the size of maturity are remarkably variable. Thus, it may be reasonable that FIZE and SERÈNE (*op. cit.*) defined rather tentatively three varieties *fuscus*, *parvulus* and *rubrolineatus*. The variety *parvulus* was synonymized with *Troglocarcinus (Favicola) minutus* (EDMONDSON) by SERÈNE (1962), but the others are remained uncertain. The specimens at hand also remarkably vary in size, as shown by carapace length 4 to 8 mm in ovigerous females, but it was difficult to show the stable morphological differences.

Cryptochirus bani and *nami* described by FIZE and SERÈNE (1957) are also closely allied to and almost impossible to be distinguished from *C. coralliodytes*.

Material examined. Many specimens were obtained from some kinds of unidentified massive corals of the Faviidae and *Merulina laxa* of the Merulinidae from the Yaeyama Group in the Ryukyu Islands and Chichi-jima Island in the Ogasawara Islands. In addition, one ovigerous female was collected from Sagami Bay at the Cape Manazuru of Kanagawa Prefecture.

Host coral. The host corals of this species were firstly summarized by HIRO (1937), and afterward by UTINOMI (1944) and FIZE and SERÈNE (1957). Although the identifications of crabs and host corals seem to be not always correct, the specific names of host corals are again picked up for reference in this paper. *Favia speciosa*, *matthaii*

and *pallida*, *Favites abdita*, *Goniastrea pectinata*, *planulata*, *aspera*, *parvistella*, *retiformis*, *quoyi*, *incrustans* and *bournomi*, *Platygyra lamellina*, *astreiformis*, *daedalea*, *gigantea* and *gracilis*, *Leptoria phrygia* and *tenuis*, *Hydnophora lobata* and *rigida*, and *Leptastrea solida* of the Faviidae, and *Merulina laxa* of the Merulinidae.

Distribution. The type-locality is the Red Sea. The geographical range is from South Africa to the Polynesia, Micronesia and Japan. Its distributional pattern is typically Indo-West Pacific, but no definite records from Australia and the Malay Archipelago.

Cryptochirus edmonsoni FIZE et SERÈNE, 1955*

[New Jap. Name: Mizo-kebuka-sangoyadorigani]

(Text-fig. 1; Pl. III)

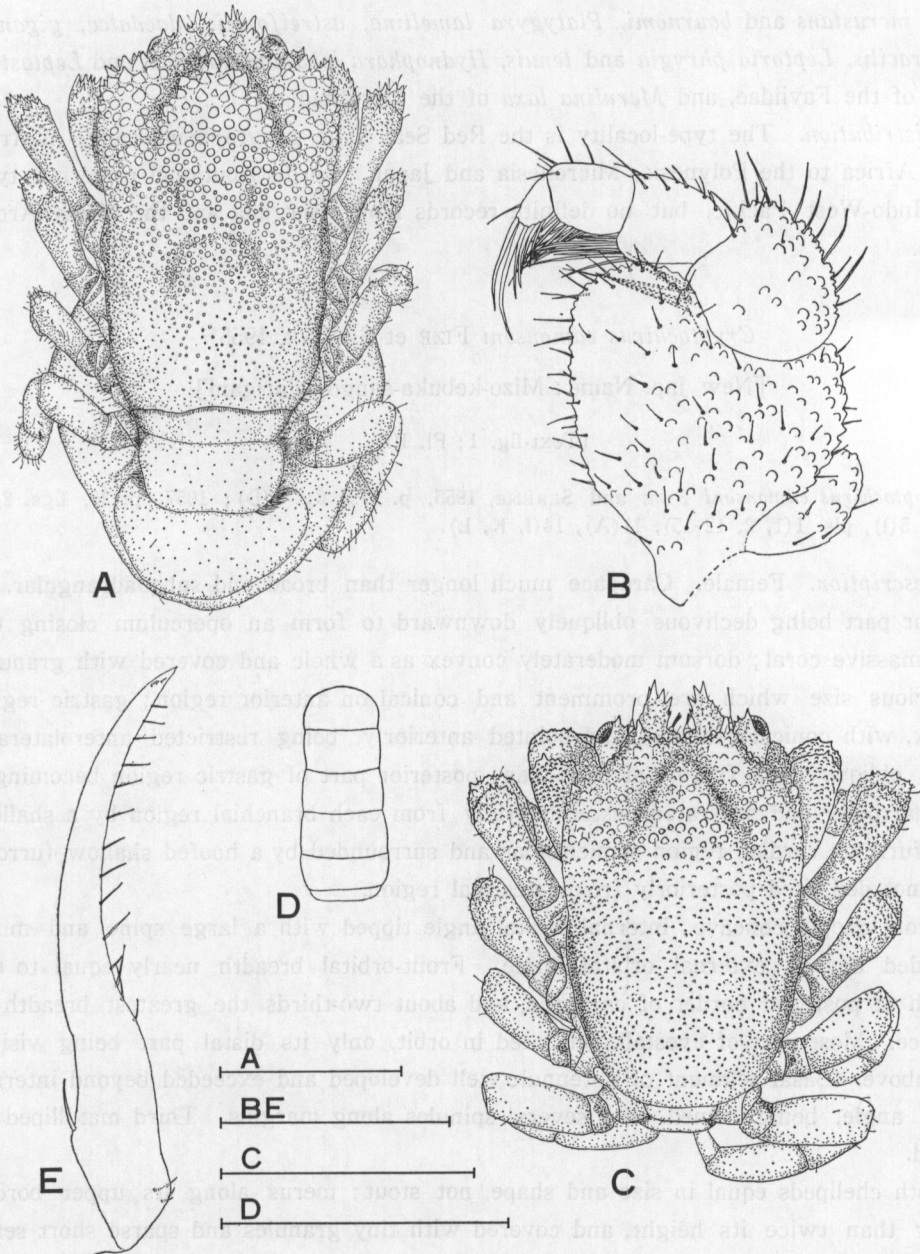
Cryptochirus edmonsoni FIZE and SERÈNE, 1955, p. 379, fig. 1(D); 1957, p. 26, figs. 2, 3, 5(I), pls. 1(1, 2, 12-15), 11(A), 14(I, K, L).

Description. Female. Carapace much longer than broad and subquadrangular, its anterior part being declivous obliquely downward to form an operculum closing the pit in massive coral; dorsum moderately convex as a whole and covered with granules of various size which are prominent and conical on anterior region; gastric region convex, with conical granules, and pointed anteriorly, being restricted anterolaterally by an oblique deep furrow at each side; posterior part of gastric region becoming a little narrower and separated posterolaterally from each branchial region by a shallow short furrow; cardiac region semicircular and surrounded by a hoofed shallow furrow, being not delimited posteriorly from intestinal region.

Front deeply concave; internal orbital angle tipped with a large spine and much protruded beyond external orbital angle. Front-orbital breadth nearly equal to the breadth of posterior border of carapace, and about two-thirds the greatest breadth of carapace. Most part of eyestalk retreated in orbit, only its distal part being visible from above. Basal segment of antennule well developed and exceeded beyond internal orbital angle, being armed with several spinules along margins. Third maxilliped as figured.

Both chelipeds equal in size and shape, not stout; merus along its upper border shorter than twice its height, and covered with tiny granules and sparse short setae on its upper surface; carpus a little longer than its greatest height; upper border of palm nearly equal to its height and also to fingers in length; fingers entire on cutting edges and leave a short gape proximally, with tips scarcely crossing each other.

* It is apparent that this species was dedicated to the late Dr. C.H. EDMONDSON of the Bernice P. Bishop Museum, but the original authors spelt his name throughout without d.



Text-fig. 1. *Cryptochirus edmonsoni* FIZE et SERÈNE.—A, B: Ovig. ♀ (NSMT-Cr 6442-1). C-E: ♂ (NSMT-Cr 6437-10). A, entire animal; B, left third maxilliped in abdominal view; C, entire animal; D, distal six segments of abdomen; E, left pleopod in abdominal view. Scales for A, C, D=2 mm, scale for B, E=0.5 mm.

First ambulatory leg longer and stouter than cheliped, covered with granules and hairs of various length; second and third legs nearly equal to each other and a little shorter than the first; fourth leg the longest. A small lobe on upper surface of each coxa from second to fourth pairs.

Male. Smaller than female. Anterior part of carapace bent downward, but not so abruptly as in female, being covered with smaller granules. Indication of regions on dorsum obscure, except for anterolateral furrow of gastric region. Both chelipeds equal in size and comparatively stouter than those of female. Abdomen elongate and composed of seven segments, only the first being visible in dorsal view. First pleopod rather slender and fringed with sparse longish setae at its external surface.

Material examined. Twenty-five ovigerous females (NSMT-Cr 6437-1~7, 6438-1~6, 6440-1, 2, 6441-1~4, 6442-1~6, 3.3×5.4~2.0×3.3 mm), five females (NSMT-Cr 6437-8, 6439-1, 6441-5, 6, 6442-7, 2.7×4.4~2.0×3.3 mm), one young female (NSMT-Cr 6439-2, 1.5×2.3 mm) and six males (NSMT-Cr 6437-9, 10, 6438-7, 6440-3, 6441-7, 6442-8, 2.0×3.3~1.5×2.2 mm) were collected at Kuroshima Island, Yaeyama Group, Ryukyu Islands. The specimens with catalog number NSMT-Cr 6437 were collected on Sept. 20, 1975 by Mr. T. FUKUDA, and the others on Apr. 12-19, 1976 by the senior author.

Host. The host corals recorded by the original authors are *Pavona varians* VERRILL [Jap. name: Shiwa-shikorosango] and *Psammocora gonagra* KLUNZINGER. The specimens from the Ryukyu Islands were obtained from *Psammocora exesa* DANA [Jap. name: Yasuri-amimesango].

The opening of pit is usually semicircular, but more or less deformed in most cases. The crab closes the opening just like an operculum by the anterior part of carapace, the chelipeds and the first pair of ambulatory legs. The pits are not very deep, and the deepest pit seen in the present specimens is about four times as long as the carapace.

Distribution. Hitherto known only from Nhatrang, Viet Nam (FIZE and SERÈNE, 1955, 1957).

Cryptochirus trii FIZE et SERÈNE, 1955, nom. emend.*

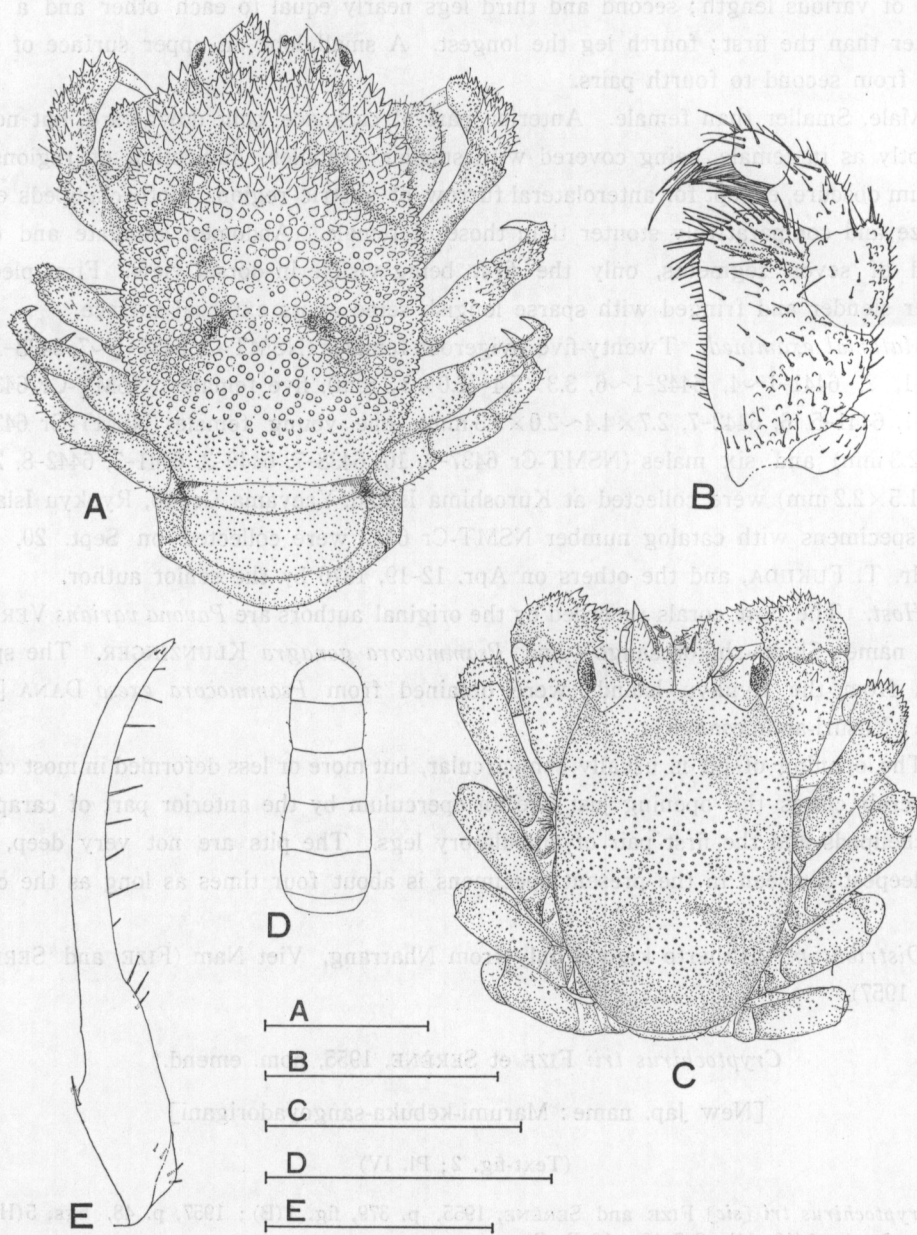
[New Jap. name: Marumi-kebuka-sangoyadorigani]

(Text-fig. 2; Pl. IV)

Cryptochirus trii [sic] FIZE and SERÈNE, 1955, p. 379, fig. 1(B); 1957, p. 48, figs. 5(H), 8, 9, pls. 1(10, 11), 2(7-10), 10(B, C).

Description. Female. Carapace much longer than broad, suboval and widest at a little behind median part, becoming narrower anteriorly and posteriorly; anterior part

* As this species was named after M.N.T. TRI, the specific name must be spelt with an additional *i*.



Text-fig. 2. *Cryptochirus trii* FIZE et SERÈNE.—A, B: ♀ infested by a *Sacculina* (NSMT-Cr 6443-3). C-E: ♂ (NSMT-Cr 6443-5). A, entire animal; B, left third maxilliped in abdominal view; C, entire animal; D, distal six segments of abdomen; E, left first pleopod in abdominal view. Scales for A, C, D=2 mm, scale for B=1 mm, scale for E=0.5 mm.

of carapace bent downward; dorsum moderately convex, and thickly covered with conical granules which are prominent and more or less spiniform on anterior part; hepatic region separated from gastric and branchial regions by a shallow oblique furrow; branchial region divided into three parts by two oblique furrows, the anterior of which is shorter and shallower than the posterior; anterior and median subdivisions of branchial region confluent with gastric region without any indication of furrows; posterior part of gastric region indistinctly separated from cardio-intestinal region by a very shallow furrow.

Front moderately concave and armed with spines. Supraorbital border concave; its internal angle provided with a large spine, and external angle with some spines. Front-orbital border nearly equal to posterior border of carapace and a little wider than half the greatest width of carapace. Proximal part of eyestalk hidden under carapace in dorsal view. Basal segment of antennule well developed and protruded beyond internal orbital angle and eyestalk, being armed with several spinules along margins and on upper surface. Third maxilliped as figured.

Both chelipeds not stout, equal in size and shape; merus nearly as long as twice its height, and its upper and lower surfaces covered with minute granules; carpus and palm covered with minute granules and fine setae mainly on upper borders, upper border of palm nearly equal to movable finger and shorter than twice the height of palm; fingers entire on cutting edges, with tips scarcely crossing each other.

First ambulatory leg a little longer and stouter than cheliped, being covered with spinules and short hairs. Second leg shorter than the first, and third leg generally resemble the second, but slightly shorter. Fourth leg slenderer than the third.

Male. Smaller than female. Dorsum thickly covered with minute granules, but smoother than in female; regions more indistinctly demarcated; anterior part of carapace moderately bent downward. Supraorbital border deeply excavated to be V, and eyestalk visible dorsally; internal orbital angle with spinules. Both chelipeds stout and equal in size; palm shorter than its height and nearly as long as movable finger; both fingers each with an indistinct blunt tooth at proximal part of cutting edge. Abdomen elongate, with seven segments, first segment being visible in dorsal view. First pleopod rather slender and fringed with sparse longish setae at its external surface.

Material examined. One ovigerous female (2.5×3.5 mm), one female (2.4×3.6 mm), one female infested by a *Sacculina* (3.8×5.2 mm), one young female (1.7×2.7 mm) and one male (1.9×2.9 mm) were collected on Apr. 29, 1979 at Taketomi-jima Island, Yaeyama Group, Ryukyu Islands about 6 m deep. All the specimens (NSMT-Cr 6444-1~5) were collected from one coral block. Four ovigerous females (NSMT-Cr 6546-1, 2, 3.0×4.2 mm, 2.7×3.8 mm; 6547, 3.1×4.8 mm; 6548, 2.8×4.1 mm) were collected on Jul. 1~8, 1976 at Miyahohama, Chichi-jima Island, Ogasawara Islands.

Host. The host corals recorded by the original authors are *Echinopora lamellosa*

(ESPER) [Jap. name: Ryukyu-kikka], *E. gemmacea* LAMARCK, *E. rosularia* (LAMARCK) and *E. tertia* GARDINER, the last two of which may be synonymous with *E. lamellosa* as rightly mentioned by them. The specimens at hand were also collected from *E. lamellosa*.

The opening of pit is circular, and its diameter is a little shorter than one and half times the carapace breadth. The pit is not deep, the largest case of the present specimens is about thrice the carapace length.

Distribution. Hitherto known only from Nhatrang, Viet Nam (FIZE and SERÈNE, 1955, 1957).

Acknowledgements

Mr. Teruo FUKUDA of the Marine Park Reserch Station at Kuroshima Island kindly presented us some interesting specimens for study. Mr. Akio KOJIMA sent us some coral blocks, one of which was represented on plate II. The junior author's cordial thanks are due to Dr. Ryôsuke ISHIKAWA of Tokyo Metropolitan University for giving him opportunity to make this study.

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Explanation of Plates

Plate II

- Figs. A-C. *Cryptochirus coralliodytes* HELLER. A, B, ovig. ♀ (NSMT-Cr 6702-1). Breadth 4.2 mm, length 6.0 mm. C, ♂ (NSMT-Cr 6703-2). Breadth 2.7 mm, length 4.1 mm.
- Figs. D, E. Entrances (D) and vertical section (E) of pits bored in *Platygyra* sp. Right pit was occupied by *Cryptochirus coralliodytes* HELLER, ovig. ♀ (NSMT-Cr 6704-1), but left pit by *Favicola rugosus* (EDMONDSON), ovig. ♀ (NSMT-Cr 6705-3).

Plate III

- Figs. A-C. *Cryptochirus edmonsoni* FIZE et SERÈNE. A, B, ovig. ♀ (NSMT-Cr 6437-1). Breadth 3.3 mm, length 5.4 mm. C, ♂ (NSMT-Cr 6437-10). Breadth 1.9 mm, length 3.1 mm.
- Figs. D, E. Entrance (D) and vertical section (E) of pit bored in *Psammocora exesa* DANA. The inhabitant is *Cryptochirus edmonsoni* FIZE et SERÈNE, ovig. ♀ (NSMT-Cr 6443-1).

Plate IV

- Figs. A-E. *Cryptochirus trii* FIZE et SERÈNE. A, B, ovig. ♀ (NSMT-Cr 6443-2). Breadth 2.4 mm, length 3.6 mm. C, ♂ (NSMT-Cr 6443-5). Breadth 1.9 mm, length 2.9 mm. D, E, ovig. ♀ (NSMT-Cr 6443-1) staying in pit of *Echinopora lamellosa* (ESPER).

摘 要

ケブカサンゴヤドリガニ属 (*Cryptochirus*) は、紅海から採集されたケブカサンゴヤドリガニ (*C. coralliodytes*) を模式種として、HELLER (1961) により創設された。サンゴヤドリガニ類の中で最もよく知られているサンゴヤドリガニ (*Hapalocarcinus marsupialis*) (1属1種) の雌が、樹枝状サンゴに瘤を作るのに対し、ケブカサンゴヤドリガニ属のカニは雌雄とも主に塊状サンゴに棲管を形成する。このような生態と関連し、サンゴヤドリガニが比較的扁平な形態をもつのに対し、ケブカサンゴヤドリガニ属のカニは歩脚を縮めると円筒形に近い形となり、頭部は下垂して蓋状を呈する。

ケブカサンゴヤドリガニ属に含まれる種として、これまでに11種、3変種が記載された。このうち、5種、1変種は別属へ移され、3種、2変種はその独立性に疑問がある。結局、現段階では、ケブカサンゴヤドリガニ、ミゾケブカサンゴヤドリガニ (新称) (*C. edmonsoni*)、マルミケブカサンゴヤドリガニ (新称) (*C. trii*) の3種がこの属の構成種ということになる。

これら3種はいずれも日本から採集され、寄主となるサンゴの分布域ではまれでないようであり、特に、ケブカサンゴヤドリガニは奄美、沖縄地方などではごく普通に見ることができる。

