Bull. Natn. Sci. Mus., Ser. A (Zool.), **5** (3), September 22, 1979

Coral-inhabiting Crabs of the Family Hapalocarcinidae from Japan

I. Three Species Obtained from Mushroom Coral, *Fungia*[1)]

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The Hapalocarcinidae is a small family of the Brachyura, individuals of which form galls on branching corals of the Pocilloporidae or pits on reef corals of various types. They are markedly specialized in morphology owing to their commensal, or rather parasitic association with corals.

An excellent contribution to this small, but interesting group was made by FIZE and SERÈNE (1957) who recognized four known genera, *Cryptochirus* HELLER, *Hapalocarcinus* STIMPSON, *Pseudohapalocarcinus* FIZE et SERÈNE and *Troglocarcinus* VERRILL, and a new genus, *Neotroglocarcinus,* and subdivided *Troglocarcinus* into four subgenera. Subsequently, SERÈNE (1966) made some amendment on their monograph, and thus *Pseudocryptochirus* HIRO was resurrected, and *Fungicola* and *Favicola* erected by them at the subgeneric rank were treated as distinct genera. The validity of some species is at present not certain, but at any rate about 27 species of 8 genera are known from the Indo-West Pacific, and 2 species of 2 genera are the inhabitants of the Atlantic.

It is a surprising fact that only 3 species of 3 genera, viz., *Hapalocarcinus marsupialis* STIMPSON, *Cryptochirus coralliodytes* HELLER and *Pseudocryptochirus viridis* HIRO, are known to date from Japan, since the crab fauna of Japan is considered in general to be well elucidated. In Japan the Hapalocarcinidae is without doubt represented at least by several species other than the 3 species already recorded, as readily understood at the field work on the exposed coral reefs of the Ryukyu Islands.

The authors extensively collected the coral blocks of various types with galls or pits. In addition, many specimens from the Yaeyama Group, Ryukyu Islands, were placed at the authors' disposal for study by several cooperators. In this first report of the series, the authors deal with 3 species of 2 genera obtained from pits of mushroom corals, *Fungia repanda* [Jap. name: Nokogiri-kusabiraishi] and *F. paumotensis* [Jap.

1) This study is supported by the Grants-in-aid for Scientific Research from the Ministry of Education, Nos. 064206 and 334035.

name: Zôriishi], two of which are new to the Japanese fauna and one is new to science.

All the specimens including the holotype of the new species are preserved in the National Science Museum, Tokyo (NSMT).

Genus ***Fungicola*** FIZE et SERÈNE, 1957

Fungicola utinomii (FIZE et SERÈNE, 1955), nom. emend.

[New Jap. name: Uchinomi-hira-sangoyadorigani]

(Fig. 1; Pls. 1–4)

Troglocarcinus utinomi FIZE et SERÈNE, 1955, p. 377, fig. 2 (E).
Troglocarcinus (*Fungicola*) *utinomi*: FIZE & SERÈNE, 1957, p. 124, figs. 31 (C, D), 32, 33, pls. 5 (15), 7 (5, 6), 8 (6, 7), 13 (A–C), 17 (A, B).
Fungicola utinomi: SERÈNE, 1966, p. 397 (in list).

Description. Female. Carapace subquadrangular and longer than broad, being depressed dorso-ventrally; dorsum nearly flat and covered with granules which are small and low on posterior region, and larger and rather spiniform on anterior region. Median gastric region almost rhombic and moderately convex, its posterior part being indistinctly separated from cardio-intestinal region. Hepatic region weakly convex, and branchial region very shallowly separated from hepatic, gastric and cardio-intestinal regions.

Front moderately concave and armed with spines of various size. Anterior part of lateral border strongly convex to form a large convex lobe with large marginal spines. Posterior part of lateral border nearly straight and only weakly convergent.

Cheliped rather slender and hidden under carapace for its most part in natural position; merus longer than twice its breadth; upper and external surfaces of merus, carpus and palm covered with fine granules. First ambulatory leg nearly as long as cheliped, though stouter; merus depressed laterally and a little longer than broad; upper and external surfaces of merus, carpus and propodus covered with granules and spinules. Second and third ambulatory legs slenderer and shorter than the first. Fourth amburatory leg slender and nearly as long as the first. A small lobe on upper surface of each coxa from second to fourth ambulatory legs.

Abdomen composed of seven segments and broadly expanded. First and second abdominal segments nearly as broad as posterior border of carapace; third to seventh segments expanded and semimembranous. Abdominal appendages with three pairs, the first being biramous with a rudimentary exopod at its base; the second and third uniramous.

Male. Male is smaller than female. Posterior part of lateral border of carapace continuous smoothly to posterior border. Abdomen expanded transversely so as to be rhombic. Both pairs of abdominal appendages well developed, the first being fringed with setae. General morphological characters are referred to those of female.

Material examined. Eight females and three males collected from Ishigaki-jima and Kuro-shima Islands at sublittoral zone down to 10 m deep. They are listed in

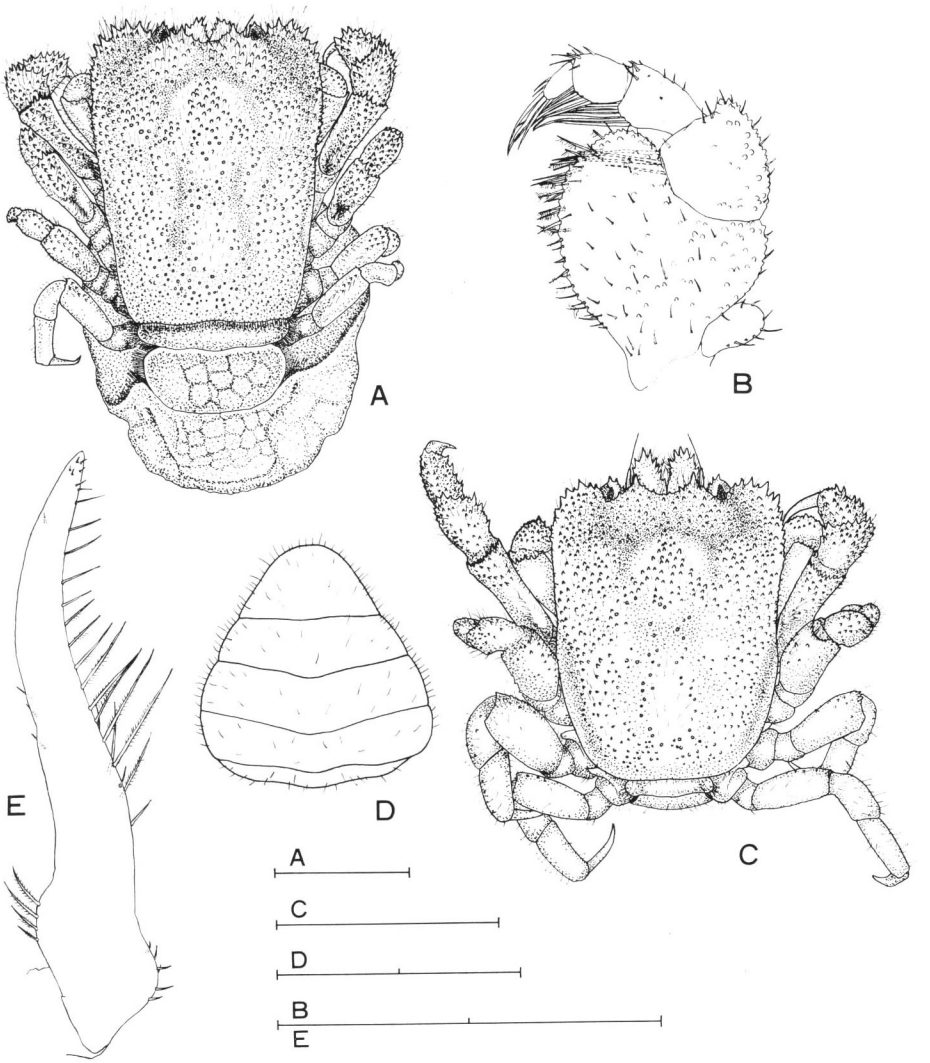

Fig. 1. *Fungicola utinomii* (FIZE et SERÈNE). —— A, B: Ovig. ♀ (NSMT-Cr. 5893-1). C–E: ♂ (NSMT-Cr. 5893-2). A, Entire animal; B, left third maxilliped in abdominal view; C, entire animal; D, distal five segments of abdomen; E, left first pleopod in abdominal view. Scales for A, C=3 mm, scales for B, D, E=1 mm.

Table 1.

Host. All the specimens were obtained from *Fungia repanda*. Both sexes formed pit at the upper side of coral, close to its centre, but in some cases near the massive abnormal outgrowths of the coral. Since these outgrowths are hollowed inside as a form of the longitudinal pit, it is highly probable that they were made to close the old

Table 1. Material identified with *Fungia utinomii*.

Specimen number NSMT-Cr	Sex	Measurement of crab in mm		Measurement of pit in mm			Host coral	Locality
		Breadth of carapace	Length of carapace	Major axis of entrance	Minor axis of entrance	Depth of pit		
5889	♀	5.1	6.8	—	—	—	?*Fungia repanda*	Kabira, Ishigaki-jima
5890–1	ovig. ♀	5.1	6.4	7.0	4.3	15.0	*Fungia repanda*	〃
5890–2	♂	3.3	4.2	6.2	2.3	12.0	〃	〃
5891	ovig. ♀	5.9	7.8	—	—	—	〃	〃
5892–1	ovig. ♀	5.7	7.3	8.4	3.6	13.0	〃	Kuro-shima
5892–2	♂	2.8	3.6	4.7	1.8	6.8	〃	〃
5893–1	ovig. ♀	5.2	6.8	7.5	3.8	13.6	〃	Kabira, Ishigaki-jima
5893–2	♂	3.3	4.2	7.0	3.5	11.7	〃	〃
5894–1	♀	4.1	5.4	7.0	3.5	8.7	〃	S.S.W. 3 miles off Ishigaki-jima
5894–2	♀	4.5	5.8	7.0	3.0	11.0	〃	〃
5895	♀	5.0	6.7	7.0	4.4	10.2	〃	Yonehara, Ishigaki-jima

In this table the specimens with same stem number were obtained from one coral.

Date of collection. NSMT-Cr. 5889–5891 — Apr. 20, 21, 1976; 5892 — Apr. 12–19, 1976; 5893–5895 — Jul. 3–8, 1978.

pits of the crab. The elliptical entrance to the pit is strongly depressed, and it allows the crab barely to enter. In case of female, depth of pit is nearly equal to body length of crab *in situ*, and in male, about twice. One or two specimens were obtained from one coral, and the latter case was represented by one pair or two females.

Distribution. This species has originally been reported by FIZE and SERÈNE (1955) from Nhatrang, Viet-Nam. SERÈNE and others (1974) recorded this species in the list of crabs from the Moluccas, Indonesia obtained by the Rumphius Expedition I. In Japan, considering our collection, this species seems not uncommon in the Yaeyama Group, Ryukyu Islands.

Fungicola fagei (FIZE et SERÈNE, 1955)

[New Jap. name: Hira-sangoyadorigani]

(Fig. 2; Pls. 5–6)

Troglocarcinus fagei FIZE et SERÈNE, 1955, p. 378, fig. 2 (F).

Troglocarcinus (*Fungicola*) *fagei*: FIZE & SERÈNE, 1957, p. 131, figs. 31 (F), 34, 35, pls. 5 (16), 8 (1–5), 13 (D–F), 17 (C).

Fungicola fagei: SERÈNE, 1966, p. 397 (in list).

Description. Male. Carapace subquadrangular and longer than broad, being depressed dorso-ventrally; anterior half broader than posterior half. Dorsum almost

flat and covered with fine granules. Median gastric region feebly convex and its posterior part confluent with cardio-intestinal region. Hepatic region only very faintly demarcated. Branchial region separated from median gastric and cardio-intestinal regions by shallow furrows.

Front moderately concave, being armed with spinules. Supraorbital border concave, its external end being directed straightly forward and joining internal end of anterior part of lateral border; they form a large lobe, which extremely protrudes beyond frontal border. Anterior part of lateral border armed with spinules and

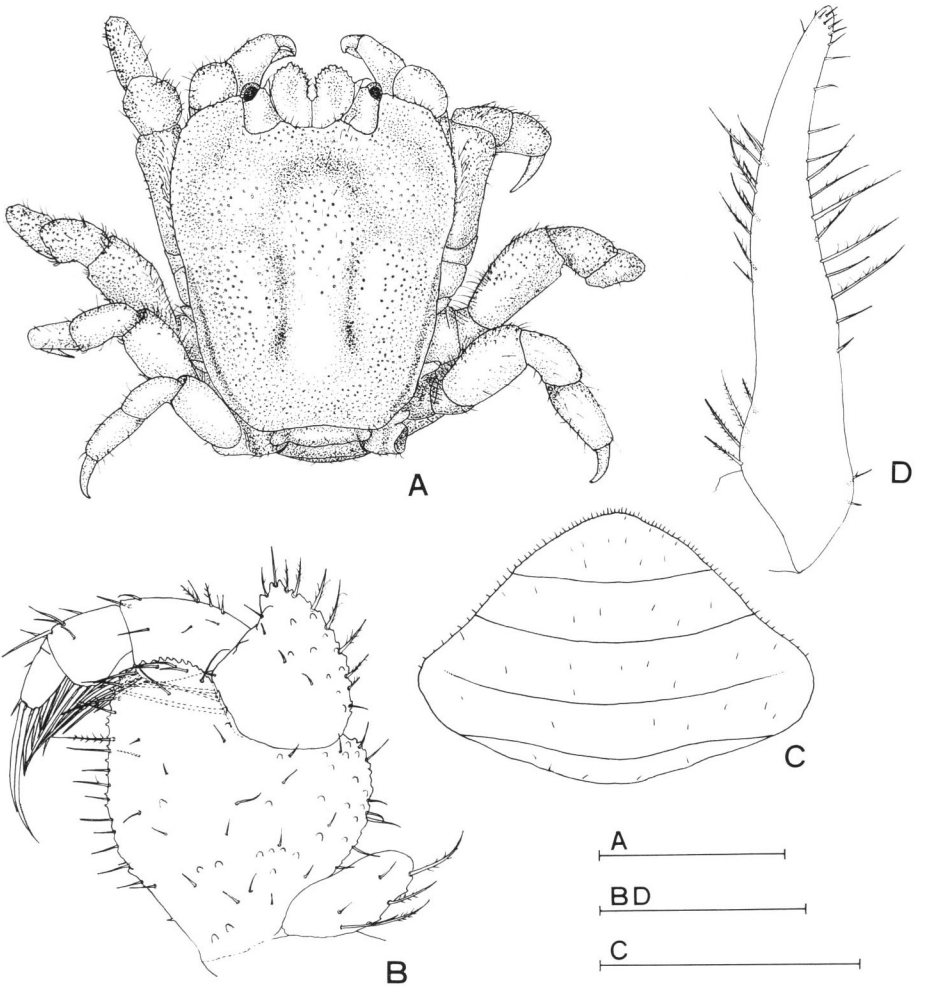

Fig. 2. *Fungicola fagei* (FIZE et SERÈNE), ♂ (NSMT-Cr. 5897). —— A, Entire animal; B, left third maxilliped in abdominal view; C, distal five segments of abdomen; D, left first pleopod in abdominal view. Scales for A, C=2 mm, scale for B, D=0.5 mm.

moderately convex; middle part of lateral border slightly concave.

Cheliped not stout; merus longer than twice its breadth, covered with fine granules; carpus a little longer than broad, and its upper border nearly as long as that of palm; upper borders of carpus and palm covered with fine granules. First ambulatory leg nearly as long as cheliped; merus depressed laterally and longer than twice its breadth; merus, carpus and propodus covered with fine granules. Last two ambulatory legs slenderer than the precedings. On upper surface of each coxa from second to fourth ambulatory legs, a small lobe protruded forward.

Abdomen rhombic, broader than long and composed of seven segments, posterior five segments being visible in ventral view; fourth abdominal segment the broadest. Both pairs of abdominal appendages well developed, first pair being fringed with setae.

Material examined. One male (3.1×3.6 mm), NSMT–Cr. 5897; Kuro-shima I., Yaeyama Group, Ryukyu Is., sublittoral zone; Apr. 12–19, 1976. One male (2.9× 3.6 mm), NSMT–Cr. 5896; Kabira, Ishigaki-jima I., Yaeyama Group, sublittoral zone; Apr. 20, 21, 1976.

Remarks. This species is readily distinguished from another representative, *Fungicola utinomii*, by its characteristic anterior part of the carapace and dorsum. In this species, the external orbital angle is markedly protruded forward beyond the internal one, and the eye-stalk is almost visible in dorsal view, but in *F. utinomii,* the external and internal orbital angles are of nearly equal level, and the eye-stalk is not seen dorsally. The dorsum is apparently flatter in this species.

Host. FIZE and SERÈNE (1957) recorded this species from *Parahalomitra robusta* of the Fungiidae, but our specimens, two males, were obtained from two specimens of *Fungia paumotensis.* In one case (NSMT–Cr. 5897) observed in detail, the crab formed a pit at the upper side of host coral, near its centre. The elliptical entrance to the pit is strongly depressed. Its major axis is 5.8 mm and minor axis is 1.8 mm, and thus the entrance allows the crab barely to enter. Depth of the pit is 8.2 mm and about twice the body length of the crab *in situ.*

Distribution. Like *Fungicola utinomii,* this species was originally reported by FIZE and SERÈNE (1955) from Nhatrang, Viet-Nam, and also recorded by SERÈNE *et al.* (1974) from the Moluccas, Indonesia. We collected only two specimens from the Yaeyama Group, Ryukyu Islands where it seems to be rarer than *F. utinomii.*

Genus ***Pseudocryptochirus*** HIRO, 1938

Pseudocryptochirus ishigakiensis sp. nov.

[New Jap. name: Ashibiro-sangoyadorigani-modoki]

(Figs. 3–4; Pl. 7)

Description. Male, holotype. Carapace subquadrangular and longer than broad, being depressed dorso-ventrally. Dorsum rather flat, moderately divided into convex regions; hepatic region isolated from adjacent regions anteriorly and internally by shallow furrows; mesogastric region moderately convex and rather sharply pointed

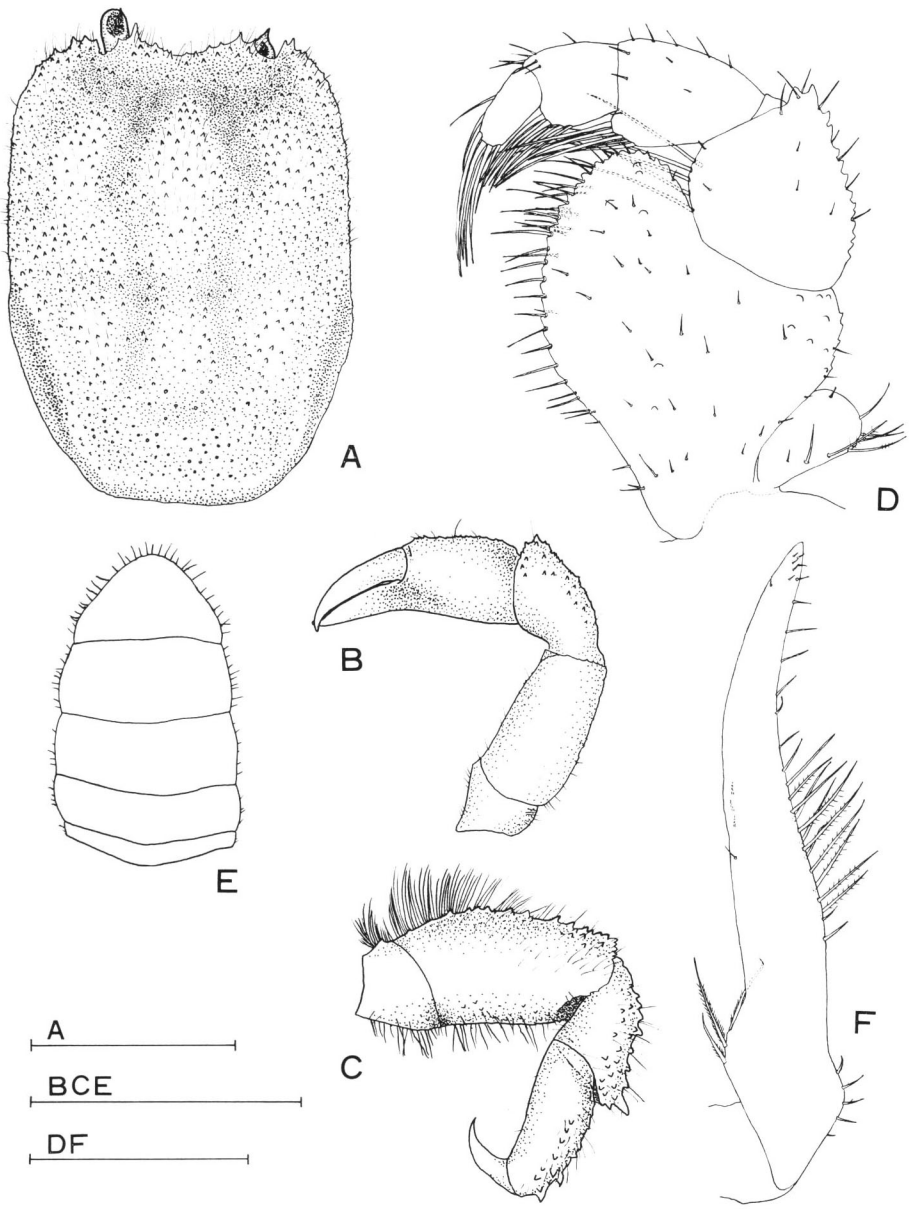

Fig. 3. *Pseudocryptochirus ishigakiensis* sp. nov., holotype ♂ (NSMT–Cr. 5898). —— A, Carapace; B, right cheliped; C, right first ambulatory leg; D, left third maxilliped in abdominal view; E, distal five segments of abdomen; F, left first pleopod in abdominal view. Scales for A, B, C, E=2 mm, scale for D, F=0.5 mm.

anteriorly; metagastric region shallowly separated from cardiac and epibranchial regions; cardiac region rather rounded and weakly convex, separated from intestinal region very indistinctively; branchial region shallowly separated from cardiac region by antero-posterior furrow, but indistinctly from hepatic region.

Front moderately concave, and armed with spines of various size, its breadth being about one-third of carapace. Internal orbital angle rather rounded and spinulated, its anterior end scarcely going beyond external orbital angle, which forms a spinulated lobe together with anterior part of lateral border. Anterior one-fifth of lateral border gradually curved; from one-fifth to three-fifths, lateral border of both sides rather straight and parallel to each other; last part convergent posteriorly and continues smoothly to posterior border which is almost straight.

Buccal frame nearly as broad as half the carapace. Buccal cavity not entirely covered by third maxillipeds. Third maxilliped with a peculiar feature; ischium subtriangular, its antero-internal angle protruding forward, rounded and fringed with setae; merus a little longer than broad, its outer distal part scarcely protruding; exopod armed with setae and as long as half the outer margin of ischium.

Both chelipeds rather slender and equal in size. Merus covered with fine granules and its length about twice its breadth; its most part not hidden under carapace. Carpus only a little longer than broad and covered with granules, especially so on its upper surface; its upper distal part moderately protruding. Upper border of palm longer than its broad; upper and outer surfaces of palm covered with fine granules. Fingers nearly as long as upper border of palm, not toothed on cutting edges and meet along their whole length, leaving a short gape at proximal end; tips of fingers scarcely crossing each other.

First ambulatory leg comparatively slender and nearly as long as cheliped. Merus depressed laterally, a little shorter than twice its breadth, and covered with granules especially on its upper surface; proximal two-thirds of its upper border bears a low of setae; its lower surface covered with sparse setae. Carpus longer than broad, covered with granules and spines especially at its upper surface, its upper distal part moderately protruding. Propodus nearly as long as twice its breadth; its upper and outer surfaces covered with granules and spines. Dactylus smooth, curved inward, with its distal end pointed. Second ambulatory leg shorter and slenderer than the first, though generally similar to the latter in its character. Merus slightly depressed laterally, a little shorter than twice its breadth. Upper surfaces of merus, carpus and propodus covered with granules and spines. Dactylus smooth, curved inward, and its distal end pointed. Third ambulatory leg only slightly slenderer than, but nearly as long as the second; its character generally resembles that of the previous one, but more sparsely covered with granules. Fourth ambulatory leg the slenderest and the most cylindrical; its surface almost smooth, and only upper surface of merus covered with few numbers of granules. Upper surface of each coxa from second to fourth ambulatory legs with a small lobe protruded forward.

Abdomen elongate-oval, longer than broad and composed of seven segments,

distal five segments being visible in ventral view. First segment hidden under carapace for its anterior half; its posterior border rather rounded. Second segment the narrowest, and broader posteriorly. Fourth segment the broadest, its length nearly one-third of its breadth. Fifth and sixth segments become narrower posteriorly. Last segment subtriangular. First and second pleopods fully developed, the first fringed with setae mainly at middle part of its external surface.

Material examined. One male (3.4×4.7 mm), holotype, NSMT–Cr. 5898; Kabira, Ishigaki-jima I., sublittoral zone; Apr. 21, 1976.

Remarks. The new species is close in general to the two members of *Fungicola* from *Fungia*, but without doubt generically distinct from them due to the quite different formation of the male abdomen. On the other hand, the shape of the male abdomen in the new species suggests a close relation to *Pseudocryptochirus*. As suggested by FIZE and SERÈNE (1957), and SERÈNE (1966), the genus in question is heterogeneous and consists of two rather different groups, the *viridis* type and the *boissoni* type, and these two groups may represent two distinct genera in due time. In the new species the general formation of the carapace and the slender ambulatory legs seem to be close to those of the *boissoni* type, and thus the tentative attribution to *Pseudocryptochirus* was made in this paper. In having the flat subquadrangular carapace and the slender cheliped, the new species is readily distinguished from the three species of the *boissoni* type, *P. boissoni* (FIZE et SERÈNE), *P. sheni* (FIZE et SERÈNE) and *P. krempfi* (FIZE et SERÈNE).

It is noted that the eyes of the holotype are not equal in size due to certain injury.

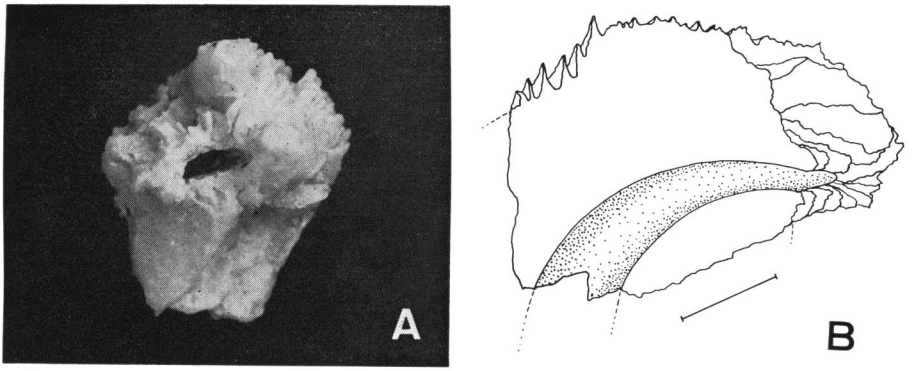

Fig. 4. Pit of *Pseudocryptochirus ishigakiensis* sp. nov., holotype ♂, on *Fungia repanda*. —— A, Entrance to pit; B, vertical section of pit. Major axis of entrance ca. 6.7 mm. Scale for B=ca. 10 mm.

Host. This specimen was obtained from *Fungia repanda*. Until now only one species, *Fungicola utinomii* (FIZE et SERÈNE), has been reported from *Fungia*, and in this report we have indicated that *Fungicola fagei* (FIZE et SERÈNE) is also associated with *Fungia*. The pit of this specimen was formed on the upper side of the coral, just at

the abnormal outgrowth massively protruded, which was perhaps caused by lodgement of the crab. The pit has a strongly depressed elliptical entrance; its major axis is 6.7 mm and minor axis is 2.2 mm. The depth is more than 30 mm with a considerable curvature, increasing the thickness; at the largest part of the pit, the bottom part of the remain, its major axis is 9.1 mm and minor axis is 7.5 mm. Size of the pit is thus very large in comparison with the size of the crab.

Acknowledgement

The authors wish to thank Mr. Kazushi OKAMOTO and Mr. Teruo FUKUDA of the Marine Park Research Station at Kuro-shima for their help in collecting the samples. Mr. Tomoyuki MIURA of the Tokyo University of Fisheries kindly presented us some interesting specimens for study. The host corals were identified by Dr. Kiyoshi YAMAZATO and Mr. Toshiharu ODA of the University of the Ryukyus, to whom the authors are deeply indebted. The junior author's cordial thanks are due to Dr. Ryô-suke ISHIKAWA of Tokyo Metropolitan University for giving him the opportunity to make this study.

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Explanation of Plates 1–7

Plate 1

Figs. A–D. *Fungicola utinomii* (FIZE et SERÈNE), staying in their pits on *Fungia repanda*. Two crabs stay in pits near the massive outgrowths of coral. Both specimens, a and b, obtained from this coral are females (NSMT–Cr. 5894–1, 2).

Plate 2

Figs. A–D. *Fungicola utinomii* (FIZE et SERÈNE), staying in their pits on *Fungia repanda*. Of the two crabs inhabiting this coral, specimen a is an ovigerous female and b is a male (NSMT–Cr. 5893–1, 2).

Plate 3

Figs. A–D. *Fungicola utinomii* (FIZE et SERÈNE). A, B: Ovig. ♀ (NSMT–Cr. 5893–1). Breadth of carapace 5.2 mm, length of carapace 6.8 mm. C, D: ♂ (NSMT–Cr. 5893–2). Breadth of carapace 3.3 mm, length of carapace 4.2 mm.

Plate 4

Figs. A–D. *Fungicola utinomii* (FIZE et SERÈNE). A, B: Ovig. ♀ (NSMT–Cr. 5891). Breadth of carapace 5.9 mm, length of carapace 7.8 mm. C, D: ♀ (NSMT–Cr. 5895). Breadth of carapace 5.0 mm, length of carapace 6.7 mm.

Plate 5

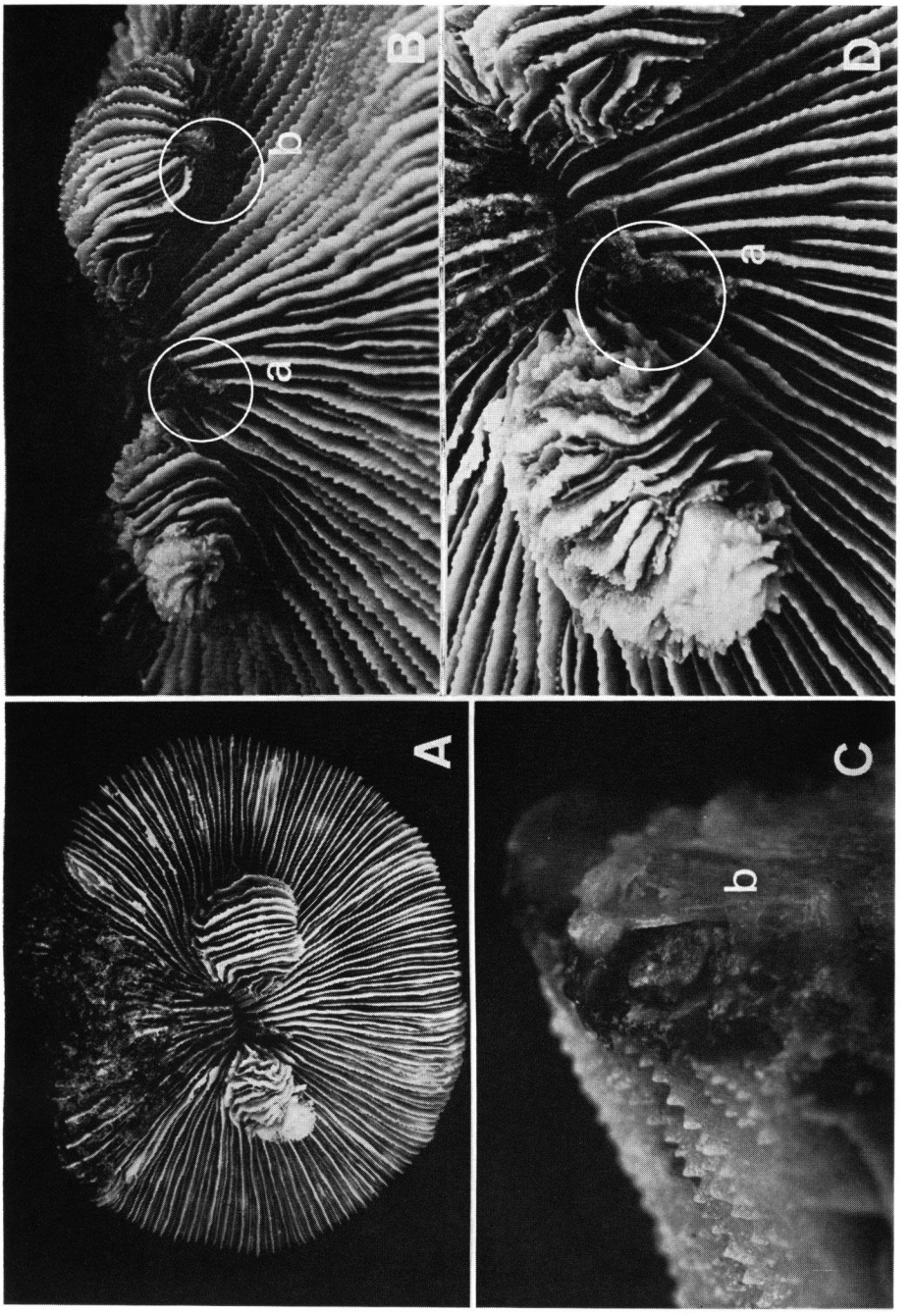
Figs. A, B, D. *Fungicola fagei* (FIZE et SERÈNE), staying in pit on *Fungia paumotensis*. Only one male specimen (NSMT–Cr. 5897) was obtained from this coral. Fig. C. Pit made by the male. Major axis of entrance is ca. 5.8 mm.

Plate 6

Figs. A–D. *Fungicola fagei* (FIZE et SERÈNE). A, B: ♂ (NSMT–Cr. 5897). Breadth of carapace 3.1 mm, length of carapace 3.6 mm. C, D: ♂ (NSMT–Cr. 5896). Breadth of carapace 2.9 mm, length of carapace 3.6 mm.

Plate 7

Figs. A–B. *Pseudocryptochirus ishigakiensis* sp. nov., ♂, holotype (NSMT–Cr. 5898). Breadth of carapace 3.4 mm, length of carapace 4.7 mm.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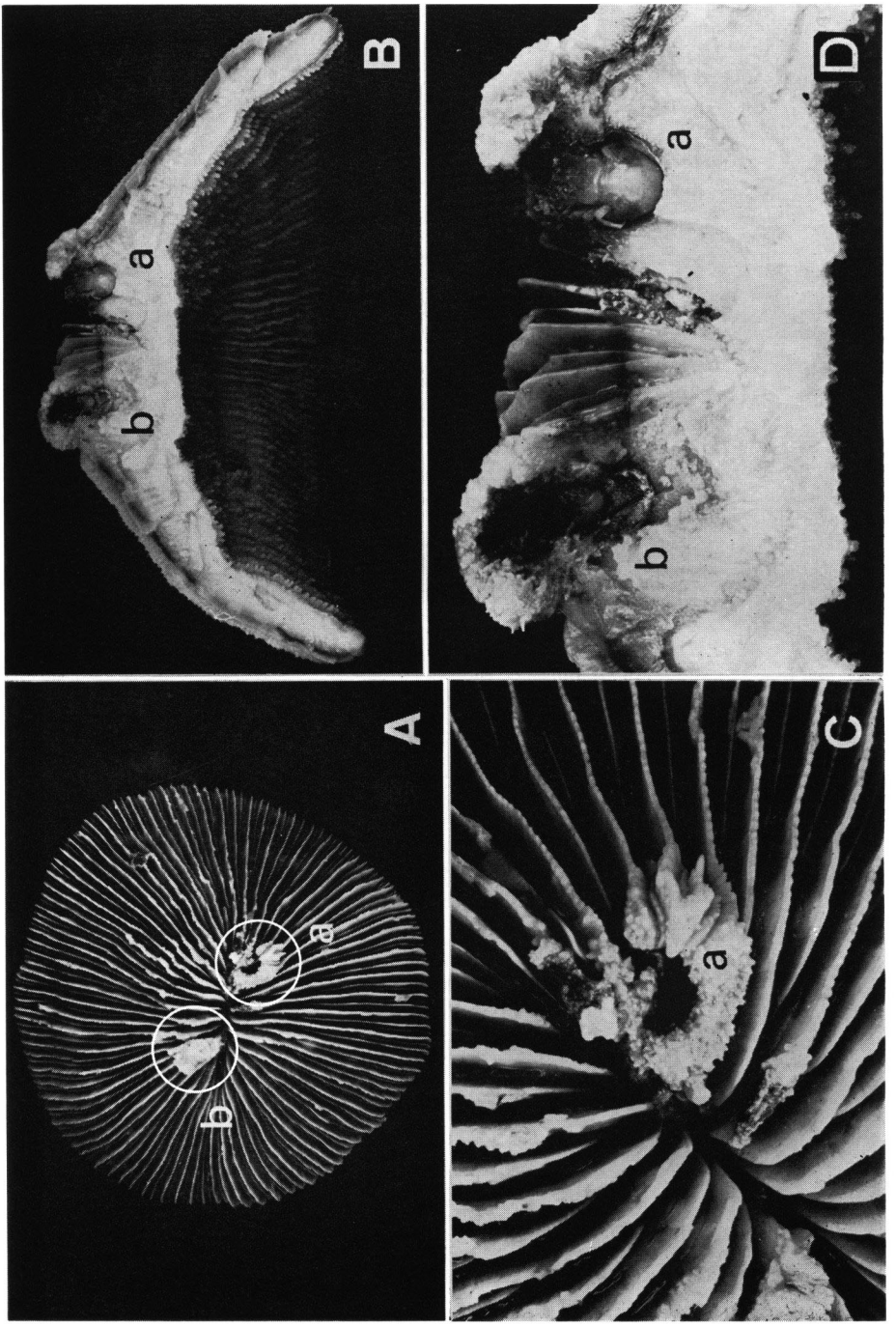
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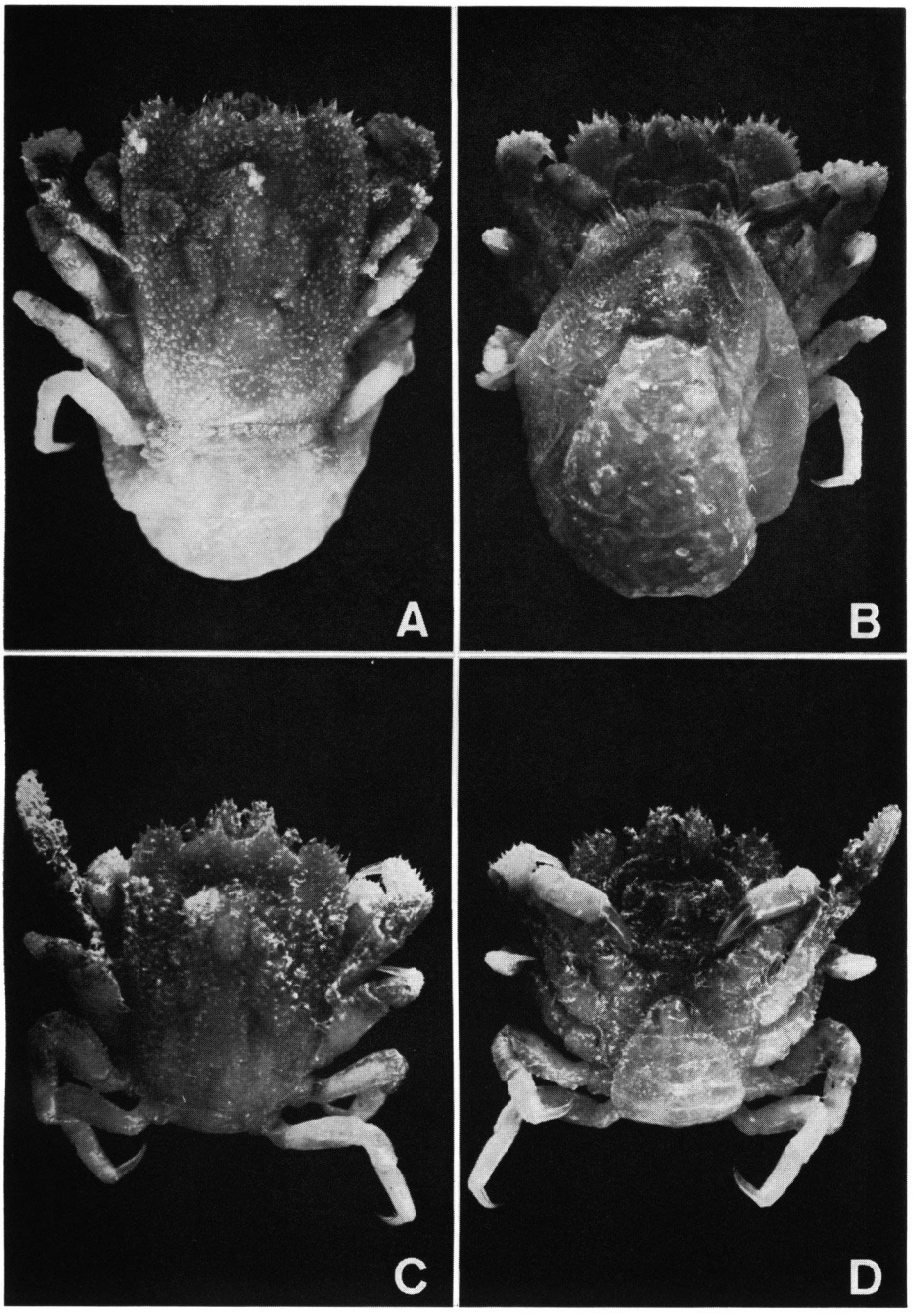
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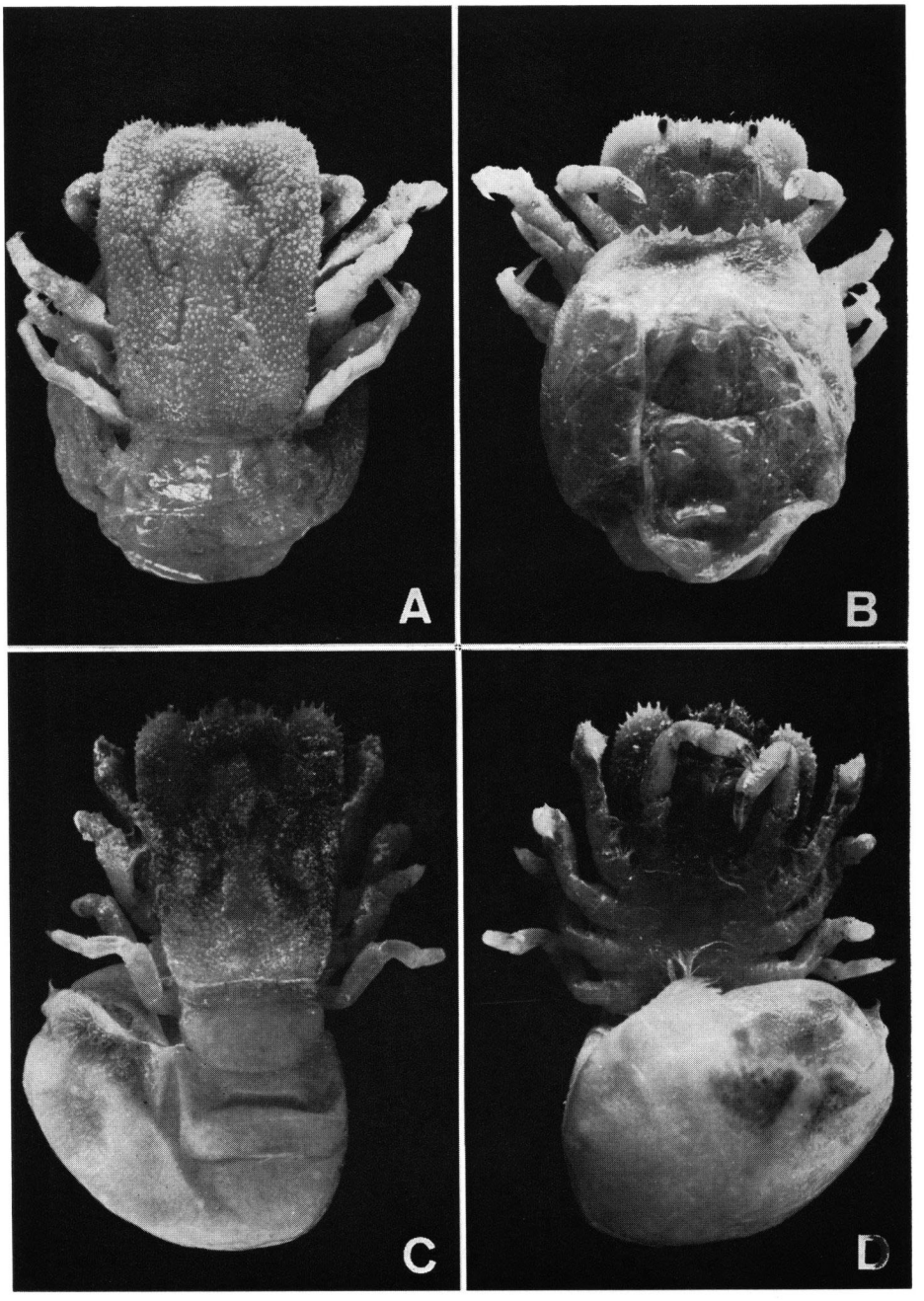
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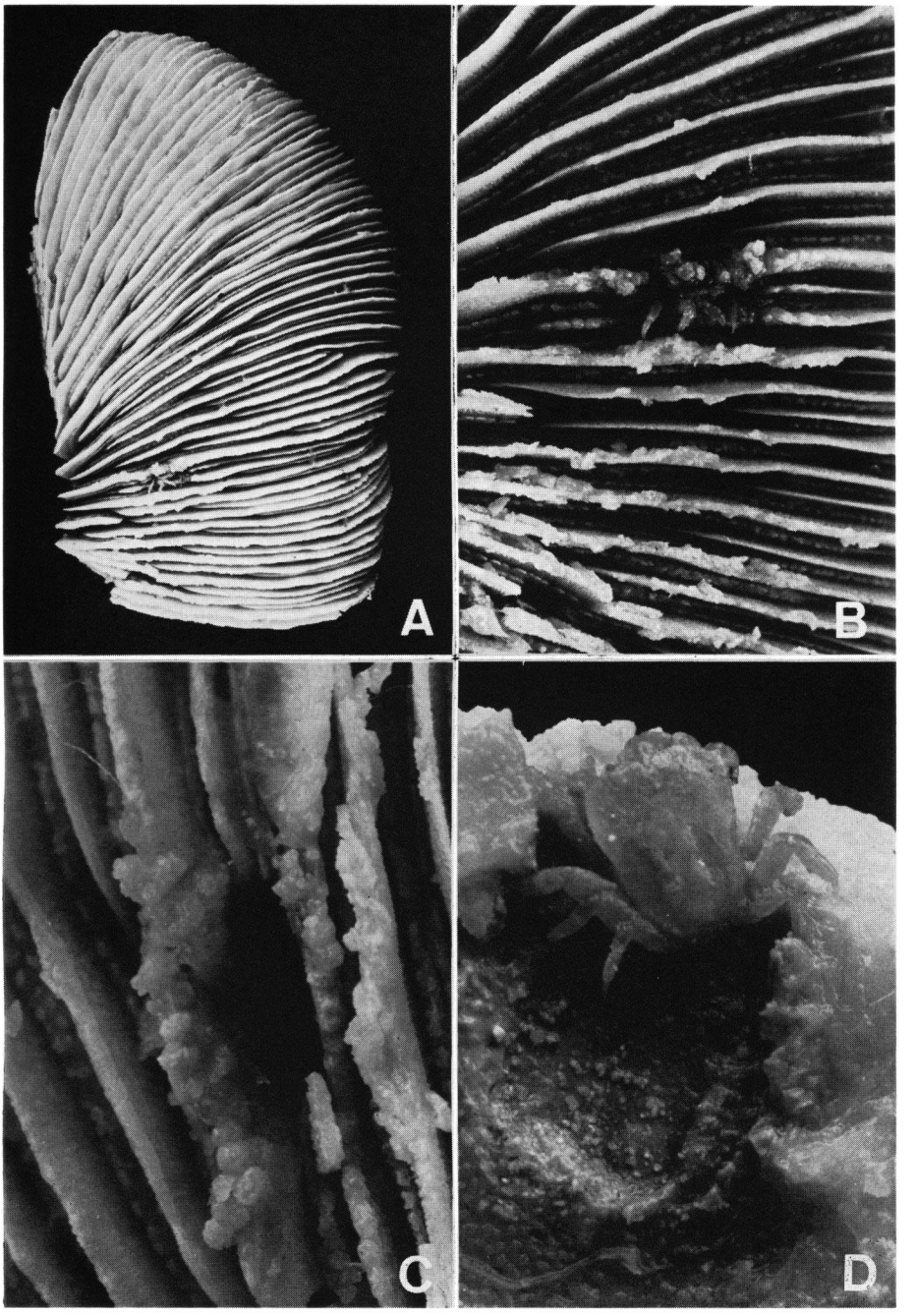
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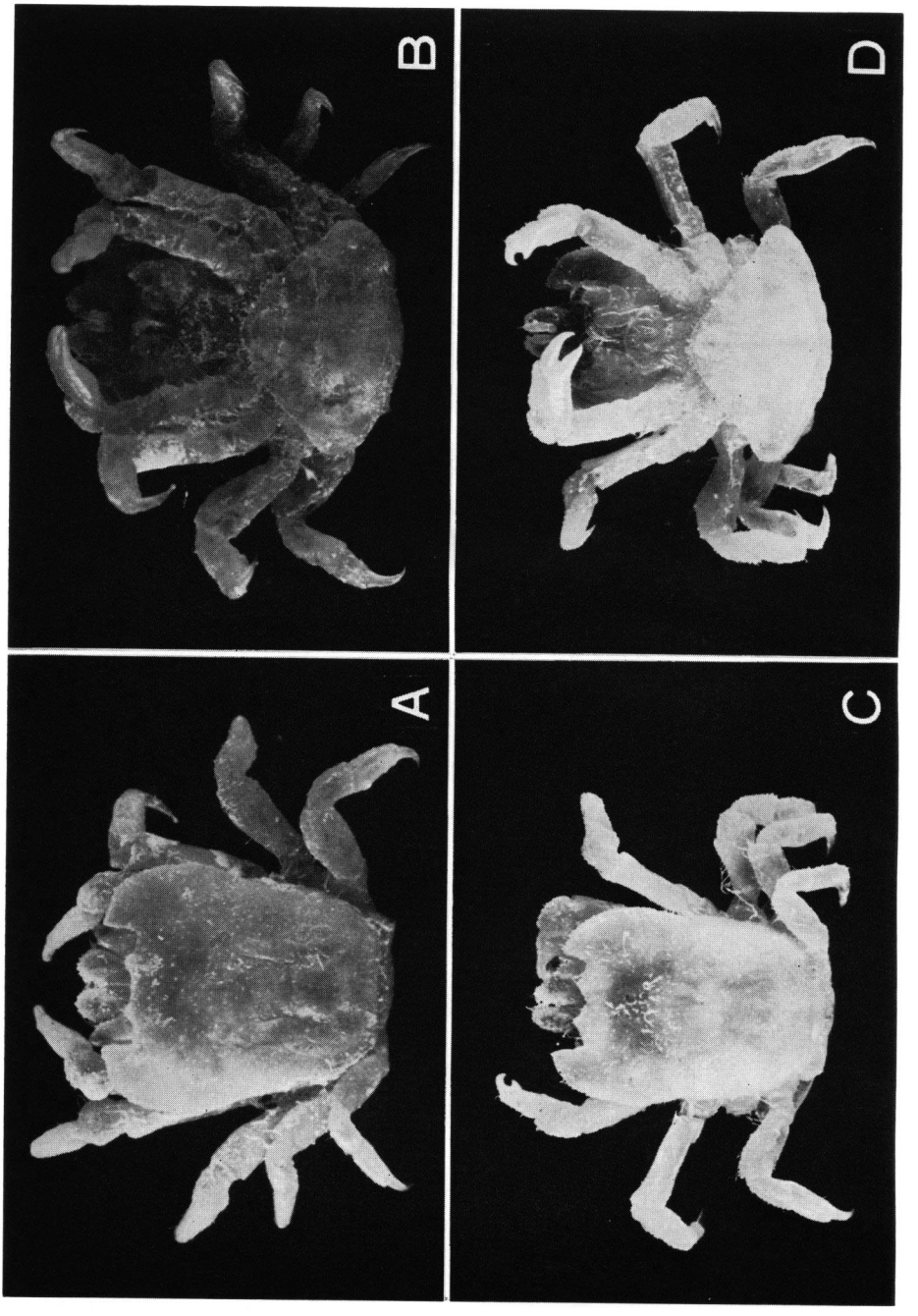
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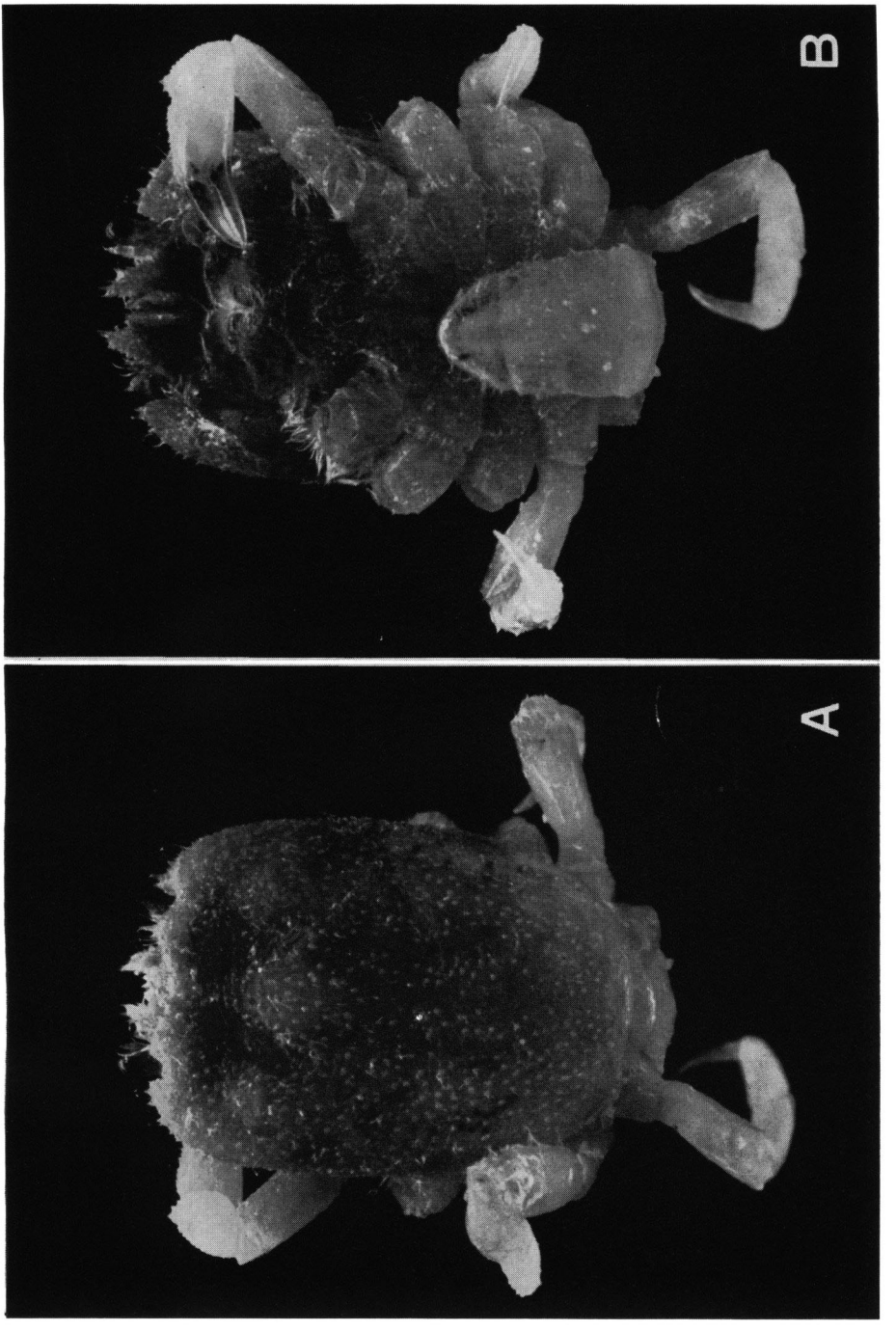
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