

## ABSTRACT

Title of Dissertation: Biology and Systematics of Coral Gall  
Crabs (Crustacea: Cryptochiridae)

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The family name of the coral gall crabs was corrected from Hapalocarcinidae Calman, 1900 to Cryptochiridae Paulson, 1875.

Study of the feeding biology of three species of gall crabs, *Favicola rugosa*, *Hapalocarcinus marsupialis*, and *Utinomia dimorpha*, falsified the previous hypothesis that gall crabs were filter feeders on minute plankton. Gall crabs were found to have feeding appendages suitable for gathering coral mucus, not straining food from the water column. Observations of feeding behavior showed that crabs collected coral mucus for food and on occasion snipped off pieces of coral tissue to ingest.

In a review of the Atlantic gall crabs three new genera, *Cecidocarcinus*, *Detocarcinus*, and *Opecarcinus*, and one new species, *C. brychius* were described. Two Atlantic genera, *Detocarcinus* and *Troglocarcinus*, showed little host specificity.

Reexamination of four previously described species clarified some taxonomic confusion. *Cryptochirus*

hongkongensis Shen was shown to be a senior synonym of Neotroglocarcinus monodi (Fize and Serène), Lithoscaptus paradoxus Milne Edwards was removed from the synonymy of Cryptochirus coralliodytes Heller which was redefined, and Cryptochirus granulatus Shen was reestablished and transferred to Opecarcinus.

The genus Opecarcinus from the Pacific was reviewed and found to be comprised of seven species, five of which were new, O. aurantius, O. lobifrons, O. peliops, O. pholeter, and O. sierra. The genus occurred on agariciid and siderastreid corals and was one of two genera reaching the eastern Pacific.

The genera of cryptochirids occurring in the Pacific were reviewed. Fizesereneia Takeda and Tamura was determined to be based on a misidentified type species and the situation referred to the International Commission on Zoological Nomenclature. Four new genera were established, Dacryomaia, Pelycomaia, Sphenomaia, and Xynomaia. Each genus is diagnosed and a list of known species and hosts for each is included.

Cladistic techniques were used to determine possible relationships of the gall crabs. These results were then compared to the relationships of the coral hosts. A trend was discovered that showed the evolution of the cryptochirids has been toward colonization of hosts

providing increasingly safe places to live. The most ancestral crabs occur on relatively nonaggressive corals, whereas derived crabs live on relatively predator and competition resistant hosts.

BIOLOGY AND SYSTEMATICS  
OF CORAL GALL CRABS  
(CRUSTACEA: CRYPTOCHIRIDAE)

by

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## TABLE OF CONTENTS

	Page
List of Tables	vii
List of Figures	viii
Prologue	1
Literature Cited	3
Chapter 1. <i>Cryptochiridae</i> , the Correct Name for the Family Containing the Gall Crabs (Crustacea: Decapoda: Brachyura)	4
Chapter 2. Feeding Biology and Mouthpart Morphology of Three Species of Coral Gall Crabs (Decapoda: <i>Cryptochiridae</i> )	7
Abstract	7
Materials and Methods	8
Results	9
Crab Dwellings	9
Feeding Behavior	10
Feeding Structures	12
Discussion	13
Acknowledgments	16
Literature Cited	16
Chapter 3. The Atlantic Gall Crabs, Family <i>Cryptochiridae</i> (Crustacea, Decapoda, Brachyura)	25
Abstract	25
Introduction	25
Family <i>Cryptochiridae</i>	31
Key to Atlantic <i>Cryptochiridae</i>	33
<u><i>Cecidocarcinus</i></u> , new genus	34
<u><i>Cecidocarcinus brychius</i></u> , new species	35
<u><i>Detocarcinus</i></u> , new genus	39
<u><i>Detocarcinus balssi</i></u> (Monod, 1956), new combination	40
<u><i>Opecarcinus</i></u> , new genus	48
<u><i>Opecarcinus hypostegus</i></u> (Shaw and Hopkins, 1977), new combination	50
<u><i>Troglocarcinus</i></u> Verrill, 1908	58
<u><i>Troglocarcinus corallicola</i></u> Verrill, 1908	61
Literature Cited	73

	Page
Chapter 4. The Status of <u>Cryptochirus hongkongensis</u> Shen, 1936 (Brachyura: Cryptochiridae)	97
Types	98
Systematic Account	100
<u>Pseudocryptochirus viridis</u> Hiro, 1938	100
<u>Neotroglocarcinus monodi</u> (Fize and Serène, 1955)	101
<u>Cryptochirus hongkongensis</u> Shen, 1936	102
Discussion	102
Acknowledgments	105
Literature Cited	105
Chapter 5. The Status of <u>Cryptochirus coralliodytes</u> Heller and <u>Lithoscaptus paradoxus</u> Milne Edwards (Brachyura: Cryptochiridae)	110
Materials and Methods	112
Systematic Account	114
<u>Cryptochirus</u> Heller, 1861	114
<u>Cryptochirus coralliodytes</u> Heller	114
<u>Lithoscaptus</u> Milne Edwards, 1862	119
<u>Lithoscaptus paradoxus</u> Milne Edwards	119
Discussion	125
Acknowledgments	126
Literature Cited	127
Chapter 6. A Revision of the Pacific Species of Gall Crabs, Genus <u>Opecarcinus</u> (Crustacea: Cryptochiridae)	139
Abstract	139
Materials and Methods	140
Key to Species of <u>Opecarcinus</u>	143
Systematic Account	144
<u>Opecarcinus crescentus</u> (Edmondson, 1925)	144
<u>Opecarcinus granulatus</u> (Shen, 1936), new combination	152
<u>Opecarcinus aurantius</u> , new species	158
<u>Opecarcinus lobifrons</u> , new species	162
<u>Opecarcinus peliops</u> , new species	168
<u>Opecarcinus pholeter</u> , new species	173
<u>Opecarcinus sierra</u> , new species	178
Discussion	181
Acknowledgments	185
Literature Cited	186



	Page
Chapter 7. <u>Fizesereneia</u> Takeda and Tamura, 1980 (Crustacea, Decapoda): Proposed Designation of a Type Species	209
Chapter 8. Revision of the Genera of Gall Crabs Occurring in the Pacific (Crustacea: Cryptochiridae)	211
Abstract	211
Introduction	211
Materials and Methods	214
Key to the Genera of Gall Crabs, Cryptochiridae	215
Systematic Account	217
CRYPTOCHIRIDAE Paulson 1875	217
<u>Cryptochirus</u> Heller, 1861	218
<u>Dacryomaia</u> , new genus	220
<u>Fizesereneia</u> Takeda and Tamura, 1980	223
<u>Fungicola</u> Serène, 1966	226
<u>Hapalocarcinus</u> Stimpson, 1859	229
<u>Hiroia</u> Takeda and Tamura, 1981	230
<u>Lithoscaptus</u> Milne Edwards, 1862	232
<u>Neotroglocarcinus</u> Takeda and Tamura, 1980	236
<u>Opecarcinus</u> Kropp and Manning, 1987	238
<u>Pelycomaia</u> , new genus	241
<u>Pseudocryptochirus</u> Hiro, 1938	243
<u>Pseudohapalocarcinus</u> Fize and Serène, 1955	244
<u>Sphenomaia</u> , new genus	246
<u>Utinomia</u> Takeda and Tamura, 1981	248
<u>Xynomaia</u> , new genus	250
Literature Cited	252
Chapter 9. Relationships and Host Specificity of Coral-dwelling Gall Crabs (Crustacea: Cryptochiridae)	281
Abstract	281
Introduction	281
Materials and Methods	283
Outgroup Selection	285
Monophyly of Cryptochiridae	286
Morphology of Cryptochiridae	289
Relationships of Cryptochiridae	297
Discussion	302
Literature Cited	311

## LIST OF TABLES

Number		Page
1.	Length:height Ratios for Meri and Propodi of Atlantic Gall Crab Walking Legs	84
2.	Character and State Summary	323
3.	Character State Matrix for Cryptochiridae	328
4.	Hosts and Distribution of Coral Gall Crabs	330

LIST OF FIGURES

Number	Page
1. Selected Mouthpart Morphology	23
2. Lateral and Median Teeth of the Gastric Mill	24
3. <u>Cecidocarcinus brychius</u> , New Species, Female	86
4. <u>Cecidocarcinus brychius</u> , New Species, Male Paratype, ICM	87
5. <u>Detocarcinus balssi</u> (Monod), Female, Angola, USNM 231666	88
6. <u>Detocarcinus balssi</u> (Monod), Male	90
7. <u>Opecarcinus hypostegus</u> (Shaw and Hopkins), Female holotype, USNM 168532	91
8. <u>Opecarcinus hypostegus</u> (Shaw and Hopkins), Male	92
9. <u>Troglocarcinus corallicola</u> Verrill, Female, Tortugas, USNM 59964	93
10. <u>Troglocarcinus corallicola</u> Verrill, Male	95
11. Distribution of Atlantic Gull Crabs Based on Material Reported Here and on Previous Literature Records	96
12. Dorsal, Lateral Views of Carapace, and Abdomen	108
13. Pereopods 1 and 3, Antennule, and Gonopod	109
14. <u>Cryptochirus coralliodytes</u>	132
15. <u>Cryptochirus coralliodytes</u>	133
16. <u>Cryptochirus coralliodytes</u>	134
17. <u>Lithoscaptus paradoxus</u>	136
18. <u>Lithoscaptus paradoxus</u>	137
19. <u>Lithoscaptus paradoxus</u>	138
20. <u>Opecarcinus crescentus</u> (Edmondson)	193
21. <u>Opecarcinus crescentus</u> (Edmondson)	194
22. <u>Opecarcinus granulatus</u> (Shen)	195
23. <u>Opecarcinus granulatus</u> (Shen)	197
24. <u>Opecarcinus aurantius</u> , new species	198
25. <u>Opecarcinus aurantius</u> , new species	199
26. <u>Opecarcinus lobifrons</u> , new species	201
27. <u>Opecarcinus lobifrons</u> , new species	202
28. <u>Opecarcinus peliops</u> , new species	203
29. <u>Opecarcinus peliops</u> , new species	205
30. <u>Opecarcinus pholeter</u> , new species	206
31. <u>Opecarcinus pholeter</u> , new species	207
32. <u>Opecarcinus sierra</u> , new species	208
33. <u>Cryptochirus coralliodytes</u> Heller	262
34. <u>Dacryomaia edmonsoni</u> (Fize and Serène)	263
35. <u>Fizesereneia heimi</u> (Fize and Serène)	264
36. <u>Fungicola utinomi</u> (Fize and Serène)	266
37. <u>Hapalocarcinus marsupialis</u> Stimpson	267
38. <u>Hiroia krempfi</u> (Fize and Serène)	268
39. <u>Lithoscaptus paradoxus</u> Milne Edwards	269

	Page
40. <u>Neotroglocarcinus hongkongensis</u> (Shen)	271
41. <u>Opecarcinus hypostegus</u> (Shaw and Hopkins)	272
42. <u>Pelycomaia minuta</u> (Edmondson)	273
43. <u>Pseudocryptochirus viridis</u> Hiro	275
44. <u>Pseudohapalocarcinus ransonii</u> (Fize and Serène)	276
45. <u>Sphenomaia pyriforma</u> (Edmondson)	277
46. <u>Utinomia dimorpha</u> (Henderson)	279
47. <u>Xynomaia sheni</u> (Fize and Serène)	280
48. Selected Gastric Mill Teeth	333
49. Carapace and Sternal Plastron Features	334
50. Pereopod Features	335
51. Epistome Features	337
52. Selected mouthparts	338
53. Tree 1	339
54. Trees 2-5	340
55. Distribution of Host Coral Suborders on Tree 1	342
56. Coral Suborder Relationships	343

## PROLOGUE

Since the first gall crab, *Hapalocarcinus marsupialis*, was described by Stimpson (1859) biologists have been fascinated with the peculiar lifestyle of these diminutive crustaceans. Most gall crabs are small. One species, in which mature females only reach about 3 mm in carapace length, may replace a pea crab as the smallest known brachyuran crab (Bell, 1987). Gall crabs live as obligate symbionts of scleractinian corals. The crabs reside in modifications of the host skeleton that result from activities of the crab. These range from the totally enclosed gall inhabited by *H. marsupialis*, which has only a few small openings to allow for water exchange, to simple cylindrical pits inhabited by a variety of gall crabs (Hiro, 1938).

Although the exact relationship of gall crabs to other brachyurans is not known, the family itself is well-defined. This attribute, in addition to the obligatory (from the crab point of view) nature of the symbiosis make the relationship between corals and the gall crabs desirable to study.

The present study was undertaken to: (1) establish a nutritional basis for the symbiosis, i. e., the crabs depend on the hosts for nutriment in addition to shelter; (2) restructure the taxonomic arrangement of the family using morphological characters; (3) correct errors made by previous taxonomists; and (4) reconstruct a hypothetical phylogeny of the family and compare that phylogeny to the

relationships of the hosts in order to investigate the distribution of the symbionts on the hosts.

Each chapter is written addressing a particular problem concerning the biology and systematics of the coral gall crabs and is designed to be ready for publication, hence each has its own abstract, methods, reference sections, and so on.

The first chapter reestablishes the name of the family as the *Cryptochiridae* Paulson, 1875, which has priority over the more familiar *Hapalocarcinidae* Calman, 1900.

The second chapter addresses the feeding biology of three species of gall crabs, testing the old hypothesis that the crabs were filter feeders on plankton. In this chapter a nutritional basis for the symbiosis between crabs and corals is established.

The third through eighth chapters are concerned with a series of taxonomic problems, which include an evaluation of some species that have for many years been considered synonyms of other species. Also included are separate revisions of the genera of gall crabs occurring in the Atlantic Ocean and those occurring in the Pacific Ocean. The only genus of gall crabs that is found in both the Atlantic and Pacific is reviewed and found to consist of eight species, five of which were previously unknown to science.

The final chapter presents a suite of morphological characters that are used to construct a hypothetical phylogeny of the family. The results of the cladistic analyses are compared to probable relationships of the host corals, in addition to other attributes such as host commonness and level of aggression, in an attempt to determine the factors contributing to the distribution of the symbionts on the host taxa.

This dissertation is not a valid publication for formal taxonomic purposes and the names of new taxa described herein are not available.

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## Chapter 1

### Cryptochiridae, the Correct Name for the Family Containing the Gall Crabs (Crustacea: Decapoda: Brachyura)

Abstract.--Cryptochiridae Paulson, 1875, is shown to be a senior synonym of Hapalocarcinidae Calman, 1900.

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Until now, most authors have assigned the gall crabs, members of the genera Cryptochirus Heller, 1861, Hapalocarcinus Stimpson, 1859, Troglocarcinus Verrill, 1908, and several others, to the family Hapalocarcinidae Calman, 1900. Manning and Holthuis (1981:250), who summarized the names applied to families of marine brachyuran crabs, cited Calman as author of the family name.

However, a different family group name was used by at least three different authors prior to 1900. O. Paulson (1875:78) introduced the subfamily Cryptochirinae within the family Pinnotheridae for the genus Lithoscaptus A. Milne-Edwards, 1862, now a synonym of Cryptochirus Heller, 1861. Paulson, who may not have been aware that Heller's account was published before that of Milne-Edwards, actually considered Cryptochirus coralliodytes Heller to be a junior synonym of Lithoscaptus paradoxus, whereas the reverse is true. Later, F. Richters (1880:159) cited the family Cryptochiridae. He recognized that Lithoscaptus paradoxus A. Milne-Edwards, 1862 was a synonym of Cryptochirus



coralliodytes Heller, 1861 and synonymized the former. He erroneously attributed the family name Lithoscaptidae to A. Milne-Edwards. As pointed out by Manning and Holthuis (1981:250), Milne-Edwards used a name in the French vernacular for the family.

E. von Martens, in the Zoological Record for 1880, cited the "Cryptochiridae" on p. 30, and noted that Richters had proposed the family but had not characterized it.

Calman (1900:48) recognized that Paulson had used the family group name Cryptochirinae, and, on p. 49, noted "we can only regard these two genera [Cryptochirus and Hapalocarcinus] as forming a family for the present incertae sedis, for which the name Hapalocarcinidae will have to replace Milne-Edwards's "Lithoscaptus", the latter being based on a synonym of Cryptochirus."

The synonymy for the family Cryptochiridae Paulson, 1875, is as follows:

Lithoscaptus A. Milne-Edwards, 1862:F10 [vernacular name; type-genus Lithoscaptus A. Milne-Edwards, 1862].

Cryptochirinae Paulson, 1875:77 [type-genus Cryptochirus Heller, 1861].

Hapalocarcinidae Calman, 1900:49 [type-genus Hapalocarcinus Stimpson, 1859].

The superfamily name (see Bowman and Abele, 1982 for a summary of crustacean classification to the family level) becomes Cryptochiroidea Paulson, 1875.

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Chapter 2  
Feeding Biology and Mouthpart Morphology of  
Three Species of Coral Gall Crabs  
(Decapoda: Cryptochiridae)

ABSTRACT

This study refutes the long-standing hypothesis that coral gall crabs are filter feeders. *Hapalocarcinus marsupialis* collected mucus by fanning the third maxillipeds or by scratching the coral with the legs. *Utinomia dimorpha* used chelipeds to collect mucus and other debris, or to snip pieces of coral tissue. *Favicola rugosa* used mouthparts and chelipeds to make a mucous ball and sweep it along the coral surface to pick up mucus and debris. SEM photographs of the mouthparts of each species show setae ill-suited for filter feeding, but useful for collecting coral mucus.

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Coral gall crabs have been known for over 100 years, yet cryptochirid feeding biology is poorly known. Stimpson (1859) described *Hapalocarcinus marsupialis* as free-living, but feeding on coral polyps. Verrill (1867) considered the crabs parasitic on corals. Henderson (1906), finding live polyps in the gall, discounted Stimpson's idea that *Hapalocarcinus* fed on coral tissue. Potts (1915) presumed that gall crabs fed on nanoplankton drawn through the holes in the gall by the respiratory currents of the crabs.

Potts' ideas have been cited frequently (Hiro, 1937; Marshall and Orr, 1960; Patton, 1967; Castro, 1976; Barnes, 1980; McLaughlin, 1982).

There are indications that Potts' ideas are not valid. Patton (1976) briefly mentioned that Hapalocarcinus picked at coral tissue with its chelipeds and passed the material to its mouthparts. Reed et al. (1982) listed Troglocarcinus corallicola as an obligate coral mucus-feeder.

Here I clarify cryptochirid feeding biology by using anatomical studies to determine the food gathering apparatus available to the crabs, and behavioral studies to describe feeding activities. These studies showed that the crabs do not filter feed, but collect food from their host corals.

#### MATERIALS AND METHODS

Collection Data.--I collected crabs on their host corals at Apra Harbor, Luminao, and Agana Bay, Guam during 1979-1981 and 1984. Crabs and corals were kept in the laboratory in large, flow-through seawater tanks. I collected Hapalocarcinus marsupialis Stimpson, 1859 on Pocillopora damicornis and P. eydouxi; Utinomia dimorpha (Henderson, 1906) on P. eydouxi; and Favicola rugosa (Edmondson, 1933) on Leptoria phrygia.

Feeding Behavior.--I used a dissection microscope to observe crabs feeding in their dwellings on small pieces of the host coral placed in a dish of sea water. Light from the microscope illuminator did not appear to affect crab

behavior. It was necessary to remove the growing edge of Hapalocarcinus galls to observe the crabs feeding, but not necessary to alter dwellings of the other crabs. Feeding was observed for at least 14 twenty-minute periods per species. To test the results of feeding motions, I put a few drops of a carmine suspension in seawater onto the coral surface adjacent to the crab dwelling. Carmine rapidly coagulated into the mucous strings permitting observation of mucus movement patterns.

Scanning Electron Microscopy.--Crabs collected in 1984 were fixed in 3% Glutaraldehyde and stored in 70% ETOH. I removed feeding appendages from these crabs and cleaned the appendages by brushing them with a fine brush. The gastric mill was removed from crabs, cut lengthwise along the ventral surface, and cleaned by gentle water currents created by passing a brush above the mill. Structures were dehydrated in a graded ethanol series, air dried, sputter coated with gold-palladium, and observed with a Cambridge S-100 or S-250 scanning electron microscope at accelerating voltages of 10-20 kv.

## RESULTS

### Crab Dwellings

Hapalocarcinus lives enclosed in a coral skeleton gall. Water circulates through the gall via small holes along the suture line between gall halves. The inside of the gall is lined with living coral tissue.

Utinomia lives in a pit in the coral skeleton. Surrounding the pit is a narrow border zone of dead coral in which brown, flocculent debris accumulates and in which filamentous algae may occur. Coral verrucae next to the zone are eroded.

A narrow border zone of dead coral surrounds pits inhabited by Favicola. The host calice wall completely surrounds the pit with the long axis of each septum perpendicular to the pit.

#### Feeding Behavior

Hapalocarcinus used chelipeds to grab coral tissue and pull it to the mouth, to pick mucous flocs off the coral, and to scoop material along the coral surface toward the buccal area. After such motions, the setae of the palp of the third maxillipeds wiped accumulated mucus from the chelipeds. Alternate or simultaneous third maxilliped fanning episodes, usually less than 30-s long, drew carmine-marked mucus to the mouth. The legs assisted feeding by vigorously shaking in a plane perpendicular to the coral surface, thus actively scratching the dactylus on polyps causing mucus to accumulate on the hooked setae of the dactylus. The chelipeds then picked the material off the dactylus and transferred it to the mouth. Usually only one leg shook at a time. Sometimes, after a shaking episode, the dactyli of two adjacent legs rubbed together casting accumulated material into the water near the crab. Fanning of the third maxillipeds pulled this debris to the mouth.

Utinomia used chelipeds to pick debris from its body or the wall of the pit and to grab debris from the border zone around the pit. Crabs snipped and ingested small pieces of tissue from the coenosteum fringing the border zone or from polyps. The chelipeds also probed the border zone or adjacent coral tissue then flexed rapidly toward the mouth. Occasionally the claw squeezed coral tissue, then flexed toward the mouth. This scooping motion, followed by maxilliped fanning, moved mucous strings that had accumulated in the border zone to the mouth. Rarely, the chelipeds pulled mucus into a bolus that was eventually carried to the mouth and manipulated by the maxillipeds. This was similar to that described in detail for Favicola. Sometimes the third maxillipeds fanned independently of any cheliped action. The results of this fanning were unclear, but did not pull mucus to the mouth.

Favicola, other than one instance when a crab ingested a piece of coral tissue, used only one method to gather food. The chelipeds or maxillipeds pulled mucus into a bolus. One cheliped then clutched the bolus, swept it along the edge of the pit and back to the starting point, then transferred it to the other cheliped which repeated the action. After 2-31 repetitions of this criss-cross pattern, the bolus was taken to the mouth where it was rotated by the third maxillipeds while being vigorously probed by setae of the second maxilliped exopod. The crab grabbed the bolus with a claw and repeated the criss-cross pattern or expelled

the bolus and formed a new one. Mucous strings, moved to the pit by coral ciliary action, were incorporated into the bolus being swept along the pit border by the criss-cross action of the claws.

### Feeding Structures

Setal terminology is based on Kunze and Anderson (1979).

**Maxillipeds.**--The third maxillipeds (Fig. 1a) are similar in all three species. The inner margin of the ischium has few relatively short, simple setae along its entire length and also has scattered serrate setae on its upper half (Fig. 1b). The palp of the third maxilliped has clumps of serrate setae on the carpus, dactylus, and along the inner margin of the propodus. Serrate setae may have distal setules forming a slight spoon (Fig. 1c), or setules terminating proximal to the sharply-pointed tip (Fig. 1d). Spoon-tipped setae are more numerous in each cluster.

The endopod of the second maxilliped has sharply-pointed serrate setae distally on the dactylus, whereas spoon-tipped serrate setae occur on the dactylus and propodus upper margins (Fig. 1e). *Favicola* has fewer setae than the other two species.

The basipodite of the first maxilliped has serrate setae on the inner margin (Fig. 1f).

**Maxillae.**--The second maxilla is a finger-like process with simple setae distally (Fig. 1g). The protopodite of the



first maxilla is undivided and has serrate setae on the inner margin in Hapalocarcinus and Utinomia (Fig. 1g). These setae are longer dorsally, decreasing in length ventrally. Favicola has multiple rows of conate tubercles along the inner margin and two serrate setae and one simple seta dorsally (Fig. 1h).

Gastric Mill.--Only the urocardiac and zygo-cardiac ossicles are present. All three species have similar median teeth, each consisting of two lateral rows of setiform projections separated by a narrow region of shorter projections or scales (Fig. 2a). The lateral teeth are entirely setiform in Favicola; mostly setiform, but with bluntly-rounded papillae in Hapalocarcinus (Fig. 2d); and mostly setiform with rounded "cusps" in Utinomia (Fig. 2c).

#### DISCUSSION

None of the cryptochirid species studied has the classical filter-feeding setal net described by Marshall and Orr (1960). Filtering nets found among decapods include the plumose third maxillipeds of porcellanids (Nicol, 1932; Caine, 1975), the plumose antennae of Paguritta (see Schuhmacher, 1977), or the plumose net on the chelae of Atya (see Felgenhauer and Abele, 1983b). The only feeding structures of gall crabs are the pincer-like chelae and the third maxillipeds which have simple or serrate setae.

Plumose nets may be used for deposit feeding by porcellanids (Kropp, 1981) or atyids (Felgenhauer and Abele,

1983b), but most deposit-feeding decapods use a nonplumose feeding structure. Ocypodid crabs have spoon-shaped setae on the first and second maxillipeds (Miller, 1961; Vogel, 1984) and hermit crabs have simple or serrate setae on maxillipeds (Kunze and Anderson, 1979). Farmer (1974) suggested that simple and serrate setae may be used for gripping food. The maxillipeds of gall crabs are appropriate for gathering soft detrital material such as coral mucus. These maxillipeds are similar to those of *Trapezia*, also a mucus-feeder (Knudsen, 1967).

The teeth of the gastric mills of the three cryptochirid species differ from those of other crabs. For example, the typically brachyuran lateral teeth of *Trapezia* consist of two to three anterior cusps and a posterior series of transverse, flattened ridges (Fig. 2b), whereas gall crabs have mostly setiform lateral teeth. This contrast may support the idea that phylogeny determines mill structure more than diet (Felgenhauer and Abele, 1983a). However, cryptochirids show a range of variation from lateral teeth having what may be remnant cusps and setiform projections (*Utinomia*) to teeth lacking cusps altogether (*Favicola* and *Hapalocarcinus*). *Utinomia* has a high likelihood of having some coarse particles in its diet, and has relatively robust lateral teeth. However, *Favicola* may also ingest coarse material, but has setiform lateral teeth. The relative role of relationship or diet to the structure of the gastric mill remains unclear in this case.

My observations show that gall crabs collect food, including coral mucus and tissue, from the surface of the host. No filter feeding was observed, but it is possible that maxilliped fanning could have been misinterpreted by others as filter feeding. Fanning did not pull particles from the water column, but drew mucous strings to the mouth.

Many animals feed on living corals, some inflicting serious damage (Chesher, 1969; Moyer et al., 1982). Coral mucus is an important food item for organisms such as bacteria (Ducklow and Mitchell, 1979b), zooplankton (Johannes, 1967; Richman et al., 1975), molluscs (Robertson, 1970), crustaceans (Knudsen, 1967), and fish (Benson and Muscatine, 1974).

Uncontaminated mucus consists primarily of acidic mucopolysaccharides (Goreau, 1956) and wax esters (Benson and Muscatine, 1974; Benson et al., 1978). Daumas and Thomassin (1977) and Ducklow and Mitchell (1979a) found glycine, serine, glutamic acid, and aspartic acid to be the most abundant amino acids in coral mucus. Krupp (1982) cautioned that pure coral mucus may be a poor nutrient source, at least in the case of *Fungia scutaria*. However, coral mucus rapidly becomes contaminated with organic material resulting in a mucus high in nitrogen and phosphorus (Coles and Strathmann, 1973; Benson, et al., 1978; Ducklow and Mitchell, 1979a). *Utinomia* and *Favicola* feed on contaminated mucus from border zones. Therefore, studies of purified mucus or of mucus taken from whole

colonies do not accurately estimate the dietary intake of these mucus-feeders. Coral mucus may represent a detrital food pathway along which the products of photosynthesis by coral-associated zooxanthellae can be transferred to other members of the reef community.

Because gall crabs feed on their hosts it is tempting to consider them as parasites. Corals, however, continuously exude mucus as part of a sediment rejection system (Abe, 1938). Therefore ingestion of mucus by cryptochirids does not represent a metabolic drain on the host. Other effects of gall crabs on corals are unknown and represent future research possibilities.

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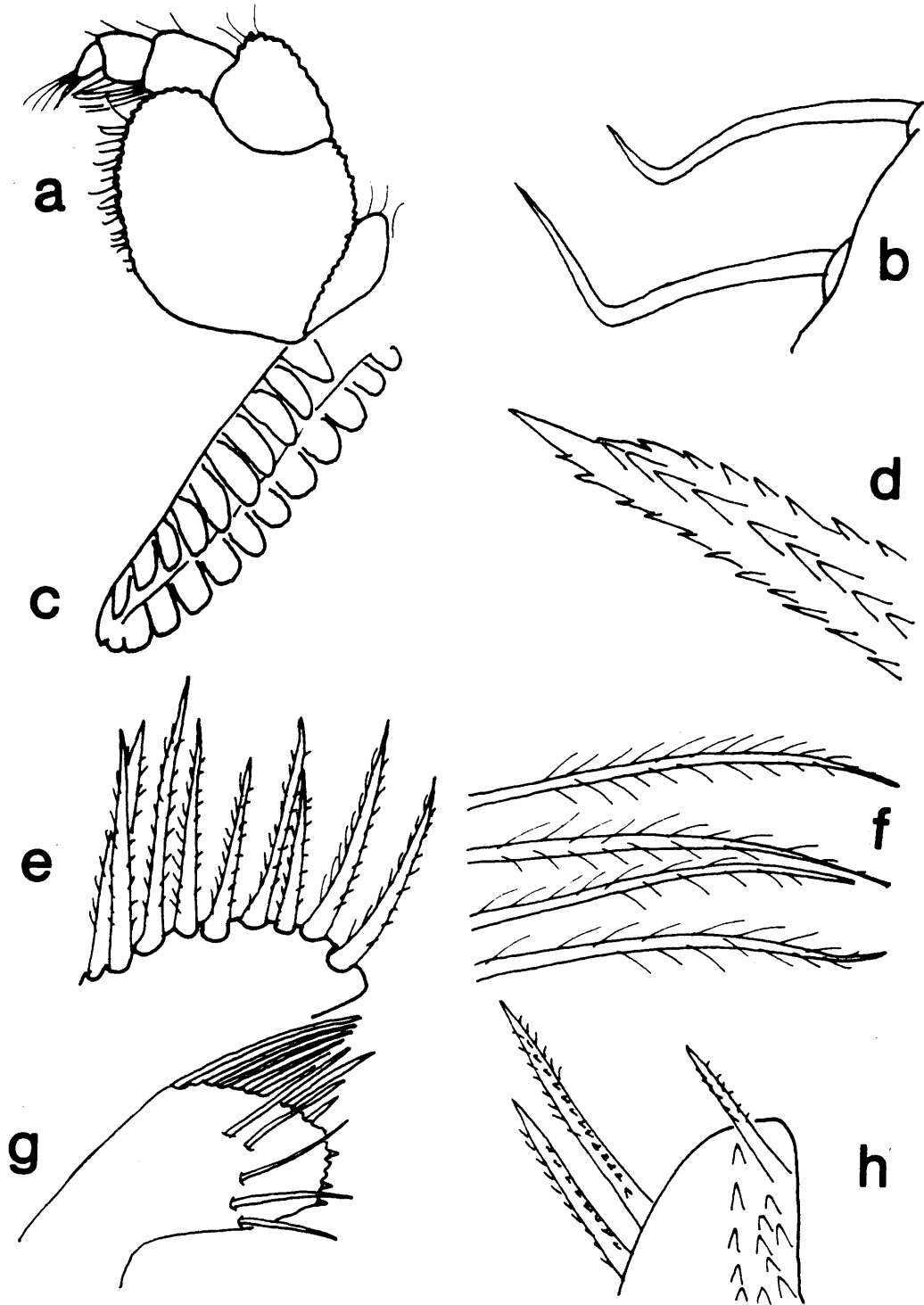
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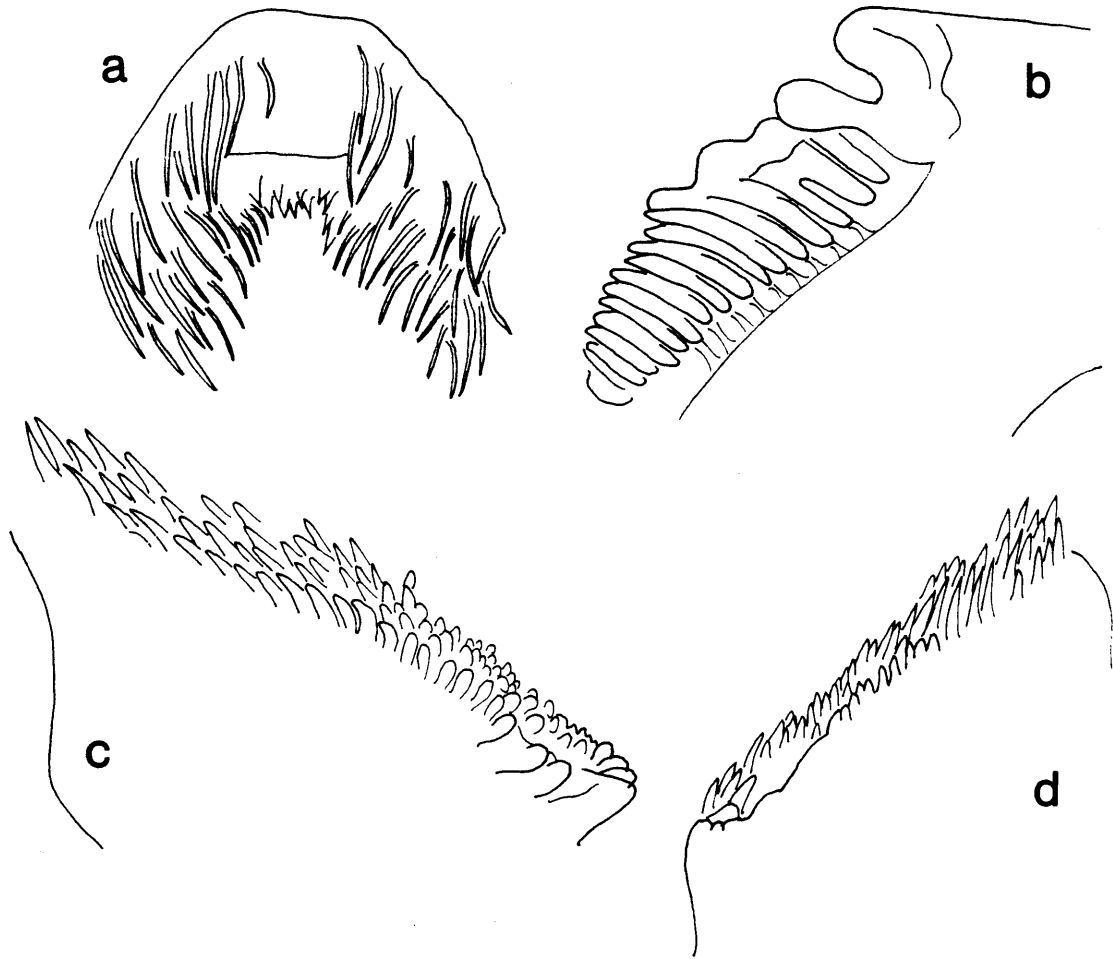


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Fig. 1. Selected mouthpart morphology. a, *Favicola rugosa*, third maxilliped; b, *F. rugosa*, setae on inner lower margin of third maxilliped; c, *Hapalocarcinus marsupialis*, seta on palp of third maxilliped; d, *Utinomia dimorpha*, setae on palp of third maxilliped; e, *U. dimorpha*, setae on endopod of second maxilliped; f, *U. dimorpha*, setae on endopod of first maxilliped; g, *U. dimorpha*, first maxilla (upper) and second maxilla (lower); h, *F. rugosa*, upper part of first maxilla. Scales: a = 200 um; b, h = 20 um; c, d = 5 um; e, f = 50 um; g = 100 um.

Fig. 2. Lateral and median teeth of the gastric mill. a, *Favicola rugosa*, median tooth; b, *Trapezia ferruginea*, right lateral tooth; c, *U. dimorpha*, left lateral tooth; d, *Hapalocarcinus marsupialis*, left lateral tooth. Scales: a, = 100 um; b-d = 50 um.





Chapter 3  
The Atlantic Gall Crabs,  
Family Cryptochiridae  
(Crustacea, Decapoda, Brachyura)

ABSTRACT

The Atlantic cryptochirids comprise four species in four different genera. One new species and three new genera are named. *Troglocarcinus corallicola* Verrill, 1908, shows an amphi-Atlantic distribution and is a generalist insofar as coral host is concerned. *Pseudocryptochirus hypostegus* Shaw and Hopkins, 1977, is assigned to a new genus, *Opecarcinus*, the only genus known in the Atlantic that also is represented in the Pacific. It ranges from the western Atlantic to Ascension Island and lives on agariciid and siderastreid corals. *Troglocarcinus balssi* Monod, 1956, is assigned to a new genus, *Detocarcinus*. It is restricted to the eastern Atlantic and lives on rhizangiid, oculinid, caryophylliid, and dendrophylliid corals. A new genus and species, *Cecidocarcinus brychius*, is named for specimens taken on dendrophyllid corals from the Valdivia Ridge, southeastern Atlantic, in 512 meters; it is the deepest occurring cryptochirid.

Introduction

The gall crabs, although long of interest to marine biologists, remain one of the poorest known of all of the marine crab groups. They are so poorly known that their

affinities with other brachyuran groups remain unclear. They are adapted to life within galls or in open pits that they form in corals, and among these adaptations are a diminution in size: the largest male I report here has cl 4.2 mm, the largest female has cl 5.8 mm. Males and females as small as cl 1.4 mm can be identified as to sex and species. In addition, the species generally are sexually dimorphic in morphological characteristics and the general facies, especially that of females, can change dramatically with age, making identification of isolated specimens difficult.

In addition to problems involved in the identification of these minute crabs, their classification at the generic level has been highly unsatisfactory. In their monumental work on Vietnamese species, Fize and Serène (1957) introduced the concept that members of different genera lived exclusively on different genera of host corals; they recognized several genera named from the host coral, e.g. *Mussicola* (= living in *Mussa*). This scheme works for some genera of crabs, but not others. One of the species I report here, *Troglocarcinus corallicola* Verrill, 1908, is a generalist, and occurs in association with a variety of corals.

More recent studies on the group, mainly by M. Takeda, National Science Museum, Tokyo, have greatly added to our knowledge of these interesting crabs, yet I find that the definition of genera now recognized is so imprecise that it

often is difficult to decide in which genus to place a species.

As a prelude to other studies in progress on the classification of the Indo-West Pacific species, I introduce here a suite of generic characters, based on the features of adult specimens, that I believe can be used to characterize other genera in the group. I have also tried to refine species descriptions, and present here accounts for males, adult females, and, where applicable, juveniles. As can be seen from the key to genera given below, the Atlantic taxa, at least, can be differentiated by the use of few, easily seen characters.

The Cryptochiridae comprises the following 12 genera:

**Hapalocarcinus** Stimpson (1859:412)

**Cryptochirus** Heller (1861:19) [with **Lithoscaptus**  
Milne Edwards (1862:362) as its synonym]

**Troglocarcinus** Verrill (1908:427) [with **Mussicola** Fize  
and Serène (1957:110) as its synonym]

**Pseudocryptochirus** Hiro (1938:150)

**Pseudobapalocarcinus** Fize and Serène (1955:378)

**Favicola** Fize and Serène (1957:84)

**Fungicola** Fize and Serène (1957:122)

**Neotroglocarcinus** Fize and Serène (1957:135)

**Fizesereneia** Takeda and Tamura (1980a:137)

**Hiroia** Takeda and Tamura (1981:20)

**Utinomia** Takeda and Tamura (1981:23)

With the exception of Troglocarcinus corallicola, described from the western Atlantic, none of the species reported here fit into any of these genera. I recognize three new genera below.

Until now, three species had been recorded from the Atlantic: Troglocarcinus corallicola Verrill, 1908, and Pseudocryptochirus hypostegus Shaw and Hopkins, 1977, both from the western Atlantic, and Troglocarcinus balssi Monod, 1956, from the east Atlantic. Each of these is assigned to a separate genus herein, and new genera are recognized for P. hypostegus and for T. balssi. In addition, a new genus and species is recognized from the southeastern Atlantic. I also have paid particular attention to the host corals of these species; these are summarized under the accounts of each species.

Materials and Methods.--Most of the material studied here is from the collection of the National Museum of Natural History, Smithsonian Institution, Washington, D. C. (USNM). Included are specimens from the western Atlantic previously discussed by Rathbun (1937); collections made by R. B. Manning et al. at Ascension Island in 1971 and 1976, all of which were detected by H. Zibrowius, Station Marine d'Endoume, Marseille, France, as a result of his examination of the corals; and eastern Atlantic crabs donated by H. Zibrowius, who removed them from host corals he studied.



The latter specimens often are badly disarticulated, but most are readily identifiable and provide valuable locality records.

Two other major collections of western Atlantic gall crabs were studied: one from the Indian River Coastal Zone Museum, Fort Pierce, Florida (IRCZM), through Paula Mikkelsen and the second from Darryl L. Felder, Department of Zoology and Center for Crustacean Research, University of Southwestern Louisiana, Lafayette, Louisiana (USLZ). Additional material was loaned by Willard Hartman, Peabody Museum, Yale University, New Haven, Connecticut (YPM); R. W. Ingle, British Museum (Natural History), London, England (BMNH); Torben Wolff, Zoological Museum, Copenhagen, Denmark (ZMC); L. B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands (RMNH); D. Guinot, Muséum National d'Histoire Naturelle, Paris, France (MP); and Enrique Macpherson, Instituto de Ciencias del Mar, Barcelona, Spain (ICM).

The latitude and longitude for each locality mentioned in the text is given at the first occurrence of that locality in the text. I have enclosed in brackets coordinates not given in the original collection data. These coordinates were determined from gazeteers of the United States Board on Geographic Names or from navigational charts.

Coral host records, if provided in the collection data, are listed. The name listed is the currently accepted name; label name, if different, is included within brackets.

Specimens were measured with an ocular micrometer in a Wild M-5 microscope and are reported to the nearest 0.1 mm. Measurements are given in the text as carapace length (measured at the midline, not including a median tubercle) x carapace width (measured at the widest part).

Gonopods were examined after preparations modified from Monod and Cals (1970). They were digested in lactic acid, containing a Chlorazol Black/Fast Green mixture (approximately 50:50), for 15 minutes at 150 °C. They were drawn with the aid of a camera lucida on a Wild M-20 compound microscope.

In my illustrations, surface setation of carapace and pereopods has been omitted.

Abbreviations for repositories are given above, in the discussion of sources of material. Other abbreviations used in the text are as follows: cl, carapace length; cb, carapace width; juv, juvenile; MXP, maxilliped; ov, ovigerous; P, pereopod; PLP, pleopod.

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Family Cryptochiridae Paulson, 1875

Lithoscaptus A. Milne Edwards, 1862:F10. [Vernacular name.

Type genus Lithoscaptus A. Milne Edwards, 1862, a subjective junior synonym of Cryptochirus Heller, 1861.]  
Cryptochirinae Paulson, 1875:72 [page 78 in translation].

[Type genus Cryptochirus Heller, 1861.]  
Cryptochiridae.--Richters, 1880:159.--Kropp and Manning, 1985:954.

Lithoscaptidae.--Richters, 1880:159.

Hapalocarcinidae Calman, 1900:3, 49. [Type genus Hapalocarcinus Stimpson, 1859.]

Hapalogarcinidae.--Coêlho and Ramos, 1972:205 [erroneous spelling].

Definition.--Mandibular palp absent, cutting edge of mandible lacking processes. MXP-3 with exopod reduced (shorter than lateral margin of ischium) and lacking flagellum or absent, merus much narrower than ischium. Maxilla 2 reduced to finger-like, undivided protopod. Maxilla 1 consisting of undivided protopod and exopod.

Gills absent from P-4 and P-5. Gastric mill with only lateral and median teeth. Adult female larger than male, with 3 pairs of pleopods, occurring on abdominal somites 2 to 4, PLP-4 uniramous. Female with posterior abdomen greatly expanded to form egg brood chamber, visible in dorsal view.

Remarks.--Fize and Serène (1957) based their classification of the cryptochirids on two major points: (1) the coral hosts of the crabs, and (2) the form of the first two pairs of pleopods in females, whether uniramous or biramous. My experience with the hosts for Troglocarcinus corallicola, discussed below under that species, suggests that they may have relied too heavily on this feature, which may vary from genus to genus. Female gall crabs have pleopods only on abdominal somites two, three, and four. Much of the literature refers to the pleopod found on somite two as the "first" pleopod, followed by the "second" and "third" pleopods, respectively. Here I number the pleopods according to the somite on which they occur. Therefore, the "first" pleopod is that found on somite two, abbreviated PLP-2. McCain and Coles (1979) reported the form of the pleopods in Utinomia dimorpha (Henderson, 1906) to vary considerably. They found pleopod two to be uniramous on one side, biramous on the other, and variable from specimen to specimen. They also mentioned similar variation in two other Indo-West Pacific species. I have confirmed these observations for specimens from Micronesia and in my opinion

this diminishes the value of pleopod one as a generic character. The examination of the Micronesian and other specimens has suggested that pleopod three may be useful as a generic character. Pleopod three may be either uniramous or biramous and does not show the variation noted for pleopod one.

Comparisons between Atlantic genera given in the text also hold for the Atlantic species, as each of the Atlantic genera contains but one species.

The Atlantic cryptochirids (genera and species) can be differentiated by using the following key. The key can be used to identify both males and females.

#### Key to Atlantic Cryptochiridae

1. Front deflected anteriorly. (Female PLP-2 uniramous).....2  
 Front not deflected anteriorly. (Female PLP-2 biramous).....3
2. P-1 sternite tuberculate. Pterygostomial region fused to carapace..... *Opecarcinus hypostegus*, new combination  
 P-1 sternite smooth. Pterygostomial region not fused to carapace..... *Troglocarcinus corallicola*
3. MXP-3 with exopod. P-1 sternite smooth. Cornea lateral..... *Cecidocarcinus brychius*, new species  
 MXP-3 without exopod. P-1 sternite with granules. Cornea terminal..... *Detocarcinus balssi*, new combination

Cecidocarcinus, new genus

Definition.--Carapace longer than broad, not deflected anteriorly, widest posteriorly. Pterygostomial region not fused to carapace, separated by distinct suture. Antennule base with lateral projection extending beyond eyestalk; angled lateral lobe present. MXP-3 with exopod; latter oval, longer than half length lateral margin of ischium; anteromesial lobe of ischium extending to merocarpal articulation; merus without distolateral projection; carpus length subequal to length of propodus and dactylus. Sternite of P-1 smooth, of P-4 with partial medial suture. P-1 of female and male visible in dorsal view. Merus of P-2 with prominent mesial expansion; carpus without mesial expansion. PLP-3 of female biramous; female opening longitudinal, oval, with hood. PLP-1 of male sharply curved distally; apex produced into blunt, expanded lobe, directed laterally.

Type species.--Cecidocarcinus brychius, new species, by present designation and monotypy.

Etymology.--From the Greek, cecis (gall) plus the generic name Carcinus. The gender is masculine.

Remarks.--Of the Atlantic representatives of the group, Cecidocarcinus appears to be most similar to Detocarcinus, differing in having an exopod on the third maxilliped, having the sternite of the first pereopod smooth rather than tuberculate, and having the cornea lateral rather than

anterolateral. Cecidocarcinus resembles Detocarcinus and differs from both Opecarcinus and Troglocarcinus in having the carapace lined laterally with erect tubercles and in not having the anterior part of the carapace noticeably deflected.

Cecidocarcinus is similar to two Indo-West Pacific genera, Neotroglocarcinus and Pseudocryptochirus. It can be separated from Neotroglocarcinus in that the epimeral plates are not fused to the carapace; they are fused in Neotroglocarcinus. Cecidocarcinus differs from Pseudocryptochirus by having an incomplete suture on the sternite of the fourth leg and a biramous second pleopod in the female; in Pseudocryptochirus the sternal suture of the fourth leg is complete and the second pleopod is uniramous.

Cecidocarcinus brychius, new species

Figures 3, 4

Material Examined.--EASTERN ATLANTIC: Off Namibia:  
Valdivia Ridge, 25° 38'S, 06° 12'E, 512 m, Valdivia I Sta. P-8, 21 May 1982, 1 female (ov), on Enallopsammia rostrata (Pourtales, 1878) (holotype, USNM 231662); same data, 1 male, 1 female (ov) (paratypes, ICM); same collection data, 1 male, on Dendrophyllia sp. (paratype, USNM 231663).

Description.--Adult Female (Figure 3): Carapace about 1.2 times longer than broad, slightly inflated laterally at branchial regions, narrowing slightly towards front. Surface convex from side to side and front to back, with

slight transverse depression anteriorly. Surface completely covered with variously sized, raised granules, some tubercles on anterior, lateral margins, forming distinct border laterally; surface covered with simple setae of length less than largest tubercles, few scattered longer setae not obscuring surface. Inner orbital angle with 1 spine. Anterolateral angle with spine, apex falling short of inner orbital angle. Front concave, tuberculate, with median spine, about 1/4 width at anterolateral angles, latter about 2/3 greatest carapace width. Orbit broadly U-shaped, margin tuberculate.

Basal segment of antennular peduncle with projection having transverse distal margin; angled lateral lobe extending beyond length of eyestalk; dorsal surface concave, variably armed with low and raised tubercles, distalmost largest. In ventral view, basal segment broadening anteriorly; surface with many granules. Second segment of antenna with low tubercles and with granules ventrally.

Eye directed anterolaterally, scarcely extending to inner orbital angle. Cornea lateral; in dorsal view, occupying most of lateral part of stalk. Stalk partially covered by carapace dorsally; surface with granules and mesial tubercles, granulate ventrally.

MXP-3 with mesial margin of ischium smooth, convex; surface with few granules distolaterally; exopod with few granules. Merus longer than broad, width less than half that of ischium. Following segments much slenderer, carpus



elongate, as long as propodus and dactylus combined. Palp segments with few pappose or simple setae on upper margins.

Chelipeds (P-1) equal, with few scattered simple setae, slightly smaller than P-2; merus not extending to anterolateral angle of carapace. Fingers as long as dorsal margin of palm; cutting edges unarmed. Dorsal margin of palm with line of erect tubercles; dorsal part of outer surface of palm and upper surface of carpus and merus tuberculate.

Walking legs (P-2 to P-5) very stout, with few scattered simple setae; P-3 largest, P-5 smallest; meri of P-2 to P-5 longer than high (Table 1), produced ventrodistally, with 3 tubercles; dorsal and ventral margins cristate, each with line of erect tubercles. Posterior surface of merus, carpus, and propodus of all legs covered with tubercles. Merus of P-2 falling short of anterolateral angles of carapace; pronounced distomesial expansion present. Carpus about as high as long, lacking mesial expansion; carpi of P-4 and P-5 with prominent posterodistal projection. Propodus much longer than carpus, with slight longitudinal depression at lower third; propodi of P-2 to P-5 not more slender than that of previous leg. Dactylus much shorter than propodus, with low tubercles proximally on upper surface; slightly curved, hollowed ventrally. P-5 similar to preceding 2 legs, distinctly smaller than P-4. Proportions of the leg segments of Atlantic cryptochirids summarized in Table 1.

Abdomen of ovigerous female, in dorsal view widest part only slightly wider than carapace. Egg size of holotype (in alcohol) 0.6 mm maximum diameter.

**Male** (Figure 4): As in female, slightly smaller, claws proportionally more robust. Palm inflated, with erect tubercles on dorsal surface. Dactylus longer than dorsal margin of palm; cutting edges of fingers with tooth proximally. P-2 lacking meral projection. Sides of abdomen subparallel; telson suboval. PLP-1 as for genus.

**Size Range.**--Males, 4.1 x 3.2 mm and 4.2 x 3.3 mm; ovigerous females, 4.8 x 4.4 mm and 5.2 x 4.2 mm.

**Etymology.**--From the Greek *brychios* (from the deep), in reference to the depth from which this species was collected.

**Type.**--The holotype is an ovigerous female, 5.2 x 4.2 mm, in the collections of the National Museum of Natural History, Smithsonian Institution, Washington, D.C., under catalogu number USNM 231662; a male paratype also is housed in the Smithsonian. A male and a female paratype are in the collections in the Instituto de Ciencias de Mar, Barcelona.

The type locality is off Namibia, on the Valdivia Ridge,  
25° 38'S, 06° 12'E.

**Biology.**--Ovigerous females were collected in May.

Collected at a depth of 512 m, this species is the deepest occurring gall crab known.

No parasites were found on the material examined.

Coral Hosts.--*Cecidocarcinus brychius* has been taken on two dendrophylliid corals, *Enallopsammia rostrata* and an unidentified species of *Dendrophyllia*.

The shape of the dwelling opening has not been recorded.

Distribution.--Known only from the type locality, on the Valdivia Ridge in the southeastern Atlantic (Figure 11).

#### *Detocarcinus*, new genus

Definition.--Carapace longer than broad, not deflected anteriorly, widest posteriorly. Pterygostomial region fused to carapace, not separated by distinct suture. Antennule base with lateral projection extending to eyestalk; angled lateral lobe present. MXP-3 without exopod; anteromesial lobe of ischium extending beyond merocarpal articulation; merus without distolateral projection; carpus length greater than length of propodus and dactylus combined. Sternite of P-1 with granules; of P-4 without medial suture. P-1 of female and male visible in dorsal view. Merus of P-2 with slight mesial expansion; carpus without mesial expansion. PLP-3 of female biramous; female opening transverse, oval, without hood. PLP-1 of male curved distally; apex produced into blunt tip, directed laterally.

Type Species.--*Troglocarcinus balssi* Monod, 1956, by present designation and monotypy.

Etymology.--The name is derived from the Greek *detos* (bound) plus the generic name *Carcinus*. The gender is masculine.

Remarks.--Detocarcinus is the only Atlantic genus of cryptochirids that lacks an exopod on the third maxilliped. It further differs from both Opecarcinus and Troglocarcinus in not having the front bent downward, and resembles Opecarcinus and differs from both Cecidocarcinus and Troglocarcinus in having granules on the sternite of the first pereopod. As in Cecidocarcinus, the lateral border of the carapace is defined by a line of granules or tubercles.

Detocarcinus also shows some resemblance to the genera Neotroglocarcinus, Pseudocryptochirus, and Utinomia from the Indo-West Pacific. Detocarcinus lacks an exopod on the third maxilliped, separating it from the first two of these, both of which have an exopod on the third maxilliped. Detocarcinus agrees with Utinomia in lacking an exopod on the third maxilliped, but females of Utinomia have a uniramous PLP-3; the PLP-3 is biramous in Detocarcinus.

Detocarcinus balssi (Monod, 1956), new combination

Figures 5, 6

Troglocarcinus corallicola.--Balss, 1922:87, 99.--Utinomi, 1944:716 [part]. [Not T. corallicola Verrill, 1908.]

Troglocarcinus balssi Monod, 1956:463, 632, figs. 620-627.--Longhurst, 1958:88.--Gauld, 1960:72.--Monod, 1963: fig. 37.--Crosnier, 1969:535.--Zibrowius, 1976:71; 1980:52, 139, 142.--Takeda and Tamura, 1980b:147.--Zibrowius, 1982:114.

Neotroglocarcinus Balssi.--Fize and Serène, 1957:6, 55, 135,  
136, 141, 142, 167.

Troglocarcinus Balssi.--Fize and Serène, 1957:54, 55, 135,  
143.

Pseudocryptochirus Balssi.--Fize and Serène, 1957:136.

Neotroglocarcinus balssi.--Takeda and Tamura, 1980b:147, 150  
.--Manning and Holthuis, 1981:251.--Serène, 1966:397.--  
Zibrowius, 1976:71, 72, plates 19A, 19C, 19G, 19I,  
82I; 1982:118.--Takeda and Tamura, 1986:63, 68.

Neotroglocarcinus bassi.--Takeda and Tamura, 1986, fig. 7  
[erroneous spelling].

Previous Records.--West Africa: Manning and Holthuis  
(1981).

Canary Islands: Fuertaventura, Punta Morro Jable [= Ponta  
da Matorra; 28° 02'N, 14° 20'W], 14 km from Morro (Manning and  
Holthuis, 1981; Zibrowius, 1982).

Mauritania: 21° 00'N, 17° 22.9'W (Zibrowius, 1982).

Senegal: île du Cap Vert [14° 43'N, 17° 28'W] (Zibrowius,  
1976).

Gambia: 12° 55.5'N, 17° 33'W (Zibrowius, 1976, 1982).

Guinea: 10° 40'N, 16° 44'W; 09° 27'N, 14° 48'W (Zibrowius,  
1976).

Sierra Leone: 08° 25'N, 14° 18'W (Monod, 1956; Longhurst,  
1958) [both records based on same specimen]; 07° 15.5'N,  
12° 05'W (Zibrowius, 1976).

Benin: 06° 07.5'N, 02° 04'E (Zibrowius, 1976).

**Ghana:** Off Accra [05° 33'N, 00° 13'W] (Monod, 1956; Gauld, 1960).

**Ivory Coast:** Off Abidjan [05° 19'N, 04° 02'W] (Manning and Holthuis, 1981).

**Congo:** Pointe-Noire [04° 48'S, 11° 51'E] (Crosnier, 1969).

**São Tomé:** Ilhéu Gago Coutinho [= Ilha das Rolas; 00° 01'S, 06° 32'E] (Balss, 1922).

In addition to these records for specimens, Zibrowius (1980, 1982) recorded crypts, presumably formed by *D. balssi*, from corals taken between Senegal and Gambia.

Material Examined.--EASTERN ATLANTIC: **West Africa:** No specific locality, A. Longhurst, 1 female (ov) (BMNH).

**Canary Islands:** Fuertaventura, Jandra, Punta Morro Jable [= Punta del Mattorral], 1 km from Morro, 20-25 m, M. Grasshoff/F. Engelhardt, 27 Jan 1975, 1 male, on *Phyllangia mouchezi* (Lacaze-Duthiers, 1897) (MP).

**Mauritania:** 20° 00'N, 17° 22' 30"W, 50-70 m, **Cornide de Saavedra**, Cruise Atlor VII, sta 48, R. Anadon, Nov 1975, 1 female (ov), on *P. mouchezi* (USNM).

**Senegal:** Dakar [14° 40'N, 17° 26'W], Iles de la Madeleine, main island, south side, 3 m, J. Laborel, 24 Jun 1971, 2 females, on *Schizoculina africana* (USNM); Cap de Naze [14° 32'N, 17° 06'W], 20 m, 1 female (ov) on *S. africana* (Thiel, 1928) [as *Cladangia gemmans* Chevalier, 1976] (USNM).

**Guinea:** 10° 49'N, 16° 39'W, 42 m, **Atlantide** Expedition, sta 153, 16 Apr 1946, 1 female (ov) (ZMC).

Ghana: Accra, 44 m, R. Bassindale, C85/53, 2 May 1951, 1 female (holotype, BMNH 1957:12.4.21), same data, 1 male (paratype, BMNH 1957:12.4.22); Kpone Bay [05° 41'N, 00° 04'W], 10 m, J. Laborel, 11 Mar 1970, 1 male, 1 female (with cryptoniscine isopod attached to inside of marsupium), on S. africana (USNM).

Ivory Coast: Abidjan, 62 m, CRO G8023, radiale 5 sta 8, 23 Aug 1968, 1 female on Asterosmilium marchadi (Chevalier, 1966) (MP).

Congo: Pointe-Noire, 10-40 m, A. Crosnier, 27 Jan 1967, 1 female (ov) (MP).

Angola: Ilha de Luanda [08° 48'S, 13° 13'E], 40-60 m, S. Gofas, 1984, 1 female on Phyllangia sp. (USNM). Cabo Ledo [09° 41'S, 13° 12'E], 10-40 m, dredged, S. Gofas, 1984, 13 females (9 ov) on S. africana (USNM); sta data unknown (COR A225), 1 female on S. fissipara Milne Edwards and Haime, 1850 [as Cladangia carvalhoi Chevalier, 1966] (USNM).

Description.--Adult Female (Figure 5): Carapace about 1.1 times longer than broad, slightly inflated laterally at branchial regions, narrowing slightly towards front. Surface flattened, slightly convex from side to side and front to back, with shallow depression on each side extending from just behind front to branchial region; surface variably ornamented, completely covered with low, rounded or raised, conical tubercles forming distinct border laterally and with scattered simple, pappose setae of length greater than largest tubercle, not obscuring surface; margin

fringed with pappose setae. Inner orbital angle with spine or tubercle. Anterolateral angle with tubercle, apex ahead of inner orbital angle. Front concave, tuberculate, with median tubercle, less than half width at anterolateral angles, latter little more than half carapace width. Orbit broadly V-shaped, margin tuberculate.

Basal segment of antennular peduncle projection with transverse distal margin, angled lateral lobe shorter than eyestalk; dorsal surface concave, variably tuberculate, lacking spines. In ventral view, basal segment tapering anteriorly, surface with stout, raised granules. Second segment of antenna with few raised granules on ventral surface.

Eyes directed anterolaterally, extending beyond anterolateral angles of carapace. Cornea anterolateral, in dorsal view, less than half length of stalk. Stalk wholly exposed dorsally, with granules, tuberculate distomesially, and covered with granules ventrally.

Ischium of MXP-3 with mesial margin denticulate, convex; surface with raised granules and scattered pappose setae. Merus longer than broad, width less than half that of ischium. Raised granules on merus and on upper margin of carpus. Carpus and propodus with many pappose setae on upper margins.

Chelipeds (P-1) equal, slightly smaller than P-2, with pappose setae on dorsal margins; merus extending about to anterolateral angle of carapace. Fingers longer than dorsal



margin of palm, cutting edges unarmed. Dorsal margin of palm cristate, tuberculate, tubercles extending about halfway down palm. Merus and carpus tuberculate dorsally. Walking legs (P-2 to P-4) stout, subequal, P-2 largest; P-5 smallest, longer, slenderer than P-2 to P-4. Posterior and upper surfaces of walking legs variably setose. P-2 to P-5 with meri longer than broad (Table 1), cristate and tuberculate dorsally, produced ventrodistally, with 1 tubercle; merus, carpus, and propodus each tuberculate on posterior face. Merus of P-2 falling short of anterolateral angle of carapace, with distinct but small distomesial expansion. Carpi broader than long, lacking mesial expansion, with clump of tubercles proximally on lower surface. Propodi longer than respective carpi. Propodus of P-3 to P-5 slenderer than that of P-2 (Table 1). Dactyli shorter than propodi, slightly curved, claw-like, dorsal surface smooth; dactylus of P-5 slenderer than those of P-2 to P-4. Proportions of segments of walking legs summarized in Table 1.

Abdomen of ovigerous female, in dorsal view no wider than carapace, up to third somite visible. Egg size (in alcohol) 0.3-0.4 mm maximum diameter.

**Male** (Figure 6): Very similar to female in form, showing typical carapace tuberculation and contour; slightly smaller. Claws proportionally larger; palm inflated. Sides of abdomen subparallel, telson suboval. PLP-1 slightly curved distally.

Size Range.--Males, 4.0 x 3.5 mm to 3.3 x 2.8 mm; females, 1.7 x 1.6 mm to 4.7 x 4.3 mm; ovigerous females, 2.2 x 2.0 mm to 4.7 x 4.3 mm.

Type.--The holotype is a mature female, 3.5 x 3.0 mm, housed in the British Museum (Natural History), under catalogue number 1957:12.4.21. It is less tuberculate than the figured specimen and the tuberculate lateral border of the carapace is not evident. There are no tubercles on the inner orbital angle, front or anterolateral angle of the carapace. The depressions on the carapace match those of the figured specimen. The holotype is missing all pereopods, pleopods, and the abdomen. All mouthparts are present.

The paratype is a mature male, in very good condition, showing the tuberculation and depressions characteristic for the species. All pereopods are present; the pleopods, and left third maxilliped are missing. It, too, is in the collections of the British Museum (Natural History).

The type locality is Accra, Ghana.

Biology.--Ovigerous females have been collected in January (Congo), April (Guinea), and November (Mauritania).

Known from depths of 3 m (present study) to 98 m (Zibrowius, 1976). Longhurst (1958) reported *D. balssi* from a depth of 200 m, but there is some doubt as to the validity of that record (see below).

One female, from Ghana, was infested by a cryptoniscine isopod parasite attached within the abdominal pouch of the

crab. No bopyrid isopods were found on the material examined. I found no evidence of a rhizocephalan parasite on this infected female.

Coral Hosts.--Detocarcinus balssi has been in association with the following corals:

Rhizangiidae: Phyllangia mouchezi, herein; Phyllangia sp. by Crosnier (1969).

Oculinidae: Schizoculina africana, S. fissipara, herein.

Caryophylliidae: Asterosimilia marchadi, herein and recorded by Zibrowius (1976, 1980); Caryophyllia smithii Broderip, 1828, recorded by Zibrowius (1976, 1980), whose records may have been based on empty crypts.

Dendrophylliidae: Dendrophyllia, recorded by Gauld (1960), who reported that his material "probably" occurred on this coral; his observation may have been in error.

As Manning and Holthuis (1981:251) pointed out, Monod's (1956) record of this species on a sea urchin of the genus Cidaris and Longhurst's (1958) record of its association with the echinoid Eucidaris, both based on the same specimen, probably was in error, as this species is not known to occur with echinoids.

The shape of the dwelling opening has not been recorded although Zibrowius (1976) has figured gall crab pits attributed to D. balssi.

Distribution.--Eastern Atlantic, off West Africa, from localities between the Canary Islands southward to Angola (Figure 11).

Zibrowius (1982) discussed crypts on corals taken from depths to 635 m in the southwestern Indian Ocean that resembled those attributable to *D. balssi*. However, no crabs were collected so those records are uncertain, especially as *D. balssi* is not known to occur outside the Atlantic.

***Opecarcinus*, new genus**

Definition.--Carapace longer than broad, deflected anteriorly at about angle of 40<sup>o</sup>, widest posteriorly. Pterygostomial region fused to carapace, not separated by suture. Antennule base with lateral projection overreaching inner margin of eyestalk; angled lateral lobe present. MXP-3 with elliptical exopod, longer than half length of lateral margin of ischium; merus with distolateral projection; anteromesial lobe of ischium extending beyond merocarpal articulation; carpus length less than length of propodus and dactylus combined. Sternite of P-1 tuberculate, of P-4 with complete medial suture. P-1 of female not visible in dorsal view; visible in male. Merus of P-2 with moderate mesial expansion; carpus with moderate mesial expansion. PLP-3 of female uniramous; female opening longitudinal, oval, without hood. PLP-1 of male slightly curved distally; apex blunt tipped, directed laterally.

Type Species.--*Pseudocryptochirus hypostegus* Shaw and Hopkins, 1977, by present designation.

Included Species.--*Opecarcinus hypostegus* (Shaw and Hopkins, 1977), from the Atlantic, and *Opecarcinus*

crescentus (Edmondson, 1925), from the East and West Pacific. Pseudocryptochirus is now restricted to one species, P. hongkongensis (Shen, 1936) from the Indo-West Pacific.

Etymology.--From the Greek ope (opening or hole) plus the generic name Carcinus. The gender is masculine.

Remarks.--Opecarcinus resembles Troglocarcinus and differs from both other western Atlantic genera in having the front of the carapace noticeably deflected ventrally and in having a uniramous second pleopod in the female; it further differs from Detocarcinus in having an exopod on the third maxilliped. Opecarcinus differs from Troglocarcinus in having distinct tubercles on the sternite of the first pereopod and in having the pterygostomial region fused to the carapace.

Species now assigned to Opecarcinus have been assigned to Pseudocryptochirus in the past; the latter genus occurs only in the Indo-West Pacific region. Members of Opecarcinus can be distinguished from members of Pseudocryptochirus by having the pterygostomial region fused to the carapace and by having the front of the carapace deflected anteriorly. The pterygostomial region is not fused to the carapace and the carapace is not deflected anteriorly in Pseudocryptochirus.

Opecarcinus hypostegus (Shaw and Hopkins, 1977),

new combination

Figures 7, 8

Troglocarcinus corallicola.--Coêlho, 1966:140 [part?] [Not  
T. corallicola Verrill, 1908].

Pseudocryptochirus hypostegus Shaw and Hopkins, 1977:179,  
figs. 1, 2a, 3a.--Takeda and Tamura, 1981:14, 15, 20.--  
Abele and Felgenhauer, 1982:318, fig on p. 318.--Scott,  
1985:345, 347.--Abele and Kim, 1986:68, 727, 728, fig.  
on p. 729.--Takeda and Tamura, 1986:63, 68, fig. 4.

Previous Records.--Gulf of Mexico: Florida Middle Ground,  
28° 30' 49" N, 84° 20' 30" W, about 137 km west of Tarpon Springs,  
Florida (Shaw and Hopkins, 1977). Florida (Abele and Kim,  
1986).

Jamaica: Discovery Bay area, 18° 28' N, 77° 24' W (Scott,  
1985).

Brazil: Brazil, northeast coast (Coêlho, 1966), exact  
localities uncertain, see below under "Coral Hosts."

Material Examined.--WESTERN ATLANTIC. Florida: Looe Key  
Reef, ~ 4.5 mi SSW of Big Pine Key [24° 41' N, 81° 21' W], D.L.  
Felder et al., 2 Jul 1979, 1 female on Agaricia (USLZ);  
same locality, Project Area IV, SCUBA transect sample, study  
finger # 2, D.L. Felder/J. Goy, 5 Oct 1983, 2 females (ov)  
(USLZ); Tortugas [24° 37' N, 82° 57' W], West Lab Dock, 6.1 m,  
14 Aug 1930, 1 female on Agaricia [= Agaricina] (USNM).

Gulf of Mexico: Florida Middle Ground, BLM-MAFLA sta 147,  
27 m, K. Shaw, 29 Jun 1976, 1 female (ov) on Agaricia

*fragilis* Dana, 1848 (holotype, USNM 168532); same data, 1 male (paratype, USNM 168533); Florida Middle Ground, BLM-37, sta 047, 29 Jun 1976, 1 male, 1 female on *Agaricia* (IRCZM 89-5117) [possibly from the type locality, station data as in types, but station number different].

Mexico: Veracruz, Isla En Medio [21° 29'N, 97° 15'W], USLTFE III-B, north side of windward reef-canyon, 12-15 m, D.L. Felder/J.W. Martin, 24 Jun 1978, 1 female (USLZ); same data, 3 males, 3 females (ov) on *Agaricia* (USLZ); same locality, 10-12 m, D.L. Felder/J.W. Martin, 22 Jun 1978, 8 females (4 ov) on *Agaricia* (USLZ).

Belize: 16° 48.2'N, 88° 04.5'W, 36 m, G. Hendler sta 22, 29 Mar 1980, 1 female (juv) (USNM); same locality, 15.2 m, fore reef crest, G. Hendler sta 14, 20 Apr 1981, 1 male, 2 females (juv) (1 with 3 cryptoniscine isopod parasites in abdominal pouch) on *Agaricia* (USNM); same locality, 24.4-27.4 m, fore reef dropoff, G. Hendler sta 85, 21 Apr 1981, 4 females (juv); 16° 48.2'N, 88° 04.6'W, 9.1 m, spur and groove zone, 24 Apr 1981, 1 male, on *Agaricia*; 16° 48.1'N, 88° 04.8'W, 1-2 m, reef platform (reef crest), G. Hendler sta 40, 41, 42, 25 Apr 1981, 1 immature, 2 females on *Agaricia*.

Jamaica: Discovery Bay, Jul 1983, B. Feifarek, 1 male, 2 females on *Agaricia* (USNM).

Puerto Rico: La Parguera [17° 58'N, 67° 04'W], Playa Rosada, V.A. Capriles, 22 Jul 1972, 2 females on *Agaricia* (USNM); Joyuda, Cabo Rojo [17° 56'N, 67° 12'W], 1.2-1.8 m, J.A.

Rivero, 21 Aug 1948, 5 females on *A. agaricites* (Linnaeus, 1758) (USNM); same locality, J.A. Rivero, 5 Aug 1948, 1 male, 2 females on *A. agaricites* (USNM).

CENTRAL ATLANTIC: *Ascension Island* [7° 57'S, 14° 22'W]: English Bay, north end at rocky point, sta RBM Asc-15, R. B. Manning et al., 22 May 1971, 1 female (USNM).

Description.--~~Adult Female~~ (Figure 7): Carapace about 1.6 times longer than wide, slightly inflated laterally at branchial regions, narrowing slightly towards front. Anterior third of carapace deflected at angle of up to 40°, angle similar at all sizes. Carapace with transverse depression confined to protogastric region; posterior surface slightly convex side to side. Surface variably ornamented with tubercles, some spines; tubercles more numerous, larger at midcarapace; posterior carapace with granules decreasing in size posteriorly, smoother than anterior. Anterolateral angle without prominent spine or tubercle; adjacent lateral margins with tubercles, not forming distinct border. Surface variably setose; setae simple, sparse, most shorter, some longer than largest tubercles, not obscuring surface. Inner orbital angle slightly swollen, having distinct spine larger than adjacent tubercles, extending almost to apex of anterolateral spine of carapace. Front slightly concave, tuberculate, with larger median tubercle; width about half carapace width at anterolateral angles, latter about 3/5 greatest carapace width. Orbit broadly V-shaped, margin with few tubercles.



Basal segment of antennular peduncles with distal projection overreaching eyestalk, projection with apex of angled lateral lobe at tip of eyestalk; dorsal surface flat, variably ornamented with spines and tubercles, marginal spines longest. In ventral view, basal segment broadening anteriorly; surface with numerous granules. Second segment of antenna with granules on ventral surface, distal margin granulate.

Eyes directed anterolaterally, extending beyond anterolateral angle. Cornea anterolateral; in dorsal view, occupying less than half lateral length of stalk. Stalk wholly exposed dorsally; surface mostly smooth tuberculate distomesially, ventral surface with granules.

Ischium of MXP-3 with mesial margin minutely denticulate, straight; surface of ischium and exopod with many prominent, raised granules. Merus as broad as long, width half that of ischium; lateral three-fourths with many prominent, raised granules. Following segments decreasing in length and size distally. Propodus and dactylus with pappose setae on upper margins, setae longer than carpus width.

Sternite of first pereopods with transverse row of tubercles, with smaller tubercles posteriorly.

Chelipeds (P-1) equal, merus not extending beyond anterolateral angle of carapace. Fingers shorter than dorsal margin of palm, cutting edges unarmed; dactylus with proximal tubercle on dorsal margin. Dorsal margin of palm variably tuberculate, with pappose setae; outer surface of

palm flat, smooth, clean. Merus and carpus tuberculate dorsally; carpus with pappose setae.

Walking legs (P-2 to P-4) stout, decreasing in size posteriorly to P 4, P-2 largest. P-5 longer, slenderer than P-4. Merus of P-2 to P-4 each with blunt, rounded tubercles dorsally and produced ventodistally, with 1 tubercle; dorsal surface with pappose setae; merus of P-2 falling short of anterolateral angle of carapace. Carpus about as broad as long, not produced ventrodistally, carpus of P-3 with proximal clump of tubercles on lower surface; carpus and propodus subequal in length. Dactylus of P-2 shorter than propodus, slightly curved, claw-like; dactyli of P-2 to P-3 with tubercles proximally on dorsal margin, of P-4 and P-5 rotated anteriorly ca. 90° with respect to merus. Meri of P-2 to P-5 decreasing in size posteriorly from P-2 to P-5, propodi increasing in length posteriorly from P-2 to P-5, becoming slenderer (Table 1).

Abdomen of ovigerous females, in dorsal view up to half again as wide as carapace; up to part of fourth somite visible. Egg size (in alcohol) 0.4-0.6 mm maximum diameter.

**Adult Male** (Figure 8): Similar to female, smaller; carapace smoother. Chelae proportionally more robust than in female; fingers shorter than dorsal margin of palm, cutting edge of dactylus may have proximal tooth. Dactli of P 2-5 more slender than female.

**Juveniles:** Not significantly different from adults.

Size Range.--Males, 1.4 x 1.3 mm to 3.4 x 2.6 mm; females, 1.6 x 1.3 mm to 5.8 x 3.5 mm; ovigerous females, 2.1 x 1.4 mm to 5.4 x 3.4 mm.

Types.--The holotype is an adult female, 3.8 x 3.3 mm, in the collections of the National Museum of Natural History, Smithsonian Institution (USNM 168532). It is ovigerous, with depressions on the protogastric and hepatic regions. The margin of the front is without a larger median tubercle. The specimen is mostly disarticulated, the the right cheliped, P-3, and right third maxilliped missing. The sternite of P 4 is punctured ventrally.

The male paratype, also in the collections of the Smithsonian, is mostly disarticulated, missing the left P-5, and with the left P-2 to P-4 missing various segments; the mouthparts are present, but the abdomen and pleopods are missing.

Two specimens in the collection of the Indian River Coastal Zone Museum, Fort Pierce, Florida, may also be paratypes. They show the same locality and date as the holotype, but a different station number.

Other types reported on by Shaw and Hopkins (1977) are in the collections of the Dauphin Island Sea Lab, Dauphin Island, Alabama. John Garth and Janet Haig pointed out to me that paratype material is also in the collection of the Allan Hancock Foundation, Los Angeles, California. I did not examine either set of material.

The type locality is the Florida Middle Ground, west of Tarpon Springs in the Gulf of Mexico.

Biology.--Ovigerous females have been taken in June (Florida Middle Ground, Shaw and Hopkins, 1977, herein; Mexico, herein) and October (Florida, herein).

This species has been collected in depths between 0 and 27 m.

One juvenile female, from Belize, was infested by three cryptoniscine isopod parasites, all attached within the abdominal pouch of the crab. I found no evidence of a rhizocephalan parasite on this infected female.

None of the material examined was infested by bopyrid isopod parasites.

Coral Hosts.--Opecarcinus hypostegus has been recorded from relatively few coral hosts, having been taken only on members of the following two families:

Agariciidae: Agaricia sp. and A. agaricites (Linnaeus, 1758), herein; A. fragilis Dana, 1848, reported by Shaw and Hopkins (1977) and herein; A. lamarcki Milne Edwards and Haime, 1851 and A. grahamae Wells, 1973 listed by Scott (1985).

Siderastreidae: Siderastrea siderea (Ellis and Solander, 1786) listed by Scott (1985).

Coêlho lists gall crabs from Brazil as being collected on mussid and agariciid corals. However, T. corallicola is not known to occur on agariciids. Because O. hypostegus is the only Atlantic gall crab known to live on agariciids, I

tentatively include part of Coêlho's records here.

The dwelling of *Q. hypostegus* has been described as a canopy-shaped tunnel (Shaw and Hopkins, 1977) resulting from the combined effects of the host coral growth and movement of the crab. Bak et al. (1977) found that experimentally damaged *Agaricia* colonies repaired lesions by forming a dome-shaped skeletal roof over the affected area. These domes took along time to close completely and ultimate closure could be delayed by a foreign substance such as algae. Therefore it seems likely that the gall crab is living in a dwelling resulting from crab-caused irritation and the usual coral regenerative process.

Remarks.--*Opecarcinus hypostegus* differs from the Pacific *Q. crescentus* by having fewer, smaller tubercles on the carapace and pereopods. In *Q. crescentus* the anterior depression of the carapace is deeper and better defined than in *Q. hypostegus*. The eyestalk of the former is partially covered dorsally and extends only to the level of the anterolateral angle of the carapace, whereas in the latter species, the eyestalk is wholly exposed and extends beyond the anterolateral angle. The third maxilliped is much more heavily granular and the anteromesial lobe of the ischium more pronounced in *Q. hypostegus* than in *Q. crescentus*.

Distribution.--Western and Central Atlantic, from northern Mexico, the Gulf of Mexico, Florida, Jamaica, Puerto Rico, probably Brazil, and from Ascension Island (Figure 11).

Troglocarcinus Verrill, 1908

Troglocarcinus Verrill, 1908a:427. [Type species

Troglocarcinus corallicola Verrill, 1908, by monotypy.

Gender masculine.]

Mussicola Fize and Serène, 1957:10, 55, 110. [Published as

Troglocarcinus (Mussicola). Type species Troglocarcinus corallicola Verrill, 1908, by present designation.

Gender masculine.]

Definition.--Carapace longer than broad, deflected anteriorly at angle of about 60<sup>o</sup>, widest posteriorly. Pterygostomial region not fused to carapace, separated by suture. Antennule base with lateral projection extending to or slightly beyond eyestalk, lacking angled lateral lobe. MXP-3 with oval exopod, slightly longer than half lateral margin of ischium; merus with distolateral projection; anteromesial lobe of ischium extending beyond merocarpal articulation; carpus length less than combined length of propodus and dactylus. Sternite of P-1 smooth, of P-4 with complete medial suture. P-1 of adult female not visible in dorsal view, visible in male. Merus of P-2 with prominent mesial expansion; carpus with prominent mesial expansion. PLP-3 of female uniramous; female opening longitudinal, oval, lacking hood. PLP-1 of male slightly curved; apex broadly pointed, directed slightly laterally.

Remarks.--The genus Troglocarcinus was established by Verrill, 1908a, with T. corallicola, from Bermuda and

Dominica, as its type species. Edmondson (1933:5) assigned T. corallicola to Cryptochirus Heller, 1861 (type species Cryptochirus coralliodytes Heller, 1861, by monotypy), and this was accepted by Shen (1936), Rathbun (1937), Garth and Hopkins (1968), and Fausto-Filho (1974).

Hiro (1938:149) named the genus Pseudocryptochirus, then monotypic, containing P. viridis Hiro, 1938, from Japan. Utinomi (= Hiro) (1944) disagreed with Edmondson, and considered Troglocarcinus Verrill, 1908, and his genus Pseudocryptochirus to be congeneric. He erroneously used the junior synonym for the genus, noting (p. 724): "For the same group VERRILL'S Troglocarcinus greatly precedes the latter [Pseudocryptochirus]; but this is not preferable since it conveys a somewhat inadequate conception about the generic distinction of this group." In this action, Utinomi was followed by Shaw and Hopkins (1977) and Scott (1985).

Monod (1956:466) commented on Utinomi's action, "Pareille raison justifie-t-elle l'abandon de nom du genre ayant une indubitable priorité? On peut en douter." In a footnote on page 466, Monod noted that Utinomi (in litt.) had accepted the synonymy of Pseudocryptochirus with Troglocarcinus.

Fize and Serène (1957:9) noted that Utinomi had written on a reprint of his 1944 paper, "the name Troglocarcinus should be used instead of my name for the genus" [Pseudocryptochirus].

Later, Serène (1962:30, footnote) remarked that "Utinomi uses Pseudocryptochirus as the name of the genus, but

Troglocarcinus has priority." Curiously, Serène (1966:396) noted that "La remarque de Monod (1956, page 466) au sujet de la priorité du nom Troglocarcinus Verrill 1908 sur Pseudocryptochirus Hiro 1938 n'était valable que parce qu'Utinomi (1944) considèrait les deux genres comme identiques, synonymes."

Fize and Serène (1957) recognized four subgenera in the genus Troglocarcinus: Troglocarcinus proper and three new subgenera, Favicola, Fungicola, and Mussicola. They incorrectly assigned the type species of Troglocarcinus, T. corallicola, to their new subgenus Mussicola, along with two other species. No type species was designated. In a later paper, Serène (1966:396) regarded Mussicola a synonym of Troglocarcinus and placed the species originally assigned to Troglocarcinus (Troglocarcinus) by Fize and Serène (1957:10, 55, 56) to Pseudocryptochirus Hiro, 1938. McNeill (1968:87) also recognized Mussicola as a synonym of Troglocarcinus, but took no corrective action.

Takeda and Tamura (1980a:138) recognized that this action by Fize and Serène was incorrect, but apparently did not realize that Mussicola could be used as a generic name by the designation of one of the other species assigned to it as its type species; they recognized a new genus, Fizesereneia (type species Troglocarcinus heimi Fize and Serène, 1955, one of the three species originally assigned to Mussicola), for a new species and the two other species originally assigned to Mussicola by Fize and Serène in 1957.



The present designation of Troglocarcinus corallicola, one of the three species originally assigned to Mussicola, as the type species of Mussicola, removes Mussicola as a potential senior synonym of Fizesereneia and makes it a harmless junior synonym of Troglocarcinus Verrill, 1908.

Troglocarcinus agrees with Opecarcinus and differs from both Cecidocarcinus and Detocarcinus in having the front of the carapace strongly deflected ventrally, in having the second pleopod uniramous in the female, and in lacking a distinct line of tubercles marking the lateral edge of the carapace. Troglocarcinus differs from Opecarcinus in having the sternum of the first pereopod smooth and in having a free epimeral plate; in Opecarcinus the epimeral plate is fused to the carapace.

Troglocarcinus has been confused with Pseudocryptochirus of the Indo-West Pacific in the past. It can be distinguished from that genus by having the front deflected anteriorly; it is not deflected in members of Pseudocryptochirus.

Troglocarcinus corallicola Verrill, 1908

Figures 9, 10

Troglocarcinus corallicola Verrill, 1908a:427, figs. 48, 49a-c, pl. 28: fig. 8; 1908b:291, fig. 3.--Edmondson, 1933:5.--Shen, 1936:21.--Hiro, 1937:140, 142 [discussion].--Utinomi, 1944:697, 698, 699, 713, 716 [part], 718-719, 721-723, fig. 14.--Fize and Serène,

1955:378; 1957:6, 8, 9, 22, 53, 54, 55, 66, 68, 110, 136, 153, 154.--Serène, 1966:396, 397.--Coêlho, 1966:140.--Garth and Hopkins, 1968:40.--McNeill, 1968:87.--Coêlho, 1970:234 [no material].--Coêlho and Ramos, 1972:205 [no material].--Zibrowius, 1976:71.--Takeda and Tamura, 1980a:137, 138.--Markham and McDermott, 1981:1272.--Scotto and Gore, 1981:486, figs. 1-6.--Reed et al., 1982:761, fig. 7.--Van Dover, 1982:212, fig. 1F.--Zibrowius, 1982:119.--Gore et al., 1983:141, 143, 147, figs. 2d, 3d.--Kropp, 1986:377.--Hines, 1986:450, 458.--Takeda and Tamura, 1986:63, 68, fig. 3.

Troglacarcinus coralliocola.--Edmonson, 1925:35 [erroneous spelling].

Cryptochirus corallicola.--Edmondson, 1933:5.--Shen, 1936:22.--Rathbun, 1937:262, fig. 47, pl. 78: figs. 5-8.--Ekman, 1953:51.--Garth and Hopkins, 1968:40.--Fausto-Filho, 1974:13, 22, 25, 28 [no material].--Shaw and Hopkins, 1977:178.

Trogrocarcinus corallicola.--Utinomi, 1944:688 [erroneous spelling].

Pseudocryptochirus corallicola.--Utinomi, 1944:698, 701, 706, 707, 709, 710, 711, 712, 713, 715, 724, 726, 728, figs. 11g, 12d, 14a, 15d, 16g-i, 17, pl. 4: figs. 11-14, pl. 5: fig. 4.--Shaw and Hopkins, 1977:178, 179, 181, 182, figs. 2b, 3b.--Scott, 1985:345, 347.--Abele and Kim, 1986:68, 727, 728, fig. on p. 729.

**Troglocarcinus (Mussicola) corallicola**.--Fize and Serène,  
1957:55, 68, 110, 115, 121, 136, 163, 165 [discussion].

**Pseudocryptochirum corallicola**.--Shaw and Hopkins, 1977:177  
[erroneous spelling].

Previous Records.--**Bermuda** [32° 18' N, 64° 45' W]: (Verrill,  
1908a, b; Markham and McDermott, 1981).

**Florida**: South of Pepper State Park, St. Lucie County,  
27° 29.6' N, 80° 17.3' W (Scotto and Gore, 1981). Off central  
east Florida, ~0.6 km off Fort Pierce [27° 28' N, 80° 16' W];  
7 miles east of St. Lucie Inlet [27° 10' N, 80° 08' W] (Reed et  
al., 1982). Dry Tortugas (Rathbun, 1937; Utinomi, 1944;  
Shaw and Hopkins, 1977). Florida Middle Ground (Shaw and  
Hopkins, 1977). Florida (Abele and Kim, 1986).

**Jamaica**: Discovery Bay area (Scott, 1985).

**Dominica**: Dominica [15° 30' N, 61° 20' W] (Verrill, 1908a, b)

**Brazil**: Atoll das Rocas [03° 52' S, 33° 49' W]. Fernando de  
Noronha [03° 51' S, 32° 25' W]. San Luiz, Maranhão [02° 31' S,  
44° 16' W]. Recife [08° 03' S, 34° 54' W] and Tamandaré  
[08° 45' S, 35° 06' W], Pernambuco. Macéio, Alagoas [09° 40' S,  
35° 45' W]. Mar Grande, Bahia [12° 57' S, 38° 37' W] (Coelho,  
1966, 1970; Coelho and Ramos, 1972).

In addition to these records, Utinomi (1944:731) recorded  
galls attributed to this species, based on accounts in the  
coral literature, from the following localities: Bermuda,  
Florida, West Indies, and Bahia, Brazil.

Material Examined.--WESTERN ATLANTIC. **Bermuda**: In hole in  
coral, A.E. Verrill, 1901, 1 female (lectotype, YPM 7162).

Castle Harbour Causeway [32° 21'N, 64° 40'W], Savazzi, VIII-1982, 1 female on Isophyllia sp. (USNM).

Florida: Monroe County: Tortugas, off east side of Loggerhead Key [24° 38'N, 82° 56'W], W.L. Schmitt, 18 Jul 1931, 2 females, on probably Diploria [as Meandrina] (USNM). Off north end of Loggerhead Key, in stomach of fish #280, A. maculatus (Poey, 1861) [as Apogon sellicauda Evermann and Marsh, 1900], W.L. Schmitt, 9 Jun 1925, 1 male (USNM). West side of Loggerhead Key, sta 33, C.R. Shoemaker, 26 Jul 1930, 3 males, 10 females (7 ov) (USNM). Bush Key Reef [24° 38'N, 82° 52'W], sta 29, 23 Jul 1930, Mr. Visscher, 3 females (ov), on Diploria [as Meandrina] (USNM); H. Boschma, Jul/Aug 1925, 4 males, 10 females (3 ov), on Manicina areolata (USNM). Fort Jefferson [24° 38'N, 82° 53'W], sta 3, C.R. Shoemaker, 17 Jul 1926, 2 females (ov) (USNM). Bush Key Reef, sta 21, C. R. Shoemaker, 14 Aug 1926, 1 male, 6 females (2 ov) (USNM). Bush Key Reef, sta 22, C.R. Shoemaker, 16 Aug 1926, 4 males, 8 females (4 ov) (USNM); W.H. Longley, Aug 1927, 1 female (ov) (USNM). St. Lucie County: Pepper State Park, 1.4 m, J. Reed, 25 May 1979, 1 female on Oculina sp. (IRCZM 89-4835); same locality, 6.1 m, 25 Jan 1977, J. Reed, 2 males, 1 female (ov), 1 female (juv) (IRCZM 89-5116); same locality, 4.5 m, J. Reed/ K.D. Cairns, 11 Jul 1979, 2 females (IRCZM 89-5114). Collier County: Sanibel Is. [26° 26'N, 82° 10'W], EJ-80-29, ~X sta K, R/V Hernan Cortez, D.K. Camp et al., 31 Jul 1980, 1 female (ov) (USLZ).

**Mexico:** Tamaulipas [23° 03'N, 97° 46'W], off Barra del Tordo, 12.8 m, D.L. Felder, 17 Aug 1979, 1 female (ov) on *Siderastrea siderea* (USLZ). Veracruz, Isla En Medio, in channel of windward reef, USLTFE III-B, ~6 m, D.L. Felder et al., 22 Jun 1978, 2 females (ov) (USLZ). Off city of Veracruz, Bird Reef, USLTFE I-B, 9 Jan 1977, 1 female (ov) (USLZ).

**Belize:** W of Twin Keys [16° 50'N, 88° 05'W], *Thalassia* grassflat, 1 m, J.E. Miller, 21 Mar 1981, 1 female (ov) on *Manicina areolata* (Linnaeus, 1758) (USNM).

**Panama:** Portobelo [09° 33'N, 79° 39'W], H. Lasker, 9/10 Dec 1975, 7 males, 5 females (juv) on *Montastrea cavernosa* (Linnaeus, 1767) (IRCZM 89-2985), males free-living on the coral surface.

**Puerto Rico:** Southwestern coast, V.A. Capriles, 1 male, 4 females (2 ov) on *Diploria strigosa* (Dana, 1848), *Isophyllia sinuosa* (Ellis and Solander, 1786), *Micetophyllia* sp. (USNM).

**Curacao:** Piscadera Baai [12° 08'N, 68° 59'W], 0-0.5 m, L.B. Holthuis, 25 Jan 1957, 1 male, 28 females (23 ov) (RMNH).

CENTRAL ATLANTIC. **Saint Paul Rocks** [00° 56'N, 29° 22'W]: SW of Belmonte Islet, 14-2b, 20 Sep 1983, 1 female on *Polycyathus* sp. (RMNH).

**Ascension Island:** Shelly Beach, in tide pool, sta RBM Asc-18, R.B. Manning et al., 23 May 1971, 1 female (USNM). Turtle Shell Beach, tide pool, sta RBM Asc-23, R.B. Manning/K. Double, 25 May 1971, 2 females (ov) (USNM).

North East Bay, tide pool, sta RBM Asc-5, R.B. Manning et al., 19 May 1971, 1 male, 1 female (ov) (USNM). MacArthur Pt., Jones, et al., 12 Jul 1976, 1 male, 1 female (ov) on Favia (USNM). Collyer Pt., Jones, et al., 14 Jul 1976, 1 female (juv) (USNM). South West Bay, C85/53, 1978:52, Nov 1972, 2 males, 8 females (7 ov) (BMNH).

St. Helena [15° 55'S, 05° 43'W]: James Bay, between landing steps and Munden's Pt. (northwestern coast), sta 15, 1-6 m, J.C. den Hartog, 19 Jun 1983 5 females (4 ov) on Sclerbelia hirtella (Pallas, 1766) (RMNH). James Bay, sta H 2-67, 8-9 m, A. Edwards/C. Glass, 18 Jul 1983, 1 male, 7 females on S. hirtella (RMNH).

EASTERN ATLANTIC. Gabon: Cap Esteiras [00° 37'N, 09° 20'E], 4-8 m, J. Laborel, 27 Jan 1971, 4 females on F. gravida (USNM).

São Tomé Island [00° 12'N, 06° 39'E]: São Tomé, S. Gofas, Nov 1983, Jun 1984, 2 female on Favia gravida Verrill, 1868 (RMNH, USNM).

Pagalu Island [= Annobon; 01° 25'S, 05° 36'E]: Between village and San Pedro, 3-9 m, J. Laborel, 18 Jan 1971, 5 females on F. gravida (USNM). On right side of village (Nizery sta 2), 3-8 m, J. Laborel, 18 Jan 1971, 9 females on F. gravida (USNM).

Description.--Adult Female (Figure 9): Carapace about 1.3 times longer than broad, slightly inflated laterally at branchial regions, narrowing slightly towards front. Anterior part of carapace strongly deflected, at angle of up

to 60<sup>o</sup>, greatest amount of deflection in older (larger) specimens, and with well-defined depression covering protogastric regions; posterior surface slightly convex side to side. Surface variably ornamented with tubercles and some spines, tuberculation increasing anteriorly, with granules decreasing posteriorly; posterior fourth may be smooth but pitted. Larger spines on dorsal surface variable, usually 3-4 occurring on mesogastric swelling, several on anterolateral margin. Inner orbital angle with 1 spine, slightly swollen. Surface of carapace variably setose, setae simple, distally curved; deflected part of front may be completely obscured by setae longer than longest spines. Anterolateral angle with spine, apex extending to or exceeding apex of inner orbital spine. Front concave, with few tubercles and with median spine or tubercle occasionally missing); front about 2/5 width at anterolateral angles, latter about 3/5 greatest carapace width. Lateral margins of carapace lacking distinct border of tubercles, but with some tubercles present behind anterolateral angles. Orbit broadly U-shaped, margin with few tubercles.

Basal segment of antennular peduncle with distal projection extending to or slightly beyond eyestalk; dorsal surface flat, variably armed with spines and tubercles, distal spines usually largest; lateral margin deflected ventrally. In ventral view, basal segment tapering sharply

anteriorly; surface with granules proximally and mesially. Second segment of antenna with raised granules on distal half.

Eyes directed anteriorly, extending beyond anterolateral angle. Cornea anterolateral, in dorsal view occupying more than distal half of stalk. Stalk partially covered dorsally, finely tuberculate, especially mesially; smooth ventrally.

Ischium of MXP-3 with mesial margin minutely denticulate, convex; surface of ischium and exopod with few scattered granules. Merus as broad as long, width half that of ischium, with few granules laterally. Following segments decreasing in length and size distally. Proximal 3 palp segments with scattered pappose setae of length greater than carpus width.

Chelipeds (P-1) equal, merus not extending beyond anterolateral angle of carapace. Fingers longer than dorsal margin of palm. Dactylus usually with low tooth in basal fourth; dorsal margin smooth. Dorsal margin of palm variably tuberculate, with simple setae; outer surface of palm flat, largely smooth, clean. Merus and carpus tuberculate, spinose dorsally; dorsal margins with simple setae.

Anterior two walking legs (P-2 and P-3) stout, P-4 and P-5 slenderer; legs decreasing in size posteriorly, first (P-2) much the largest. P-2 to P-5 each with merus tuberculate dorsally, variably ornamented, usually sparsely, with



simple, distally-curved setae. Merus of P-2 extending almost to anterolateral angle of carapace, distomesial expansion most prominent in larger specimens; inner margin of merus matching carapace edge in contour. Meri of P-2 to P-4 with ventrodiscal tubercle. Carpus of P-2 about as broad as long; carpi of P-2 to P-4 with clump of tubercles proximally on outer surface; meral and carpal expansions variably spined and tuberculate, largest spines on mesial lobes. Propodus slightly shorter than carpus, tapering distally, becoming more slender from P-2 to P-5 (Table 1); propodi of P-2 to P-5 shorter than respective meri. Dactylus slenderer than propodus, shorter, curved, claw-like; dorsal margin smooth. Dactyli of P-4 and P-5 rotated  $\sim 90^{\circ}$  to longitudinal plane of merus. Outer and upper surfaces of leg variably tuberculate and setose. P-5 shortest, smallest, slenderest, and smoothest of walking legs.

Abdomen of ovigerous females, in dorsal view as wide as to half again as wide as carapace, somites separate, up to fourth somite visible. Egg size (in alcohol) 0.3-0.5 mm maximum diameter.

**Adult Male** (Figure 10): As in female but smaller, carapace and pereopods less tuberculate, front much less deflected. Chelipeds proportionally larger than in female, visible in dorsal view, part of carpus extending beyond anterolateral angle of carapace. Fingers longer than dorsal margin of palm, with basal tooth on dactylus; palm inflated. Walking

legs (P-2 to P-5) slenderer, less tuberculate; merus of P-2 with slight mesial projection distally. Abdomen margins convex, telson broadly rounded. PLP 1 simple, as for genus.

**Juveniles** (Figure 10b): Carapace with slight deflection anteriorly, often with anterior, submedian shallow depressions. Chelipeds equal, small, palm of chela not inflated. Walking legs very slender, elongate, P-2 merus, carpus lacking expanded lobes mesially. P-2 to P-5 largely smooth, with some dorsal tubercles only and few scattered long setae, not obscuring surface.

**Size Range.**--Males, 1.6 x 1.4 mm to 3.1 x 2.6 mm; females, 1.4 x 1.3 mm to 5.2 x 3.9 mm; ovigerous females, 2.5 x 1.9 mm to 5.2 x 3.9 mm. Verrill (1908a) reports a female 7.0 x 4.0 mm.

**Type.**--Verrill (1908a) did not originally designate a holotype. He reported on specimens from Bermuda and Dominica. Rathbun (1937) reported the type locality as Dominica, but did not designate a lectotype albeit reporting a type in the Peabody Museum. Shaw and Hopkins (1977) reported a holotype collected on Mussa from Dominica in the Yale Peabody Museum under catalog number 7612. The only specimen collected by Verrill I have found in the Peabody Museum is from Bermuda, with the designation holotype on the label, under catalog number 7162. No coral host is mentioned on the label. This specimen is herein designated the lectotype. It is a preovigerous female, 2.4 x 1.8 mm, having an abdomen not fully expanded to form the typical

marsupium. The specimen is missing the left P-2, the distal three segments of the left P-3, the dactylus of the right P-5, and the left cheliped. The carapace has been punctured at the mesogastric region. The lectotype shows other typically juvenile features as mentioned above. The lectotype does not resemble any of the specimens shown in Verrill's (1908a) figure 49.

By the lectotype designation herein, the type locality becomes Bermuda.

Biology.--Ovigerous females have been collected in January (Florida, Mexico, Curacao, all herein), March (Belize, herein), May (Florida, Scotto and Gore, 1981; Ascension Island, herein), June (Florida Middle Ground, Shaw and Hopkins, 1977; Mexico, St. Helena, both herein), July (Florida, Ascension Island, both herein), August (Florida, Mexico, both herein), and November (Ascension Island, herein).

Lasker noted on his collection labels that males were found free-living on the coral colonies he examined in Panama. This observation may indicate that the male found in the stomach of an apogonid fish from the Tortugas was not picked from out of a dwelling by the fish, but rather taken from the surface of the coral. Schmitt's field notes (archived in the USNM) indicate the fish was collected by dynamiting the reef.

This species has been recorded from 0-0.5 m (present study) to 75 m (Coêlho, 1970). Most records are from shallower water.

No parasites were found on the material examined.

Coral Hosts.--*T. corallicola* shows the least degree of host specificity yet known for any gall crab, Atlantic or Pacific (R.K.K, unpublished; also see Fize and Serene, 1957). Because of this, I feel that host coral group should not be used as a character defining genera, as has been used in the past.

Astrocoeniidae: *Stephanocoenia michelinii* Milne Edwards and Haime, 1848, listed by Scott (1985).

Siderastreaeidae: *Siderastrea siderea*, herein.

Faviidae: *Diploria clivosa* (Ellis and Solander, 1786), by Scott (1985); *D. strigosa*, by Scott (1985) and herein; *Favia gravida*, herein; *Manicina areolata*, by Shaw and Hopkins (1977), Scott (1985), and herein; *Montastrea annularis*, by Scott (1985) and herein; *M. cavernosa*, herein.

Oculinidae: *Oculina varicosa* Lesueur, 1820, by Scotto and Gore (1981) and Reed et al. (1982); *Oculina* sp., herein; *Sclerbelia hirtella*, herein.

Meandrinidae: *Dichocoenia* sp., by Shaw and Hopkins (1977:179), but not listed in their material examined.

Mussidae: *Isophyllia sinuosa*, by Scott (1985) and herein; *Mussa angulosa* (Pallas, 1766), by Shaw and Hopkins (1977:179), but not in their material examined; *Mussismilia hispida tenuisepta* (Verrill, 1901), by Coêlho (1966) as

Mussismilia cf. tenuisepta; Mycetophyllia sp., herein;  
Scolymia lacera (Pallas, 1766), by Shaw and Hopkins (1977).

Caryophylliidae: Polycyathus sp., herein.

The dwelling of T. corallicola is a cylindrical pit that may be of considerable length. Dwelling openings are suboval.

Distribution.--Amphi-Atlantic (Figure 11). Troglocarcinus corallicola is the most widely distributed of the Atlantic cryptochirids. In the western Atlantic it has been taken at localities between Bermuda and southeastern Florida to Brazil. In the central Atlantic it occurs on St. Paul Rocks, Ascension Island, and at St. Helena. In the eastern Atlantic it is known from the islands of São Tomé and Pagalu (= Annobon), and off Gabon.

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Table 1. Length:height ratios for meri and propodi of Atlantic gall crab walking legs. Cb = *Cecidocarcinus brychius*; Db = *Detocarcinus balssi*; Oh = *Opecarcinus hypostegus*; Tc = *Troglocarcinus corallicola*.

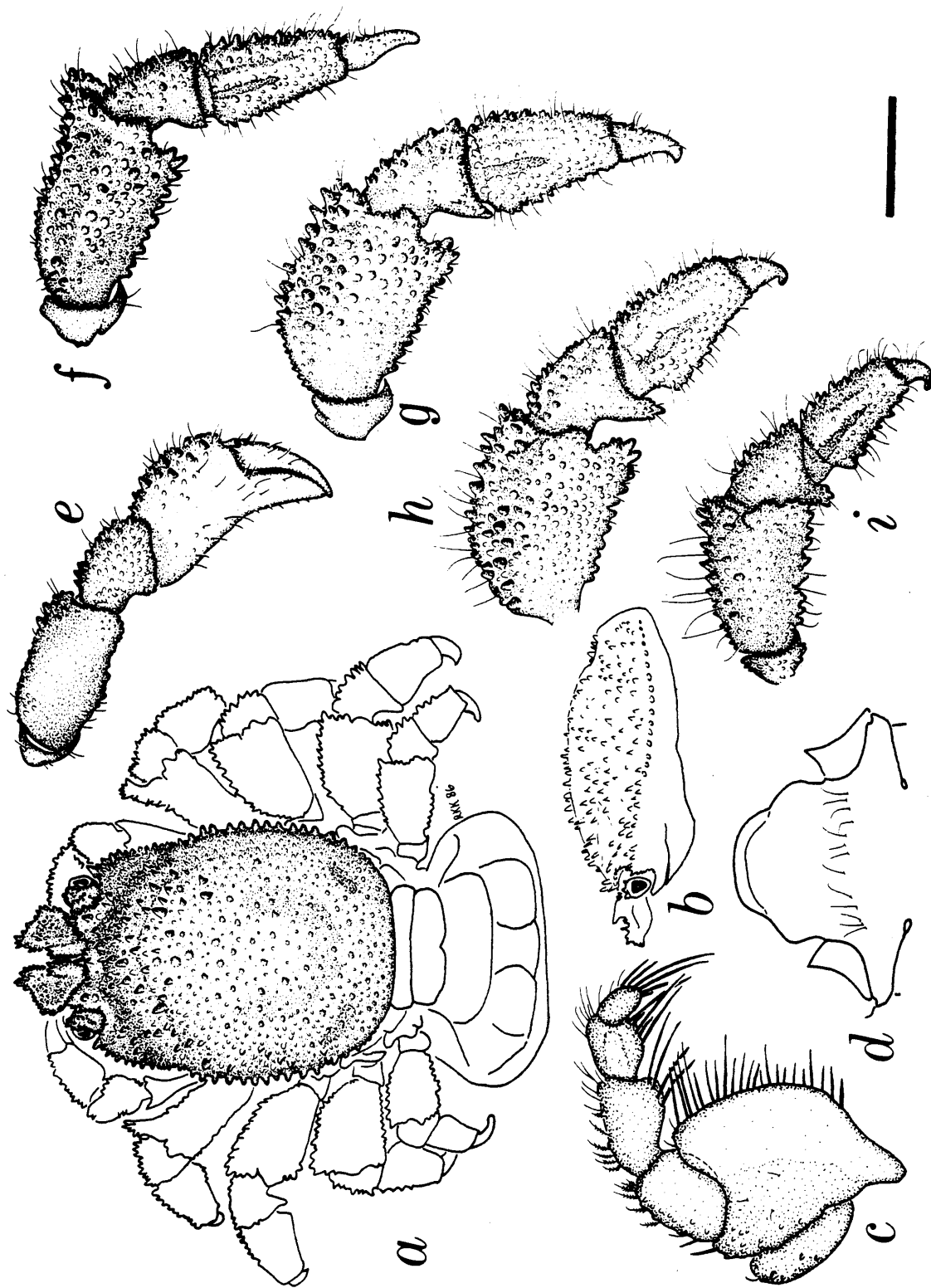
	Cb	Db	Oh	Tc
<b>Merus</b>				
P 2	1.6	1.5	1.7	1.7
P 3	1.6	1.4	1.5	1.6
P 4	1.4	1.4	1.5	1.6
P 5	1.5	1.6	1.8	1.8
<b>Propodus</b>				
P 2	1.8	1.2	1.2	1.1
P 3	1.7	1.7	1.2	1.3
P 4	1.8	1.9	1.6	1.9
P 5	1.6	2.2	2.4	3.1

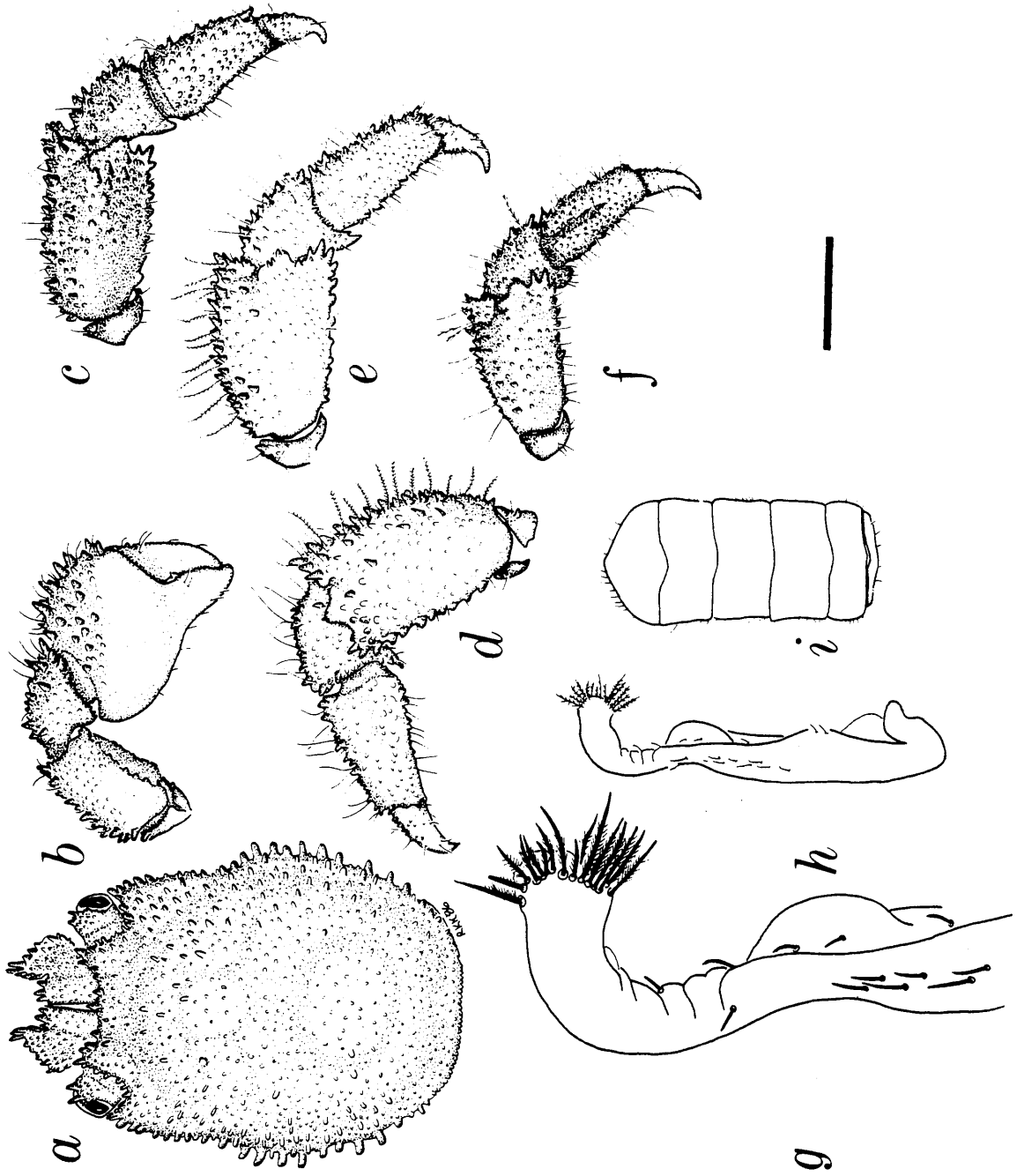


Figure 3. *Cecidocarcinus brychius*, new species, female. **a**, dorsal view of carapace; **b**, lateral view of carapace; **c**, MXP-3; **d**, P-1 sternite; **e-i**, P-1 to P-5. (**a**, holotype, USNM 231662; **b-i**, paratype, ICM. Scale: **a,d-i** = 1 mm; **b** = 2.1 mm; **c** = 0.5 mm.)

Figure 4. *Cecidocarcinus brychius*, new species, male paratype, ICM. **a**, dorsal view of carapace; **b-f**, P-1 to P-5; **g**, detail of PLP-1; **h**, PLP-1. (Scale: **a-f,i** = 1 mm; **g** = 238 um; **h** = 95 um.)

Figure 5. *Detocarcinus balssi* (Monod), female, Angola, USNM 231666. **a**, dorsal view of carapace; **b**, P-1 sternite; **c**, lateral view of carapace; **d-h**, P-1 to P-5; **i**, MXP-3. (Scale: **a,c-h** = 1 mm; **b,i** = 0.5 mm.)





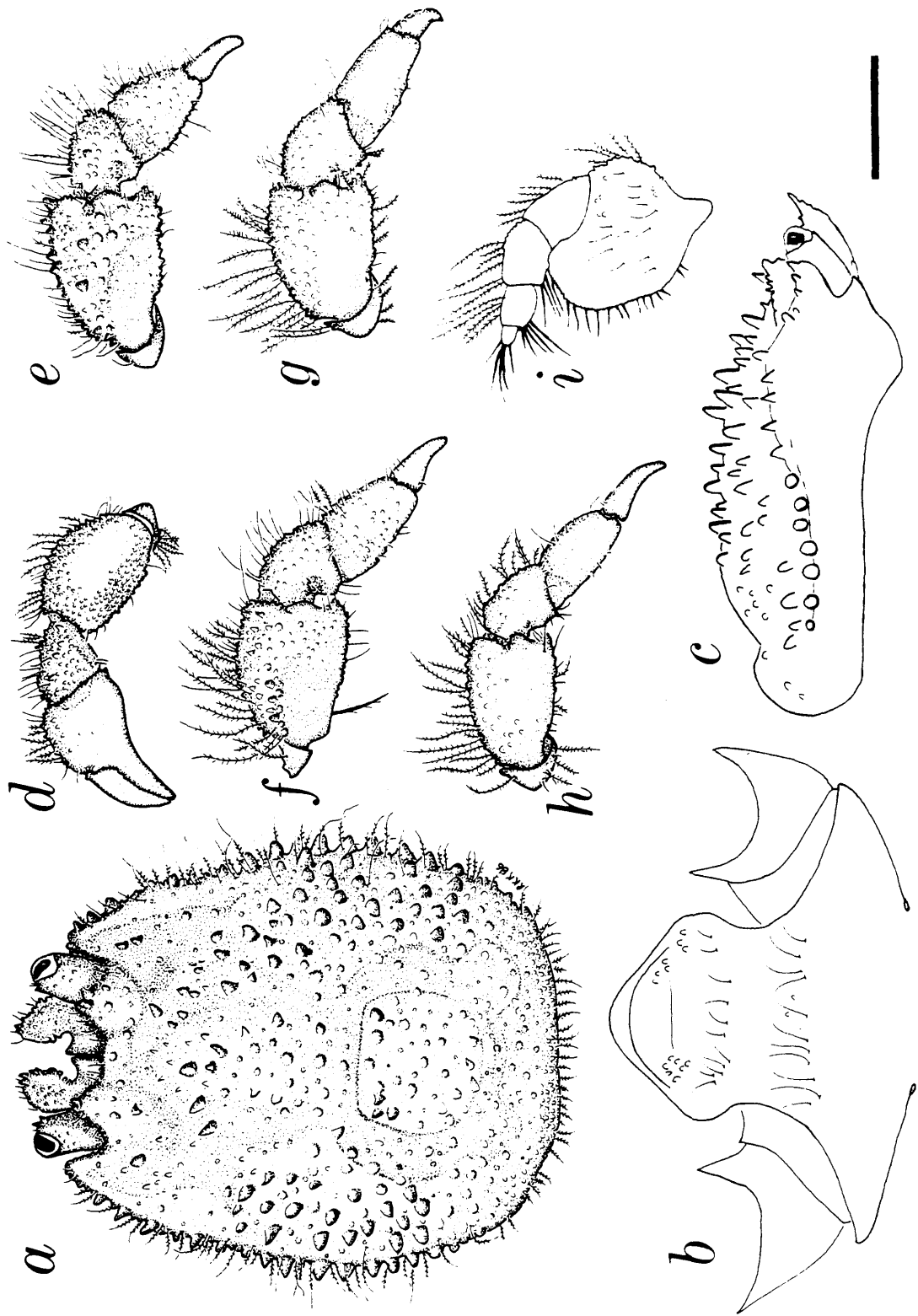
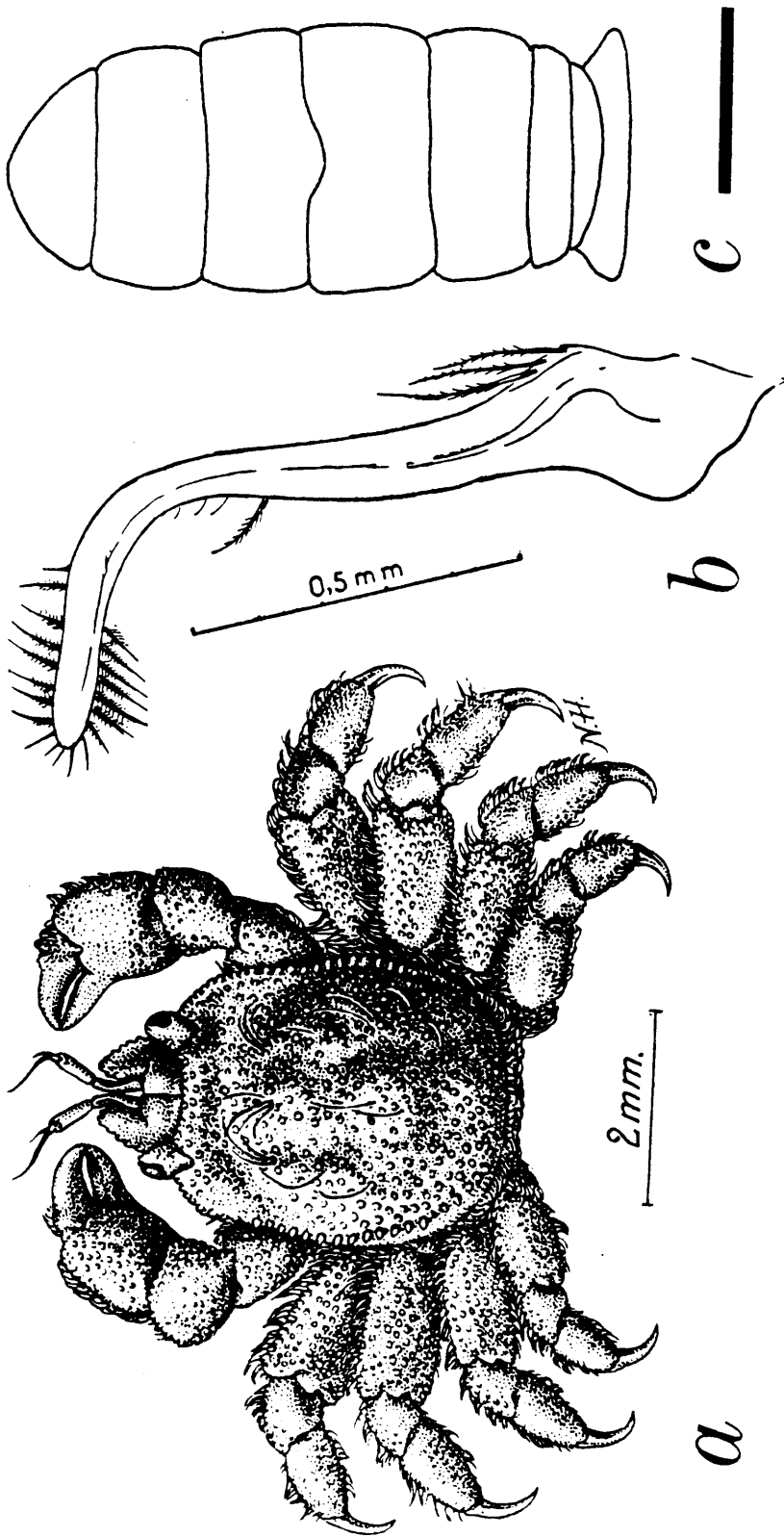


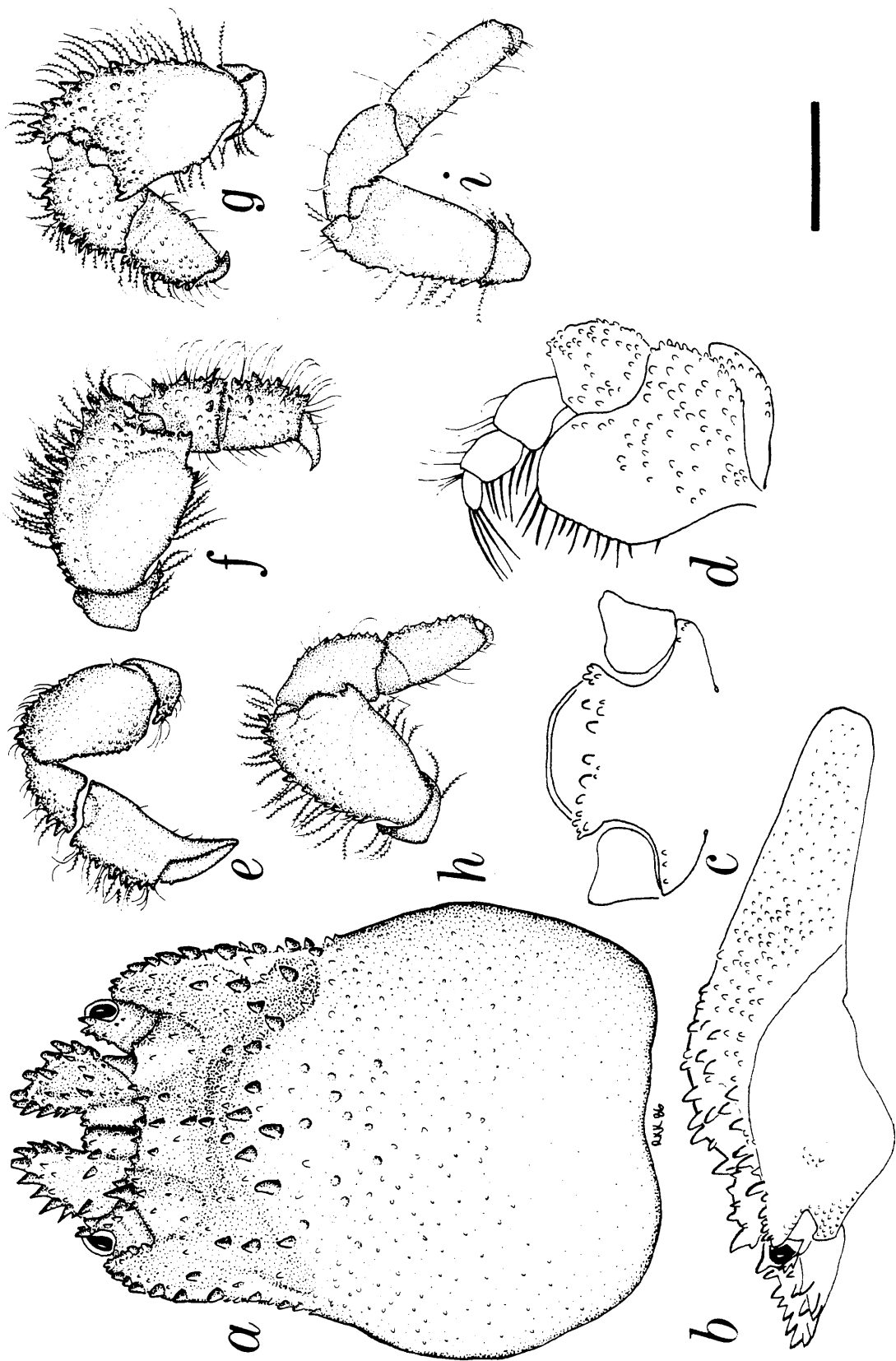
Figure 6. *Detocarcinus balssi* (Monod), male. **a**, dorsal view of paratype; **b**, PLP-1; **c**, abdomen. (**a,b** from Monod, 1956; **c**, Ghana, USNM 231665. Scale: **c** = 0.5 mm.)

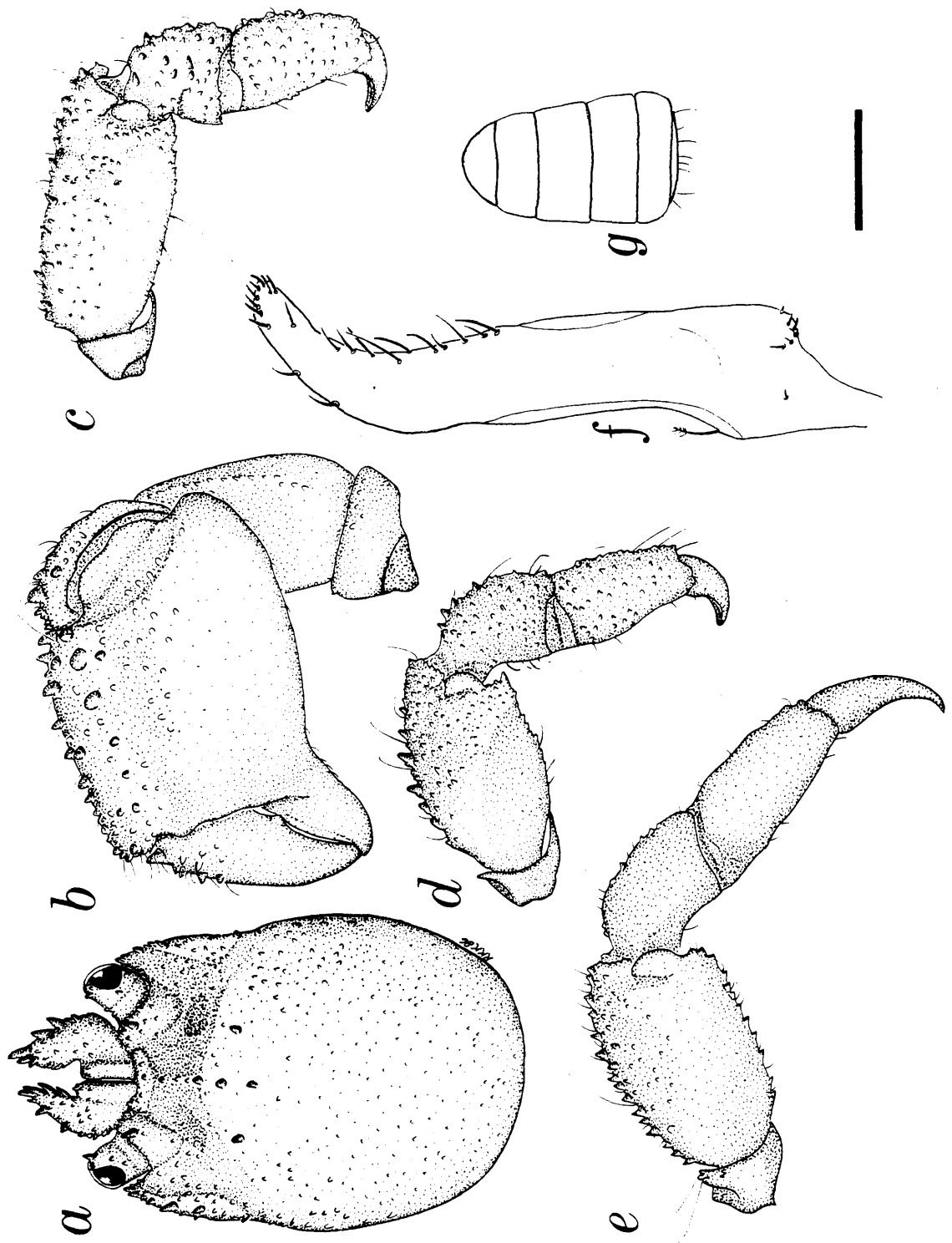
Figure 7. *Opecarcinus hypostegus* (Shaw and Hopkins), female holotype, USNM 168532. **a**, dorsal view of carapace; **b**, lateral view of carapace; **c**, P-1 sternite; **d**, MXP-3; **e-i**, P-1 to P-5. (Scale: **a-c, e-i** = 1 mm; **d** = 0.5 mm.)

Figure 8. *Opecarcinus hypostegus* (Shaw and Hopkins), male. **a**, dorsal view of carapace; **b-e**, P-1 to P-4; **f**, PLP-1; **g**, abdomen. (**a-e**, paratype, USNM 168533; **f**, Florida Middle Ground, IRCZM 89:5117; **g**, USLZ 2708. Scale: **a** = 0.8 mm; **b,e,g** = 0.5 mm; **c,d** = 1 mm; **f** = 238 um.)

Figure 9. *Troglocarcinus corallicola* Verrill, female, Tortugas, USNM 59964. **a**, dorsal view of carapace; **b**, lateral view of carapace; **c**, MXP-3; **d**, P-1 sternite; **e-i**, P-1 to P-5. (Scale: **a,b** = 0.8 mm; **c,d** = 0.5 mm; **e-i** = 1 mm.)









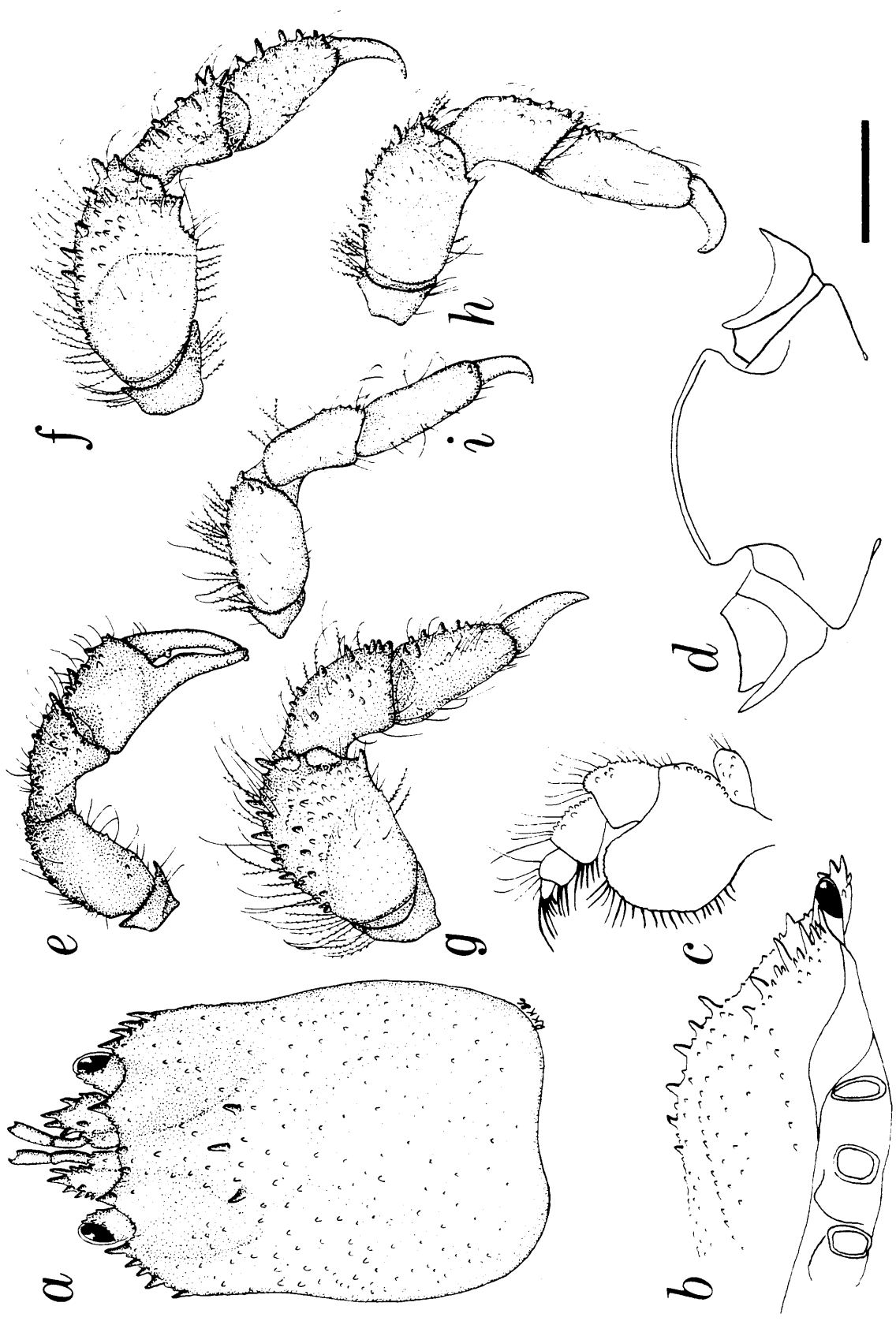
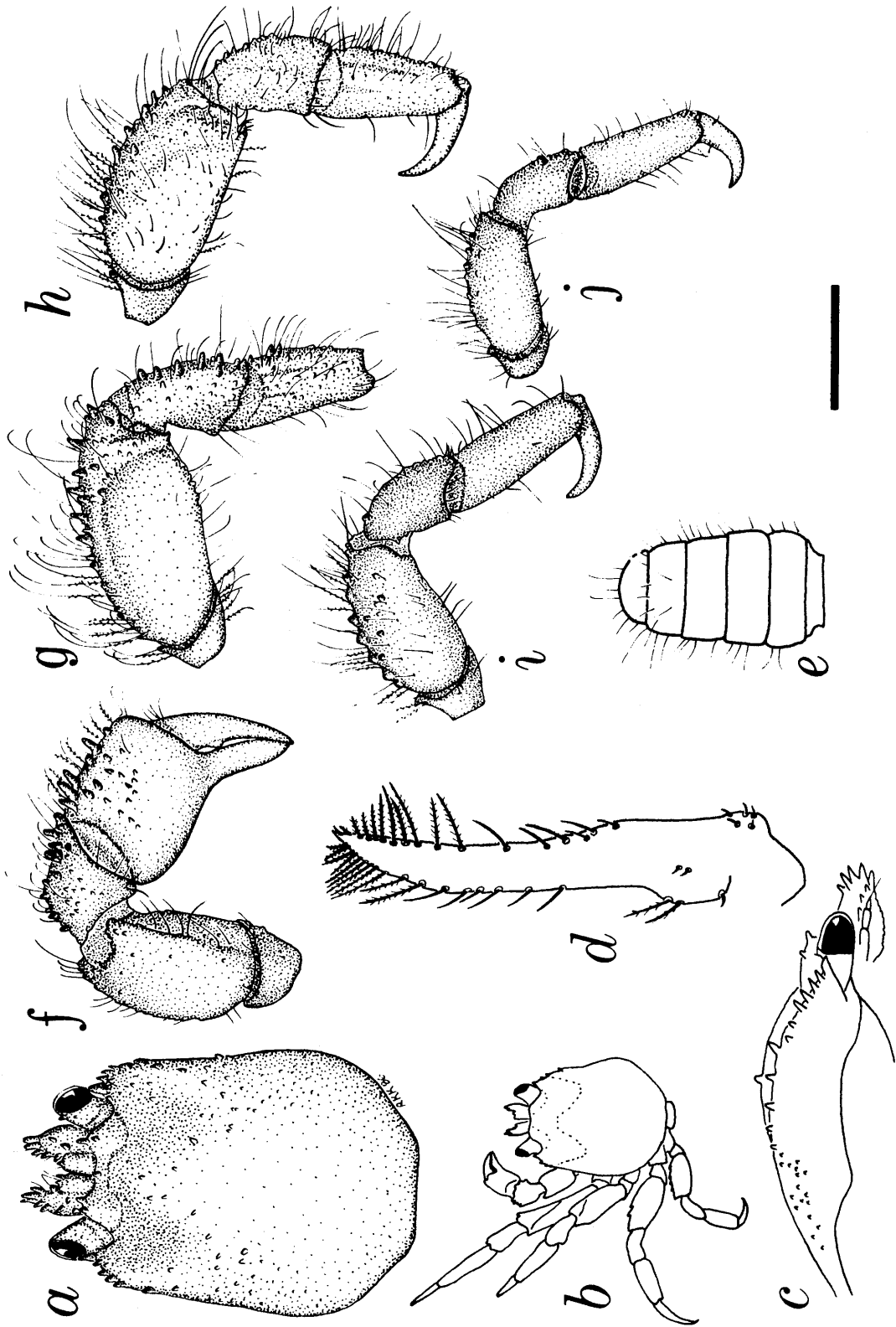
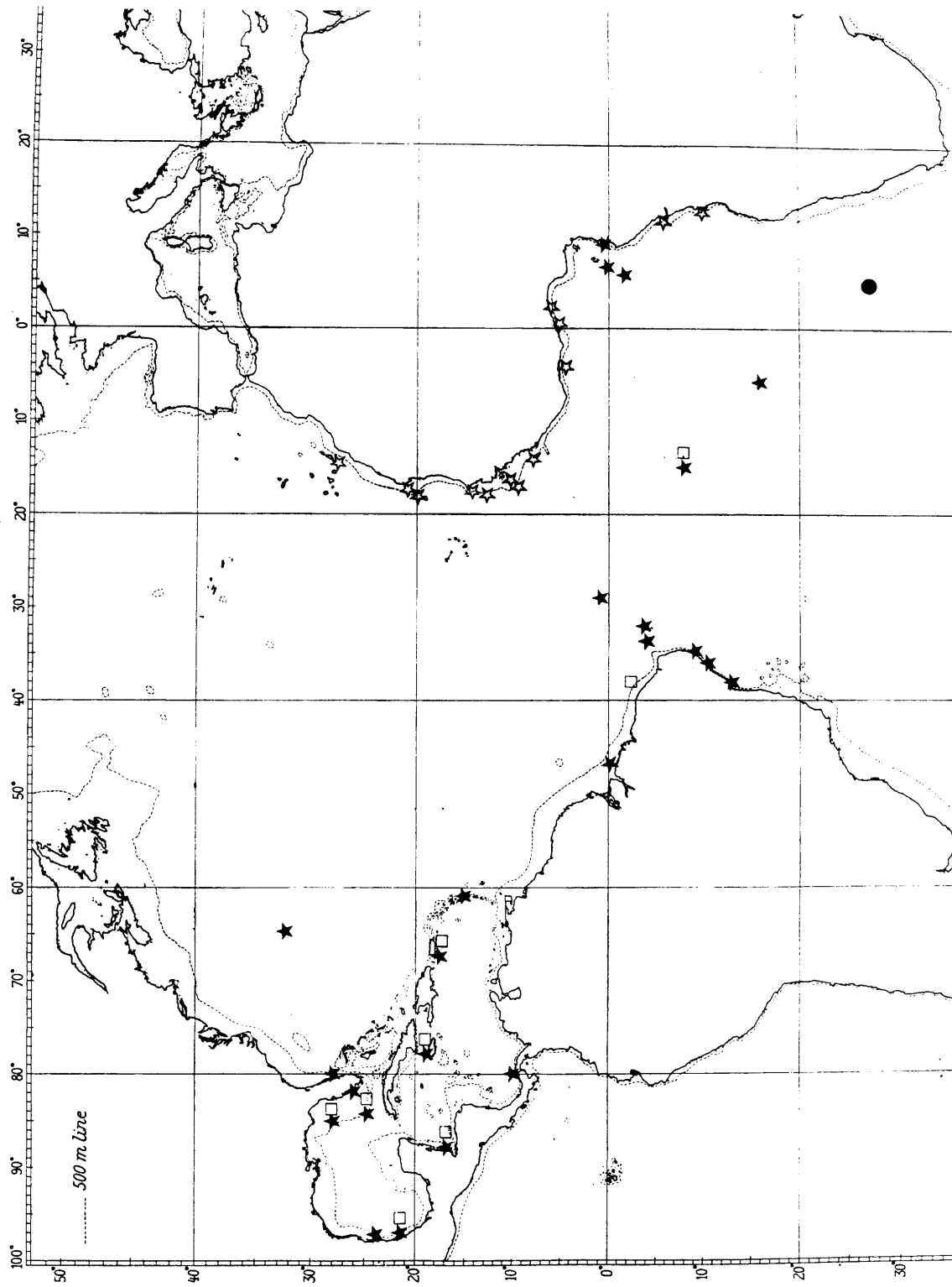


Figure 10. *Troglocarcinus corallicola* Verrill, male. **a**, dorsal view of carapace; **b**, dorsal view of juvenile (right pereopods omitted); **c**, lateral view of carapace; **d**, PLP-1; **e**, abdomen; **f-j**, P-1 to P-5. (**a,c,f-j**, Tortugas, USNM 59964; **b**, Panama, IRCZM 89-2985; **d**, Tortugas, USNM 77365 (cl = 2.9 mm); **e**, off Pepper State Park, IRCZM 89-5116 (cl = 3.6 mm). Scale: **a** = 0.8 mm; **b** = 2.1 mm; **c,e,g-j** = 1 mm; **d** = 238 um; **f** = 1.3 mm.)

Figure 11. Distribution of Atlantic gall crabs based on material reported here and on previous literature records. (Key: solid circle = *Cecidocarcinus brychius*, new species; star = *Detocarcinus balssi* (Monod); square = *Opecarcinus hypostegus* (Shaw and Hopkins); solid star = *Troglocarcinus corallicola* Verrill.)





## Chapter 4

### The Status of *Cryptochirus hongkongensis* Shen, 1936 (Brachyura: Cryptochiridae)

Abstract.--Morphological differences in the extent of the inner orbital angle, the length of the dactylus of the claw, and the shape of the abdomen are presented that support the removal of *Pseudocryptochirus viridis* Hiro from the synonymy of *Cryptochirus hongkongensis* Shen. This evidence also indicates that *C. hongkongensis* should be transferred to *Neotroglocarcinus* and considered a subjective senior synonym of *N. monodi* Fize and Serène.

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In a short paper, Shen (1936) described two new species of the coral gall crab genus *Cryptochirus*. One of these, *C. granulatus*, was synonymized with *C. crescentus* Edmondson, 1925 [now *Opecarcinus crescentus*, see Kropp and Manning (1987)] by Utinomi (= Hiro, 1944), an action followed by all subsequent authors. The status of *C. granulatus* is under review and will be discussed in a subsequent manuscript on the genus *Opecarcinus* in the Indo-Pacific.

The second species described by Shen was *C. hongkongensis*. Utinomi (1944) transferred it to his genus *Pseudocryptochirus* as a subjective senior synonym of *P. viridis* Hiro, 1938, but erred by continuing to use the latter as the valid name for the taxon. This mistake was followed by Fize and Serène (1957), but corrected by Takeda

and Tamura (1981). Both of the major works on Indo-West Pacific gall crabs published since Utinomi have upheld the synonymy (Fize and Serène, 1957; Takeda and Tamura, 1981). Both noted apparent discrepancies between Shen's account and the morphology of *P. viridis*, but neither disputed the synonymy of the two.

Here, I discuss the discrepancies mentioned by Fize and Serène and Takeda and Tamura and present additional evidence supporting the argument for the dissolution of the synonymy between *P. viridis* and *C. hongkongensis*. Furthermore, I argue that *C. hongkongensis* is a subjective senior synonym of *Troglocarcinus monodi* Fize and Serène (1955), the type species of *Neotroglocarcinus* Fize and Serène (1957).

#### Types

I have not been able to locate the type specimen of *Cryptochirus hongkongensis* Shen, 1936. Contrary to the assertion of Fize and Serène (1957:59), the type is probably not in the British Museum (Natural History), London (BMNH). Dr. Raymond B. Manning (Smithsonian Institution, Washington, D. C.), in 1984 and 1987, examined the gall crab collection in the British Museum and did not see any type specimen for the species although he did find the type of *C. granulatus*. Shen (1936) did not report the disposition of the type of *C. hongkongensis*. Although relatively crude, his figures and description do provide enough information by which comparisons to other species can be made. The types for

Neotroglocarcinus monodi (Fize and Serène, 1955) are also not available, however material identified by Serène is available from the BMNH and the Muséum National d'Histoire Naturelle, Paris (MNHN). Additional material examined was collected by the author in Micronesia (HAP and PHAP denote my collection numbers) and is deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C. (USNM).

A series of morphological features that were easily interpreted was selected from the figures and description of C. hongkongensis published by Shen (1936). This series was compared among the species in question. As the type description of Shen's species is based on a male, only males were used in the comparisons. The results are presented below in the form of brief comparative diagnoses, based on males only, for each species. I have reproduced Shen's figures of C. hongkongensis and provided comparative figures of P. viridis and N. monodi. Abbreviations used in the text are: km, kilometers; m, meters; ov, ovigerous; P, pereopod. Size ranges of material examined are given in millimeters as carapace length (cl) x width.

At the first occurrence in the text of collection localities in the Caroline Islands, locality names are given as the new orthographic spelling (Motteler, 1986) followed parenthetically by the former spelling.

Systematic Account

*Pseudocryptochirus viridis* Hiro, 1938

Fig. 12 a-c; 13 a-d

Material.--VIETNAM; Nhatrang [12° 14'N, 109° 12'E]:  
Rocher Noir; Rte. 1643; on *Turbinaria* sp.; 1 + (ov), 1 o;  
BMNH. GUAM: Toguan Bay [13° 17'N, 144° 39'E]; reef front  
south of river channel; 6 m; 27 May 1984; HAP 229; on *T.*  
*stellulata* (Lamarck, 1816); 1 + (ov), 1 o; USNM. Cocos  
Lagoon [13° 14'N, 144° 39'E]; southwest corner of lagoon just  
inside barrier reef; 1 m; 6 Mar, 3 Oct 1984; HAP 155, 272;  
on *Turbinaria stellulata*; 3 + (2 ov), 1 o; USNM. BELAU  
(Palau): Ngeruktabel (Urukthapel) Is. [07° 15'N, 134° 24'E];  
north shore, west end of rock islands; 2 m; 22 Jul 1984;  
PHAP 166; on *T. reniformis* Bernard, 1896; 2 + (ov); USNM.  
Same locality; 2 m; 23 Jul 1984; PHAP 193, 199; on *T.* cf.  
*patula* (Dana, 1846), *T. reniformis*; 3 + (2 ov); USNM.  
POHNPEI (Ponape): Main lagoon, inside barrier reef about  
1.6 km north of Main Passage [07° 00'N, 158° 13'E]; 2 m; 14  
Nov 1984; PHAP 244; on *T.* cf. *mesenterina* (Lamarck, 1816); 1  
+ (ov), 2 o; USNM. Ant Atoll [06° 47'N, 157° 58'E]; reef  
front off Imwinyap Is., 100 m west of pass; 8 m; 17 Nov  
1984; PHAP 284; on *T. reniformis*; 1 +, 1 o; USNM.

Size Ranges.--Females, 1.8 x 1.6 to 3.3 x 2.8; smallest  
ovigerous female, 1.8 x 1.6; males; 1.6 x 1.3 to 2.1 x 1.8.

Diagnosis.--Anterior third of carapace slightly  
depressed, not sharply set off from posterior carapace,



latter lacking grooves or depressions; internal orbital angle greatly exceeding anterolateral angle of carapace. Basal segment of antennule with mesial margin straight, dorsal surface with longitudinal row of spines near mesial margin. Width of abdominal somite 6 about 1/2 that of somite 3. Dactylus of cheliped (P-1) longer than dorsal margin of palm, latter with spines along entire length. Propodus of P-3 about 1.4 times longer than high, dorsal margin with tubercles. Gonopod tapering sharply, mesial, and lateral margins with plumose setae originating just proximal to midlength.

***Neotroglocarcinus monodi* (Fize and Serène, 1955)**

Fig. 12 g-i; 13 i-1

Material.--VIETNAM; Nhatrang: Rte. 1590; on *T. peltata* (Esper, 1797); 1 + (ov), 1 o; MNHN. Bai Mieu; 11 Apr 1956; Rte. 1637; on *T. peltata*; 1 o; BMNH. Rocher Noir; 8 May 1956; Rte. 1643; on *T. peltata*; 1 + (ov); BM(NH).

Size Ranges.--Females, 3.2 x 2.7 to 4.6 x 4.1; smallest ovigerous female, 3.2 x 2.7; males, 3.2 x 2.9 to 3.8 x 3.4.

Diagnosis.--Anterior third of carapace markedly depressed, sharply set off from posterior carapace, latter with series of shallow, longitudinal depressions; internal orbital angle slightly exceeding anterolateral angle of carapace. Basal segment of antennule with mesial margin convex, dorsal surface with scattered tubercles, lacking longitudinal row of spines near mesial margin. Width of

abdominal somite 6 about 3/4 that of somite 3. Dactylus of P-1 shorter than dorsal margin of palm, latter with few tubercles proximally. Propodus of P-3 about 1.8 times longer than high, dorsal margin entire. Gonopod not tapering sharply, mesial, and lateral margins with plumose setae originating at about midlength.

Cryptochirus hongkongensis Shen, 1936

Fig. 12 d-f; 13 e-h

From Shen (1936).

Size.--Male, 2.3 x 2.0.

Diagnosis.--Anterior third of carapace markedly depressed, sharply set off from posterior carapace, surface of latter uncertain; internal orbital angle slightly exceeding anterolateral angle of carapace. Basal segment of antennule with mesial margin convex, dorsal surface with scattered tubercles, lacking longitudinal row of spines near mesial margin. Width of abdominal somite 6 about 3/4 that of somite 3. Dactylus of P-1 shorter than dorsal margin of palm, latter with few tubercles proximally. Propodus of P-3 about 1.7 times longer than high, dorsal margin entire. Gonopod tapering sharply, mesial, and lateral margins with simple setae originating near or distal to midlength.

Discussion

From the above comparisons and the figures provided, it is clear that C. hongkongensis is quite different from P. viridis, and further, that C. hongkongensis strongly

resembles *N. monodi*. These relationships are most strongly supported by features such as the relative extent of the internal orbital angle compared to the anterolateral angle of the carapace, the relative demarcation between the anterior and posterior parts of the carapace, the relative length of the dactylus of the P-1, and the shape of the abdomen as indicated by the relative widths of somite 3 and 6.

Some evidence is equivocal. Setation on the dorsal margins of the walking legs (Fig. 13) allies *C. hongkongensis* more closely to *P. viridis* than to *T. monodi*. However, I have noticed that setation can be variable within gall crab species. Also, setules on walking leg setae are often difficult to see and may have been missed by Shen. The gonopod figured by Shen is problematic. It tapers, as does the gonopod of *P. viridis*. Yet, the setation differs between the two, both in type (plumose in *P. viridis*, simple in *C. hongkongensis*) and position of origin (proximal to midlength in *P. viridis*, midlength or just distal in *C. hongkongensis*). Shen may have erred in figuring the gonopod. Shen's figures and descriptions of the mouthparts and antenna of *C. hongkongensis* are too general to be of use in resolving the affinities of each taxon.

The evidence presented by Utinomi (1944) for synonymizing *P. viridis* with *C. hongkongensis* is weak. He noted (p. 702) the antennule of "*hongkongensis* seems akin to *viridis*" and (p. 703) the third maxilliped of *hongkongensis*

"shows close similarity to that of viridis." He further argued (p. 725) that the probable identity of the two was supported by "distributional evidences that both forms have been recorded together from neighboring seas."

Fize and Serène (1957:142) noted in particular the differences in the relative extent of the internal orbital angle and the relative length of the dactylus of the P-1 among the three taxa that I have mentioned. However, they did not ally C. hongkongensis with T. monodi, stating that Shen described the carapace as having "petites épines" a feature they attribute to P. viridis, not T. monodi. This is not true. Shen (p. 23) describes the carapace as "finely granulate", not as having spinules.

Takeda and Tamura (1981:16) noted the same two discrepancies mentioned above and the relative demarcation between the anterior and posterior carapace regions. They declared that these differences are "too small" to warrant separation of the two species. I disagree. Differences of the magnitude presented here are enough to separate species of gall crabs.

The evidence presented here supports the restoration of Pseudocryptochirus viridis Hiro to valid status. This evidence further indicates that Cryptochirus hongkongensis Shen is a subjective senior synonym of Troglocarcinus monodi Fize and Serène, the type species of Neotroglocarcinus Fize and Serène. Shen's species should now be known as Neotroglocarcinus hongkongensis (Shen).

### Acknowledgments

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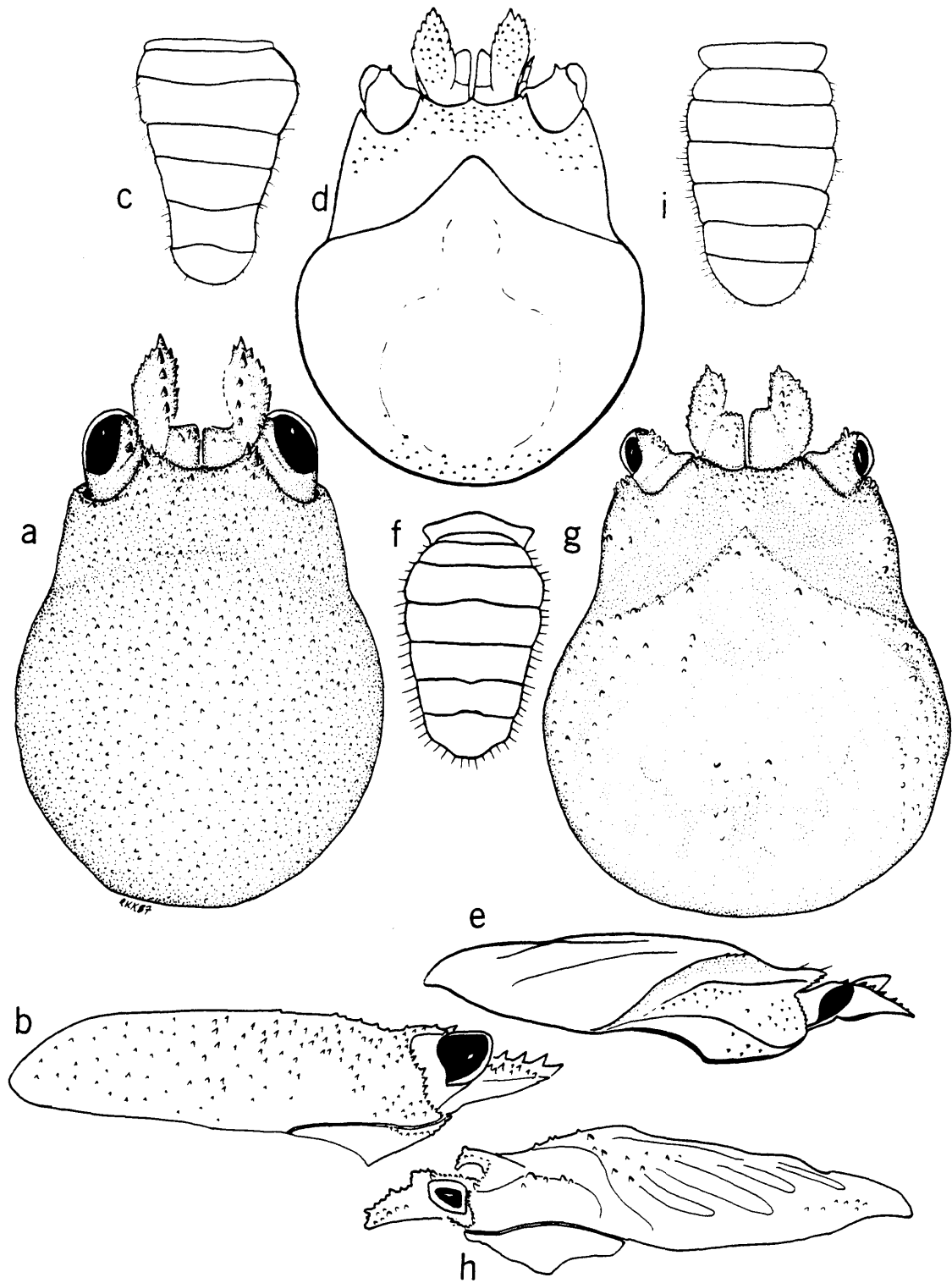
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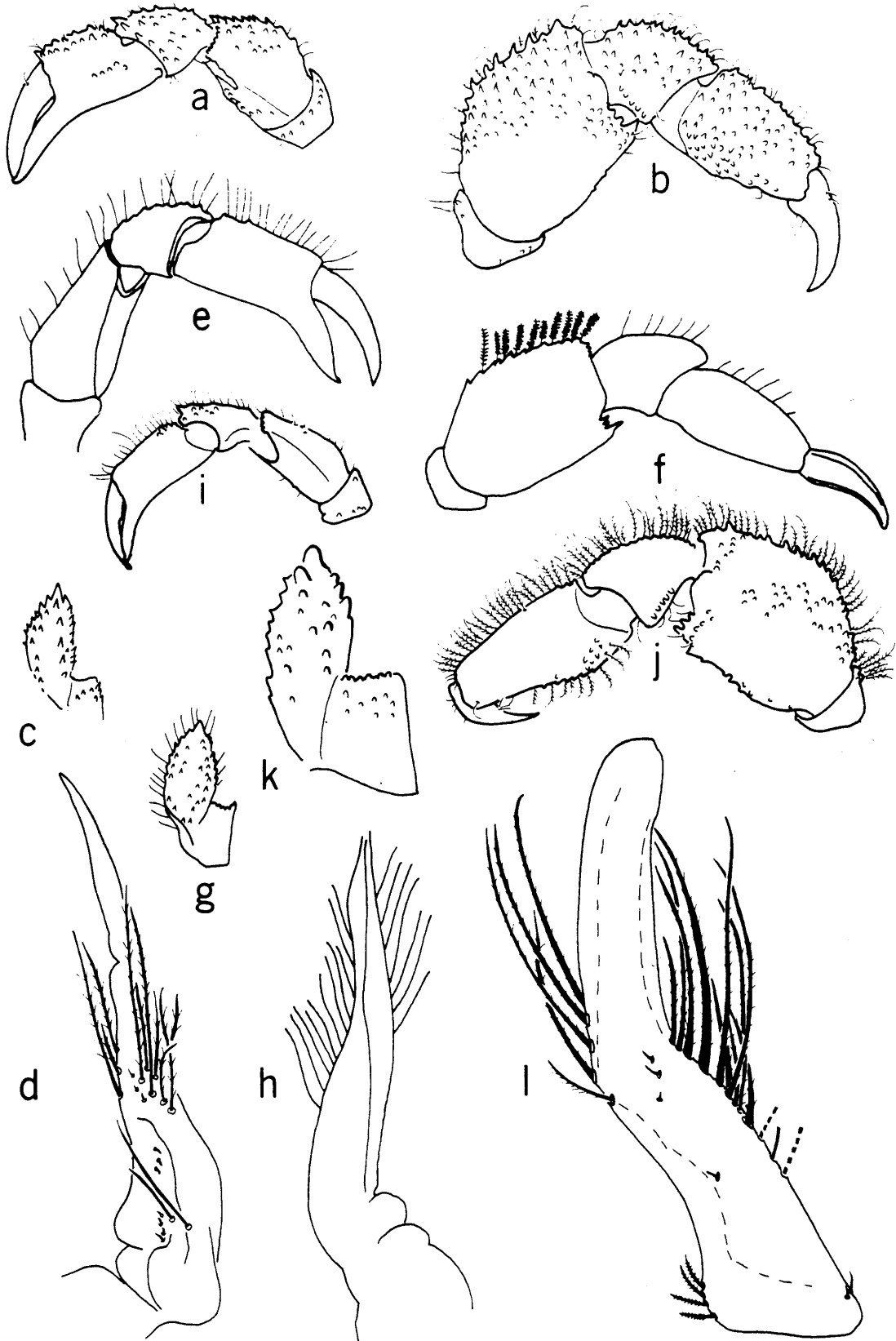
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Fig. 12. Dorsal, lateral views of carapace, and abdomen. (a-c), *Pseudocryptochirus viridis*, Pohnpei, USNM, cl = 1.9 mm; (d-f), *Cryptochirus hongkongensis*, from Shen (1936), cl = 2.3 mm; (g-i), *Neotroglocarcinus monodi*, Vietnam, MNHN B-18762, cl = 3.8 mm. All males. Not to scale.

Fig. 13. Pereopods 1 and 3, antennule, and gonopod. (a-d), *Pseudocryptochirus viridis*, USNM; (e-h), *Cryptochirus hongkongensis*, from Shen (1936); (i-l), *Neotroglocarcinus monodi*, MNHN B-18762. All males. Not to scale.







## Chapter 5

### The Status of *Cryptochirus coralliodytes* Heller and *Lithoscaptus paradoxus* Milne Edwards (Brachyura: Cryptochiridae)

Abstract.--The types of *Cryptochirus coralliodytes* Heller and *Lithoscaptus paradoxus* Milne Edwards were examined and found to differ in sculpture of the carapace, the epistome, and relative lengths of the carpus and merus of the fifth pereopod among other features. Therefore, the latter is removed from the synonymy of the former. The type of *Cryptochirus rugosus* Edmondson was examined and found to be indistinguishable from *C. coralliodytes*; thus, *C. rugosus* is placed in synonymy with *C. coralliodytes*. The available data suggest that *Cryptochirus bani* Fize and Serène is synonymous with *L. paradoxus*. Lectotypes are designated for *C. coralliodytes* and *L. paradoxus* and are described and figured.

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Two years after the description of the first known coral gall crab, *Hapalocarcinus marsupialis* Stimpson, 1859, the second recorded species, *Cryptochirus coralliodytes*, was described by Heller (1861:19). Milne Edwards (1862:F10) followed this with the description of a third species, *Lithoscaptus paradoxus*. All three species were rather incompletely described, probably because they were reasonably different from most other brachyurans known at

the time. Although this inadequacy has not been a problem for the first species it has resulted in some misunderstanding regarding the latter two species.

The problem regarding the identities of *C. coralliodytes* and *L. paradoxus* can be traced to the failure of authors to examine type specimens or carefully consider information provided in the original descriptions that should have been useful in separating the two species. Paulson (1875) was the first to place the two in synonymy, but did so by erroneously considering *L. paradoxus* a senior synonym of *C. coralliodytes*. He did not justify his action. Richters (1880) agreed, but did correct the order of synonymy. Rathbun (1897) also noted Paulson's error. After Calman (1900) followed Paulson's action, all authors up until the review of the family by Fize and Serène (1957) attributed the synonymy of the two species to Paulson and/or Calman without question or examination of the types (e. g. Edmondson, 1933; Shen, 1936; Utinomi, 1944). Fize and Serène (1957) discussed *Cryptochirus* in detail and examined the syntypes of *Lithoscaptus* and *Cryptochirus* that are in the collection of the Muséum National d'Histoire Naturelle, Paris. In spite of doing so, they upheld the synonymy of the two species. More recently, Takeda and Tamura (1980) reviewed *Cryptochirus*, but did not alter the status of the two species.

I examined the syntypes of *C. coralliodytes* and *L. paradoxus* and determined that they are not synonymous.

Herein I designate lectotypes for each species and conclude that Heller's species is a subjective senior synonym of *Cryptochirus rugosus* Edmondson, 1933. Because *C. rugosus* is the type species of the genus *Favicola* Fize and Serène, 1957, the latter should now be considered a subjective junior synonym of *Cryptochirus* Heller, 1861.

#### Materials and Methods

I examined the male and female syntypes of *Cryptochirus coralliodytes* Heller housed in the Muséum National d'Histoire Naturelle, Paris (MNHN) and Naturhistorisches Museum, Vienna (NMW), respectively; the syntypes of *Lithoscaptus paradoxus* Milne Edwards in the MNHN; and the holotype of *Cryptochirus rugosus* Edmondson held in the B. P. Bishop Museum, Honolulu (BPBM). Additional material examined came from the BPBM and my own collections (denoted as HAP and PHAP) made in Micronesia in 1984. The Micronesian material is deposited in the National Museum of Natural History, Smithsonian Institution, Washington D. C. (USNM). Place names for collection sites in the Caroline Islands are from Bryan (1971). At the first occurrence in the text of each locality, the new orthographic spelling (Motteler, 1986) is given followed parenthetically by the former spelling. Subsequently, only the new spelling is used.

Some of the Micronesian material was used in the preparation of the figures and for study by Scanning

Electron Microscopy (SEM). In preparation for SEM, specimens were dissected and cleaned by gentle mechanical agitation, and brushing with a fine paint brush. Specimens were then transferred to 100% ethanol via a graded series and air-dried overnight. Dried specimens were mounted on stubs and sputter-coated with gold-palladium and viewed with a Cambridge Stereoscan-100 microscope at an accelerating voltage of 10 kv.

Drawings were made with a camera lucida mounted on a Wild M-5 microscope. The cheliped was drawn so that the outer surface of the manus is in the plane of the printed page. This distorts the relative proportions of the other segments, particularly the merus. Male pleopods were prepared for illustration by lactic acid digestion and staining using methods described in Kropp and Manning (1987), except acid fuchsin was substituted for fast green.

The carapace length and width of each specimen were measured to the nearest 0.1 mm with an ocular micrometer on a Wild M-5 microscope and are reported in mm as length x width. Abbreviations used in the text are: m, meters; MXP, maxilliped; ov, ovigerous; P, pereopod; PLP, pleopod; and TL, type locality.

In the systematic account, I have restricted the generic synonymies to the original usage of a name for each taxon. For each nominal species the type locality and the location of the type specimen are included.

Systematic Account

Cryptochirus Heller, 1861

Cryptochirus Heller, 1861a:19 [type species: Cryptochirus coralliodytes Heller, 1861a:19 by monotypy; gender masculine].

Favicola Fize and Serène, 1957:84 [type species: Cryptochirus rugosus Edmondson, 1933:6 subsequent designation by Serène (1966:396); gender masculine (see Remarks)].

Remarks.--The International Code of Zoological Nomenclature (ICZN, 1985) specifies that a genus-group name ending in a noun of variable gender, such as -icola, should be treated as masculine unless its author specifies that it is feminine or treats it as feminine by the use of feminine species-group names [Article 30 (a) (i)]. Serène (1966) was the first to use Favicola as a distinct generic name and did so with masculine species-group names. Therefore, the gender of Favicola is masculine.

Cryptochirus coralliodytes Heller

Figures 14-16

Cryptochirus coralliodytes Heller, 1861a:19 [TL: Red Sea; lectotype NMW, paralectotype MNHN]; 1861b:370, plate IV, figures 33-39.

Cryptochirus corralliodytes Heller, 1861a:19 [incorrect original spelling].

Cryptochirus rugosus Edmondson, 1933:6, figure 1, plate 1  
[TL: Line Islands, Teraina [= Washington Island];  
holotype BPBM S3668].

Types.--Two syntypes of C. coralliodytes are extant. The female syntype is ovigerous, 6.6 x 4.5 mm, and housed in the Naturhistorisches Museum, Vienna. It is herein designated the lectotype. The specimen is disarticulated, with the carapace being detached from the thorax which is missing. The right P-3 to P-5, mouthparts, antennae, and antennules are missing. The abdomen is detached, in poor condition, some pleopods are present. The male syntype, 5.0 x 3.0 mm, is in good condition having all pereopods, mouthparts, and pleopods present. It is housed in the Muséum National d'Histoire Naturelle, Paris, and is herein designated the paralectotype. I examined the holotype of C. rugosus at the BPBM in 1984, but have not been able to re-examine it as it is now missing (B. Burch personal communication to R. B. Manning, 1987). It is a female and agrees with the lectotype of C. coralliodytes.

Material Examined.--RED SEA [no specific locality]:  
lectotype, female, 6.6 x 4.5, (NMW); paralectotype, male,  
5.0 x 3.0, (MNHN 198-63). CAROLINE ISLANDS: Belau (Palau):  
Ngerekebesang (Arakabesan) Is. [07° 21'N, 134° 27'E]; north  
side of cove on west side of island; PHAP 078; 4 m; 7 Jul  
1984; on Platygyra lamellina (Ehrenberg, 1834); 2 + (1 ov),  
1 o. Pohnpei (Ponape): Sokehs Passage [07° 00'N, 158° 11'E];  
patch reef bordering west side of reef; PHAP 270; 2 m; 16

Nov 1984; on P. daedalea Ellis and Solander, 1786; 2 +.  
MARIANA ISLANDS: Guam: Double Reef [13 36'N, 144 50'E];  
shoreward side of main patch reef; HAP 125; 9 m; 24 Feb  
1984; on Platygyra sp.; 1 +, 1 o. LINE ISLANDS: Teraina (= Washington Is.) [04 43'N, 160 24'W]: 1 + (BPBM S3668, holotype of Cryptochirus rugosus Edmondson).

Description.--Lectotype female (Fig. 14, 15, NMW), except mouthparts, antenna, antennule, and epistome (based on material from Micronesia). Carapace about 1.5 times longer than broad, widest near midlength. Anterior carapace with inverted "V"-shaped depression, anterior gastric region slightly inflated; mid carapace with clusters of prominent, rounded tubercles on posterior gastric, anterior and posterior epigastric regions; posterior surface with scattered pointed and rounded tubercles. Regions of posterior half of carapace set off by series of well-formed grooves, epigastric region divided into anterior, posterior portions by distinct groove. Anterolateral margin of carapace spinous.

Anterolateral angle of carapace with single tubercle, apex exceeding inner orbital angle, latter swollen, with tubercle. Front concave, with few tubercles just behind margin; width about 1/2 that at anterolateral angles, latter about 2/5 greatest carapace width. Orbit deeply "V"-shaped.

Epistome with subparallel longitudinal ridges laterally, median area produced anteriorly into longitudinal ridge subequal in thickness to lateral ridges; anterior



margin with few tubercles, slightly sinuous, with scant median indentation.

Basal segment of antennular peduncle with elliptical projection extending beyond length of eyestalk, apex spine-tipped, no angled lateral lobe. Dorsal surface flat, with few pointed tubercles. Mesial margin spinous. Ventral surface of second antennal segment with scattered granules, distal margin toroidal (Fig. 15c).

Eye directed anterolaterally, extending beyond anterolateral angle; cornea subterminal, occupying distal third of stalk in dorsal view. Stalk mostly exposed, broadening proximally; ventral surface with few granules.

MXP-3 with exopod, mesial margin of ischium convex; outer surface with distally-raised granules. Merus longer than broad, width less than half that of ischium. Carpus shorter than length of propodus and dactylus combined.

Endopod of MXP-1 triangular, mesial margin about  $2/3$  length of lateral margin, anterior margin with sharp curve occurring mesially, lined with stout simple setae.

Chelipeds (P-1) with few scattered simple, pappose setae on upper margins. Dactylus longer than dorsal margin of palm, cutting edges of fingers entire. Dorsal margin of palm entire, outer and upper surfaces with few granules proximally. Manus slightly smaller than merus.

Dorsal margin of merus of P-2 with spines distally, fringed with pappose setae of length  $> 2$  times that of spines; outer surface flat, with granules dorsodistally,

ventrally; ventral margin relatively straight, with few tubercles, fringed with pappose setae; ventrodistal angle with prominent tubercles (tubercles worn on lectotype). Merus height < 2 times that of carpus. Dorsal margins of carpus and propodus with robust spines, simple setae; outer surfaces with tubercles dorsally, ventrally; carpus subequal in length to propodus. Dactylus with proximal tooth dorsally; tip with subterminal pore. P-3, P-4 similar in form to P-2, stockier, P-4 less setose. P-5 elongate, smooth; carpus longer than other segments; propodus, dactylus directed anteriorly.

Sternite of P-1 with few granules, that of P-4 with median suture. Female opening longitudinal, oval, with hood; PLP-2 biramous, PLP-3 uniramous.

Variations.--May have spines instead of tubercles at inner orbital angles, anterolateral angles, and on anterior surface of carapace. Spines vary as to number and sharpness. The width and depth of the grooves on the carapace varies considerably. The proximal tooth on the dorsal surface of the dactylus of P-2 may be missing. Smaller females may have a deeper depression on the anterior carapace, may be less spiny, and have a more elongate projection of the antennule base than larger females. The carapace length:width ratio ranged from 1.2 to 1.7 with most crabs within 1.4 to 1.6.

Paralectotype male (Figure 16).--Similar to, smaller than female. Carapace regions distinctly marked as female,

spines, rounded tubercles less pronounced. Projection of antennule base more elongate, pointed. P-1 robust, palm inflated, with tubercles; dactylus slightly longer than dorsal margin of palm. Abdominal somites 5-7 narrower than somites 3-4; telson broadly rounded. PLP-1 reaching middle of sternite of P-1; slightly curved, apex sharply pointed, directed slightly laterally; lateral margin with stout setae.

Variations.--P-1 much less robust in smaller males, with the dactylus relatively longer than paralectotype. Regions of carapace may have fewer tubercles.

Lithoscaptus Milne Edwards, 1862

Lithoscaptus Milne Edwards, 1862:F10 [type species:

Lithoscaptus paradoxus Milne Edwards, 1862:F10, by monotypy; gender masculine].

Lithoscaptus paradoxus Milne Edwards

Figures 17-19

Lithoscaptus paradoxus Milne Edwards, 1862:F10 [TL: Reunion; lectotype, MNHN].

Cryptochirus coralliodytes var. rubrolineata Fize and

Serène, 1957:40, figure 5D, plate 14, figures E-H [TL: Nhatrang, Vietnam; location of type unknown].

Cryptochirus coralliodytes var. cubrolineata.--Fize and Serène, 1957:201 [erroneous spelling].

Cryptochirus coralliodytes var. fusca Fize and Serène,  
1957:40, figure 5B [TL: Nhatrang, Vietnam; location of  
type unknown].

Cryptochirus coralliodytes var. parvulus Fize and  
Serène, 1957:40, figure 5C [TL: Nhatrang, Vietnam;  
location of type unknown].

Cryptochirus bani Fize and Serène, 1957:44, figures 5F, 6,  
plates 1, figure 7 [TL: Nhatrang, Viet-Nam; location of  
type unknown].

Type.--Two specimens are in the vial from the MNHN  
labelled Lithoscaptus paradoxus "TYPE". One is a  
nonovigerous female that is herein designated the lectotype.  
The carapace of this female is somewhat misshapen, but still  
recognizable. Both P-2 are missing, but the remaining  
pereopods are present as are all mouthparts. The pleopods  
are present and are uniramous. The second specimen is  
Cryptochirus coralliodytes Heller. Milne Edwards indicated  
which specimen on which he based his description by his  
reference to uniramous female pleopods (1862:F12). For this  
reason that the larger female is selected as the lectotype.

Material examined.--INDIAN OCEAN: Reunion Island  
[20° 18'S, 57° 29'E]: lectotype, 1 + 6.4 x 5.3, (MNHN).  
PACIFIC OCEAN: CAROLINE ISLANDS: Belau: Ngeruktabel Is.;  
patch reef among rock islands on northeast shore; PHAP 045;  
2 m; 2 Jul 1984; on Goniastrea pectinata (Ehrenberg, 1834);  
2 + (1 ov), 1 o. MARIANA ISLANDS: Guam: Luminao Reef  
[13° 28'N, 144° 39'E]; reef flat toward Magundas; HAP 315; 1

m; 13 Oct 1984; on *P. daedalea*; 2 + (ov), 1 o. COOK  
ISLANDS: Rarotonga [21° 14'S, 159° 46'W], Ararua; Wilder and  
Parks; Jun-Jul 1929; [no host]; 13 + (ov) (BPBM S3221).

Description.--Female, based on lectotype in conjunction with a Guam female (Figure 17, 18 USNM). Carapace about 1.2 times longer than broad, widest just posterior to midlength. Anterior carapace with broadly "W"-shaped depression having scattered spines; anterior gastric region slightly inflated; median gastric with 2 depressions; mid to posterior carapace with many rounded tubercles, regions of carapace not well defined; cardio-intestinal region rimmed anteriorly, laterally with depression. Anterolateral margin of carapace spinous.

Anterolateral angle of carapace with single spine, apex exceeding inner orbital angle, latter swollen, with subterminal spine. Front concave, entire, width about 1/2 that at anterolateral angle, latter 2/5 greatest carapace width. Orbit "V"-shaped.

Epistome with subparallel longitudinal ridges laterally; median area swollen, lacking ridge; anterior margin entire, straight, with scant median indentation.

Basal segment of antennular peduncle with suboval projection extending slightly beyond eyestalk, rounded distally, no angled lateral lobe; dorsal surface flat, without tubercles; entire margin with subequal spines. Ventral surface of second antennal segment with few granules, distal margin with few raised granules.

Eye directed anterolaterally, extending just beyond anterolateral angle; cornea subterminal, occupying distal quarter of stalk dorsally. Stalk mostly exposed, not broadening proximally; ventral surface smooth.

MXP-3 with exopod, mesial margin of ischium slightly convex, outer surface with many distally-raised granules. Merus longer than broad, width less than half that of ischium. Carpus shorter than length of propodus and dactylus combined.

Endopod of MXP-1 subquadrate, mesial margin about  $3/5$  length of lateral margin; anterior margin with sharp median curve, lined with stout simple setae.

Chelipeds (P-1) with many scattered simple setae on upper margins. Dactylus longer than dorsal margin of palm; cutting edge with low tooth proximally. Dorsal margin of palm with few tubercles proximally, outer surface smooth. Manus much smaller than merus.

Dorsal margin of merus of P-2 with spines distally, fringed with pappose setae of length  $> 2$  times that of spines; outer surface flat, with tubercles distally; ventral margin convex, with few tubercles, fringed with pappose setae. Merus height  $> 2$  times that of carpus. Dorsal margins of carpus, propodus with spines, simple setae; outer surfaces with few tubercles; carpus longer than propodus. Dactylus lacking proximal tooth dorsally, tip with subterminal pore. P-3, P-4 similar in form to P-2; outer surfaces of carpi, propodi with longitudinal row of rounded

tubercles near upper margins, upper margins with simple, pappose setae. P-5 elongate, with tubercles dorsally on proximal 3 segments; merus and carpus subequal in length, each longer than propodus; propodus, dactylus directed anteriorly.

Sternite of P-1 smooth, that of P-4 with median suture. Female opening longitudinal, oval, with anterior hood; PLP-2, PLP-3 uniramous.

Variations.--Relative sculpture of the carapace variable, particularly the median gastric area which may have depressions from two to four in number which may vary from very obvious to faintly detectable. The extent of the depression on the anterior carapace varies from occupying the entire surface between the anterolateral margins to somewhat less. The size and number of spines and/or tubercles is highly variable. The carapace length:width ratio ranged from 1.2 to 1.5 with most crabs within 1.3 to 1.4. In some specimens the lateral projection of the antennule base is more elongate than described. Also, the anterolateral angles of the carapace may extend only slightly beyond the inner orbital angles.

Male (Figure 19).--Based on specimens from Micronesia. Similar to, smaller than female. Carapace detail similar to females, spines proportionally smaller. Projection of antennule base elongate, with apical spine. P-1 robust, palm inflated, with few tubercles; dactylus longer than dorsal margin of palm. Abdominal somites 3-7 similar in

width, telson broadly rounded. PLP-1 slightly curved, apex sharply pointed, directed slightly laterally; reaching posterior of sternite of P-1; lateral margin with stout setae.

Variations.--Smaller males have relatively smooth carapace, with the anterior depressions more distinct. The inner orbital angle may equal or exceed anterolateral angle of the carapace.

Remarks.--The original description of Cryptochirus bani by Fize and Serène (1957) did not provide information necessary to distinguish it from Lithoscaptus paradoxus. Serène (1962), in a discussion of some material from Rarotonga sent to him by Edmondson, alluded that C. bani might be synonymous with C. coralliodytes. Serène thought that this material was very similar to C. bani. I have examined material from the same collection (BPBM S3221) and found them to be L. paradoxus. Without examination of the type of C. bani, there is some uncertainty, but it is likely that C. bani is a subjective junior synonym of L. paradoxus. Fize and Serène (1957) named three varieties of C. coralliodytes based primarily on color differences, giving no substantial morphological data by which to distinguish them. The varieties, rubrolineata, fusca, and parvulus are therefore considered subjective junior synonyms of L. paradoxus.



## Discussion

Paulson (1875) felt that many taxonomists of the period were not making useful contributions to systematics as a science, and that their research "provides only a useless ballast." He was particularly critical of Heller and A. Milne Edwards. Yet careful consideration of the original species descriptions by Heller and Milne Edwards and comparisons of those with material at hand might have prevented Paulson's confusion of *C. coralliodytes* with *L. paradoxus*. Heller's original species account (1861a:19) was scanty, but the generic description included a characterization of the endopod of the first maxilliped that is useful. This was supported by his later (1861b), more detailed, account which included an accurate figure of the appendage (1861b, plate IV, figure 39). The endopod of the first maxilliped is quite different in *L. paradoxus*, (triangular in *coralliodytes* versus subquadrate in *paradoxus*, compare Fig. 2d and 5d herein). Heller's figure of the female type (1861b: plate IV, figure 33) shows enough carapace detail, despite Edmondson's (1933:4) complaint, to distinguish the two species.

Milne Edwards also gave information sufficient to separate the two species by referring to the uniramous condition of the female pleopods (1862:F12). Although female PLP-2 form is often not a reliable character (McCain and Coles, 1979; Kropp and Manning, 1987), in this case it is applicable because among the specimens of either species

that I have examined, the PLP-2 is consistently uniramous in L. paradoxus and consistently biramous in C. coralliodytes.

Several features other than the above information from the original literature allow separation of the two species. The most obvious difference is that the regions of the carapace of C. coralliodytes are well defined whereas those of L. paradoxus are not. Additionally, in the former, the epistome has a median ridge, and leg P-5 is smooth, with the carpus longer than the other segments whereas there is no median epistomal ridge and leg P-5 is tuberculate dorsally, with the carpus and merus subequal in length in L. paradoxus. Leg P-2 permits the two species to be distinguished because the merus is larger relative to the carpus in Lithoscaptus than in Cryptochirus.

The changes made here have a bearing on the other species presently included in Cryptochirus and Favicola. I am reviewing these species and will clarify their status as a part of a revision of the genera of cryptochirids.

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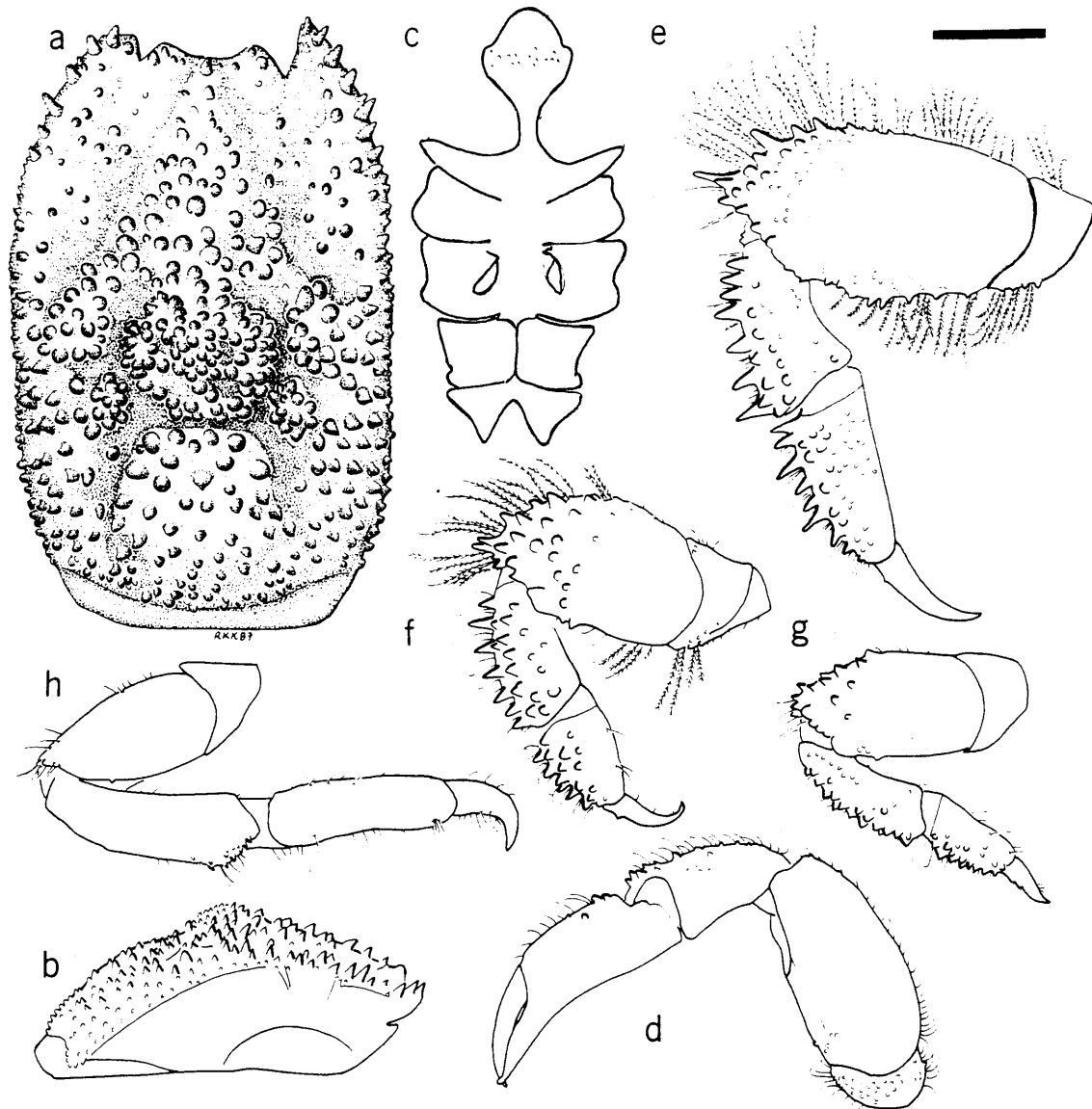
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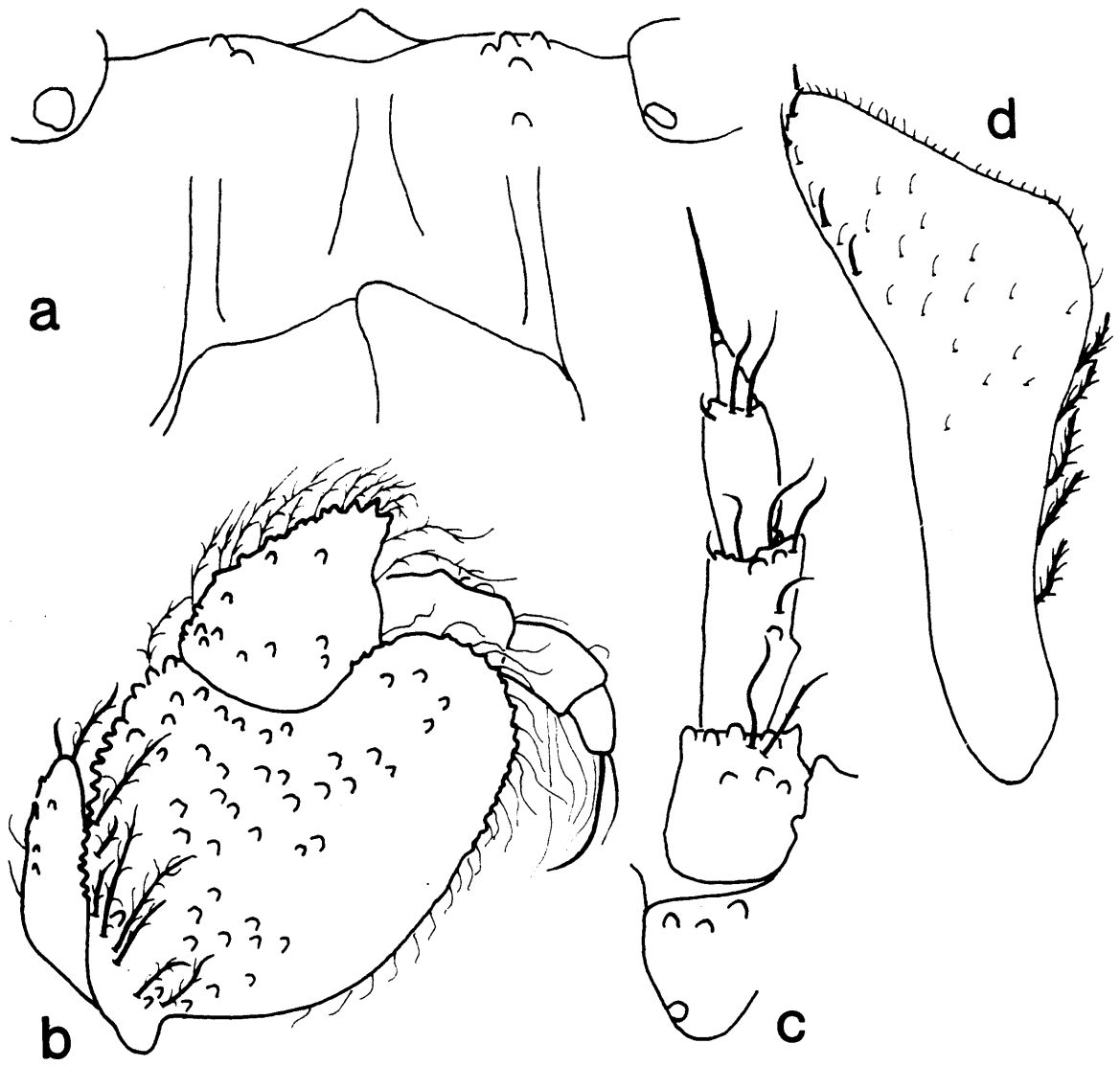
Fig. 14. Cryptochirus coralliodytes, +. (a, b, d-h from lectotype, c from Guam +, USNM): a, carapace (dorsal view); b, carapace (lateral view); c, thoracic sternites; d-h, P-1 to P-5. Scale: a = 0.8 mm; b = 2.1 mm; c-h = 1 mm. [Setae on surface of carapace and pereopods not shown].

Fig. 15. Cryptochirus coralliodytes, +. (Guam, SEM micrographs): a, epistome; b, MXP-3 (outer view); c, antenna (ventral view); d, endopod of MXP-1 (outer view). Scale: a, c = 0.3 mm; b = 0.5 mm; d = 0.2 mm.

Fig. 16. Cryptochirus coralliodytes, o. (a-d from paralectotype, e from Guam o, USNM): a, carapace (dorsal view); b, abdomen; c, left P-1; d, right P-2; e, PLP-1 (outer view). Scale: a = 0.9 mm; b-d = 1 mm; e = 0.1 mm.







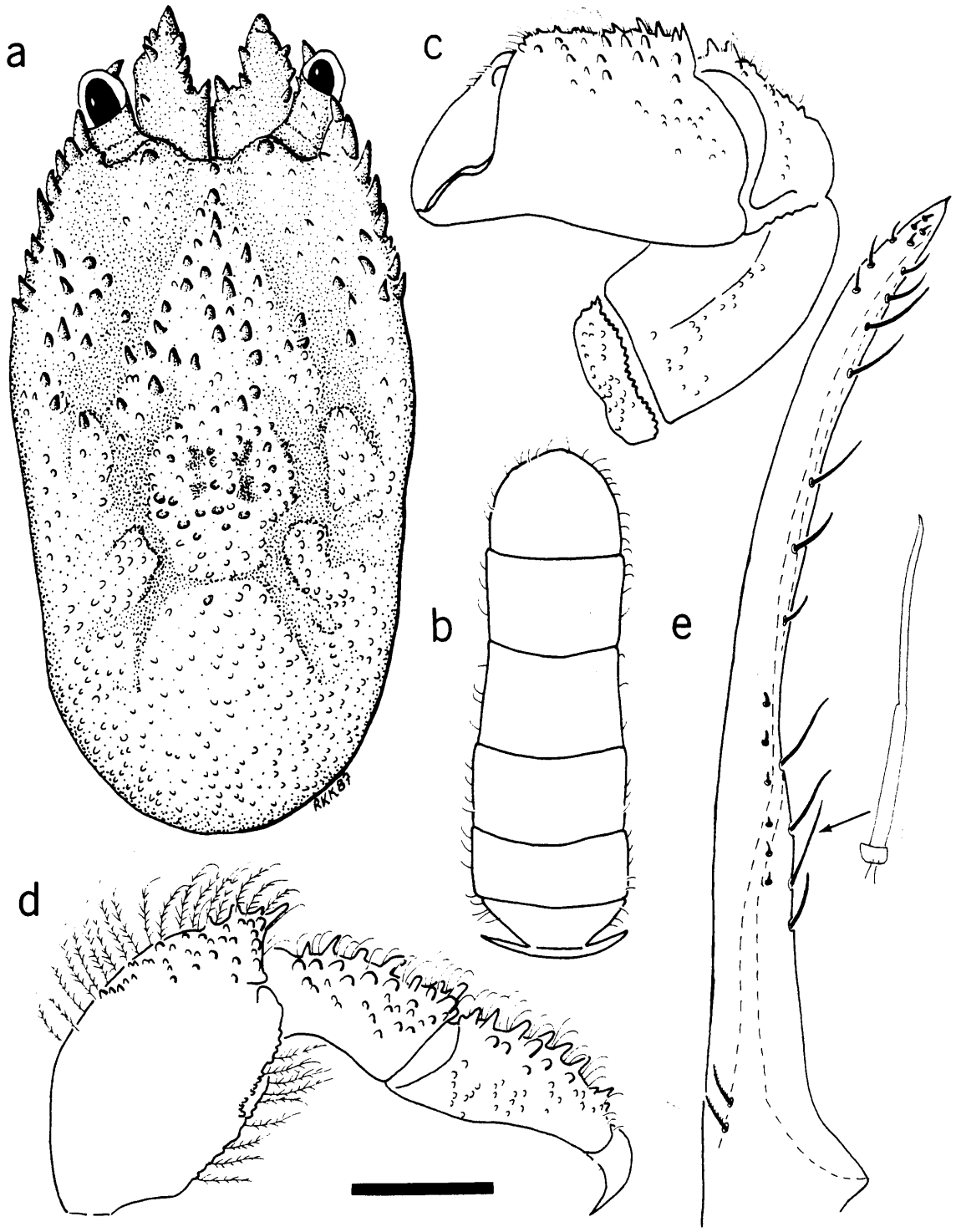
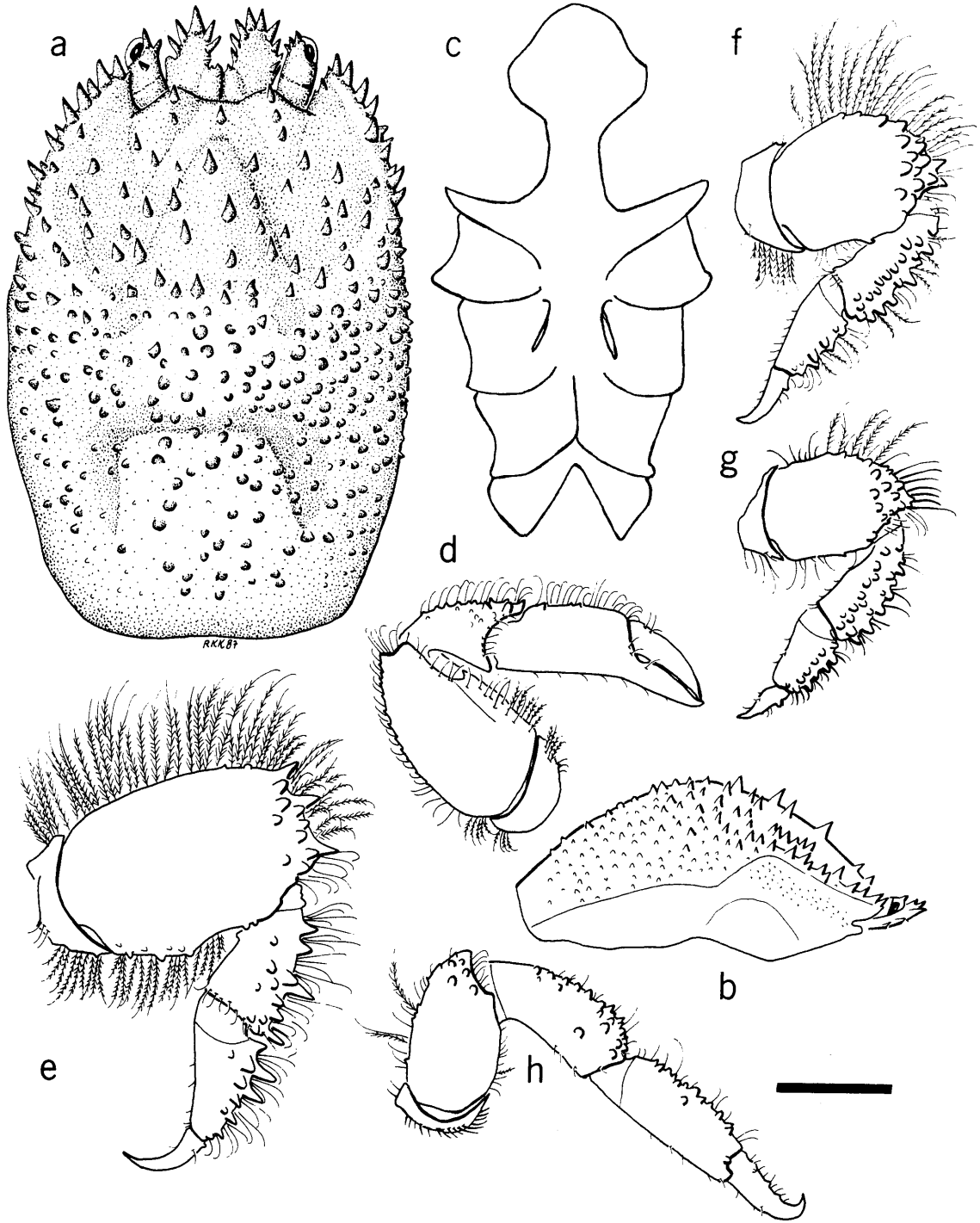
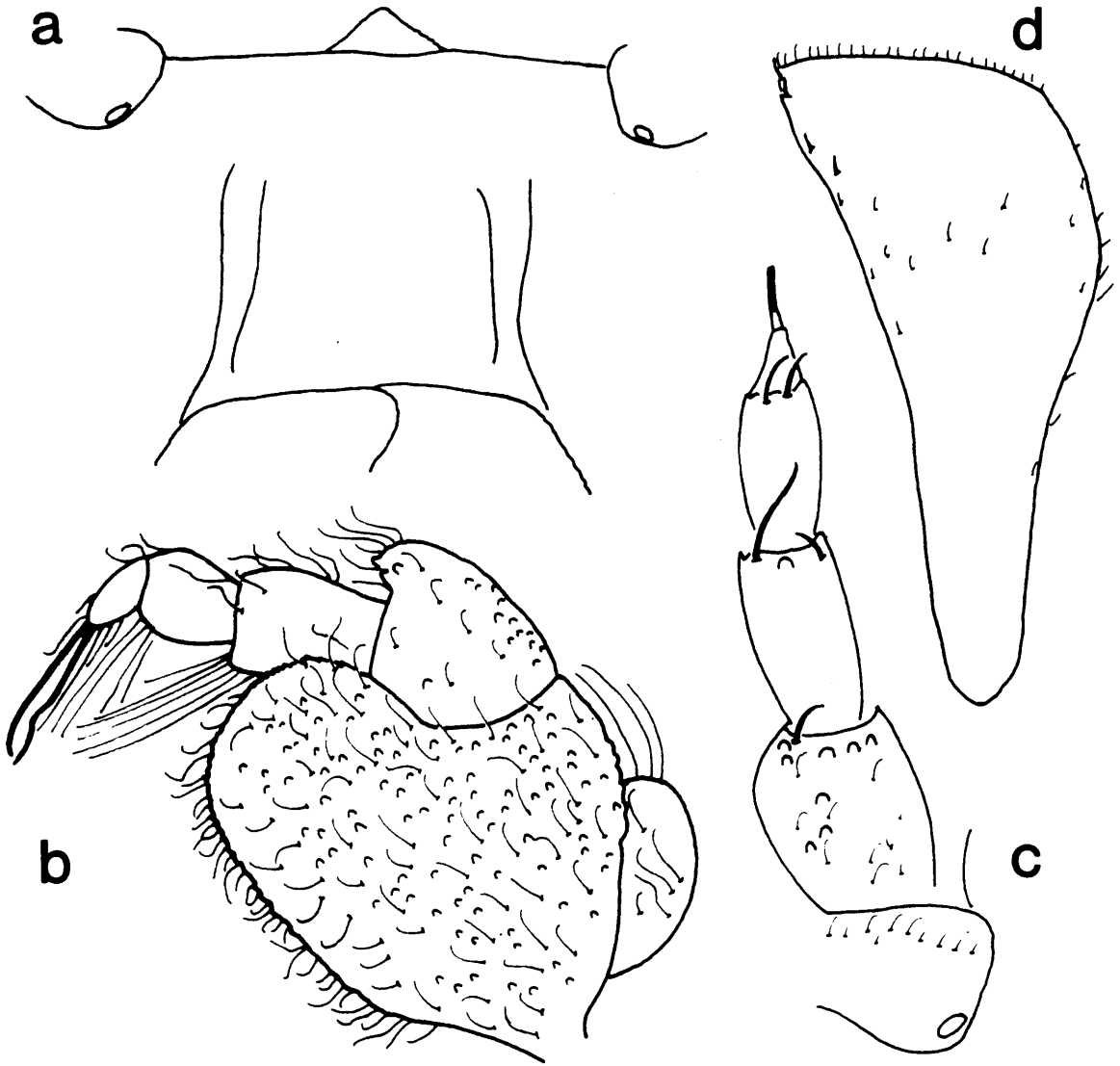


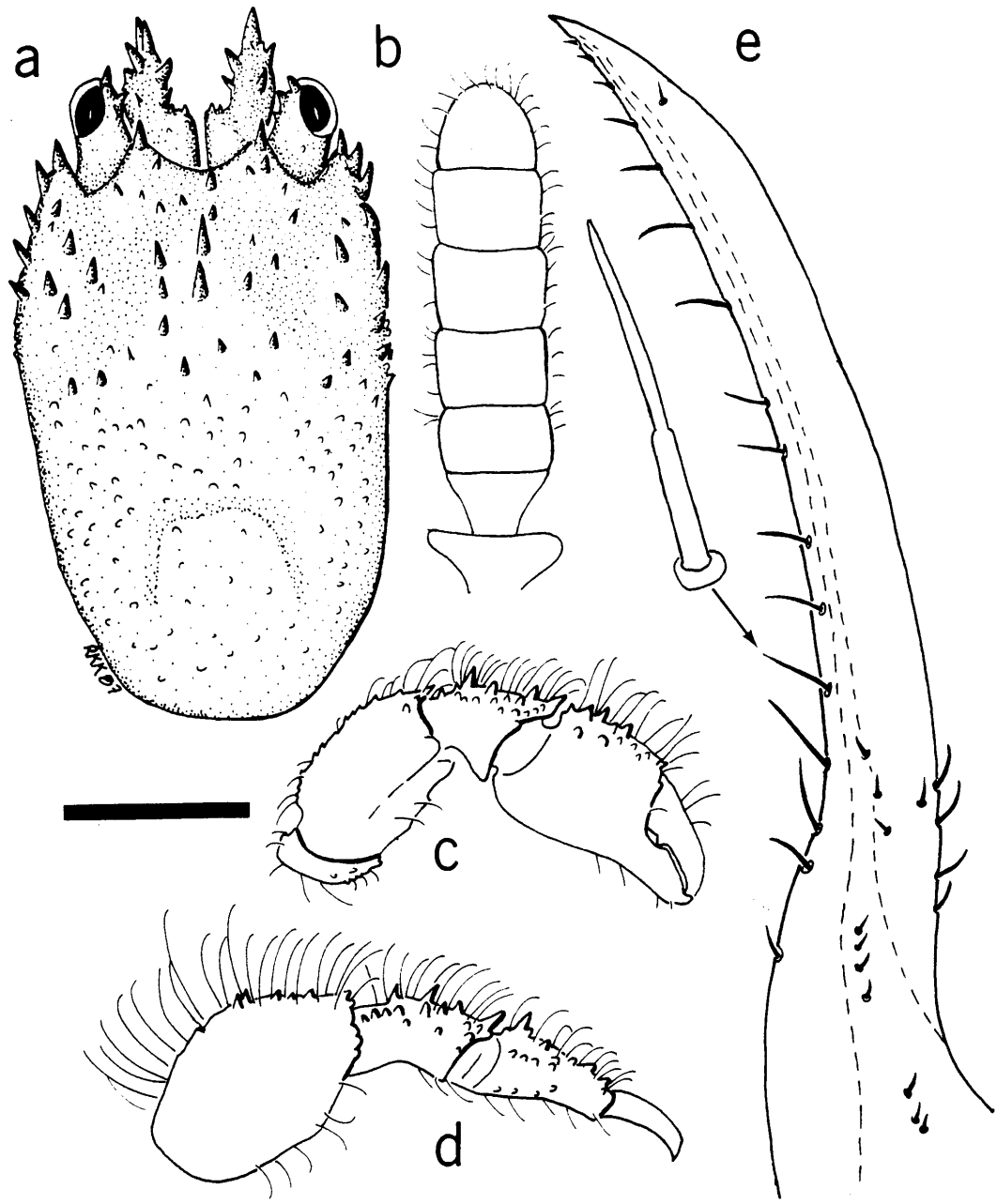
Fig. 17. Lithoscaptus paradoxus, +. (Guam, USNM):  
a, carapace (dorsal view); b, carapace (lateral view); c,  
thoracic sternites; d-h, P-1 to P-5. Scale: a = 0.8 mm;  
b = 2.1 mm; c-h = 1 mm. [Setae on surface of carapace and  
pereopods not shown].

Fig. 18. Lithoscaptus paradoxus, +. (Guam, SEM  
micrographs): a, epistome; b, MXP-3 (outer view); c, antenna  
(ventral view); d, endopod of MXP-1 (outer view). Scale: a  
= 0.4 mm; b = 0.6 mm; c = 0.3 mm; d = 0.2 mm.

Fig. 19. Lithoscaptus paradoxus, o. (Guam, USNM):  
a, carapace (dorsal view); b, abdomen; c-d, right P-1, P-2;  
e, PLP-1 (outer view). Scale: a-d = 1 mm; e = 0.1 mm.







## Chapter 6

### A Revision of the Pacific Species of Gall Crabs, Genus Opecarcinus (Crustacea: Cryptochiridae)

#### ABSTRACT

Pacific species of the gall crab genus Opecarcinus are reviewed. Q. granulatus (Shen), by having a much less ornate carapace and having the cornea situated anterolaterally on the eyestalk, differs from Q. crescentus (Edmondson), which has a carapace ornamented with numerous tubercles and the cornea situated terminally on the eyestalk, and is removed from the synonymy of Q. crescentus. Five new species are described: Q. aurantius, having a very elongate antennular peduncle; Q. lobifrons, having the internal orbital angle exceeding the anterolateral angle of the carapace; Q. peliops, living specimens having a blue-black cornea; Q. pholeter, having 3 longitudinal depressions on the posterior carapace; and Q. sierra, having a convex carapace with many larger, subequal, conical tubercles. All of these species were found on agariciid corals. The genus is known from the eastern Indian Ocean, the Pacific Ocean from Asia to Baja California, and from the Atlantic Ocean. A key to all species of the genus is provided.

The cryptochirid genus Opecarcinus was defined by Kropp and Manning (1987) to include two species, Q. hypostegus (Shaw and Hopkins, 1977) found in the Atlantic Ocean and Q.

crescentus (Edmondson, 1925) found in the Pacific Ocean. Species in this genus occur on agariciid and siderastreid corals, where they usually live in tunnels on the coral surface or in crescent-shaped pits in the corallum.

I collected a large suite of material of Opecarcinus in the course of research on coral symbionts in Micronesia. Among the crabs collected were many specimens not fitting within the definitions of the two presently known species. These are herein recognized as five new species. Additionally, I examined the type of Cryptochirus granulatus Shen, 1936 and found evidence for its removal from the synonymy of O. crescentus. A key to all known species of Opecarcinus is provided.

#### Materials and Methods

I obtained the type specimens of Cryptochirus granulatus Shen from the British Museum (Natural History), London, England (BMNH), the type of Cryptochirus crescentus Edmondson from the B. P. Bishop Museum, Honolulu, Hawaii (BPBM), and the type of Pseudocryptochirus hypostegus Shaw and Hopkins from the National Museum of Natural History, Smithsonian Institution, Washington, D. C. (USNM). Specimens of C. crescentus were obtained from the BMNH, the Allan Hancock Foundation, Los Angeles, California (AHF), the Muséum National d'Histoire Naturelle, Paris, France (MNHN), Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands (RMNH), and the Zoological Museum, Copenhagen,



Denmark (ZMC). The remainder of the material examined was collected by me (collection numbers denoted by HAP and PHAP) in Micronesia during 1984 and L. G. Eldredge at Johnston Atoll in 1983.

Drawings were made with a camera lucida mounted on a Wild M-5 or M-20 microscope. The cheliped was drawn so that the outer surface of the manus is parallel to the plane of the printed page which distorts the other segments somewhat. Setae on the surfaces of the carapace and pereopods are not shown. The carapace length and width of each specimen were measured to the nearest 0.1 mm with an ocular micrometer on a Wild M-5 microscope and are reported in mm as length x width. Abbreviations used in the text are: ALA, anterolateral angle of carapace; IOA, internal orbital angle of carapace; km, kilometers; m, meters; MXL, maxilla; MXP, maxilliped; ov, ovigerous; P, pereopod; and PLP, pleopod.

In this study I use the term tubercle to describe several cuticular projections in which the basal width is about 1/2 or more than the height; conical tubercles are those having a relatively acute apex (see Fig. 21b); rounded tubercles have a broadly rounded apex (see Fig. 21c); and angled tubercles the height of which is much less than the basal width (see Fig. 20g). Other cuticular projections include spines, in which the basal width is much less than 1/2 the height (see Fig. 29a), and granules, generally small, round slightly raised structures (see Fig. 20c). Orbits are defined as deep, in which the depth is greater

than half the width, and shallow, in which the depth is much less than half the width (see Fig. 20a, 24a, respectively). The lateral margin of the female gonopore of some species has a mesial expansion at the anterior end that I refer to as a hood (see Fig 20d). Setal terminology follows that of Kunze and Anderson (1979).

The degree of ornamentation of the carapace varies within species. Many individuals, particularly juveniles, are smoother than others. For this reason degree of tuberculation and granulation are not useful in separating species. Degree of setation on the carapace also seems variable, with a few exceptions. Species accounts are based on the holotype or a representative specimen. Variations occurring among the other material examined are placed within brackets where appropriate. Some proportions appear to be useful in characterizing certain species. These are given for the primary specimen, with the range of variation occurring among the other material examined included within brackets.

Color is based on freshly collected material from Micronesia.

At the first occurrence of a collection locality in the text, the latitude and longitude are given. For some localities new orthographic spellings have been advocated (Motteler, 1986). At the first occurrence of these localities in the text the new orthography is given followed parenthetically by the former spelling. Subsequently, only

the new spelling is given. Specific locality names in Micronesia (except Guam) are from Bryan (1971). Guam names are from a United States Geological Survey topographic map. Geographic records from the literature are given in brackets in the synonymies.

Key to the species of Opecarcinus

(based on females)

1. Cornea anterolateral.....2  
     Cornea terminal.....4
2. Distal margin of antennule longer than lateral margin  
     (ventral view).....3  
     Distal margin of antennule shorter than lateral margin  
     (ventral view)..... Q. hypostegus
3. P-5 carpus smooth..... Q. pholeter  
     P-5 carpus tuberculate dorsally..... Q. granulatus
4. Sternite of P-2 smooth laterally; antennule base  
     oblique.....5  
     Sternite of P-2 tuberculate laterally; antennule base  
     transverse.....6
5. IOA extends beyond ALA; distal margin of antennule  
     shorter than lateral margin..... Q. lobifrons  
     IOA not extending beyond ALA; distal margin of antennule  
     longer than lateral margin..... Q. aurantius
6. Dorsal margin of P-2 notched distally; dorsal margin of  
     cornea irregularly sinuous..... Q. peliops

- Dorsal margin of P-2 not notched distally; dorsal margin of cornea evenly concave.....7
7. Carapace strongly convex; anterior depression restricted to protogastric region..... *O. sierra*
- Carapace relatively flat; anterior depression extending to epibranchial region..... *O. crescentus*

Systematic Account

*Opecaercinus crescentus* (Edmondson, 1925)

Fig. 20, 21

*Cryptochirus crescentus* Edmondson, 1925:33, Fig. 6a-i, Pl.

IB-C [Johnston Atoll]; 1933a:16, Pl. 4C-D [Teraina = Washington Is.]; 1933b:233 [Hawaii].--Shen, 1936:23.--Hiro, 1937:142; 1938:149.--Utinomi, 1944:688.--Edmondson, 1946:273 [Hawaii].--Fize and Serène, 1957:9 [Vietnam].--Serène, 1962:30.--Garth, 1974:398.--Takeda and Tamura, 1980b:138; 1980c:46.

*Pseudocryptochirus crescentus*.--Utinomi, 1944:701, Figs. 5D,

6D, 7C, 7F, 10, 11H, 12C, 14B, 15C, 15G, 16C, 16D, 17.--Serène, 1966:396.--Garth and Hopkins, 1968:41.--Garth, 1974:401.--Serène et al., 1974:20 [Indonesia].--Shaw and Hopkins, 1977:179.--Monod and Serène, 1976:26.--McCain and Coles, 1979:85.--Takeda and Tamura, 1980a:57; 1980b:138; 1980c:47; 1981:14, Fig. 1, Pl. 2 [Japan]; 1983:1; 1986:63, Fig. 4.

**Troglocarcinus crescentus.**--Fize and Serène, 1957:5, Figs. 10, 11C, 11D, 12B, Pl. 3 Figs. 4-7, Pl. 5 Fig. 2.-- Serène, 1962:31.--Garth and Hopkins, 1968:41 [Mexico].--Maragos, 1977:186.

**Opecarcinus crescentus.**--Kropp and Manning, 1987:9.

**Material examined.**--Holotype: JOHNSTON ATOLL; "Tanager" 1923; on *Pavona duerdeni* Vaughan, 1907; + (ov); BPBM S1805. Other material: VIETNAM: Nhatrang [12° 14'N, 109° 12'E]; Rte. 1588; [no specific locality or host recorded]; 1 o; Rte. 1644 (Bai Suot); 31 Mar 1956; [no host recorded]; 1 + (ov); BMNH 1958.10.20.3-4. THAILAND: Ko Kaeo [07° 45'N 98° 18'E], Phuket; 12 Nov 1972; Coll. Serène and Lundøer; [no host recorded]; 6 + (ov), 3 o; ZMC. INDONESIA: Moluccas; Expedition Rumphius I; 11 Jan 1973; CB 307; [no host recorded]; 1 + (ov), 1 o; MNHN B.12667. BELAU (Palau): Ulong (Aulong) Is. [07° 16'N, 134° 17'E]; fringing reef on west coast of island; 1 m; 28 Jun 1984; PHAP 035; on *Pavona venosa* (Ehrenberg, 1834); 1 + (ov), 3 o; USNM 234254. Ngeruktabel (Urukthapel) Is. [07° 15'N, 134° 24'E]; patch reef in bay on northeast coast, facing Ngemelachel (Malakal) Pass; 1 m; 5, 20 Jul 1984; PHAP 068, 071, 141; on *P. cactus* (Forsk., 1775), *P. venosa*; 13 + (7 ov), 5 o; USNM 234255, BPBM. Ngeruktabel Is.; north shore, at west end of rock islands; 2 m; 22 Jul 1984; PHAP 165; on *P. explanulata* (Lamarck, 1816); 1 + (ov), 1 o; USNM 234256. Ngemelachel Is. [07° 20'N, 134° 28'E]; south of Marine Mariculture Demonstration Center (MMDC); 2 m; 18 Jul 1984; PHAP 126; on

*P. explanulata*; 3 + (ov); BMNH. GUAM: Double Reef [13° 36'N, 144° 50'E]; fringing reef; 3 m; 7 Feb 1984; HAP 073; on *P. varians* Verrill, 1864; 2 + (ov), 1 o; MNHN; from main patch reef; 6 m; 24 Feb 1984; HAP 121; on *P. duerdeni*; 2 + (1 ov, 1 with cryptoniscine isopod attached to inside of abdominal pouch), 1 o; USNM 234257. Agaña Bay [13° 29'N, 144° 46'E]; reef front off Alupat Is.; 8 m; 20 Feb 1984; HAP 108; on *P. duerdeni*; 1 +, 1 o; RMNH; reef flat north of boat basin channel; 1 m; 5 Mar 1984; HAP 145; on *P. venosa*; 2 + (1 ov), 1 o; AHF. Piti Bay [13° 29'N, 144° 42'E]; north side of bay at mid reef flat; 1 m; 26 Jan 1984; HAP 038; on *P. decussata* (Dana, 1846); 5 + (3 ov); USNM 234258. Luminao Reef [13° 28'N, 144° 39'E]; reef flat; 1 m; 13, 27 Oct 1984; HAP 319, 361; on *P. varians*, *Payona* sp.; 6 + (ov), 2 o; BMNH. Calalan Bank [13° 27'N, 144° 38'E]; reef front near Magundas; 10 m; 16 Oct 1984; HAP 334; on *P. duerdeni*; 2 + (ov); RMNH. Apra Harbor [13° 27'N, 144° 38'E]; patch reef at Western Shoals; 21 m; 15 Mar 1984; HAP 170; on *P. divaricata* (Lamarck, 1816); 3 + (2 ov); USNM 234259. Agat Bay [13° 24'N, 144° 39'E]; 0.8 km north of Nimitz Beach; reef front; 14 m; 29 Mar 1984; HAP 186; on *Gardineroseris planulata* (Dana, 1846); 4 + (3 ov), 2 o; MNHN; reef flat; 1 m; 29 Mar 1984; HAP 187; on *Payona* sp.; 3 + (1 ov), 1 o; RMNH. Fouha Bay [13° 18'N, 144° 39'E]; south wall of channel; 8 m; 26 Apr 1984; HAP 214; on *P. explanulata*; 1 + (ov); AHF. TRUK: off Moen Is. [07° 26'N, 151° 52'E]; 11 Apr 1981; HAP 084; on *P. maldiviensis* (Gardiner, 1905); 1 + (ov); USNM

234260. JOHNSTON ATOLL: Pres. R. Gurney; on *P. duerdeni*; 1 +, 1 o; BMNH 1949.v.4.1-2; East, North Islands; 1 m; 24 Oct 1983; HAP 052, 053; Coll. L. G. Eldredge; on *Payona* sp.; 4 + (ov); USNM 234261. HAWAII: Oahu; Waikiki [21° 17'N, 157° 50'W]; reef off Waikiki Aquarium; 1.5 m; 18 Dec 1984; HAP 429; on *P. varians*; 2 + (1 ov); USNM 234262. MEXICO: Baja California; El Tule Ranch, 6 km east of Cabo San Lucas [22° 53'N, 109° 54'W]; Jun 1965; Coll. G. F. Crozier; [host not recorded, but listed as *P. gigantea* Verrill, 1869 by Garth and Hopkins (1968)]; 2 + (1 ov); AHF 2776-01.

**Size Range.**--Females, 1.4 x 1.2 to 4.4 x 3.8; ovigerous females, 2.1 x 1.8 to 4.0 x 3.3; males, 1.5 x 1.2 to 3.6 x 2.9.

**Type data.**--Holotype: + (ov), 2.1 x 1.8; BPBM S1805. Type locality: Johnston Atoll [16° 45'N, 169° 32'W]. Other types: Edmondson (1925) only designated a "type specimen", the holotypic female. He also described males, but the whereabouts of these specimens is not known. The BMNH material (a male and female) from Johnston Atoll listed among the material examined is accompanied by a note reading "may be type material!", but Edmondson did not mention depositing any types in the BMNH. That the material was deposited in 1949 reduces the likelihood that these specimens are types.

**Description.**--Adult female (Holotype, Fig. 20): Carapace 1.2 [1.1-1.3] times longer than wide. Anterior 1/3 of carapace moderately deflected, not sharply set off from

posterior carapace, with transverse depression extending from frontal margin, across protogastric region, to anterolateral angles (ALA) and epibranchial margin of carapace. Posterior 2/3 of carapace with elongate H-shaped depression extending from gastric to cardio-intestinal region. Transverse section of carapace at midlength convex overall, median 1/3 slightly [markedly] concave, with few conical tubercles, scattered setae longer [much longer] than tubercles. Carapace surface ornamented with many rounded and conical tubercles, largest, most numerous at midlength, diminishing slightly in size and number posteriorly. Anterolateral margins of carapace with few conical tubercles, ALA lacking prominent tubercle. Inner orbital angles (IOA) marked with tubercle, slightly inflated, totally elevated above level of and extending to or just beyond apex of ALA. Front concave with few smaller tubercles, lacking prominent median tubercle, width 0.5 [0.4-0.5] that of carapace at ALA, latter 0.7 [0.5-0.7] that of greatest carapace width. Orbit deep, broadly V-shaped, margin with few tubercles.

Basal segment of antennular peduncle transverse, slightly inflated mesially, with distal projection having apex of angled lateral lobe extending beyond eyestalk; dorsal surface concave with few scattered smaller tubercles; margin with 6-10 subequal spines. In ventral view, basal segment broadening distally, length 2.2 [2.0-2.5] times



width; distal margin shorter than lateral margin; surface convex with scattered granules.

Eyestalk partially exposed dorsally. Cornea terminal, in dorsal view, occupying about 1/2 length of stalk, dorsal margin evenly concave, lateral margin just reaching ALA.

Mesial margin of ischium of MXP-3 coarsely crenulated; lateral margin of merus strongly produced distally, mesial margin with 2 plumo-denticulate setae. Mesial margin of MXL-1 with 4 stout simple setae, lower margin with 1 stout simple seta; outer surface with 1 serrate seta, not extending beyond mesial margin.

Sternite of cheliped (P-1) with transverse row of 7 [5-8] rounded [conical] tubercles at midlength, none posteriorly. Sternite of first walking legs (P-2) smooth, with tubercles at lateral margin. Gonopore elliptical, lateral margin having [lacking in some specimens] anterior hood.

Manus of P-1 1.8 [2.1-2.3] times longer than high. Dactylus subequal in length to dorsal margin of palm, with proximal tubercle dorsally; cutting edges of fingers entire. Dorsal margin of palm with few scattered conical tubercles along entire length, few rounded tubercles; outer surface of palm flat with few granules proximally. Dorsal margin of carpus lacking [present in some specimens] prominent tubercle distally. Merus shorter, taller than manus, ventral margin granular.

Merus of P-2 1.2 [1.3-1.4] times longer than high; dorsal margin moderately convex with larger conical tubercles on distal half; ventral margin convex, tuberculate, moderately emarginate distally; distoventral angle produced into prominent tubercle; outer surface with many larger rounded tubercles on distodorsal half, with elevated transverse row of rounded tubercles distoventrally. Propodus 1.0 [1.1] times longer than high, dorsal margin as long as that of carpus.

Merus of last walking leg (P-5) 1.4 [1.7-1.9] times longer than high; dorsal margin with tubercles along entire length; ventral margin straight, with few angled tubercles; distoventral angle formed into blunt tubercle; outer surface with many tubercles dorsodistally. Dorsal margin of carpus with few tubercles. Propodus 1.6 [2.5-2.9] times longer than high; dorsal margin entire.

Adult male (Vietnam, BMNH 1958.10.20.3, Fig. 21): Carapace ornamentation similar to female; posterior carapace with slight median H-shaped depression. IOA marked with tubercle, extending to or just exceeding ALA. Eyestalk similar to female; cornea terminal, lateral margin extending just beyond ALA. P-1 slightly more robust than female, manus length 1.7 times height. Dorsal margin of dactylus with few conical tubercles proximally, cutting edge with low tooth proximally, dactylus slightly shorter than dorsal margin of palm, latter with subequal conical tubercles along entire margin; ventral margin of palm entire. Dorsal margin

of merus of P-2 convex, with conical tubercles on distal half; ventral margin scarcely convex, with few angled tubercles at midlength. Dorsal margin of merus of P-5 with angled tubercles; ventral margin with few tubercles distally; dorsal margin of carpus with few tubercles. Sternite of P-1 with 7 conical tubercles at midlength, 12 granules posteriorly. PLP-1 (Guam, USNM) with plumose seta at proximomesial angle.

Color.--Adult female: Carapace overall off-white; posterior carapace with 4 longitudinal black bands, similar transverse band at apex of carapace; anterior depression red-brown. Cornea dark red, may have white spot.

Comparisons.--See "Discussion" section.

Hosts/habitats.--Agariciidae: Payona cactus, P. duerdeni, P. venosa, P. explanulata, P. varians, P. divaricata, P. maldiviensis, P. decussata, and Gardineroseris planulata. Material on which this report is based was collected at depths of < 1 m to 14 m from a variety of reef habitats ranging from the open coast to protected embayments.

Several literature host records need to be clarified. Four species listed by Fize and Serène (1957) are now recognized as junior synonyms of species listed above (Veron and Pichon, 1980). These are P. venusta Dana, P. formosa Dana, and P. praetorta Dana (misspelled as proetorta by Fize and Serène), all of which are synonyms of P. cactus. Fize and Serène listed P. muelleri Milne Edwards and Haime as a

possible synonym of P. cactus, but I have not been able to verify this. Also listed is P. lata Dana, a synonym of P. decussata. Veron and Pichon (1980) also listed P. duerdeni as a synonym of P. clavus Dana. Other coral taxonomists prefer to separate the two (Randall and Myers, 1983) and I have done so in order to avoid obscuring the host records. Takeda and Tamura (1983) recorded O. crescentus as occurring on corals of the genus Coscinastrea of the family Agariciidae. Their record is uncertain because the name Coscinastrea is actually a printing error for Coscinarea Milne Edwards and Haime of the family Siderastreidae (see Veron and Pichon, 1980). The genus Opecarcinus occurs on siderastroid corals in the Atlantic (Scott, 1985; 1987).

Distribution.--Known from Vietnam to Baja California.

Opecarcinus granulatus (Shen, 1936),

new combination

Fig. 22, 23

Cryptochirus granulatus Shen, 1936:23, Pl. 2 [Christmas Is., Indian Ocean].--Utinomi, 1944:688.--Fize and Serène, 1957:54.

Pseudocryptochirus granulatus.--Takeda and Tamura, 1981:14.

Material examined.--Holotype: CHRISTMAS IS. (Indian Ocean); 45 fathoms (82 m); no host recorded; Pres. R. Kirkpatrick; o; BMNH 1911.8.15.2. Other material: GUAM: Fouha Bay; south wall of channel; 8 m; 26 Apr 1984; HAP 215; on Leptoseris sp.; 1 + (ov), 1 o; USNM 234263. Cetti Bay

<sup>o</sup> [13 19'N, 144 <sup>o</sup> 39'E]; patch reef in middle of bay; 13-14 m;  
30 Nov 1984; HAP 407, 410; on Gardineroseris planulata,  
Payona explanulata; 2 +; USNM 234264/5.

Size range.--Females, 1.9 x 1.6 to 2.4 x 2.2; ovigerous female, 2.4 x 2.2; males 1.9 x 1.7 to 2.2 x 2.0.

Type data.--Holotype: o, 2.2 x 2.0; BMNH 1911.8.15.2.  
Type locality: Christmas Island (Indian Ocean) [10 <sup>o</sup> 30'S,  
105 <sup>o</sup> 40'E]. No other types were described.

Description.--Adult female (Guam, USNM 234263, Fig. 22): Carapace 1.1 [1.2] times longer than wide. Anterior 1/3 of carapace slightly deflected, sharply set off from posterior carapace, with transverse depression extending from frontal margin, across protogastric region, to ALA and epibranchial regions. Posterior 2/3 of carapace with broad, shallow inverted U-shaped central depression. Transverse section of carapace at midlength angularly convex overall, median 1/3 slightly concave, with scattered variously sized tubercles, moderately setose with unequal setae longer than tubercles. Carapace surface ornamented with various granules and conical tubercles, largest at midlength, diminishing considerably in size and number posteriorly. Anterolateral margins of carapace having conical tubercles, ALA lacking prominent tubercle. IOA marked with tubercle, inflated, totally elevated above level of and extending to apex of ALA. Front concave with subequal tubercles, lacking prominent median tubercle, width 0.5 that of carapace at

ALA, latter 0.7 greatest carapace width. Orbit deep, broadly V-shaped, margin granulate.

Basal segment of antennular peduncle slightly oblique, scarcely inflated mesially, with distal projection having apex of angled lateral lobe not reaching tip of eyestalk; dorsal surface flat with few scattered granules; margin with 8-9 spines, those of distal margin larger than those of mesial margin. In ventral view, basal segment tapering anteriorly, length 2.3 [2.6] times width; distal margin longer than lateral margin; surface convex with scattered granules.

Eyestalk mostly exposed dorsally. Cornea anterolateral, in dorsal view, occupying 1/2 length of stalk, dorsal margin evenly concave, lateral margin not extending beyond ALA.

Mesial margin of ischium of MXP-3 coarsely crenulated; lateral margin of merus strongly produced distally, mesial margin with 2 plumo-denticulate setae. Mesial margin of MXL-1 with 3 stout simple setae, lower margin with 3 stout simple setae; outer surface without setae.

Sternite of P-1 with transverse row of 9 conical tubercles, 4 smaller, rounded tubercles at midlength, 1 granule posteriorly. Sternite of P-2 smooth, lacking tubercles at lateral margin. Gonopore oval, lateral margin lacking anterior hood.

Manus of P-1 2.3 times longer than high. Dactylus subequal in length to dorsal margin of palm, with proximal

tubercle dorsally; cutting edges of fingers entire. Dorsal margin of palm with conical tubercles along entire length; outer surface of palm flat with few granules proximally. Dorsal margin of carpus with prominent tubercle distally. Merus shorter, taller than manus, ventral margin with few tubercles.

Merus of P-2 1.7 [1.5] times longer than high; dorsal margin convex proximally, straight distally, having various acute conical tubercles, largest on distal 1/2, ventral margin convex, with angled tubercles, moderately emarginate distally; distoventral angle produced into prominent tubercle; outer surface with many granules, tubercles on distodorsal 1/2, with elevated transverse row of tubercles distoventrally. Propodus 1.2 [1.3] times longer than high, dorsal margin as long as that of carpus.

Merus of P-5 1.4 [1.3] times longer than high; dorsal margin with angled tubercles along entire length; ventral margin convex, with few angled tubercles; distoventral angle with 2 tubercles; outer surface with few smaller conical tubercles dorsally. Dorsal margin of carpus with rounded tubercles. Propodus 1.6 [1.5] times longer than high; dorsal margin entire.

Adult Male (Holotype, Fig. 23): Similar to female in general form. Carapace smoother, but showing same pattern of depressions. IOA lacking prominent tubercle, extending to level of ALA. Eyestalk proportionally larger than in female, cornea anterolateral, lateral margin just exceeding

ALA. P-1 more robust than in female; manus length 1.6 times height. Dorsal margin of dactylus with few conical tubercles proximally; cutting edge with low tooth proximally; dactylus longer than dorsal margin of palm, latter with several sharp tubercles on proximal half; ventral margin of palm entire. Dorsal margin of merus of P-2 relatively straight with variously sized conical tubercles along entire length; ventral margin convex, entire. Dorsal margin of merus of P-5 bearing tubercles along entire length; ventral margin entire; carpus having tubercles on dorsal margin. Sternite of P-1 with 10 various granules. PLP-1 with plumose setae on proximomesial angle.

Color.--Adult female: Carapace opaque, covered with many small black chromatophores posteriorly, with much larger black chromatophores anteriorly, latter overlain with white, giving a gray hue. Eyestalk clear with black chromatophores, cornea red-orange. Meri of P-2 to P-5 opaque with fine orange line network. Distal merus, carpus, and propodus of P-2 and P-3 grayish with scattered bright blue spots. Male: Generally similar to female, cornea more orange, some fine red chromatophores on P-1.

Comparison.--See "Discussion" section.

Remarks.--Utinomi (1944) synonymized this species with Cryptochirus crescentus because the two were fairly similar and they were found in the same locality. The latter argument was based on the type locality of granulatus being



Christmas Island and Edmondson (1933) having recorded crescentus from Christmas Island. However, Edmondson was referring to Christmas Island (now = Kiritimati) in the Pacific, whereas the type locality for granulatus is Christmas Island in the Indian Ocean. Shen (1936) did not specify the ocean of the type locality for granulatus, but the label with the holotype reads "Xmas Island, Indian Ocean." Fize and Serène (1957) asserted that the relative lack of carapace ornamentation in Shen's granulatus, as compared to male Q. crescentus that they observed, could be attributed to differences in size, smaller specimens generally being less ornate. However, the male Q. crescentus figured herein (Fig. 23) is about the same size as the holotype of Q. granulatus (carapace lengths--2.1 and 2.2 mm, respectively) and shows quite different carapace ornamentation. Other differences, including the position of the cornea on the eyestalk, anterolateral in Q. granulatus versus terminal in Q. crescentus and the pattern of depressions on the posterior carapace, inverted "U"-shaped in Q. granulatus versus "H"-shaped in Q. crescentus, would not seem to be size related and strengthen the argument for separation of the two species.

**Hosts/Habitats.**--Agariciidae: Gardineroseris planulata, Leptoseri sp., and Pavona explanulata. Host of the holotype was not recorded. On Guam this species was collected from embayments, habitats of relatively high productivity. It has been collected at depths of 8-82 m.

Distribution.--Known from Christmas Island (Indian Ocean) and Guam.

Opecarcinus aurantius, new species

Fig. 24, 25

Material examined.--Holotype: GUAM: Cetti Bay; reef on south side of bay; 6 m; 30 Nov 1984; HAP 412; on Payona minuta Wells, 1954; + (ov); USNM 234266. Paratypes: GUAM: Fouha Bay; south wall of channel; 7, 9 m; 6, 26 Apr 1984; HAP 194, 212; on P. minuta; 2 +; BPBM, BMNH. Cetti Bay; same collection data as holotype; 3 + (ov); USNM 234267. POHNPEI (Ponape): Ant Atoll [06° 47'N, 157° 58'E]; in lagoon on patch reef on northeast side of channel at Matenpita; 4.5 m; 23 Nov 1984; PHAP 349; on P. minuta; 1 +, 1 o; USNM 234268.

Size range.--Females, 2.0 x 1.7 to 3.4 x 2.9; ovigerous females, 2.5 x 2.0 to 3.4 x 2.9; male, 2.9 x 2.2.

Type data.--Holotype: + (ov), 3.3 x 2.7; USNM 234266. Type locality: Cetti Bay, Guam [13° 19'N, 144° 39'E]. Paratypes: Several females and males as listed in material examined.

Description.--Adult female (Holotype, Fig. 24): Carapace 1.2 [1.2-1.3] times longer than wide. Anterior 1/3 of carapace moderately deflected, not sharply set off from posterior carapace, with transverse depression extending from frontal margin, across protogastric region, to ALA, not extending to epibranchial margin of carapace. Posterior

carapace with shallow H-shaped depression at cardio-intestinal region. Transverse section of carapace at midlength evenly convex overall, with many subequal conical tubercles, sparse setae subequal and shorter than tubercles. Carapace surface ornamented with many conical, rounded tubercles and granules, largest at midcarapace, diminishing markedly posteriorly. Anterolateral margins of carapace having conical tubercles much smaller than those on anterior carapace, ALA lacking prominent tubercle. IOA marked with tubercle, barely inflated, partially elevated above ALA, not reaching apex of latter. Front concave, granulate, having prominent median tubercle, width about 0.5 [0.4-0.5] that at ALA, latter about 0.5 [0.5-0.7] that of greatest carapace width. Orbit shallow, broadly V-shaped, margin tuberculate.

Basal segment of antennular peduncle oblique, not inflated mesially, with distal projection having apex of angled lateral lobe not reaching tip of eyestalk; dorsal surface slightly concave, covered with rounded tubercles and granules; margin with 7-8 [5-8] spines, those of distal margin larger than those of mesial margin. In ventral view, distal projection tapering sharply anteriorly, length 3.0 [2.9-3.0] times width; distal margin subequal in length to lateral margin; surface concave with many granules.

Eyestalk mostly exposed dorsally. Cornea terminal, in dorsal view, occupying  $\frac{2}{5}$  length of stalk, dorsal margin

evenly concave, lateral margin extending to or just beyond level of ALA.

Mesial margin of ischium of MXP-3 coarsely crenulated; lateral margin of merus weakly produced distally, mesial margin with 4-5 plumo-denticulate setae. Mesial margin of MXL-1 with 3 stout simple setae, lower margin with 2 stout simple setae; outer surface lacking setae.

Sternite of P-1 with transverse row of 13 [8-13] conical tubercles at midlength, with few granules posteriorly. Sternite of P-2 smooth, lacking tubercles at lateral margin. Gonopore oval, lateral margin lacking anterior hood.

Manus of P-1 2.8 [2.4-2.8] times longer than high. Dactylus shorter than dorsal margin of palm, with proximal tubercle dorsally; cutting edges of fingers entire. Dorsal margin of palm with conical tubercles along entire length, larger on proximal half; outer surface of palm flat with few granules proximally. Dorsal margin of carpus with prominent tubercle distally. Merus shorter, taller than manus, ventral margin densely granulate.

Merus of P-2 1.5 [1.4-1.6] times longer than high, dorsal margin evenly convex, entire length with conical tubercles, slightly larger distally; ventral margin straight, with few angled tubercles, moderately emarginate distally; distoventral angle produced having 1 larger, 2 smaller tubercles, outer surface with various conical, rounded tubercles on distodorsal 1/3, lacking elevated

transverse row of tubercles distoventrally. Propodus 1.0 [0.9-1.1] times longer than high; dorsal margin shorter than that of carpus.

Merus of P-5 1.7 [1.4-1.9] times longer than high, dorsal margin slightly concave with fine tubercles proximally, convex with larger tubercles distally; ventral margin relatively straight, entire; distoventral angle obtuse, lacking tubercle. Dorsal margin of carpus entire. Propodus 2.3 [2.0-2.4] times longer than high, dorsal margin entire.

Adult male (Fig. 25): Similar in form to female, carapace lacking larger tubercles, having many smaller tubercles and granules. IOA lacking prominent tubercle, extending beyond ALA. Eyestalk longer than in female; cornea terminal, lateral margin extending beyond ALA. P-1 more robust than in female; manus length 1.7 times height. Dorsal margin of dactylus with many angled tubercles proximally, cutting edge with low tooth proximally; dactylus slightly shorter than dorsal margin of palm, latter with larger conical tubercles on proximal 1/2, many smaller tubercles distally; ventral margin of palm with serrations. Dorsal margin of merus of P-2 straight, with various conical tubercles along entire length; ventral margin straight with many subequal angled tubercles along entire length. Dorsal margin of merus of P-5 with many smaller tubercles; ventral margin with few tubercles; dorsal margin of carpus with

tubercles. Sternite of P-1 with 10 rounded tubercles. PLP-1 with stout simple setae at proximomesial angle.

**Color.**--Adult female: Anterior carapace white, rest opaque with scattered whitish areas, with overall light orange tint. ALA, IOA red-orange. Eyestalk opaque with red-orange tint; cornea bright rust, may have black line proximally. Antennule base rust. Dorsal P-2 matches anterior carapace, eyestalk, and antennules. Color of some specimens may have more orange than holotype. Male: Similar to female, anterior carapace bright white, posterior carapace red-orange.

**Comparison.**--See "Discussion" section.

**Etymology.**-- From the Latin aurantium, meaning "orange," in reference to the prevalent color found on these crabs.

**Hosts/habitats.**--Agariciidae: Payona minuta. Collected at depths to 9 m from habitats of relatively high productivity; river embayments at Guam and an atoll lagoon at Pohnpei.

**Distribution.**--Known from Guam and Pohnpei.

Opecarcinus lobifrons, new species

Fig. 26, 27

Troglocarcinus (Troglocarcinus) crescentus--Garth, 1965:8, figs. 3-6 [Clipperton Is.].

Pseudocryptochirus crescentus--Garth and Hopkins, 1968:41 (in part).

**Material examined.**--Holotype: GUAM; Tanguisson Pt.; reef front; 3 m; 25 May 1984; HAP 226; on Gardineroseris planulata; 1 +; USNM 234269. Paratypes: GUAM; Tanguisson Pt.; same collection data as holotype; 1 +; USNM 234270. Tanguisson Pt.; reef front; 2 m; 7 Feb 1984; HAP 067; on G. planulata; 1 +, 1 o; USNM 234271; 2 + (ov); BPBM. Agaña Bay; 300 m north of boat basin channel; reef front; 9 m; 3 Feb 1984; HAP 061; on G. planulata; 1 +, 1 o; BMNH. Agat Bay; 0.9 km north of Facpi Pt. [13 20'N, 144 38'E]; reef front; 7 m; 8 Mar 1984; HAP 161; on G. planulata; 2 + (ov), 1 o; MNHN. CLIPPERTON IS. [10 17'N, 109 13'W]; NE Transect; 78 ft [24 m]; 27-VIII-1958; Coll. C. Limbaugh; [host not recorded]; 1 +; AHF 2777-01.

**Size range.**--Females, 2.4 x 1.9 to 4.6 x 3.8; ovigerous females, 2.4 x 1.9 to 2.6 x 2.0; males, 2.1 x 1.6 to 2.4 x 1.9.

**Type data.**--Holotype: +, 2.9 x 2.3; USNM 234269. Type locality: Tanguisson Pt., Guam [13 33'N, 144 49'E]. Paratypes: several males and females as listed in material examined.

**Description.**--Adult female (Holotype, Fig. 26): Carapace length 1.2 [1.2-1.3] times width. Anterior 1/4 of carapace slightly deflected, not sharply set off from posterior carapace, with transverse depression restricted to protogastric region. Posterior carapace with inverted U-shaped depression at cardio-intestinal region. Transverse section of carapace at midlength evenly convex overall with

scattered variously sized conical tubercles, moderately setose with setae subequal, slightly longer than tubercles. Carapace surface with scattered rounded and conical tubercles, largest just anterior to midlength, decreasing sharply in size posteriorly to fine granules; posterolateral margins rounded. Anterolateral margins with few larger conical tubercles, ALA lacking prominent tubercle. IOA marked with tubercle, inflated, entirely elevated above level of and extending beyond ALA. Front concave, lacking prominent prominent tubercle, with many rounded tubercles; width 0.4 [0.4-0.5] that of carapace at ALA, latter 0.6 [0.7] greatest carapace width. Orbit shallow, broadly J-shaped, margin tuberculate.

Basal segment of antennular peduncle oblique, not inflated mesially, with distal projection having apex of angled lateral lobe not reaching tip of eyestalk; dorsal surface scanty concave with many smaller tubercles; margin with 7-8 [7-8] spines, those of distal margin larger than those of mesial margin. In ventral view, basal segment tapering anteriorly, length 2.3 [2.4-2.6] times width; distal margin shorter than lateral margin; surface convex with scattered granules, most near mesial margin.

Eyestalk partially exposed dorsally. Cornea terminal, in dorsal view, occupying 2/5 length of stalk, dorsal margin evenly concave, lateral margin extending just beyond ALA.

Mesial margin of ischium of MXP-3 coarsely crenulated; lateral margin of merus weakly produced distally, mesial



margin with 1 plumo-denticulate seta. Mesial margin of MXL-1 with 3 stout simple setae, lower margin with 2 stout simple setae; outer surface with 1 stout serrate seta not exceeding mesial margin.

Sternite of P-1 with transverse row of 12 [8-13] rounded [conical] tubercles at midlength, none posteriorly. Sternite of P-2 smooth, lacking tubercles at lateral margin. Gonopore oval, lateral margin lacking anterior hood.

Manus of P-1 2.1 [1.8-2.1] times longer than high. Dactylus slightly shorter than dorsal margin of palm, with proximal tubercle dorsally; cutting edges of fingers entire. Dorsal margin of palm with conical tubercles along entire length, largest on proximal 1/2; outer surface of palm flat with few rounded tubercles proximally. Dorsal margin of carpus with prominent tubercle distally. Merus shorter, taller than manus, ventral margin irregularly tuberculate.

Merus of P-2 1.6 [1.4-1.6] times longer than high; dorsal margin slightly convex, with various conical tubercles, largest on distal 1/4; ventral margin relatively straight, with several angled tubercles, gently emarginate distally; distoventral angle produced into prominent tubercle; outer surface with many granules, rounded tubercles on distodorsal 1/3, with elevated transverse row of tubercles distoventrally. Propodus 1.1 [1.0-1.1] times longer than high, dorsal margin shorter than dorsal margin of carpus.

Merus of P-5 1.9 [1.6-2.1] times longer than high; dorsal margin with smaller angled tubercles along entire length, with few larger conical tubercles distally; ventral margin straight, entire; distoventral angle with small tubercle; outer surface smooth. Dorsal margin of carpus with few smaller tubercles distally. Propodus 2.5 [1.8-2.2] times longer than high; dorsal margin entire.

Adult male (Fig. 27): Similar in form to female, depression on anterior carapace extends to epibranchial regions; carapace relatively flat with fewer tubercles. IOA marked with spine, not inflated, extending beyond level of ALA. Eyestalk stockier than in female; cornea terminal, lateral margin extending to or just falling short of ALA. P-1 manus more robust than in female, 1.5 times longer than high. Dorsal margin of dactylus with few conical tubercles dorsally, cutting edge with low tooth proximally; dactylus shorter than dorsal margin of palm, latter with few larger tubercles proximally, many rounded tubercles distally; ventral margin of palm entire. Dorsal margin of merus of P-2 scarcely convex, with various conical tubercles; ventral margin scarcely convex with few angled tubercles. Dorsal margin of P-5 convex with smaller angled tubercles on distal 3/4; ventral margin straight, entire. Sternite of P-1 with 6-8 tubercles. PLP-1 with plumose setae at proximomesial angle.

**Color.**--Adult female: Anterior carapace bright white, posterior carapace with clear band laterally having many

fine black chromatophores and overall red-orange hue. Eyestalks clear with red-orange tint, corneas red. Antennule base red-orange around margin, brownish mesially. P-2 clear with fine white lines becoming densely packed distally. P-3 to P-5 clear dorsally with irregular orange lines, thicker distally. Male: Anterior carapace white, posterior brownish with blue spots near anterior edge of brown area. Corneas pink.

Comparison.--See "Discussion" section.

Remarks.--Garth (1965) noticed that the Clipperton specimen differed from typical specimens of *Q. crescentus*. This material was examined by Serène who (in Garth, 1965) stated that the differences were age-related. I disagree. The main features separating *Q. lobifrons* from *Q. crescentus*, the extent of the IOA beyond the ALA and the restricted anterior depression, are consistent among all of the specimens of the two species that I have examined, regardless of size. However these features are exaggerated in the Clipperton specimen of *Q. lobifrons*. I have not seen the dried specimens discussed and figured by Garth (1965:10, fig. 4-6).

Etymology.--From the Latin "lobus", elongated projection, in combination with "frons", forehead, in reference to the extension of the front of the carapace beyond the level of the anterolateral angles of the carapace; a noun in apposition.

Hosts/habitats.--Agariciidae: Gardineroseris planulata.  
On Guam, collected from open water reef front areas to a  
depth of 9 m. The host of the Clipperton Island specimen,  
collected at 24 m, was not recorded. The coral fauna of  
Clipperton Island does not seem to be well documented. Two  
species of Payona, P. gigantea Verrill and P. explanulata  
were listed by Durham and Barnard (1952). Of interest is  
the record of P. ponderosa Gardiner at Cocos Island (Durham,  
1962). P. ponderosa is now considered a junior synonym of  
G. planulata (see Veron and Pichon, 1980), thus the known  
host of O. lobifrons occurs in eastern Pacific waters.

Distribution.--Known from Guam and Clipperton Island.

Opecarcinus peliops, new species

Fig. 28, 29

Material examined.--Holotype: POHNPEI: Pakin Atoll;  
reef front south of Mant Is.; 3 m; 19 Nov 1984; PHAP 302; on  
Payona duerdeni; +; USNM 234272. Paratypes: Same location  
and host species as holotype; 3-6 m; 19 Nov 1984; PHAP 299,  
303; 1 + (ov), 1 o; USNM 234273/4.

Size range.--Females, 2.1 x 1.8 to 3.3 x 2.9; ovigerous  
female, 2.1 x 1.8; male, 2.0 x 1.6.

Type data.--Holotype: + (ov), 3.3 x 2.9; USNM 234272.  
Type locality: Pakin Atoll, Pohnpei [07 04'<sup>o</sup>N, 157 48'<sup>o</sup>E].  
Paratypes: One female (ov), one male as listed in material  
examined.

**Description.**--Adult female (Holotype, Fig. 28):  
Carapace 1.2 times longer than wide. Anterior 1/3 of carapace moderately deflected, not sharply set off from posterior carapace, with shallow transverse depression extending from frontal, across protogastric region, to ALA, not reaching epibranchial margin of carapace. Posterior carapace with central H-shaped depression. Transverse section of carapace at midlength evenly convex overall with many subequal conical tubercles, moderately setose with setae subequal, much longer than tubercles. Carapace surface ornamented with erect conical tubercles, largest at midcarapace, smaller tubercles anteriorly; posterior half of carapace with round granules diminishing in size and number posteriorly. Anterolateral margins with few erect conical tubercles, ALA lacking prominent tubercle. IOA marked with tubercle, slightly inflated, elevated above and extending to apex of ALA. Front slightly concave, with larger median tubercle, width 0.4 that of ALA, latter 0.6 that of greatest carapace width. Orbit shallow, broadly U-shaped, margin with few tubercles.

Basal segment of antennular peduncle transverse, not inflated mesially, with distal projection having apex of angled lateral lobe extending beyond eyestalk; dorsal surface slightly concave with few granules; margin with 7-9 [11] subequal spine. In ventral view, basal segment broadening anteriorly, length 2.1 times width; distal margin

shorter than lateral margin; surface flat with scattered granules.

Eyestalk mostly exposed dorsally. Cornea terminal; in dorsal view, occupying 1/3 length of stalk, dorsal margin irregularly sinuous, lateral margin of cornea extending beyond ALA.

Mesial margin of ischium of MXP-3 coarsely crenulated; lateral margin of merus weakly produced distally, mesial margin with 4 stout plumo-denticulate setae. Mesial margin of MXL-1 with 3 stout simple setae, lower margin with 1 stout simple seta; outer surface with 1 pappose seta, exceeding mesial margin.

Sternite of P-1 with transverse row of 6 rounded tubercles at midlength, few smaller tubercles along anterolateral margins, 2-3 rounded tubercles posterolaterally. Sternite of P-2 smooth, with tubercles at lateral margins. Gonopore oval, lateral margin lacking anterior hood.

Manus of P-1 1.8 [1.9] times longer than high. Dactylus slightly longer than dorsal margin of palm, with proximal tubercle dorsally; cutting edges of fingers entire. Dorsal margin of palm with erect conical tubercles on proximal 1/2, smaller rounded tubercles distally; outer surface of palm flat with few granules proximally. Dorsal margin of carpus lacking larger tubercle distally. Merus as long as, taller than manus.

Merus of P-2 1.5 times longer than high; dorsal margin convex with transverse notch distally and rounded tubercles proximal to notch, prominent blunt tubercles distal to notch; ventral margin convex with few conical tubercles, abruptly emarginate distally; distoventral angle produced into 3 subequal tubercles; outer surface with few scattered tubercles on distodorsal 1/3, lacking elevated transverse row of tubercles distoventrally. Propodus 1.1 times longer than high, dorsal margin shorter than that of carpus.

Merus of P-5 (from paratype) 1.7 times longer than high; dorsal margin with few smaller tubercles; ventral margin convex, entire; distoventral angle with small tubercle; outer surface smooth. Dorsal margin of carpus entire. Propodus 1.7 times longer than high; dorsal margin entire.

Adult male (Fig. 29): Carapace similar to female, much less tuberculate. IOA marked with spine, slightly exceeding apex of ALA. Eyestalk as in female; cornea terminal, lateral margin exceeding ALA. P-1 more robust than female, manus 1.4 times longer than high. Dorsal margin of dactylus with few tubercles proximally, cutting edge entire; dactylus about as long as dorsal margin of palm, latter elevated above level of joint with dactylus, with few smaller tubercles; ventral margin of palm entire. Dorsal margin of merus of P-2 straight with larger conical tubercles along entire length; ventral margin slightly convex with angled tubercles on distal 1/2. Dorsal margin of merus of P-5

slightly convex with few angled tubercles; ventral margin relatively straight with few angled tubercles. Sternite of P-1 with 4 tubercles. PLP-1 with long simple seta at proximomesial angle.

**Color.**--Adult female: Carapace white with two curved longitudinal opaque bands posteriorly; with fine, irregular fluorescent orange and black lines on most of carapace; may have black, orange, and blue spots; transverse groove opaque; external orbital angle red-orange. Eyestalk opaque with red-orange tint; cornea with black outer ring, bright, light blue center. Carpus of P-1 similar to eyestalk, dorsal margin of manus yellow-white with light blue spots. P-2 similar to carapace. Male: Carapace bright white, transverse groove opaque. Eyestalk opaque with irregular black marks and red-orange tint; cornea bright blue.

**Comparison.**--See "Discussion" section.

**Etymology.**--From the Greek "pelios", black and blue, in combination with "ops", eye, in reference to the peculiar eye color of the females.

**Hosts/Habitat.**-- Agariciidae: *Payona duerdeni*. Collected from areas of rich coral growth at depths of 3-6 m in nutrient-poor reef front waters off small atolls.

**Distribution.**--Known only from Pohnpei.



Opeccarcinus pholeter, new species

Fig. 30, 31

Material examined.--Holotype: GUAM: Cetti Bay; on isolated patch reef in middle of bay; 14 m; 30 Nov 1984; HAP 410; on Payona explanulata; + (ov); USNM 234275. Paratypes: BELAU: Ngeruktabel Is.; patch reef between Ngeruktabel and rock island directly south of MMDC; 3 m; 2 Jul 1984; PHAP 041; on P. explanulata; 1 + (ov), 1 o; USNM 234276; 2 m; 3 Jul 1984; PHAP 057; on P. explanulata; 1 + (ov), 1 o; RMNH. Ngeruktabel Is.; north shore, cove at west end of main rock island group; 3 m; 23 Jul 1984; PHAP 195; on Leptoseris yabei (Pillai and Scheer, 1976); 2 o; USNM 234277; PHAP 196; on P. explanulata; 1 +; NMNH. GUAM: Agat Bay; Taleyfac Channel; north wall of channel; 3-4 m; 20 Mar 1984; HAP 178, 179; on P. explanulata; 1 + (ov); AHF; 3 + (2 ov); BPBM. Fouha Bay; south side of bay on wall of channel; 6 m; 6 Apr 1984; HAP 193; on P. explanulata; 1 +, 1 o; AHF; 8 m; 26 Apr 1984; on P. explanulata; 1 o; NMNH. Cetti Bay; same collection data as holotype; 1 + (ov), 2 o; BMNH.

Size range.--Females, 2.4 x 2.1 to 5.6 x 4.6; ovigerous females, 3.9 x 3.4 to 5.6 x 4.6; males, 1.4 x 1.2 to 4.2 x 3.4.

Type data.--Holotype, + (ov), 5.6 x 4.6; USNM 234275. Type locality: Cetti Bay, Guam [13 19'<sup>o</sup>N, 144 39'<sup>o</sup>E]. Paratypes: Several females and males as listed in material examined.

**Description.**--Adult female (Holotype, Fig. 30):  
Carapace 1.2 [1.1-1.3] times longer than wide. Anterior 1/3 of carapace slightly deflected, not sharply set off from posterior carapace, with transverse depression extending from frontal area, across protogastric region, to ALA and epibranchial regions. Posterior carapace with 3 longitudinal depressions extending from gastric to cardiac region, covered with round granules decreasing in size posteriorly. Transverse section of carapace at midlength relatively flat overall, each 1/3 slightly concave, with scattered variously sized conical tubercles, moderately dense unequal setae mostly shorter than tubercles. Carapace surface covered with conical tubercles, largest at midlength. Anterolateral margins with few conical tubercles, ALA lacking prominent tubercle. IOA with spine, slightly inflated, totally elevated above level of and extending to apex of ALA. Front concave lacking larger median tubercle, with few granules, width 0.5 [0.4-0.5] that of carapace at ALA, latter 0.6 times greatest carapace width. Orbit deep, broadly V-shaped, margin with few tubercles.

Basal segment of antennular peduncle slightly oblique, not inflated mesially, with distal projection having apex of lateral lobe reaching apex of eyestalk; dorsal surface scarcely concave with scattered conical tubercles; margin with 6-7 [5-8] spines, those of distal margin larger than those of mesial margin. In ventral view, basal segment

tapering anteriorly, length 2.6 [2.5-2.7] times width; distal margin longer than lateral margin; surface flat with scattered granules.

Eyestalk partially exposed dorsally. Cornea anterolateral, in dorsal view, occupying 1/4 length of stalk, dorsal margin evenly concave, lateral margin not reaching ALA.

Mesial margin of ischium of MXP-3 finely crenulated; lateral margin of merus strongly produced distally, mesial margin with 6 plumo-denticulate setae. Mesial margin of MXL-1 with 5 stout simple setae, lower margin with 4-5 stout simple setae; outer surface with 2 stout serrate setae, not exceeding mesial margin.

Sternite of P-1 with transverse band of 22 [15-20] rounded tubercles of various sizes at midlength, several rounded tubercles postero-laterally. Sternite of P-2 granular [smooth], with tubercles at lateral margin. Gonopore elliptical, lateral margin having anterior hood.

Manus of P-1 2.5 [2.1-2.5] times longer than high. Dactylus shorter than dorsal margin of palm, with proximal tubercle dorsally; cutting edges of fingers entire. Dorsal margin of palm with few conical tubercles on proximal 1/2, smaller tubercles distally. Dorsal margin of carpus with prominent spine distally. Merus shorter, taller than manus, ventral margin densely covered with angled tubercles.

Merus of P-2 1.6 [1.4-1.7] times longer than high; dorsal margin slightly convex, having various conical tubercles, largest on distal 1/4; ventral margin convex, with angled tubercles, gently emarginate distally; distoventral angle produced into single ventral tubercle with 3 smaller tubercles dorsal to it; outer surface with many rounded tubercles on distodorsal 1/2, with elevated transverse row of tubercles distoventrally. Propodus 1.2 [1.1-1.2] times longer than high, dorsal margin shorter than that of carpus.

Merus of P-5 1.6 [1.4-1.8] times longer than high; dorsal margin convex, with smaller angled tubercles along entire length; ventral margin relatively straight, entire; distoventral angle with small tubercle; outer surface smooth with few tubercles near dorsal margin. Dorsal margin of carpus entire. Propodus 2.1 [1.9-2.2] times longer than high; dorsal margin entire.

Adult male (Fig. 31): Carapace overall similar to female, showing similar pattern of depressions, generally less tuberculate, those present smaller than in female. IOA with blunt tubercle, exceeding apex of ALA. Basal segment of antennule relatively shorter than in female. Eyestalk as in female; cornea anterolateral, lateral margin extending to or just beyond ALA. P-1 proportionally more robust than in female, manus 1.6 times longer than high. Dorsal margin of dactylus with many angled tubercles proximally, cutting edge with low tooth proximally; dactylus slightly shorter than

dorsal margin of palm, latter with smaller tubercles along entire length, lacking larger tubercles; ventral margin of palm entire. Dorsal margin of merus of P-2 slightly convex with larger conical tubercles on distal 1/2; ventral margin straight with few angled tubercles. Dorsal margin of merus of P-5 convex with smaller angled tubercles along entire length; ventral margin relatively straight, entire. Sternite of P-1 with transverse band of 20 variously sized conical, rounded tubercles. PLP-1 with plumose setae at proximomesial angle.

Color.--Adult female: Anterior carapace off-white, transverse groove dark amber. Posterior carapace opaque with alternating bands of amber, infused with fine, irregular black spots, and bands of white chromatophores (8 white, 9 amber bands). Eyestalk opaque to off-white; cornea red-brown. Walking legs opaque proximally with fine black-line network and amber tint, rimmed with off-white. Male: Similar to female.

Comparisons.--See "Discussion" section.

Etymology.--From the Greek "pholeter", one who lurks in a hole; a noun in apposition.

Hosts/habitat.--Agariciidae: Payona explanulata and Leptosaris yabei. All were collected at depths of 2-14 m from areas of relatively high productivity. The Belau specimens were collected in the lagoon next to a high island (Ngeruktabel). The Guam specimens were collected from embayments into which nutrient-laden rivers empty.

Distribution.--Known from Guam and Belau.

Opecarcinus sierra, new species

Fig. 32

Material examined.--Holotype: GUAM: Agat Bay; Taleyfac Channel, from wall on north side of channel; 3 m; 20 Mar 1984; HAP 177; on Payona varians; + (ov); USNM 234278. Paratypes: GUAM: Luminao Reef; mid reef flat; 1 m; 20, 27 Oct 1984; HAP 350, 366; on P. divaricata, P. venosa; 2 + (ov); MNHN. Apra Harbor; Hotel Reef; 1 m; 31 Jan 1984; HAP 046; on P. venosa; 2 + (ov); RMNH. Apra Harbor; Sasa Bay [13 27'N, 144 41'E]; harbor side of large patch reef; 2.5 m; 15 Mar 1984; HAP 166; on P. varians; 1 + (ov); USNM 234279. Apra Harbor; Western Shoals; [13 27'N, 144 39'E]; west slope of shoals; 21 m; 15 Mar 1984; HAP 169; on P. divaricata; 1 + (ov); BMNH. Agat Bay; same collection data as holotype; 4 + (ov); MNHN, BMNH, BPBM. Cocos Lagoon; southwest corner of lagoon just inside barrier reef; 1.5 m; 6 Mar 1984; HAP 148; on P. venosa; 2 + (ov); USNM 234280.

Size range.--Ovigerous females, 2.2 x 1.9 to 3.5 x 2.8.

Type data.--Holotype: + (ov), 2.3 x 1.8; USNM 234278.

Type locality: Agat Bay, Guam [13 24'N, 144 39'E].

Paratypes: Several females as listed in material examined.

Description.--Adult female (Holotype, Fig. 32):

Carapace 1.3 [1.2-1.4] times longer than wide. Anterior 1/4 of carapace strongly deflected, not sharply set off from posterior carapace, with transverse depression restricted to

protogastric region. Posterior carapace with H-shaped depression at cardio-intestinal region. Transverse section of carapace at midlength convex overall with many conical tubercles, moderately dense setae subequal, shorter than tubercles. Carapace surface with many conical tubercles anteriorly, largest at midlength, posterior surface with rounded tubercles diminishing in size and number posteriorly. Anterolateral margins with few larger tubercles, ALA lacking prominent tubercle. IOA marked with tubercle, inflated, entirely elevated above and extending to apex of ALA. Front concave, margin with many subequal conical tubercles, lacking prominent median tubercle; width 0.5 that of ALA, latter 0.6 [0.6-0.7] that of greatest carapace width. Orbit deep, broadly V-shaped, margin tuberculate.

Basal segment of antennular peduncle transverse, not inflated mesially, with distal projection having apex of angled lateral lobe extending beyond tip of eyestalk; dorsal surface slightly concave, with few rounded tubercles, margin with 11-12 [9-14] subequal spines. In ventral view, basal segment broadening distally, length 2.5 [2.2-2.5] times width; distal margin shorter than lateral margin; surface convex, covered with granules.

Eyestalk mostly exposed dorsally. Cornea terminal, in dorsal view, occupying 1/3 length of stalk, dorsal margin evenly concave lateral margin extending to or just beyond apex of ALA.

Mesial margin of ischium of MXP-3 coarsely crenulated; lateral margin of merus strongly produced distally, mesial margin with 2 plumo-denticulate setae. Mesial margin of MXL-1 with 5, lower margin with 4, stout simple setae; outer surface lacking setae.

Sternite of P-1 with 7 [7-10] larger conical tubercles in single row at midlength, with 10 [0-9] granules posteriorly. Sternite of P-2 smooth, with tubercles at lateral margin. Gonopore oval, lateral margin lacking anterior hood.

Manus of P-1 2.3 [2.3-2.6] times longer than high. Dactylus shorter than dorsal margin of manus, with proximal tubercle dorsally; cutting edges of fingers entire. Dorsal margin of palm with smaller conical tubercles along entire length, slightly larger proximally; outer surface of palm flat with several granules proximally. Dorsal margin of carpus lacking prominent spine distally. Merus shorter, taller than manus; ventral margin with few tubercles.

Merus of P-2 1.3 [1.3-1.5] times longer than high; dorsal margin evenly convex, with conical tubercles along entire length, largest on distal 1/2; ventral margin relatively straight, with angled tubercles, moderately emarginate distally; distoventral angle produced into tubercle; outer surface with many rounded tubercles on distodorsal 1/2, with elevated transverse row of tubercles distoventrally. Propodus 1.0 [1.0] times longer than high, dorsal margin as long as that of carpus.



Merus of P-5 1.5 [1.4-1.6] times longer than high; dorsal margin lined with subequal angled tubercles; ventral margin straight, entire; distoventral angle produced into tubercle; outer surface with few rounded tubercles distally near dorsal margin. Dorsal margin of carpus entire. Propodus 2.3 [1.9-2.4] times longer than high; dorsal margin entire.

Male: Unknown.

Color.--Adult female: Posterior carapace off-white, posterior branchial regions solid brown with mix of orange and brown; or with 7 longitudinal black bands. Anterior carapace off-white, anterior depression dark brown. Cornea dark red.

Comparisons.--See "Discussion" section.

Etymology.--From the Spanish "sierra", mountains with a craggy skyline, in reference to the appearance of the carapace in transverse section; a noun in apposition.

Hosts/Habitats.--Agariciidae: Payona varians, P. divaricata, and P. venosa. Collected from relatively high productivity areas such as river embayments, lagoons, and from a barrier reef flat at depths to 21 m.

Distribution.--Known only from Guam.

#### Discussion

Comparisons.--Orientation of the cornea on the eyestalk can be used to separate the species of Opecarcinus into two groups. The cornea is oriented anterolaterally in O.

*hypostegus*, *Q. granulatus*, and *Q. pholeter*, whereas it is terminal in *Q. crescentus*, *Q. aurantius*, *Q. lobifrons*, *Q. peliops*, and *Q. sierra*. Among the first three species, *Q. hypostegus*, an Atlantic species, can be distinguished from the other two by having the distal margin of the basal segment of the antennule longer than the lateral margin; the opposite is true for *Q. granulatus* and *Q. pholeter*. The latter two species can be differentiated by the condition of the dorsal margin of the carpus of leg P-5; it is tuberculate in *Q. granulatus* and smooth in *Q. pholeter*. Also, the posterior carapace of *Q. pholeter* has 3 longitudinal depressions as compared to the broad, inverted U-shaped depression of *Q. granulatus*.

Among species having a terminally situated cornea, the orientation of the basal segment of the antennule, oblique in *Q. aurantius* and *Q. lobifrons*, as compared to transverse in *Q. crescentus*, *Q. peliops*, and *Q. sierra*, divides those species into two groups. The extent of the IOA separates *Q. lobifrons*, in which it extends beyond the apex of the ALA, from *Q. aurantius* in which it does not exceed the apex of the ALA. *Q. peliops* has a notch distally on the dorsal margin of the merus of leg P-2 and the dorsal margin of the cornea is irregularly sinuous, thereby distinguishing it from *Q. crescentus* and *Q. sierra* in which the dorsal margin is not notched and the dorsal margin of the cornea is evenly concave. The latter two species can be separated by the marked convexity of the carapace and restriction of the

anterior depression from the epibranchial region in *Q. sierra* versus the relatively flat carapace and the extension of the anterior depression to the epibranchial region in *Q. crescentus*.

Color pattern is useful in distinguishing the species. Cornea color is distinctive for three species; black and blue in *Q. peliops*, bright rust in *Q. aurantius*, and red-orange in *Q. granulatus*. The other four Pacific species of *Opecarcinus*, in which the dominant cornea color is red, can be distinguished by color patterns of the carapace. *Q. lobifrons* has a bright white carapace with a red-orange hue posteriorly, but lacks dark bands. The remaining three have off-white carapaces; *Q. crescentus* has four black longitudinal bands posteriorly, *Q. sierra* has seven black bands (or may be solid brown) posteriorly, and *Q. pholeter* has nine amber bands posteriorly. Live color has not been reported for *Q. hypostegus*.

**Hosts.**--The Pacific species of *Opecarcinus* may be restricted to corals of the family Agariciidae. All of the material examined here, for which the host was recorded, occurred on agariciid corals. All literature records for the Pacific species list agariciid corals as hosts, except the questionable record of Takeda and Tamura (1983) as mentioned previously. *Opecarcinus hypostegus* occurs on siderastreid, as well as agariciid, corals in the Atlantic (Kropp and Manning, 1987).

Of the five extant genera of agariciid corals in the Pacific, species of Opecarcinus occur on three; Gardineroseris Scheer and Pillai, Leptoseris Milne Edwards and Haime, and Payona Lamarck. The absence of Opecarcinus on Coeloseris Vaughan may be an artifact of collection bias. Coeloseris is known from Nicobar to New Caledonia (Veron and Pichon, 1980), a region from which there are few gall crab records. That Opecarcinus has not yet been found on Pachyseris Milne Edwards and Haime is noteworthy. Pachyseris is widespread, occurring from Madagascar to Samoa (Ditlev, 1980), and has affinities with two gall crab-inhabited genera, Gardineroseris and Payona (Veron and Pichon, 1980). It occurs in Guam (Randall and Myers, 1983) where it is fairly common (pers. obs.). During my field studies in Micronesia I examined over 100 colonies of Pachyseris for the presence of gall crabs and did not find any. Reasons for the absence of gall crabs on Pachyseris are not immediately obvious.

Two species of Opecarcinus, O. aurantius on Payona minuta and O. peliops on P. duerdeni, each may be restricted to a single host species. Each of the other species of Opecarcinus occurs on several host coral species.

**Distribution.**--Opecarcinus is the only cryptochirid genus known to have representatives in the three major ocean basins. O. hypostegus occurs from the western to central Atlantic (Kropp and Manning, 1987). O. granulatus occurs in the easternmost Indian Ocean and in the western Pacific.

The absence of *Opecarcinus* from the main Indian Ocean basin may be a result of a collection deficiency as gall crabs are not well-represented in general decapod collections. Two species (*O. crescentus* and *O. lobifrons*) occur in the eastern as well as the western Pacific, thus having distributions not interrupted by the purported East Pacific Barrier (discussed by Vermeij, 1978). All gall crab species known from the eastern Pacific, *Hapalocarcinus marsupialis* Stimpson is the third, also occur in the western Pacific. Four species of *Opecarcinus*, *O. aurantius*, *O. peliops*, *O. pholeter*, and *O. sierra*, occur only on the Pacific Plate or the islands on its western margin. However, all are newly described and may not represent true Pacific Plate species (see Springer, 1982), as further studies may increase their known distributional ranges.

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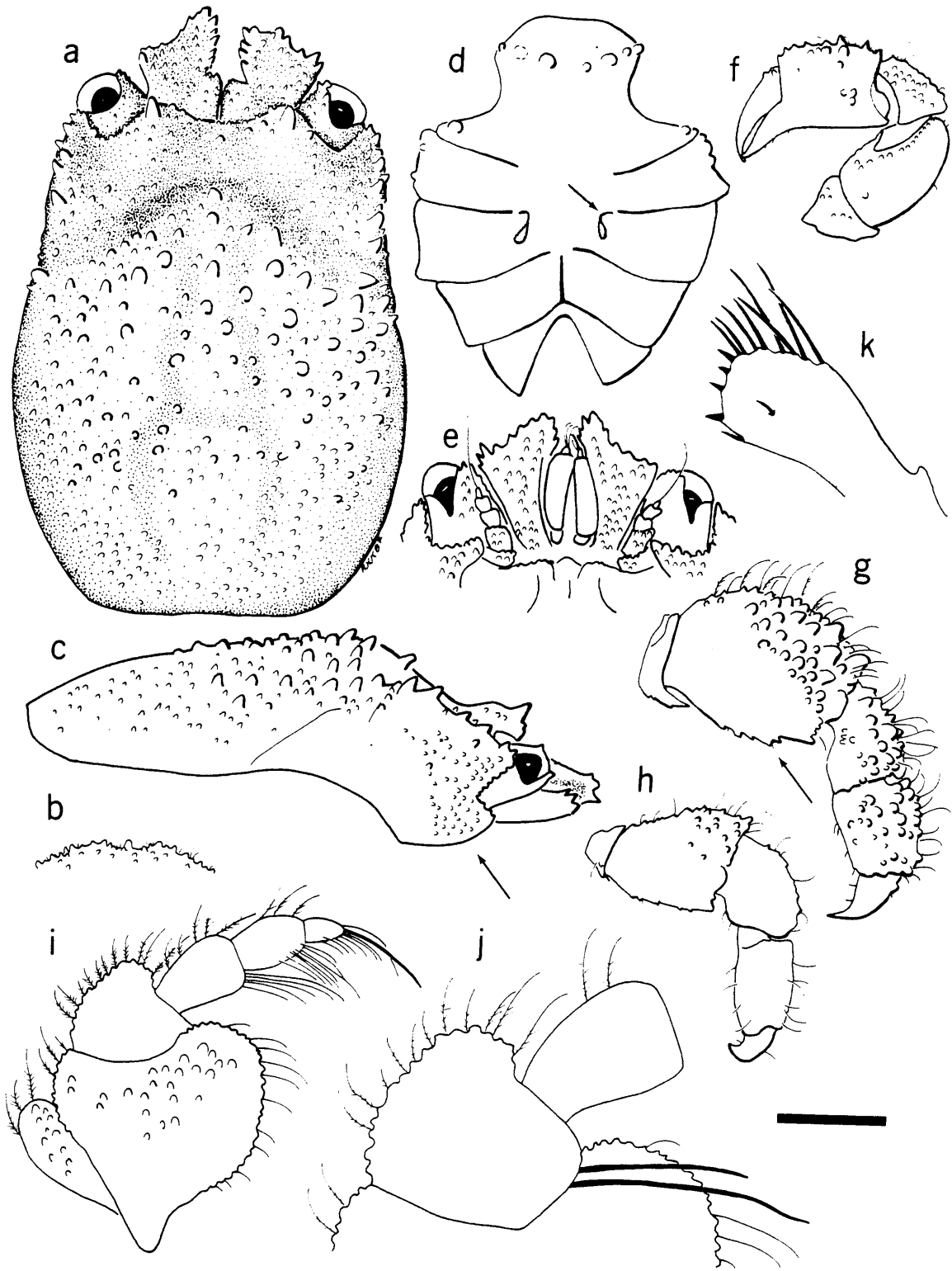
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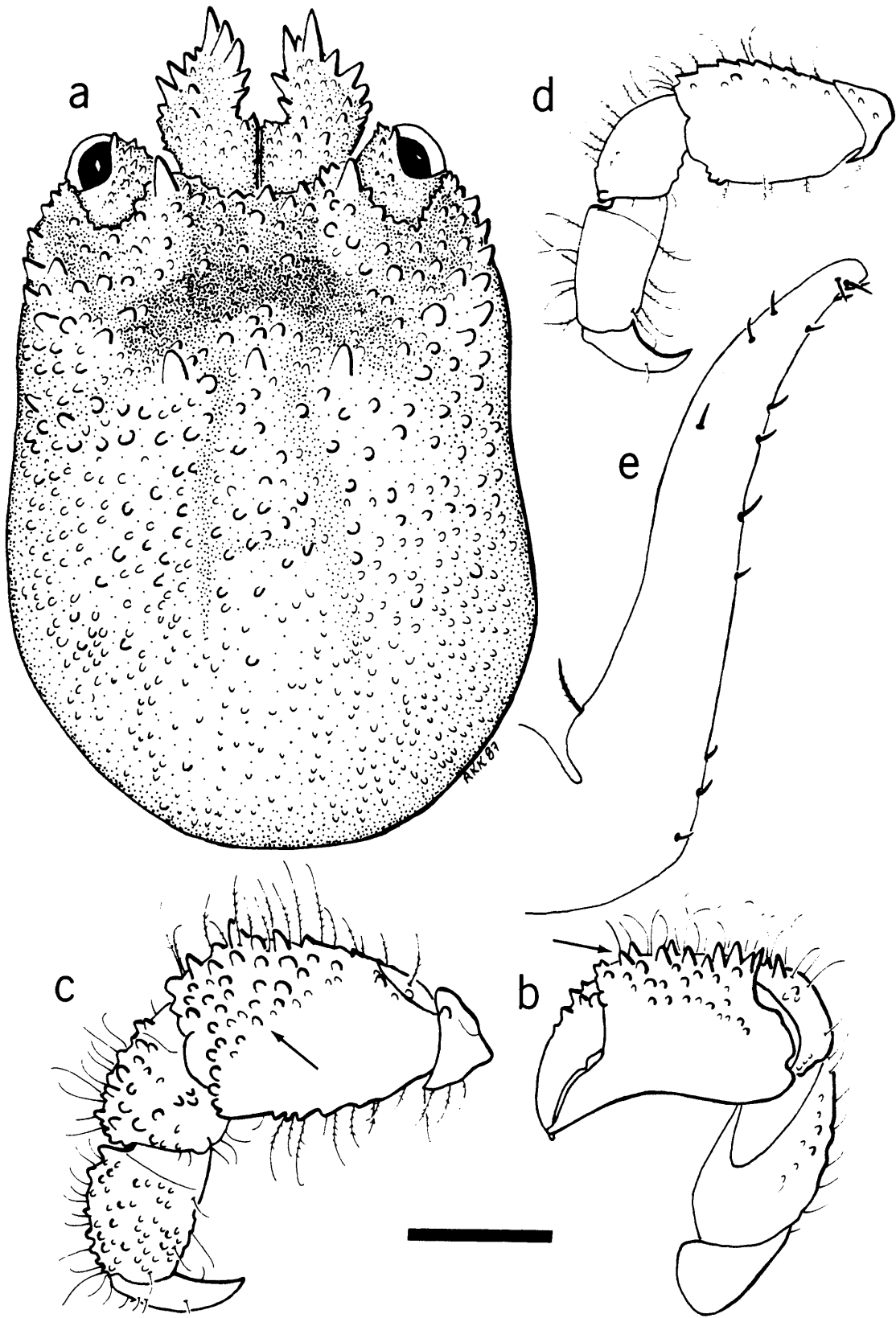
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Fig. 20. Opecarcinus crescentus (Edmondson), +, Holotype. (Johnston Atoll: BPBM S1805): a, carapace (dorsal view); b, carapace (transverse section at midlength); c, carapace (lateral view, arrow points to granules); d, thoracic sternites (arrow points to gonopore hood); e, eyes, antennules (ventral view); f, left P-1; g, right P-2 (arrow points to angled tubercles); h, right P-5; i, MXP-3 (outer view); j, MXP-3 (inner view of merus); k, MXL-1 (outer view). Scale: a, c-h = 0.5 mm; b = 1 mm; i, k = 0.3 mm; j = 0.2 mm.

Fig. 21. Opecarcinus crescentus (Edmondson), o. (Vietnam: BMNH 1958.10.20.3-4): a, carapace (dorsal view); b, left P-1 (arrow points to conical tubercles); c, left P-2 (arrow points to rounded tubercles); d, right P-5; e, PLP-1 (outer view). Scale: a-d = 0.5 mm; e = 0.2 mm.

Fig. 22. Opecarcinus granulatus (Shen), +. (Guam: USNM 234263): a, carapace (dorsal view); b, carapace (transverse section at midlength); c, carapace (lateral view); d, thoracic sternites; e, eyes, antennules (ventral view); f-h, right P-1, P-2, P-5; i, MXP-3 (outer view); j, MXP-3 (inner view of merus); k, MXL-1 (outer view). Scale: a, c, d, f-h = 0.5 mm; b = 0.8 mm; e, j = 0.4 mm; i = 0.3 mm; k = 0.2 mm.





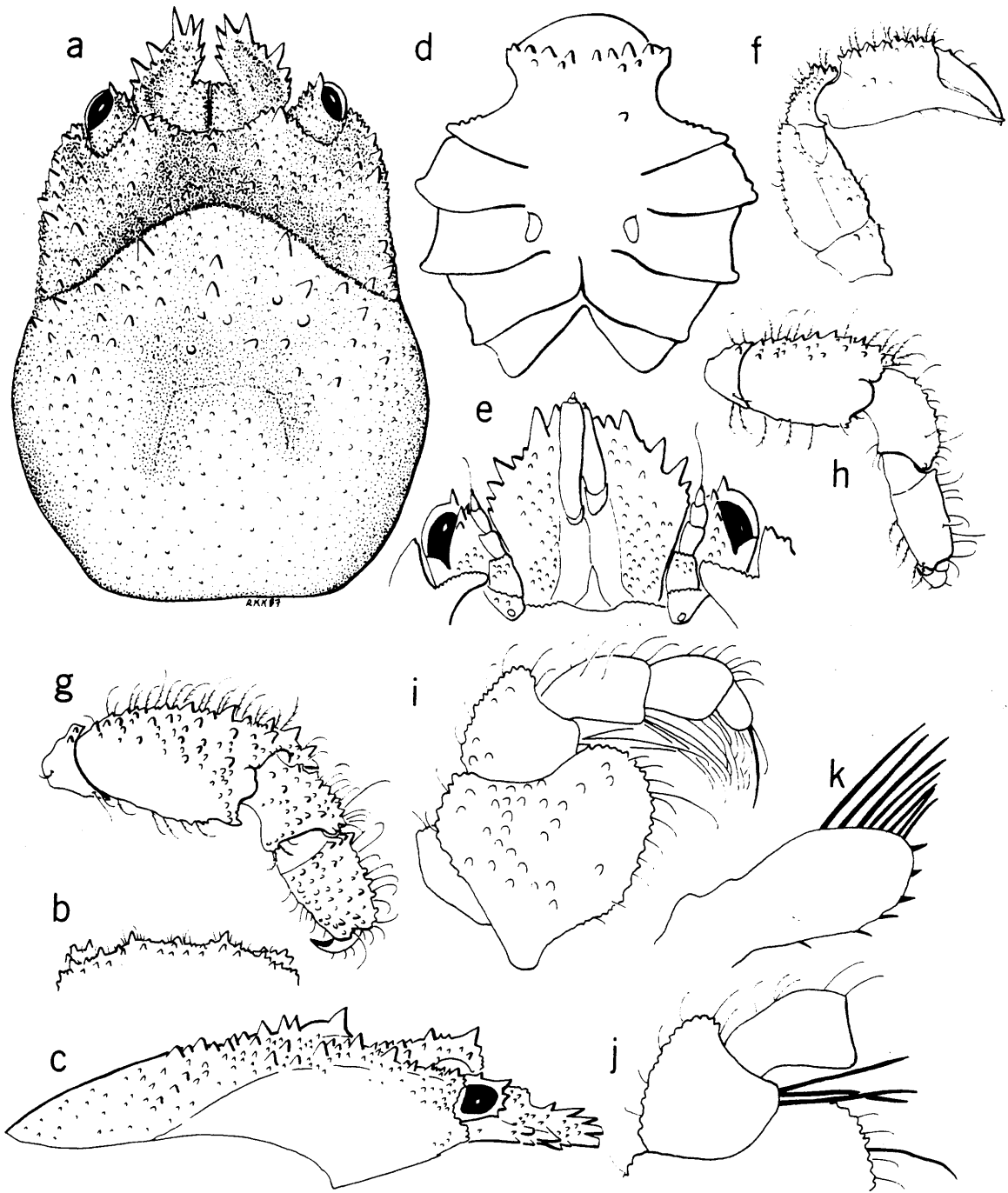
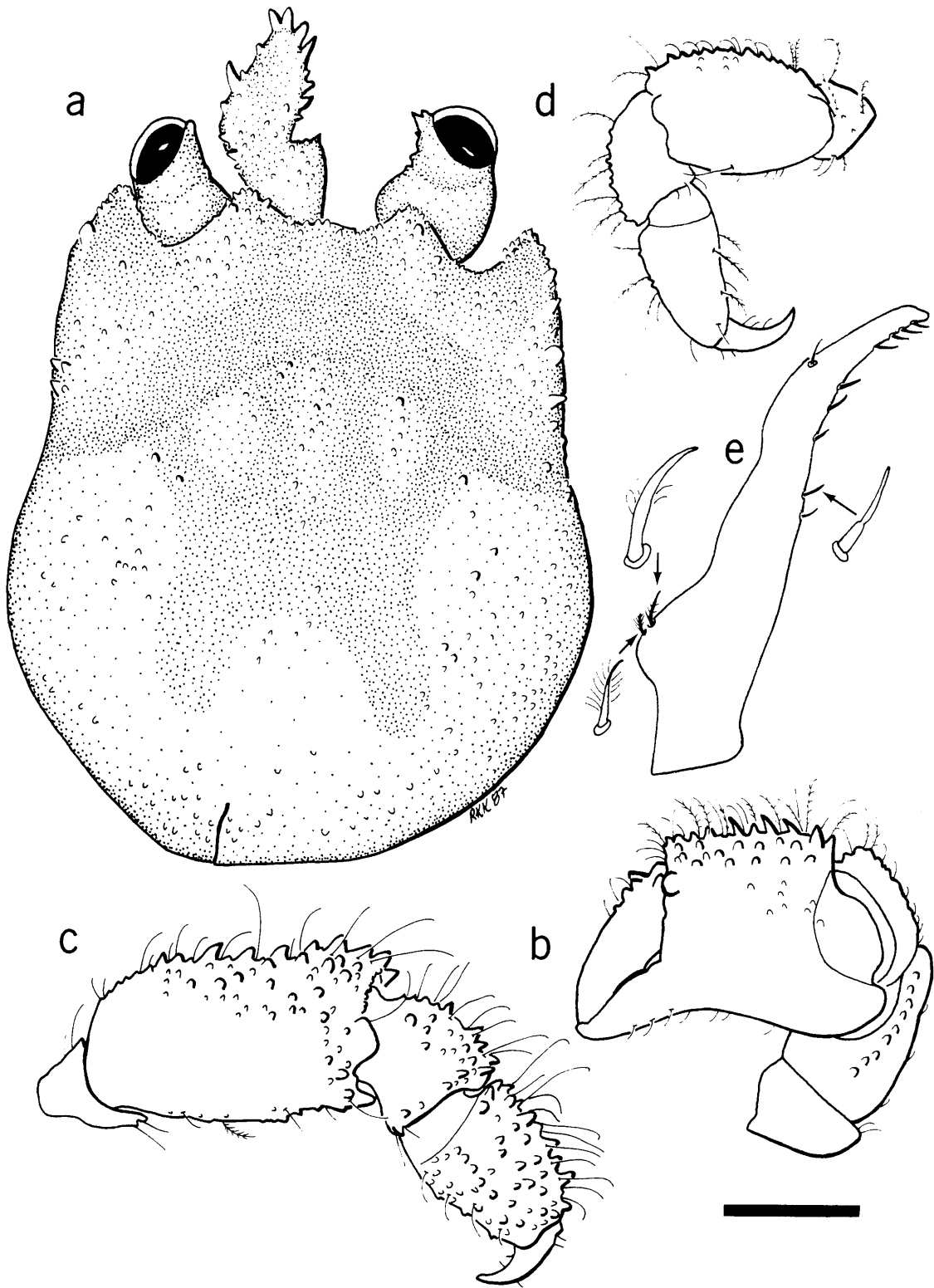


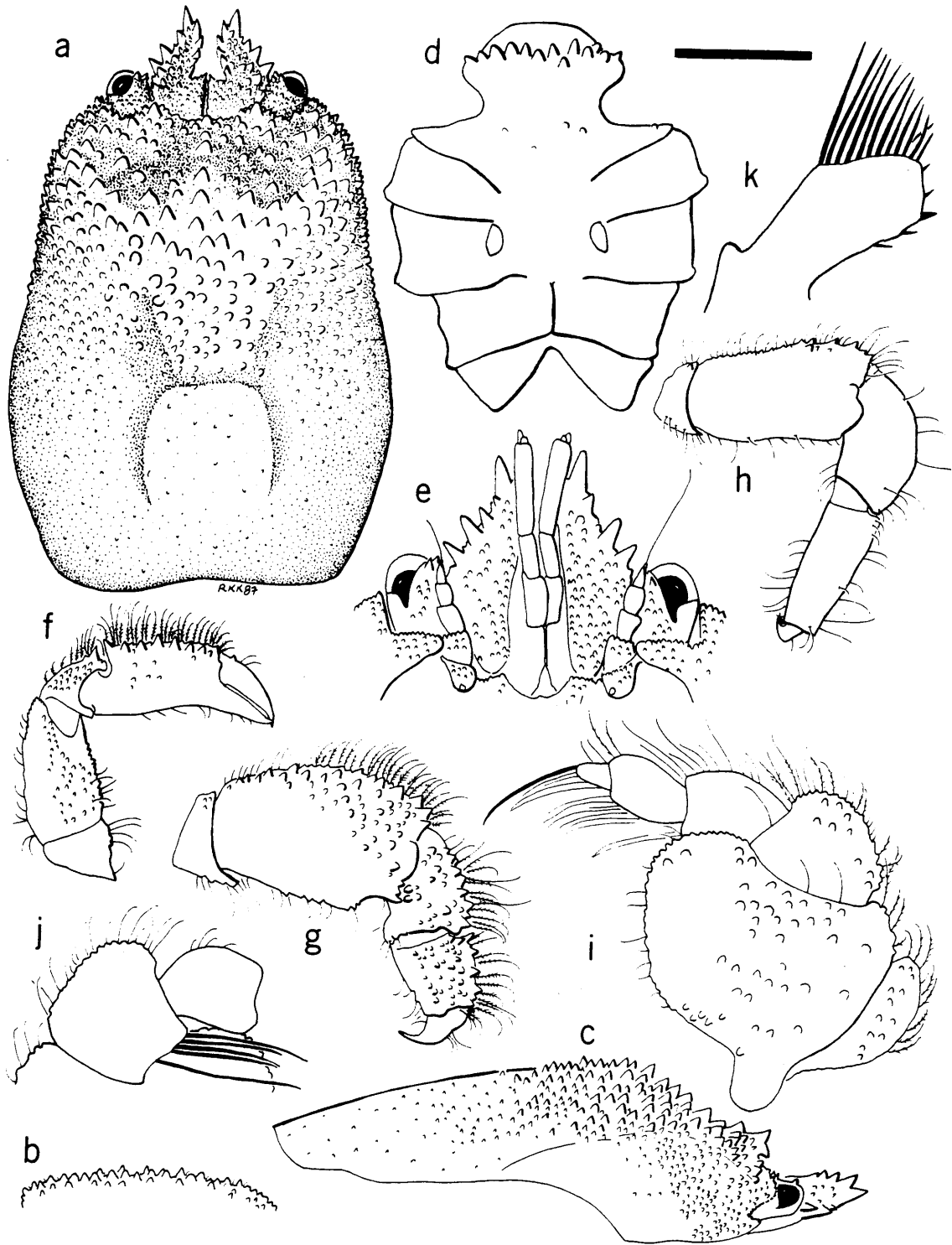
Fig. 23. Opecarcinus granulatus (Shen), o, Holotype. (Christmas Island: BMNH 1911.8.15.2): a, carapace (dorsal view); b, left P-1; c, right P-2; d, left P-5; e, PLP-1 (outer view). Scale: a-d = 0.5 mm; e = 0.3 mm.

Fig. 24. Opecarcinus aurantius, new species, +, Holotype. (Guam: USNM 234266): a, carapace (dorsal view); b, carapace (transverse section at midlength); c, carapace (lateral view); d, thoracic sternites; e, eyes, antennules (ventral view); f-h, right P-1, P-2, P-5; i, MXP-3 (outer view); j, MXP-3 (inner view of merus); k, MXL-1 (outer view). Scale: a, c-d = 1 mm; b = 1.3 mm; e = 0.6 mm; f-h = 0.8 mm; i-j = 0.5 mm; k = 0.2 mm.

Fig. 25. Opecarcinus aurantius, new species, o, Paratype. (Pohnpei: USNM 234268): a, Carapace (dorsal view); b-d, Right P-1, P-2, P-5; e, PLP-1 (outer view). Scale: a-d = 0.5 mm; e = 0.2 mm.







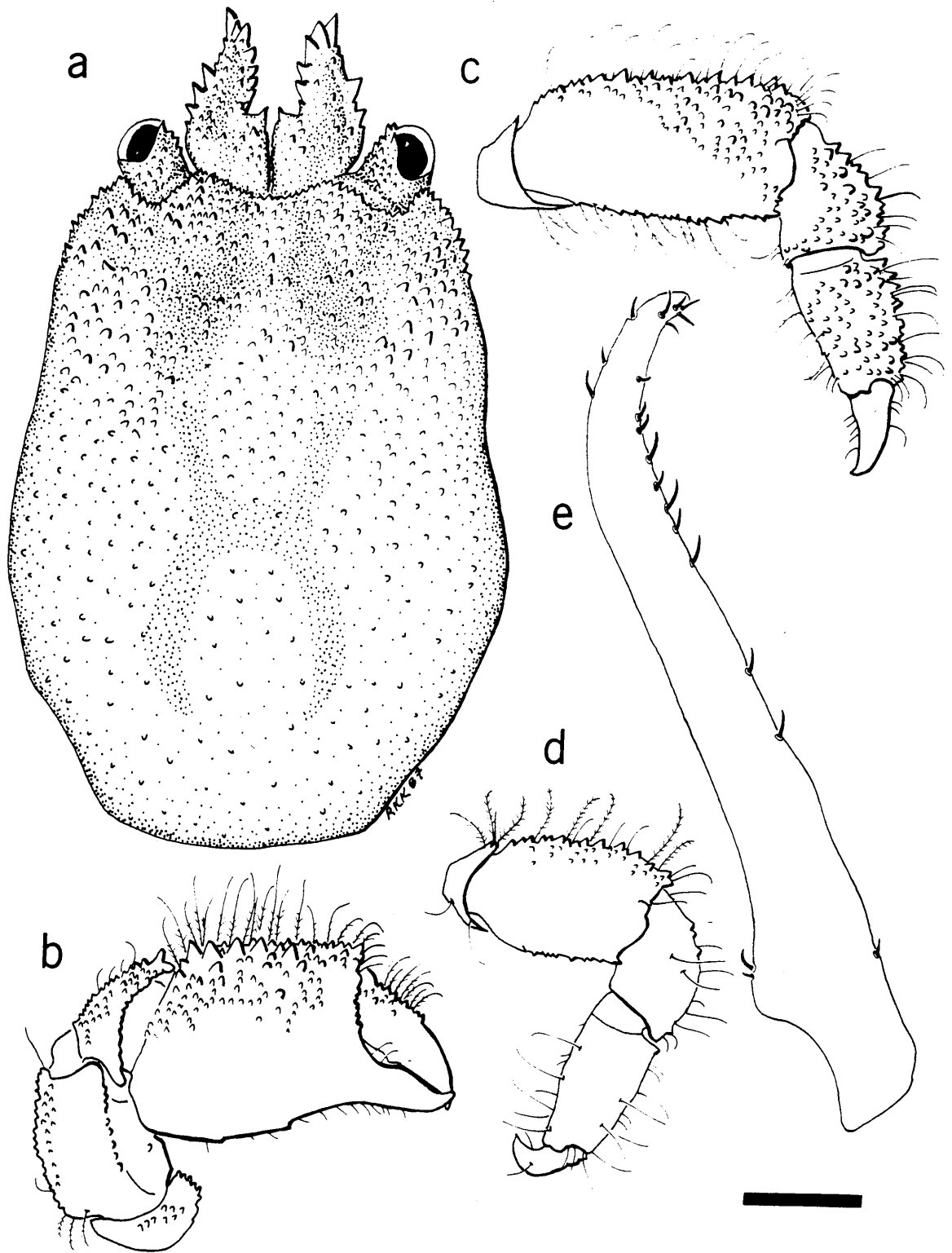
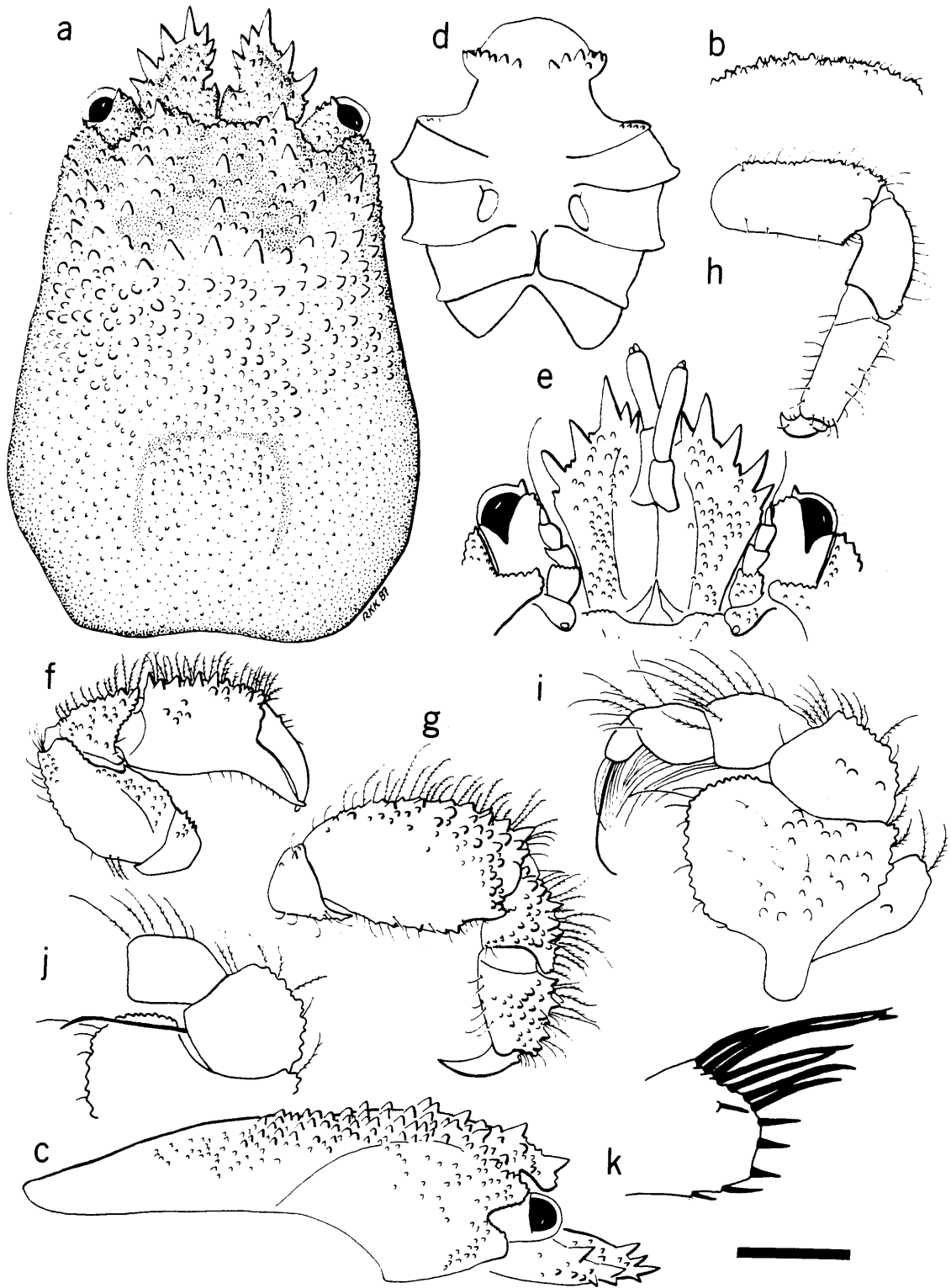
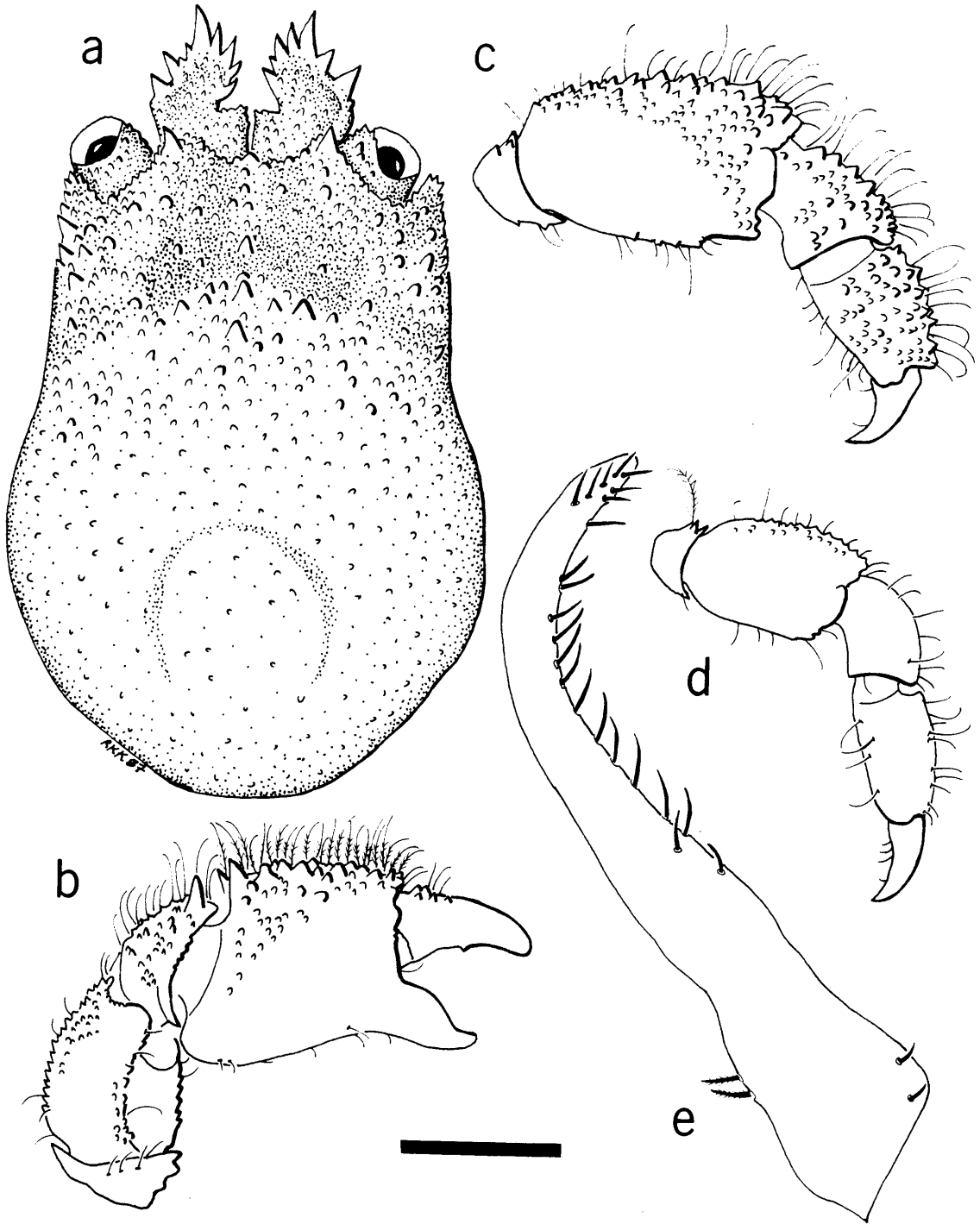


Fig. 26. Opecarcinus lobifrons, new species, +, Holotype. (Guam: USNM 234269): a, carapace (dorsal view); b, carapace (transverse section at midlength); c, carapace (lateral view); d, thoracic sternites; e, eyes, antennules (ventral view); f-h, right P-1, P-2, P-5; i, MXP-3 (outer view); j, MXP-3 (inner view of merus); k, MXL-1 (outer view). Scale: a, c, f-h = 0.6 mm; b = 1 mm; d = 0.8 mm; e = 0.5 mm; i, j = 0.3 mm; k = 0.1 mm.

Fig. 27. Opecarcinus lobifrons, new species, o, Paratype. (Guam: USNM 234271): a, carapace (dorsal view); b-d, right P-1, P-2, P-5; e, PLP-1 (outer view). Scale: a-d = 0.5 mm; e = 0.2 mm.

Fig. 28. Opecarcinus peliops, new species, +, Holotype. (Pohnpei: USNM 234272): a, carapace (dorsal view); b, carapace (transverse section at midlength); c, carapace (lateral view); d, thoracic sternites; e, eyes, antennules (ventral view); f-g, left P-1, P-2; h, right P-5 (from paratype); i, MXP-3 (outer view); j, MXP-3 (inner view of merus); k, MXL-1 (outer view). Scale: a, c-h = 0.5 mm; b = 1 mm; i, j = 0.3 mm; k = 0.2 mm.





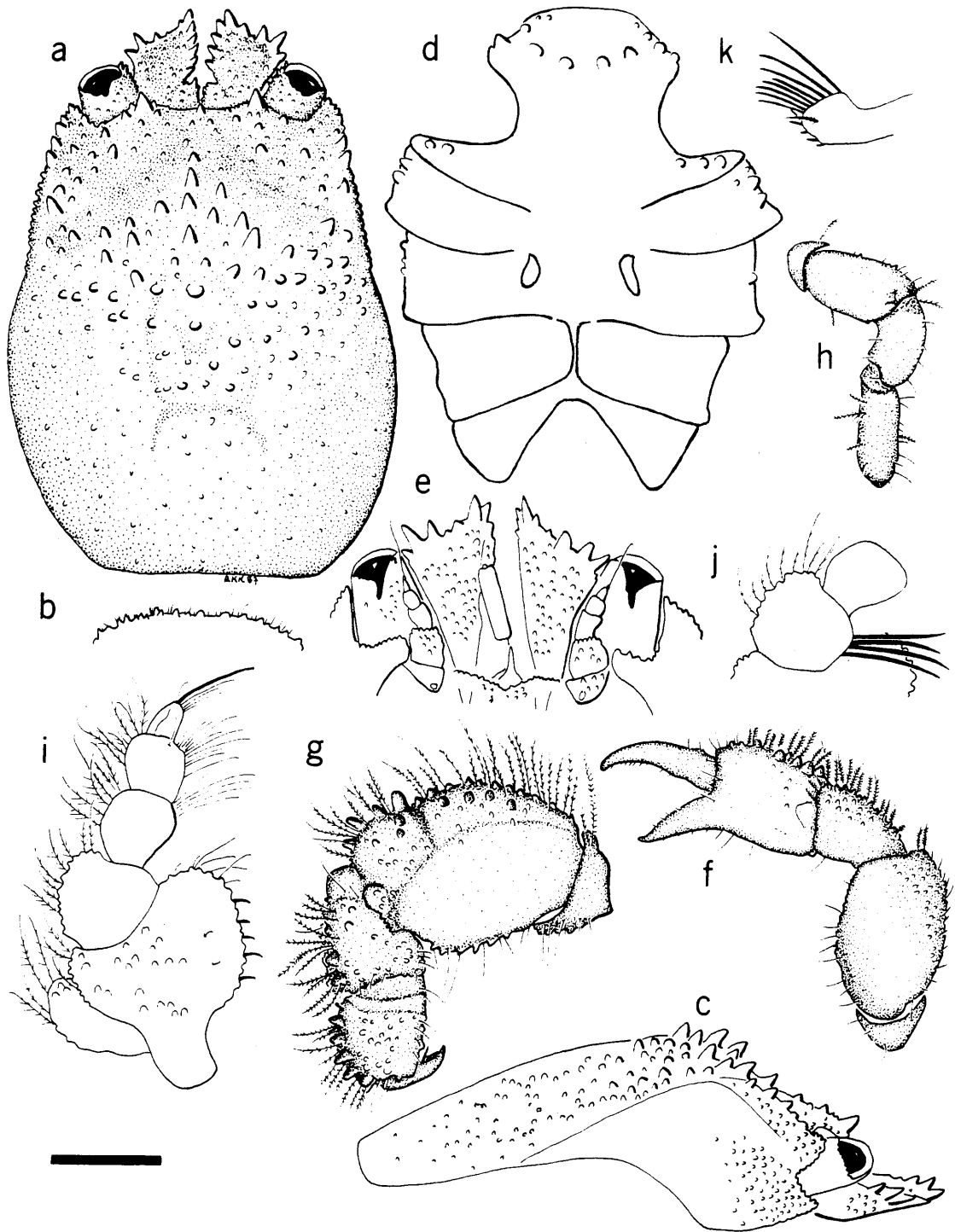


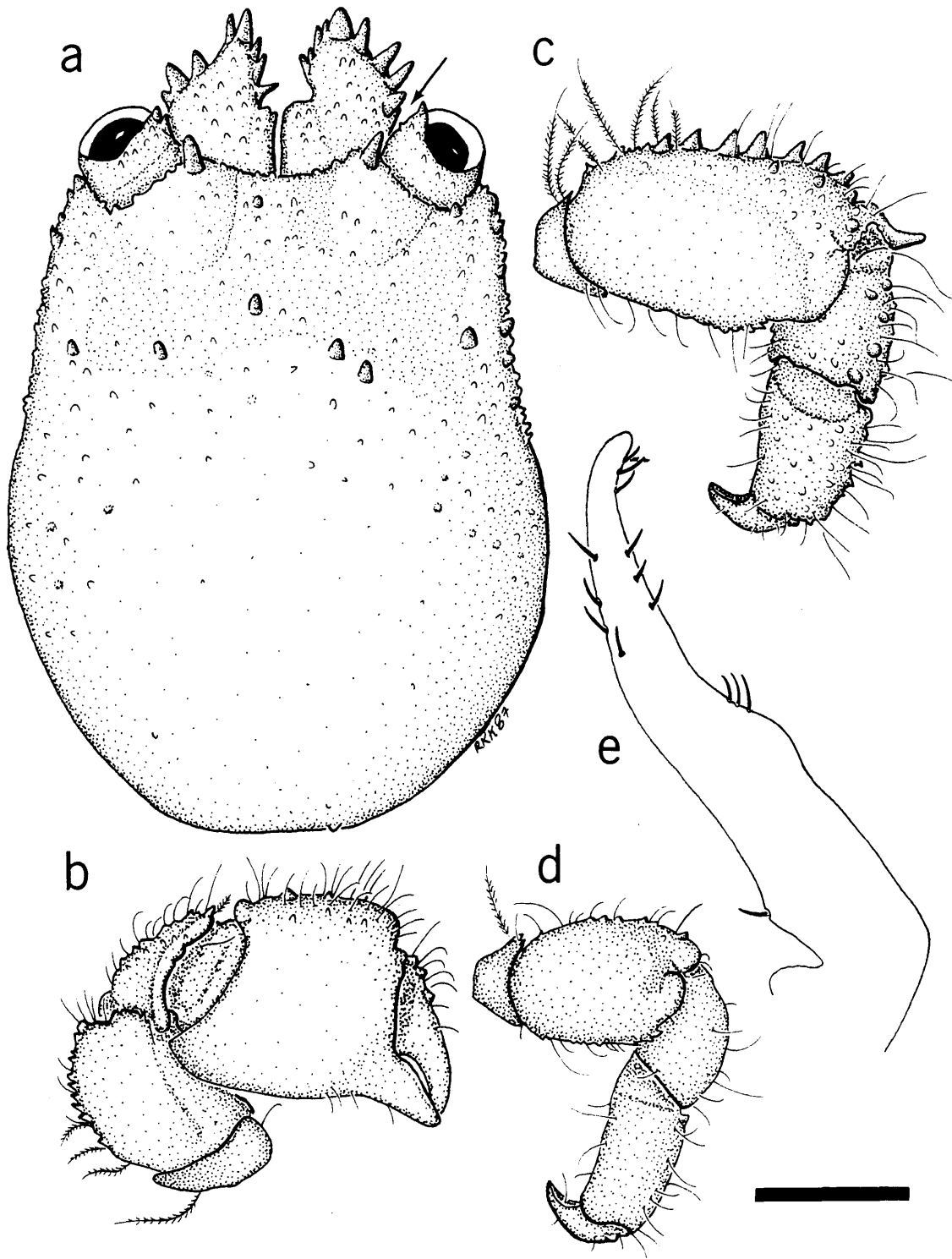
Fig. 29. Opecarcinus peliops, new species, o, Paratype. (Pohnpei: USNM 234273): a, carapace (dorsal view, arrow points to spine on IOA); b-d, right P-1, P-2, P-5; e, PLP-1 (outer view). Scale: a-d = 0.5 mm; e = 0.2 mm.

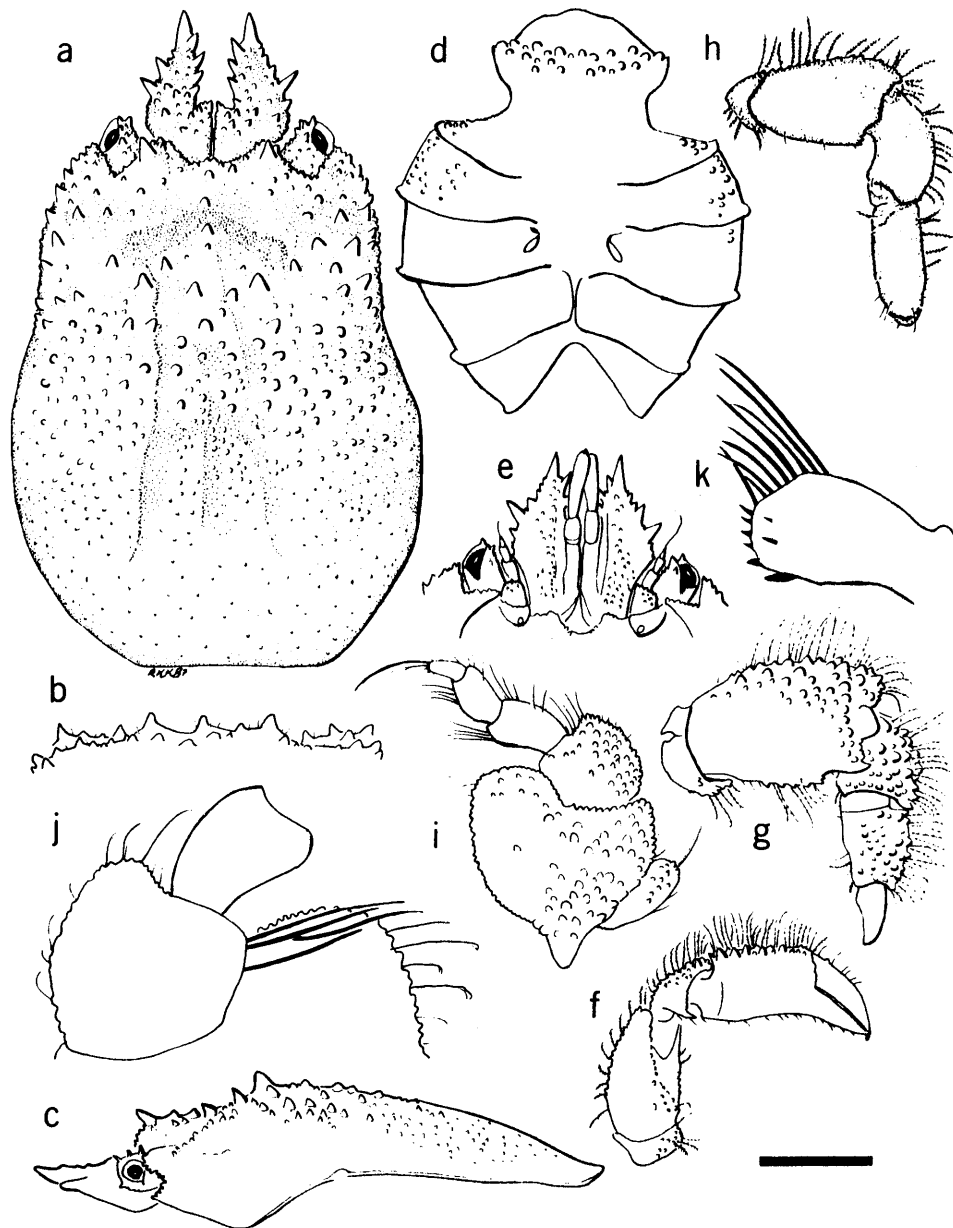
Fig. 30. Opecarcinus pholeter, new species, +, Holotype. (Guam: USNM 234275): a, carapace (dorsal view); b, carapace (transverse section at midlength); c, carapace (lateral view); d, thoracic sternites; e, eyes, antennules (ventral view); f-h, right P-1, P-2, P-5; i, MXP-3 (outer view); j, MXP-3 (inner view of merus); k, MXL-1 (outer view). Scale: a-h = 1 mm; i = 0.5 mm; j-k = 0.2 mm.

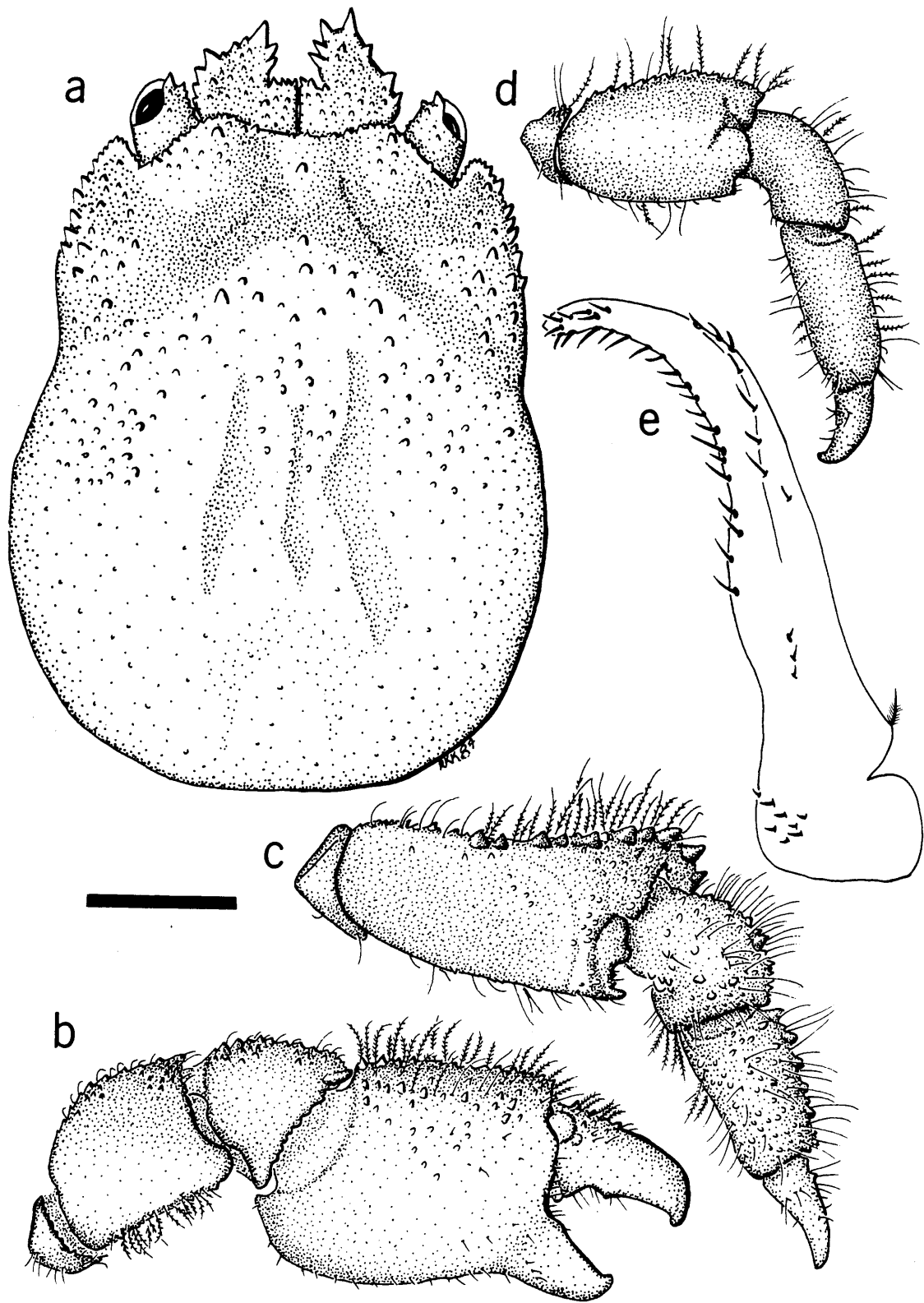
Fig. 31. Opecarcinus pholeter, new species, o, Paratype (Guam: USNM 234276): a, carapace (dorsal view); b-d, right P-1, P-2, P-5; e, PLP-1 (outer view). Scale: a-d = 1 mm; e = 0.3 mm.

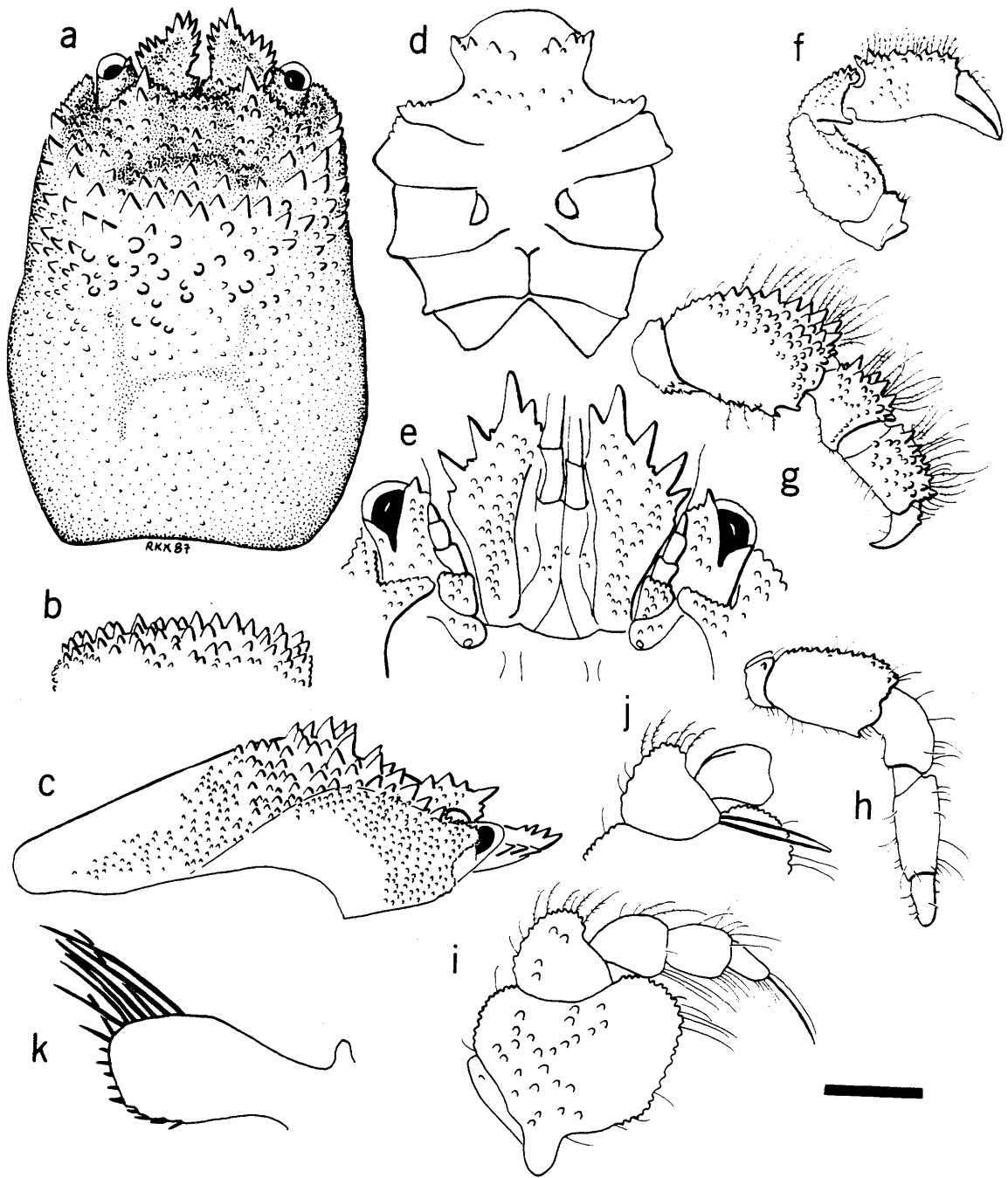
Fig. 32. Opecarcinus sierra, new species, +, Holotype. (Guam: USNM 234278): a, carapace (dorsal view); b, carapace (transverse section at midlength); c, carapace (lateral view); d, thoracic sternites; e, eyes, antennules (ventral view); f-h, right P-1, P-2, P-5; i, MXP-3 (outer view); j, MXP-3 (inner view of merus); k, MXL-1 (outer view). Scale: a, c, d, f-h = 0.5 mm; b = 0.8 mm; i-k = 0.2 mm.











## Chapter 7

**Fizesereneia** Takeda and Tamura, 1980 (Crustacea, Decapoda): Proposed Designation of a Type Species.

This is a case of a genus with a misidentified type species and is referred to the Commission for a decision as prescribed by Article 70b of the International Code of Zoological Nomenclature.

2. As a part of a series of reports on the gall crab fauna of Japanese waters, Takeda and Tamura, 1980 (Bull. Natn. Sci. Mus. Tokyo, vol. 6) established the genus **Fizesereneia** to include two species formerly placed in **Troglocarcinus** Verrill, 1908 (Trans. Conn. Arts Sci. vol. 13) and a new species. These are **T. heimi** Fize and Serène, 1955 (Bull. Soc. Zool. France, vol. 80, no. 5-6), **T. stimpsoni** Fize and Serène, 1955, and **F. ishikawai** Takeda and Tamura, 1980, respectively. Takeda and Tamura designated **T. heimi** as the type species of **Fizesereneia**.

3. Examination of the figure and description of the type of **F. heimi** as published by Fize and Serène, 1957 (Arch. Mus. Nat. Hist. Nat., Paris, ser. 7, vol. 5) indicated that the figure and description of the species as published by Takeda and Tamura did not correspond to **F. heimi**, but to an undescribed species of **Fizesereneia**.

4. Thus, the genus **Fizesereneia** Takeda and Tamura, 1980, is based on a misidentified type species, and the Commission should now select the legal type species of that

genus. The options available to the Commission are: (1) to accept Troglocarcinus heimi Fize and Serène, 1955 as the type species of Fizesereneia; or (2) to select one of the other species included in the genus, T. stimpsoni Fize and Serène, 1955, F. ishikawai Takeda and Tamura, 1980, or the undescribed species as the type species.

5. In my opinion the first option is preferable as it will cause the least disturbance.

6. The following are the proposals I submit to the Commission, asking that it:

(1) use its plenary powers to set aside all designations of type species previously made for the nominal genus Fizesereneia Takeda and Tamura, 1980 and designate Troglocarcinus heimi Fize and Serène, 1955, as the type species of that genus;

(2) place Fizesereneia Takeda and Tamura, 1980 (gender: feminine), type species, by designation under the plenary powers in (1) above, Troglocarcinus heimi Fize and Serène, 1955, on the Official List of Generic Names in Zoology;

(3) place heimi Fize and Serène, 1955, as published in the binomen Troglocarcinus heimi (specific name of the type species of Fizesereneia Takeda and Tamura, 1980), on the Official List of Specific Names in Zoology.

Chapter 8  
Revision of the Genera of Gall Crabs  
Occurring in the Pacific  
(Crustacea: Cryptochiridae)

Abstract

The coral gall crabs, Family Cryptochiridae, occurring in the Pacific Ocean are reviewed. Fifteen genera, including four described herein, are recognised: *Cryptochirus* Heller; *Dacryomaia*, new genus; *Fizesereneia* Takeda and Tamura; *Fungicola* Serène; *Hapalocarcinus* Stimpson; *Hiroia* Takeda and Tamura; *Lithoscaptus* Milne Edwards; *Neotroglocarcinus* Takeda and Tamura; *Opecarcinus* Kropp and Manning; *Pelycomaia*, new genus; *Pseudocryptochirus* Hiro; *Pseudohapalocarcinus* Fize and Serène; *Sphenomaia*, new genus; *Utinomia* Takeda and Tamura; and *Xynomaia*, new genus. Host, depth, and distribution records are given for each genus. A key to all gall crab genera, including Atlantic taxa, is provided.

Introduction

The coral gall crabs, Family Cryptochiridae, are obligate associates of living scleractinian corals. Not only do they reside in galls, tunnels, or pits in the coral skeleton, they also feed on the host coral mucus and tissues (Kropp, 1986). Though the family has been known for 130 years, its taxonomy has been marred by many errors. These errors have resulted from (a) failures to consider type

material or available literature, (b) use of inappropriate characters to define genera, or (c) failure to follow proper taxonomic procedure.

Two problems related to (a) above have been resolved by the reestablishment of Lithoscaptus Milne Edwards and Cryptochirus hongkongensis Shen, the latter as the type species of Neotroglocarcinus Fize and Serène (Kropp, 1988a; b).

Two characters inappropriate for use in the definition of genera were the nature (uniramous or biramous) of the second pleopod of the female and the host coral taxon on which crab species occurred. The form of the second pleopod has been shown to be variable within a species. McCain and Coles (1979) found the second pleopod to be uniramous on one side of the abdomen, biramous on the other, and variable among individuals of Utinomia dimorpha (Henderson, 1906). I have made similar observations for this species and others among my collections from Micronesia. Cryptochirids show some degree of host specificity, and some authors thought that this specificity could be used to define genera (Fize and Serène, 1957; McCain and Coles, 1979). Both features subsequently were shown to be unreliable (Kropp and Manning, 1987).

In a monograph of the gall crabs from Vietnam, Fize and Serène (1957) created a new genus, Neotroglocarcinus and initiated the use of subgenera in the genus Troglocarcinus Verrill. The subgenera they established were based on the



family of corals on which the crabs were found. However, they did not follow proper taxonomic procedure by creating the subgenus Mussicola and including within it T. corallicola Verrill, the type species of Troglocarcinus and by not naming type species for any of their newly created genus-group taxa. Thus, those new names were unavailable.

Serène (1966) validated two genera when he designated Cryptochirus rugosus Edmondson as the type species of Favicola and Troglocarcinus utinomi Fize and Serène as the type species of Fungicola. His actions also helped to establish the host taxon as a generic character.

By the beginning of the 1980s the taxonomic situation of the family was far from serene, but the work of Takeda and Tamura in Japan had begun to unravel some of the remaining confusion. Their primary contribution was to remove Pseudocryptochirus as a "catch all" taxon by creating two new genera, Hiroia and Utinomia (Takeda and Tamura, 1981b), for species previously assigned to Pseudocryptochirus. However, Utinomia Takeda and Tamura, 1981 is a junior homonym of Utinomia Tomlinson, 1963, a genus of acrothoracican barnacle (Tomlinson, 1963; 1969). The gall crab genus name needs to be replaced. Takeda and Tamura (1980b) also erected a new genus, Fizesereneia, to accommodate species in the erroneously created Mussicola Fize and Serène, 1957. They did not realize that Mussicola could be used as an available name by designating one of the species included in it as its type. Kropp and Manning (1987)

rectified this by naming *T. corallicola* as the type of *Mussicola*, rendering *Mussicola* a junior synonym of *Troglocarcinus*. Takeda and Tamura (1980b) further erred in misidentifying the type species of their new genus *Eizeserensia*, a situation that must be solved by the International Commission on Zoological Nomenclature.

By the mid 1980's many morphological inconsistencies within the generic structure of the family still remained.

Here I use morphology to reorganize the species of gall crabs occurring in the Pacific, removing totally the concept of host affinity as a generic character. I also provide a key to the females of all known cryptochirid genera. The species of gall crabs occurring in the Atlantic were reviewed by Kropp and Manning (1987).

#### Materials and Methods

I collected much of the material used in this revision in Micronesia in 1984 and 1986. Specimens from these collections have been deposited in the Allan Hancock Foundation (AHF), Los Angeles, California; the B. P. Bishop Museum (BPBM), Honolulu, Hawaii; the British Museum of Natural History (BMNH), London, England; the National Museum of Natural History, Smithsonian Institution (USNM), Washington, D. C.; and the Muséum National d'Histoire Naturelle (MNHN), Paris, France. Supplementary material was borrowed from each of the above museums and the Naturhistorisches Museum (NMW), Vienna, Austria and the

National Science Museum (NSMT), Tokyo, Japan. I examined the types of many species; these are marked by an \* in the lists of species.

Most of the figures are based on material from Micronesia and were prepared with the use of a camera lucida on a Wild M-5 dissection microscope or were traced from Scanning Electron Microscope (SEM) micrographs. The type species of each genus is figured. Setae on the surface of the carapace and pereopods are not shown. Specimens for SEM study were prepared as described in Kropp (1986).

I have restricted the synonymies to the first useage of a particular name for a taxon, including erroneous spellings. Abbreviations used in the text are: MXP, maxilliped; P, pereopod; PLP, pleopod; and TL, type locality.

I have listed only those host, depth, and distribution records that I am reasonably certain are accurate. The abbreviation "RKK" indicates unpublished data from my collections in Micronesia and Hawaii.

#### Key to the Genera of Gall Crabs, Cryptochiridae

(Based on females)

1. Thoracic sternites flat .....2
- Thoracic sternites concave mesially .....13
2. Epistome with lateral ridges .....3
- Epistome lacking lateral ridges .....10

3.	Gonopore semicircular .....	4
-	Gonopore elliptical .....	8
4.	Orbit V-shaped .....	5
-	Orbit broadly U-shaped .....	7
5.	P-1 sternite with large tubercles .....	6
-	P-1 sternite without tubercles .....	<u>Troglocarcinus</u>
6.	P-4 sternite with median suture .....	<u>Opecarcinus</u>
-	P-4 sternite lacking median suture ....	<u>Neotroglocarcinus</u>
7.	Carapace longer than wide, vase-shaped .....	
	.....	<u>Pseudocryptochirus</u>
-	Carapace as long as wide, quadrate .....	
	.....	<u>Pseudohapalocarcinus</u>
8.	Carapace with 2 large concavities anteriorly, deflected anteriorly .....	9
-	Carapace lacking large concavities anteriorly, not deflected anteriorly .....	<u>Fungicola</u>
9.	Distal margin of antennal segment 2-3 with lateral spine .....	<u>Fizesereneia</u>
-	Distal margin of antennal segment 2-3 lacking lateral spine .....	<u>Pelycomaia</u>
10.	PLP-3 biramous .....	11
-	PLP-3 uniramous .....	12
11.	Pterygostomial region fused to carapace; MXP-3 lacking exopod .....	<u>Detocarcinus</u>
-	Pterygostomial region not fused to carapace; MXP-3 with exopod .....	<u>Cecidocarcinus</u>

12. Carapace longer than wide; MXP-3 lacking exopod.....  
 .....*Utinomia*
- Carapace as long as wide; MXP-3 with exopod .....  
 .....*Hapalocarcinus*
13. Anterior carapace deflected .....14  
 - Anterior carapace not deflected .....17
14. P-4 coxal lobe well-developed .....15  
 - P-4 coxal lobe reduced .....16
15. Posterior regions of carapace divided by series of  
 grooves .....*Cryptochirus*
- Posterior regions of carapace not divided by series of  
 grooves .....*Dacryomaia*
16. Mesogastric region of carapace inflated ....*Lithoscaptus*  
 - Mesogastric region of carapace not inflated ..*Sphenomaia*
17. Pterygostomial region fused to carapace; distal margin  
 of antennal segment 2-3 lacking lateral spine ..*Hiroia*
- Pterygostomial region not fused to carapace; distal  
 margin of antennal segment 2-3 with lateral spine ..  
 .....*Xynomaia*

Systematic Account

CRYPTOCHIRIDAE Paulson 1875

*Lithoscaptus* Milne Edwards, 1862:F10. [Vernacular name; type  
 genus *Lithoscaptus* Milne Edwards, 1862].

Cryptochirinae Paulson, 1875:72 [page 78 in translation;  
 type genus *Cryptochirus* Heller, 1861].

Cryptochiridae.--Richters, 1880:159; Kropp and Manning,  
1985:954.

Lithoscaptidae.--Richters, 1880:159.

Hapalocarcinidae Calman, 1900:49.

Hapalogarcinidae.--Coêlho and Ramos, 1972:205 [erroneous  
spelling].

Cryptochirus Heller, 1861

Fig. 33

Cryptochirus Heller, 1861:19 [type species: Cryptochirus  
coralliodytes Heller (1861:19), by monotypy; gender  
masculine].

Cryptochyrys.--Nobili, 1906:325 [erroneous spelling].

Favicola Fize and Serène, 1957:84 [name unavailable].

Favicola Serène, 1966:396 [type species: Cryptochirus  
rugosus Edmondson (1933:6), by original designation;  
gender masculine (see Kropp, 1988b)].

Diagnosis.--Carapace longer than broad, widest at  
midlength, convex in lateral view, not deflected anteriorly,  
mesogastric region inflated. Posterior region of carapace  
isolated by system of grooves, cardio-intestinal region  
outlined. Pterygostomial region fused to carapace.  
Epistome with parallel lateral ridges, anterior margin  
sinuous with shallow, wide median indentation. Lateral lobe  
of antennule elliptical, extending beyond eyestalk.  
Antennal segment 2-3 longer than broad, distal margin  
lacking lateral spine. MXP-3 with exopod; merus with

distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest distal to midlength; distal margin convex. Ventral thorax longer than wide, concave mesially. Anterior extension of sternite of P-1 with granules. Sternite of P-4 with suture. Female gonopore oval, with anterior hood. P-1 cutting edges entire. P-2 merus lacking distomesial projection; propodus slender. P-3 coxa with reduced, P-4 coxa with well developed anterior lobe. P-5 dactylus rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 3.3 times width, segments subequal in width, lateral margins parallel; PLP-1 curved laterally, apex pointed, lateral margin with simple setae, mesial margin with few pappose setae proximally.

Included species: Two:

Cryptochirus coralliodytes Heller, 1861

Cryptochirus coralliodytes Heller, 1861:19 [TL: Red Sea; \*  
lectotype NMW].

Cryptochirus rugosus Edmondson, 1933:6. [TL: Washington Is.; \*  
holotype BPBM S3668].

Troglocarcinus (Favicola) rugosus.--Fize and Serène,  
1957:85.

Favicola rugosus.--Serène, 1966:396.

Favicola rugosum.--Lundoer, 1974:10.

Favicola rugosa.--Takeda and Tamura, 1981a:43.

***Cryptochirus planus*** (Takeda and Tamura, 1983),  
new combination

***Favicola plana*** Takeda and Tamura, 1983:4 [TL: Koza, Japan;  
holotype\* NSMT-Cr. 8556].

Remarks: Fize and Serène (1957) failed to designate a type species for ***Troglocarcinus*** (***Favicola***), thus rendering ***Favicola*** Fize and Serène unavailable for use as a genus-group name [International Code of Zoological Nomenclature Art. 13 (b)]. Serène (1966) designated ***Cryptochirus rugosus*** Edmondson as the type species of ***Favicola***.

Hosts: Faviidae--***Cyphastrea***, ***Barabattoia***, ***Favia***, ***Favites***, ***Goniastrea***, ***Leptoria***, ***Montastrea***, ***Platygyra*** (Fize and Serène, 1957; RKK); Oculinidae--***Cyathelia*** (Takeda and Tamura, 1983).

Depth: < 1 m to 30 m (Takeda and Tamura, 1983; RKK).

Distribution: Indo-West Pacific--Red Sea (Heller, 1861); Vietnam (Fize and Serène, 1957); Japan (Takeda and Tamura, 1983); Micronesia: Belau, Guam, Pohnpei (RKK).

***Dacryomaia***, new genus

Fig. 34

***Dacryomaia***, new genus [type species ***Cryptochirus edmonsoni*** Fize and Serène (1955b:379), by original designation; gender feminine].

Diagnosis.--Carapace longer than broad, widest anterior to midlength, convex in lateral view, deflected anteriorly, with deep inverted V-shaped groove flanking mesogastric,



latter inflated. Cardiointestinal outlined by depression. Pterygostomial region fused to carapace. Epistome with parallel lateral ridges, anterior margin straight with slight median indentation. Lateral lobe of antennule oval, extending to or just beyond eyestalk. Antennal segment 2-3 longer than broad, distal margin lacking lateral spine. MXP-3 with exopod; merus with distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest at midlength; distal margin evenly convex. Ventral thorax longer than broad, flat. Anterior extension of sternite of P-1 with transverse band of granules. Sternite of P-4 with suture. Female gonopore elliptical, with anterior hood. P-1 dactylus with low tooth proximally on cutting edge. P-2 merus lacking distomesial projection; propodus thick. P-3, P-4 coxae with well-developed anterior lobes. P-5 dactylus rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 2.6 times width, segment 3 widest, lateral margins subparallel; PLP-1 slightly curved laterally, apex pointed, lateral margin with several simple setae, with few pappose setae proximally, mesial margin with few simple setae proximally.

Etymology.--From the Greek, dakryon, meaning droplet, in combination with maia, a kind of crab, in reference to the shape of the tubercles on the anterior part of the carapace.

Included species: Two:

Dacryomaia edmonsoni (Fize and Serène, 1955),

new combination

Cryptochirus edmonsoni Fize and Serène, 1955b:379 [TL:

Nhatrang, Vietnam; location of type unknown].

Dacryomaia japonica (Takeda and Tamura, 1981a),

new combination

Favicola japonica Takeda and Tamura, 1981a:47 [TL: Kuro-  
shima, Ryukyu, Japan; holotype NSMT-Cr 7422].

Hosts: Thamnasteriidae--Psammocora (Fize and Serène, 1957); Siderastreidae--Coscinaraea (RKK); Faviidae--Cyphastrea, Goniastrea, Leptastrea (Takeda and Tamura, 1981a; RKK). Fize and Serène (1957) listed Pavona (Agariciidae) as a host for D. edmonsoni. However, the host was figured and the crescentic pit pictured is more typical of Opecarcinus species than it is of D. edmonsoni.

Therefore, I think that the record is probably an error.

Depth: < 1 m to 8 m (RKK).

Distribution: Pacific Ocean--Vietnam (Fize and Serène, 1957); Japan: Izu Is., Ogasawara Is., Ryukyu Is. (Takeda and Tamura, 1980d; 1981a; 1983); Micronesia: Belau, Guam (RKK).

Fizesereneia Takeda and Tamura, 1980

Fig. 35

Fizesereneia Takeda and Tamura, 1980b:137 [type species: Troglocarcinus heimi Fize and Serène (1955:378), by plenary powers of International Commission on Zoological Nomenclature; gender feminine].

Fizeserenea.--Kropp and Manning, 1987:2 [erroneous spelling].

Diagnosis.--Carapace longer than broad, widest anterior to midlength, convex in lateral view, deflected anteriorly, formed into 2 bowl-shaped concavities, mesogastric region inflated. Cardio-intestinal flanked by 2 depressions. Pterygostomial region not fused to carapace. Epistome with parallel lateral ridges, anterior margin sinuous with shallow, wide median indentation. Lateral lobe of antennule oval, extending just beyond eyestalk. Antennal segment 2-3 longer than broad, distal margin with lateral spine. MXP-3 with exopod; merus with distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest distal to midlength; distal margin convex. Ventral thorax longer than wide, flat. Anterior extension of sternite of P-1 smooth. Sternite of P-4 with suture. Female gonopore elliptical, with anterior hood. P-1 cutting edges entire. P-2 merus lacking distomesial projection; propodus slender. P-3, P-4 coxae with moderate anterior lobes. P-5 dactylus rotated anteriorly. PLP-3 of

female uniramous. Male with robust P-1; abdomen length 2.3 times width, segment 4 widest, lateral margins convex; PLP-1 curved laterally, apex pointed, lateral margin with many simple setae, mesial margin with few simple setae proximally.

Included species: Three:

Fizesereneia heimi (Fize and Serène, 1955)

Troglocarcinus heimi Fize and Serène, 1955a:378 [TL:

Nhatrang, Vietnam; location of type unknown].

Troglocarcinus (Mussicola) heimi.--Fize and Serène,

1957:111.

Fizesereneia heimi.--Takeda and Tamura, 1980a:137.

Fizesereneia ishikawai Takeda and Tamura, 1980

Fizesereneia ishikawai Takeda and Tamura, 1980b:144 [TL:

Ishigakijima Is., Ryukyu Is., Japan; holotype NSMT-Cr

6340].

Fizesereneia stimpsoni (Fize and Serène, 1955)

Troglocarcinus stimpsoni Fize and Serène, 1955b:380 [TL:

Nhatrang, Vietnam; location of type unknown].

Troglocarcinus (Mussicola) stimpsoni.--Fize and Serène,

1957:116.

Fizesereneia stimpsoni.--Takeda and Tamura, 1980b:146.

Remarks: Takeda and Tamura (1980b) designated T. heimi as the type species of Fizesereneia, a genus named in honor of two Gaul crab specialists. However, the species they

described and figured was not *T. heimi*, but an undescribed species. Their figured species differs from *T. heimi* by having the median ridge incompletely separating the concavities on the anterior carapace, by having a hexagonally shaped carapace, and by being a different color. The type of *T. heimi* (see Fize and Serène, 1957: fig. 29A) has the median ridge completely dividing the anterior concavities and has a rectangular carapace. The color of *T. heimi* that I collected in Guam is predominately gray, matching that figured by Fize and Serène (1957: pl. 18B) and differing from the predominant green color of the undescribed species, also figured by Fize and Serène (1957: pl. 18A). Because the genus was based on a misidentified type species, I have petitioned the International Commission on Zoological Nomenclature to designate a type species (Kropp, ms 2). *Fizesereneia stimpsoni* differs markedly from the other two described species of *Fizesereneia* and is probably not congeneric with them (Kropp, unpublished). However, until the Commission selects a type species for the genus, the three cannot be separated.

Hosts: Mussidae--*Lobophyllia*, *Symphyllia*, *Acanthastrea* (Fize and Serène, 1957; Takeda and Tamura, 1980b).

Depth: 1 m to 15 m (Takeda and Tamura, 1980b; RKK).

Distribution: Indo West Pacific--Vietnam (Fize and Serène, 1957); Indonesia (Serène et al, 1974); Japan: Izu Is., Ryukyu Is. (Takeda and Tamura (1980b); Australia (McNeill, 1968); Micronesia: Belau, Guam, Pohnpei (RKK).

Fungicola Serène, 1966

Fig. 36

Fungicola Fize and Serène, 1957:122 [name unavailable].

Fungicola Serène, 1966:396 [type species: Troglocarcinus utinomi Fize and Serène (1955:377), by original designation (Serène, 1966:396); gender masculine (see Remarks)].

Fungicora.--Takeda and Tamura, 1986:64 [erroneous spelling].

Diagnosis.--Carapace longer than broad, widest anterior to midlength, flat in lateral view, not deflected anteriorly, with broad inverted U-shaped depression, mesogastric region slightly inflated. Cardiointestinal region outlined. Pterygostomial region fused to carapace. Epistome with parallel lateral ridges, anterior margin sinuous with shallow, wide median indentation. Lateral lobe of antennule oval, extending just beyond eyestalk. Antennal segment 2-3 longer than broad, distal margin lacking lateral spine. MXP-3 with exopod; merus with distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest distal to midlength; distal margin convex. Ventral thorax longer than broad, flat. Anterior extension of sternite of P-1 with few granules. Sternite of P-4 with suture. Female gonopore oval, with anterior hood. P-1 cutting edges entire. P-2 merus without distomesial projection; propodus thick. P-3, P-4 coxae with well developed anterior lobes. P-5 dactylus

rotated anteriorly. PLP-3 of female uniramous. Male with slender P-1; abdomen length 1.2 times width, segment 3 widest, lateral margins markedly convex; PLP-1 slightly curved laterally, apex pointed; lateral margin with simple setae distally, pappose setae proximally, mesial margin with pappose and simple setae.

Included species: Two:

Fungicola utinomi (Fize and Serène, 1955)

Troglocarcinus utinomi Fize and Serène, 1955a:377 [TL: Nhatrang, Vietnam; location of type unknown].

Troglocarcinus (Fungicola) utinomi.--Fize and Serène, 1957:124.

Fungicola utinomi.--Serène, 1966:396 [unjustified emendation].

Pseudocryptochirus ishigakiensis Takeda and Tamura, 1979:188  
\*  
[TL: Ishigaki-jima Is., Ryukyu, Japan; holotype NSMT-Cr 5898].

Hiroia ishigakiensis.--Takeda and Tamura, 1981b:20.

Fungicola fagei (Fize and Serène, 1955)

Troglocarcinus fagei Fize and Serène, 1955a:378 [TL: Nhatrang, Vietnam; location of type unknown].

Troglocarcinus (Fungicola) fagei.--Fize and Serène, 1957:131.

Fungicola fagei.--Serène, 1966:397.

Remarks.--Because Fize and Serène (1957) did not designate a type species for Troglocarcinus (Fungicola), the

name Fungicola was unavailable [International Code of Zoological Nomenclature Art. 13 (b)] until Serène (1966) designated T. utinomi as the type species.

The International Code of Zoological Nomenclature (1985) specifies that a genus-group name ending in a noun of variable gender should be treated as masculine unless its author specifies that that it is feminine or treats it as feminine by the use of feminine species-group names [Art. 30 (a) (i)]. Serène (1966) was the first to use Fungicola as an available generic name and did so with masculine species-group names. Therefore, the gender of Fungicola is masculine.

Serène (1966) and later Takeda and Tamura (1979) emended the specific name utinomi to utinomii. These actions were improper as the Code [Art. 31 (a) (ii)] specifies that the stem of a species-group name is determined by the action of the original author. Fize and Serène (1955a) originally used utinomi, thus making the stem "utinom."

I have examined the holotype, a male, of Pseudocryptochirus ishigakiensis and determined that it differs from other males of F. utinomi only by having a less convex abdominal outline. However, this condition occurs in other material of F. utinomi that I have examined thereby making it of dubious value for distinguishing the two species, much less placing them in separate genera.



Hosts: Fungiidae--Fungia, Podobacia, Sandalolitha (as Parahalomitra) (Fize and Serène, 1957; Monod and Serène, 1976).

Depth: 1 m to 15 m (RKK).

Distribution: West Pacific--Vietnam (Fize and Serène, 1957); Indonesia (Serène et al., 1974); Japan: Ryukyu Is. (Takeda and Tamura, 1979); Micronesia: Belau, Guam (RKK).

Hapalocarcinus Stimpson, 1859

Fig. 37

Hapalocarcinus Stimpson, 1859:412 [type species:

Hapalocarcinus marsupialis Stimpson (1859:412), by monotypy; gender masculine].

Diagnosis.--Carapace as long as wide, widest at midlength, slightly convex in lateral view, not deflected anteriorly, lacking depressions, mesogastric region not inflated. Cardiointestinal region not outlined by depression. Pterygostomial region fused to carapace. Epistome without lateral ridges, anterior margin sinuous with deep median indentation. Antennule not produced past midlength of eyestalk, apex pointed or rounded. Antennal segment 2-3 longer than broad, margin lacking lateral spine. MXP-3 with exopod; merus without distolateral projection, mesial margin lacking setae. Second segment of MXP-2 endopod with setae at distal margin of inner surface. MXP-1 endopod quadangular. Ventral thorax wider than long, flat. Sternite of P-1 smooth. Sternite of P-4 without suture.

Female gonopore circular, without hood. P-1 dactylus with or without proximal tooth on cutting edge. P-2 merus lacking distomesial projection, propodus thin. P-3, P-4 coxae lacking anterior lobes. P-5 dactylus not rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 1.7 times width, segment 4 widest, lateral margins convex; PLP-1 curved laterally, apex pointed, lateral margin lacking setae, mesial margin with few pappose setae.

Included species: One:

Hapalocarcinus marsupialis Stimpson

Hapalocarcinus marsupialis Stimpson, 1859:412 [TL: Hilo, Hawaii; location of type unknown].

Cryptochirus marsupialis.--Taylor, 1971:100.

Hosts: Pocilloporidae--Pocillopora, Stylophora, Seriatopora (Fize and Serène, 1957).

Depth: < 1 m to 27 m (RKK).

Distribution: Indo-West Pacific--South Africa and Red Sea to Columbia (see references in Takeda and Tamura, 1986).

Hiroia Takeda and Tamura, 1981

Fig. 38

Hiroia Takeda and Tamura, 1981b:20 [type species:

Troglocarcinus k Kempfi Fize and Serène (1955:378), by original designation; gender feminine].

Diagnosis.--Carapace longer than broad, widest at midlength, flat in lateral view, not deflected anteriorly,

with broad, shallow W-shaped depression, mesogastric region slightly inflated. Cardiointestinal region outlined by depression. Pterygostomial region fused to carapace. Epistome with subparallel lateral ridges, converging slightly anteriorly, anterior margin sinuous with slight median indentation. Lateral lobe of antennule oval, extending beyond eyestalk. Antennal segment 2-3 longer than broad, distal margin lacking lateral spine. MXP-3 with exopod; merus with distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest distal to midlength; distal margin convex. Ventral thorax longer than wide, concave mesially. Anterior extension of sternite of P-1 with few granules. Sternite of P-4 with suture. Female gonopore oval, with anterior hood. P-1 cutting edges entire. P-2 merus lacking distomesial projection; propodus thick. P-3 coxa lacking, P-4 coxa with reduced, anterior lobe. P-5 dactylus rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 1.9 times width, segment 4 widest, lateral margins convex; PLP-1 slightly curved laterally, apex pointed, lateral margin with several pappose, few simple setae, mesial margin with several simple setae proximally.

Included species: One:

Hiroia krempfi (Fize and Serène, 1955)

Troglocarcinus krempfi Fize and Serène, 1955a:378 [TL:

Nhatrang, Vietnam; location of type unknown].

Troglocarcinus (Troglocarcinus) krempfi.--Fize and Serène,  
1957:79.

Pseudocryptochirus krempfi.--Serène, 1966:396.

Hiroia krempfi.--Takeda and Tamura, 1981b:20.

Hosts: Faviidae--Cyphastrea, Hydnophora, (Fize and Serène, 1957; RKK); Merulinidae--Merulina (Fize and Serène, 1957).

Depth: 1 m to 19 m (RKK).

Distribution: West Pacific--Vietnam (Fize and Serène, 1957); Japan: Izu Is., Ryukyu Is. (Takeda and Tamura, 1981b; 1985); Micronesia: Belau, Guam (RKK).

Lithoscaptus Milne Edwards, 1862

Fig. 39

Lithoscaptus Milne Edwards, 1862:F10 [type species:

Lithoscaptus paradoxus Milne Edwards (1862:F10), by monotypy; gender masculine].

Diagnosis.--Carapace longer than broad, widest near midlength, sharply convex in lateral view, deflected anteriorly, with broad W-shaped depression, mesogastric region inflated. Cardiointestinal region outlined by inverted U-shaped depression. Pterygostomial region fused to carapace. Epistome with parallel lateral ridges,

anterior margin straight with slight median indentation. Lateral lobe of antennule oval, extending beyond eyestalk. Antennal segment 2-3 longer than broad, distal margin lacking lateral spine. MXP-3 with exopod; merus with distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest distal to midlength; distal margin convex. Ventral thorax longer than wide, concave mesially. Anterior extension of sternite of P-1 smooth. Sternite of P-4 with suture. Female gonopore oval, with anterior hood. P-1 dactylus cutting edge with tooth proximally. P-2 merus lacking distomesial projection; propodus slender. P-3, P-4 coxae with reduced anterior lobes. P-5 dactylus rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 3.8 times width, segment subequal in width, lateral margins parallel; PLP-1 curved laterally, apex pointed; lateral margin with simple setae, mesial margin with shorter simple setae proximally.

Included species: Six:

Lithoscaptus paradoxus Milne Edwards, 1862

Lithoscaptus paradoxus Milne Edwards, 1862:F10 [TL: Reunion

\*  
Is.; lectotype MNHN].

Cryptochirus coralliodytes var. rubrolineatus Fize and

Serène, 1957:40. [TL: Nhatrang, Vietnam; location of type unknown].

Cryptochirus coralliodytes var. fusca Fize and Serène,  
1957:40. [TL: Nhatrang, Vietnam; location of type  
unknown].

Cryptochirus coralliodytes var. parvulus Fize and Serène,  
1957:40. [TL: Nhatrang, Vietnam; location of type  
unknown].

Cryptochirus bani Fize and Serène, 1957:44 [TL: Nhatrang,  
Vietnam; location of type unknown].

? Lithoscaptus pacificus (Edmondson, 1933),  
new combination

Cryptochirus pacificus Edmondson, 1933:8 [TL: Palmyra Is.;  
\*  
holotype BPBM S3669].

Lithoscaptus tri (Fize and Serène, 1955),  
new combination

Cryptochirus tri Fize and Serène, 1955:379 [TL: Nhatrang,  
Vietnam; location of type unknown].

Cryptochirus trii.--Takeda and Tamura, 1980d:51 [unjustified  
emendation].

Lithoscaptus helleri (Fize and Serène, 1957),  
new combination

Troglocarcinus (Favicola) helleri Fize and Serène, 1957:93  
[TL: Nhatrang, Vietnam; type unknown].

Favicola helleri.--Serène, 1966:397.

Lithoscaptus nami (Fize and Serène, 1957),

new combination

Cryptochirus nami Fize and Serène, 1957:46 [TL: Nhatrang, Vietnam; location of type unknown].

Lithoscaptus grandis (Takeda and Tamura, 1983),

new combination

Cryptochirus grandis Takeda and Tamura, 1983:2 [TL:

\*  
Kushimoto, Japan; holotype NSMT-Cr. 8551].

Remarks: The emendation of the specific name tri to trii by Takeda and Tamura (1980d) is not justified as the root of the name is "tr" (see analogous argument for Fungicola utinomi in "Remarks" section under the genus Fungicola).

The type of Cryptochirus pacificus Edmondson is not in good condition, therefore the placement of that species in Lithoscaptus is tentative.

Hosts: Faviidae--Cyphastrea, Echinopora, Favia, Favites, Hydnophora, Goniastrea, Leptastrea, Platygyra, Plesiastrea, (Fize and Serène, 1957, RKK); Merulinidae--Merulina, (Fize and Serène, 1957).

Depth: < 1 m to 12 m (RKK).

Distribution: Indo-Pacific--Reunion (Milne Edwards, 1862); Vietnam (Fize and Serène, 1957); Sumatra (Serène, 1966); Japan: Izu Is., Kushimoto, Ogasawara Is., Ryukyu Is. (Takeda and Tamura, 1980d; 1981a; 1983; 1985); Micronesia:

Belau, Guam; Pohnpei (RKK); Palmyra (Edmondson, 1933);  
Teraina (Edmondson, 1933).

Neotroglocarcinus Takeda and Tamura, 1980

Fig. 40

Neotroglocarcinus Fize and Serène, 1957:135 [name  
unavailable].

Neotroglocarcinus Takeda and Tamura, 1980c:147 [type  
species: Troglocarcinus monodi Fize and Serène  
(1955a:375), a subjective junior synonym of Cryptochirus  
hongkongensis Shen, 1936 (see Kropp, 1988a), by original  
designation; gender masculine].

Diagnosis.--Carapace longer than broad, widest  
posterior to midlength, flat in lateral view, deflected  
anteriorly, with irregular depression flanking mesogastric,  
latter slightly inflated. Cardiointestinal outlined by  
depression. Pterygostomial region not fused to carapace.  
Epistome with parallel lateral ridges, anterior margin  
straight with deep, narrow median indentation. Lateral lobe  
of antennule triangular, extending beyond eyestalk.  
Antennal segment 2-3 longer than broad, distal margin  
lacking lateral spine. MXP-3 with exopod; merus without  
distolateral projection, mesial margin with setae. Inner  
surface of second segment of MXP-2 endopod lacking setae at  
distal margin. MXP-1 endopod triangular, widest near distal  
margin; latter concave. Ventral thorax about as long as  
broad, flat. Anterior extension of sternite of P-1 with



tubercles. Sternite of P-4 lacking suture. Female gonopore semicircular, with anterior hood. P-1 cutting edges entire. P-2 merus with distomesial projection; propodus thick. P-3, P-4 coxae with well developed anterior lobes. P-5 dactylus not rotated anteriorly. PLP-3 of female biramous. Male with slender P-1; abdomen length 1.7 times width, segment 3 widest, lateral margins convex; PLP-1 angularly curved laterally, apex blunt, lateral and mesial margins with long pappose setae at midlength.

Included species: Two:

Neotroglocarcinus hongkongensis (Shen, 1936)

Cryptochirus hongkongensis Shen, 1936:23 [TL: Hong Kong; location of type unknown].

Pseudocryptochirus hongkongensis.--Takeda and Tamura, 1981b:15.

Troglocarcinus monodi Fize and Serène, 1955a:375 [TL: Nhatrang, Vietnam; location of type unknown].

Neotroglocarcinus monodi.--Fize and Serène, 1957:137.

Neotroglocarcinus hongkongensis.--Kropp, 1988a.

Neotroglocarcinus dawydoffi (Fize and Serène, 1955)

Troglocarcinus dawydoffi Fize and Serène, 1955a:376 [TL: Nhatrang, Vietnam; location of type unknown].

Neotroglocarcinus dawydoffi.--Fize and Serène, 1957:144.

Remarks: Fize and Serène (1957) did not designate a type species for Neotroglocarcinus rendering that name unavailable [International Code of Zoological Nomenclature

Art. 13 (b)]. Takeda and Tamura (1980c) made Neotroglocarcinus available by designating Troglocarcinus monodi as the type species of the genus. Kropp (1988a) determined that T. monodi is a subjective junior synonym of Cryptochirus hongkongensis Shen.

Hosts: Dendrophylliidae--Turbinaria (Fize and Serène, 1957).

Depth: < 1 m to 13 m (RKK).

Distribution: Indo-West Pacific--Vietnam (Fize and Serène, 1957); Japan: Izu Is., Ryukyu Is. (Takeda and Tamura, 1980c; 1985); Micronesia: Belau, Guam, Pohnpei (RKK), Enewetak (Garth et al., 1987).

Opecarcinus Kropp and Manning, 1987

Fig. 41

Opecarcinus Kropp and Manning, 1987:9 [type species: Pseudocryptochirus hypostegus Shaw and Hopkins (1977:179), by original designation; gender masculine].

Diagnosis.--Carapace longer than broad, widest posterior to midlength, convex in lateral view, deflected anteriorly, with transverse depression on protogastric, mesogastric slightly inflated. Cardiointestinal outlined by depression. Pterygostomial region fused to carapace. Epistome with parallel lateral ridges, anterior margin sinuous with deep, wide median indentation. Lateral lobe of antennule triangular, extending beyond eyestalk. Antennal segment 2-3 longer than broad, distal margin lacking lateral

spine. MXP-3 with exopod; merus with distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod lacking setae at distal margin. MXP-1 endopod triangular, widest near midlength; distal margin convex. Ventral thorax longer than wide, flat. Anterior extension of sternite of P-1 with tubercles. Sternite of P-4 with suture. Female gonopore oval, lacking or with anterior hood. P-1 cutting edges entire. P-2 merus with distomesial projection; propodus thick. P-3, P-4 coxae with well developed anterior lobes. P-5 dactylus rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 1.8 times width, segment 3 widest, lateral margins convex; PLP-1 curved laterally, apex blunt, lateral margin with several, mesial margin with few, stout simple setae.

Included species: Eight:

Opecarcinus crescentus (Edmondson, 1925)

Cryptochirus crescentus Edmondson, 1925:33 [TL: Johnston  
\*  
Is.; holotype BPBM S1805].

Pseudocryptochirus crescentus.--Utinomi, 1944:697.

Troglocarcinus (Troglocarcinus) crescentus.--Fize and  
Serène, 1957:62.

Opecarcinus crescentus.--Kropp and Manning, 1987:9.

Opecarcinus granulatus (Shen, 1936)

Cryptochirus granulatus Shen, 1936:23. [TL: Hong Kong;  
\*  
holotype BM(NH) 1911.8.15.2].

Opecarcinus granulatus.--Kropp, ms 1.

Opecarcinus hypostegus (Shaw and Hopkins, 1977)

Pseudocryptochirus hypostegus Shaw and Hopkins, 1977:179

\*  
[TL: Florida Middle Ground, Florida; holotype USNM  
168533].

Opecarcinus hypostegus.--Kropp and Manning, 1987:10.

Opecarcinus aurantius Kropp

Opecarcinus aurantius Kropp, ms 1 [TL: Cetti Bay, Guam;

\*  
holotype USNM 234266].

Opecarcinus lobifrons Kropp

Troglocarcinus (Troglocarcinus) crescentus.--Garth, 1965:8

[not Cryptochirus crescentus Edmondson].

Pseudocryptochirus crescentus.--Garth and Hopkins, 1968:41

[in part; not Cryptochirus crescentus Edmondson].

Opecarcinus lobifrons Kropp, ms 1 [TL: Tanguisson Pt., Guam;

\*  
holotype USNM 234269].

Opecarcinus peliops Kropp

Opecarcinus peliops Kropp, ms 1 [TL: Pakin Atoll, Pohnpei;

\*  
holotype USNM 234272].

Opecarcinus pholeter Kropp

Opecarcinus pholeter Kropp, ms 1 [TL: Cetti Bay, Guam;

\*  
holotype USNM 234275].

Opecarcinus sierra Kropp

Opecarcinus sierra Kropp, ms 1 [TL: Agat Bay, Guam;  
\*  
holotype USNM 234278].

Hosts: Agariciidae--Agaricia, Gardineroseris,  
Leptoseris, Payona, (Fize and Serène, 1957; Scott, 1985;  
RKK); Siderasteriidae--Siderastrea, Coscinaraea [recorded as  
?Coscinastrea of Agariciidae] (Takeda and Tamura, 1983;  
Scott, 1985).

Depth: < 1 m to 82 m (Shen, 1936; RKK).

Distribution: West, Central Atlantic--(see Kropp and  
Manning, 1987). Indo-Pacific--Christmas Is. (Indian Ocean;  
Shen, 1936); Vietnam and Japan to Mexico (see Kropp, ms 1).

Pelycomaia, new genus

Fig. 42

Pelycomaia, new genus [type species Troglocarcinus minutus  
Edmondson (1933:12), by original designation, gender  
feminine].

Diagnosis.--Carapace longer than broad, widest anterior  
to midlength, convex in lateral view, deflected anteriorly,  
with two isolated bowl-shaped concavities, mesogastric  
region slightly inflated. Pterygostomial region fused to  
carapace. Epistome with lateral ridges, anterior margin  
straight with slight median indentation. Lateral lobe of  
antennule oval, extending just beyond eyestalk. Antennal  
segment 2-3 longer than broad, distal margin lacking spine.  
MXP-3 with exopod; merus with distolateral projection,

mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest distal to midlength; distal margin convex. Ventral thorax longer than broad, concave mesially. Anterior extension of sternite of P-1 smooth. Sternite of P-4 with suture. Female gonopore elliptical, with anterior hood. P-1 dactylus with low tooth proximally on cutting surface. P-2 merus lacking distomesial projection; propodus thick. P-3 coxa with reduced, P-4 coxae with well-developed anterior lobes. P-5 dactylus rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 3.0 times width, segment 5 widest; PLP-1 not available for study.

Etymology.--From the Greek, pelykos, bowl, in combination with maia, a kind of crab, in reference to the bowl-shaped concavities on the anterior carapace.

Included species: One:

Pelycomaia minuta (Edmondson, 1933),

new combination

Cryptochirus minutus Edmondson, 1933:12 [TL: Oahu, Hawaii,  
\*  
holotype BPBM S3671].

Troglocarcinus (Favicola) minutus.--Fize and Serène,  
1957:106.

Favicola minutus.--Serène, 1966:397.

Favicola minutum.--Serène et al., 1976:20.

Favicola minuta.--Takeda and Tamura, 1981b:43.

Hosts: Faviidae.--Cyphastrea, Leptastrea (Fize and Serène, 1957).

Depth: < 2 m (RKK).

Distribution: Pacific Ocean--Vietnam (Fize and Serène, 1957); Micronesia: Guam (RKK); Hawaii (Edmondson, 1933; RKK).

Pseudocryptochirus Hiro, 1938

Fig. 43

Pseudocryptochirus Hiro, 1938:149 [type species:

Pseudocryptochirus viridis Hiro (1938:149), by monotypy; gender masculine].

Diagnosis.--Carapace longer than broad, widest posterior to midlength, slightly convex in lateral view, not deflected anteriorly, lacking depression, mesogastric very slightly inflated. Cardiointestinal regions not outlined by depression. Pterygostomial region not fused to carapace. Epistome with parallel lateral ridges, anterior margin sinuous with shallow, narrow median indentation. Lateral lobe of antennule quadrangular, extending beyond eyestalk. Antennal segment 2-3 shorter than broad, distal margin lacking lateral spine. MXP-3 with exopod; merus without distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod lacking setae at distal margin. MXP-1 endopod triangular, widest near distal margin; latter concave. Ventral thorax about as long as wide, flat. Anterior extension of sternite of P-1 with few

granules. Sternite of P-4 with partial suture. Female gonopore oval, with anterior hood. P-1 cutting edges entire. P-2 merus with distomesial projection; propodus thick. P-3, P-4 coxae with well developed anterior lobes. P-5 dactylus not rotated anteriorly. PLP-3 of female uniramous. Male with slender P-1; abdomen length 1.4 times width, segment 3 widest, lateral margins concave; PLP-1 slightly curved laterally, apex sharply pointed, lateral and mesial margins with long pappose setae at midlength.

Included species: One:

Pseudocryptochirus viridis Hiro, 1938

Pseudocryptochirus viridis Hiro, 1938:150 [TL: Tanabe Bay, Japan; location of type unknown].

Hosts: Dendrophylliidae--~~Turbinaria~~ (Fize and Serène, 1957).

Depth: 1 m to 6 m (RKK).

Distribution: West Pacific--Vietnam (Fize and Serène, 1957); Indonesia (Serène, et al., 1974); Japan: Izu Is. (Takeda and Tamura, 1981b; 1985); Micronesia: Belau, Guam, Pohnpei (RKK). The record from Enewetak (Garth and Hopkins, 1968) are apparently erroneous (Garth et al., 1987).

Pseudohapalocarcinus Fize and Serène, 1955

Fig. 44

Pseudohapalocarcinus Fize and Serène, 1955a:378 [type species: Pseudohapalocarcinus ransoni Fize and Serène (1955a:378), by monotypy; gender masculine].



Diagnosis.--Carapace as long as wide, widest posterior to midlength, evenly convex in lateral view, not deflected anteriorly, lacking depression, mesogastric region not inflated. Cardiointestinal not outlined by depression. Pterygostomial region fused to carapace. Epistome with parallel lateral ridges, anterior margin sinuous, with deep, wide median indentation. Lateral lobe of antennule quadrangular, not extending beyond eyestalk. Antennal segment 2-3 shorter than broad, distal margin lacking lateral spine. MXP-3 with exopod; merus lacking distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod lacking setae at distal margin. MXP-1 endopod triangular, widest near midlength; distal margin convex. Ventral thorax wider than long. Anterior extension of sternite of P-1 smooth. Sternite of P-4 without suture. Female gonopore semicircular, lacking anterior hood. P-1 cutting edges entire. P-2 merus lacking distomesial projection; propodus slender. P-3, P-4 coxae with well developed anterior lobes. P-5 dactylus not rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 1.4 times width, segment 4 widest, lateral margin convex; PLP-1 slightly curved distally, apex blunt; lateral and mesial margins with few simple setae.

Included species: One:

Pseudohapalocarcinus ransoni Fize and Serène, 1955

Pseudohapalocarcinus ransoni Fize and Serène, 1955a:378 [TL:

Nhatrang, Vietnam; location of type unknown].

Hosts: Agariciidae--Payona (Fize and Serène, 1957)

Depth: < 1 m to 21 m (RKK).

Distribution: West Pacific--Vietnam (Fize and Serène, 1957); Japan: Ryukyu Is. (Takeda and Tamura, 1980a); Micronesia: Belau, Guam, Pohnpei (RKK).

Sphenomaia, new genus

Fig. 45

Sphenomaia, new genus [type species: Cryptochirus pyriformis Edmondson (1933:10); by original designation and monotypy; gender feminine].

Diagnosis.--Carapace longer than broad, widest at midlength, strongly convex in lateral view, not deflected anteriorly, with broad depression over entire anterior, mesogastric not inflated. Cardiointestinal region outlined by inverted U-shaped depression. Pterygostomial region fused to carapace. Epistome with lateral ridges, anterior margin sinuous with broad, shallow median indentation. Lateral lobe of antennule extending to or just beyond eyestalk. Antennal segment 2-3 longer than broad, distal margin lacking spine. MXP-3 with exopod; merus lacking distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest distally;

distal margin slightly convex. Ventral thorax longer than broad, concave mesially. Anterior extension of sternite of P-1 with granules. Sternite of P-4 with suture. Female gonopore elliptical, with anterior hood. P-1 dactylus entire. P-2 merus lacking distomesial projection; propodus slender. P-3, P-4 coxae anterior lobes. P-5 dactylus rotated anteriorly. PLP-3 of female uniramous. Male not available for study.

Etymology.--From the Greek, sphenos, wedge, in combination with maja, a kind of crab, in reference to the appearance of the carapace in lateral view.

Included species: One:

Sphenomaia pyriforma (Edmondson, 1933),  
new combination

Cryptochirus pyriformis Edmondson, 1933:10 [TL: Washington  
\*  
Island, holotype BPBM S3670].

Troglocarcinus (Favicola) pyriformis.--Fize and Serène,  
1957:84.

Favicola pyriformis.--Serène, 1966:397.

Hosts: Faviidae--Favites, Hydnophora, and Platygyra  
(Edmondson, 1933).

Depth: Not recorded.

Distribution: Known from Teraina (= Washington Island)  
in the central Pacific (Edmondson, 1933).

Utinomia Takeda and Tamura, 1981

Fig. 46

Utinomia Takeda and Tamura, 1981b:23 [type species:

Cryptochirus dimorphus Henderson (1906:214), by  
original designation and monotypy; gender feminine].

Diagnosis.--Carapace longer than broad, widest posterior to midlength, flat in lateral view, not deflected anteriorly, with broad, shallow depression, mesogastric slightly inflated. Cardiointestinal region outlined by depression. Pterygostomial region fused to carapace. Epistome lacking lateral ridges, anterior margin sinuous with shallow, wide median indentation. Lateral lobe of antennule rectangular, extending to tip of eyestalk. Antennal segment 2-3 longer than broad, distal margin lacking lateral spine. MXP-3 lacking exopod; merus lacking distolateral projection, mesial margin lacking setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest near distal margin; latter convex. Ventral thorax longer than broad, flat. Anterior extension of sternite of P-1 smooth. Sternite of P-4 with partial suture. Female gonopore semicircular, lacking anterior hood. P-1 cutting edges entire. P-2 merus without distomesial projection; propodus slender. P-3 coxa with reduced, P-4 coxa with well developed anterior lobe. P-5 dactylus not rotated anteriorly. PLP-3 of female uniramous. Male with robust P-1; abdomen length 1.7 times width, segment 3 widest, lateral

margin convex; PLP-1 slightly curved distally, apex blunt, lateral and mesial margins with few long pappose setae distally.

Remarks.--Tomlinson (1963:264) used the name Utinomia for a genus of acrothoracican barnacle; though it was later synonymized with Weltneria Berndt, 1907 (Tomlinson, 1969). Utinomia is therefore unavailable for use as a gall crab genus and needs to be replaced. In accordance with the recommendation of the International Code of Zoological Nomenclature (Appendix A, 3), I have contacted Dr. Takeda regarding this homonymy.

Included species: One:

Utinomia dimorpha (Henderson, 1906)

Cryptochirus dimorphus Henderson, 1906:214 [TL: Andaman Is.; location of type unknown].

Pseudocryptochirus kahe McCain and Coles, 1979:81 [TL: Kahe Pt., Oahu, Hawaii; holotype BPBM S8512].

Pseudocryptochirus dimorphus.--Takeda and Tamura, 1980d:47.

Utinomia dimorpha.--Takeda and Tamura, 1981b:23.

Hosts: Pocilloporidae--Pocillopora, Stylophora (Takeda and Tamura, 1981b; RKK).

Depth: 1 m to 29 m (RKK).

Distribution: Indo-West Pacific--Andaman Is.

(Henderson, 1906); Japan: Ryukyu Is. (Takeda and Tamura, 1981b); Micronesia: Belau, Guam, Pohnpei (RKK); Hawaii (McCain and Coles, 1979).

Xynomaia, new genus

Fig. 47

Xynomaia, new genus [type species: Troglocarcinus sheni Fize and Serène (1955b:380), by original designation; gender feminine].

Diagnosis.--Carapace longer than broad, widest at midlength, convex in lateral view, not deflected anteriorly, with broadly W-shaped depression, mesogastric region slightly inflated. Cardiointestinal outlined by depression. Pterygostomial region not fused to carapace. Epistome with parallel lateral ridges, anterior margin straight with slight median indentation. Lateral lobe of antennule oval, extending to tip of eyestalk. Antennal segment 2-3 longer than broad, distal margin with lateral spine. MXP-3 with exopod; merus with distolateral projection, mesial margin with setae. Inner surface of second segment of MXP-2 endopod with setae at distal margin. MXP-1 endopod triangular, widest proximal to midlength; distal margin evenly convex. Ventral thorax longer than broad, concave mesially. Anterior extension of sternite of P-1 smooth or with fine granules. Sternite of P-4 with suture. Female gonopore elliptical, with anterior hood. P-1 dactylus with low tooth on cutting edge. P-2 merus lacking distomesial projection; propodus slender. P-3 coxa with poorly-developed anterior lobe, P-4 coxa with well-developed anterior lobe. P-5 dactylus rotated anteriorly. PLP-3 of

female uniramous. Male with robust P-1; abdomen length 2.8 times width, segment 4 widest, lateral margins subparallel; PLP-1 slightly curved laterally, apex pointed, lateral margin with many proximally pappose setae, few simple setae, mesial margin with several short simple setae.

Etymology.--From the Greek xynon, companion, in combination with maia, a kind of crab, in reference to the symbiotic lifestyle of the crab.

Included species: Three:

Xynomaia sheni (Fize and Serène, 1955),  
new combination

Troglocarcinus sheni Fize and Serène, 1955b:380 [TL:  
Nhatrang, Vietnam; location of type unknown].

Troglocarcinus (Troglocarcinus) sheni.--Fize and Serène,  
1957:74.

Pseudocryptochirus sheni.--Serène, 1966:396.

Hiroia sheni.--Takeda and Tamura, 1981b:20.

Xynomaia boissoni (Fize and Serène, 1955a),  
new combination

Troglocarcinus boissoni Fize and Serène, 1955a:376 [TL:  
Nhatrang, Vietnam; location of type unknown].

Troglocarcinus (Troglocarcinus) boissoni.--Fize and Serène,  
1957:69.

Pseudocryptochirus boissoni.--Serène, 1966:396.

Hiroia boissoni.--Takeda and Tamura, 1981b:20.

Xynomaia verrilli (Fize and Serène, 1957),  
new combination

Troglocarcinus (Favicola) verrilli Fize and Serène, 1957:101

[TL: Nhatrang, Vietnam; location of holotype unknown,  
paratype MNHN].

Favicola verrilli.--Serène, 1966:397.

Hosts: Faviidae--Favia, Goniastrea, Montastrea,  
Oulophyllia, Platygyra (Fize and Serène, 1957; RKK);  
Merulinidae--Merulina (Fize and Serène, 1957).

Pectiniidae--Pectinia (RKK).

Depth: 1 m to 15 m (RKK).

Distribution: West Pacific--Vietnam (Fize and Serène,  
1957); Sumatra (Serène, 1966); Japan: Izu Is., Kushimoto  
(Takeda and Tamura, 1983; 1985); Micronesia: Belau, Guam  
(RKK).

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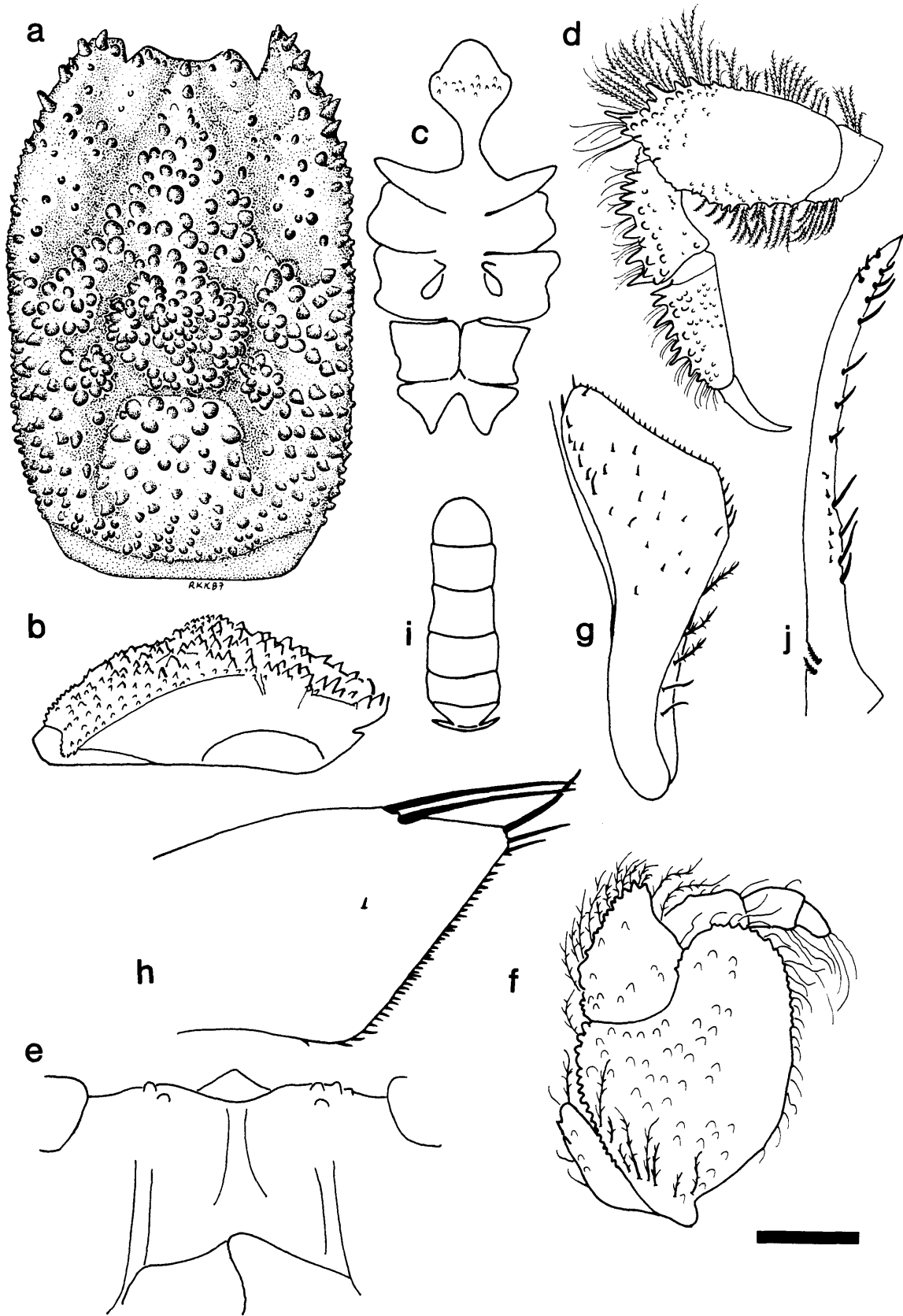
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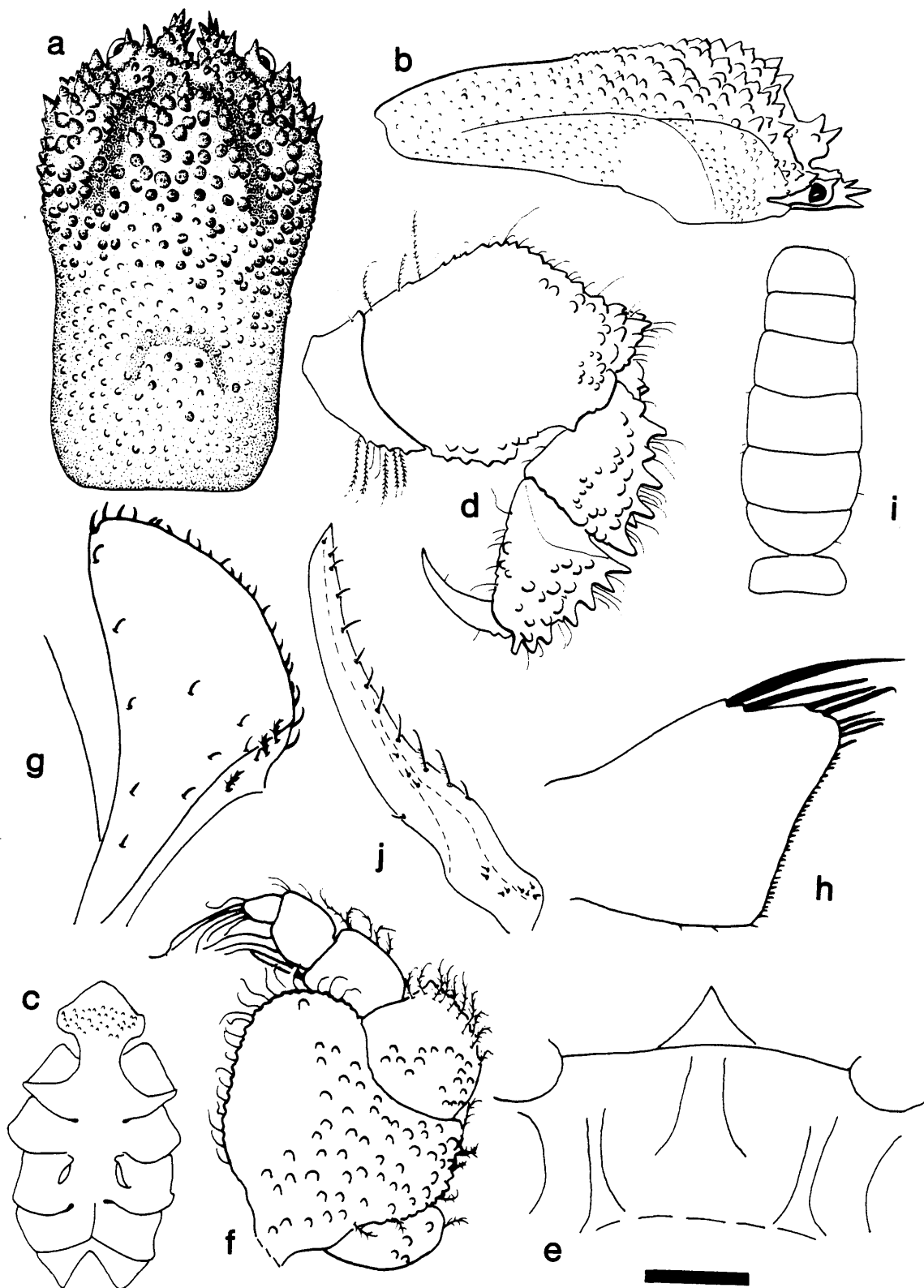


Fig. 33. Cryptochirus coralliodytes Heller. Female lectotype (Red Sea): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Guam): i, abdomen; j, gonopod. Scale: b = 2.1 mm; c = 1 mm; a = 0.8 mm; d, i = 0.7 mm; f = 0.4 mm; e = 0.3 mm; g = 0.2 mm; h = 0.1 mm.

Fig. 34. Dacryomaia edmonsoni (Fize and Serène). Female (Guam): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Guam): i, abdomen; j, gonopod. Scale: a-c, i = 1 mm; d = 0.5 mm; e = 0.2 mm; f, g = 0.1 mm.

Fig. 35. Fizesereneia heimi (Fize and Serène). Female (Guam): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male Guam: i, abdomen; j, gonopod. Scale: a, b, d, i = 1 mm; c = 0.9 mm; e = 0.3 mm; g, h = 0.1 mm.





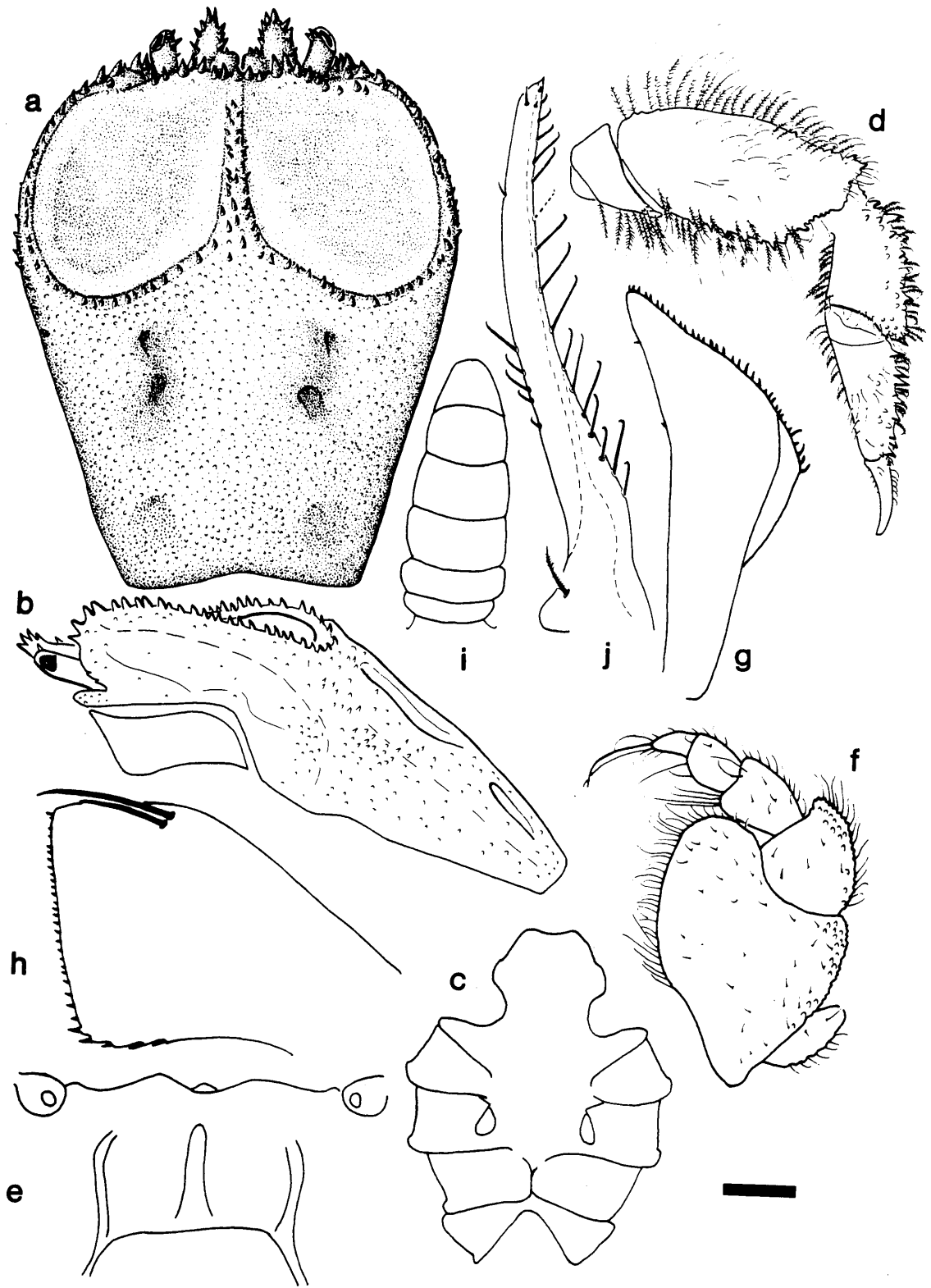
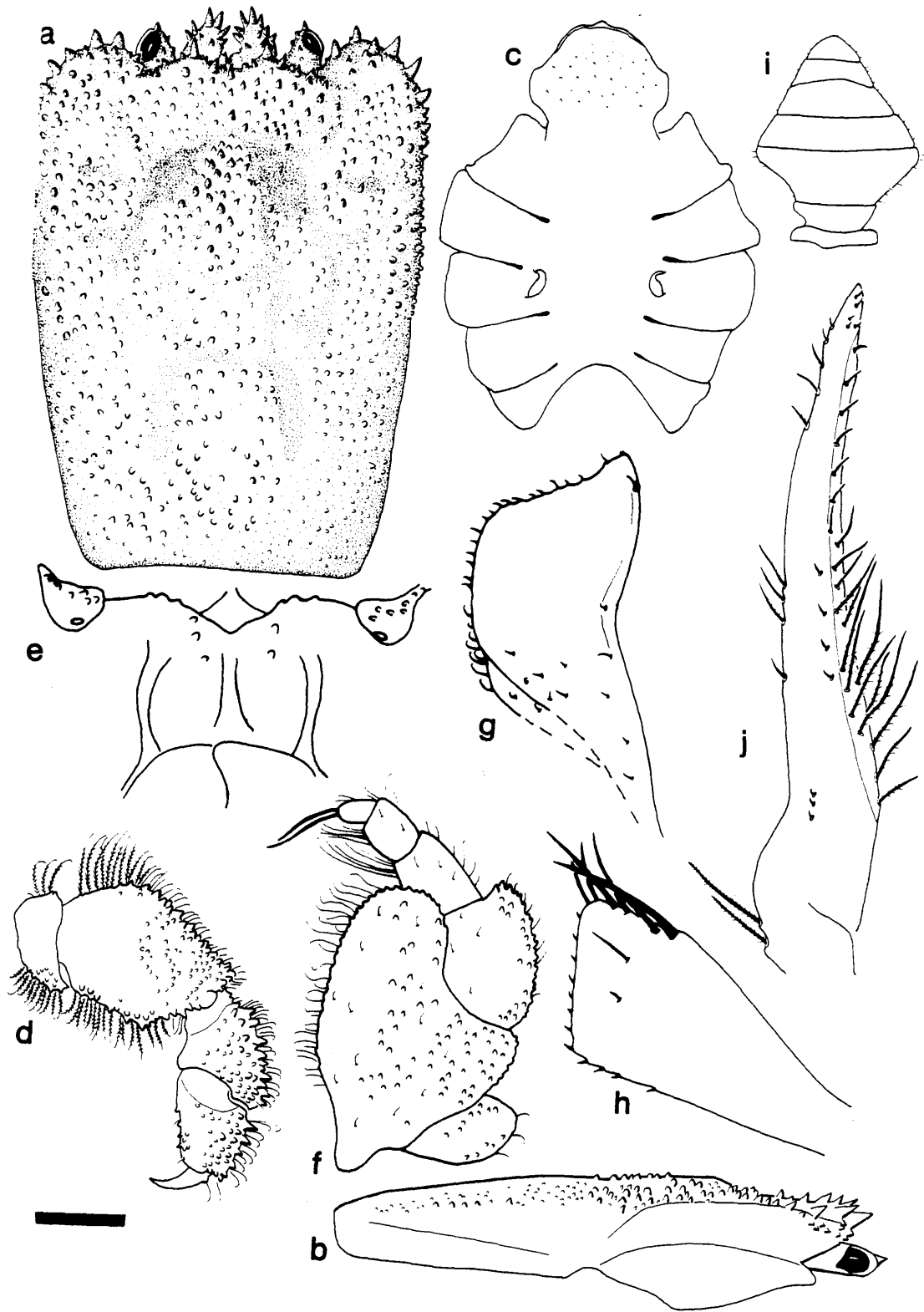


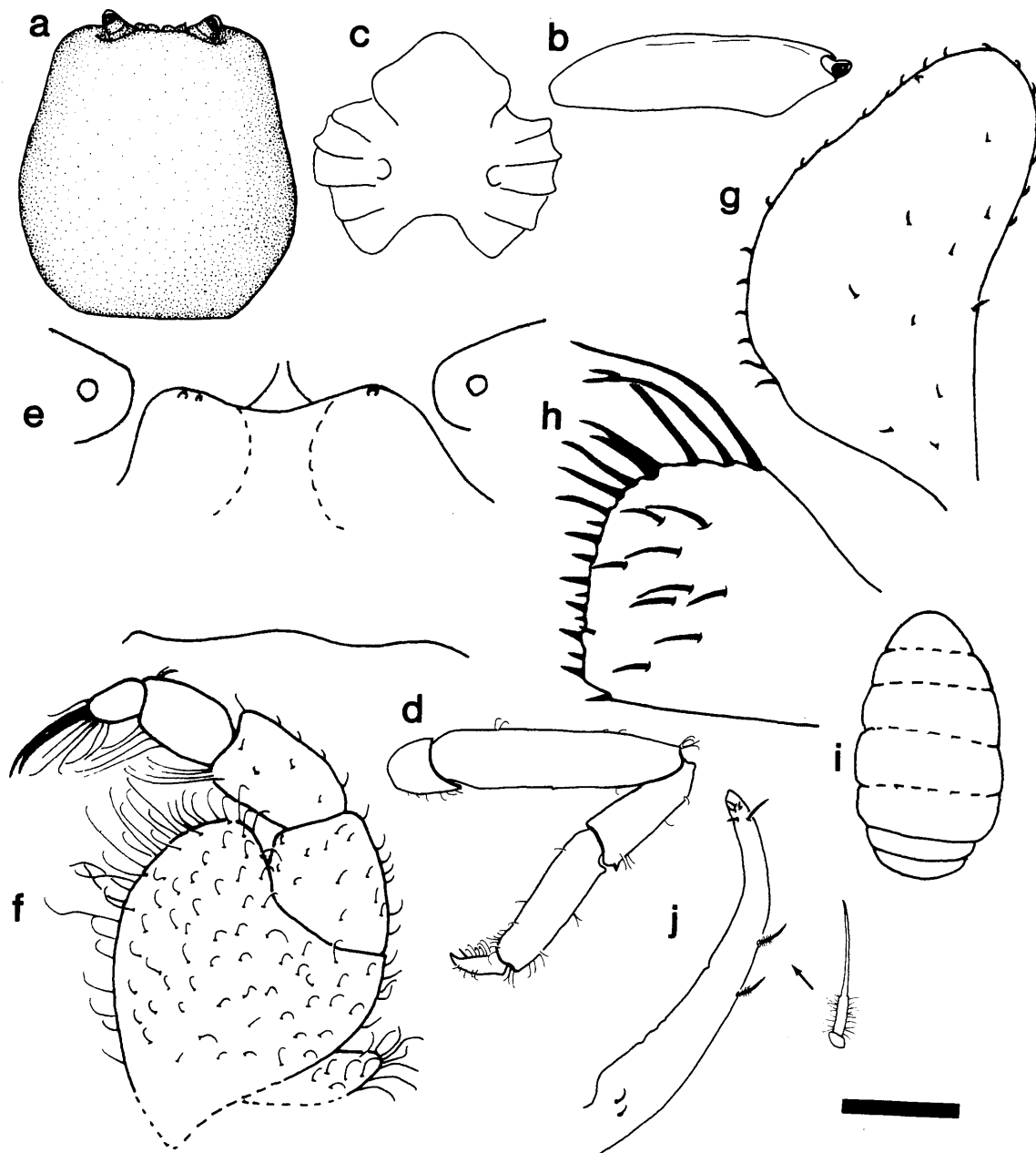
Fig. 36. Fungicola utinomi (Fize and Serène). Female (Belau): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Palau): i, abdomen; j, gonopod. Scale: a, b = 1 mm; c, d, i = 0.9 mm; e, f = 0.3 mm; g = 0.2 mm; h = 0.1 mm.

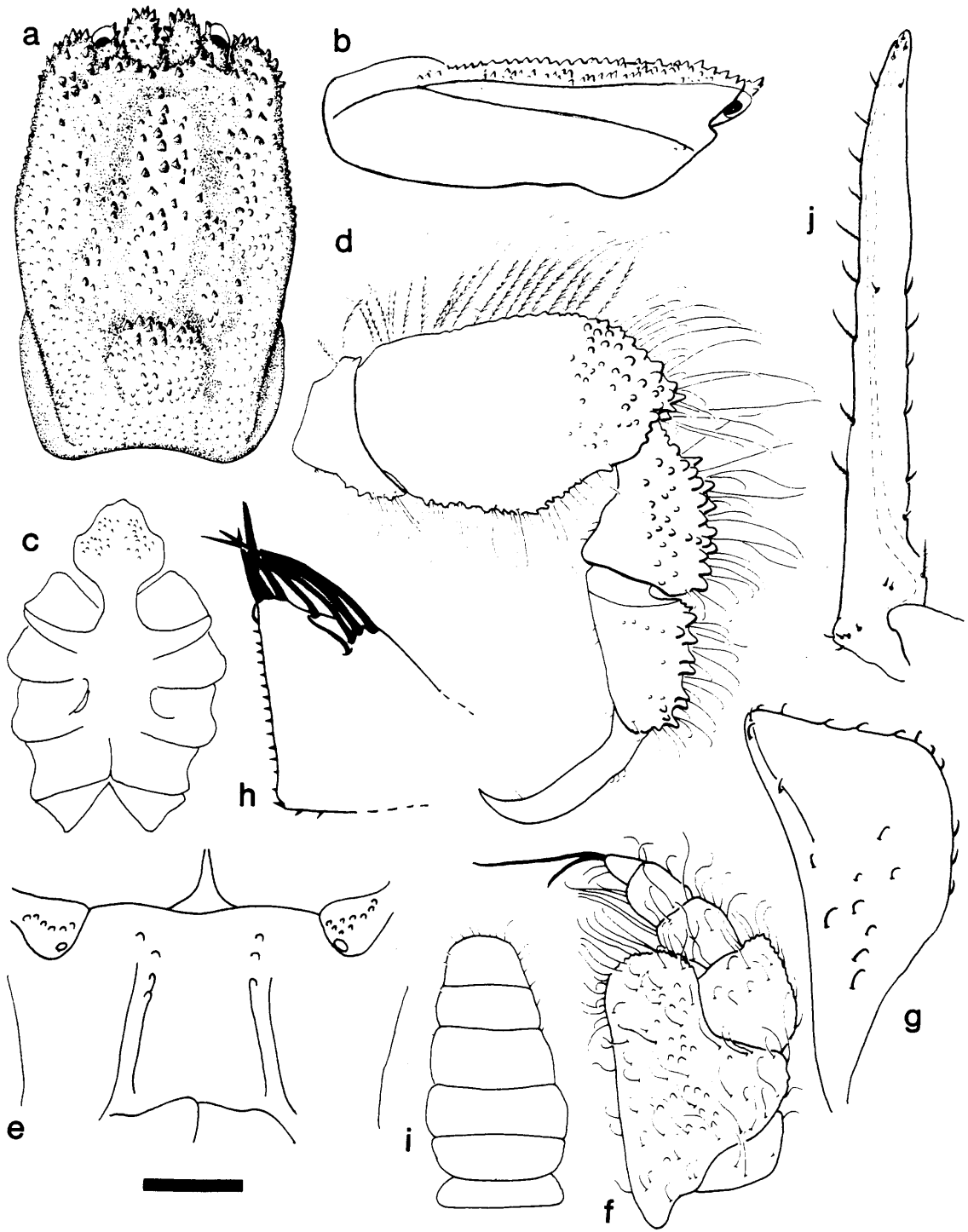
Fig. 37. Hapalocarcinus marsupialis Stimpson. Female (Guam): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Papua New Guinea): i, abdomen; j, gonopod (from MacNamee, 1961). Scale: a-c = 2.1 mm; d = 1 mm; i = 0.4 mm; f = 0.3 mm; e, g = 0.2 mm; h = 0.1 mm.

Fig. 38. Hiroia krempfi (Fize and Serène). Female (Belau): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Pohnpei): i, abdomen; j, gonopod. Scale: a-c = 1 mm; d, i = 0.5 mm; f = 0.3 mm; e = 0.2 mm; g, h = 0.1 mm.

Fig. 39. Lithoscaptus paradoxus Milne Edwards. Female (Guam): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Guam): i, abdomen; j, gonopod. Scale: b = 2.1 mm; a = 0.8 mm; c = 1 mm; d = 0.7 mm; f = 0.5 mm; e = 0.3 mm; g = 0.2 mm.









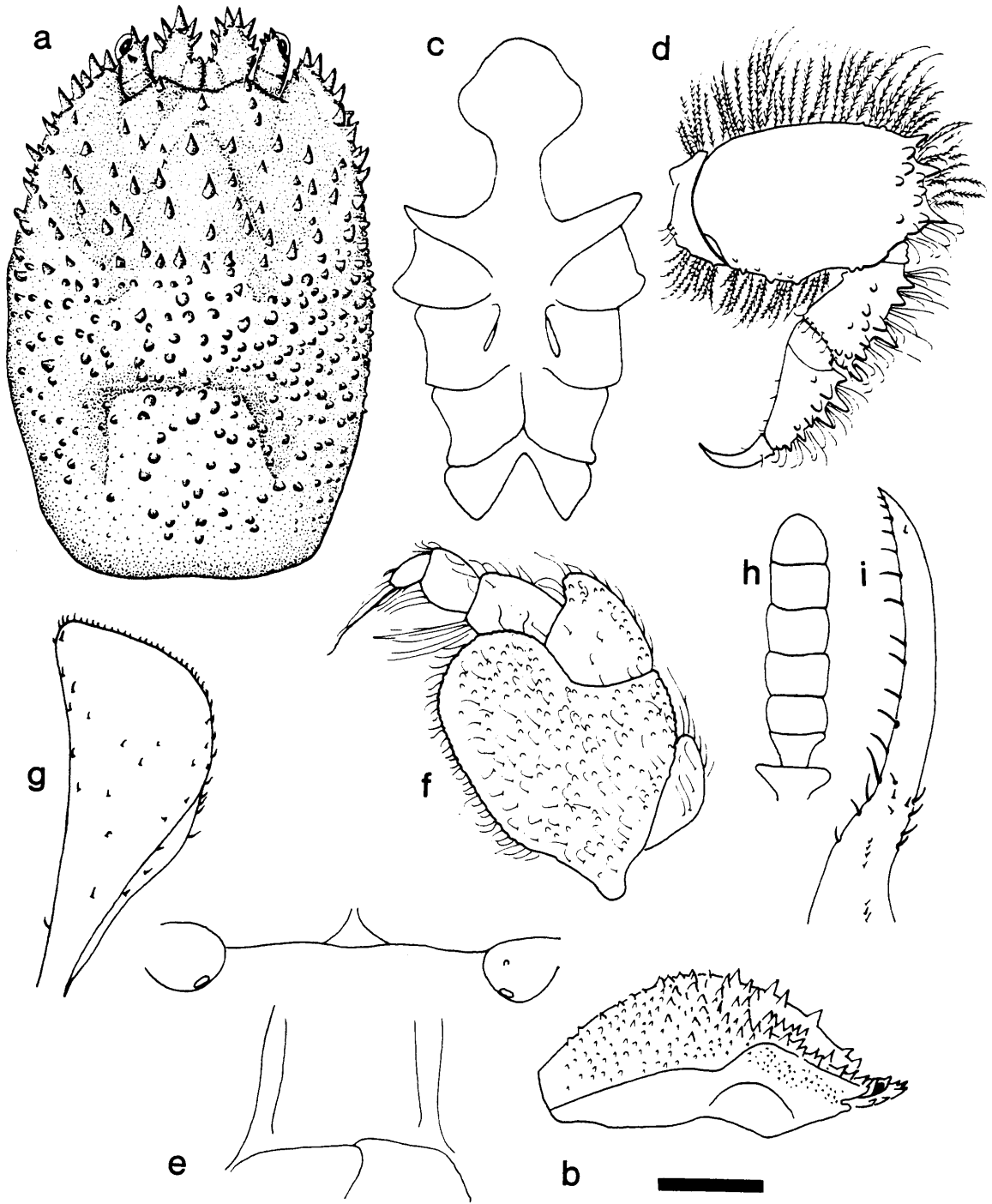
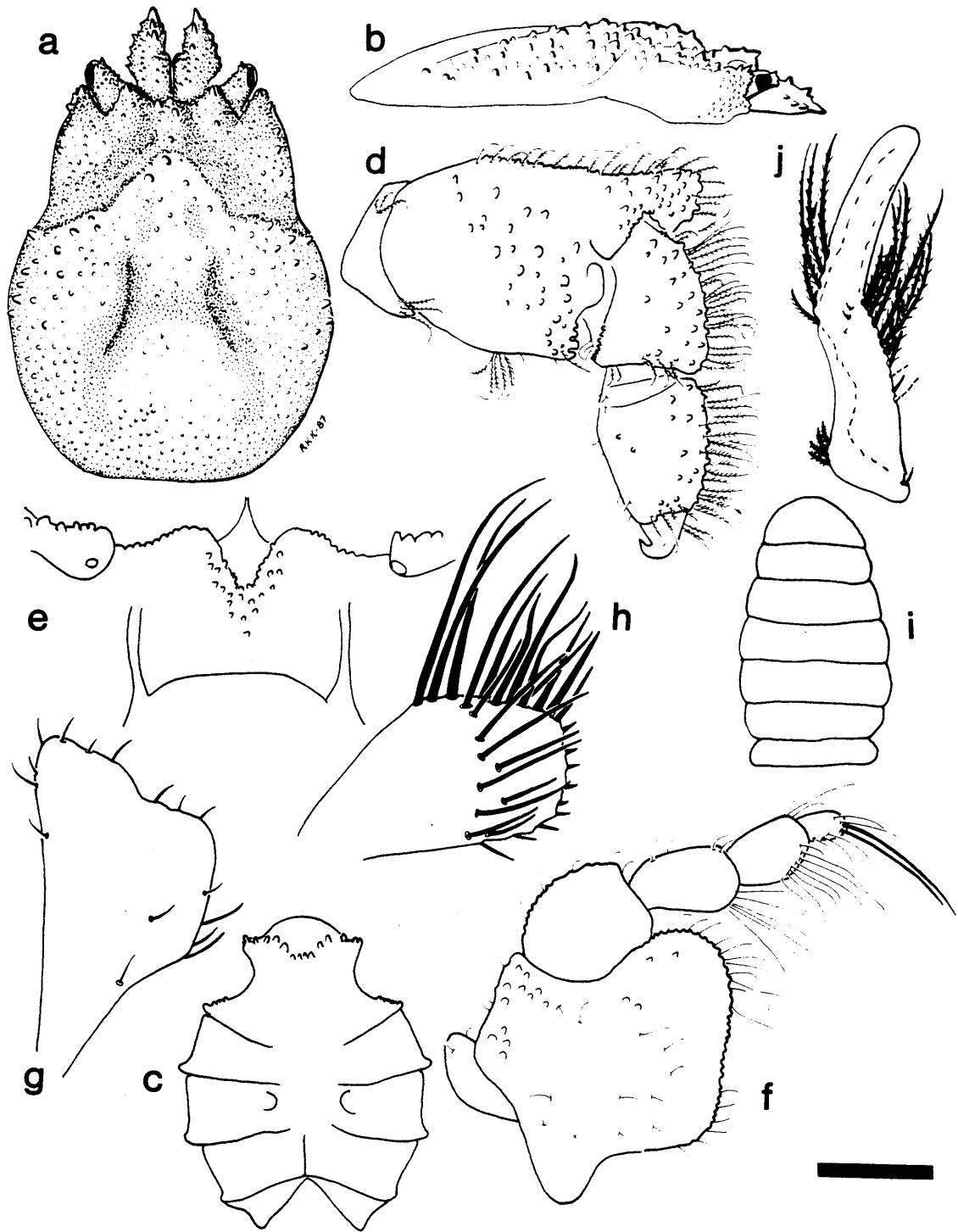
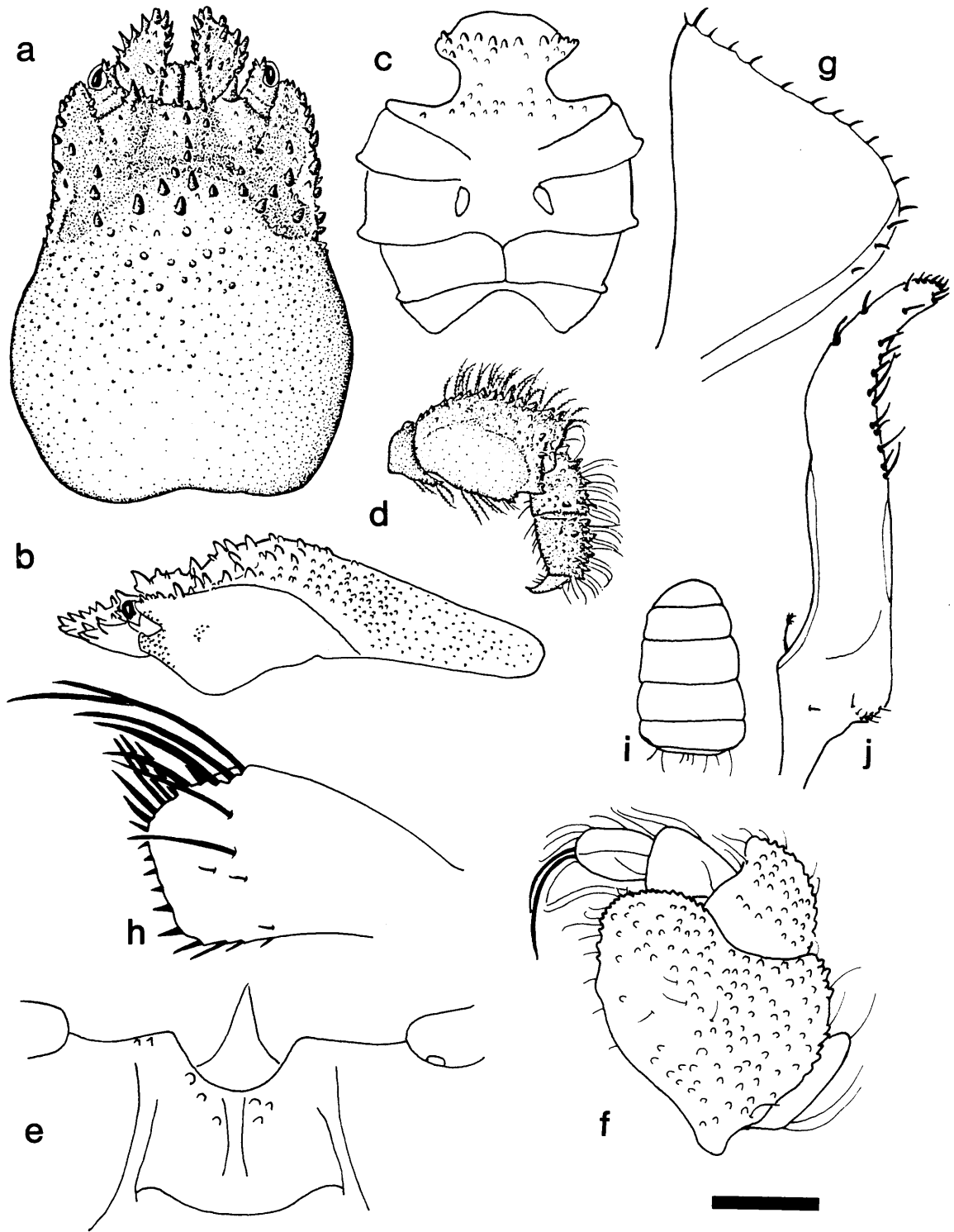


Fig. 40. Neotroglocarcinus hongkongensis (Shen). Female (Vietnam): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Guam): i, abdomen; j, gonopod. Scale: a-c = 2.1 mm; d = 1 mm; e = 0.5 mm;

Fig. 41. Opecarcinus hypostegus (Shaw and Hopkins). Female holotype (Florida): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male paratype (Florida): i, abdomen; j, gonopod. Scale: c = 1.2 mm; b, d = 1 mm; a = 0.7 mm; f, i = 0.5 mm; e = 0.3 mm; h, j = 0.2 mm; g = 0.1 mm.

Fig. 42. Pelycomais minuta (Edmondson). Female (Hawaii): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Hawaii, from Edmondson, 1933): h, abdomen. Scale: c = 0.8 mm; a, b, d = 0.5 mm; f = 0.2 mm; e, g, h = 0.1 mm.





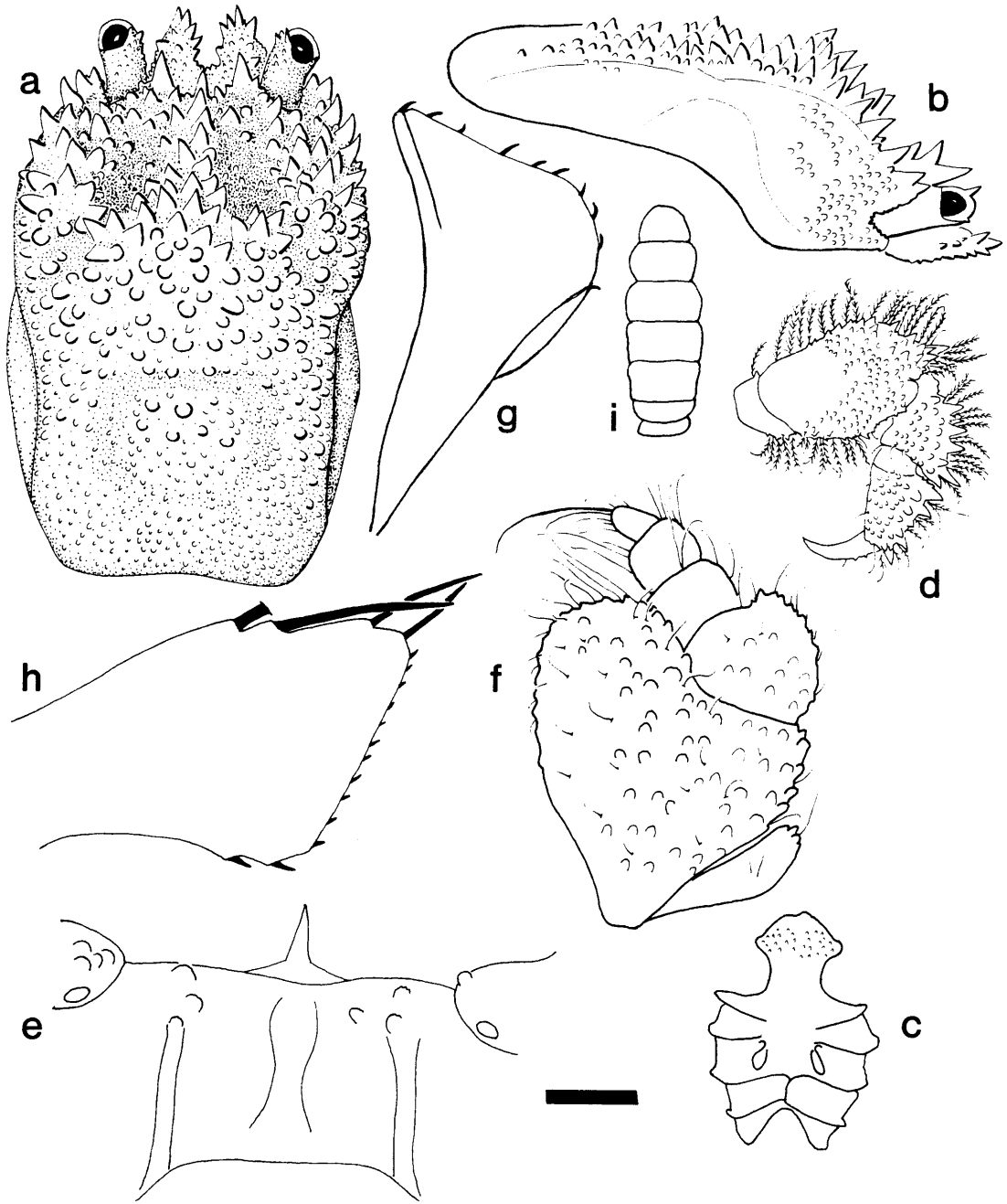


Fig. 43. Pseudocryptochirus viridis (Hiro). Female (Belau): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Belau): i, abdomen; j, gonopod. Scale: a = 1.2 mm; b, c = 1 mm; d = 0.5 mm; e, f = 0.2 mm; g, h = 0.1 mm.

Fig. 44. Pseudohapalocarcinus ransoni Fize and Serène. Female (Guam): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1; h, MXL-1; male (Belau): i, abdomen; j, gonopod. Scale: a, b = 1 mm; c, i = 0.5 mm; e, f = 0.3 mm; g, h = 0.1 mm.

Fig. 45. Sphenomaia pyriforma (Edmondson). Female (Teraina): a, dorsal view of carapace; b, lateral view; c, thoracic sternites; d, Pereopod 2; e, epistome; f, MXP-3; g, endopod of MXP-1. Scale: a-d = 1 mm; e = 0.5 mm;

