

Crustacea Decapoda: Hermit crabs of the family Paguridae from the KARUBAR Cruise in Indonesia

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ABSTRACT

The French-Indonesian 1991 campagne to the islands of Kai, Aru, and Tanimbar, part of the Maluku region of Indonesia, revealed an unexpected wealth of hermit crabs of the family Paguridae. Although only 295 specimens were collected in depths ranging from 85 to 1024 meters, an incredible 19 genera and 36 species are represented, of which seven genera and 26 species are described for the first time. Included are the monotypic *Alainopaguroides* gen. nov., *Enneopagurus* gen. nov., *Enneophyllus* gen. nov., *Icelopagurus* gen. nov., and *Tarrasopagurus* gen. nov., and their respective new species. The genus *Michelopagurus*, gen. nov., is established for "*Pagurodes*" *limatulus* Henderson, 1888, and one additional new species, and the genus *Pseudopagurus* is created for "*Pagurodes*" *piliferus* Henderson, 1888, the last of the original trio of species initially assigned to the heterogeneous *Pagurodes*. A lectotype for *Pagurodes inarmatus* Henderson, 1888, the type species of the now monotypic *Pagurodes*, is also designated. The genus *Turleania* is proposed as a replacement name for *Laurentia* McLaughlin & Haig.

Of the new genera, three are particularly noteworthy. Not only are *Enneopagurus* and *Enneophyllus* just the second and third genera of the Paguridae to be characterized, in part, by the absence of gills on the third maxillipeds, the latter genus is unique, at least for the present. Its type species, *E. spinirostris* sp. nov., is the first pagurid known to have a well developed epi-rostral spine. *Alainopaguroides* joins that very specialized group of genera distinguished by marked reduction in the abdomen, accompanied by total loss of male pleopods and reduction in the number of female pleopods. Two additional genera of this group, *Solitariopagurus* and *Porcellanopagurus*, are also represented in the KARUBAR collection, each by a new species.

In addition to the new genera, new species are described in several of the less commonly reported genera, e.g., *Catapaguroides*, *Decaphyllus*, *Catapagurus*, and *Tomopaguropsis*. Although *Pagurus* is widely represented in the colder waters, particularly of the northern hemisphere, the discovery of three new species from the restricted geographic region of the KARUBAR campagne was unexpected. A third species has been added to, and extends the distributional range of, the recently described *Bathypaguropsis* from Australian and New Zealand waters. A new species described in *Australeremus* has provided continuity to the heretofore disjunct distribution of this genus. Only one genus, *Pylopaguropsis*, was represented entirely by known species.

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The KARUBAR collection is also significant for its number of highly evolved genera. Specifically, development of the male sexual tube(s) is uncommonly prevalent. In the 19 genera included in the collection, males of 13 develop a sexual tube on one or both coxae of the fifth pereopods, or nearly two-thirds of the total genera.

All species are fully illustrated and detailed descriptions or diagnoses provided. Keys are provided for the regional genera and species, including those reported from the Maluku area, but not included in the KARUBAR collection.

RÉSUMÉ

Crustacea Decapoda : Pagures de la famille des Paguridae récoltés lors de la campagne KARUBAR en Indonésie.

La campagne franco-indonésienne KARUBAR faite aux Moluques, en 1991, dans la région des îles Kai, Aru et Tanimbar a révélé une richesse inattendue en bernard-l'ermite de la famille des Paguridae. Bien que 295 spécimens seulement de cette famille aient été récoltés à des profondeurs comprises entre 85 et 1024 mètres, ils forment un ensemble incroyable de 19 genres et 36 espèces, parmi lesquels sept genres et 26 espèces sont nouveaux. On y trouve les genres monotypiques *Alainopagurus* gen. nov., *Enneopagurus* gen. nov., *Enneophyllus* gen. nov., *Icelopagurus* gen. nov. et *Tarrasopagurus* gen. nov. et les espèces nouvelles qui leur correspondent. Le genre *Michelopagurus*, gen. nov., est établi pour "*Pagurodes*" *limatulus* Henderson, 1888, et une espèce nouvelle additionnelle, tandis que le genre *Pseudopagurus* est créé pour "*Pagurodes*" *piliferus* Henderson, 1888, la dernière des trois espèces assignées, à l'origine, au genre hétérogène *Pagurodes*. Un lectotype pour *Pagurodes inarmatus* Henderson, 1888, l'espèce type du genre *Pagurodes*, maintenant monotypique, est désigné. Le genre *Turleania* est proposé en remplacement de *Laurentia* McLaughlin & Haig, préemployé.

Parmi les nouveaux genres, trois sont particulièrement intéressants. Non seulement *Enneopagurus* et *Enneophyllus* sont les second et troisième genres de Paguridae à être caractérisés, en partie, par l'absence de branchies sur les troisièmes maxillipèdes, mais en outre, le dernier cité est unique, au moins pour le moment, son espèce type, *E. spinirostris*, étant le premier paguride connu à posséder une épine épistroale bien développée. *Alainopagurus* fait partie du groupe très spécialisé de genres se distinguant par une réduction marquée de l'abdomen, accompagnée par la perte totale des pléopodes mâles et la réduction en nombre des pléopodes femelles. Deux genres appartenant à ce groupe, *Solitariopagurus* et *Porcellanopagurus*, sont également représentés dans les récoltes de KARUBAR, chacun par une espèce nouvelle.

Des espèces nouvelles sont également décrites dans plusieurs autres genres peu communs, à savoir *Catapaguioides*, *Decaphyllus*, *Catapagurus* et *Tomopaguropsis*. Bien que *Pagurus* soit largement représenté dans les eaux froides, en particulier de l'hémisphère nord, la découverte de trois nouvelles espèces appartenant à ce genre dans la région restreinte prospectée par la campagne KARUBAR était inattendue. Une troisième espèce a été ajoutée au genre *Bathypaguropsis*, récemment décrit des eaux australiennes et néo-zélandaises. La description d'une nouvelle espèce dans le genre *Australeremus* permet de rendre cohérente la distribution de ce genre jusqu'à présent discontinue. Seul un genre, *Pylopaguropsis*, était représenté dans la collection par des espèces toutes connues.

La collection KARUBAR est également significative par le nombre de genres très évolués qu'elle renferme. En particulier, le développement des tubes sexuels mâles est anormalement prédominant. Parmi les 19 genres représentés dans la collection, 13, soit environ les deux tiers, ont des mâles avec un tube sexuel développé sur l'une ou les deux coxae des cinquièmes périopodes.

Toutes les espèces sont figurées et décrites en détail ou des diagnoses sont fournies. Des clés d'identification regroupant les genres ou les espèces récoltés lors de KARUBAR et ceux et celles déjà signalés de la région étudiée sont proposées.

INTRODUCTION

Prior to the 1991 French-Indonesian campaign, KARUBAR (named for the islands of Kai, Aru and Tanimbar), the regional marine hermit crab fauna of the Maluku (formerly Moluccas) region of Indonesia was known primarily from the expeditions of the "*Alert*" (MIERS, 1884), "*Challenger*" (HENDERSON, 1888), "*Siboga*" (DE SAINT LAURENT, 1968a, b; McLAUGHLIN & HAIG, 1996), "*Snellius*" (BUITENDIJK, 1937) and "*Alpha Helix*" (HUMES, 1981; FOREST, 1984; HAIG & BALL, 1988), and the shallow water collections of the Indonesian Institute of Sciences (RAHAYU & FOREST, 1993, 1995). Eight species were reported in the combined collections of the "*Alert*" and "*Challenger*" and one from the "*Snellius*". Five species from the "*Siboga*" collections were described by DE SAINT LAURENT (1968a, b); however, in subsequent publications FOREST and DE SAINT LAURENT (1968) and DE SAINT LAURENT (1970a, b) indicated that numerous species from that expedition remained to be described. McLAUGHLIN and HAIG (1996) have just recently described three of those. RAHAYU and FOREST (1993, 1995) reported on 14 species of the diogenid genus *Diogenes* and 20 species of *Clibanarius* from Indonesian waters, although not all were represented in the Maluku region. Isolated species reports have also come from several

sources, particularly those concerning associations with rhizocephalans, e.g., the "*Siboga*" (VAN KAMPEN & BOSCHMA, 1925; BOSCHMA, 1931b); MORTENSEN's Pacific Expedition (BOSCHMA, 1931a), and the Danish Expedition to the Kei Islands (VAN BAAL, 1937), as well as museum collections (DE MAN, 1881; LEWINSON, 1969); however, the most comprehensive report is that of HAIG and BALL (1988) from the "*Alpha Helix*" expedition. These authors documented the occurrence of 46 marine species (including four new and four left undescribed); however, most were collected at depths of 20 meters or less; seven genera of the Paguridae were represented.

It has long been postulated that the most diverse marine faunas are to be found in the tropical oceans, especially the Indo-West Pacific, but at depths generally less than 200 meters (e.g., EKMAN, 1953; BRIGGS, 1974). Within the Paguridea (sensu FOREST, 1987), most hermit crabs inhabiting these tropical environs were thought to belong to the family Diogenidae. The hermit crabs of the family Paguridae that were collected during the KARUBAR expedition consisted of 295 specimens, all coming exclusively from depths ranging from 85 to 1024 meters. The assemblage includes an astonishing 19 genera, of which seven are proposed herein, and 36 species, 29 of which are reported for the first time. More than 65 percent of the species covered by this report were collected from depths in excess of 200 meters, whereas only four species appeared restricted to more shallow depths.

Of the new genera, *Michelopagurus* gen. nov., with type species *Pagurodes limatulus* Henderson, 1888, has been erected for one of two species originally described in the heterogeneous genus *Pagurodes* Henderson, 1888, but subsequently restricted from that genus by designation of *P. inarmatus* Henderson, 1888, as the type species (DE SAINT LAURENT, 1969). Although the second species, *Pagurodes piliferus* Henderson, 1888, is not present in the KARUBAR collection, it is in the interest of stability in nomenclature that a new genus, *Pseudopagurodes* gen. nov., also be established for it.

The general terminology used in the species descriptions is that of McLAUGHLIN (1974), with exception of the fourth pereopods. A distinction is made herein between **subchelate** fourth pereopods, in which the pereopod is developed as a prehensile structure by the folding back of the dactyl against the propodus, and **semichelate** fourth pereopods, where the ventral margin of the propodus is produced beneath the dactyl to such an extent that flexion of the dactyl becomes much more akin to the action of a dactyl against a fixed finger of a chelate appendage. Terms pertaining to regions of the carapace follow those proposed by PILGRIM (1973) and MORGAN and FOREST (1991). Gill structure, i.e., trichobranchiate, intermediate, or phyllobranchiate follow the definitions provided by LEMAITRE (1989). The lists of specimens examined follow the station data provided by CROSNIER *et al.* (1997). The station abbreviations DW, CP, and CC refer to Warén dredge, beam trawl, and shrimp trawl respectively. Shield lengths (to the nearest 0.1 mm) of the specimens examined are indicated in parentheses, and measured from the tip or midpoint of the rostrum to the midpoint of the posterior margin of the shield. In keys provided for the Maluku regional taxa, those not encountered during the KARUBAR expedition are indicated by an asterisk (*). The majority of the specimens reported herein are shared between the Muséum national d'Histoire naturelle, Paris (MNHN) and the Puslitbang Oseanologi - LIPI, Jakarta (POLIPI). Supplemental materials of selected species are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM) and the Swedish Natural History Museum, Stockholm (SNHM). Comparative materials used in the study have come from the Muséum national d'Histoire naturelle (MNHN), Museums and Art Galleries of the Northern Territory, Darwin, Australia (MNT), National Museum of Natural History, (USNM), Natural History Museum, London (NHM), Natural History Museum and Institute, Chiba, Japan (CBM-ZC), Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (UMML), and the author's personal collection. Photographs were taken with a Nikon 35 mm camera and a professional camera 4 x 5 inches.

LIST OF GENERA AND SPECIES

Genus **ALAINOPAGUROIDES** gen. nov.

A. lemaitrei sp. nov.

Genus **ANAPAGRIDES** de Saint Laurent-Dechancé, 1966.

? *Anapagrides* sp.

- Genus **ANAPAGURUS** Henderson, 1886 (key).
- Genus **AUSTRALEREMUS** McLaughlin, 1981.
A. indonesiensis sp. nov.
A. triserratus (Ortmann, 1892).
- Genus **BATHYPAGUOPSIS** McLaughlin, 1994.
B. rahayuuae sp. nov.
- Genus **CATAPAGUROIDES** A. Milne Edwards & Bouvier, 1892.
C. cristimanus de Saint Laurent, 1968 (key).
C. declivis sp. nov.
C. inermis de Saint Laurent, 1968 (key).
C. karubar sp. nov.
C. melini de Saint Laurent, 1968 (key).
C. mortenseni de Saint Laurent, 1968 (key).
C. spinulimanus de Saint Laurent, 1968 (key).
- Genus **CATAPAGURUS** A. Milne Edwards, 1880.
C. ensifer Henderson, 1893 (key).
C. holthuisi sp. nov.
C. oculocrassus sp. nov.
Catapagurus sp. of HAIG & BALL, 1988 (key).
C. tanimbarensis sp. nov.
- Genus **DECAPHYLLUS** de Saint Laurent, 1968.
D. barunajaya sp. nov.
D. junquai de Saint Laurent, 1968 (key).
D. maci sp. nov.
D. similis de Saint Laurent, 1968 (key).
- Genus **ENNEOPAGURUS** gen. nov.
E. garciagomezi sp. nov.
- Genus **ENNEOPHYLLUS** gen. nov.
E. spinirostris sp. nov.
- Genus **ICELOPAGURUS** gen. nov.
I. crosnieri sp. nov.
- Genus **MICHELOPAGURUS** gen. nov.
M. chacei sp. nov.
M. limatulus (Henderson, 1888).
- Genus **MICROPAGURUS** McLaughlin, 1986 (key).
- Genus **NEMATOPAGURUS** A. Milne Edwards & Bouvier, 1892.
N. alcocki sp. nov.
N. australis (Henderson, 1888) (key).
N. cf. indicus Alcock, 1905.
N. ostlingochirus sp. nov.
N. scutelliformis sp. nov.
Nematopagurus sp.
N. spinulosensoris McLaughlin & Brock, 1974.
- Genus **PAGURODES** Henderson, 1888.
P. inarmatus Henderson, 1888 (photos).
- Genus **PAGURUS** Fabricius, 1775.
P. capsularis sp. nov.

- P. compressipes* (Miers, 1884) (key, photos).
P. haigae sp. nov.
P. hedleyi Grant & McCulloch, 1906 (key).
P. hirtimanus (Miers, 1880) (key).
P. kaiensis sp. nov.
P. moluccensis Haig & Ball, 1988 (key).
P. pergranulatus (Henderson, 1896) (key).
?Pagurus sp.
- Genus **PORCELLANOPAGURUS** Filhol, 1885.
P. jacquesi sp. nov.
- Genus **PSEUDOPAGURODES** gen. nov.
P. piliferus (Henderson, 1888) (photos).
- Genus **PYLOPAGUOPSIS** Alcock, 1905.
P. fimbriata McLaughlin & Haig, 1989 (key).
P. laevispinosa McLaughlin & Haig, 1989.
P. lewinsohni McLaughlin & Haig, 1989 (key).
P. zebra (Henderson, 1893).
- Genus **SOLITARIOPAGURUS** Türkay, 1986.
S. tuerkayi sp. nov.
- Genus **SPIROPAGURUS** Stimpson, 1858 (key).
- Genus **TARRASOPAGURUS** gen. nov.
T. rostrudenticulatus sp. nov.
- Genus **TOMOPAGUOPSIS** Alcock, 1905.
T. crinita sp. nov.
T. miyakei sp. nov.
- Genus **TURLEANIA** nom. nov.
T. albatrossae (McLaughlin & Haig, 1996) (key).
T. balli (McLaughlin & Haig, 1996) (key).
T. multispina sp. nov.
T. senticosa (McLaughlin & Haig, 1996).
T. sibogae (McLaughlin & Haig, 1996) (key).

SYSTEMATIC ACCOUNT

Family PAGURIDAE Latreille, 1803

Key to the genera of the Maluku Paguridae

1. Crista dentata of third maxilliped with accessory tooth 6
- Crista dentata of third maxilliped without accessory tooth 2
2. Rostrum strongly deflected downward over ocular lobes; with epi-rostral spine *Enneophyllus* gen. nov.
- Rostrum not strongly deflected downward over ocular lobes; without epi-rostral spine ... 3
3. Pleurobranch present above fourth pereopod; males with elongate left sexual tube; females with paired gonopores 4
- Pleurobranch absent above fourth pereopod; males with elongate right sexual tube; females with single left gonopore 5

4. Male sexual tube with terminal tuft of sparse setae; paired arthrobranches on third maxillipeds *Turleania* nom. nov.
- Male sexual tube with terminal fringe of dense stiff setae; no paired arthrobranches on third maxillipeds *Enneopagurus* gen. nov.
5. Males with 3 unpaired left pleopods; fourth pereopod semichelate *Catapaguroides*
- Males with 4 unpaired left pleopods; fourth pereopod simple, not semichelate *Decaphyllus*
6. Males with sexual tube developed on one or both coxae of fifth pereopods 7
- Males without sexual tube developed on one or both coxae of fifth pereopods 17
7. Abdomen well developed; males with 2 to 4 unpaired left pleopods 9
- Abdomen reduced; males without unpaired left pleopods 8
8. Pleurobranch present above fourth pereopod; lateral margins of shield rounded *Alainopaguroides* gen. nov.
- Pleurobranch absent above fourth pereopod; lateral margins of shield drawn out into spinose projections *Solitariopagurus*
9. Females with paired first pleopods modified as gonopods 10
- Females without paired first pleopods modified as gonopods 12
10. Chelipeds subequal; rostrum smoothly rounded; males with very short to very long sexual tube on coxa of right fifth pereopod; left sometimes also with very short sexual tube . 11
- Chelipeds markedly unequal; rostrum denticulate; males with moderately short sexual tube on coxa of left fifth pereopod, right sometimes also with short tube *Tarrasopagurus* gen. nov.
11. Males with elongate right sexual tube; ocular acicles very broadly separated; gills phyllobranchiate *Nematopagurus*
- Males with very short right sexual tube; ocular acicles separated by approximately basal width of 1 acicle; gills trichobranchiate *Michelopagurus* gen. nov.
12. Males with well developed right sexual tube 13
- Males with well developed left sexual tube 15
13. Right sexual tube elongate, curving up over dorsal surface of body from right to left; telson subtriangular *Catapagurus*
- Right sexual tube short, not curving up over dorsal surface of body; telson not subtriangular 14
14. Ocular acicles elongate; chelipeds subequal; fourth pereopods with prominent tubular preungual process at base of claw *Icelopagurus* gen. nov.
- Ocular acicles short; chelipeds markedly unequal; fourth pereopods without prominent preungual process *Anapagrides*
15. Telson with median cleft; ocular acicles simple 16
- Telson without median cleft; ocular acicles multifid *Micropagurus**
16. Chelipeds grossly unequal *Anapagurus**
- Chelipeds subequal *Spiropagurus**
17. Pleurobranches above second, third and fourth pereopods 20
- Pleurobranches above fourth pereopod only 18
18. Abdomen reduced; lateral margins of shield drawn out into strongly calcified projections; males without unpaired left pleopods *Porcellanopagurus*

- Abdomen not reduced; lateral margins of shield not drawn out into strongly calcified projections; males with some unpaired left pleopods 19
- 19. Females with first pleopods paired and modified as gonopods; right chela circumscribed by row of spines *Australeremus*
- Females without first pleopods paired and modified as gonopods; right chela not circumscribed by row of spines *Pagurus*
- 20. Chelipeds subequal *Tomopaguropsis*
- Chelipeds grossly unequal, right markedly larger than left 21
- 21. Females with first pleopods paired and modified as gonopods; males with 3 unpaired left pleopods *Pylopaguropsis*
- Females without first pleopods paired and modified as gonopods; males with four unpaired left pleopods *Bathypaguropsis*

Genus *ENNEOPHYLLUS* nov.

DIAGNOSIS. — Nine pairs of phyllobranchiate gills; arthrobranchs absent from third maxillipeds. Rostrum well developed, strongly depressed. Ocular acicles simple. Antennal peduncle with supernumerary segmentation not clearly evident. Third maxilliped with 1 spine on basis; ischium with crista dentata somewhat reduced, without accessory tooth (Fig. 1a). Sternite of third maxillipeds unarmed. Chelipeds unequal, right appreciably larger. Dactyls of ambulatory legs with spinose ventral margins. Sternite of third pereopods with small anterior lobe. Fourth pereopods semichelate, with single row of scales in propodal rasp. Fifth pereopods weakly semichelate. Sternite of fifth pereopods developed as single small lobe.

Coxa of left fifth pereopod in males with elongate, basally stout sexual tube directed exteriorly and curved dorsally across abdomen from left to right, with few terminal setae; right fifth coxa with gonopore, no apparent asexual tube; 3 unequally biramous unpaired left pleopods. Females not known.

Abdomen straight; uropods (Fig. 1k) only slightly asymmetrical. Telson with transverse suture very weakly indicated; terminal margins oblique.

TYPE SPECIES. — *Enneophyllus spinirostris* sp. nov. Gender masculine.

ETYMOLOGY. — From the Greek *ennea* meaning nine, and *phyllon* meaning leaf, and referring to the nine pairs of phyllobranchiate gills in this genus.

AFFINITIES. — *Enneophyllus* very closely resembles the other two genera of pagurids now recognized that have only nine pairs of gills, *Enneobranchus* García-Gómez, 1988, and *Enneopagurus* gen. nov. All three are characterized by the absence of an accessory tooth on the crista dentata of the third maxilliped, an elongate left male sexual tube, and a subtriangular telson that has the transverse suture faintly, if at all, indicated. However, the three genera differ fundamentally in gill structure: phyllobranchiate in *Enneophyllus*, intermediate in *Enneobranchus*, and trichobranchiate in *Enneopagurus*. Additional characters that distinguish the three taxa include: 1) the termination of the left sexual tube - apparently lacking any terminal setae in *Enneobranchus* (cf. GARCÍA-GÓMEZ, 1988), with a dense fringe of setae in *Enneopagurus*, but only a very few setae in *Enneophyllus*; 2) a distinctive preungual process at the base of the dactylar claw on the fourth pereopod in *Enneobranchus*, but lacking in both *Enneopagurus* and *Enneophyllus*; and 3) subequal chelipeds in both *Enneobranchus* and *Enneopagurus*, but conspicuously unequal in *Enneophyllus*.

REMARKS. — *Enneophyllus* at present is known only from a single representative of the type species, *E. spinirostris* sp. nov. For this reason, no attempt has been made at this time to determine the precise structure

of the mouthparts in this genus; however, a flagellum on the first maxilliped can be observed without dissection. The supernumerary segment of the antennal peduncle that is usually calcified and readily apparent is, in this specimen, represented only as a chitinous area between the third and fourth segments. A character that sets *Enneophyllus* apart, not only from *Enneobranchus* and *Enneopagurus*, but all other pagurids, is its remarkable rostral structure. The rostrum is exceptionally well developed, lobe-like, and bent downward over the ocular plate between the ocular acicles (Fig. 1b-c). At least in *E. spinirostris* a prominent epi-rostral spine is developed.

Enneophyllus spinirostris sp. nov.

Figs 1a-k, 33a-b

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (1.5 mm) (MNHN-Pg 5250).

TYPES. — The unique specimen is the holotype.

DESCRIPTION. — Shield (Fig. 1b) considerably longer than broad, but with lateral portions distinctly rounded; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced; posterior margin truncate; dorsal surface glabrous, but with small areas of decalcification anterolaterally. Rostrum strongly produced as rounded lobe, deflected downward over ocular lobes, and provided with extremely prominent epi-rostral spine (Fig. 1b-c). Lateral projections well developed, acutely triangular, with marginal or submarginal spine.

Ocular peduncles (including corneae) approximately 0.60 shield length; peduncles appearing somewhat laterally compressed; corneae slightly dilated. Ocular acicles moderately small, roundly triangular, with submarginal spine; separated basally by width of rostrum or equivalent to basal width of 1 acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles by 0.80 length of ultimate segment. Ultimate segment with 1 long seta dorsodistally. Penultimate segment with few short setae. Basal segment with statocyst region expanded laterally, with small spine on dorsolateral margin distally.

Antennal peduncles overreaching ocular peduncles by approximately half length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with small ventrodistal spinule. Second segment with dorsolateral distal angle produced, terminating in acute simple spine and with slightly smaller spine on mesial margin; dorsomesial distal angle with prominent acute spine. First segment with spine at dorsolateral distal angle; 1 small spine on ventrolateral margin distally. Antennal acicle reaching to proximal margin of fifth peduncular segment; straight, terminating in acute spine and with few very short setae. Antennal flagellum short, not reaching tip of dactyl of left cheliped, with 1 or 2 short (1 or 2 article length) setae on each article. Crista dentata with 7 relatively evenly-sized teeth (Fig. 1a).

Chelipeds unequal; right appreciably larger. Right cheliped (Fig. 1d) moderately elongate, chela (Fig. 33a) operculate; propodal-carpal articulation perpendicular. Dactyl 0.80 length of palm, broad; cutting edge with 2 distinct calcareous teeth; terminating in small calcareous claw; slightly overlapped by fixed finger; dorsal surface flattened, smooth, dorsomesial margin drawn out into subacute obliquely elevated unarmed ridge; mesial and ventral surfaces with few scattered setae. Palm approximately equaling length of carpus; dorsomesial margin rounded proximally, strongly elevated into prominent acute crest in distal half, with 1 spinule basally on distal margin; dorsal surface weakly convex on palm, but weakly concave on fixed finger, dorsolateral margin not delimited in proximal third of palm, but produced as obliquely elevated crest distally and extending length of fixed finger; mesial face of palm and ventral surfaces of palm and fixed finger with scattered setae; cutting edge of fixed finger with 2 prominent calcareous teeth, terminating in calcareous claw. Carpus slightly shorter than merus; dorsomesial distal angle with small subacute spine, dorsomesial margin with few low protuberances and long setae, all surfaces with sparse tufts of setae, most numerous and longest on mesial and ventral surfaces. Merus subtriangular; dorsodistal margin with small spine; dorsal surface with row of very small protuberances and few setae; ventromesial margin with prominent spine at distal angle and 1 smaller spine in distal third; ventrolateral margin with 1 spinule at distal angle. Ischium with row of minute spinules and few setae on ventromesial margin.

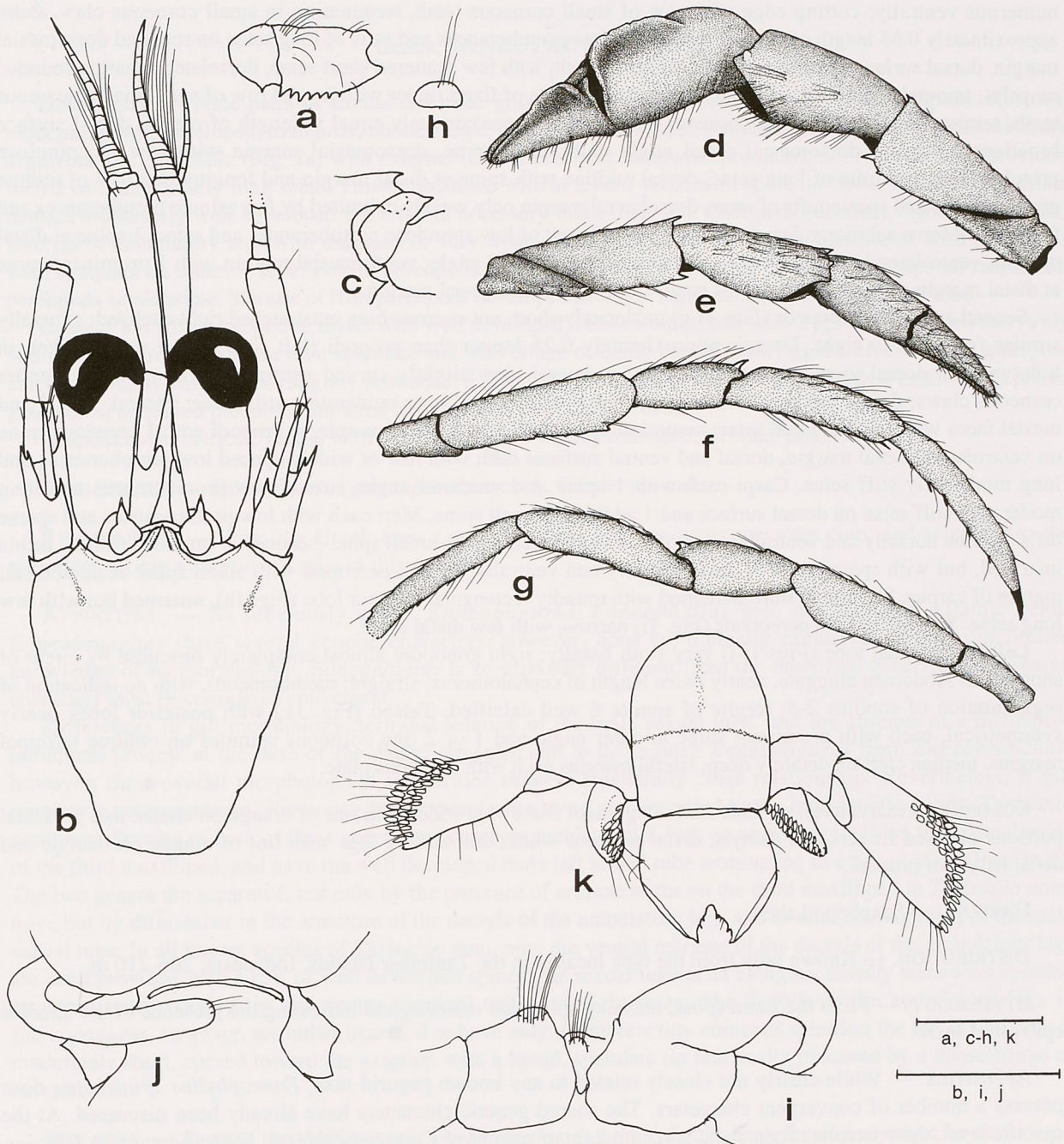


FIG. 1. — *Enneophyllus spinirostris* sp. nov., holotype ♂ (1.5 mm) from KARUBAR Stn DW 49: **a**, basis and ischium of left third maxilliped; **b**, shield and cephalic appendages; **c**, rostrum and right ocular acicle (lateral view); **d**, right cheliped (mesial view); **e**, left cheliped (mesial view); **f**, right second pereopod (lateral view); **g**, left third pereopod (lateral view); **h**, anterior lobe of sternite of third pereopods; **i**, coxae and sternite of fifth pereopods; **j**, left sexual tube (dorsal view); **k**, uropods and telson. Scales equal 0.5 mm (a, c, h, k) and 1.0 mm (b, d-g, i-j).

Left cheliped (Figs 1e, 33b) with propodal-carpal articulation nearly perpendicular; chela somewhat dorsoventrally flattened. Dactyl only slightly longer than palm, unarmed but with scattered setae, longer and more

numerous ventrally; cutting edge with row of small corneous teeth, terminating in small corneous claw. Palm approximately 0.65 length of carpus; row of few low protuberances and tufts of long setae on rounded dorsomesial margin, dorsal surface of palm and fixed finger smooth, with few scattered short setae, dorsolateral margin rounded on palm, minutely spinulose on fixed finger; cutting edge of fixed finger with jagged row of very small calcareous teeth, terminating in very small corneous claw. Carpus approximately equal to length of merus, dorsal surface broadened distally; dorsomesial distal angle with small spine, dorsomesial margin with row of spinulose protuberances and tufts of long setae, dorsal midline with spine at distal margin and longitudinal row of minute protuberances and sparse tufts of setae, dorsolateral margin only weakly delimited by few minute protuberances and few setae. Merus subtriangular; dorsal margin with row of low spinulose protuberances and setae, 1 spine at distal margin; ventrolateral margin with 1 very small spine at distal angle; ventromesial margin with 1 prominent spine at distal margin. Ischium with row of small spines on ventromesial margin.

Second and third pereopods (Figs 1f-g) moderately short, not overreaching outstretched right cheliped; generally similar from left to right. Dactyls approximately 0.25 longer than propodi (left second and third broken in holotype); in dorsal view, generally straight; in lateral view slightly curved ventrally; terminating in slender corneous claws; dorsal margins each with row of widely-spaced long moderately stiff setae; ventral, lateral and mesial faces with few scattered setae; ventral margins with 5 or 6 corneous spines. Propodi with 1 corneous spine on ventrolateral distal margin, dorsal and ventral surfaces each with row of widely-spaced low protuberances and long moderately stiff setae. Carpi each with 1 spine at dorsodistal angle, row of low protuberances and long moderately stiff setae on dorsal surface and 1 additional small spine. Meri each with low protuberances and sparse tufts of setae dorsally and ventrally; ventrodistal margins each with small spine (second) or unarmed (third). Ischia unarmed, but with sparse tufts of setae dorsally and ventrally. Fourth pereopod with small spine at dorsodistal margin of carpus. Sternite of third pereopod with roundly rectangular anterior lobe (Fig. 1h), unarmed but with few long setae. Sternite of fifth pereopods (Fig. 1i) narrow, with few distal setae.

Left male sexual tube (Figs 1i-j) very stout basally; right gonopore almost completely obscured by circle of short setae. Abdomen elongate, nearly twice length of cephalothorax, straight; membranous, with no indication of segmentation of somites 2-5; tergite of somite 6 well calcified. Telson (Fig. 1k) with posterior lobes nearly symmetrical, each with prominent spine at outer angle and 1 or 2 tiny corneous spinules on oblique terminal margins, median cleft moderately deep; lateral margins each with chitinous plate.

COLOR (in preservative). — Calcified integument somewhat iridescent; tint of orange on chelae and proximal portions of fixed fingers and dactyls, distal portions white; ambulatory legs with tint of orange on dactyls and distal halves of propodi.

HABITAT. — Scaphopod shell.

DISTRIBUTION. — Known only from the type locality in the Tanimbar Islands, Indonesia; 206-210 m.

ETYMOLOGY. — From the Latin *spina*, meaning spine and *rostrum*, and indicating the presence of the unusual epi-rostral spine.

AFFINITIES. — While clearly not closely related to any known pagurid taxa, *Enneophyllus spinirostris* does possess a number of convergent characters. The shared generic characters have already been discussed. At the specific level, the operculate right chela is reminiscent of species of *Catapaguroides* A. Milne Edwards & Bouvier, 1892 and *Pylopagurus* A. Milne Edwards & Bouvier, 1891. The use of a scaphopod microhabitat is also seen in some species of *Pylopagurus*, *Orthopagurus* Stevens, 1927, occasionally *Pagurus* species (cf. McLAUGHLIN & KONISHI, 1994), and the parapagurid genus *Tsunogaipagurus* Osawa, 1995. The left sexual tube curving over the abdomen is suggestive of species of *Catapagurus* A. Milne Edwards, 1880.

REMARKS. — The phylogenetic position of this extraordinary taxon cannot be even speculated upon until the morphology of the female is known, and until sufficient specimens become available to permit a more detailed study of the mouthparts and "skeletal" anatomy. Nonetheless, in having both reduced gill number and well developed sexual tube, it can be hypothesized that the rostral development reflects yet another apomorphic character.

Genus *ENNEOPAGURUS* nov.

DIAGNOSIS. — Nine pairs of trichobranchiate gills; arthrobranchs absent from third maxillipeds. Rostrum moderately well developed, triangular, not deflected. Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 2a) with external lobe of endopod somewhat produced, not recurved, but provided with 2 or 3 moderately long setae. Third maxilliped with at least 1 prominent spine on basis; ischium with crista dentata moderately well developed but without accessory tooth (Fig. 2b). Chelipeds subequal, right more robust. Dactyls of ambulatory legs with unarmed or very weakly spinulose ventral margins. Sternite of third pereopods with subquadrate anterior lobe. Fourth pereopods semichelate; with single row of scales in propodal rasp. Fifth pereopods semichelate. Sternite of fifth pereopods developed as single small subovate or subcircular lobe.

Coxa of left fifth pereopod in males with well developed, rather stout sexual tube (Figs 3a-b) directed exteriorly and upward, terminally somewhat spatulate and with fringe of dense curved setae; right fifth coxa with gonopore and occasionally vas deferens slightly protruded; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; no paired pleopods, unpaired left pleopods on somites 2 to 5.

Uropods asymmetrical. Telson with transverse suture weakly indicated; terminal margins oblique.

TYPE SPECIES. — *Enneopagurus garciagomezi* sp. nov. Gender masculine.

ETYMOLOGY. — From the Greek *ennea* meaning nine, and *pagouros* meaning crab, and referring to the presence on only nine pairs of gills in this genus.

AFFINITIES. — As previously noted, *Enneopagurus*, *Enneophyllus* gen. nov. and the Atlantic genus *Enneobranchus* share several generic characters, however, none are mutually exclusive. Despite our limited knowledge of its morphology, *Enneophyllus* is so markedly different from the other two genera that its shared characters must be considered convergent.

Differences in gill morphology, terminal setation of the male sexual tube, and the absence of a distinctive preungual process at the base of the dactyl are sufficient to distinguish *Enneopagurus* from *Enneobranchus*; however, their overall morphological similarities suggest a generally close relationship. Nevertheless, if gill number is not considered, *Enneopagurus* appears even more closely allied to the Indo-Pacific genus, *Turleania* nom. nov. Species of both of these genera have trichobranchiate gills, lack an accessory tooth on the crista dentata of the third maxilliped, and have the well developed male left sexual tube terminating in a tuft of setae (Figs 3a-d). The two genera are separated, not only by the presence of arthrobranchs on the third maxilliped in *Turleania* nom. nov., but by differences in the armature of the dactyls of the ambulatory legs and in setal development of the male sexual tube. In all known species of *Turleania* nom. nov. the ventral margins of the dactyls of the ambulatory legs are each provided with a row of well developed spines; the sexual tube is an elongate, usually somewhat spiraled structure with rounded tip and sparse terminal tuft of straight setae. The dactyls of the ambulatory legs in *Enneopagurus*, however, are either unarmed or have only a very few tiny corneous spinules; the left sexual tube is moderately short, curved toward the exterior, with a broad, spatulate tip practically obscured by a dense fringe of curved setae.

REMARKS. — Despite their differences, *Enneopagurus* and the Atlantic *Enneobranchus* might be considered analog genera, set apart from most other pagurid genera chiefly by the absence of gills on the third maxillipeds. Two additional characters shared by these genera, i.e., lack of an accessory tooth on the crista dentata, and left male sexual tube closely align them with a second analog pair of Indo-Pacific/Atlantic genera, *Turleania* nom. nov. and *Iridopagurus* de Saint Laurent-Dechancé, 1966a.

GARCÍA-GÓMEZ (1988) related *Enneobranchus* to *Anapagrises* de Saint Laurent-Dechancé, 1966b (sensu lato) and *Iridopagurus* de Saint Laurent-Dechancé, 1966a, noting that all three genera shared the diagnostic characters of 1) a long left sexual tube and, 2) absence of an accessory tooth on the crista dentata. He also believed that they all possessed "intermediate" type branchiae, defining his term "intermediate" by reference to LEMAITRE's subsequently published PhD dissertation (LEMAITRE, 1989, Fig. 2I-K). Recently MCLAUGHLIN and SANDBERG (1995) showed

that DE SAINT LAURENT-DECHANCÉ's (1966b) *Anapagrides*, as defined by its type species, *A. facetus* (Melin, 1939), did not correspond to the diagnosis given by its author, nor by DE SAINT LAURENT (1968b), and emended *Anapagrides* to reflect the characters of *A. facetus*. Subsequently, McLAUGHLIN and HAIG (1996) proposed the genus *Laurentia*, a name now found to be a junior homonym (see, p. 477) for DE SAINT LAURENT-DECHANCÉ's (1966b) taxon. GARCÍA-GÓMEZ's (1988) remarks now apply to *Turleania* nom. nov.

Enneopagurus, *Turleania* nom. nov., *Enneobranchus*, and *Iridopagurus* appear to form a very cohesive phylogenetic unit in being four of only five taxa presently known that have a left male sexual tube, but lack an accessory tooth on the crista dentata. Additionally, species of all four share, albeit not exclusively, elongate ambulatory dactyls, propodal rasps of the fourth pereopods which consist of a single row of scales, and generally subtriangular telsons. However, some interesting divergent pathways, both morphological and geographic, should be noted: 1) gills in species of *Turleania* nom. nov. are trichobranchiate, as are those of *Enneopagurus*; species of the Atlantic *Iridopagurus* and *Enneobranchus* have intermediate gills; 2) the external lobe of the endopod of the maxillule is well developed, but not recurved, in species of *Enneopagurus* and *Turleania* nom. nov., but obsolete in *Enneobranchus* (cf. GARCÍA-GÓMEZ, 1988) and *Iridopagurus* (cf. GARCÍA-GÓMEZ, 1983); 3) the rostrum is triangular and well developed in *Enneopagurus* and *Turleania* species, in contrast to the reduced and broadly rounded rostra of species of both Atlantic genera; 4) the transverse suture dividing the telson into anterior and posterior lobes is weakly indicated in the Indo-Pacific genera, but apparently absent in *Enneobranchus* and *Iridopagurus*. Although there is a suggested trend toward simplification in morphological structure from Indo-Pacific to Atlantic in these analog genera, all are still highly complex taxa about which we still have only fragmented knowledge.

Enneopagurus garciagomezi sp. nov.

Figs 2a-j, 3a-b, 33 c-f

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn CP 39, 07°47'S, 132°26'E, 466-477 m, 28.10.1991: 4 ♂, 1 ov. ♀ (2.4-3.1 mm) (POLIPI).

Tanimbar Islands: stn CP 56, 08°16'S, 131°59'E, 552-548 m, 31.10.1991: 3 ♂, 2 ♀, 1 ov. ♀ (2.4-3.3 mm) (USNM 276005). — Stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 2 ♂, 2 ♀ (2.7-3.3 mm) (SNHM 4808). — Stn CP 70, 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 1 ♂ (3.3 mm) (MNHN-Pg 5251). — Stn CP 71, 08°38'S, 131°44'E, 447-480 m, 2.11.1991: 11 ♂, 18 ♀, 6 ov. ♀ (1.8-3.6 mm) (MNHN-Pg 5252). — Stn CP 70, 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 7 ♂, 5 ♀ (2.2-3.3 mm) (MNHN-Pg 5253); 1 ♀ (2.8 mm) (POLIPI). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 7 ♂, 12 ♀, 1 ov. ♀ (2.3-3.6 mm) (MNHN-Pg 5254). — Stn CP 75, 08°46'S, 131°36'E, 452-451 m, 3.11.1991: 1 ♂, 3 ♀ (2.5-2.9 mm) (POLIPI). — Stn CP 77, 08°57'S, 131°27'E, 352-346 m, 3.11.1991: 6 ♀ (1.8-3.3 mm) (USNM 276020).

TYPES. — The male (3.3 mm, MNHN-Pg 5251) collected at the station 70 of KARUBAR cruise is the holotype. All the other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 2c) slightly broader than long or length approximately equal to width; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping or terraced; posterior margin truncate; dorsal surface with several tufts of setae. Rostrum triangular, well developed, reaching beyond bases of ocular acicles, terminating subacutely and with tiny spinule. Lateral projections well developed, acutely or obtusely triangular, with submarginal spine.

Ocular peduncles (including corneae) approximately 0.75 shield length; corneae strongly dilated. Ocular acicles narrowly triangular, with submarginal spine; separated basally by less than 0.50 to 0.75 basal width of 1 acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles by 0.75 to nearly entire length of ultimate segment. Ultimate segment with 5 to 8 long setae forming arc on dorsodistal margin and irregular row of long setae on dorsal surface. Penultimate segment with few short setae. Basal segment with statocyst region expanded laterally and dorsoventrally flattened, with small spine near dorsolateral margin in distal half.

Antennal peduncles overreaching ocular peduncles by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with scattered long setae. Third segment unarmed or with small ventrodistal spinule. Second segment with dorsolateral distal angle produced, terminating in acute simple or more frequently bifid spine; dorsomesial

distal angle with prominent acute spine. First segment with small spine at dorsolateral distal angle; 1 or 2 very small spines on ventrolateral margin distally. Antennal acicle frequently reaching to distal margin of cornea or beyond; terminating in acute spine and with long setae on mesial margin. Antennal flagellum long, overreaching outstretched chelipeds, with 1 to 3 long and sometimes 1 or 2 shorter setae every 1 to 3 articles, at least in proximal third. Crista dentata with 7 to 14 regularly or irregularly-sized teeth, decreasing in size distally.

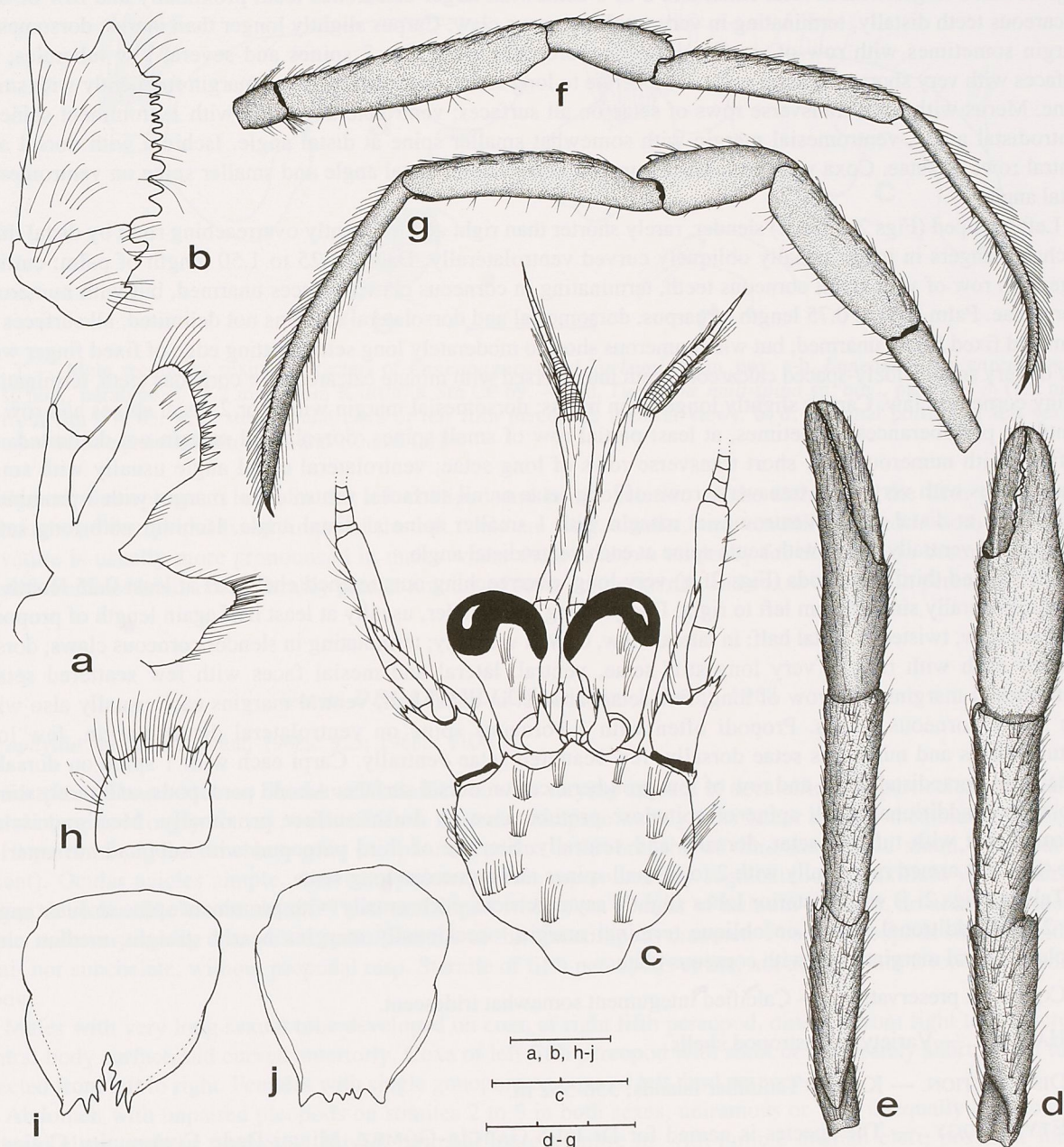


FIG. 2. — *Enneopagurus garciagomezi* sp. nov., a-b, paratype ♀ (3.6 mm) from KARUBAR Stn CP 69; c-i, holotype ♂ (3.3 mm) from Stn DW 70; j, paratype (2.9 mm) from Stn CP 39: a, left maxillule; b, basis and ischium of left third maxilliped; c, shield and cephalic appendages; d, right cheliped (dorsal view); e, left cheliped (dorsal view); f, right second pereopod (lateral view); g, left third pereopod (lateral view); h, anterior lobe of sternite of third pereopods; i-j, telson. Scales equal 0.5 mm (a-b, h-j), 2.0 mm (c), and 3.0 mm (d-g).

Chelipeds subequal; left frequently longer, but not as robust. Right cheliped (Figs 2d, 33c, e) elongate, quite slender. Dactyl slightly shorter to approximately as long as palm; cutting edge with blunt or sometimes denticulate calcareous margin and 2 or 3 more prominent calcareous teeth; terminating in very small corneous claw; dorsomesial margin not delimited; dorsal surface convex, elevated proximally into slender ridge, all surfaces unarmed but with numerous fine setae. Palm 0.60 to 0.80 length of carpus; dorsomesial and dorsolateral margins not delimited, dorsal surface convex, surfaces of palm and fixed finger unarmed, but with many fine setae; cutting edge of fixed finger with several small and 2 or 3 somewhat larger calcareous teeth proximally and row of tiny calcareous teeth distally, terminating in very small corneous claw. Carpus slightly longer than merus; dorsomesial margin sometimes with row of small spines, or more often only 1 to 3 spines and several low tubercles; all surfaces with very short transverse rows of moderate to long setae; ventrolateral distal margin frequently with small spine. Merus with short transverse rows of setae on all surfaces; ventrolateral margin with 1 prominent spine at ventrodistal angle, ventromesial margin with somewhat smaller spine at distal angle. Ischium with dorsal and ventral rows of setae. Coxa with prominent spine on ventrolateral distal angle and smaller spine on ventromesial distal angle.

Left cheliped (Figs 2e, 33d, f) slender, rarely shorter than right and frequently overreaching right by distal third of chela; fingers in males usually obliquely curved ventrolaterally. Dactyl 1.25 to 1.50 length of palm; cutting edge with row of very small corneous teeth, terminating in corneous claw; surfaces unarmed, but with numerous short setae. Palm 0.60 to 0.75 length of carpus, dorsomesial and dorsolateral margins not delimited, all surfaces of palm and fixed finger unarmed, but with numerous short to moderately long setae; cutting edge of fixed finger with row of very small widely-spaced calcareous teeth interspersed with minute calcareous or corneous teeth, terminating in tiny corneous claw. Carpus slightly longer than merus; dorsomesial margin with 1 or 2 distal spines and row of spinulose protuberances, sometimes, at least partial row of small spines, dorsolateral margin not delimited; all surfaces with numerous very short transverse rows of long setae; ventrolateral distal angle usually with small spine. Merus with very short transverse rows of long setae on all surfaces; ventrolateral margin with 1 prominent acute spine at distal angle; ventromesial margin with 1 smaller spine at distal angle. Ischium with long setae dorsally and ventrally. Coxa with acute spine at each ventrodistal angle.

Second and third pereopods (Figs 2f-g) very long, overreaching outstretched chelipeds at least 0.25 length of dactyls; generally similar from left to right. Dactyls long and slender, usually at least half again length of propodi; in dorsal view, twisted in distal half; in lateral view, curved ventrally; terminating in slender corneous claws; dorsal margins each with row of very long stiff setae, ventral, lateral and mesial faces with few scattered setae, ventromesial margins with row of long, fine setae, at least in distal half, ventral margins each usually also with 1 to 5 tiny corneous spines. Propodi often with 1 corneous spine on ventrolateral distal margin, few low protuberances and numerous setae dorsally; few scattered setae ventrally. Carpi each with 1 spine on dorsally adjacent to dorsodistal angle and row of low protuberances on dorsal surface; second pereopods, and rarely third, also with 1 additional small spine or spinulose protuberance on dorsal surface proximally. Meri and ischia unarmed, but with tufts of setae dorsally and ventrally. Sternite of third pereopod with subquadrate anterior lobe (Fig. 2h) armed marginally with 2 to 6 small spines and numerous long setae.

Telson (Figs 2i-j) with posterior lobes slightly asymmetrical, each usually with prominent spine at outer angle and 2 to 4 additional spines on oblique terminal margin, occasionally margins nearly straight, median cleft obsolete; lateral margins each with corneous plate.

COLOR (in preservative). — Calcified integument somewhat iridescent.

HABITAT. — Variety of gastropod shells.

DISTRIBUTION. — Kai and Tanimbar Islands; 356-552 m.

ETYMOLOGY. — The species is named for Dr Julio GARCÍA-GÓMEZ, Miami-Dade Community College, Miami, Florida, not only a friend and colleague, but the first carcinologist to document gill loss on the third maxillipeds in pagurids.

AFFINITIES. — Among KARUBAR species, *Enneopagurus garciagomezi* bears considerable resemblance to species of *Turleania* nom. nov. However, in addition to the characters separating the two genera, *E. garciagomezi*

is characterized by setose, but unarmed chelae, and ambulatory legs that have little or no armature on the ventral margins of the dactyls.

REMARKS. — The sexual tube in males of this species (Figs 3a-b) tends to be moderately short to moderately long, thick, curved outwardly and directed dorsally; the tip is spatulate and provided with a dense fringe of curved setae. Males obviously infected with rhizocephalans still exhibit a well developed sexual tube.

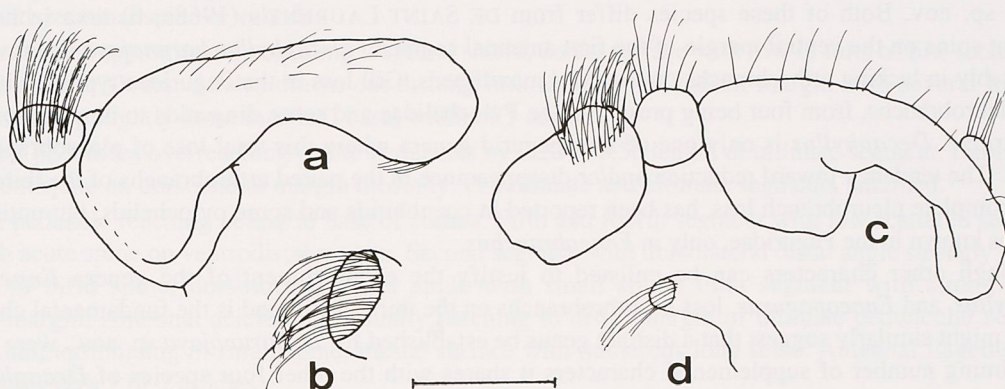


FIG. 3. — Male secondary sexual characters of *Enneopagurus* and *Turleania* nom. nov. a-b, *Enneopagurus garciagomezi* sp. nov., paratype ♂ (3.2 mm) from KARUBAR Stn CP 69. — c-d, *Turleania multispina* sp. nov., paratype ♂ (1.9 mm) from Stn DW 03: a, c, sternite and coxa of left fifth pereopods (ventral view); b, d, terminal portion of left sexual tube. Scale equals 0.5 mm (c, d) and 1.0 mm (a, b).

Sexual dimorphism is seen in the left cheliped and in the setation of the sternite of the fifth pereopods. Although the dactyl and fixed finger of the left chela are long, slender, and ventrally curved in both sexes, the curvature is usually more pronounced in males where there is also a tendency for the chela to become laterally twisted. Females have a considerably greater amount of setae on the sternite and coxae of the fifth pereopods.

Genus *DECAPHYLLUS* de Saint Laurent, 1968

Decaphyllus de Saint Laurent, 1968a: 925; 1968b: 1100.

EMENDED DIAGNOSIS. — Shield well calcified or with varying amount of decalcification particularly medially, lateral margins strongly convex, well calcified. Posterior carapace weakly calcified or entirely membraneous. Eight to 10 pairs of phyllobranchiate gills (no pleurobranchs; arthrobranchs of third maxilliped small, vestigial or absent). Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule with external endopodal lobe obsolete or absent. Third maxilliped with crista dentata of ischium reduced, no accessory tooth; merus with very strong dorsodistal spine. Sternite of third maxillipeds unarmed. Fourth pereopods simple, neither semi- nor subchelate; without propodal rasp. Sternite of fifth pereopods entire, not divided into 2 lobes by median groove.

Males with very long sexual tube developed on coxa of right fifth pereopod, directed from right to left across ventral body surface and curved anteriorly. Coxa of left fifth pereopod with short or moderately short sexual tube directed from left to right. Females with single gonopore on coxa of left third pereopod.

Abdomen with unpaired pleopods on somites 2 to 5 in both sexes, uniramous or very unequally biramous in males. Telson without transverse suture; terminal margin entire or with minute median cleft; posterior lobes strongly asymmetrical, each with 2 to 4 spines.

REMARKS. — In her revision of the genera *Catapaguroides* A. Milne Edwards & Bouvier, 1892 and *Cestopagurus* Bouvier, 1897, DE SAINT LAURENT (1968a) established the genus *Decaphyllus* for three previously unknown species. In that publication, DE SAINT LAURENT presented only a brief generic diagnosis and a slightly

more detailed diagnosis of its type species, *D. spinicornis* de Saint Laurent. In a subsequent paper she (DE SAINT LAURENT, 1968b) provided a detailed description of the general characters of *Decaphyllus*, gave full descriptions of the three species, *D. spinicornis*, *D. similis* de Saint Laurent and *D. junquai* de Saint Laurent, and compared this rather distinctive genus with its closest cohort, *Catapaguroides*. *Decaphyllus spinicornis* is known only from Japan, whereas *D. similis* and *D. junquai* are reported from New Guinea and Indonesia.

Two additional species have been discovered during the course of this study, *D. barunajaya* sp. nov. and *D. maci* sp. nov. Both of these species differ from DE SAINT LAURENT's (1968a, b) taxa in having a very prominent spine on the ventral margin of the first antennal segment. *Decaphyllus barunajaya* sp. nov. also differs more notably in lacking arthrobranchs on the third maxillipeds. Gill loss in the Paguridea typically is manifest by loss of pleurobranchs, from four being present in the Pylochelidae and some diogenids to none in some genera of the Paguridae. *Decaphyllus* is only one of four pagurid genera where this total loss of pleurobranchs has been observed. The tendency toward reduction and/or disappearance in the paired arthrobranchs of the third maxilliped, without complete pleurobranch loss, has been reported in coenobitids and some pylochelids, but until this present report was known in the Paguridae, only in *Enneobranchus*.

Although other characters can be enlisted to justify the establishment of the genera *Enneobranchus*, *Enneophyllus*, and *Enneopagurus*, loss of arthrobranchs on the third maxilliped is the fundamental character. That rationale might similarly suggest that a distinct genus be established for *D. barunajaya* sp. nov., were it not for the overwhelming number of supplemental characters it shares with the other four species of *Decaphyllus*. These include the broadly rounded rostrum; characteristic shape of the ocular acicles; lower ramus of antennular flagellum with only three segments; distinctive profile of the coxal endite of the maxillule; reduced and irregular dentition of the crista dentata; absence of an accessory tooth on the crista dentata; loss of the pleurobranch above the fourth pereopod; uniform armature of the dorsal margins of the carpi of the second pereopods; very specialized development of the dactyl and propodus of the fourth pereopod; length and orientation of both the right and left sexual tubes; male pleopod development; single female left gonopore; and unusual telson shape and armature. In view of all these shared characters, clearly a simple emendation of *Decaphyllus* to accommodate *D. barunajaya* is the appropriate action.

Key to the Indonesian species of *Decaphyllus*

1. Gill lamellae of third maxillipeds vestigial or absent; dactyl of right cheliped unarmed *D. barunajaya* sp. nov.
- Gill lamellae of third maxillipeds normally developed; dactyl of right cheliped armed at least with few spinules 2
2. Dactyl of right cheliped with numerous spines or spinules on dorsal surface; telson with nearly symmetrical posterior lobes, each with 2 small spines *D. similis**
- Dactyl of right cheliped with only 1 or 2 spines or spinules on dorsal surface; telson with asymmetrical posterior lobes, terminal margins each with 2 to 4 spines 3
3. Palm of right cheliped with prominent median longitudinal row of spines on dorsal surface; telson with 3 or 4 spines on each terminal margin *Decaphyllus maci* sp. nov.
- Palm of right cheliped without prominent median longitudinal row of spines on dorsal surface; telson with 2 spines on each terminal margin *Decaphyllus junquai**

Decaphyllus barunajaya sp. nov.

Figs 4a-l

MATERIAL EXAMINED. — **Indonesia.** KARUBAR. *Kai Islands*: stn DW 31, 05°40'S, 132°51'E, 288-289 m, 26. 10. 1991: 1 ♂ (1.8 mm) (MNHN-Pg 5255).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29. 10. 1991: 1 ov. ♀ (1.9 mm) (MNHN-Pg 5256).

TYPES. — The ovigerous female (MNHN-Pg 5256) from the KARUBAR station DW 50 is the holotype. The other specimen is a paratype.

DESCRIPTION. — Shield (Fig. 4a) longer than broad; anterior margin between rostral region and lateral projections very weakly concave; anterolateral margins sloping; posterior margin roundly truncate; surface with median regions poorly calcified. Rostrum very broadly rounded or nearly obsolete. Lateral projections well developed, with terminal spine or spinule.

Ocular peduncles approximately equaling length of shield, dorsal surface with row of tufts of fine setae; corneae very slightly dilated. Ocular acicles drawn out distally into acute spine, mesial margin with several long setae; separated basally by slightly more than half basal width of 1 acicle.

Antennular peduncles overreaching ocular peduncles by 0.20 to 0.50 length of ultimate segment. Basal segment with prominent spine on dorsolateral margin medially. Penultimate and ultimate segments unarmed.

Antennal peduncle reaching nearly to base of cornea. Fifth and fourth segment with few scattered setae. Third segment with acute spine on ventrodistal margin. Second segment with dorsolateral distal angle strongly produced, terminating in bifid spine, dorsomesial distal angle with small spine. First segment with strong spine on ventrodistal margin. Antennal acicle long, usually reaching to distal margin of ultimate peduncular segment or slightly beyond; terminating in small spine; mesial surface with numerous long setae. Antennal flagellum with 2 to 4 short setae every 1 or 2 articles.

Crista dentata of third maxilliped with 5 or 6 irregularly-spaced and sized teeth; merus with very strong spine on dorsodistal angle. Arthrobranchs of third maxillipeds vestigial or absent.

Chelipeds subequal in length, right only slightly longer, but appreciably stronger. Right cheliped (Fig. 4b) with dactyl set at slightly oblique angle to palm; cutting edges of dactyl and fixed finger each with row of small calcareous teeth. Dactyl slightly shorter than palm; unarmed, but with moderately dense long setae dorsally and ventrally. Palm slightly shorter than carpus; dorsomesial margin with row of small spines not reaching to distal margin, dorsal midline with row of small spines not extending onto fixed finger, dorsolateral margin row of small spines and dorsal surface laterad of midline with numerous small spines, lateral face with faint transverse striations, some minutely spinulose and long setae; fixed finger unarmed but with moderately dense long setae particularly dorsally and ventrally. Carpus slightly longer than merus; dorsomesial margin with row of spines, smallest proximally and distally, dorsolateral surface with row of small spines, surfaces all with long setae. Merus with 1 acute spine on dorsodistal margin laterally; dorsal surface with transverse rows of long setae; ventromesial and ventrolateral margins each with small spine distally, partially obscured by long setae, ventrolateral margin with additional small spine in proximal half. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and long setae on ventral margin.

Left cheliped (Figs 4c-d) with longitudinal hiatus between dactyl and fixed finger; cutting edges each with row of small calcareous teeth. Dactyl slightly to considerably longer than palm, unarmed but with long setae particularly mesially and ventrally. Palm 0.50 to 0.70 length of carpus; dorsal surface with 2 rows of small spines, dorsolateral margin with irregular single or double row of small spines, not extending on to fixed finger; latter unarmed but with long moderately dense setae particularly laterally and ventrally; surfaces of palm also with scattered long setae. Carpus with row of 4 to 6 spines on dorsomesial margin and 2 to 4 spines on dorsolateral margin; all surfaces with scattered setae. Merus with transverse rows of setae on dorsal surface, 1 prominent spine on dorsodistal margin mesially; ventrolateral margin with 2 rather widely-spaced spines, ventromesial margin with 3 spines; ventral surface with scattered long setae. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and scattered setae.

Ambulatory legs (Figs 4e-f) overreaching tip of right cheliped. Dactyls 1.50 to nearly twice length of propodi; slightly curved ventrally; all surfaces unarmed, but with numerous setae, particularly longer and stronger on dorsal margins. Propodi slightly longer than carpi, unarmed but with numerous moderately long setae, particularly dorsally and ventrally. Carpi each with dorsodistal spine and 2 (second) or 1 (third) additional spines on dorsal margin in proximal half. Meri each with 1 spine in proximal half of dorsal margin, also usually 1 spine proximally in distal half, at least on second pereopods; ventral margins with numerous setae. Ischia unarmed but with numerous long setae. Fourth pereopods with claw of dactyl (Figs 4g-h) almost entirely masked by tufts of

dense, pectinate setae. Fifth pereopods semichelate. Anterior lobe of sternite (Fig. 4i) of third pereopods subsemicircular, with long marginal setae.

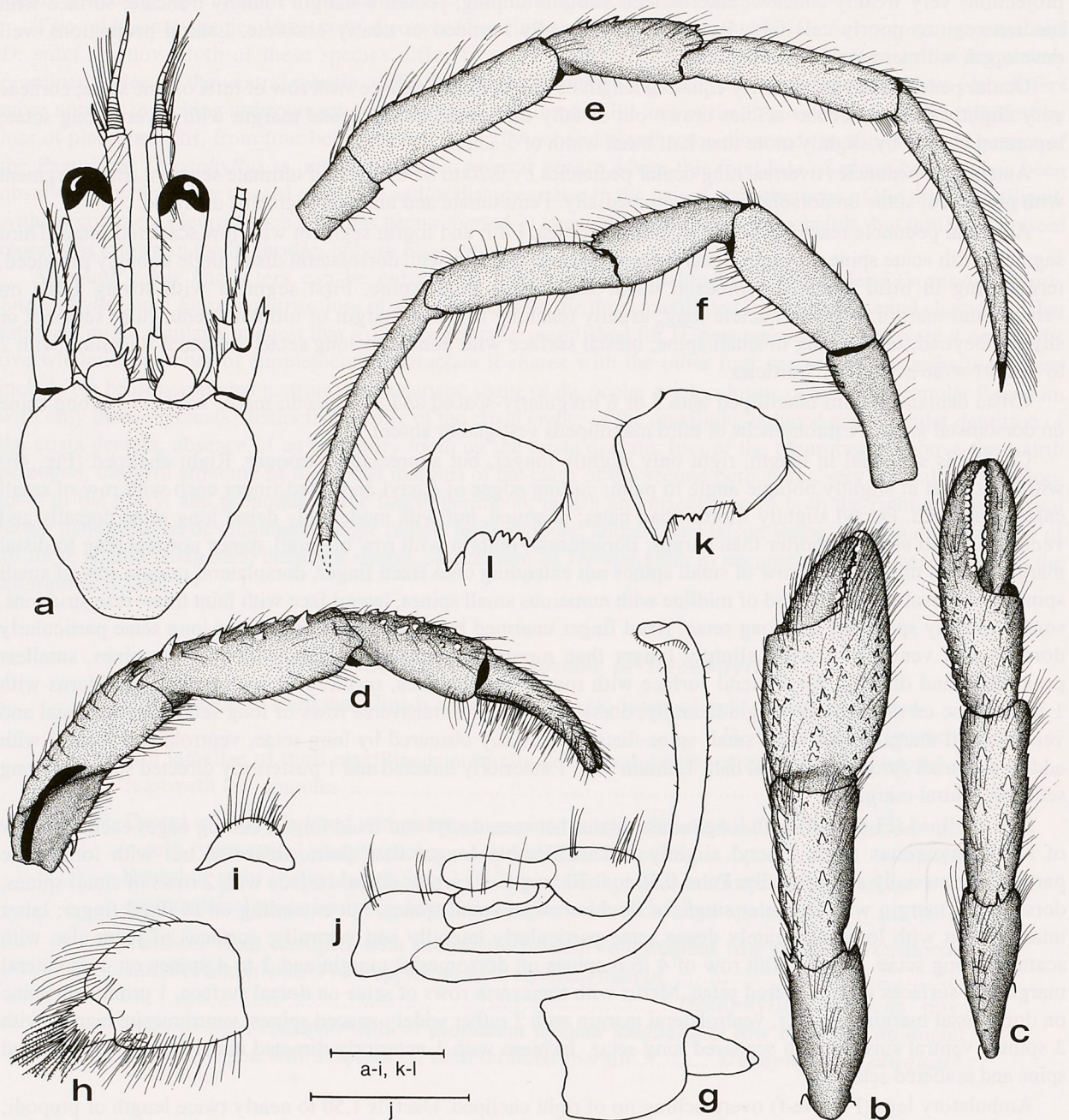


FIG. 4. — *Decaphyllus barunajaya* sp. nov., a-c, e-i, k, holotype ♀ (1.9 mm), from KARUBAR Stn DW 50; d, j, l, paratype ♂ (1.8 mm) from Stn DW 31: a, shield and cephalic appendages; b, right cheliped (dorsal view); c, left cheliped (dorsal view); d, left cheliped (mesial view); e, right second pereopod (lateral view); f, left third pereopod (lateral view); g, dactyl and propodus of right fourth pereopod (lateral view; setae omitted); h, dactyl and propodus of left fourth pereopod (lateral view); i, anterior lobe of sternite of third pereopods; j, coxae and sternite of fifth pereopods; k-l, telson. Scales equal 0.5 mm (g, h, i, k, l) and 1.0 mm (a-f, j).

Male with unequally biramous pleopod on abdominal somite 2, pleopods 3 to 5 uniramous. Right sexual tube (Fig. 4j) reaching to level of coxa of left third pereopod; left sexual tube reaching to base of coxa of right fifth.

Telson (Figs 4k-l) with median cleft not apparent; terminal margin with prominently produced left exterior angle separated by irregularly-spaced series of 3 or 4 spines from weakly developed right exterior angle; lateral margins each with narrow chitinous plate.

COLOR (in preservative). — Shield and cephalic appendages with faint orange hue. Chelipeds and ambulatory legs mottled orange with white distally on most segments. Calcified integument somewhat iridescent.

HABITAT. — Unknown.

DISTRIBUTION. — Tanimbar and Kai Islands, Indonesia; 184 to 289 m.

ETYMOLOGY. — The species is named for the vessel "*Baruna Jaya I*", from which the specimens were collected.

AFFINITIES. — *Decaphyllus barunajaya* differs from the other species of the genus in the absence of arthrobranchs on the third maxillipeds, in having an unarmed dactyl of the right cheliped, two proximal spines on the dorsal surfaces of the carpi of the second pereopods, and shorter right sexual tube. The slightly dilated corneae, unarmed ventral margin of the carpus of the right cheliped, and distinctly different telson armature are additional characters that set *D. barunajaya* apart from *D. spinicornis*. Among Indonesian species, it resembles *D. similis* in having moderately long ocular peduncles with slightly dilated corneae, but differs in having shorter antennular peduncles, a bifid dorsolateral distal angle of the second antennal segment, and two rows of spines on the carpus of the left cheliped. *Decaphyllus barunajaya* is also readily distinguished from *D. junquai* by its longer ocular, but shorter antennular peduncles and armature of the right cheliped. Additional characters that serve to distinguish *Decaphyllus barunajaya* from *D. maci* sp. nov. include the anterior lobe of the sternite of the third pereopods, which is subsemicircular in the former species, but subtriangular in the latter. The carpus of the left cheliped has only two to four spines on the dorsolateral margin in *D. barunajaya*, but five or six in *D. maci*, and the left chela exhibits a pronounced hiatus between the dactyl and fixed finger in the former species that is lacking in the latter.

Decaphyllus maci sp. nov.

Figs 5a-i

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 118-111 m, 26.10.1991: 1 ♂ (1.8 mm) (MNHN-Pg 5257), 1 ov. ♀ (1.8 mm) (MNHN-Pg 5258).

TYPES. — The ovigerous female (MNHN-Pg 5258) from KARUBAR station DW 30 is the holotype. The male is a paratype.

DESCRIPTION. — Shield (Fig. 5a) longer than broad; anterior margin between rostral region and lateral projections very weakly concave; anterolateral margins sloping; posterior margin roundly truncate; surface with median regions poorly calcified proximally and distally. Rostrum very broadly rounded or nearly obsolete. Lateral projections well developed, with terminal spine.

Ocular peduncles approximately equaling length of shield, dorsal surface with row of tufts of long setae; corneae not dilated. Ocular acicles each drawn out distally into long, acute spine, mesial margin with several long setae; separated basally by approximately 0.75 basal width of an acicle.

Antennular peduncles overreaching ocular peduncles by 0.50 to 0.80 length of ultimate segment. Basal segment with prominent spine on dorsolateral margin medially. Penultimate and ultimate segments unarmed.

Antennal peduncle reaching to distal half of ocular peduncle but not to base of cornea. Fifth and fourth segment with few scattered setae. Third segment with acute spine on ventrodistal margin. Second segment with dorsolateral distal angle strongly produced, terminating in unequally bifid spine; dorsomesial distal angle with prominent spine. First segment with strong spine on ventrodistal margin. Antennal acicle longer than peduncle, usually reaching to

base of cornea; terminating in small spine; mesial surface with numerous long setae. Antennal flagellum with 2 to 4 short and 1 or 2 somewhat longer setae every 1 or 2 articles.

Crista dentata of ischium of third maxilliped with 3 to 5 irregularly-spaced and sized teeth; merus with very strong spine on dorsodistal angle. Arthrobranchs of third maxillipeds normally developed.

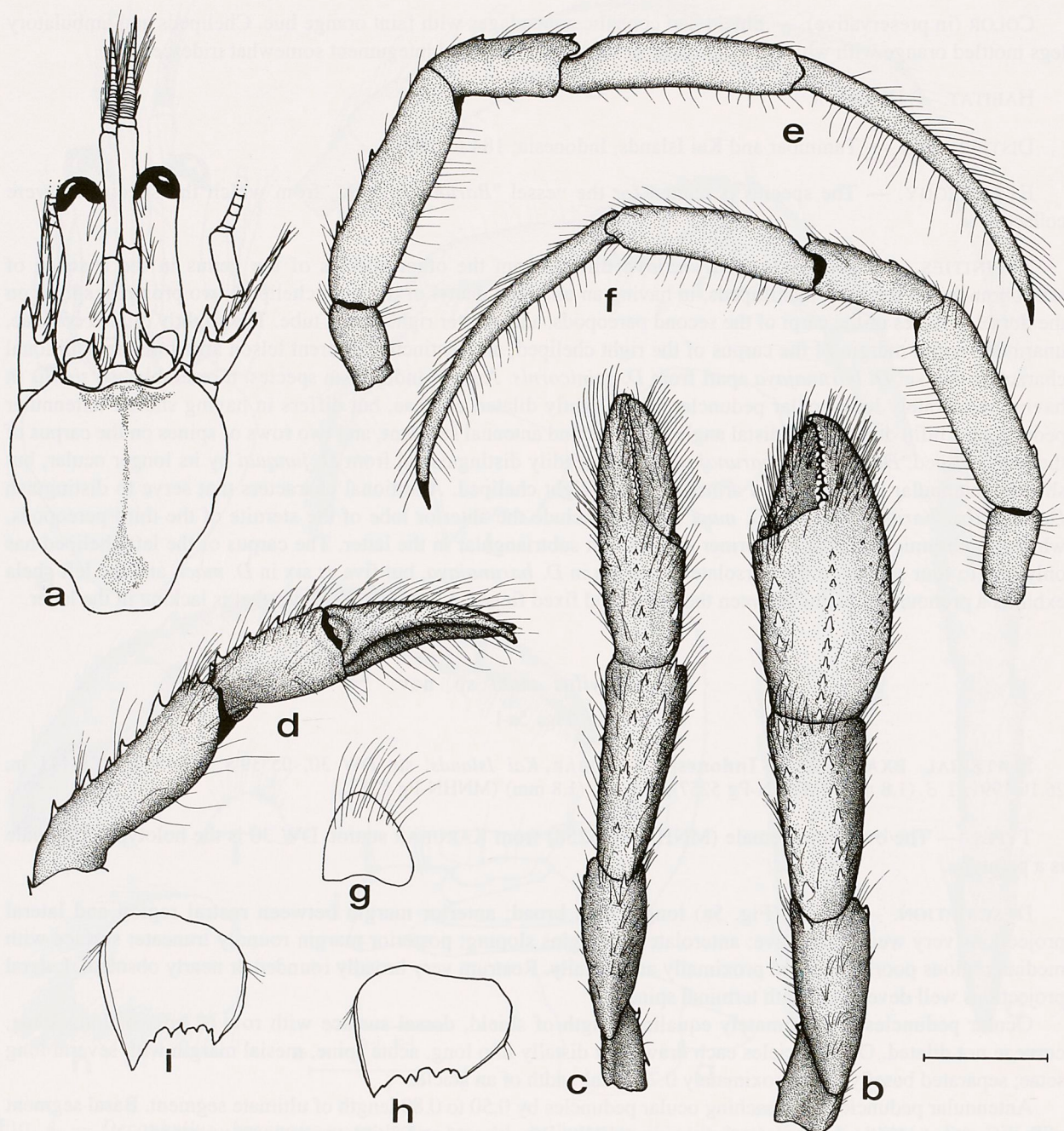


FIG. 5. — *Decaphyllus maci* sp. nov., a-c, e-h, holotype ♀ (1.8 mm) from KARUBAR Stn DW 30; d, i, paratype ♂ (1.8 mm) from Stn DW 30: a, shield and cephalic appendages; b, right cheliped (dorsal view); c, left cheliped (dorsal view); d, left cheliped (mesial view); e, right second pereopod (lateral view); f, left third pereopod (lateral view); g, anterior lobe of sternite of third pereopods; h-i, telson. Scale equals 0.5 mm (g-i) and 1.0 mm (a-f).

Chelipeds subequal in length, right only slightly longer, but appreciably stronger. Right cheliped (Fig. 5b) with dactyl generally straight; cutting edges of dactyl and fixed finger each with row of small calcareous teeth. Dactyl approximately 0.80 length of palm; with 1 spine on dorsal surface proximally and relatively dense long setae, particularly laterally and ventrally. Palm approximately equal to length of carpus; dorsomesial margin with row of spines not reaching to distal angle, dorsal midline with row of small spines not extending full length of palm, dorsolateral margin with row of moderately widely-spaced small spines, few additional spinules on dorsal surface laterad of midline; lateral and mesial faces with scattered long setae; fixed finger unarmed but with relatively dense long setae particularly laterally and ventrally. Carpus slightly longer than merus; dorsomesial margin with row of moderately small spines, largest proximally, dorsolateral margin with row of slightly larger spines; surfaces all with scattered long setae. Merus with 1 acute spine on dorsodistal margin laterally; dorsal surface with transverse rows of long setae; ventromesial and ventrolateral margins each with small distal and proximal spine and scattered long setae, ventral surface with median spinule. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and long setae on ventromesial margin, ventrolateral distal angle with minute spinule.

Left cheliped (Figs 5c-d) without longitudinal hiatus between dactyl and fixed finger but tips crossing; cutting edge of dactyl with row of sharp spine-like teeth, cutting edge of fixed finger with row of small, blunt calcareous teeth. Dactyl approximately equal to length of palm, unarmed but with long setae particularly mesially and ventrally. Palm 0.60 to 0.80 length of palm; dorsal surface with row of small spines in midline not extending onto fixed finger and 1 or 2 small spines dorsolaterally, dorsolateral margin with row of small spines, extending only slightly, if at all, onto fixed finger; dorsomesial margin with 2 or 3 acute spines; fixed finger unarmed but with long moderately dense setae particularly laterally and ventrally; surfaces of palm also with scattered long setae. Carpus with row of 4 or 5 spines on dorsomesial margin and 5 or 6 spines on dorsolateral margin; ventrolateral distal angle with small acute spine; all surfaces with scattered setae. Merus with transverse rows of setae on dorsal surface, 1 acute spine on dorsodistal margin; ventrolateral margin with 2 or 3 rather widely-spaced spines, ventromesial margin with 3 spines, ventral surface with 1 or 2 acute spines and scattered long setae. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and scattered setae on ventromesial margin.

Ambulatory legs (Figs 5e-f) overreaching tip of right cheliped. Dactyls 1.50 to nearly twice length of propodi; slightly curved ventrally; all surfaces unarmed but with numerous setae, particularly longer and stronger on dorsal margins. Propodi 0.25 to 0.40 longer than carpi, unarmed but with numerous moderately long setae, particularly dorsally and ventrally. Carpi each with dorsodistal spine and 1 additional spine on dorsal margin in proximal half. Meri each with 1 spine on dorsal surface at mid-length and 1 additional spine in proximal half; ventral margins with numerous setae. Ischia unarmed but with numerous long setae. Fourth pereopods with claw of dactyl almost entirely masked by tufts of dense, pectinate setae. Fifth pereopods semichelate. Anterior lobe of sternite (Fig. 5g) of third pereopods bluntly subtriangular, with long submarginal setae.

Male with uniramous pleopods on abdominal somites 2, 4 and 5, pleopod of somite 3 unequally biramous. Right sexual tube reaching to level of coxa of left cheliped; left sexual tube not quite reaching to base of coxa of right fifth.

Telson (Figs 5h-i) sometimes with very small median cleft; terminal margin with prominently produced left exterior angle separated by irregularly-spaced series of 5 or 6 spines from more weakly developed right exterior angle; lateral margins each with narrow chitinous plate.

COLOR (in preservative). — Shield and cephalic appendages with faint orange hue. Chelipeds and ambulatory legs also with faint orange hue, appearing as indistinct bands on most segments. Calcified integument somewhat iridescent.

HABITAT. — Unknown.

DISTRIBUTION. — Kai Islands, Indonesia; 111-118 m.

ETYMOLOGY. — This species is named for the late E.J. "Mac" McGEORGE, whose photographs have enhanced many pagurid reports.

AFFINITIES. — As previously indicated, all known species of *Decaphyllus* share a considerable number of morphological characters. In proportions and armature of the cephalic appendages, and armature of the right

cheliped, *D. maci* most closely resembles *D. spinicornis*. Both species have relatively long ocular peduncles with corneae showing no dilation; bifid termination of the dorsolateral distal angles of the second segments of the antennal peduncles; and antennular peduncles that overreach the ocular peduncles by 0.50 to 0.80 length of the ultimate segment. Similarly, the right chelipeds of both species have a single small spine on the dorsoproximal surface of the dactyl and both dorsomesial and median longitudinal rows of spines. However, *D. maci* also has a row of small spines on the clearly delimited dorsolateral margin, whereas *D. spinicornis* is described as having the dorsolateral margin only weakly delimited and with few scattered spinules. Although both species also have two rows of spines on the dorsal surface of the carpus, the ventrolateral margin is armed with a few spines in *D. spinicornis*, but unarmed in *D. maci*. Differences are also found in the development of the telson. In *D. maci* a small median cleft is sometimes apparent, but even when obscured, there is a distinct separation of right and left lobes, each terminal margin armed with two or occasionally three small spines in addition to the spine of the external angle. By contrast, *D. spinicornis* has only two spines on the terminal margin between the spinose external angles.

From the remaining species of *Decaphyllus*, all occurring in Indonesian waters, *D. maci* is best distinguished from *D. similis* by its shorter antennular peduncles, dactyl of the right cheliped having only a single spine on the dorsal surface, and by having two rows of spines on the dorsal surface of the carpus of the left cheliped. From *D. junquai*, this new species is also readily separated by the relative shortness of its antennular peduncles, less strongly armed right chela, and more strongly armed telson. Like *D. spinicornis*, the telsons of both *D. similis* and *D. junquai* have only two spines on the terminal margin between the spinose external angles. *Decaphyllus maci* bears a superficial resemblance to *D. barunajaya* sp. nov. in having relatively long ocular and short antennular peduncles; bifid termination of the dorsolateral distal angles of the second segments of the antennal peduncles; strong spine on the ventrodiscal margin of the first segment of the antennal peduncle; and weak median calcification of the shield. However, the two species are easily distinguished by the armature of the chelipeds and the carpi of the second pereopods.

Genus *CATAPAGUROIDES* A. Milne Edwards & Bouvier, 1892

Catapaguroides A. Milne Edwards & Bouvier, 1892: 211 (in part). — BOUVIER, 1922: 26 (in part). — DE SAINT LAURENT, 1968a: 927.

DIAGNOSIS. — Ten pairs of phyllobranchiate gills (no pleurobranch above arthrobranchs of fourth pereopod). Antennal peduncle with supernumerary segmentation. Ischium of third maxilliped with crista dentata more or less reduced, without accessory tooth. Chelipeds unequal, right appreciably stronger. Carpi of ambulatory legs with dorsodistal spine. Fourth pereopods semichelate; propodal rasp with single row of corneous scales.

Males with sexual tube developed on coxa of right fifth pereopod, directed from right to left under thorax and recurved anteriorly. Short tube developed on coxa of left fifth pereopod and concealed between 2 thick tufts of setae on sternite; unpaired biramous left third to fifth pleopods. Females with single gonopore on coxa of left third pereopod. No paired pleopods and 4 unpaired, left second to fifth biramous pleopods.

Telson with transverse suture only weakly delineated; posterior lobes not markedly asymmetrical.

REMARKS. — Prior to the revisionary work of DE SAINT LAURENT-DECHANCÉ (1966b) and DE SAINT LAURENT (1968a), the position of the male sexual tube was often the only criterion used in generic assignments. Use of the collective possession of a right sexual tube had resulted a heterogeneous conglomerate of taxa assigned to the genera *Catapaguroides*, *Cestopagurus*, and *Catapagurus* that otherwise shared few characters of phylogenetic significance. With her redefinition of *Catapaguroides* (DE SAINT LAURENT, 1968a), the genus was left with only three of its formerly assigned taxa, all with Atlantic distributions. She reassigned three Indo-Pacific species, two previously included in *Cestopagurus* and one in *Catapagurus* to *Catapaguroides* and described six new species. Five of these, *C. inermis* de Saint Laurent, 1968a; *C. cristimanus* de Saint Laurent, 1968a; *C. mortenseni* de Saint Laurent, 1968a; *C. melini* de Saint Laurent, 1968a; and *C. spinulimanus* de Saint Laurent, 1968a, occur in Indonesian waters, although none were collected during the KARUBAR expedition.

Key to the Indonesian species of *Catapaguroides*

1. Right cheliped with subcircular chela and subtriangular carpus (dorsal view) 2
- Right cheliped with subrectangular or subovate chela and subrectangular carpus (dorsal view) 3
2. Right cheliped with row of spines on dorsomesial margin of palm, carpus with row of spines in dorsal midline; palm of left chela with 2 spinulose tubercles *C. cristimanus**
- Right cheliped with 1 prominent spine on dorsomesial margin of palm; carpus few spines on dorsomesial margin and 2 spines in dorsal midline distally; palm of left chela unarmed. *C. karubar* sp. nov.
3. Palm of right cheliped armed with numerous spines, at least on dorsomesial margin 4
- Palm of right cheliped unarmed or with only 1 small tubercle at dorsomesial distal angle 6
4. Dorsal surface of palm of right cheliped with 3 irregular rows of fine spines or spinules *C. spinulimanus**
- Dorsal surface right cheliped unarmed or with only 1 spine or tubercle proximally, dorsomesial margin with row of spines 5
5. Carpus of right cheliped distinctly shorter than palm; dactyl with convex dorsal surface *C. melini**
- Carpus of right cheliped distinctly longer than palm; dactyl with median ridge or crest in distal half *C. declivis* sp. nov.
6. Antennular peduncles overreaching distal margins of corneae by nearly half length of penultimate segment; ocular peduncles moderately slender *C. inermis**
- Antennular peduncles overreaching distal margins of corneae by length of ultimate segment; ocular peduncles moderately short and stout *C. mortenseni**

Catapaguroides declivis sp. nov.

Figs 6a-j, 33g

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (1.5 mm) (MNHN-Pg 5259); 1 ov. ♀ (1.1 mm) (MNHN-Pg 5260); 1 ♂ (0.9 mm) (POLIPI). — Stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ov. ♀ (1.2 mm) (USNM 276009).

TYPES. — The male (MNHN-Pg 5259) from the KARUBAR station DW 49 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 6a) longer than broad; anterior margin between rostrum and lateral projections weakly concave; anterolateral margins sloping, posterior margin truncate, but with shallow median concavity; dorsal surface with few setae. Rostrum broadly rounded. Lateral projections triangular, produced little if at all beyond level of rostrum; with small marginal spinule.

Ocular peduncles moderately long and moderately stout, 0.70 to 0.80 shield length; dorsomesial margins each with row of sparse tufts of long setae; corneae slightly dilated. Ocular acicles narrowly triangular, with few marginal setae and submarginal distal spine.

Antennular peduncles overreaching ocular peduncles by at least full length of ultimate peduncular segment. Basal segment elongate, with statocyst lobe produced laterally and with acute spine on distolateral margin, distal margin with several long setae. Penultimate segment with few scattered short setae. Ultimate segment with 1 or 2 very long, distally plumose setae.

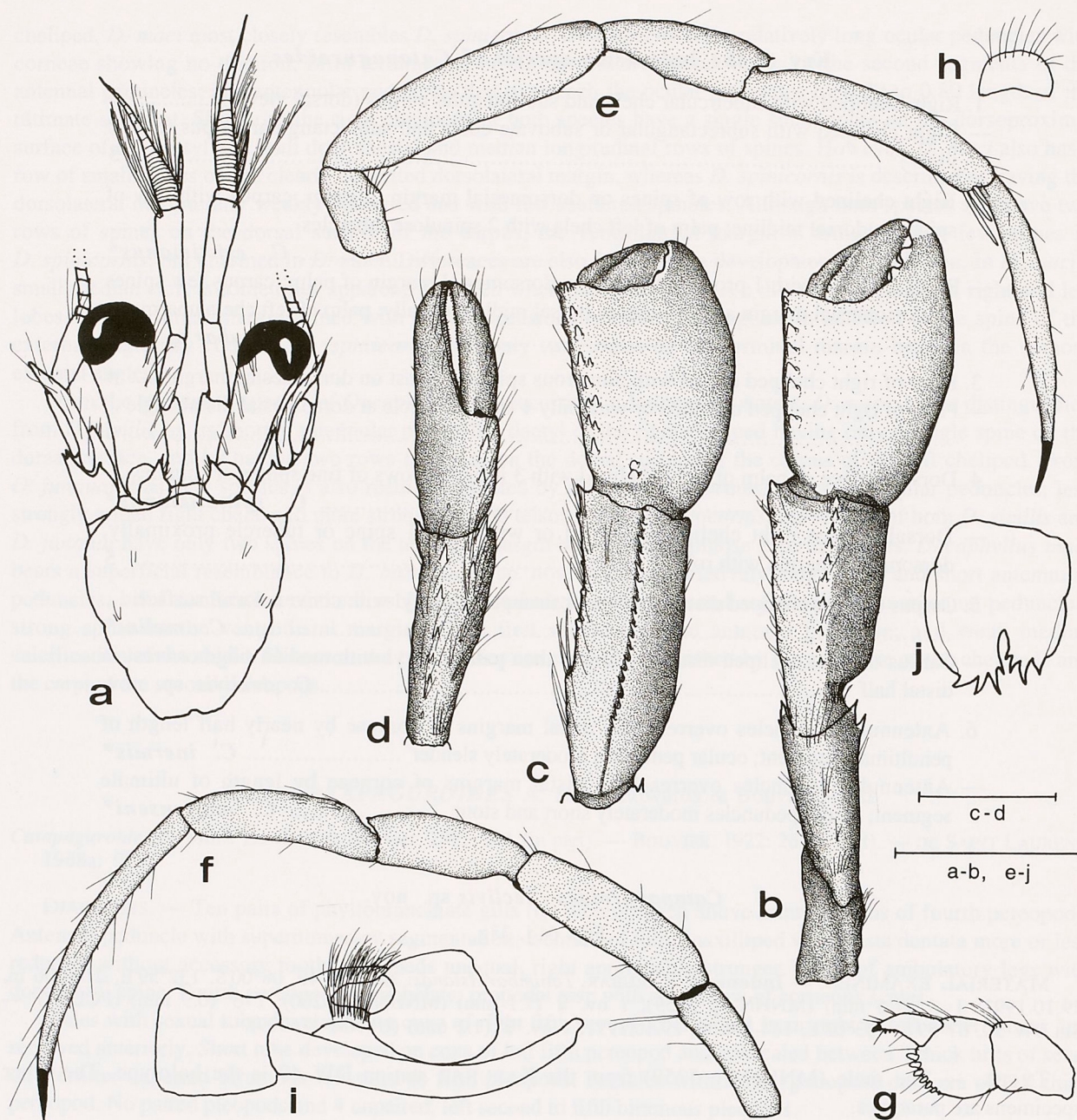


FIG. 6. — *Catapaguroides declivis* sp. nov., a-b, e-j, paratype ♂ (1.1 mm) from KARUBAR Stn DW 49; c-d, holotype ♂ (1.5 mm) from Stn DW 49: a, shield and cephalic appendages; b, right cheliped; c, carpus and chela of right cheliped; d, carpus and chela of left cheliped; e, right second pereopod (lateral view); f, left third pereopod (lateral view); g, dactyl, propodus and carpus of left fourth pereopod (lateral view); h, anterior lobe of sternite of third pereopods; i, coxae and sternite of fifth pereopods; j, telson. Scales equal 0.5 mm (g-j) and 1.0 mm (a-f).

Antennal peduncle moderately short, reaching to distal margin of cornea or slightly beyond. Fifth segment with few scattered setae and 2 or 3 longer at distal margin. Fourth segment glabrous. Third segment with few setae and acute spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in strong simple or bifid spine; dorsomesial distal angle with small spine. First segment with small spine on ventrolateral

margin. Antennal acicle slender, arcuate, reaching approximately to middle of ultimate peduncular segment; terminating in small spine and with several marginal long setae. Antennal flagella (missing in holotype) overreaching right cheliped; with 1 or 2 moderately long and also 1 or 2 very short setae every 1 or 2 articles proximally, only very short setae distally.

Right cheliped (Figs 6b-c, 33g) with dactyl articulating obliquely with palm; propodal-carpal articulation rotated clockwise 15° to 45° from perpendicular. Dactyl 0.70 to approximately equaling length of palm; cutting edge with 2 prominent calcareous teeth; terminating in small calcareous claw and slightly overlapped by fixed finger; dorsal surface with distinct but very faintly granular or smooth crest in proximal half, dorsomesial margin drawn out into very weak subacute ridge, armed proximally with 2 to several very small spinulose tubercles; mesial and ventral surfaces with few scattered moderately long setae. Palm 0.65 to 0.80 length of carpus; dorsomesial margin with single or irregularly double row of 5 to 11 small to moderately strong acute or subacute spines, 1 or 2 well-developed tubercles at dorsoproximal margin in mesial half, dorsal surface of palm and fixed finger convex, dorsolateral margin not delimited; mesial face and ventral surface of palm and fixed finger with scattered setae; cutting edge of fixed finger with 2 prominent calcareous teeth, terminating in corneous or calcareous claw. Carpus 1.25 to 1.50 times longer than merus; dorsomesial distal angle with acute spine, usually also with row of 3 to several small spinules on dorsomesial margin, long setae along entire dorsomesial margin and on mesial face; dorsal surface laterad of midline with row of 5 to 18 spines, dorsolateral surface strongly sloping ventrally; lateral and ventral surfaces with scattered long setae, most numerous ventrally, ventrolateral distal angle with acute spine. Merus subtriangular; dorsodistal margin with small spine or spinule; dorsal surface somewhat flattened but with double row of long setae sometimes arising from low protuberances; ventromesial margin with 2 to 4 prominent spines distally and row of long setae; ventrolateral margin with 1 or 2 prominent spines near distal angle and row of long setae. Ischium with long setae dorsally and ventrally.

Left cheliped (Fig. 6d) (missing in male paratype) not reaching to proximal margin of dactyl of right; with propodal-carpal articulation twisted 30° to 45° counterclockwise from perpendicular; dactyl and fixed finger curved ventrally and with slender hiatus. Dactyl 1.25 to 1.50 longer than palm, unarmed but with scattered setae; cutting edge with row of small corneous teeth. Palm approximately 0.60 length of carpus; dorsomesial margin with 2 or 3 spines and sparse tufts of long setae, dorsal surface of palm unarmed or with 1 minute spinule proximally in midline, fixed finger unarmed; both with few long setae, particularly on dorsomesial margin of palm; dorsolateral margin not delimited. Carpus approximately 1.25 length of merus; dorsomesial distal angle with strong slender spine, margin with 2 or 3 spines and numerous long setae; dorsolateral distal angle with 1 or 2 tiny spinules, dorsolateral margin with 3 to 6 spines; ventrolateral distal angle with prominent spine; mesial and ventral surfaces with few scattered long setae. Merus with tufts of setae on dorsal margin; ventrolateral margin with 2 slender spines in distal half; ventromesial margin with 1 or 2 spines in distal half. Ischium with small spine at ventromesial distal angle. Coxa with acute spine at distolateral angle.

Ambulatory legs (Figs 6e-f) elongate, overreaching right cheliped by nearly entire length of dactyls; terminating in long, slender claws. Dactyls of right pereopods slightly longer than propodi; dactyls of left second (regenerating in holotype) from 1.25 to 1.50 and dactyls of left third from 1.50 to nearly twice length of propodi; slightly curved and twisted distally, surfaces with few long and short setae most numerous dorsally; ventral margins with 2 or 3 short, fine corneous spinules. Propodi of second pereopods each with single long and 1 or 2 pairs of short or moderately short stiff articulated bristles at ventrodistal margin (males) or unarmed (females); propodi of third with ventrodistal margins unarmed or with 1 short corneous spinule; dorsal and ventral surfaces all with sparse tufts of setae most numerous on third. Carpi each with spinule at dorsodistal angle and few setae dorsally. Meri and ischia each with few setae. Fourth pereopods with 3 or 4 denticles on ventral margin of dactyl; propodal rasp consisting of 6 to 8 corneous scales (Fig. 6g). Fifth pereopod semichelate. Sternite of third pereopods with roundly rectangular anterior lobe (Fig. 6h).

Male with long sexual tube developed on coxa of right fifth pereopod (Fig. 6i), directed from right to left and reaching beyond coxa of left fifth pereopod; coxa of left with short sexual tube directed from left to right and partially obscured by setae arising from sternal surface.

Telson (Fig. 6j) with asymmetrical posterior lobes separated by deep median cleft; terminal margins each with 3 or 4 very strong and often 1 smaller acute spines; lateral margins each delimited by chitinous plate.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the Tanimbar Islands, Indonesia; 206-209 m.

ETYMOLOGY. — From the Latin *declivis* meaning downhill or sloping, referring to the strongly sloping dorsolateral face of the carpus of the right cheliped.

AFFINITIES. — *Catapaguroides declivis* bears some resemblance to both *C. melini* and *C. cristimanus*. From *C. melini*, *C. declivis* differs in having shorter ocular peduncles with more dilated corneae; shorter antennal peduncles; distinctly different armature of the right cheliped; shorter male right sexual tube; and more strongly armed telson. *Catapaguroides declivis* is readily distinguished from *C. cristimanus* by the longer, more slender shield of the former species and most specifically, by its narrower and differently armed right chela, which has one or two dorsoproximal tubercles on the palm and lacks sharply crested dorsomesial and dorsolateral margins. *Catapaguroides declivis* is immediately distinguished from the second species of *Catapaguroides* found during the KARUBAR expedition by shape and armature of the carpus of the right cheliped.

REMARKS. — The spines on the dorsomesial margin of the palm of the right chela are stronger, but fewer in number in the very small, but mature, female (0.92 mm) than in either of the larger males. In the holotype, the right chela is more strongly twisted, and the row of spines on the dorsal surface of the carpus is composed of numerous, but irregular, more serrate appearing spines. The characteristic proximomedial tuberculation of the right chela is a single tubercle in both male and female paratypes, and double in the holotype.

Catapaguroides karubar sp. nov.

Figs 7a-h

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°17'49"S, 133°00'51"E, 205-212 m, 24.10.1991: 1 ♀ (1.1 mm) (MNHN-Pg 5261).

TYPES. — The single specimen is the holotype.

DESCRIPTION. — Shield (Fig. 7a) approximately as long as broad; anterior margin between rostrum and lateral projections weakly concave; anterolateral margins sloping, posterior margin truncate. Rostrum broadly rounded. Lateral projections triangular, produced only slightly beyond level of rostrum, with small marginal spine.

Ocular peduncles moderately long and moderately stout, approximately 0.80 shield length; corneae approximately 0.30 length of peduncle, not dilated. Ocular acicles triangular, with small distal spine; separated basally by basal width of an acicle.

Antennular peduncles when extended overreaching ocular peduncles by slightly less than length of ultimate peduncular segment. Basal segment elongate, with statocyst lobe produced laterally and with acute spine on dorsolateral margin. Penultimate segment with few scattered short setae. Ultimate segment with 2 or 3 long, distally plumose setae.

Antennal peduncle moderately short, reaching to proximal margin of cornea. Fifth segment with 1 or 2 long setae at distal margin. Fourth segment glabrous. Third segment with very prominent acute spine at ventrodistal margin. Second segment with dorsolateral distal angle strongly produced as elongate spine, with accessory spinule on mesial margin; dorsomesial distal angle with prominent spine. First segment with acute spine on ventrolateral margin. Antennal acicle slender, arcuate, reaching distal margin of ultimate peduncular segment; terminating in small spine, and with few setae distally. Antennal flagella short; each article with 2 or 3 moderately short and 1 or 2 somewhat longer setae. Crista dentata with 5 or 6 irregularly-spaced and sized teeth on ischium; basis unarmed. Right cheliped (Fig. 7b) with operculate chela. Dactyl articulating somewhat obliquely with palm; approximately 1.30 times length of palm; cutting edge with 3 widely separated calcareous teeth; terminating in

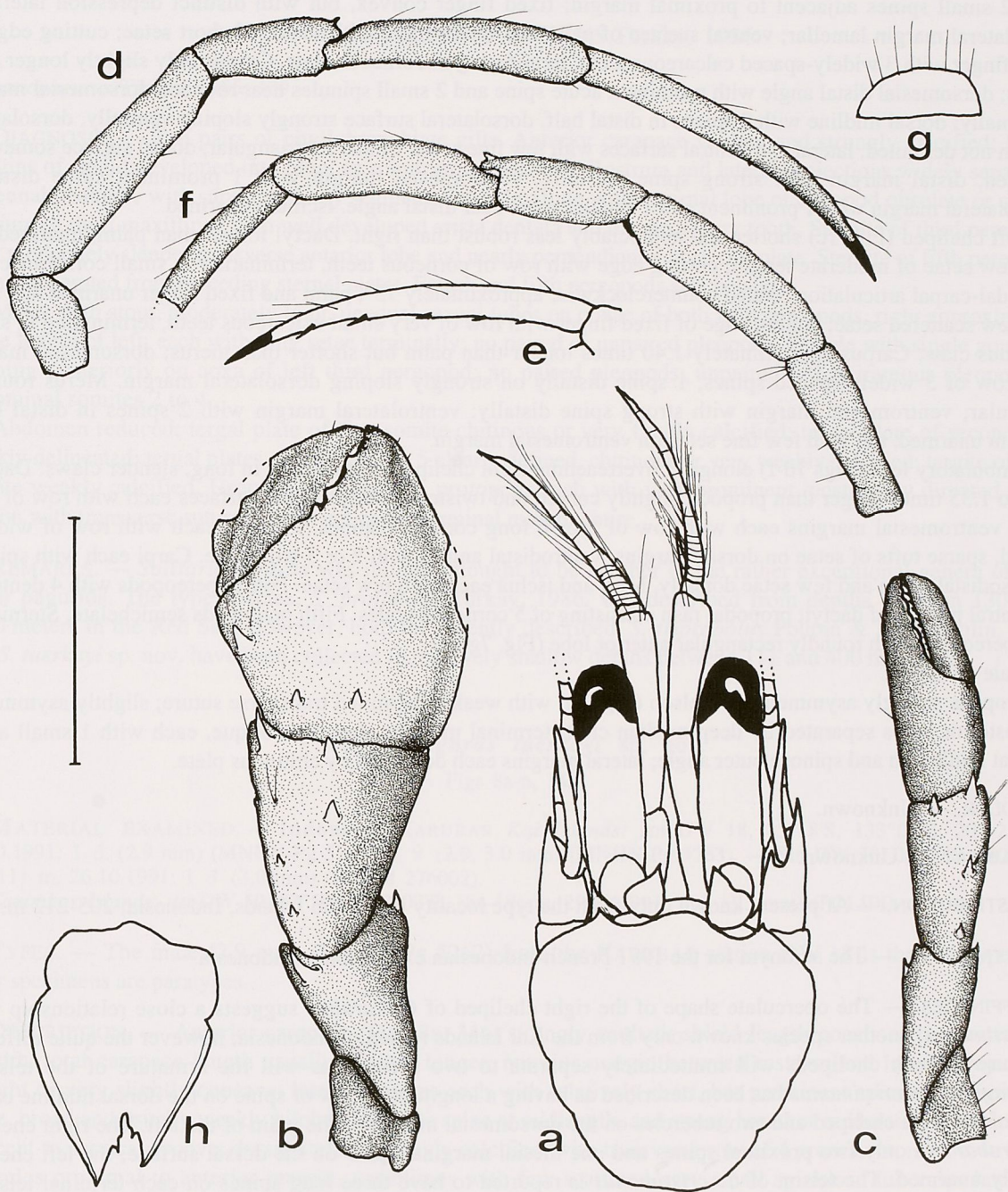


FIG. 7. — *Catapaguroides karubar* sp. nov., holotype ♀ (1.1 mm) from KARUBAR Stn DW 18: **a**, shield and cephalic appendages; **b**, right cheliped; **c**, left cheliped; **d**, right second pereopod (lateral view); **e**, dactyl of right second pereopod (mesial view); **f**, left third pereopod (lateral view); **g**, anterior lobe of sternite of third pereopods; **h**, telson. Scale equals 0.5 mm (g, h) and 1.0 mm (a-f).

small corneous claw, slightly overlapped by fixed finger; dorsal surface convex, with weak ridge in proximal half, dorsomesial margin distinctly lamellar; ventral surface with distinct median ridge. Palm approximately 0.65 length of carpus; dorsomesial margin not delimited, but with 1 well-developed spine in distal third, dorsal surface convex,

with 2 small spines adjacent to proximal margin; fixed finger convex, but with distinct depression laterally, dorsolateral margin lamellar; ventral surface of palm and fixed finger with scattered short setae; cutting edge of fixed finger with 3 widely-spaced calcareous teeth, terminating in corneous claw. Carpus only slightly longer than merus; dorsomesial distal angle with prominent acute spine and 2 small spinules near rounded dorsomesial margin proximally; dorsal midline with 2 spines in distal half, dorsolateral surface strongly sloping ventrally, dorsolateral margin not delimited; lateral and ventral surfaces with few fine setae. Merus subtriangular; dorsal surface somewhat rounded, distal margin with strong spine mesially; ventromesial margin with 1 prominent spine distally; ventrolateral margin with 1 prominent and 1 smaller spine near distal angle. Ischium unarmed.

Left cheliped (Fig. 7c) shorter and appreciably less robust than right. Dactyl longer than palm, unarmed but with few setae of moderate length; cutting edge with row of corneous teeth, terminating in small corneous claw. Propodal-carpal articulation rotated counterclockwise approximately 75°; palm and fixed finger unarmed and with only few scattered setae; cutting edge of fixed finger with row of very small calcareous teeth, terminating in small corneous claw. Carpus approximately 1.40 times longer than palm but shorter than merus; dorsomesial margin with row of 3 widely-spaced spines, 1 spine distally on strongly sloping dorsolateral margin. Merus roundly triangular; ventromesial margin with strong spine distally; ventrolateral margin with 2 spines in distal half. Ischium unarmed, but with few fine setae on ventromesial margin.

Ambulatory legs (Figs 7d-f) elongate, overreaching right cheliped; terminating in long, slender claws. Dactyls 1.25 to 1.35 times longer than propodi, slightly curved and twisted distally, dorsal surfaces each with row of stiff setae; ventromesial margins each with row of 5 or 6 long corneous spines. Propodi each with row of widely-spaced, sparse tufts of setae on dorsal margins, ventrodiscal angles with 2 or 3 stiff setae. Carpi each with spinule at dorsodistal angle and few setae dorsally. Meri and ischia each with few setae. Fourth pereopods with 4 denticles on ventral margin of dactyl; propodal rasp consisting of 5 corneous scales. Fifth pereopods semichelate. Sternite of third pereopods with roundly rectangular anterior lobe (Fig. 7g).

Male unknown.

Uropods strongly asymmetrical. Telson (Fig. 7h) with weakly delimited transverse suture; slightly asymmetrical posterior lobes separated by deep median cleft; terminal margins strongly oblique, each with 1 small acute spine at midlength and spinose outer angle; lateral margins each delimited by chitinous plate.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the type locality in the Kai Islands, Indonesia; 205-212 m.

ETYMOLOGY. — The acronym for the 1991 French-Indonesian expedition to Indonesia.

AFFINITIES. — The operculate shape of the right cheliped of *C. karubar* suggests a close relationship with *C. cristimanus*, another species known only from the Kai Islands region of Indonesia; however the quite different armature of both chelipeds will immediately separate to two species, as will the armature of the telsons. *Catapaguroides cristimanus* has been described as having a longitudinal row of spine on the dorsal midline of the palm of the right cheliped and two tubercles on the dorsomesial margin of the palm of the left. The right chela of *C. karubar* has only two proximal spines and one mesial marginal spine on the dorsal surface; the left chela is entirely unarmed. The telson of *C. cristimanus* is reported to have three long spines on each terminal telsonal margin, whereas, *C. karubar* has a single small spine on each margin. As previously noted, the shape and armature of the carpi of the right chelipeds will immediately separate *C. karubar* from *C. declivis*. In the former, the carpus is subtriangular and armed with very few spines, whereas in the latter species, the carpus is subrectangular and armed with a complete row of spines on the dorsolateral margin.

REMARKS. — Although this species is known from a single female, its assignment to *Catapaguroides* is reasonably certain. It shares with other members of the genus, 10 pairs of phyllobranchiate gills, reduced crista dentata lacking an accessory tooth, and single female left gonopore.

Genus *SOLITARIOPAGURUS* Türkay, 1986

Solitariopagurus Türkay, 1986: 139.

DIAGNOSIS. — Ten pairs of phyllobranchiate gills. Anterior carapace vaulted and strongly calcified; lateral margins of shield developed into blunt or spiniform projections. Rostrum and lateral projections widely separated. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod obsolete or absent. Ischium of third maxilliped with well developed crista dentata and one accessory tooth. Sternite of third pereopods with moderately slender transverse anterior lobe and nearly perpendicular posterior plate. Sternite of fifth pereopods widely separated from preceding sternal plates. Fourth and fifth pereopods subchelate.

Males with stout, moderately long, unequal sexual tubes on coxae of both fifth pereopods, right approximately twice length of left; each with long setae terminally; no paired or unpaired pleopods. Female with single gonopore opening posteriorly on coxa of left third pereopod; no paired pleopods; unpaired left uniramous pleopods on abdominal somites 2 to 4.

Abdomen reduced; tergal plate of first somite chitinous or very faintly calcified; tergal plate of second only weakly delineated; tergal plates of somites 3 to 5 clearly defined, chitinous or very weakly calcified; tergite of sixth somite weakly calcified. Uropods symmetrical; protopods each with very prominent, posteriorly directed spine. Telson with transverse suture at least indicated; terminal margin entire.

REMARKS. — *Solitariopagurus* was initially thought to be another of the rather exceptional genera of deep water pagurids. The type species, *S. profundus* Türkay, 1986, was described from depths between 1300 and 2000 meters in the Red Sea. However, both the recently described, *S. triprobolus* Poupin & McLaughlin, 1996, and *S. tuerkayi* sp. nov. have been collected in relatively shallow depths between 111 and 400 meters.

Solitariopagurus tuerkayi sp. nov.

Figs 8a-n, 34a

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (2.9 mm) (MNHN-Pg 5262); 2 ♀ (2.9, 3.0 mm) (MNHN-Pg 5263). — Stn DW 30, 05°39'S, 132°56'E, 118-111 m, 26.10.1991: 1 ♂ (3.0 mm) (USNM 276002).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ♂ (3.3 mm) (POLIPI).

TYPES. — The male (2.9 mm) (MNHN-Pg 5262) from the KARUBAR station DW 18 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Anterior carapace (Figs 8a, 34a) strongly vaulted; shield length consistently shorter than breadth, total carapace length usually slightly longer; anterior margin between rostrum and lateral projections straight or very slightly concave; lateral margins each with relatively short, but prominent spine at anterolateral angle, broad and usually weakly bilobed subacute spine at midlength, and strong broad or moderately slender spine adjacent to cervical groove; dorsal surface strongly calcified, with transverse row of 4 prominent, narrow to broad tubercles proximal to anterior margin, sometimes with few scattered very small spinulose tubercles laterally; posterolateral region weakly delineated and usually somewhat globular; posterior margin broadly rounded. Linea transversalis present as well calcified, broad rod. Rostrum elongate, usually reaching to proximal half of ocular peduncles; broad, slightly to strongly upturned, triangular, with elevated lateral margins and median keel; usually terminating bluntly. Lateral projections triangular; elongate, as long or slightly longer than rostrum. Posterior carapace with anterolateral regions developed distolaterally as pair of unarmed calcified plates, sometimes projecting laterally as short blunt or spinose process; posterolateral regions distomesially and posteromedian plate distally with very weakly calcified transverse rod-like area; remainder of posterior carapace membranous (damaged in illustrated male paratype).

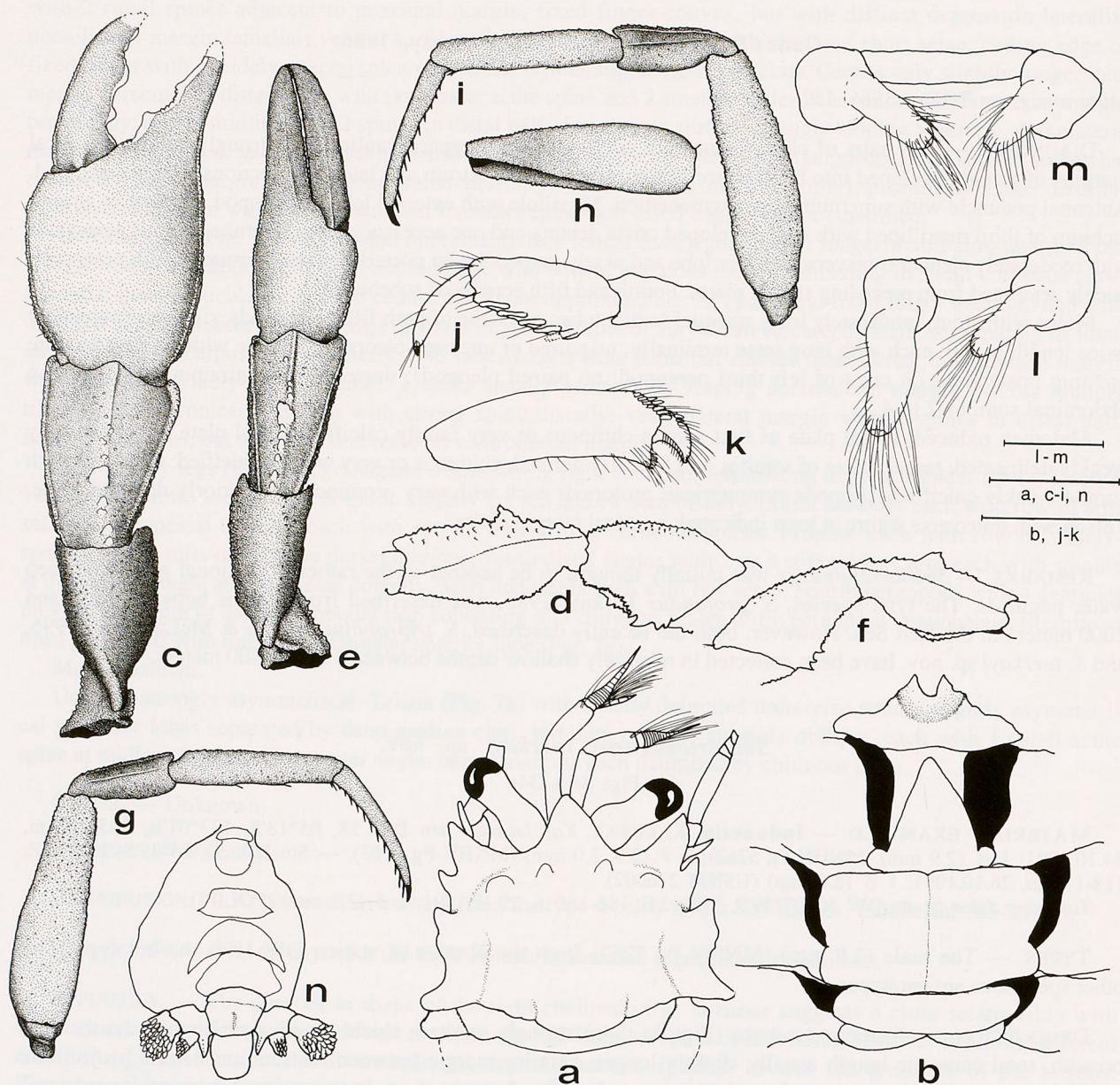


FIG. 8. — *Solitariopagurus tuerkayi* sp. nov., a-k, m-n, paratype ♂ (3.3 mm) from KARUBAR Stn DW 50; l, holotype ♂ (2.9 mm) from Stn DW 18: **a**, shield and cephalic appendages; **b**, thoracic sternites; **c**, right cheliped (dorsal view); **d**, carpus and merus of right cheliped (mesial view); **e**, left cheliped (dorsal view); **f**, carpus and merus of left cheliped (mesial view); **g**, right second pereopod (lateral view); **h**, merus of second right pereopod (mesial view); **i**, left third pereopod (lateral view); **j**, dactyl, propodus and carpus of left fourth pereopod (lateral view); **k**, propodus and dactyl of right fifth pereopod (lateral view); **l-m**, sternite and coxae of fifth pereopods; **n**, abdomen, uropods and telson (dorsal view). Scales equal 0.5 mm (l, m), 1.0 mm (b, j, k), 2.0 mm (a, c-i, n).

Ocular peduncles short, slightly less than half length of shield, with prominent ventral swelling proximally and slight submedian constriction; cornea somewhat dilated, diameter 0.25 to 0.35 length of peduncle. Ocular acicles small, acutely triangular, obscured from dorsal view by base of rostrum; separated basally by more than basal width of one acicle.

Antennular peduncles elongate, overreaching ocular peduncles by full length of ultimate segment or slightly more. Ultimate segment with 2 or 3 long plumose setae on dorsodistal margin. Penultimate segment with few scattered short setae. Basal segment with small spinule on distolateral margin. Epistomial plate well calcified, broad.

Antennal peduncles overreaching ocular peduncles by 0.33 to 0.50 length of ultimate segment, but appreciably shorter than antennular peduncles. Fifth and fourth segments with few scattered, very short setae. Third segment unarmed. Second segment with dorsolateral distal angle produced, terminating subacutely; dorsomesial distal angle rounded. First segment with row of small or very small tubercles on ventrolateral margin. Antennal acicle moderately short, not reaching distal margin of fourth peduncular segment, subtriangular and terminating subacutely, with 2 or 3 minute spinules on lateral margin. Antennal flagellum long, overreaching outstretched chelipeds; every 1 to 4 articles with 1 or 2 very short setae.

Sternite of third maxillipeds (Fig. 8b) produced into blunt or acute spinose process on either side of midline. Sternite of chelipeds (Fig. 8b) moderately broad, elongate and subtriangular with surface concave, apex blunt or with shallow median groove. Sternite of second pereopods (Fig. 8b) broad, plate-like, with median longitudinal groove. Sternite of third pereopods with narrowly subrectangular anterior lobe.

Right cheliped (Figs 8c-d, 34a) elongate; considerably stronger than left; propodal-carpal articulation perpendicular. Dactyl equal to or slightly longer than palm; articulating obliquely; cutting edge smooth or serrate and with 2 prominent calcareous teeth; terminating in small calcareous claw, slightly overlapped by fixed finger; dorsal surface convex, smooth or minutely granular, dorsomesial margin minutely serrate; ventral surface smooth or microscopically granular. Palm equal to or slightly longer than carpus; somewhat dorsoventrally compressed; dorsal surface convex, smooth or minutely granular; spinulose or serrate dorsomesial and dorsolateral margins slightly elevated; fixed finger also with smooth or minutely granular dorsal surface; cutting edge smooth or serrate, with large teeth; ventral surface of fixed finger with obliquely longitudinal and microscopically tuberculate ridge extending onto palm in distal half. Carpus equal to or slightly longer than merus; trapezoidal (in dorsal view), spinulose dorsomesial and dorsolateral margins slightly elevated; dorsal surface with scattered small tubercles or spinules, also with longitudinal median ridge or crest, most distinct distally and armed with spinules or tuberculate spines, one strongest in proximal half; mesial and lateral faces minutely granular or spinulose; ventral surface "hourglass" in shape, ventromesial and ventrolateral margins each with row of very small tubercles or blunted spines. Merus broadly subtriangular; dorsal margin spinose or spinulose; lateral and mesial faces spinulose or granular; ventrolateral margin with row of small spines, strongest proximally; ventromesial margin with row of small spines distally, 3 or 4 very prominent spines proximally. Ischium with row of small tubercles or spinules on ventromesial margin.

Left cheliped (Figs 8e-f, 34a) dorsoventrally compressed; not reaching to base of dactyl of right; dactyl and fixed finger curved ventrally. Dactyl 1.50 to twice length of palm; cutting edge with row of corneous teeth; terminating in corneous claw and very slightly overlapped by fixed finger; dorsal and ventral surfaces unarmed; dorsomesial margin serrate, at least in proximal half; mesial face with few scattered very short setae. Palm 0.60 to 0.75 length of carpus; dorsal surface smooth or minutely granular, dorsomesial and dorsolateral margins serrate and slightly elevated; ventral surface granular or minutely tuberculate, with short distal longitudinal row of small tubercles extending onto proximal half of fixed finger; cutting edge of fixed finger with row of small calcareous teeth interspersed with corneous teeth; terminating in corneous claw. Carpus slightly shorter to slightly longer than merus; dorsal surface trapezoidal (dorsal view), with few scattered very small tubercles or spinules; dorsomesial and dorsolateral margins raised and serrate, midline elevated into prominent crest armed with row of simple or multidenticulate spinulose tubercles or small spines, strongest proximally, and with 1 very prominent tuberculate spine at midlength; mesial, lateral, and ventral surfaces spinulose or tuberculate, ventrodistal margin with row of tubercles. Merus broadly subtriangular; dorsal surface spinose or spinulose, mesial and lateral faces spinulose or tuberculate particularly near ventral margins; ventromesial margin with row of small spinules and 3 strong spines proximally; ventrolateral margin minutely spinulose distally becoming row of stronger spines in proximal half. Ischium with row of small tubercles or spines on ventromesial margin.

Ambulatory legs (Figs 8g-i) moderately long and slender, but not overreaching extended right cheliped; generally similar. Dactyls approximately equal to length of propodi; laterally compressed, slightly curved

ventrally; dorsal margins with few scattered short setae; ventral margins each with row of 9 to 12 corneous spines. Propodi 1.75 to nearly twice length of carpi; dorsal margins serrate; mesial and lateral faces minutely spinulose, particularly ventrally; ventral margins each with 1 or 2 corneous spines at distal angle and 2 additional widely-spaced corneous spines. Carpi approximately half or slightly less than half length of meri; dorsal margins minutely serrate, no distinct spine at distal angle; lateral faces each with dorsal and median longitudinal ridges separated by concavity, most distinct on third, and with numerous microscopic spinules in ventral halves. Meri with serrate or spinulose dorsal margins; ventral surfaces oblique (Fig. 8h), ventromesial and ventrolateral margins spinulose. Fourth pereopods strongly subchelate; propodal rasp (Fig. 8j) consisting of single row of often distally bulbous corneous scales. Fifth pereopods weakly subchelate; dactyl and propodus (Fig. 8k) each with small rasp of corneous scales dorsally.

Males with subequal or markedly unequal sexual tubes on coxae of fifth pereopods (Figs 8l-m); each with subterminal and terminal long setae. Females with uniramous, unpaired left pleopods on somites 2 to 4.

Abdomen (Fig. 8n) markedly reduced, segmentation clearly delineated dorsally. Tergite of first abdominal somite usually chitinous, rod-shaped. Tergites of somites 2 to 5 moderately broad, weakly chitinous plates, occasionally showing slight tendency toward calcification. Tergite of sixth somite with moderately well calcified anterior rod-like and posterior paired rectangular plates. Uropods symmetrical; protopods each with very strong, posteriorly directed subacute spine armed dorsally with longitudinal row of 5 or 6 small spinules; exopods subcircular, each with large circular rasp of corneous scales; endopods appreciably smaller, ovate, each with small oval rasp. Telson elongate; transverse suture clearly delineated; terminal margin entire, with rounded external angles.

COLOR (in preservative). — After four years in alcohol only faint orange tint remains on chelae and dactyls of ambulatory legs; propodi of ambulatory legs with one or two very faint bands.

HABITAT. — Unknown.

DISTRIBUTION. — Presently known only from the Kai and Tanimbar Islands, Indonesia; 111-212 m.

ETYMOLOGY. — This species is named for Dr Michael TÜRKAY, Forschungsinstitut Senckenberg, who first recognized the distinctiveness of this genus.

AFFINITIES. — *Solitariopagurus tuerkayi* bears a strong resemblance to *S. triprobolus* from French Polynesia, in the elongation of the rostrum and lateral projections and development of the lateral carapace spines, as well as the structure of the abdomen, uropods and telson. However, the lateral projections of *S. tuerkayi* are generally shorter and stouter than in *S. triprobolus*; the antennular peduncles of the former species are appreciably shorter. The first of the lateral carapace projections also are much smaller in *S. tuerkayi* than those of *S. triprobolus*. There are clear similarities in the shape of the chelipeds of the two species; however, the dorsodistal angles of the carpi are not developed into wing-like projections in *S. tuerkayi* as they are in *S. triprobolus*. The dorsal surfaces of these segments in *S. tuerkayi* each have a raised median crest armed with a row of spines or tubercles set off by one particularly prominent, tuberculate spine in midlength, whereas the median elevations of these surfaces in *S. triprobolus* are slight and very weakly armed. The dactyls and propodi of the ambulatory legs of *S. tuerkayi* are approximately equal in length, in contrast to the much longer propodi of *S. triprobolus*.

Genus *PORCELLANOPAGURUS* Filhol, 1885

Porcellanopagurus Filhol, 1885a: 47; 1885b: 23; 1885c: 410, pl. 49, figs 2-4. — BORRADAILE, 1916: 111. — BENNETT, 1932: 520. — FOREST, 1951a: 82; 1951b: 182. — WOLFF, 1961: 28. — MIYAKE, 1978: 117. — TÜRKAY, 1986: 140.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Anterior carapace vaulted and well calcified; lateral margins of shield developed into blunt or spiniform projections. Rostrum and lateral projections widely separated. Posterolateral plates calcified anteriorly and usually drawn out into projecting lobes; remainder of posterior carapace

membraneous or with areas of slight calcification. Ocular acicles reduced, simple. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod slightly produced, not recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth.

Chelipeds unequal. Ambulatory legs generally similar. Fourth pereopods usually semichelate. Fifth pereopods chelate.

Males without sexual tube on coxa of one or both fifth pereopods; without paired or unpaired pleopods. Females with paired gonopores; no paired pleopods, unpaired left pleopods on somites 2 to 4.

Abdomen reduced, usually globular, membraneous, but with tergites at least faintly delineated. Uropods symmetrical or slightly asymmetrical.

REMARKS. — In the original description of *Porcellanopagurus tridentatus* Whitelegge, 1900, the author overlooked the first segment of the antennal peduncle, i.e., the segment upon which the antennal gland opens, and attributed the armature of the second peduncular segment to the first. TAKEDA (1981, 1985) and SUZUKI and TAKEDA (1987) may, in part, have followed WHITELEGGE's (1900) interpretation of the first segment in their inaccurate descriptions of the segmentation and armature of the antenna of their *Porcellanopagurus* species. These authors described the basal segment as having a spinule at its outer distal angle and its inner angle developed forward as a long lobe to grasp the inner margin of second segment, when in fact it is the second segment that is so armed, and the third segment that is produced. In *P. belauensis* Suzuki & Takeda, 1987, the authors further described the "third segment twice as long as the antennal acicula." Neither the true third nor fourth segments are illustrated as longer than the acicle (SUZUKI & TAKEDA, 1987, figs 2b-c); only the fifth (ultimate) segment agrees with that description.

POUPIN and McLAUGHLIN (1996) noted that, among other characters, the subchelate fourth pereopods found in species of *Solitariopagurus* suggested a closer relationship with *Alainopagurus* Lemaître & McLaughlin, 1995, than with *Porcellanopagurus*, in which the fourth pereopods are semichelate. The fourth pereopods of *P. truncatifrons* Takeda, 1981, were described by the author as having "propodus widened and spatulated; its lower border fringed with a row of horny curved spines, its distal end being prolonged only slight beyond articulation with dactylus which is talon-like and curved dorsally." From his figure [TAKEDA, 1981, fig. 3 (3)], it would appear that this appendage is inverted, thereby giving the impression of a dorsally directed dactyl; however, the appendage appears distinctly subchelate.

Reference to the telson has been intentionally omitted in the generic diagnosis of *Porcellanopagurus* given here. In most species, a typical pagurid-like telson is developed. However, in two recently described Japanese species, *P. truncatifrons* and *P. nihonkaiensis* Takeda, 1985, telsons apparently are lacking. For *P. truncatifrons*, TAKEDA (1981: 12) commented "It is remarkable that I failed to find the telson, but the presence of marginal hairs along the posterior border of the penultimate segment may justify the absence of the telson." TAKEDA (1985) illustrated only the sixth abdominal somite and uropods, but made no comment about the missing telson in *P. nihonkaiensis*. Both of these species are known only from their respective holotypes; therefore, it is not clear whether this ostensible telson loss reflects evolutionary change or simply injury.

Porcellanopagurus jacquesi sp. nov.

Figs 9a-l, 34b

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (2.8 mm) (MNHN-Pg 5264); 1 ♂ (3.2 mm) (MNHN-Pg 5265).

TYPES. — The male (2.8 mm) (MNHN-Pg 5264) from the KARUBAR station DW 18 is the holotype. The other male is a paratype.

DESCRIPTION. — Anterior carapace (Figs 9a, 34b) vaulted; shield length slightly shorter than maximum breadth, total carapace length usually slightly longer; anterior margin between rostrum and lateral projections

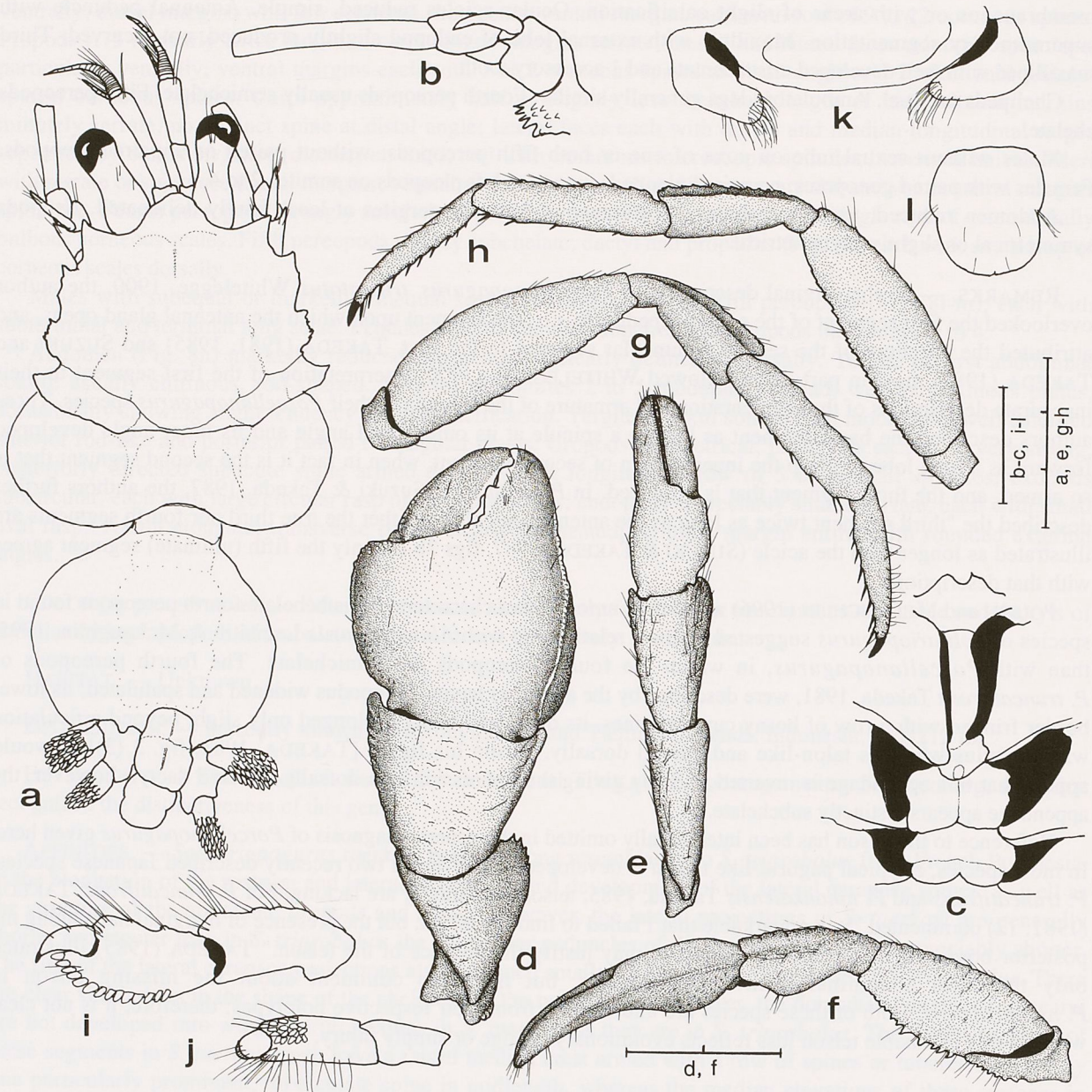


FIG. 9. — *Porcellanopagurus jacquesi* sp. nov., a-b, e, g-l, paratype ♂ (3.2 mm) from KARUBAR Stn DW 18; c-d, f, holotype ♂ (2.8 mm) from Stn DW 18: a, cephalothorax with cephalic appendages and abdomen; b, left antennal peduncle (lateral view); c, thoracic sternites; d, right cheliped; e, left cheliped (dorsal view); f, left cheliped (mesial view); g, right second pereopod (lateral view); h, left third pereopod (lateral view); i, dactyl, propodus and carpus of left fourth pereopod (lateral view); j, carpus, propodus and dactyl of left fifth pereopod (lateral view); k, sternite and coxae of fifth pereopods; l, telson. Scales equal 1.0 mm (b-c, i-l), 2.0 mm (d, f), and 3.0 mm (a, e, g-h).

straight or very slightly concave; lateral margins each with short acute spine at basally broadened anterolateral angle, broad multispinose process at midlength, and strong broad or moderately slender spinose process posterior to cervical groove; dorsal surface strongly calcified, with faintly marked postrostral furrows and weakly delineated, usually somewhat globular posterolateral regions; posterior margin roundly truncate. Cardiac sulci and

posteromedian plate chitinous or weakly calcified. Rostrum broadly triangular, usually reaching to proximal fourth of ocular peduncles; terminating subacutely or bluntly. Lateral projections triangular; produced, but not in advance of rostrum.

Ocular peduncles short, slightly less than half length of shield, with distinct submedian constriction; cornea slightly dilated, diameter approximately 0.33 length of peduncle. Ocular acicles small, acutely triangular, obscured from dorsal view by base of rostrum.

Antennular peduncles moderately short, but overreaching ocular peduncles by nearly full length of ultimate segment. Ultimate segment with 2 or 3 long plumose setae on dorsodistal margin. Penultimate and basal segments unarmed.

Antennal peduncles (Fig. 9b) overreaching ocular peduncles by 0.25 to 0.50 length of ultimate segment. Fifth and fourth segments with few scattered, very short setae. Third segment unarmed. Second segment with dorsolateral distal angle produced, terminating in acute spine; dorsomesial distal angle rounded. First segment with cluster of spines on lateral surface ventrally. Antennal acicle moderately short, but sometimes reaching beyond distal margin of fourth peduncular segment, terminating acutely. Antennal flagellum long, slightly overreaching outstretched chelipeds; every 1 to 4 articles with 1 or 2 very short setae, at least in proximal half.

Sternite of third maxillipeds (Fig. 9c) produced into rounded or acute spinose process on either side of midline. Sternite of chelipeds (Fig. 9c) slender, elongate with asymmetrical posterior lobe. Sternite of second pereopods (Fig. 9c) broad, plate-like, with median longitudinal groove. Sternite of third pereopods with roundly subrectangular anterior lobe.

Right cheliped (Figs 9d, 34b) (missing in paratype) stout; not much longer, but considerably stronger than left; propodal-carpal articulation twisted clockwise approximately 45° from perpendicular. Dactyl slightly longer than palm; articulating obliquely; cutting edge with 4 prominent teeth; terminating in small calcareous claw, slightly overlapped by fixed finger; dorsal surface convex, armed with few tiny spinules, dorsomesial margin minutely serrate; ventral surface with few widely-spaced tufts of setae. Palm approximately equal to length of carpus; somewhat swollen dorsoventrally; dorsal surface convex, dorsomesial and dorsolateral margins slightly elevated, tuberculate or spinulose; fixed finger with few tufts of short setae on dorsal surface; cutting edge with 2 large teeth; ventral surface of palm and fixed finger microscopically spinulose and with scattered tufts of setae. Carpus slightly longer than merus; trapezoidal (in dorsal view), dorsomesial and dorsolateral margins also slightly elevated, at least distally, crenulate and with few low transverse ridges; all surfaces with scattered short low transverse ridges providing rough-textured appearance. Merus broadly subtriangular; dorsal margin with several transverse ridges and few fine setae; lateral and mesial faces minutely granular in ventral halves; ventromesial margin with row of small spines; ventrolateral margin with row of somewhat stronger spines distally and few widely-spaced spinules proximally. Ischium with row of small spinules on ventromesial margin.

Left cheliped (Figs 9e-f, 34b) with dactyl and fixed finger curved ventrally. Dactyl approximately 1.25 length of palm; cutting edge with row of corneous teeth; terminating in corneous claw and very slightly overlapped by fixed finger; dorsal surface unarmed, dorsomesial margin not delimited; mesial and ventral surfaces with scattered setae. Palm nearly 0.75 length of carpus; dorsal surface smooth or microscopically granular, dorsomesial and dorsolateral margins serrate and slightly elevated; ventral surface weakly granular; cutting edge of fixed finger with row of small calcareous teeth, terminating in corneous claw. Carpus 0.65 to 0.75 length of merus; with low transverse ridges mesially and laterally; dorsolateral margin raised proximally and distally; mesial, lateral and ventral surfaces each with few short transverse low ridges and sparse setae. Merus subtriangular; dorsal surface with few short transverse ridges and short setae; lateral face minutely spinulose or tuberculate; ventromesial margin with row of small spines, ventrolateral margin with row of stronger spines. Ischium with row of small tubercles on ventrolateral margin; row of small spines on ventromesial margin.

Ambulatory legs (Figs 9g-h) moderately long and slender, overreaching extended right cheliped; generally similar. Dactyls approximately equal to or slightly shorter than propodi; in dorsal and lateral views, nearly straight; dorsal margins with short setae; mesial and lateral faces with few short setae; ventral margins each with row of 8 to 11 corneous spines. Propodi 1.10 to 1.25 length of carpi; dorsal margins slightly tuberculate; ventral margins each with 1 or 2 corneous spines at distal angle and 2 to 6 additional widely-spaced corneous spines. Carpi approximately half or slightly more than half length of meri; dorsal margins slightly spinulose, no distinct spine

at distal angle; lateral faces each with longitudinal ridge separated by concavity from dorsal margin. Meri with minutely protuberant or serrate dorsal margins; ventral surfaces oblique (mesial view), ventromesial and ventrolateral margins spinulose. Fourth pereopods strongly semichelate; propodal rasp (Fig. 9i) consisting of single row of corneous scales. Propodus of fifth pereopods with small rasp of corneous scales (Fig. 9j).

Males with coxae of fifth pereopods (Fig. 9k) drawn out posteromedially, gonopores each masked by long setae. Females unknown.

Abdomen (Fig. 9a) somewhat reduced, globular. Tergite of first abdominal somite rod-shaped, membraneous and only faintly delineated. Tergites of somites 2 to 5 also membraneous, moderately broad, weakly indicated. Tergite of sixth somite moderately well calcified, divided into anterior and posterior lobes by transverse suture, each with median furrow. Uropods symmetrical; protopods with weak posteriorly directed subacute protuberance on right side only. Telson (Fig. 9l) (missing in holotype) with transverse suture weakly delineated; posterior lobes separated by very small median cleft, terminal margins rounded, unarmed.

COLOR (in preservative). — Both specimens, after four years in alcohol, showed faint light orange banding at proximal margins of dactyls and medianly on propodi of ambulatory legs; carpi each with nearly imperceptible longitudinal stripe on lateral ridge.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the type locality in the Kai Islands, Indonesia; 205-212 m.

ETYMOLOGY. — This species is named for Professor Jacques FOREST of the Muséum national d'Histoire Naturelle, Paris, in recognition, not only of his landmark studies of *Porcellanopagurus*, but his many contributions to hermit crab systematics.

AFFINITIES. — *Porcellanopagurus jacquesi* most closely resembles *P. japonicus* Balss, 1913, *P. nihonkaiensis* Takeda, 1985, and *P. belauensis* Suzuki & Takeda, 1987, in having a broadly triangular rostrum, somewhat broad and spinulose or denticulate lateral carapace lobes, and additionally with the latter two species, the laterally ridged carpi of the ambulatory legs. *Porcellanopagurus jacquesi* shares with *P. japonicus* a small, spiniform posterior carapace lobe; in both *P. nihonkaiensis* and *P. belauensis* this lobe is quite blunt. Like *P. jacquesi*, a postrostral furrow is present in both *P. japonicus* and *P. belauensis* that is lacking in the only known specimen of *P. nihonkaiensis*. The presence of a strongly acute, spiniform rostrum and absence of laterally ridged carpi of the ambulatory legs immediately distinguishes *P. japonicus* from the other three species. The development, in *P. nihonkaiensis* and *P. belauensis*, of a triangular distal lobe on the rostrum also sets these species apart from *P. jacquesi*, where the rostrum terminally is subacute or rounded and slightly depressed. The width of the shield is appreciably greater in *P. belauensis* than in the other three species.

In *P. nihonkaiensis* the ventral margins of the propodi of the ambulatory legs are described as having five corneous spines, the dactyls seven; *P. belauensis* is reported to have three corneous spines on the ventrodiscal angle and a row of seven additional spines on the ventral margins of the propodi of the second pereopods, while the spines on the third pereopods number two distally and five marginally. The dactyls of the second pereopods have nine spines, the third, 11 in this species. *Porcellanopagurus jacquesi* is intermediate in having one or two corneous spines on the ventrodiscal angles of the propodi and three to six on the ventral margins; the ventral spines of the dactyls range from eight to 11.

TAKEDA (1985, figs 1A-C) illustrated, but did not discuss the tergites of the sixth abdominal somite and uropods in *P. japonicus*, *P. nihonkaiensis* and *P. truncatifrons*. For *P. japonicus* the sixth tergite is represented by a rounded anterior lobe with shallow, incomplete median furrow and rectangular posterior lobe with deeper but still incomplete median furrow. This tergite in *P. nihonkaiensis* and *P. truncatifrons* is illustrated as having a triangular anterior lobe with central median depression; the rectangular posterior lobe has a well developed and nearly complete longitudinal groove. As described above and illustrated in Fig. 9a, *P. jacquesi* has two subequal rectangular lobes, each with a longitudinal median furrow, incomplete only on the posterior lobe. Like *P. jacquesi*, the uropods of *P. japonicus* show only a small protuberance posteriorly from the protopod of the right uropod. In *P. nihonkaiensis* the protopods of both uropods show a well developed posterior protuberance, and in

P. truncatifrons an even more prominent spiniform protuberance. Depicted by SUZUKI and TAKEDA (1987, fig. 3p), but not described is a similar strong spine on the protopod of each uropod of *P. belauensis*; the sixth abdominal tergite in this species is clearly divided into four distinct, well separated lobes.

BALSS (1913) did not describe the telson of *P. japonicus* but his figure (fig. 40) shows a reduced and subtriangular structure. As previously mentioned, TAKEDA (1985, fig. 1B-C) illustrates *P. nihonkaiensis* and *P. truncatifrons* without telsons. His specimen of *P. japonicus* is depicted with an elongate telson, lacking both transverse suture and median cleft. The telson of *P. belauensis*, as illustrated by SUZUKI and TAKEDA (1987), has the anterior and posterior lobes divided by a complete transverse suture, and the posterior lobes by a longitudinal median groove over their entire length. *Porcellanopagurus jacquesi* has a well developed telson with transverse suture weakly marked and with a small median cleft separating the posterior lobes.

Rather abundant setation was illustrated by BALSS (1913, fig. 40) for *P. japonicus*. Both in the description and figures (SUZUKI & TAKEDA, 1987) *P. belauensis* is characterized as having abundant setation on the carapace and all appendages. In contrast, setation was described by TAKEDA (1985) as being sparse in *P. nihonkaiensis*. Very sparse setation is also characteristic of *P. jacquesi*.

REMARKS. — Although the specimen selected as the holotype is the smaller of the two, it is the only specimen with all appendages still attached. The carapaces of both specimens were damaged in collection; however, that of the paratype had been severed in such a way that it has been possible to reconstruct it accurately (Fig. 9a). The abdomen of this specimen is in excellent condition, whereas that of the holotype is badly shriveled and the telson is missing.

WHITELEGGE (1900), in his original description of *Porcellanopagurus tridentatus*, described the coxae of the fifth pereopods as having a "tubular prolongation, directed inwards and downwards, and their margins are fringed with long setae". His statement could apply equally well to the coxae of *P. jacquesi*, although there is no doubt that the two are distinct taxa. When discussing the relationship of *Solitariopagurus* with *Porcellanopagurus*, TÜRKAY (1986), called attention to WHITELEGGE's (1900) report, but commented that he could detect no sexual tubes in the male syntype of this species that he examined. Close inspection of the coxae of both males of *P. jacquesi* similarly does not support the supposition that these elongations represent sexual tubes.

Genus *ALAINOPAGUROIDES* nov.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Anterior carapace vaulted and generally well calcified, with anterolateral regions slightly depressed. Linea transversalis as calcified rod, posterior carapace membranous or with slight calcification. Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule with external endopodal lobe obsolete or absent. Third maxilliped with crista dentata of ischium (Fig. 10a) somewhat reduced, but with 1 accessory tooth. Sternite of third maxillipeds with anterior margin rounded on either side of median concavity. Sternite of second pereopods subdivided into broad lateral lobes by deep longitudinal median groove. Sternite of third pereopods (Fig. 10b) with narrow, transverse anterior lobe and broad posterior lobe divided by deep median groove. Fourth pereopods weakly semichelate, propodal rasp rudimentary; with prominent tubular preungual process (Fig. 10c) at base of claw.

Abdomen reduced; tergal plate of first somite chitinous; tergal plates of second through fifth somites sometimes very faintly delineated; tergite of sixth somite (Fig. 10d) weakly calcified, subdivided into narrow to moderately broad anterior lobe, and posterior pair of broad plates separated by distinct median groove. Uropods generally symmetrical. Telson with transverse suture; posterior lobes usually separated by shallow median cleft.

Males with moderately long and stout sexual tube on coxa of right fifth pereopod (Fig. 10e), left often with very short tube; no paired or unpaired pleopods. Female with paired gonopores; no paired pleopods; unpaired left biramous pleopods on abdominal somites 2 to 4 (Fig. 10f).

TYPE SPECIES. — *Alainopaguroides lemaitrei*, sp. nov. Gender masculine.

ETYMOLOGY. — This genus is named for Alain CROSNIER, marine biologist of ORSTOM, in recognition of his many contributions to our knowledge of the decapod fauna of the Indo-Pacific.

AFFINITIES. — Although *Alainopaguroides* shares a number of important characters with several other genera, no precise phylogenetic relationships can yet be determined. In reduction of the abdomen, total absence of paired or unpaired pleopods in males and lack of the left fifth pleopod in females, *Alainopaguroides*, *Porcellanopagurus*, *Ostraconotus* A. Milne Edwards, 1880, *Solitariopagurus*, and *Alainopagurus* conceivably might all be considered sister taxa. However, 11 pairs of phyllobranchiate gills are common to species of *Porcellanopagurus*, *Alainopagurus* and *Alainopaguroides*, while *Ostraconotus* and *Solitariopagurus* species have only 10. The rostrum is very strongly produced and broadly triangular in species of *Solitariopagurus* and some species of *Porcellanopagurus*, developed as a prominent slender spiniform projection in *Alainopagurus*, but broad and bluntly truncated in other species of *Porcellanopagurus* or upturned in *Ostraconotus* and *Alainopaguroides*. The lateral regions of the anterior carapace are drawn out into spinose lobes in *Porcellanopagurus* and *Solitariopagurus*, or simply globular in *Alainopagurus*, whereas only spinulose margins are seen in *Ostraconotus*, and simply rounded margins in *Alainopaguroides*. Varying areas of weak calcification are observed on the posterior carapaces of species of four of the genera; yet, only in *Ostraconotus* is there nearly complete calcification of the posterior carapace. The second through fifth abdominal tergites of *Solitariopagurus* and *Alainopagurus* are chitinated or calcified to some extent, while those of the other three genera are only faintly indicated.

Quite different specializations in the fourth pereopods are seen among the five genera. With the one exception previously mentioned, in *Porcellanopagurus* species the fourth pereopod is semichelate; the propodal rasp consists of a single row of very small spinules. The semichelae of *Alainopagurus* and *Alainopaguroides* are similar in having the ventrodistal portion of the propodus very weakly produced; the propodal rasp consists of a single row of small spines in *Alainopagurus*, but only two or three distal scales or corneous spines in *Alainopaguroides*. The fourth pereopods of *Solitariopagurus* species are distinctly subchelate, allowing the dactyl to articulate against the ventral margin of the propodus; the propodal rasp consists of a row of bulbous scales. Major structural differences and sexual dimorphism are seen in the fourth pereopods of *Ostraconotus*. Females of the only known species, *Ostraconotus spatulipes* A. Milne Edwards, 1880, have an extremely paddle-shaped propodus and simple articulating dactyl; the propodus of the male is approximately half the breadth of the female, but the dactyl is similar. Rather typical pagurid type, minutely chelate, fifth pereopods are found in *Ostraconotus*, *Porcellanopagurus* and *Alainopaguroides*, but subchelate in *Solitariopagurus* and in *Alainopagurus*. Species of *Porcellanopagurus*, *Alainopagurus* and one species of *Solitariopagurus* are known to utilize bivalve shells as their microhabitat; nothing is known for the others.

Extensions of the vas deferens as sexual tubes are present in all of the aforementioned genera except *Porcellanopagurus*. Species of this latter genus occasionally show a posterior elongation of one or both coxae, but no tubular structure arises from a gonopore. In contrast, males of *Alainopagurus* and *Solitariopagurus* have short, equal or unequal sexual tubes produced from the gonopores of both fifth pereopods. Males of *Ostraconotus* have a single right sexual tube, whereas *Alainopaguroides* has an elongate right sexual tube and usually a very short left, although it may only resemble a small protuberance in smaller specimens. While females of all five genera have no paired pleopods and only left unpaired egg-bearing pleopods (left second through fourth), paired gonopores occur in *Porcellanopagurus*, *Ostraconotus*, and *Alainopaguroides*, but only single left gonopores are found in females of *Solitariopagurus* and *Alainopagurus*.

Until TÜRKAY's (1986) account of *Solitariopagurus*, *Ostraconotus* and *Porcellanopagurus* had been considered the prime examples of carcinization in the Paguridae (e.g., BORRADAILE, 1916; WOLFF, 1961). The recent discovery of *Alainopagurus*, and now *Alainopaguroides*, brings to five the candidates for this distinction. As may be seen from the foregoing brief review of major characters in these genera, no clearly defined evolutionary pathway can yet be observed.

Alainopaguroides lemaitrei sp. nov.

Figs 10a-m, 34c-e, 35a

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-415 m, 24.10.1991: 1 ♂, 4 ♀ (1.3-2.6 mm) (MNHN-Pg 5266). — Stn DW 31, 05° 40'S, 132°51'E, 288-289 m, 26.10.1991: 1 ♂ (2.1 mm) (POLIPI). — Stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ov. ♀

(4.9 mm) (MNHN-Pg 5267). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♂, 1 ♀ (2.6, 3.6 mm) (USNM 276007).

Tanimbar Islands: stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 ♂ (6.2 mm) (MNHN-Pg 5268 A), 3 ♀, 2 ov. ♀ (4.7-5.2 mm) (MNHN-Pg 5268 B); 1 ♂, 2 ♀, 1 ov. ♀ (4.5-5.6 mm) (USNM 276006). — Stn CP 62, 09°01'S, 132°42'E, 246-253 m, 1.11.1991: 1 ♂ (5.4 mm) (SMNH 4813). — Stn CP 70, 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 1 ♂ (3.9 mm) (POLIPI).

TYPES. — The male (6.2 mm) (MNHN-Pg 5268 A) from KARUBAR station CP 59 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 10f, 34c, 35a) usually considerably broader than long, dorsal surface swollen, anterolateral region somewhat depressed; anterior margin between rostrum and lateral projections slightly concave; posterior margin roundly truncate; dorsal surface with light covering of short to moderately long setae, longest and most abundant laterally; frequently with moderately deep transverse postrostral depression. Rostrum broad, blunt or rarely subacute, unarmed, upturned. Lateral projections broadly rounded or obtusely triangular, with small marginal or submarginal spine or spinule.

Ocular peduncles (including corneae) very short, slightly more than half shield length, slender basally but enlarged distally; with corneae strongly dilated. Ocular acicles moderately short to moderately long, 0.35 to 0.50 length of peduncle (excluding cornea), slender, triangular; terminating acutely and with dorsal surface longitudinally grooved; mesial margins each with row of moderately long setae and few additional setae laterally; separated basally by more than basal width of one acicle.

Antennular peduncles (left broken in holotype) overreach ocular peduncles by approximately half length of penultimate segment. Ultimate segment with 2 widely separated rows of long setae on dorsal surface. Penultimate segment with few setae. Basal segment unarmed, but with statocyst enlarged.

Antennal peduncles overreaching ocular peduncles (including corneae) by 0.25 to 0.50 length of ultimate segment. Ultimate and penultimate segments with few to several moderately long setae. Third segment with small spinule on ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in slender spine and frequently with accessory spine on lateral margin, with long setae dorsally, mesially and laterally; dorsal surface with numerous long setae and prominent longitudinal furrow, mesial and lateral margins with low, spinulose protuberances and long setae; dorsomesial distal angle with small spine. First segment with strong spine on laterodistal margin; ventrally produced and with 1 small spine distolaterally. Antennal acicle reaching nearly to distal margin of ultimate peduncular segment; terminating in small spine; mesial, lateral and dorsal surfaces all with long setae, margins sometimes also with spinulose protuberances. Antennal flagellum longer than outstretched ambulatory legs; each article naked or proximal articles with 1 or 2 minute bristles.

Right cheliped (Figs 10g, 34d) stronger; frequently but not always, shorter than left in large males; palm, fixed finger and dactyl somewhat dorsoventrally compressed. Dactyl 0.65 to 0.75 length of palm; cutting edge with 2 broad calcareous teeth and often numerous small calcareous denticles; terminating in small corneous claw, slightly overlapped by fixed finger; dorsomesial margin not delimited, dorsal surface with few tufts of short setae; mesial and ventral surfaces with moderate to dense long setae. Palm 1.35 to 1.50 length of carpus; dorsal surface very slightly convex, unarmed; dorsomesial and dorsolateral margins not delimited, mesial and lateral faces spinulose, sometimes almost imperceptibly so; fixed finger with scattered short and long setae on weakly convex dorsal surface; cutting edge with 1 broad sometimes denticulate calcareous tooth, few to many much smaller calcareous teeth proximally and distally, terminating in small corneous claw; ventral surfaces of palm and fixed finger with moderate to dense long setae. Carpus 0.65 to 0.75 length of merus; dorsomesial and dorsolateral margins each with row of irregularly-sized slender spines, strongest distally, dorsal surface with scattered spinules; lateral, mesial and ventral surfaces also spinose, ventromesial and ventrolateral margins with slightly stronger serrations; all surfaces with scattered fine setae. Merus subtriangular; dorsodistal margin with 1 strong sometimes nearly erect spine; slightly flattened dorsal margin with very short transverse rows of spines or spinules; lateral face spinulose, ventrolateral margin with irregular single or double row of small spines, 1 more prominent spine at distal angle; mesial and ventral surfaces spinulose, ventromesial margin spinulose or with distinct row of small spines, 1 stronger spine at distal angle. Ischium with row of fine setae on ventral margin.

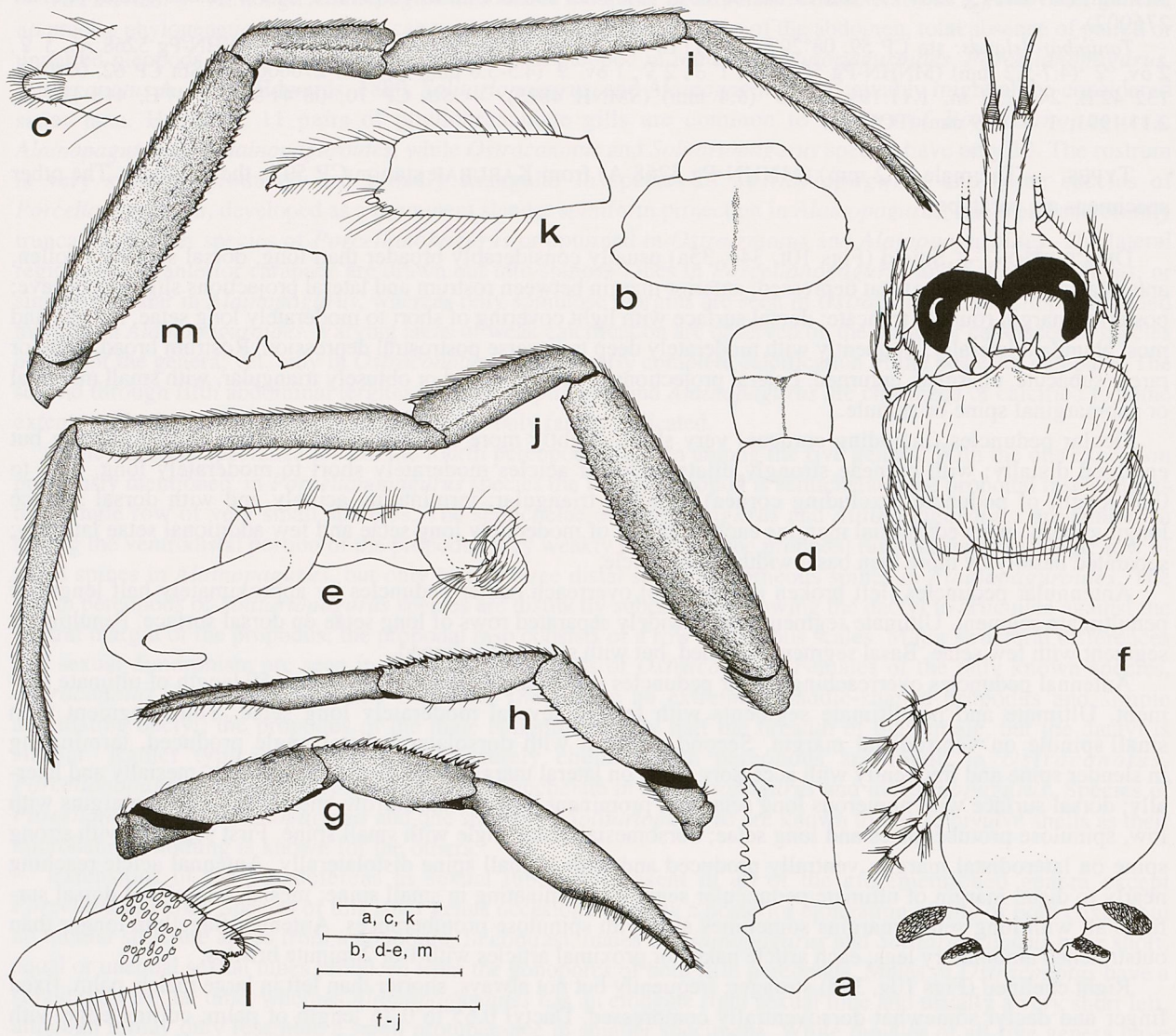


FIG. 10. — *Alainopaguroides lemaitrei* sp. nov., a, c-d, g-l, paratype ♀ (5.6 mm) from KARUBAR Stn CP 59; b, e, m, holotype ♂ (6.2 mm) from Stn CP 59: a, basis and ischium of left third maxilliped with crista dentata and accessory tooth; b, sternite of third pereopods; c, tip of dactyl and preungual process of left fourth pereopod; d, sixth abdominal somite and telson (dorsal view); e, sternite and coxae of fifth pereopods; f, cephalothorax with cephalic appendages and abdomen; g, right cheliped (lateral view); h, left cheliped (lateral view); i, right second pereopod (lateral view); j, left third pereopod (lateral view); k, dactyl and propodus left fourth pereopod (lateral view); l, propodus and dactyl of right fifth pereopod (lateral view); m, telson. Scales equal 0.1 mm (c), 1.0 mm (a, k-l), 2.0 mm (b, d, e, m) and 5.0 mm (f-j).

Left cheliped (Figs 10h, 34e) in large males sometimes overreaching right cheliped by as much as half length of dactyl; chela dorsoventrally compressed; dactyl and fixed finger slightly arched. Dactyl long, approximately twice length of palm; dorsomesial margin microscopically serrate, at least proximally; dorsal and ventral surfaces with scattered long and short setae; cutting edge with row of tiny corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger. Palm 0.50 to 0.65 length of carpus; with nearly flat dorsal surface, dorsomesial and dorsolateral margins usually minutely serrate, latter also often with row of widely-spaced tiny bristles extending almost entire length of fixed finger; mesial, lateral and ventral surfaces with scattered usually

short setae; cutting edge of fixed finger with few widely-spaced very small calcareous teeth, interspaces occupied by short rows of corneous teeth, terminating in small simple or bifid claw; dorsal and ventral surfaces with scattered long setae. Carpus about 0.65 length of merus, subrectangular; dorsomesial and dorsolateral margins weakly elevated, each with row of small slender spines, strongest at distal angles, dorsal surface slightly concave, unarmed; mesial and lateral faces nearly perpendicular, unarmed; ventromesial margin with row of widely-spaced short setae, ventrolateral margin with row of very small spines. Merus subtriangular; dorsodistal margin with spine, slightly flattened dorsal margin with small spinules and moderately short setae; lateral face spinulose, ventrolateral margin with row of small spines; ventromesial margin with row of spinules, ventral surface with scattered small spines and spinules. Ischium with row of fine setae on ventromesial margin.

Ambulatory legs (Figs 10i-j) overreaching right cheliped by full length of dactyls; generally similar. Dactyls slightly blade-shaped, particularly third, usually somewhat shorter than propodi; laterally compressed; in dorsal view, slightly twisted in distal half; in lateral view, curved ventrally; terminating in small corneous claws; dorsal surfaces each with row of regularly-spaced stiff long setae; lateral faces each with faint broad longitudinal sulcus proximally, mesial faces glabrous; ventral margins each with row of shorter and finer but also regularly-spaced setae. Propodi 1.75 to twice length of carpi, somewhat laterally compressed; dorsal and ventral surfaces each with row of long setae; mesial and lateral faces unarmed. Carpi 0.45 to 0.65 length of meri; dorsal surfaces each with row of tiny spinules, 1 stronger spine at distal margin; lateral faces each with median longitudinal row of short fine setae sometimes accompanied by tiny spinules; mesial and ventral surfaces unarmed. Meri each usually with small spine at dorsodistal margin, at least on second, dorsal surfaces often spinulose or spinose and with abundant short fine setae; mesial faces glabrous; lateral faces minutely spinulose, each also with irregular rows of short fine setae; ventromesial margins unarmed or with few minute spinules proximally, ventrolateral margins, and occasionally also broadened ventral surfaces, each with irregularly double or triple rows of spinules or small spines, 1 slightly larger spine at distal angle. Ischia unarmed. Fourth pereopods each with 2 or 3 ovate corneous scales or spines at ventrodistal angle of propodus (Fig. 10k), lateral face often abundantly setose; dactyl with prominent preungual process at base of claw (Fig. 10d). Fifth pereopods chelate; propodus with diffuse rasp (Fig. 10l).

Uropods (Fig. 10f) with elongate moderately narrow rasps of corneous scales on both exopods and endopods; protopods not produced posteriorly. Telson (Figs 10d, m) with roundly subtriangular posterior lobes usually separated by small median cleft, sometimes cleft nearly obsolete; narrowly or broadly oblique terminal margins each usually with 1 or 2 spinules and very short bristles.

COLOR. — Unknown.

HABITAT. — One specimen found occupying gastropod shell well covered by anemone.

DISTRIBUTION. — Presently known only from the Kai and Tanimbar Islands, Indonesia; 210 - 502 m.

ETYMOLOGY. — This species is named for Dr. Rafael LEMAITRE, National Museum of Natural History, Smithsonian Institution in recognition of his continuing contributions to pagurid systematics.

AFFINITIES. — The generic discussion previously presented pertains directly to *A. lemaitrei* as it is the only known representative of the genus. However, the elongation of the right sexual tube and its right-to-left direction over the dorsal part of the abdomen in this genus is more reminiscent of sexual tube development in *Catapagurus* than in any of the other previously discussed genera. *Alainopaguroides* also shares with *Catapagurus* such characters as short and stout ocular peduncles with dilated corneae and moderate to long ocular acicles, although these are also seen in *Ostraconotus spatulipes*. The general structure and armature of the chelipeds and ambulatory legs, as well as the specialized preungual process on the fourth pereopod, also resemble those of *Catapagurus* species.

REMARKS. — Contrary to the typical relationship of shield length to animal size in the majority of pagurids, this is not the case in *A. lemaitrei*. In this species, there is a marked increase in shield breadth in proportion to length with increased animal size. However, as width increases, so does the general convexity of the shield, making accurate linear width measurements impossible.

As indicated in the description, there is a tendency in some males for the length of the left cheliped to noticeably exceed that of the right; however, this phenomenon does not appear to necessarily be a function of size. In the holotype, which was the largest male examined, the left cheliped was shorter than the right, as it was in all females. In two of the slightly smaller males, the left cheliped overreached the right by a quarter to a half the length of the left dactyl.

Genus *ANAPAGRIDES* de Saint Laurent-Dehancé, 1966

Anapagrides de Saint Laurent-Dehancé, 1966b: 262 (in part). — MIYAKE, 1978: 141 (in part). — McLAUGHLIN & SANDBERG, 1995: 580.

Nanopagurus McLaughlin, 1986: 797.

Not *Anapagrides* - DE SAINT LAURENT, 1968b: 1115. — HAIG & BALL, 1988: 177 (= *Turleania* nom. nov.).

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Shield with well developed rostrum. Ocular acicles triangular. Antennal peduncle with supernumerary segmentation. Third maxilliped with well developed crista dentata and 1 accessory tooth. Chelipeds unequal, right appreciably larger. Ambulatory legs similar from left to right; carpi with or without dorsodistal spinule. Fourth pereopod semichelate; with single row of corneous scales in propodal rasp.

Males with coxae of fifth pereopods slightly asymmetrical; right larger and with short sexual tube directed posteriorly. No paired pleopods, 3 unpaired left pleopods. Females with single gonopore on coxa of third left pereopod. No paired pleopods, 4 unpaired pleopods; second to fourth with both rami well developed, fifth reduced.

Telson with transverse suture; posterior lobes separated by median cleft; terminal margins with few small spines.

REMARKS. — The inclusion of *Anapagrides* in the KARUBAR material is based upon a single ovigerous female of uncertain specific identity, and must therefore be considered tentative.

?*Anapagrides* sp.

Figs 11a-g

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ov. ♀ (1.1 mm) (MNHN-Pg 5269).

DIAGNOSIS. — Shield (Fig. 11a) slightly longer than broad. Rostrum broadly triangular, not produced in advance of lateral projections. Lateral projections triangular, with small marginal or submarginal spine. Ocular peduncles moderately short and stout, much shorter than antennular peduncles. Ocular acicles narrowly triangular, with submarginal spine. Antennal peduncles reaching slightly beyond distal margin of corneae; shorter than antennular peduncles.

Right cheliped (Fig. 11b) with moderately long fine setae particularly laterally on carpus and ventrally on merus. Dorsal surface of dactyl elevated in midline and armed with row of tiny spinules, dorsomesial margin with row of very small spines. Palm with row of small spines on dorsomesial and dorsolateral margins and slightly shorter row adjacent to dorsomesial margin, dorsal surface of palm and fixed finger with scattered spinules. Carpus with row of spines on dorsomesial margin, 1 spine on dorsodistal margin and row of slightly smaller spines on dorsal surface mesially; dorsolateral margin not distinctly delimited, but with row of tiny spinules; ventrolateral margin with row of minute tubercles. Merus with row of spines on ventrolateral margin.

Left cheliped (Fig. 11c) with long fine setae, particularly mesially on carpus and ventrally on merus. Dorsal surface of dactyl with few tiny spinulose protuberances. Palm strongly elevated in midline and armed with row of small spines extending to distal half of fixed finger. Carpus with short row of spines on dorsolateral margin, dorsomesial margin with 1 small spine distally and row of minutely spinulose protuberances; distal margin with 1 spine dorsally and 2 laterally. Merus with 2 strong spines on ventrolateral margin distally.

Ambulatory legs (Figs 11d-e) similar. Dactyls each with row of 7 or 8 corneous spines on ventral margins; mesial faces of third pereopods each with row of widely-spaced corneous spines dorsally. Propodi with 1 or

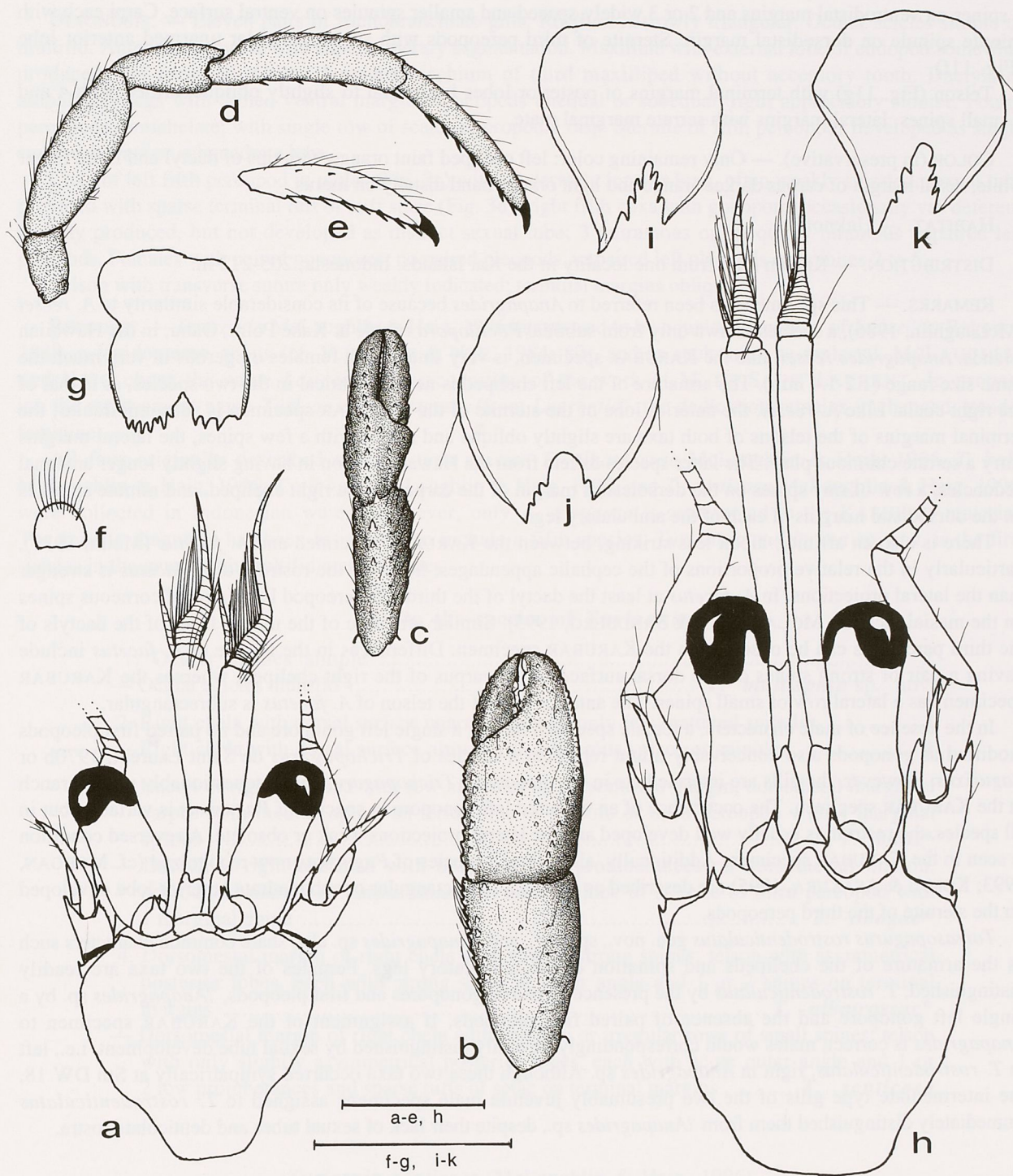


FIG. 11. — ?*Anapagrises* sp., a-g, ov. ♀ (1.1 mm) from KARUBAR Stn DW 18. — *Turleania senticosa* McLaughlin & Haig, 1996, h, ♂ (2.1 mm) from Stn DW 22; i, ♂ (2.3 mm) from Stn DW 22; j, ♂ (1.6 mm) from Stn DW 50; k, ♀ (1.6 mm) from Stn DW 50: a, h, shield and cephalic appendages; b, chela and carpus of right cheliped (dorsal view); c, chela and carpus of left cheliped (dorsal view); d, right second pereopod (lateral view); e, dactyl of left third pereopod (mesial view); f, anterior lobe of sternite of third pereopods; g, i-k, telson. Scales equal 0.5 mm (f-g, i-k) and 1.0 mm (a-e, h).

2 spines on ventrodistal margins and 2 or 3 widely-spaced and smaller spinules on ventral surface. Carpi each with minute spinule on dorsodistal margin. Sternite of third pereopods with subsemicircular unarmed anterior lobe (Fig. 11f).

Telson (Fig. 11g) with terminal margins of posterior lobes horizontal to slightly oblique, armed with 4 and 7 small spines, lateral margins with serrate marginal plate.

COLOR (in preservative). — Only remaining color: left cheliped faint orange with tips of dactyl and fixed finger white, distal margin of carpus darker orange and light orange band distally on merus.

HABITAT. — Unknown.

DISTRIBUTION. — Known only from one locality in the Kai Islands, Indonesia; 205-212 m.

REMARKS. — This specimen has been referred to *Anapagridentes* because of its considerable similarity to *A. reesei* (McLaughlin, 1986), a species known only from subtidal *Pocillopora* rubble at Kahe Point, Oahu, in the Hawaiian Islands. *Anapagridentes reesei*, like the KARUBAR specimen, is very small, with females ovigerous in very much the same size range (1.2-1.4 mm). The armature of the left cheliped is nearly identical in the two species, as is that of the right chela. Like *A. reesei*, the anterior lobe of the sternite of the KARUBAR specimen is subsemicircular; the terminal margins of the telsons of both taxa are slightly oblique and armed with a few spines, the lateral margins carry a serrate chitinous plate. The latter species differs from the Hawaiian taxon in having slightly longer antennal peduncles, a row of tiny spines on the dorsolateral margin of the carpus of the right cheliped, and minute spinules on the dorsodistal margins of each of the ambulatory legs.

There is also an affinity, albeit less striking, between the KARUBAR specimen and *A. facetus* (Melin, 1939), particularly in the relative proportions of the cephalic appendages; however the rostrum of *A. facetus* is stronger than the lateral projections. In *A. facetus* at least the dactyl of the third left pereopod has a row of corneous spines on the mesial face (cf. McLAUGHLIN & SANDBERG, 1995). Similar armature of the mesial faces of the dactyls of the third pereopods can be observed in the KARUBAR specimen. Differences in the female of *A. facetus* include having a pair of strong spines on the dorsal surface of the carpus of the right cheliped, whereas the KARUBAR specimen has a lateral row of small spines. The anterior lobe of the telson of *A. facetus* is subrectangular.

In the absence of male characters, a female specimen having a single left gonopore and no paired first pleopods modified as gonopods also conceivably might represent a species of *Trichopagurus* de Saint Laurent, 1970b or *Pagurixus*. However, the gills are intermediate in the monotypic *Trichopagurus*, but unquestionably phyllobranch in the KARUBAR specimen. The occurrence of an unpaired left gonopore in species of *Pagurixus* is variable; but in all species, the rostrum is usually well developed and the lateral projections weak or obsolete. A reversed condition is seen in the KARUBAR specimen. Additionally, all of the 13 species of *Pagurixus* now recognized (cf. MORGAN, 1993; KOMAI & ASAKURA, 1995) are described as having a subrectangular or subquadrate anterior lobe developed on the sternite of the third pereopods.

Tarrasopagurus rostrodenticulatus gen. nov., sp. nov., and ?*Anapagridentes* sp. also share common characters such as the armature of the chelipeds and spination of the ambulatory legs. Females of the two taxa are readily distinguished, *T. rostrodenticulatus* by the presence of paired gonopores and first pleopods, ?*Anapagridentes* sp. by a single left gonopore and the absence of paired first pleopods. If assignment of the KARUBAR specimen to *Anapagridentes* is correct, males would correspondingly be easily distinguished by sexual tube development, i.e., left in *T. rostrodenticulatus*, right in *Anapagridentes* sp. Although these two taxa occurred sympatrically at Stn DW 18, the intermediate type gills of the two presumably juvenile male specimens assigned to *T. rostrodenticulatus* immediately distinguished them from ?*Anapagridentes* sp., despite their lack of sexual tubes and denticulate rostra.

Genus *TURLEANIA* nom. nov.

Anapagridentes de Saint Laurent-Dechancé, 1966b: 262 (in part). — MIYAKE, 1978: 142 (in part).

Anapagridentes, DE SAINT LAURENT, 1968b: 1115. — HAIG & BALL, 1988: 177; not *Anapagridentes* de Saint Laurent-Dechancé, 1966b.

Laurentia McLaughlin & Haig, 1996: 76; not *Laurentia* Ragonot, 1888: 49.

DIAGNOSIS. — Eleven pairs of trichobranchiate gills. Rostrum narrowly triangular. Ocular acicles simple or multifid. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod somewhat produced, not recurved. Crista dentata of ischium of third maxilliped without accessory tooth. Dactyls of ambulatory legs with armed ventral margins. Chelipeds unequal or subequal, right appreciably stouter. Fourth pereopods semichelate; with single row of scales in propodal rasp. Sternite of fifth pereopods developed as single small subovate or subquadrate lobe.

Coxa of left fifth pereopod in males (Fig. 3c) with moderately long or long, often weakly spiraled, sexual tube provided with sparse terminal tuft of stiff setae (Fig. 3d); right fifth coxa with gonopore, occasionally vas deferens slightly produced, but not developed as distinct sexual tube; 3 uniramous or unequally biramous unpaired left pleopods. Females with paired gonopores; no paired pleopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture only weakly indicated; terminal margins oblique.

REMARKS. — *Laurentia* McLaughlin & Haig, 1996 has proved to be a junior homonym of *Laurentia* Ragonot, 1888, a lepidopteran genus (cf. FLETCHER & NYE, 1984: 80), and as such must be replaced. McLAUGHLIN and HAIG chose the name *Laurentia* in recognition of the work of M. DE SAINT LAURENT. In proposing the replacement name *Turleania*, an anagram (from *Laurentia*), the dedication remains unchanged; gender feminine.

All four originally described species, type species *T. albatrossae* McLaughlin & Haig, 1966, *T. balli* McLaughlin & Haig, 1996, *T. sibogae* McLaughlin & Haig, 1996, and *T. senticosa* McLaughlin & Haig, 1996, were collected in Indonesian waters; however, only *T. senticosa* is represented in the KARUBAR material. The generic diagnosis has been broadened to include a fifth species. *Turleania multispina* sp. nov. is the first species in the genus with multifid ocular acicles.

Key to the species of *Turleania*

1. Ocular acicles simple 2
— Ocular acicles multifid *T. multispina* sp. nov.
2. Right chela with dorsal surface unarmed or with only few scattered spinules 3
— Right chela with dorsal surface armed with numerous spines or spinules 4
3. Dactyl of right cheliped with row of spines on dorsomesial margin, dorsodistal margin of carpus with median spine; anterior lobe of sternite of third pereopod with 4 marginal spines *T. balli**
— Dactyl of right cheliped with only few low protuberances on dorsomesial margin, dorsodistal margin of carpus unarmed; anterior lobe of sternite of third pereopod with 1 marginal spine *T. sibogae**
4. Dorsomesial margin of right chela with row of strong spines; telson with asymmetrical posterior lobes, each with strong spine at outer angle and 1 or 2 spines on terminal margins *T. albatrossae**
— Dorsomesial margin of right chela with spinules or irregular rows of small spines; telson with only slightly asymmetrical posterior lobes, each with acute outer angle and 1 or 2 low protuberances and sparse tufts of setae on terminal margins *T. senticosa*

Turleania senticosa (McLaughlin & Haig, 1996)

Figs 11h-k

Laurentia senticosa McLaughlin & Haig, 1996: 87, figs 3E, 6

MATERIAL EXAMINED. — **Indonesia**, KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ov. ♀ (1.5 mm) (POLIPI). — Stn DW 22, 05°22'S, 133°01'E, 85-124 m, 25.10.1991: 2 ♂ (2.1, 2.3 mm) (MNHN-Pg 5270).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ♂, 2 ♀, 1 ov. ♀ (1.6-1.8 mm) (USNM 275999, 276000).

DIAGNOSIS. — Shield (Fig. 11h) slightly to considerably longer than broad. Rostrum triangular, terminating bluntly or subacutely. Lateral projections well developed, triangular, with strong marginal or submarginal spine. Ocular peduncles subcylindrical, 0.65 to 0.80 shield length; overreached by both antennular and antennal peduncles; corneae dilated. Ocular acicles subtriangular, with small submarginal spine.

Second segment of antennal peduncle with dorsolateral distal angle produced, terminating in acute spine and sometimes with accessory spine; dorsomesial distal angle with very prominent spine. Antennal acicle reaching to base of cornea or slightly beyond; terminating in acute spine and with long setae mesially and terminally. Antennal flagellum moderately short, with 1 or 2 short or long setae every 1 to 4 articles.

Right cheliped moderately long and stout; sometimes with hiatus between dactyl and fixed finger. Dactyl 0.60 to 0.90 length of palm; dorsomesial margin and dorsal midline each with row(s) of very small spines or spinules and long setae. Palm with dorsomesial margin not clearly delimited, but with irregular rows of spinules or small spines; dorsal surface convex, armed with small spines or spinules particularly in lateral half and on fixed finger; surfaces all with long, but not particularly dense setae. Carpus with row of moderately slender, acute spines on dorsomesial margin, dorsal surface with 1 row of slightly smaller spines laterad of midline and scattered small spines or spinules laterally, dorsolateral margin not delimited; surfaces all with long setae. Merus with 1 or 2 prominent spines on ventrolateral margin distally, ventromesial margin with 1 prominent spine at distal angle, sometimes also 1 additional spine at midlength, and occasionally smaller spine proximally.

Left cheliped not appreciably shorter than right but much less robust. Dactyl unarmed or with few spinules and tufts of long setae in dorsal midline, low occasionally spinulose protuberances and long setae on dorsomesial margin. Palm with convex dorsal surface armed with tiny spines or spinules, particularly laterally, and long setae. Carpus with row of slender spines on dorsolateral and dorsomesial margins, both rows partially obscured by long setae; ventrolateral margin with acute spine distally. Merus with long setae on all surfaces; ventrolateral margin with 1 or 2 prominent acute spines distally, and frequently irregular row of smaller spinules on lateral face ventrally; ventromesial margin with 1 spine near distal angle.

Ambulatory legs similar from left to right. Dactyls slightly to considerably longer than propodi, slender; dorsal and ventral margins each with row of stiff setae, latter also with 5-8 long corneous spines. Carpi each with 1 spine on dorsal surface adjacent to dorsodistal angle, 1 additional spine on dorsal surface proximally (second). Meri each with 1 spine on ventral margin in distal third (second) or unarmed (third). Sternite of third pereopods with small, subovate or subtriangular anterior lobe usually with 1 to 4 marginal spines and row of long setae.

Telson (Figs 11i-k) with posterior lobes slightly asymmetrical, each outer angle acutely produced or with terminal spine, 0 to 3 spines on oblique terminal margins.

COLOR (in preservative). — Ocular acicles retain faint orange tint. Chelipeds with some iridescence. Right cheliped with faint spot of orange near the tip of fixed finger and larger patch proximally. Left cheliped with band of light orange proximally on dorsal surfaces of dactyl and fixed finger. Band of light orange present distally on dactyls of ambulatory legs.

HABITAT. — Unknown.

DISTRIBUTION. — Seram, Kai and Tanimbar Islands, Indonesia; 85-186 m.

AFFINITIES. — McLAUGHLIN and HAIG (1996), discussed the similarities between *T. senticosa* and *T. albatrossae*. *Turleania multispina* similarly resembles *T. senticosa* in having the dorsal surfaces of the chelae armed with small spines or spinules. The other species, *T. balli* and *T. sibogae* both have unarmed chelae. The specimens of *T. senticosa* collected during the KARUBAR expedition all have the spines of the dorsomesial region of the palm of the right cheliped more strongly developed than in the type series. With that exception, two males from the Kai Islands agree exceptionally well with the holotype; the specimens from Tanimbar Islands do not exhibit the hiatus between the dactyl and fixed finger.

REMARKS. — Antennal flagella were missing from the type specimens described by MCLAUGHLIN and HAIG (1996). They have been included in the diagnosis presented based upon the present material. The KARUBAR specimens of *T. senticosa*, while agreeing with the type material from Seram Island in most characters, do exhibit some variations not noted by MCLAUGHLIN and HAIG. As previously indicated not all of the present specimens have a hiatus between the dactyl and fixed finger of the right cheliped; in one specimen, the spine on the ventromesial distal angle of the merus is absent. Similarly, the left cheliped of one specimen has one rather than two spines on the ventrolateral distal angle. The most noteworthy variation is seen in the telson. In all of present specimens the posterior lobes are clearly asymmetrical; the oblique margins are armed with two or three spines (Figs 11b-d).

Turleania multispina sp. nov.

Figs 12a-j

MATERIAL EXAMINED. — **Indonesia**, KARUBAR, *Kai Islands*: stn DW 02, 05°47'S, 132°13'E, 209-240 m, 22.10.1991: 1 ov. ♀ (2.1 mm) (USNM 276003). — Stn DW 03, 05°48'S, 132°13'E, 278-301 m, 22.10.1991: 1 ♂ (1.8 mm) (MNHN-Pg 5271); 1 ♀ (1.9 mm) (POLIPI). — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 26.10.1991: 1 ov. ♀ (2.1 mm) (MNHN-Pg 5272). — Stn CP 35, 06°08'S, 132°45'E, 390-508 m, 27.10.1991: 1 ov. ♀ (2.3 mm) (MNHN-Pg 5273).

TYPES. — The ovigerous female (2.3 mm) (MNHN-Pg 5273) from KARUBAR station CP 35 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 12a) longer than broad; anterior margin between rostrum and lateral projections somewhat concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with few tufts of setae. Rostrum triangular, well developed, reaching beyond bases of ocular acicles, terminating acutely. Lateral projections well developed, acutely or obtusely triangular, with submarginal spine.

Ocular peduncles (including corneae) approximately 0.80 shield length; corneae dilated. Ocular acicles subrectangular, with 3 to 6 terminal spines; separated basally by approximately half basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles (including corneae) by 0.75 to nearly entire length of ultimate segment. Ultimate segment with 2 to 6 long setae on dorsodistal margin and scattered shorter setae on dorsal and ventral surfaces. Penultimate segment with few short setae. Basal segment with statocyst region expanded laterally and dorsoventrally flattened; with 0-3 small spines on protuberances of dorsodistal margin mesially and 1 stronger spine dorsodistal margin laterally.

Antennal peduncles overreaching ocular peduncles by 0.35 to 0.50 length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment unarmed or with small ventrodistal spinule. Second segment with dorsolateral distal angle produced, terminating in acute simple or bifid spine; dorsomesial distal angle with prominent acute spine. First segment often with small spine at dorsolateral distal angle; 1 to 3 small spines on ventrolateral distal margin. Antennal acicle reaching beyond base of cornea, but not to distal margin; terminating in acute spine and with long setae on mesial margin. Antennal flagellum long, overreaching outstretched chelipeds; with 2 to 4 short (≤ 2 articles length) setae every 1 to 3 articles in proximal half, fewer longer and irregularly-spaced setae in distal half.

Right cheliped (Fig. 12b) moderately long and stout. Dactyl slightly less than length of palm; cutting edge with 2 large calcareous teeth in proximal half, row of very small calcareous teeth distally; terminating in small corneous claw; dorsomesial margin not delimited, dorsal surface convex, with long setae and scattered small spines or spinules in proximal third; ventral and mesial surfaces also with scattered long setae. Palm 0.60 to 0.75 length of carpus; dorsomesial margin not delimited, but sometimes with prominent tubercle at proximal angle; dorsal surface convex, with scattered small spines and spinules, not extending onto dorsolateral surface or fixed finger, armature partially to entirely obscured by long simple or plumose setae; dorsal surface of fixed finger also with numerous long setae; cutting edge with 2 large rather sharp and several small calcareous teeth, terminating in small corneous claw. Carpus slightly longer than merus; dorsomesial distal angle with acute spine and usually 1 or 2 smaller spines on dorsomesial margin, dorsal surface with short transverse rows of long setae,

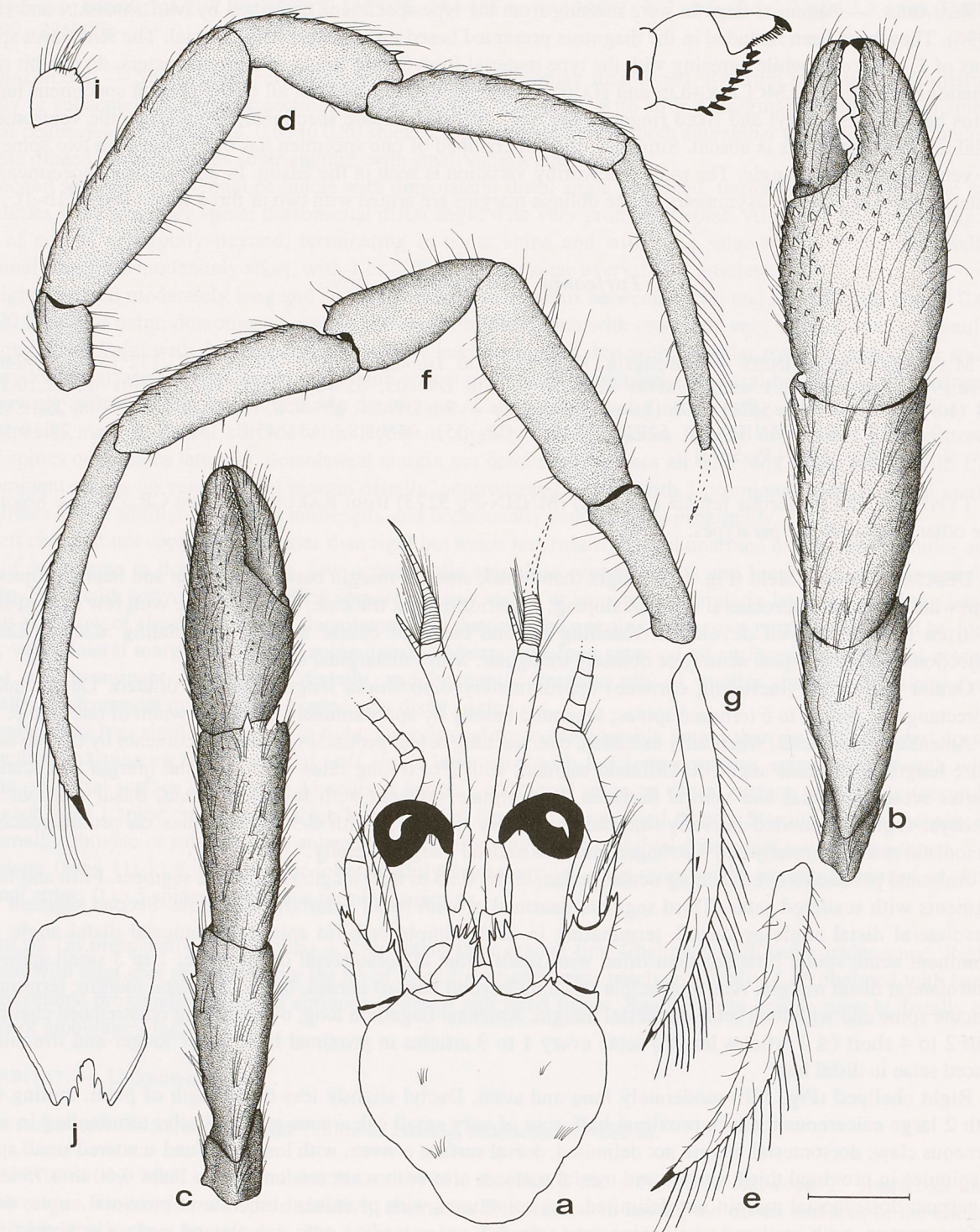


FIG. 12. — *Turleania multispina* sp. nov., holotype ♀ (2.3 mm) from KARUBAR Stn CP 35: a, shield and cephalic appendages; b, right cheliped; c, left cheliped; d, right second pereopod (lateral view); e, dactyl of left second pereopod (mesial view); f, left third pereopod (lateral view); g, dactyl of left third pereopod (mesial view); h, dactyl and propodus of right fourth pereopod (lateral view); i, anterior lobe of sternite of third pereopods; j, telson. Scale equals 0.5 mm (h-j) and 1.0 mm (a-g).

dorsolateral margin not delimited; mesial, lateral and ventral surfaces also with scattered long setae. Merus with numerous long setae on dorsal margin and mesial and lateral faces; ventrolateral and ventromesial distal angles each with 1 acute spine, or occasionally only blunt protuberance at ventromesial angle. Ischium with setae mesially and ventrally. Coxa with spine at ventrolateral distal angle.

Left cheliped (Fig. 12c) slender; usually equaling right in length but less robust. Dactyl approximately equal to or slightly longer than palm; cutting edge with row of very small corneous teeth, terminating in corneous claw; dorsal surface convex, unarmed but with numerous long setae. Palm 0.50 to 0.60 length of carpus; dorsal surface convex, armed with scattered small spines and spinules laterally and on proximal half of fixed finger, both with numerous long setae; cutting edge of fixed finger with row of small calcareous teeth, terminating in small corneous claw; ventral surfaces also with numerous long setae. Carpus approximately as long as merus; dorsodistal margin with 1 mesial acute spine and second in midline, dorsolateral and dorsomesial margins unarmed but with tufts of long setae; mesial, lateral and ventral faces also with long setae. Merus with long setae on dorsal, lateral and ventral surfaces; ventrolateral margin with 2 acute spines distally, ventromesial margin with 1 spine near distal angle. Ischium with long setae on ventral margin. Coxa with spine at ventrolateral distal angle.

Ambulatory legs (Figs 12d-g) similar from left to right. Dactyls 1.20 to 1.50 length of propodi, slender; in dorsal view, straight; in lateral view, curved ventrally; terminating in long, slender corneous claws; dorsal margins each with row of long stiff setae, mesial faces with scattered long setae and 1 to 3 widely-spaced corneous spines near ventral margin. Propodi with long setae dorsally and ventrally, often arising from low protuberances, particularly on dorsal surfaces. Carpi each with 1 spine on dorsal surface adjacent to dorsodistal angle, often 1 additional spine on dorsal surface proximally (second). Meri unarmed but with several tufts of moderately long setae on dorsal and ventral margins. Ischia unarmed. Sternite of third pereopods with small, subquadrate or subcircular anterior lobe (Fig. 12i) unarmed or with 1 or 2 marginal spinules. Fourth pereopod with 8 or 9 clearly separated, sharp corneous scales in propodal rasp (Fig. 12h). Fifth pereopods semichelate.

Telson (Fig. 12j) with posterior lobes only slightly asymmetrical, each outer angle prominent, blunt or subacute; terminal margins oblique and armed with 2 to 4 acute spines.

COLOR (in preservative). — Calcified integument somewhat iridescent. Ventral surfaces of carpi of chelipeds retaining faint orange tint.

HABITAT. — Two of the specimens were inhabiting shells covered by an unidentified bryozoan.

DISTRIBUTION. — Kai Islands, Indonesia; 209-502 m.

ETYMOLOGY. — From the Latin *spina* meaning spined, and refers to the multispined ocular acicles of this species.

AFFINITIES. — In having the dorsal surfaces of the chelae armed with small spines or spinules, *T. multispina* resembles both *T. albatrossae* and *T. senticosa*; however, this new species is immediately distinguished from all known species of the genus by its multispined ocular acicles.

Genus *MICHELOPAGURUS* nov.

Pagurodes Henderson, 1888: 94 (in part). — ALCOCK, 1901: 224; 1905b: 106 (in part). — GORDAN, 1956: 324 (in part; lit.). — DE SAINT LAURENT, 1969: 740 (in part).
? *Pagurodes* - BOUVIER, 1922: 22. — INGLE, 1993: 102; not *Pagurodes* Henderson, 1888.

DIAGNOSIS. — Eleven pairs of trichobranchiate gills. Rostrum broadly rounded or obtusely and bluntly triangular. Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 13a) with external lobe of endopod well developed, not recurved. Ischium of third maxilliped with accessory tooth on crista dentata. Chelipeds elongate, subequal, right appreciably stouter. Fourth pereopods semichelate; with single row of scales or rarely incomplete double row in propodal rasp; no distinctive preungual process.

Coxae of fifth pereopods in males (Fig. 13b) symmetrical; right, left, or both with short sexual tube; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; paired first pleopods modified as gonopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture; posterior lobes separated by distinct median cleft; terminal margins rounded; lateral margins, at least left, with corneous plate.

ETYMOLOGY. — The genus is named for Michèle DE SAINT LAURENT, who first recognized that HENDERSON's (1888) *Pagurodes* consisted of three distinct taxa.

TYPE SPECIES. — *Pagurodes limatulus* Henderson, 1888. Gender masculine.

REMARKS. — HENDERSON (1888) described the genus *Pagurodes* for three superficially similar Indo-Pacific species collected during the "Challenger" expedition. *Pagurodes inarmatus* was based upon eight syntypes; *P. piliferus* and *P. limatulus* were each represented by single specimens, although a second small, poorly preserved specimen was "doubtfully" referred to *P. piliferus*. HENDERSON indicated that while the trichobranchiate gills, presumably, possessed by all three species suggested a relationship with *Parapagurus* Smith, 1879, *Pagurodes* was distinct because males had sexual tubes rather than paired first and second pleopods, modified as gonopods.

When DE SAINT LAURENT (1969) erected the genus *Acanthopagurus* de Saint Laurent, she expressed her belief that HENDERSON's (1888) species of *Pagurodes* actually represented three distinct genera. She designated *Pagurodes inarmatus* as the type species of HENDERSON's taxon, thus restricting *Pagurodes*, and indicated that *P. piliferus* and *P. limatulus* would be separated in a later publication. That separation was never formalized. Having now reexamined five of HENDERSON's syntypes of *P. inarmatus*, including the male specimen from "Challenger" station 168 upon which he based his description, as well as all "syntypes" of the two other species, it is clear that DE SAINT LAURENT (1969) was correct in her evaluation. *Pagurodes*, as defined by the characters of the examined syntypes of *P. inarmatus*, is a plainly identifiable taxon. Although *P. inarmatus* is not represented in the KARUBAR material, it is in the interest of stability in nomenclature that HENDERSON's (1888) described male (NHM 88.33) (Figs 15d, 35b-e) be designated as the lectotype of *P. inarmatus*.

ALCOCK (1905b) redescribed *P. limatulus*, pointing out that his female specimen(s) possessed paired first pleopods modified as gonopods; however, he did not propose a distinct genus for this species. Instead he simply noted in his generic description that paired first pleopods were present in females of at least one species. When BOUVIER (1922) assigned two new abyssal Atlantic species to *Pagurodes* sensu lato, he remarked that since his species were both represented by only single specimens, he could not be sure that all characters of the genus were present. As previously indicated, DE SAINT LAURENT (1969) noted that neither *P. limatulus* nor *P. piliferus* were congeners of *P. inarmatus*. Of *P. limatulus* she commented that this species would be assigned to a new taxon, together with BOUVIER's (1922) species, *Pagurodes richardi* Bouvier and *Pagurodes atlanticus* Bouvier. That publication was never completed. In his comprehensive treatment of Atlantic pagurids, INGLE (1993) retained *P. richardi* and *P. atlanticus* in *Pagurodes* (sensu BOUVIER, 1922), noting that until DE SAINT LAURENT's (1969) opinions could be reevaluated through a thorough study of HENDERSON's (1888) Indo-Pacific species, the generic placement of the Atlantic species was uncertain.

McLAUGHLIN (1988) considered the possible relationship of "*Pagurodes*" *limatulus* with the Atlantic "*Pagurus*" *piercei* Wass, 1963, unlikely, when she proposed the genus *Goreopagurus* for the latter taxon. The recent discovery of a second species of *Goreopagurus* from the eastern Pacific (McLAUGHLIN & HAIG, 1995) confirms the distinctive characters of this genus that set it apart from HENDERSON's (1888) species. *Pagurodes limatulus* is herein reassigned to *Michelopagurus* gen. nov. as its type species; *Pagurodes richardi* and *Pagurodes atlanticus* are also, provisionally, reassigned to this genus.

***Michelopagurus limatulus* (Henderson, 1888) new combination**

Figs 13a-d, 36a-f

Pagurodes limatulus Henderson, 1888: 97, pl. 10, fig. 6. — ALCOCK, 1905b: 107, pl. 12, fig. 6. — ESTAMPADOR, 1937: 507 (list). — GORDAN, 1956: 325 (lit.). — DE SAINT LAURENT, 1969: 740. — McLAUGHLIN, 1988: 262.
Pagurodes sp. ?*limatulus*: ALCOCK, 1901: 225.

MATERIAL EXAMINED. — **South of Philippines.** "Challenger", Stn 214, 1414 m: 1 ♂ holotype (3.5 mm) (NHM 88.33).

Indonesia. KARUBAR, *Kai Islands*: stn CP 20, 05°15'S, 132°59'E, 769-809 m, 25.10.1991: 5 ♂, 11 ♀, 3 ov. ♀ (2.1-3.6 mm) (MNHN-Pg 5274). — Stn CC 21, 05°14'S, 133°00'E, 688-694 m, 25.10.1991: 5 ♂, 6 ♀ (1.9-3.6 mm) (USNM 276001). — Stn CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 2 ♂, 3 ♀ (2.1-4.0 mm) (MNHN-Pg 5275); 2 ♀ (USNM 275997); 1 ♀ (1.7) (POLIPI); 1 ♂, 1 ♀ (2.9-3.2) (SNHM 4809). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 5.11.1991: 1 ♀ (2.4 mm) (POLIPI).

DIAGNOSIS. — Shield (Figs 13c, 36a, d) broader than long. Rostrum produced beyond level of lateral projections, broadly rounded. Lateral projections somewhat produced, broadly rounded. Ocular peduncles (including corneae) very short and stout, less than half length of shield; corneae 0.25 to 0.33 length of peduncles, dilated little if at all. Ocular acicles triangular, with submarginal spine.

Antennular peduncle with very prominent spine on dorsolateral margin of basal segment. Third segment of antennal peduncle with very strong spine at ventrodiscal angle; second segment with dorsolateral distal angle strongly produced, terminating in simple or bifid spine and frequently with small secondary spine on mesial margin, dorsomesial distal angle with acute spine. Sternite of third maxillipeds with prominent spine on either side of midline.

Right cheliped (Figs 36b, e) moderately elongate. Dactyl slightly shorter than palm; surface with scattered setae, occasionally unarmed but more frequently with row of tubercles on dorsomesial margin. Palm narrow, somewhat compressed dorsoventrally; dorsomesial margin tuberculate and with 2 or 3 prominent spines at proximal margin, convex dorsal surface with short transverse sometimes tuberculate ridges and rows of setae, usually 1 spine or tubercle in midline at proximal margin. Carpus with row spines on dorsomesial margin, dorsal surface often with short transverse rows of tubercles and slightly oblique row of small spines, dorsolateral margin with irregular row of small spines not extending to proximal or distal margins. Merus with irregular single or double row of spines or spinulose protuberances on ventrolateral margin, most distal usually strongest; ventromesial margin with row of small spines.

Left cheliped (Figs 36c, f) with elongate slender unarmed or weakly tuberculate dactyl and fixed finger, tending to curve ventrally. Palm with midline elevated and armed 1 or 2 double rows of small spinules or tubercles, dorsal surface spinulose or tuberculate. Carpus with row of spines on both dorsolateral and dorsomesial margins; ventrolateral margin with row of tuberculate spines or spinules. Merus with small spines on distal half of ventromesial margin; 1 to 3 spines distally and transverse rows of spinules or tubercles in proximal half of ventrolateral margin.

Second and third pereopods similar from left to right. Dactyls 1.20 to 1.35 length of propodi; dorsal margins each with row of stiff setae, mesial and lateral faces each with longitudinal sulcus, flanked above on mesial faces by 1 or 2 rows of corneous spinules; ventral margins each with row of 11 to 19 corneous spines. Propodi with low protuberances and tufts of setae on dorsal surfaces, 1 or 2 corneous spinules at ventrodiscal margins. Carpi each with dorsodistal spine and row of low protuberances with tufts of setae on dorsal surface. Meri each with 1 to 3 spines at ventrolateral distal angle and row, sometimes double, of spinules or tubercles on ventral surface (second) or unarmed (third). Fifth pereopods weakly semichelate. Anterior lobe of sternite of third pereopods subrectangular, subdivided by median longitudinal groove into two sub-lobes, each with tuft of setae.

Males usually with vas deferens produced as short, almost transparent, sexual tube from both right and left coxa of fifth pereopods, sometimes from only one, and occasionally hardly produced at all.

Telson (Fig. 13d) with prominent median cleft separating slightly asymmetrical posterior lobes; rounded terminal margins each with 3 to 7 prominent spines often interspersed with smaller spines.

COLOR (in preservative). — Overall reddish orange.

HABITAT. — Gastropod shells sometimes encased in bryozoan.

DISTRIBUTION. — South of Philippine Islands, Indonesia; ?Travancore coast of India; 620 - 1414 m.

AFFINITIES. — *Michelopagurus limatulus* shows greater affinity to *M. chacei* sp. nov. than to either of its Atlantic congeners, particularly in the armature of the telson and lack of armature of the anterior lobe of the

sternite of the third pereopods. The two Indo-Pacific species are separated by the shorter and more stout ocular peduncles of *M. limatulus* and its more elongate and slender chelipeds.

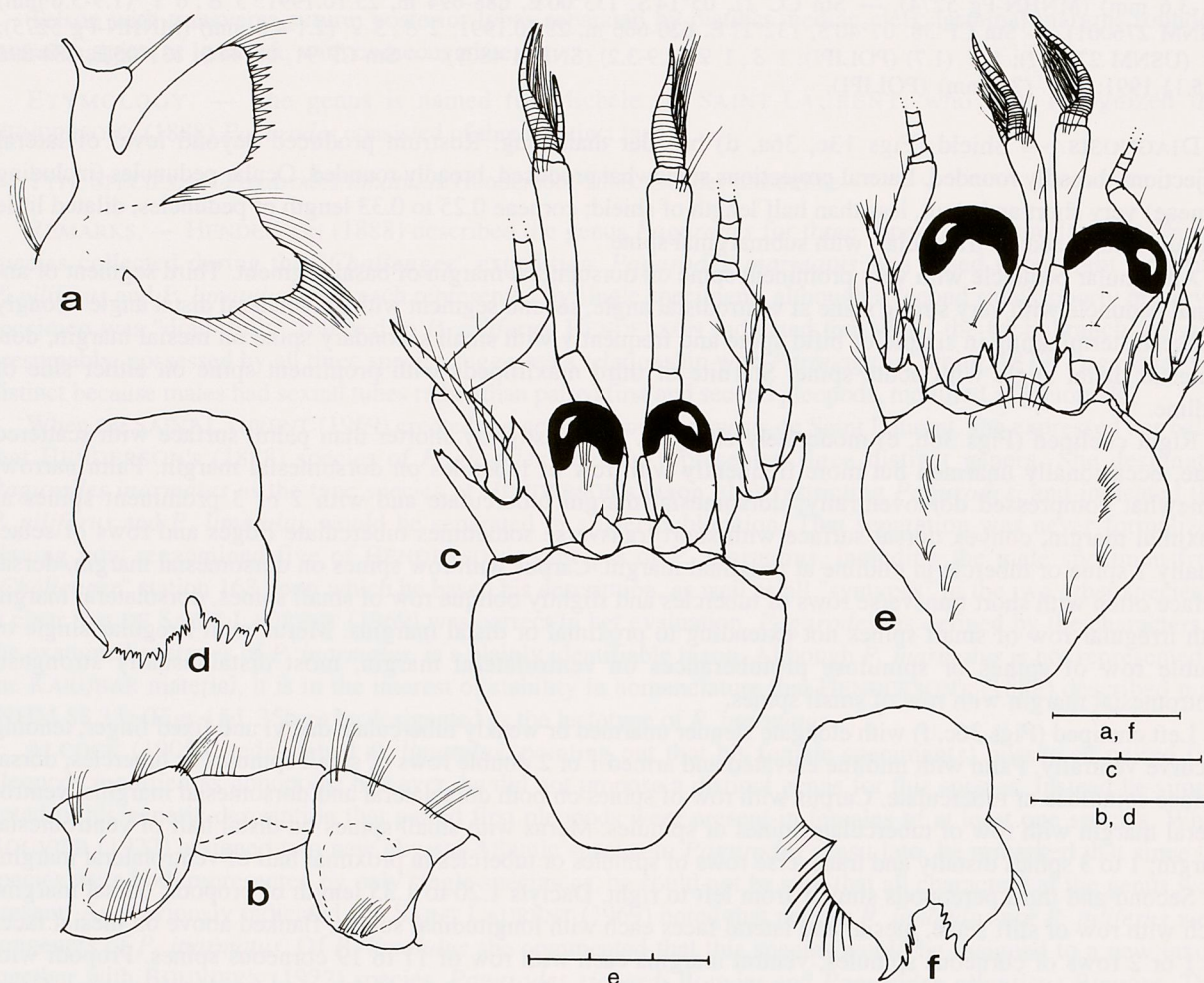


FIG. 13. — *Michelopagurus limatulus* (Henderson, 1888), new combination, a-d, ♂ (2.8 mm) from KARUBAR Stn CP 38. — *Pseudopagurodes piliferus* (Henderson, 1888), new combination, e-f, holotype ♀ (4.5 mm) from "Challenger" Stn Tablas Islands (NHM 88.33): a, left maxillule; b, sternite and coxae of fifth pereopods; c-e, shield and cephalic appendages; d-f, telson. Scales equal 0.5 mm (a), 1.0 mm (b, d, f), 2.0 mm (c), and 3.0 mm (e).

REMARKS. — In addition to the species of HENDERSON (1888) and BOUVIER (1922) now assigned to *Michelopagurus*, DE SAINT LAURENT (1969) indicated that she had seen three undescribed species among the "Albatross" and "Siboga" collections. As indicated above, one additional species assignable to this genus is present in the KARUBAR material, but it is unknown whether it is one of the three seen by DE SAINT LAURENT.

Michelopagurus chacei sp. nov.

Figs 14a-h, 37c-e

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 24.10.1991: 1 ov. ♀ (2.5 mm) (MNHN-Pg 5276). — Stn CP 26, 05°34'S, 132°52'E, 265-302 m, 26.10.1991: 1 ♂ (2.1 mm) (MNHN-Pg 5277).

TYPES. — The ovigerous female (2.5 mm) (MNHN-Pg 5276) from KARUBAR station DW 13 is the holotype. The other specimen is a paratype.

DESCRIPTION. — Shield (Fig. 14a, 37c) as broad or slightly broader than long; anterolateral margins slightly terraced; posterior margin truncate; dorsal surface with scattered tufts of setae. Rostrum broadly rounded, reaching approximately to level of lateral projections. Lateral projections strongly produced, obtusely triangular, unarmed.

Ocular peduncles short and stout, dorsal surface with tufts of setae; corneae large, occupying 0.25 to 0.33 length of peduncle, but only weakly dilated. Ocular acicles triangular, terminating subacutely and with strong submarginal spine; separated basally by approximately 0.75 basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles (including corneae) by 0.25 to 0.50 length of ultimate peduncular segment. Ultimate segment with prominent tuft of long setae on dorsal surface distally and with row of short setae at least in distal half. Penultimate segment glabrous. Basal segment with acute spine on dorsolateral margin.

Antennal peduncle overreaching ocular peduncles by nearly full length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in strong simple or bifid spine and sometimes with small accessory spine on mesial margin; dorsomesial distal angle with prominent spine. First segment with spine at laterodistal margin and 1 spine on ventrodistal margin. Antennal acicle quite long, reaching to distal half of fifth peduncular segment; terminating in acute spine and tuft of setae; mesial margin with few setae. Antennal flagellum long but usually not overreaching tips of dactyls of outstretched ambulatory legs; with 1 or 2 very few short setae every 2 to 4 articles.

Chelipeds subequal; right usually slightly longer and stouter. Right cheliped (Figs 14b, 37d) elongate, moderately slender. Dactyl 1.10 to 1.20 length of palm; dorsomesial margin with row of very small spines, dorsal surface unarmed but with few scattered setae; mesial and ventral surfaces with scattered setae; cutting edge with 2 widely-spaced calcareous teeth in proximal half, row of corneous teeth distally. Palm slightly compressed dorsoventrally; 0.75 length of carpus; dorsomesial margin with irregular row of small spines, decreasing in size distally, dorsolateral margin not delimited; dorsal, mesial and lateral surfaces unarmed but with scattered short setae; fixed finger unarmed; cutting edge with 2 large and distal row of small calcareous teeth. Carpus slightly broadened distally; dorsomesial margin with row of prominent spines, dorsolateral margin distinct proximally and armed with irregular row of very small spinulose tubercles; dorsal surface with double longitudinal row of very small spines laterad of midline and numerous very small spines forming short quasi-transverse rows in proximal half; mesial and lateral faces with sparse tufts of setae; ventrolateral distal angle with small spine. Merus with transverse rows of setae dorsally; ventromesial distal angle with 1 spine and few marginal spinules; ventrolateral margin with 2 spines distally and spinules proximally. Ischium with ventromesial margin spinulose proximally.

Left cheliped (Figs 14c, 37e) only slightly shorter than right. Dactyl and fixed finger long and slender, somewhat dorsoventrally compressed, with tips deflected ventrally; margins of dactyl and fixed finger not delimited, rounded surfaces smooth. Palm markedly shorter than both dactyl and carpus; dorsal surface elevated in midline and armed with row of small spines not extending onto fixed finger, dorsomesial margin with row of small spines on spinulose tubercles; dorsolateral margin not delimited, lateral surface with few small spinules dorsally. Carpus with dorsolateral and dorsomesial margins each with row of spines, 1 spine on dorsodistal margin; ventrolateral distal angle with 1 or 2 small spines, ventral surface spinulose. Merus with transverse rows of setae on dorsal margin; ventrolateral margin with row of spines, ventromesial margin with row of very small spines or spinules. Ischium unarmed.

Ambulatory legs (Figs 14d-e) similar from left to right; moderately long and slender; overreaching outstretched chelipeds by nearly entire length of dactyls. Dactyls relatively long, 1.10 to 1.25 length of propodi; nearly straight; dorsal surfaces each with row of stiff setae; mesial and lateral faces with few setae; ventral margins each with 9 to 11 corneous spines. Propodi each with irregular row of setae on dorsal surface; mesial and lateral faces unarmed; ventral surfaces with few setae and 1 or 2 corneous spines at distal angle. Carpi each with small dorsodistal spine and dorsal row of sparse tufts of setae. Meri usually with 1 or 2 spinules distally on ventral margins of second, third unarmed but with few dorsal and ventral setae. Ischia unarmed. Sternite of third pereopods

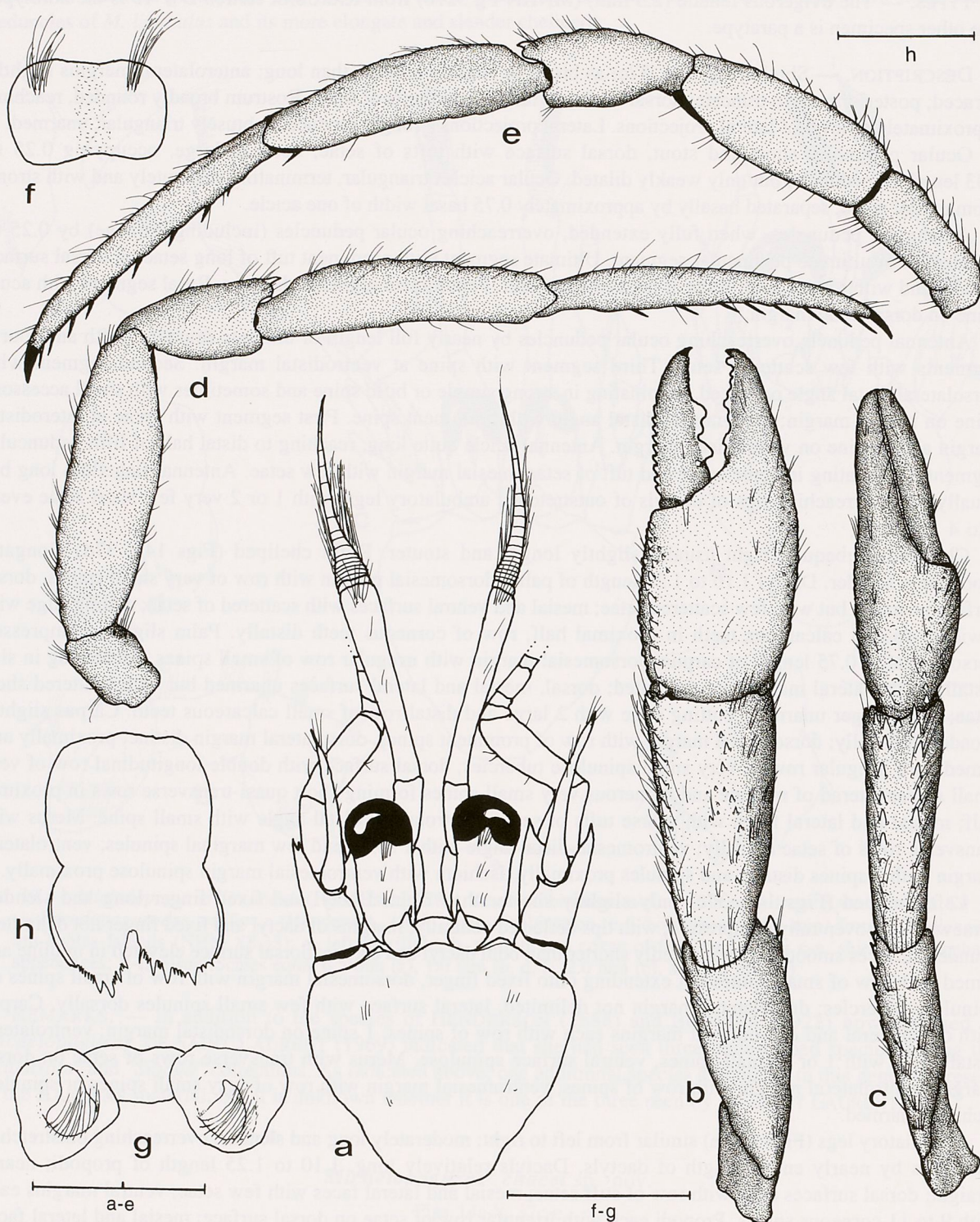


FIG. 14. — *Michelopagurus chacei* sp. nov. a, f, h, holotype ♂ (2.5 mm) from KARUBAR Stn DW 13; b-e, g, paratype ♂ (2.1 mm) from Stn CP 26: a, shield and cephalic appendages; b, right cheliped; c, left cheliped; d, second right pereopod (lateral view); e, third left pereopod (lateral view); f, anterior lobe of sternite of third pereopods; g, coxae and sternite of fifth pereopods; h, telson. Scales equal 0.5 mm (f, h), 1.0 mm (g), and 2.0 (a-e).

with anterior lobe (Fig. 14f) broadly subrectangular, concave as result of median depression, unarmed but with submarginal tuft of setae adjacent to each lateral angle. Fifth pereopods chelate.

Coxae of fifth pereopods in males (Fig. 14g) with short right sexual tube and even shorter left.

Telson (Fig. 14h) with well defined transverse suture; posterior lobes subcircular to subtriangular, median cleft prominent; terminal margins slightly oblique or rounded, armed with 3 to 5 spines interspersed with much smaller slender spines or spinules.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — Kai Islands, Indonesia; 264-425 m.

ETYMOLOGY. — Dedicated to Dr Fenner A. CHACE, Zoologist Emeritus of the Division of Crustacea, National Museum of Natural History, Smithsonian Institution, who, during a continuing long and active career has contributed so much to decapod systematics.

AFFINITIES. — As previously noted, *Michelopagurus chacei* bears a considerable resemblance to *M. limatulus*, particularly in the structure of the anterior lobe of the sternite of the third pereopods and development of the telson armature. In addition to the distinguishing characters of *M. limatulus* mentioned above, the shield of *M. chacei* tends to be slightly broader and the antennular flagella longer than seen in *M. limatulus*; however, these characters may well be subject to intraspecific variation when large samples are available for examination. The ambulatory legs appear to provide the best characters for separating the two species. A row of spinules or tubercles is present on the ventral margins of the meri of the second pereopods of *M. limatulus*, and the ventral margins of the dactyls are provided with 11 to 19 corneous spines. In *M. chacei*, the meri of the second pereopods have only one or two distal spinules on the ventral margins; the ventral margins of the dactyls are armed with nine to 11 corneous spines.

Genus *PSEUDOPAGURODES* nov.

Pagurodes Henderson, 1888: 94 (in part). — ALCOCK, 1901: 224; 1905b: 106 (in part). — GORDAN, 1956: 324 (in part; lit.). — DE SAINT LAURENT, 1969: 740 (in part).

DIAGNOSIS. — Eleven pairs of intermediate type gills. Rostrum reduced and rounded. Ocular acicles small, widely separated. Maxillule with external lobe of endopod well developed, not recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth. Chelipeds subequal. Dactyls of ambulatory legs without corneous spinules on ventral margins. Fourth pereopods semichelate; propodal rasp with single row of scales; no preungual process at base of dactylar claw. Fifth pereopods chelate.

Male unknown. Female with paired gonopores, no paired pleopods on first abdominal somite, and 4 unequally biramous left pleopods on somites 2 to 5.

Asymmetrical uropods. Telson with transverse suture, subtriangular posterior lobes separated by median cleft.

ETYMOLOGY. — From the Greek *pseudes* meaning false, and *pagouros* meaning crab, reflecting the deceptive similarities between this genus and *Pagurodes* sensu stricto.

TYPE SPECIES. — *Pagurodes piliferus* Henderson, 1888. Gender masculine.

REMARKS. — With the restriction of *Pagurodes* to taxa exhibiting the characters manifest by *P. inarmatus* and the establishment of *Michelopagurus* gen. nov. for *P. limatulus*, *Pagurodes piliferus* is left in a systematic limbo. The damaged male specimen from the Arafura Sea that HENDERSON (1888) doubtfully assigned to *P. piliferus* was subsequently redetermined to be *Pagurus compressipes* Miers, 1884, by M. DE SAINT LAURENT (unpublished). I concur with her identification. The remaining, and true type specimen of *Pagurodes piliferus* (NHM 88.33) is a female (Figs 13e-f, 37a-b) with intermediate gills, thus clearly not allied to *Pagurodes* sensu stricto, nor to

Michelopagurus gen. nov. In gill structure *Pseudopagurodes* approaches *Tarrasopagurus* gen. nov., but differs from that genus in having subequal, elongate chelipeds and ambulatory legs, while lacking paired first pleopods. No specimens of *Pseudopagurodes* were found during the KARUBAR expedition.

Genus *ICELOPAGURUS* nov.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Rostrum triangular. Ocular acicles triangular, elongate. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 15a) with external lobe of endopod rudimentary or vestigial. Crista dentata of third maxilliped somewhat reduced, but with accessory tooth. Chelipeds elongate, subequal, right stouter. Sternal plate of third pereopods broad, with weak longitudinal groove. Fourth pereopods semichelate; with single row of spiniform scales in propodal rasp; dactyl with tubular preungual process (Fig. 15b).

Coxae of fifth pereopods in males (Fig. 15c) symmetrical, right with stout, relatively short sexual tube directed posteriorly and externally, left usually with very short sexual tube; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; without paired first pleopods modified as gonopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture; rounded posterior lobes separated by distinct median cleft with nearly perpendicular margins, terminal margins armed; lateral margins with very narrow chitinous plate.

TYPE SPECIES. — *Icelopagurus crosnieri* sp. nov. Gender masculine.

ETYMOLOGY. — From the Greek *ikelos* meaning like or resembling, and *pagouros* meaning crab, and referring to the similarities shared with another pagurid genus, namely, *Catapagurus*.

REMARKS. — As indicated in the derivation of its name, *Icelopagurus* is superficially very similar to *Catapagurus*. Both genera are characterized by unusually elongate ocular acicles, rudimentary or vestigial external endopodal lobe on the maxillule, more or less reduced crista dentata with one accessory tooth, distinctive tubular preungual process on the dactyl of the fourth pereopod, well developed right male sexual tube, and females lacking specialized secondary sexual characters. However, *Icelopagurus* is readily separated from *Catapagurus* by the shortness of the male sexual tube that does not curve up over the dorsal surface of the body and by the very distinctive development of the telson.

Icelopagurus is also ostensibly quite similar to *Pagurodes* sensu stricto. As presently known, both taxa are monotypic, and their type species share such immediately observable characters as elongate chelipeds and ambulatory legs, well calcified shields that tend to be somewhat vaulted, long antennal acicles, triangular rostra, very short, stout ocular peduncles provided with low protuberances and tufts of setae, and males with a short sexual tube arising from the coxa of the right fifth pereopod and an even shorter tube from the left (Figs 15c-d). However, upon closer inspection, the ocular acicles of *Pagurodes inarmatus* (Fig. 35b) are short, reaching only to the basal portion of the peduncles; the external lobe of the maxillular endopod is completely absent; the gills are trichobranchiate; the dactyl of the fourth pereopod lacks a preungual process; and the posterior lobes of the telson are acutely subtriangular with strongly oblique terminal margins armed with 3 or 4 small spines. In contrast, *I. crosnieri* sp. nov. has very long ocular acicles (fig. 38b), reaching to or beyond the bases of the corneae; the external lobe of the maxillular endopod is vestigial; the gills are phyllobranchiate; the dactyl of the fourth pereopod is provided with a large tubular preungual process; and the posterior lobes of the telson are broadly rounded, with convex terminal margins armed with 4 or 5 widely-spaced long corneous spines.

Icelopagurus crosnieri sp. nov.

Figs 15a-c, e-j, 38a-d

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Tanimbar Islands*: stn CP 87, 08°49'S, 130°49'E, 1017-1024 m, 5.11.1991: 1 ♀ (5.2 mm) (USNM 276004). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 5.11.1991: 1 ov. ♀ (4.3 mm) (MNHN-Pg 5278); 1 ♂, 2 ♀, 1 ov. ♀ (3.1-4.3 mm) (MNHN-Pg 5279); 1 ♀ (3.2 mm) (POLIPI).

TYPES. — The ovigerous female (4.3 mm) (MNHN-Pg 5278) from KARUBAR station CP 91 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 15e; 38a-b) broader than long, well calcified, slightly vaulted; cervical groove deep; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with numerous tufts of setae. Posterior carapace with patches of calcification medianly posterior to cervical groove, remainder membranous. Rostrum triangular, terminally subacute or acute, usually not reaching level of lateral projections. Lateral projections strongly produced, acutely or obtusely triangular, with prominent terminal marginal or submarginal spine.

Ocular peduncles very short and stout, dorsal surface with tufts of setae; corneae large, occupying 0.25 to 0.33 length of peduncle, but not dilated. Ocular acicles slender, elongate, length variable (extending from 0.25 length of peduncle to nearly base of cornea), terminating acutely or with distinct spine; separated basally by entire to 1.25 basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles by slightly less to slightly more than entire combined lengths of ultimate and penultimate peduncular segments. Ultimate segment with prominent tuft of long setae on dorsal surface distally and with additional row of short setae. Penultimate segment with sparse row of short setae dorsally. Basal segment unarmed.

Antennal peduncle overreaching ocular peduncles by at least 0.25 length of penultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in simple or bifid spine and with small accessory spine on lateral margin; dorsomesial distal angle with small spine. First segment with spine at laterodistal margin and 1 spine on ventrodistal margin. Antennal acicle quite long, reaching to or beyond distal margin of fifth peduncular segment; terminating in acute spine; mesial margin with row of long setae. Antennal flagellum long but usually not overreaching tips of dactyls of outstretched ambulatory legs, naked or with very few short setae on proximal articles. Sternite of third maxillipeds with median concavity, unarmed.

Chelipeds subequal; right usually slightly longer and stouter. Right cheliped (Figs 15f, 38c) with dactyl 0.65 to 0.80 length of palm; dorsomesial margin rounded, unarmed or minutely spinulose, dorsal surface with scattered moderately long setae and row of shorter setae adjacent to cutting edge; ventral surface also with few tufts of setae; cutting edge calcareous, with 2 prominent teeth. Palm somewhat dorsoventrally compressed; slightly shorter to approximately equal to length of carpus; dorsomesial and dorsolateral margins not well defined; dorsal, mesial and lateral surfaces covered with very small spinules or tubercles; fixed finger minutely spinulose on proximal portion of dorsal surface; cutting edge with 2 or 3 large and distal row of small calcareous teeth. Carpus appreciably broadened distally; dorsomesial and dorsolateral margins distinct distally, each armed with irregular double row of small spines or spinulose tubercles; dorsal surface with numerous small spines; mesial and lateral faces with spinules or tubercles dorsally, minutely spinulose or granular ventrally. Merus with all surfaces uniformly spinulose or tuberculate. Ischium with minutely spinulose ventromesial margin.

Left cheliped (Fig. 38d) only slightly shorter than right. Dactyl and fixed finger long and slender, somewhat dorsoventrally compressed, with tips deflected ventrally; margins of neither dactyl nor fixed finger delimited, rounded surfaces smooth or minutely spinulose. Palm markedly shorter than both dactyl and carpus; dorsal surface weakly convex, dorsomesial and dorsolateral margins not delimited; all surfaces spinulose or tuberculate, ventral surface minutely so. Carpus with dorsal surface relatively flat, covered with small spines; mesial, lateral and ventral surfaces spinulose. Merus with dorsal, lateral and ventral surfaces uniformly spinulose; mesial face nearly smooth. Ischium with minutely spinulose ventral margin.

Ambulatory legs (Figs 15g-h) similar from left to right; slender and very long, overreaching outstretched chelipeds by half to entire length of dactyls. Dactyls long, very slender, ventrally curved, and slightly twisted distally; approximately 1.25 length of propodi; dorsal surfaces each with row of low protuberances and long stiff setae; mesial faces each with longitudinal row of shorter setae. Propodi each with irregular double row of small spines and short setae on dorsal surface; mesial, lateral and ventral surfaces usually spinulose. Carpi with single or double row of small spines on dorsal surface; mesial and lateral faces spinulose, at least dorsally. Meri with spinulose dorsal, lateral and ventral surfaces, spinules strongest ventrally; mesial faces smooth or minutely spinulose. Ischia with minutely spinulose ventral margins. Fifth pereopods weakly chelate.

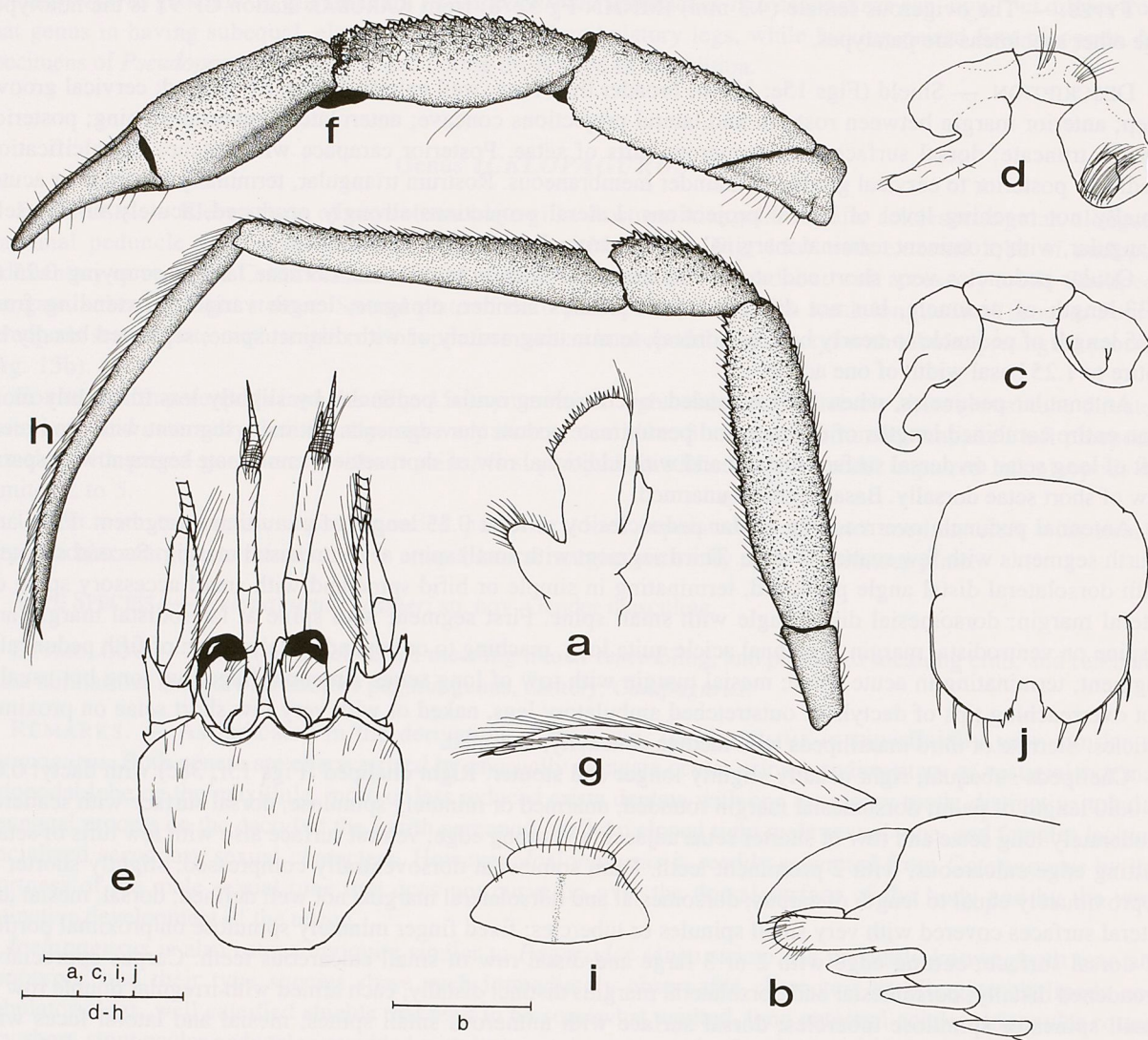


FIG. 15. — *Icelopagurus crosnieri* sp. nov. a, c, g-j, paratype ♂ (3.1 mm) from KARUBAR Stn CP 91; b, paratype ♀ (5.2 mm) from Stn CP 87; e, holotype ♂ (4.3 mm) from Stn CP 91; f, paratype ♀ (4.3 mm) from Stn CP 91. — d, *Pagurodes inarmatus*, lectotype ♂ (7.0 mm) from "Challenger" Stn 168: a, maxillule; b, distal portion of dactyl of fourth pereopod; c-d, sternite and coxae of fifth pereopods; e, shield and cephalic appendages; f, right cheliped (mesial view); g, dactyl of right second pereopod (mesial view); h, left third pereopod (lateral view); i, sternite of third pereopods; j, telson. Scales equal 0.25 mm (b), 0.5 mm (j), 1.0 mm (a, c, i), and 3.0 mm (d-h).

Sternite of third pereopods (Fig. 15i) broad; anterior lobe subrectangular, unarmed but with marginal row of setae.

Coxae of fifth pereopods in males (Fig. 15c) with right sexual tube short and moderately thick basally, curving posteriorly and externally; small protuberance of left vas deferens.

Telson (Fig. 15j) with prominent transverse suture; posterior lobes obliquely rounded and chitinous lateral plate armed with 4 to 6 long corneous spines; median cleft prominent, margins slightly oblique and armed with 0 to 2 small spines and often 1 more prominent at outer angle.

COLOR. — Unknown.

HABITAT. — Gastropod shells.

DISTRIBUTION. — Tanimbar Islands, Indonesia; 884-891 m.

ETYMOLOGY. — Dedicated to Alain CROSNIER, marine biologist of ORSTOM, who made the collection available for study.

AFFINITIES. — *Icelopagurus crosnieri* most closely resembles *Catapagurus oculocrassus* sp. nov. in overall morphology, but is immediately distinguished from that species by the major differences in the telsons of the two species. As noted in the remarks for the genus, *I. crosnieri* also shares several general characters with *Pagurodes inarmatus*, but differs significantly from the latter species in the spination of the chelipeds, as well as in the numerous characters cited above.

Genus *TARRASOPAGURUS* nov.

DIAGNOSIS. — Eleven pairs of intermediate gills. Rostrum obtusely triangular or broadly rounded, with 1 or more marginal spinules. Ocular acicles triangular. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 16a) with external lobe of endopod moderately well developed, not recurved. Crista dentata well developed, 1 accessory tooth. Chelipeds markedly unequal, right considerably longer and stronger. Fourth pereopods semichelate; with single row of scales in propodal rasp.

Coxae of fifth pereopods in males (Fig. 16b) generally symmetrical, left with short sexual tube directed anteriorly or posteriorly, right sometimes also with short tube developed, sometimes with vas deferens only slightly protruded; 3 unpaired, unequally biramous pleopods. Females with paired gonopores; paired first pleopods modified as gonopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture; posterior lobes subequal, terminal margins oblique.

ETYMOLOGY. — From the Greek *tarraso* meaning confused, and *pagouros* meaning crab, and referring to the characters of this genus shared with several other pagurid genera.

TYPE SPECIES. — *Tarrasopagurus rostrodenticulatus* sp. nov. Gender masculine.

REMARKS. — As its etymology indicates, *Tarrasopagurus* shares a number of characters with several other pagurid genera. In having intermediate type gills (Fig. 16c), markedly unequal chelipeds and relatively short ambulatory legs, it agrees with *Cestopagurus* as redefined by DE SAINT LAURENT (1968c). It is distinguished from species of *Cestopagurus* by the presence in the latter genus of an elongate right sexual tube, which is directed from right to left across the ventral part of the body and a very short left sexual tube that may or may not be developed. Intermediate gills are also a character that *Tarrasopagurus* shares with *Pseudopagurodes*, but females of that genus lack the paired first pleopods found in *Tarrasopagurus* species; males of *Pseudopagurus* are not presently known. Short paired male sexual tubes is a character that *Tarrasopagurus* shares with *Parapagurodes* McLaughlin & Haig, 1973; but again, females of this latter genus lack paired first pleopods modified as gonopods. A character that *Tarrasopagurus* shares with *Michelopagurus* nov. gen., in addition to short or very short male sexual tubes, is paired female first pleopods. However, the gills in *Michelopagurus* are clearly trichobranchiate in structure, whereas those of *Tarrasopagurus* are intermediate. The chelipeds in this genus are grossly unequal; the ambulatory legs are relatively short, overreaching the outstretched right cheliped little if at all. In contrast, the chelipeds of *Michelopagurus* species are elongate and subequal; the ambulatory legs are long and slender, and considerably overreach the outstretched chelipeds.

Tarrasopagurus rostrodenticulatus sp. nov.

Figs 16a-l

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn CP 05, 05°49'S, 132°18'E, 296-299 m, 22.10.1991: 1 ♂ (2.7 mm) (MNHN-Pg 5280). — Stn DW 13, 05°26'S, 132°38'E, 417-425 m, 24.10.1991: 4 ♀ (0.9-

1.2 mm) (MNHN-Pg 5281). — Stn DW 18, 05°17'49"S, 133°00'51"E, 205-212 m, 24.10.1991: 4 ♂, 4 ♀ (1.6-1.8 mm) (MNHN-Pg 5282); 1 ♂, 2 ♀ (1.0-1.1 mm) (POLIPI); 2 ♂, 4 ♀, 1 ov. ♀ (1.3-1.7 mm) (USNM 276011). — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 26.10.1991: 1 ♂ (1.6 mm) (MNHN-Pg 5283). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♀ (1.9 mm) (USNM 276010).

TYPES. — The male (2.7 mm) (MNHN-Pg 5280) from KARUBAR station CP 05 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 16d) longer than broad; anterior margin between rostrum and lateral projections weakly concave; anterolateral margins terraced; posterior margin truncate; dorsal surface with few tufts of setae. Rostrum broadly rounded or weakly subtriangular, usually not reaching level of lateral projections, armed with 1 to several small marginal spines or spinules. Lateral projections broadly rounded or obtusely triangular, usually with small terminal marginal or submarginal spine.

Ocular peduncles short and stout; corneae occupying approximately 0.15 to 0.25 length of peduncle, not dilated. Ocular acicles small, triangular, with submarginal spine; separated basally by 0.75 to entire basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles (including corneae) by slightly less to slightly more than entire length of ultimate peduncular segment. Ultimate segment with 1 long seta on dorsal surface in distal third, and with additional row of sparse short setae. Penultimate segment with few short setae dorsally. Basal segment with strong spine on dorsolateral margin.

Antennal peduncle overreaching ocular peduncles by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in bi- or trifid spine and usually with 1 or 2 smaller accessory spines on both lateral and mesial margins; dorsomesial distal angle with small spine. First segment with spine at laterodistal margin and 1 or 2 spines on ventrolateral margin. Antennal acicle long, reaching to or beyond distal margin of cornea; terminating in acute spine and tufts of moderately long setae. Antennal flagellum long but usually not overreaching tips of dactyls of outstretched ambulatory legs; with 1-3 moderately long and 1 or 2 very short setae every, or every other, article. Sternite of third maxillipeds with slight median concavity, unarmed.

Chelipeds markedly unequal; right longer and stronger. Right cheliped (Figs 16e-f) with dactyl 0.65 to 0.80 length of palm; armature variable: dorsomesial margin rounded and unarmed, delimited but unarmed, or delimited by row of small spines; dorsal surface convex or with distinct median elevation, unarmed or with scattered small spinules or tubercles; ventral surface with few tufts of setae; cutting edge calcareous, usually with 2 more prominent teeth. Palm somewhat dorsoventrally swollen; slightly to considerably shorter than carpus; dorsomesial and dorsolateral margins frequently not well defined, often armed with 1 or 2 irregular rows of low tubercles, strongest mesially, less commonly with irregular, almost double row of distinct spines on dorsomesial margin and row of blunt spines or spinulose tubercles on dorsolateral margin extending nearly to tip of fixed finger; dorsal surface with few very small tubercles, with scattered small tubercles and spinules, or with numerous small spines; mesial, lateral and ventral surfaces with few scattered setae; fixed finger sometimes with few spinules or low tubercles on dorsal surface; cutting edge calcareous, also usually with 2 or 3 larger teeth. Carpus somewhat longer than merus; with double or triple row of small spines on and/or adjacent to dorsomesial margin; longitudinal row of small spines or spinules on dorsal surface laterad of midline, dorsolateral margin not delimited, but dorsal surface laterally and extending onto lateral faces usually armed with scattered spinules or tubercles; ventrolateral margin usually with few spinules; mesial surface generally glabrous; ventral surface with few long setae. Merus with few very short setae on dorsal surface; ventrolateral margin with row of 4 or 5 slender spines, ventromesial margin with 1 or 2 spines distally. Ischium unarmed.

Left cheliped (Figs 16g-h) reaching to or slightly beyond base of dactyl of right; with or without hiatus between dactyl and fixed finger. Dactyl 0.25 to 0.33 longer than palm; dorsomesial margin not delimited, dorsal, mesial and ventral surfaces with few scattered setae. Palm 0.50 to 0.75 length of carpus; dorsal surface elevated in midline and armed with row of spines usually extending at least to proximal half of fixed finger; dorsomesial surface weakly to strongly sloping, with longitudinal row of spines not clearly marginal; dorsolateral surface very strongly sloping, usually with 1 longitudinal row of small spinules and scattered spinules or tubercles; ventral

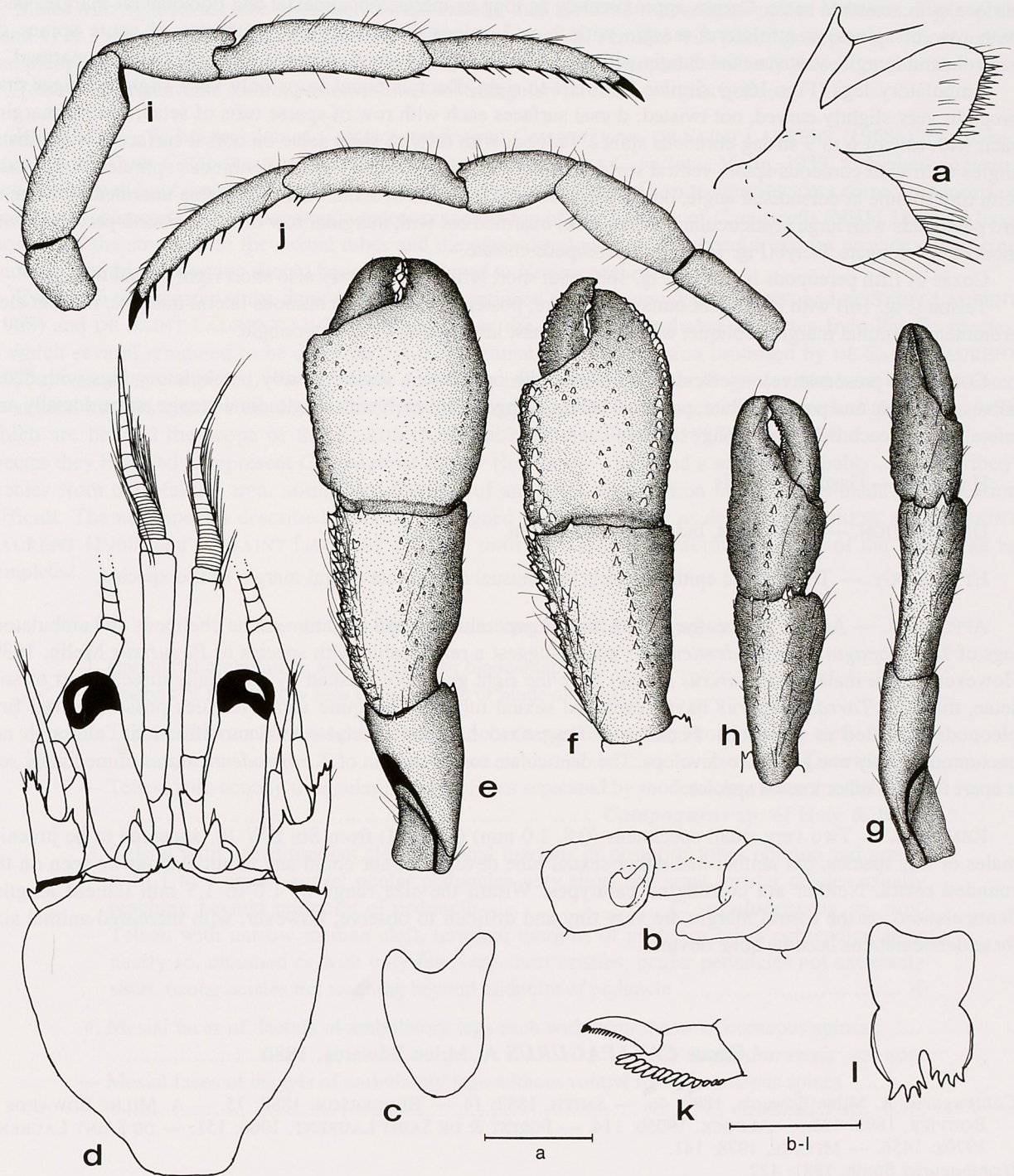


FIG. 16. — *Tarrasopagurus rostrodenticulatus* sp. nov., a, c, f, h, paratype ♂ (1.5 mm) from KARUBAR Stn DW 18; d, holotype ♂ (2.7 mm) from Stn CP 05; b, e, g, i-l, paratype ♂ (1.5 mm) paratype, from Stn DW 18: a, right maxillule; b, coxae and sternite of fifth pereopods; c, intermediate arthrobranchiate gill lamella; d, shield and cephalic appendages; e, right cheliped (dorsal view); f, carpus and chela of right cheliped (dorsal view); g, left cheliped (dorsal view); h, carpus and chela of left cheliped (dorsal view); i, second right pereopod (lateral view); j, third left pereopod (lateral view); k, propodus and dactyl of left fourth pereopod (lateral view); l, telson. Scales equal 0.25 mm (a, c), 0.5 mm (b, k, l), and 1.0 mm (d-j).

surface with scattered setae. Carpus approximately as long as merus; dorsomesial and dorsolateral margins each with row of spines; ventrolateral margin with 2 or 3 spines distally. Merus with row of acute spines on ventrolateral margin, ventromesial margin with 3 or 4 widely-spaced small spines or spinules. Ischium unarmed.

Ambulatory legs (Figs 16i-j) similar from left to right. Dactyls equal to or only very slightly longer than propodi; very slightly curved, not twisted; dorsal surfaces each with row of sparse tufts of setae; ventral margins each with row of 6 to 9 strong corneous spines. Propodi with tufts of short setae on dorsal surfaces; ventrodiscal angles each with corneous spine, ventral surfaces each with row of widely-spaced corneous spinules. Carpi each with tiny spinule at dorsodistal angle, dorsal surfaces with few tufts of setae. Meri and ischia unarmed. Sternite of 3rd pereopods with large semicircular anterior lobe, unarmed but with marginal row of setae. Fourth pereopod with moderately elongate dactyl (Fig. 16k). Fifth pereopods chelate.

Coxae of fifth pereopods in males (Fig. 16b) with short left and frequently also short right sexual tube.

Telson (Fig. 16l) with prominent transverse suture; posterior lobes with chitinous lateral margins, median cleft prominent; terminal margins oblique, with 4 or 5 spines, largest usually at outer angle.

COLOR (in preservative). — Ocular peduncles with orange tint, darker basally. Ambulatory legs with distal halves of dactyls and propodi white, proximal halves orange; carpi each with longitudinal orange stripe dorsally and laterally; meri each with faint orange band on lateral face distally.

HABITAT. — Gastropod shells.

DISTRIBUTION. — Kai Islands, Indonesia; 205-425 m.

ETYMOLOGY. — The specific epithet reflects the unusual denticulate rostral margin of this species.

AFFINITIES. — At first glance, the small size and general shape and armature of the chelipeds and ambulatory legs of *Tarrasopagurus rostrudenticulatus* might suggest a relationship with species of *Pagurixus* Melin, 1939. However, where males of *Pagurixus* species have the right gonopore masked by a mesially directed tuft of stiff setae, males of *Tarrasopagurus* have developed sexual tubes, albeit quite short; females possess paired first pleopods modified as gonopods. Females of *Pagurixus* have no special sexual modifications, although not uncommonly only one gonopore develops. The denticulate rostral margin of *T. rostrudenticulatus* immediately sets it apart from all other known species.

REMARKS. — Two very small specimens (0.8, 1.0 mm) (POLIPI) from Stn DW 18, appeared to be juvenile males of this species, but neither had either sexual tube developed, nor could any denticulations be seen on the rounded rostra. Neither are considered paratypes. Within the size range of 1.0 to 1.5 mm (shield length), denticulations on the rostral margin are very tiny and difficult to observe; however, with increased animal size these denticulations become quite obvious.

Genus *CATAPAGURUS* A. Milne Edwards, 1880

Catapagurus A. Milne Edwards, 1880: 46. — SMITH, 1882: 14. — HENDERSON, 1888: 75. — A. MILNE EDWARDS & BOUVIER, 1893: 125. — ALCOCK, 1905b: 114. — FOREST & DE SAINT LAURENT, 1968: 151. — DE SAINT LAURENT, 1970a: 1456. — MIYAKE, 1978: 141.
Hemipagurus Smith, 1881: 422.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Shield with rostrum weakly developed. Ocular acicles simple, slender, elongate. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod rudimentary. Ischium of third maxilliped with crista dentata more or less reduced, 1 accessory tooth. Sternite of third maxillipeds unarmed.

Chelipeds long and slender; right stronger. Ambulatory legs very long and slender; dactyls and propodi similar. Fourth pereopods semichelate; propodal rasp consisting of 1 row of scales; distinctive preungual process present.

Males with right sexual tube orientated toward exterior then recurved over anterior part of abdomen; 2 (pleopods 3 and 4) or 3 (pleopods 3-5) unpaired, usually uniramous pleopods. Females with paired gonopores; without paired first pleopods modified as gonopods, with pleopods 2 to 4 biramous, pleopod 5 similarly present or absent.

Telson with transverse suture; posterior lobes subtriangular; terminal margins oblique.

REMARKS. — In her revision of *Catapaguroides* and *Cestopagurus*, DE SAINT LAURENT (1968a) transferred three species from *Catapagurus* to other existing genera, including *C. vallatus* Melin, 1939, to *Nematopagurus*. However, she did not consider *Catapagurus australis* Henderson, 1888. Despite HENDERSON's correct diagnosis of the generic characters of *Catapagurus*, a recent reexamination of the syntypes of *C. australis* (NHM 1888.33) have shown that the structure of the sexual tubes and the weak development of the ocular acicles provide convincing evidence that this species too should have been assigned to *Nematopagurus*.

Even with the transfer of the three species aforementioned from *Catapagurus*, FOREST and DE SAINT LAURENT (1968) and DE SAINT LAURENT (1970a) indicated that the genus still included about ten Indo-Pacific species, of which several remained to be described. It is unfortunate that the revision promised by DE SAINT LAURENT (1970a) was never completed. Not only there are serious inconsistencies in the diagnoses that have been presented by several authors cited in the above synonymy, but major problems in species interpretations prevail as well, which are beyond the scope of the KARUBAR study. HAIG and BALL (1988) reported the occurrence of a species they believed to represent *Catapagurus ensifer* Henderson, 1893, and a second "probably ... undescribed" species from the Maluku area, noting that the lack of an up-to-date revision of the genus made identification difficult. The new species described herein are assigned to *Catapagurus* as defined by FOREST and DE SAINT LAURENT (1968) and DE SAINT LAURENT (1970a), until such time as a thorough review of the genus can be completed.

Key to the Indonesian species of *Catapagurus*

1. Dactyls of ambulatory legs spatulate or blade-shaped 2
- Dactyls of ambulatory legs not spatulate or blade-shaped 3
2. Telson with roundly triangular posterior lobes separated by very broad median cleft *C. ensifer**
- Telson with acutely triangular posterior lobes separated by moderately narrow median cleft *Catapagurus* sp. of Haig & Ball*
3. Telson with broad median cleft, terminal margins of posterior lobes oblique and armed with 1 to 4 small spines; ocular peduncles very short and stout, ocular acicles usually reaching beyond midpoint of peduncle *C. oculocrassus* sp. nov.
- Telson with narrow median cleft, terminal margins of posterior lobes perpendicular or nearly so, unarmed or with only few very short bristles; ocular peduncles not extremely short, ocular acicles not reaching beyond midpoint of peduncle 4
4. Mesial faces of dactyls of ambulatory legs each with ventral row of corneous spines *C. tanimbarensis* sp. nov.
- Mesial faces of dactyls of ambulatory legs without ventral row of corneous spines *C. holthuisi* sp. nov.

Catapagurus oculocrassus sp. nov.

Figs 17a-k, 39a-b

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn CP 20, 05°15'S, 132°59'E, 769-809 m, 25.10.1991: 2 ♂, 3 ♀, 2 ov. ♀ (2.7-3.7 mm) (MNHN-Pg 5284). — Stn CP 21, 05°14'S, 133°00'E, 688-694 m, 25.10.1991: 2 ♂, 6 ♀, 4 ov. ♀ (1.5-2.7 mm) (MNHN-Pg 5285). — Stn CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 1 ♂ (3.1 mm) (MNHN-Pg 5286). — Stn CP 39, 07°47'S, 132°26'E, 477-466 m, 28.10.1991: 1 ov. ♀ (2.4 mm) (POLIPI).

Tanimbar Islands: stn CC 56, 08°16'S, 131°59'E, 552-549 m, 31.10.1991: 1 ♂, 1 ♀ (2.1, 2.3 mm) (SNHM 4810). — Stn CC 57, 08°19'S, 131°53'E, 603-620 m, 31.10.1991: 2 ♂, 2 ov. ♀ (1.9-2.2 mm) (MNHN-Pg 5287); 1 ♂ (1.8 mm) (POLIPI); 2 ♂, 2 ♀, 1 ov. ♀ (1.7-2.3 mm) (USNM 276016).

TYPES. — The male (3.1 mm) (MNHN-Pg 5286) from KARUBAR Station CP 38 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 17a-b) usually broader than long, occasionally longer than broad in some females; anterior margin between rostrum and lateral projections slightly concave; anterolateral margins rounded; posterior margin roundly truncate; surface with numerous tufts of setae. Rostrum broadly rounded, produced to or slightly beyond level of lateral projections. Lateral projections very obtusely triangular, subacute or acute, with terminal spine or spinule.

Ocular peduncles very short and stout, dorsal surfaces each with 2 or 3 short transverse rows of setae; corneae usually dilated (not noticeably so in illustrated paratype); equal to slightly less than half length of peduncle. Ocular acicles triangular, moderately to very slender, reaching to or slightly beyond bases of corneae; terminating in acute spine, mesial margins each with row of moderately long setae; separated basally by 1.00 to 1.35 basal width of one acicle.

Antennular peduncles overreach distal margin of corneae by half to entire length of penultimate segment. Ultimate segment with short row of long setae or bristles on dorsal surface mesially and longer row laterally, usually several additional setae at dorsodistal margin. Penultimate and basal segments unarmed, but with few scattered setae.

Antennal peduncles overreach distal margin of cornea by 0.75 to 1.25 length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine or spinule at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute spine, lateral margin usually with 1 or 2 spinules distally; dorsomesial distal angle with smaller spine, mesial margin with few setae. First segment with small spine on laterodistal margin; ventral margin also with 1 small spine distolaterally. Antennal acicle long, reaching to distal half or third of fifth segment, with small terminal spinule; mesial margin with numerous long setae. Antennal flagellum long, overreaching outstretched chelipeds; 1 or 2 very short setae every 1 to 4 articles, at least in proximal third.

Right cheliped (Figs 17c, 39a) long, moderately slender, somewhat dorsoventrally compressed. Dactyl 0.50 to 0.80 length of palm; dorsal surface minutely granular, at least in mesial half and with few scattered setae; rounded dorsomesial margin and mesial face granular or spinulose; cutting edge with 1 or 2 broad calcareous teeth, terminating in small corneous claw. Palm equal to or slightly longer than carpus; dorsomesial margin not delimited, dorsolateral margin weakly indicated by slightly elevated granular or spinulose ridge sometimes extending nearly to tip of fixed finger; dorsal surface smooth, granular or minutely spinulose; mesial and lateral surfaces minutely spinulose or granular; fixed finger with scattered moderately long setae, cutting edge with 1 or 2 distinct teeth, terminating in small corneous claw; ventral surfaces smooth or microscopically granular and with scattered long setae. Carpus slightly shorter to slightly longer than merus; dorsomesial margin with irregular sometimes double or triple row of small to very small spines and spinules, dorsal surface spinulose or granular, dorsolateral margin spinulose but not distinctly delimited; lateral mesial and ventral surfaces spinulose or granular. Merus subtriangular; dorsal surface with few short transverse setal ridges at least in distal half, occasionally 1 or 2 small spines at distal margin; mesial, lateral and ventral surfaces granular or spinulose; ventromesial margin sometimes with larger spines in distal half; ventrolateral margin rounded, granular or spinulose. Ischium unarmed or with row of minute spinules on ventromesial margin.

Left cheliped (Figs 17d, 39b) slender, somewhat dorsoventrally compressed; dactyl and fixed finger 1.00 to 1.75 length of palm; in lateral view, straight or ventrally curved; terminating in corneous claws. Dactyl with dorsomesial margin and mesial half of dorsal surface spinulose in proximal half, numerous long setae distally. Palm and proximal half of fixed finger with minutely spinulose dorsal surfaces; rounded dorsomesial margin spinulose; ventral surfaces smooth or microscopically spinulose, distal halves of dactyl and fixed finger with numerous tufts of long setae. Carpus slightly shorter or equal to length of merus; dorsomesial margin with irregular single or nearly double row of small spines; dorsolateral margin also with single or double row of smaller

spines; all surfaces at least partially covered with very small spinules and sparse short to moderately long setae, particularly dorsally. Merus with few short occasionally spinulose transverse ridges or low protuberances and tufts of setae; lateral, mesial and ventral surfaces spinulose, slightly stronger spines on ventromesial and ventrolateral margins distally. Ischium unarmed or with microscopically spinulose ventromesial margin.

Ambulatory legs (Figs 17e-f) elongate, overreaching outstretched right cheliped. Dactyls not blade-shaped; in dorsal view, twisted; in lateral view, slightly curved ventrally in distal halves; exceeding length of propodi usually

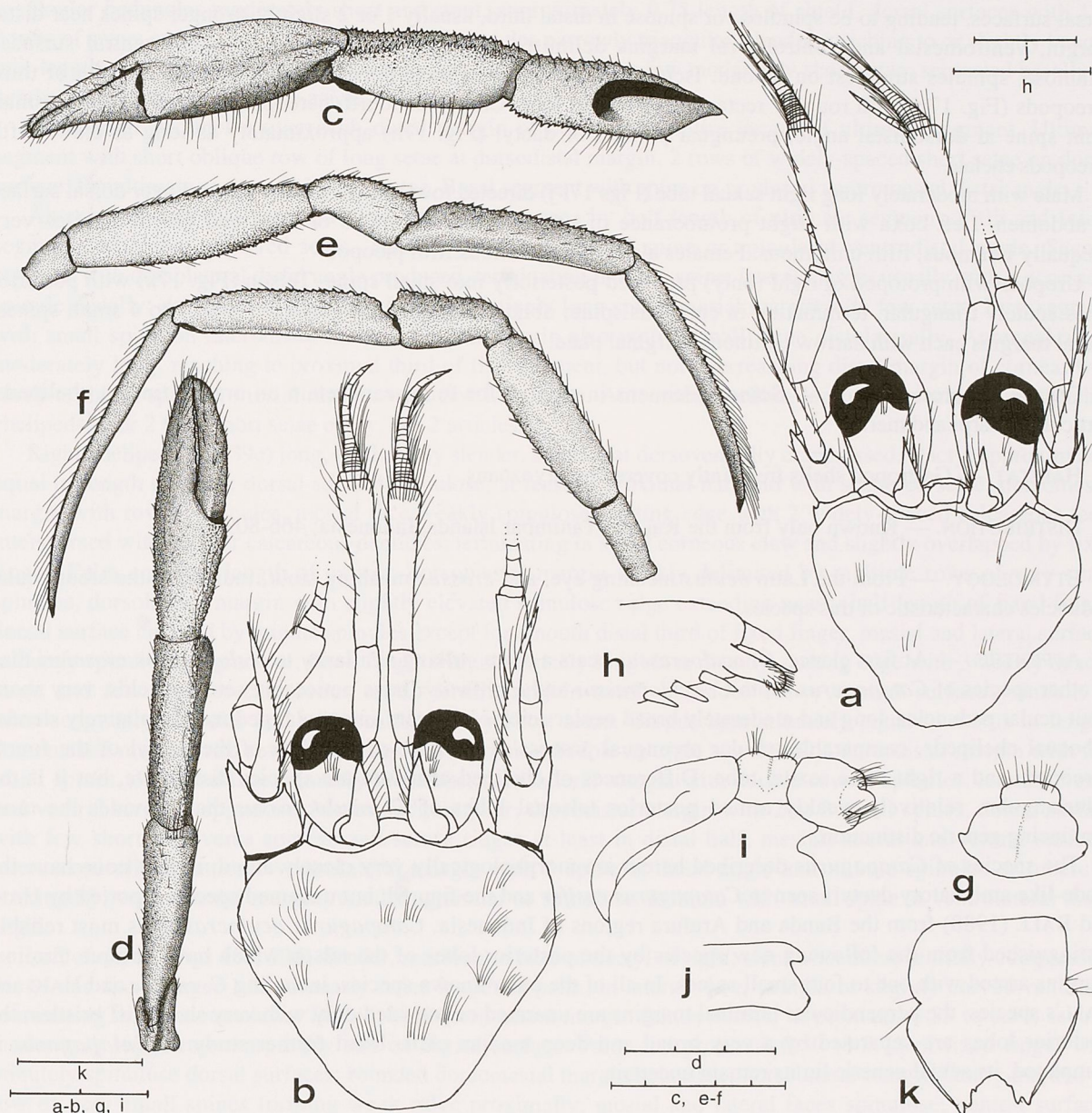


FIG. 17. — *Catapagurus oculocrassus* sp. nov., a, c, g-k, holotype ♂ (3.1 mm) from KARUBAR Stn CP 38; b, e-f, paratype ♂ (3.7 mm) from KARUBAR Stn CP 20; d, paratype ♀ (3.7 mm) from Stn CP 20: a-b, shield and cephalic appendages; c, right cheliped (mesial view); d, left cheliped (dorsal view); e, second right pereopod (lateral view); f, third left pereopod (lateral view); g, sternite of third pereopods; h, tip of dactyl and preungual process of left right fourth pereopod (lateral view); i, coxae and sternite of fifth pereopods; j, tip of right sexual tube; k, telson. Scales equal 0.25 mm (h), 0.5 mm (j), 1.0 mm (k), 2.0 mm (a-b, g, i), 3.0 mm (d), and 5.0 mm (c, e-f).

by more than 0.35 own length, third pair usually slightly longer than second; dorsal margins each with row of long rather stiff setae; mesial faces each with ventral row of long fine setae; lateral faces and ventral margins with few setae. Propodi 1.5 to nearly twice length of carpi; dorsal surfaces each with row of small spines interspersed with short often stiff setae; mesial faces and sometimes also lateral faces spinulose, at least in dorsal halves; ventral margins each usually with row of minute setae and 1 stiff bristle at distal angle. Carpi short, frequently less than half length of meri; dorsal surfaces each with sparse setae and numerous small spinules, largest distally; lateral faces, and mesial faces dorsally, also spinulose. Meri with short transverse rows of moderately long setae on dorsal surfaces, tending to be spinulose or spinose in distal third, usually 1 or 2 slightly stronger spines near distal margin; ventromesial and ventrolateral margins delimited only distally, usually unarmed, ventral surfaces spinulose, spinules strongest on second. Ischia with few tufts of setae dorsally and ventrally. Sternite of third pereopods (Fig. 17g) with roundly rectangular anterior lobe. Carpus of fourth pereopods unarmed or with small blunt spine at dorsodistal angle; preungual process of dactyl (Fig. 17h) approximately as long as claw. Fifth pereopods chelate.

Male with moderately long right sexual tube (Figs 17i-j) directed toward exterior and upward over dorsal surface of abdomen. Left coxa with slight protuberance of vas deferens. Pleopods of third and fourth somites very unequally biramous, fifth uniramous. Females also with uniramous fifth pleopod.

Uropods with protopod of right (only) produced posteriorly into small spine. Telson (Fig. 17k) with posterior lobes acutely triangular, terminating in corneous spine; oblique terminal margins each with 1 to 4 small spines; lateral margins each with narrow chitinous marginal plate.

COLOR (in preservative). — Some specimens in alcohol for four years retain an orange tint on chelipeds, particularly carpi and meri.

HABITAT. — Gastropod shells frequently covered by bryozoans.

DISTRIBUTION. — Known only from the Kai and Tanimbar Islands, Indonesia; 466-809 m.

ETYMOLOGY. — From the Latin *oculus* meaning eye, and *crassus* meaning stout, indicating the stout ocular peduncles characteristic of this species.

AFFINITIES. — At first glance, *C. oculocrassus* bears a more striking similarity to *Icelopagurus crosnieri* than to other species of *Catapagurus*. Both *C. oculocrassus* and *I. crosnieri* have noticeably setose shields, very short, stout ocular peduncles, long and moderately broad ocular acicles, elongate antennular peduncles, relatively slender subequal chelipeds, comparable tubular preungual process at the base of the claw of the dactyl of the fourth pereopod, and a right male sexual tube. Differences of cheliped armature are species distinctive, but it is the subtriangular, relatively weakly armed posterior telsonal lobes of *C. oculocrassus* that provides the most convincing generic distinction.

The species of *Catapagurus* described herein are morphologically very closely allied, in that none have the blade-like ambulatory dactyls seen in *Catapagurus ensifer* and the figured, but unnamed species reported by HAIG and BALL (1988) from the Banda and Arafura regions of Indonesia. *Catapagurus oculocrassus* is most reliably distinguished from the following new species by the posterior lobes of the telson which have oblique terminal margins armed with one to four small spines. In all of the other known species, including *C. ensifer* and HAIG and BALL's species, the perpendicular terminal margins are unarmed or provided only with very short stiff bristles; the posterior lobes are separated by a very broad and deep median cleft. Until further study of *Catapagurus* is completed, its actual generic limits remain uncertain.

Catapagurus tanimbarensis sp. nov.

Figs 18a-m, 39c-d

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ov. ♀ (2.1 mm) (MNHN-Pg 5288); 1 ♂, 1 ov. ♀ (1.9-2.1 mm) (MNHN-Pg 5289).

TYPES. — The ovigerous female (2.1 mm) (MNHN-Pg 5288) is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 18a-b) slightly longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; surface with several tufts of setae. Rostrum broadly rounded, produced to or slightly beyond level of lateral projections. Lateral projections obtusely triangular, with terminal spine.

Ocular peduncles moderately short and stout, approximately 0.75 length of shield, dorsal surfaces with 1 or 2 tufts of setae; corneae strongly dilated. Ocular acicles narrowly triangular, slender, reaching to or slightly beyond mid-length of peduncle; terminating acutely, mesial margins with few moderately short setae; separated basally by nearly entire basal width of one acicle.

Antennular peduncles overreach distal margin of corneae by entire length of ultimate segment. Ultimate segment with short oblique row of long setae at dorsodistal margin, 2 rows of widely-spaced short setae on dorsal surface. Penultimate segment with few setae. Basal segment with spine on produced ventromesial distal angle.

Antennal peduncles overreach distal margin of cornea by half length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine or spinule at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute spine, lateral margin usually with 1 accessory spinule distally; dorsomesial distal angle with relatively long spine, mesial margin with few setae. First segment with small spine on laterodistal margin, ventral margin also with 1 small spine distolaterally. Antennal acicle moderately long, reaching to proximal third of fifth segment, but not overreaching distal margin of cornea; with small terminal spinule, mesial margin with few long setae. Antennal flagellum long, overreaching outstretched chelipeds; 1 or 2 very short setae every 1 or 2 articles.

Right cheliped (Fig. 39c) long, moderately slender, somewhat dorsoventrally compressed. Dactyl approximately equal to length of palm; dorsal surface spinulose, at least in proximal half and with scattered setae; dorsomesial margin with row of spinules, mesial face weakly spinulose; cutting edge with 2 widely-spaced calcareous teeth interspersed with smaller calcareous denticles; terminating in small corneous claw and slightly overlapped by fixed finger. Palm equaling length of carpus; dorsomesial margin weakly delimited by multiple rows of very small spinules, dorsolateral margin with slightly elevated spinulose ridge extending nearly half length of fixed finger; dorsal surface covered by minute spinules except for smooth distal third of fixed finger, mesial and lateral surfaces minutely spinulose or granular; fixed finger with moderately long setae distally; cutting edge with 3 widely-spaced large and few smaller calcareous teeth, terminating in small corneous claw; ventral surfaces smooth or microscopically granular and with scattered very short setae. Carpus approximately equal to merus in length; dorsomesial margin with row of small spines becoming double or triple row distally, dorsodistal margin with few small spines, dorsal surface minutely spinulose, dorsolateral margin with double row of spinules; lateral, mesial and ventral surfaces spinulose. Merus subtriangular; dorsodistal margin with 2 or 3 small spines, dorsal surface with few short transverse spinose and setose ridges at least in distal half; mesial, lateral and ventral surfaces microscopically spinulose; ventrolateral margin with 1 spine at distal angle and minute spinules or tubercles proximally; ventromesial margin rounded, granular or spinulose. Ischium with small spine at ventrolateral distal angle.

Left cheliped (Figs 18c, 39d) slender, reaching to base of dactyl of right; somewhat dorsoventrally compressed; dactyl and fixed finger 1.25 to nearly twice length of palm; in lateral view, straight or slightly curved ventrally; terminating in corneous claws. Dactyl with dorsomesial margin faintly serrate in proximal 0.25 to 0.50, several moderately long setae marginally and on dorsal surface. Palm and proximal 0.50 to 0.75 of fixed finger with minutely spinulose dorsal surfaces; rounded dorsomesial margin spinulose, dorsolateral margin faintly marked by row of very small spines forming weak ridge proximally; mesial and lateral faces spinulose; ventral surfaces smooth or microscopically spinulose, distal halves of dactyl and fixed finger with few long setae. Carpus equal to or slightly longer than merus; dorsomesial and dorsolateral margins each with row of small spines; all surfaces with very small spinules and few short to moderately long setae. Merus with short, occasionally spinulose, transverse ridges and stiff setae; lateral and mesial faces minutely spinulose; ventral surface with scattered very small spines or tubercles, ventromesial and ventrolateral margins spinulose, each with 1 stronger spine at distal angle. Ischium unarmed.

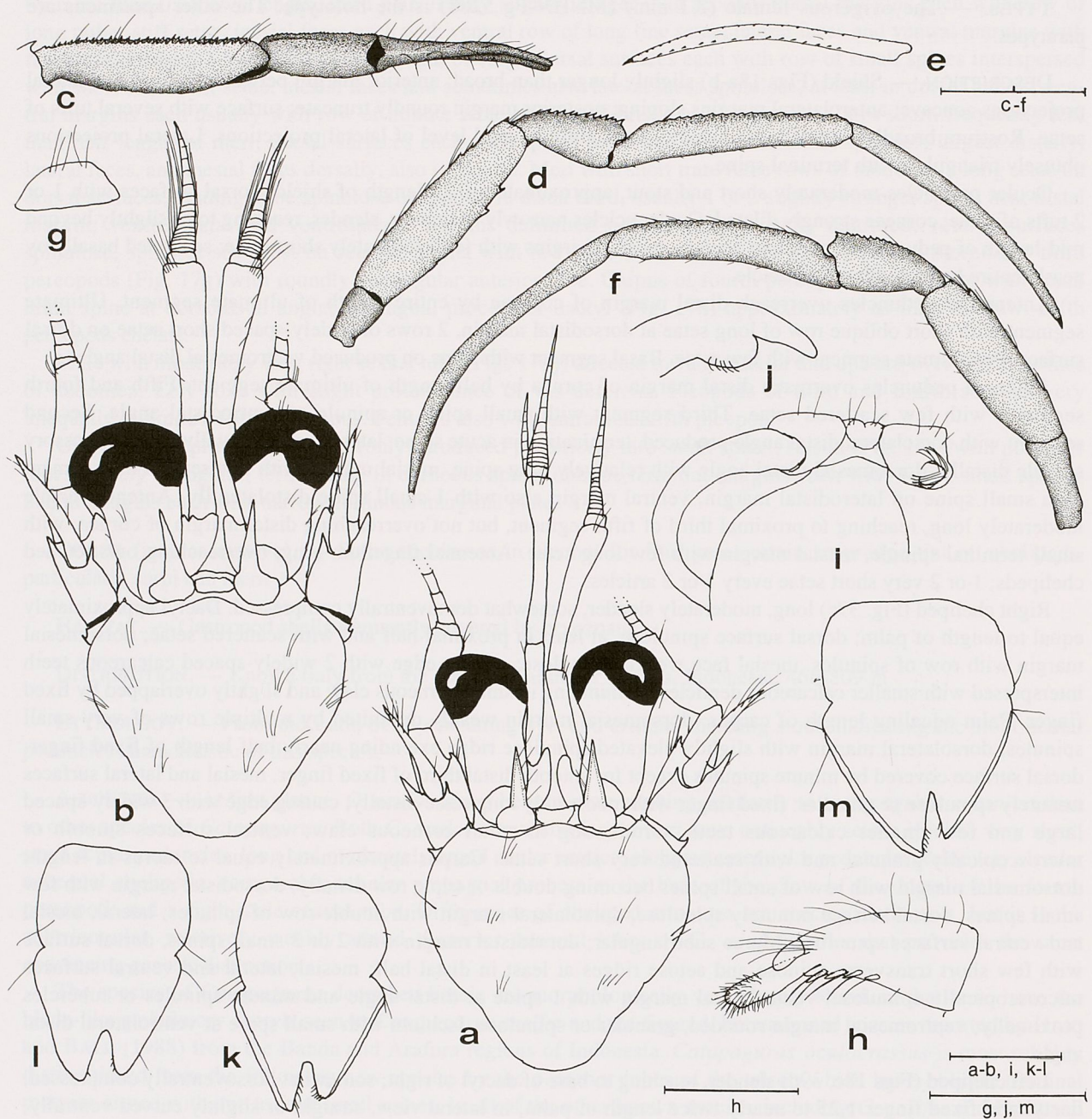


FIG. 18. — *Catapagurus tanimbarensis* sp. nov., a, d-f, k, holotype ov. ♀ (2.1 mm) from KARUBAR Stn DW 49; b-c, g-j, l, paratype ♂ (2.0 mm) from Stn DW 49; m, paratype ♀ (1.9 mm) from Stn DW 49; a-b shield and cephalic appendages; c, carpus and chela of left cheliped (mesial view); d right second pereopod (lateral view); e, dactyl of right second pereopod (mesial view); f, third left pereopod (lateral view); g, anterior lobe of sternite of third pereopods; h, tip of dactyl and preungual process of left right fourth pereopod (lateral view); i, coxae and sternite of fifth pereopods with sexual tubes; j, tip of right sexual tube; k-m, telson. Scales equal 0.25 mm (h), 0.5 mm (j-m), 1.0 mm (a-b, g, i), and 2.0 mm (c-f).

Ambulatory legs (Figs 18d-f) elongate, overreaching outstretched right cheliped. Dactyls not blade-shaped; in dorsal view, straight; in lateral view, slightly curved ventrally in distal half; equaling or exceeding length of

propodi usually by approximately 0.25 own length, third pair usually slightly longer than second; dorsal margins each with row of setae, longer and more bristle-like distally (most broken off in holotype); mesial faces each with ventral row of 12 to 14 corneous spinules; lateral faces with few setae; ventral margins glabrous. Propodi 1.75 to twice length of carpi; dorsal surfaces each with row of low protuberances and short stiff setae or bristles; mesial and ventral faces unarmed; ventral margins occasionally with few short setae and 1 stiff bristle at distal angle. Carpi short, 0.50 to 0.75 length of meri; dorsal surfaces each with sparse setae and row of small spines, strongest on second pereopods; lateral, mesial and ventral surfaces glabrous. Meri with 4 short transverse ridges dorsally, each usually with 1 small spine and 2 or 3 short bristles; ventromesial and ventrolateral distal angles each with very small spine, ventromesial and ventrolateral margins of second pereopods minutely spinulose or granular, third unarmed. Ischia unarmed. Sternite of third pereopods with narrowly subrectangular anterior lobe (Fig. 18g). Preungual process of fourth pereopods (Fig. 18h) elongate and setose. Fifth pereopods chelate.

Male with moderately long right sexual tube (Figs 18i-j) directed toward exterior and upward over dorsal surface of abdomen. Left coxa with slight protuberance of vas deferens encircled by short stiff setae. Pleopods of third and fourth somites uniramous and rudimentary, fifth uniramous and moderately well developed. Females also with uniramous fifth pleopod.

Uropods with protopod of right (only) produced posteriorly and armed with small spinule. Telson (Figs 18k-m) with posterior lobes separated by moderately deep V-shaped median cleft, triangular; terminating acutely or subacutely and sometimes with small corneous spine at tip; oblique terminal margins each with 2 to several very short stiff bristles and rarely small protuberance or spinule; lateral margins each with narrow chitinous marginal plate.

COLOR. — Unknown.

HABITAT. — One specimen occupied a shell of *Natica* sp.

DISTRIBUTION. — Known from the Kai and Tanimbar Islands, Indonesia; 184-301 m.

ETYMOLOGY. — Named for the Tanimbar Islands of Indonesia.

AFFINITIES. — *Catapagurus tanimbarensis* and the following new species share many general morphological attributes, but can be distinguished by the shapes of their telsons, as is the case of other Indo-Pacific species of the genus (HAIG & BALL, 1988). Additionally, neither of the other new species described herein have the mesial faces of the ambulatory dactyls armed with a ventral row of spines. The shorter antennular peduncles, but longer antennal acicles distinguish *C. tanimbarensis* from *C. holthuysi* sp. nov., while the more strongly dilated corneae and more slender ocular acicles immediately separate *C. tanimbarensis* from *C. oculocrassus*.

REMARKS. — Particularly in the holotype, but also to a lesser extent in both paratypes, the setae on the dorsal margins of the dactyls of the ambulatory legs have been broken off. All that remains to indicate their original presence is a row of distinct sockets (Fig. 18e).

Two additional ovigerous females, both with shield lengths of 1.5 mm, are assigned to *C. tanimbarensis* based on the shape of the telson and armature of the ambulatory dactyls; but because of their conditions, neither are considered paratypes. The specimen from station DW 50 (POLIPI), collected at a depth of 184 to 186 m, is missing both third pereopods and chelipeds; the specimen from station DW 03 (MNHN), collected at a depth of 278-301 m, is missing both chelipeds. However, both are included in the geographical and depth distributions of the species.

Catapagurus holthuysi sp. nov.

Figs 19a-j, 39e-f

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 27, 05°33'S, 132°51'E, 304-314 m, 26.10.1991: 1 ♂ (1.5 mm) (MNHN-Pg 5290).

Tanimbar Islands: stn CP 77, 08°57'S, 131°27'E, 352-346 m, 03.11.1991: 1 ov. ♀ (2.8 mm) (MNHN-Pg 5291). — Stn DW 84, 09°23'S, 131°09'E, 275-246 m, 04.11.1991: 2 ov. ♀ (1.8-1.8 mm) (USNM 276017). — Stn 86, 09°26'S, 131°13'E, 225-223 m, 04.11.1991: 1 ov. ♀ (1.5 mm) (POLIPI).

TYPES. — The ovigerous female (2.8 mm) (MNHN-Pg 5291) from KARUBAR station CP 77 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 19a-b) slightly to considerably broader than long; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; surface with numerous tufts of setae. Rostrum usually broadly subtriangular, occasionally rounded, not produced to level of lateral projections. Lateral projections triangular, with marginal spine.

Ocular peduncles moderately short and stout, approximately 0.65 length of shield, dorsal surfaces each with 1 or 2 tufts of setae; corneae strongly dilated. Ocular acicles narrowly triangular, slender, reaching beyond mid-length of peduncle; terminating acutely, sometimes with distinct simple or minutely bifid spine, mesial margins each with few moderately short setae; separated basally by more than basal width of one acicle.

Antennular peduncles overreach distal margin of corneae by 0.25 to 0.40 length of penultimate segment. Ultimate segment with 3 or 4 long setae at dorsodistal margin, row of long setae on dorsal surface. Penultimate segment with very few setae. Basal segment unarmed.

Antennal peduncles overreaching distal margin of cornea by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute spine; dorsomesial distal angle with well developed spine, mesial margin with few setae. First segment with small spine on laterodistal margin, ventral margin also with 1 small spine distolaterally. Antennal acicle moderately short, usually reaching little, if any, beyond proximal margin of fifth segment or distal margin of cornea; with small terminal spinule, mesial margin with few long setae. Antennal flagellum long, overreaching outstretched chelipeds; 1 or 2 very short setae every 1 to several articles.

Right cheliped long, moderately slender; chela (Fig. 39e) somewhat dorsoventrally compressed. Dactyl approximately equal to length of palm; dorsal surface minutely spinulose, at least in mesial half, and with scattered setae; dorsomesial margin with row of spinules and sparse long setae, mesial face weakly spinulose; cutting edge with 2 broad calcareous teeth; terminating in small corneous claw and slightly overlapped by fixed finger. Palm equaling length of carpus; dorsomesial margin rounded and armed with multiple rows of very small spinules or tubercles, dorsolateral margin usually with slightly elevated spinulose ridge extending nearly entire length of fixed finger; dorsal surface covered by minute spinules or granules except for smooth distal half of fixed finger; mesial and lateral surfaces minutely spinulose or granular; fixed finger with moderately long setae distally; cutting edge with 1 prominent calcareous tooth proximally and 2 widely-spaced broad smaller teeth and few calcareous denticles distally, terminating in small corneous claw; ventral surfaces smooth or microscopically granular and with sparse setae. Carpus slightly shorter than merus; dorsomesial margin with single or irregularly double row of small spines, extending onto mesiodistal margin dorsally, rounded or very weakly ridged dorsolateral margin armed with multiple rows of spinules or small tubercles; lateral, mesial and ventral surfaces spinulose. Merus subtriangular; dorsodistal margin with 2 or 3 small spines, dorsal surface with few short transverse spinose and setose ridges at least in distal half; mesial, lateral and ventral surfaces microscopically spinulose; ventrolateral margin with 1 spine at distal angle and minute spinules or tubercles proximally; ventromesial margin rounded, granular or spinulose. Ischium with spine at ventrolateral distal angle, ventrolateral and ventromesial margins sometimes spinulose.

Left cheliped (Figs 19c, 39f) slender, reaching well beyond base of dactyl of right; somewhat dorsoventrally compressed; dactyl and fixed finger 1.25 to twice length of palm; in lateral view, straight or very slightly curved ventrally; terminating in corneous claws. Dactyl with row of spinules on dorsomesial margin in proximal half and row of long setae along entire length of margin. Palm 0.65 to 0.75 length of carpus; dorsal surface of palm and fixed finger spinulose and with scattered long setae; rounded dorsomesial margin spinulose, dorsolateral margin with row of very small spines forming weak ridge extending almost entire length of fixed finger; mesial and lateral faces spinulose; ventral surfaces smooth or microscopically spinulose, dactyl and fixed finger with numerous long setae. Carpus equal to length of merus; dorsomesial and dorsolateral margins each with row of small spines;

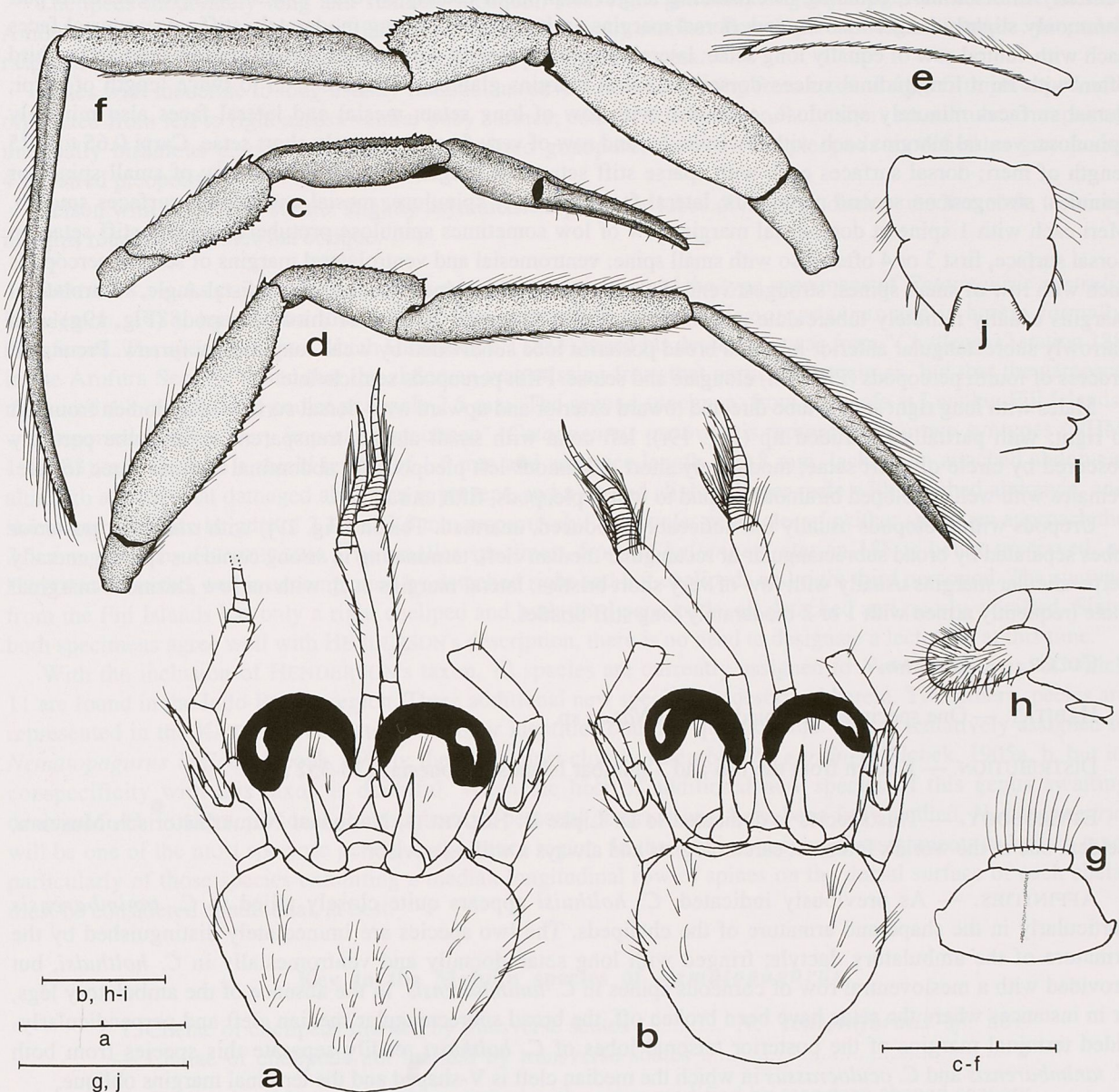


FIG. 19. — *Catapagurus holthuisi* sp. nov., a, d-g, j, holotype ov. ♀ (2.8 mm) from KARUBAR Stn CP 77; b-c, h-i, paratype ♂ (2.0 mm) from Stn DW 27: a-b shield and cephalic appendages; c, left cheliped (mesial view); d, right second pereopod (lateral view); e, dactyl of right second pereopod (mesial view); f, third left pereopod (lateral view); g, sternite of third pereopods; h, tip of dactyl and preungual process of left right fourth pereopod (lateral view); i, tip of right sexual tube; j, telson. Scales equal 0.10 mm (h), 0.5 mm (i), 1.0 mm (b, g, j), 2.0 mm (a), and 3.0 mm (c-f).

distomesial and distolateral margins each with 2 or 3 small spines; all surfaces with small spinules or tubercles and few moderately long setae. Merus with spine at dorsodistal margin, 1 or 2 additional spines on dorsal surface in distal half and double row of stiff setae; lateral and mesial faces minutely spinulose at least in ventral halves; ventral surface with scattered small spines or tubercles, ventromesial and ventrolateral margins each with row of small spines, strongest at distal angle. Ischium with spine on ventrolateral margin distally.

Ambulatory legs (Figs 19d-f) elongate, overreaching outstretched right cheliped by more than half length of dactyls. Dactyls not blade-shaped; in dorsal view, straight or slightly twisted; in lateral view, slightly curved

ventrally in distal half; equaling or exceeding length of propodi usually by 0.25 to 0.35 own length, third pair commonly slightly longer than second; dorsal margins each with row of long moderately stiff setae; mesial faces each with ventral row of equally long setae; lateral faces occasionally with row of widely-spaced short setae, third often with faint longitudinal sulcus dorsally; ventral margins glabrous. Propodi 1.65 to twice length of carpi; dorsal surfaces minutely spinulose, each also with row of long setae; mesial and lateral faces also minutely spinulose; ventral margins each with few spinules and row of very fine, moderately short setae. Carpi 0.65 to 0.75 length of meri; dorsal surfaces each with sparse stiff setae and irregular almost double row of small spines or spinules, strongest on second pereopods; lateral faces minutely spinulose; mesial and ventral surfaces smooth. Meri each with 1 spine at dorsodistal margin, row of low sometimes spinulose protuberances and stiff setae on dorsal surface, first 3 or 4 often also with small spine; ventromesial and ventrolateral margins of second pereopods each with row of small spines, strongest ventrolaterally; third with spine at ventrolateral distal angle, ventrolateral margins usually minutely tuberculate or spinulose. Ischia unarmed. Sternite of third pereopods (Fig. 19g) with narrowly subrectangular anterior lobe and broad posterior lobe subdivided by weak longitudinal furrow. Preungual process of fourth pereopods (Fig. 19h) elongate and setose. Fifth pereopods semichelate.

Males with long right sexual tube directed toward exterior and upward over dorsal surface of abdomen from left to right; with partially protruded tip (Fig. 19i); left coxa with small almost transparent sexual tube partially obscured by circle of short setae; moderately short uniramous left pleopods on abdominal somites three to five. Females with well developed biramous second to fourth pleopods, fifth uniramous.

Uropods with protopods usually not noticeably produced, unarmed. Telson (Fig. 19j) with triangular posterior lobes separated by broad subrectangular or rectangular median cleft, terminating in strong corneous spine; generally perpendicular margins usually with row of very short bristles; lateral margins each with narrow chitinous marginal plate frequently armed with 1 or 2 moderately long stiff bristles.

COLOR. — Unknown.

HABITAT. — One specimen occupied shell of *Natica* sp.

DISTRIBUTION. — Known from the Kai and Tanimbar Islands, Indonesia; 223-352 m.

ETYMOLOGY. — This species is dedicated to Dr Lipke B. HOLTHUIS, Nationaal Natuurhistorisch Museum, Leiden, one of the world's foremost carcinologists and always a willing advisor.

AFFINITIES. — As previously indicated, *C. holthuisi* appears quite closely allied to *C. tanimbarensis* particularly in the shape and armature of the chelipeds. The two species are immediately distinguished by the armature of the ambulatory dactyls; fringed with long setae dorsally and ventromesially in *C. holthuisi*, but provided with a mesioventral row of corneous spines in *C. tanimbarensis*. In the absence of the ambulatory legs, or in instances where the setae have been broken off, the broad subrectangular median cleft and perpendicularly-sided terminal margins of the posterior telsonal lobes of *C. holthuisi* readily separate this species from both *C. tanimbarensis* and *C. oculocrassus* in which the median cleft is V-shaped and the terminal margins oblique.

Genus *NEMATOPAGURUS* A. Milne Edwards & Bouvier, 1892

Nematopagurus A. Milne Edwards & Bouvier, 1892: 209; 1899: 59; 1900: 200. — ALCOCK, 1905b: 108. — MIYAKE, 1978: 128.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Shield with rostrum weakly and obtusely subtriangular, broadly rounded or obsolete. Ocular peduncles relatively stout; corneae often prominently dilated. Ocular acicles triangular or ovate, with strong submarginal spine. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod usually rudimentary, sometimes somewhat developed, not recurved. Ischium of third maxilliped with crista dentata well developed, 1 accessory tooth.

Chelipeds moderately long and slender; subequal, with right generally slightly longer and/or more robust. Ambulatory legs moderately long; dactyls and propodi usually similar. Fourth pereopods semichelate; propodal rasp with 1 row of scales; dactyls without prominent preungual process.

Males with moderate to long usually filamentous sexual tube emanating from coxa of right fifth pereopod and orientated from left to right across ventral body surface; coxa of left with papilla or short sexual tube; 3 unpaired unequally biramous pleopods. Females with paired gonopores, paired first pleopods modified as gonopods, 4 unpaired pleopods.

Telson with transverse suture; slightly asymmetrical posterior lobes divided by distinct median cleft; terminal margins rounded or somewhat oblique.

REMARKS. — As previously mentioned, personal examination of the type specimens of *Catapagurus australis* Henderson, 1888, has shown that this species correctly belongs in *Nematopagurus* and is herein formally transferred. The specimen upon which HENDERSON (1888) based his description was from "Challenger" station 188 in the Arufura Sea. He stated that the abdomen was missing from that particular specimen, but that the carapace measured 4.8 mm and the ocular peduncle 2.5 mm. The second specimen, from the reefs at Levuku, Fiji Islands, was reported to be a "very imperfect specimen". *Catapagurus australis* is represented by two syntypes (NHM 1888.33), a male with a shield length of 1.5 mm and carapace length of 2.8 mm, lacking an attached abdomen, although a somewhat damaged abdomen is present, and a second slightly larger male with attached abdomen, and shield and carapace lengths of 2.1 and 3.5 mm respectively. The ocular peduncles of neither specimen approach the 2.5 mm given by HENDERSON. The smaller specimen, from "Challenger" station 188 is better preserved, as HENDERSON noted, and is accompanied by detached right and left chelipeds and right third pereopod. The syntype from the Fiji Islands has only a right cheliped and both third pereopods, all detached and poorly calcified. Since both specimens agree well with HENDERSON's description, there is no need to designate a lectotype at this time.

With the inclusion of HENDERSON's taxon, 12 species are currently assigned to *Nematopagurus*, of which 11 are found in the Indo-Pacific region. Three additional new species are described herein. Two others species are represented in the KARUBAR collection, but their identities both are questionable. One is tentatively assigned to *Nematopagurus indicus* Alcock, 1905b; the other most closely resembles *N. gardineri* Alcock, 1905a, b, but its conspecificity with this taxon is doubtful. When the host of additional new species of this genus awaiting description (J. FOREST, personal communication; personal observations) have been fully studied, *Nematopagurus* will be one of the most speciose genera in the entire region. In the interim, specimen assignments to known taxa, particularly of those species exhibiting a median longitudinal row of spines on the dorsal surface of each chela, must be considered conditional, at best.

Key to the Maluku species of *Nematopagurus*

1. Chelae of chelipeds marked by transverse scutes *N. scutelliformis* sp. nov.
- Chelae of chelipeds not marked by transverse scutes 2
2. Chelipeds with dorsal surfaces armed with spines modified by tear-drop shaped sensory structures *N. spinulosensoris*
- Chelipeds without dorsal surfaces armed with spines modified by tear-drop shaped sensory structures 3
3. Mesial and lateral faces of carpi of chelipeds each with short transverse rows of long stiff iridescent bristle-like setae 4
- Mesial and lateral faces of carpi of chelipeds without short transverse rows of long stiff iridescent bristle-like setae 5
4. Dactyls of chelipeds each with dorsomesial row of spines; dorsal surface of fixed finger of right chela spinulose *N. australis**
- Dactyls of chelipeds each without dorsomesial row of spines; dorsal surface of fixed finger of right chela unarmed *N. alcocki* sp. nov.

5. Telson with subtriangular posterior lobes; terminal margins oblique 6
 — Telson with rounded posterior lobes; terminal margins convex and armed with marginal and submarginal spines *N. cf. indicus*
6. Chelae with setae of dorsal surfaces curved or curled; dactyls of ambulatory legs with 5 or fewer corneous spines on ventral margins *N. ostlingochirus* sp. nov.
 — Chelae with setae of dorsal surfaces long and straight; dactyls of ambulatory legs with more than 5 corneous spines on ventral margins
 *Nematopagurus* sp. (? = *N. gardineri* sensu HAIG & BALL, 1988)

Nematopagurus cf. *indicus* Alcock, 1905

Figs 20a, e-f, 40a-c

Nematopagurus indicus Alcock, 1905b: 109, pl. 12, fig. 4. — KEMP & SEWELL, 1912: 26. — BALSS, 1912: 110.
 Not *Nematopagurus indicus* - MIYAKE, 1961: 12 (list); 1978: 30 (list). — MIYAKE, SAKAI & NISHIKAWA, 1962: 126 (list). =
Nematopagurus vallatus (Melin, 1939).

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-226 m, 29.10.1991: 1 ♂ (5.2 mm) (MNHN-Pg 5292).

DIAGNOSIS. — Shield (Fig. 20a) longer than broad, with tufts of setae anteriorly and laterally. Rostrum broadly rounded, not reaching level of lateral projections. Lateral projections with 1 or 2 marginal spines. Ocular peduncles moderately stout; approximately as long as antennal peduncles but reaching only to middle of ultimate segment of fully extended antennular peduncles and with sparse setae dorsally; corneae dilated. Ocular acicles moderately small, terminating subacutely and with strong submarginal spine. Antennal acicle slightly arcuate; with terminal spine and setose margins, reaching distal half of ultimate peduncular segment. Antennal flagellum long, nude.

Chelipeds similar in form and ornamentation; left slightly shorter; right (Fig. 40a) stouter; copiously setose, but not obscuring surface armature. Palm of right cheliped longer than broad and approximately equal to length of dactyl; dorsomesial margin with row of spines, dorsal surface with median row of spines not extending onto fixed finger; dorsolateral margin with row of spines extending only to proximal half of fixed finger; ventral surfaces of dactyl, palm and fixed finger with few long setae. Carpus about as long as merus and longer than palm; dorsomesial margin with row of spines, dorsal surface with irregular longitudinal row of somewhat smaller spines laterally; 1 spine on dorsodistal margin. Merus with 3 strong spines on ventrolateral margin; ventromesial margin with 1 distal and 1 proximal spine, ventral surface with scattered spines.

Left cheliped (Fig. 40b) with palm slightly shorter than dactyl; similar in armature and setation to that of right. Carpus with dorsomesial and dorsolateral row of spines; 1 spine at dorsodistal margin. Merus with ventromesial and ventrolateral row of spines; ventral surface with few spinulose protuberances.

Ambulatory legs overreaching chelipeds by 0.50 to 0.75 length of dactyls (second shorter). Dactyl of left third straight, almost peg-like (Fig. 40c), with row of 14 corneous spines on ventral margin; second and right third with slight ventral curvature, ventral margins with 8 to 12 corneous spines; all with abundant long setae randomly arranged. Propodi with short transverse rows of setae on dorsal surfaces. Carpi each with spine at dorsodistal angle; second right with 2 and second and third left each with 1 additional spine on dorsal surface posteriorly. Meri of second pereopods each with row of spines on ventral margin; ventral margins of third only with protuberances.

Right sexual tube (Fig. 20e) short, directed from right to left across ventral surface of body, but not reaching coxa of left fifth pereopod. No development of left sexual tube. Telson (Fig. 20f) with asymmetrical posterior lobes separated by prominent median cleft; terminal margins with several strong curved spines and few additional smaller spines on dorsal surface marginally, most numerous on left.

COLOR (in preservative). — Only faint reddish tint on the tips of spines of chelae remains after four years in alcohol.

HABITAT. — Unknown.

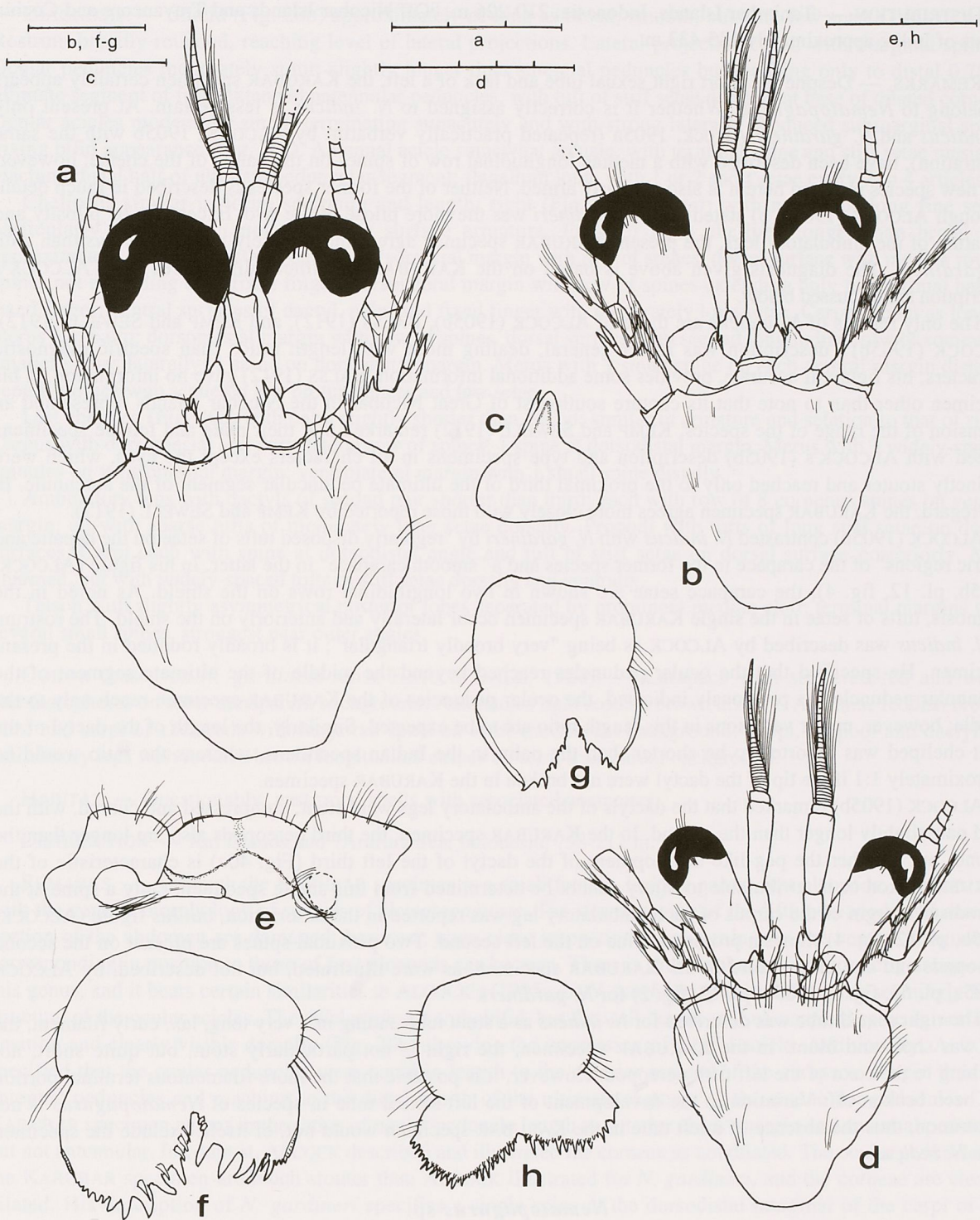


FIG. 20. — *Nematopagurus* cf. *indicus* Alcock, 1905, a, e-f, ♂ (5.2 mm) from KARUBAR Stn DW 49. — *Nematopagurus* sp., b-c, g, ♀ (1.7 mm) from Stn DW 18. — *Nematopagurus spinulosensoris* McLaughlin & Brock, 1974, d, h, ♀ (5.6 mm) from Stn CP 86: a-b, d, shield and cephalic appendages; c, right ocular acicle; e, coxae and sternite of fifth pereopods; f-h, telson. Scales equal 0.5 mm (c, g), 1.0 mm (b, f), 2.0 mm (e, h), 3.0 mm (a), and 5.0 mm (d).

DISTRIBUTION. — Tanimbar Islands, Indonesia; 210-226 m. ?Off Nicobar Islands and Travancore and Cochin coasts of India; approximately 185-433 m.

REMARKS. — Despite the short right sexual tube and lack of a left, the KARUBAR specimen certainly appears to belong to *Nematopagurus*. Whether it is correctly assigned to *N. indicus* is less certain. At present only *N. indicus* and *N. gardineri* Alcock, 1905a (repeated practically verbatim by ALCOCK, 1905b with the same illustration), have been described with a median longitudinal row of spines on the palms of the chelae; however, one new species reported herein is also similarly armed. Neither of the former species is described in much detail, although ALCOCK (1905a, b) stated that *N. gardineri* was the more pilose of the two. Except for its pilosity and armature of the ambulatory legs, the present KARUBAR specimen agrees more closely with *N. indicus* than with *N. gardineri*. The diagnosis given above is based on the KARUBAR specimen; differences with ALCOCK's description are discussed below.

The only reports of *N. indicus* are those of ALCOCK (1905b), BALSS (1912), and KEMP and SEWELL (1912). ALCOCK (1905b)'s description was rather general, dealing more with length ratios than specific diagnostic characters; his figure, if accurate, provides some additional information. BALSS (1912) gave no information on his specimen other than to note that its capture southwest of Great Nicobar in the Nicobar Islands represented an extension of the range of the species. KEMP and SEWELL (1912) remarked that their male and female specimens agreed with ALCOCK's (1905b) description and type specimens in all characters except the eyes, which were distinctly stouter and reached only to the proximal third of the ultimate peduncular segment of the antennule. In this regard, the KARUBAR specimen agrees more closely with those reported by KEMP and SEWELL (1912).

ALCOCK (1905b) contrasted *N. indicus* with *N. gardineri* by "regularly disposed tufts of setae on the hepatic and gastric regions" of the carapace in the former species and a "smooth carapace" in the latter. In his figure (ALCOCK, 1905b, pl. 12, fig. 4), the carapace setae are shown in two longitudinal rows on the shield. As noted in the diagnosis, tufts of setae in the single KARUBAR specimen occur laterally and anteriorly on the shield. The rostrum of *N. indicus* was described by ALCOCK as being "very broadly triangular"; it is broadly rounded in the present specimen. He specified that the ocular peduncles reached beyond the middle of the ultimate segment of the antennular peduncle. As previously indicated, the ocular peduncles of the KARUBAR specimen reach only to the middle; however, minor variations in this length ratio are to be expected. Similarly, the length of the dactyl of the right cheliped was reported to be shorter than the palm in the Indian specimens, whereas the ratio would be approximately 1:1 if the tip of the dactyl were not broken in the KARUBAR specimen.

ALCOCK (1905b) remarked that the dactyls of the ambulatory legs were stout, compressed and curved, with the third pair slightly longer than the second. In the KARUBAR specimen, the third pereopods also are longer than the second, but whether the peg-like development of the dactyl of the left third (Fig. 40c) is characteristic of the KARUBAR taxon or is attributable to injury cannot be determined from this single specimen. Only a spine at the dorsodistal margin of the carpus of each ambulatory leg was reported in the description, but his figure (ALCOCK, 1905b, pl. 12, fig. 4) shows a proximal spine on the left second. Two proximal spines are present on the second pereopods and one on the third in the KARUBAR specimen, as were illustrated, but not described, by ALCOCK (1905a, pl. 68, fig. 3; 1905b, pl. 12, fig. 2) for *N. gardineri*.

The right sexual tube was described for *N. indicus* as a stout tube ending in a very long, lax, curly filament, the left was short and blunt. In the KARUBAR specimen, the right is not particularly stout, but quite short, not reaching to the coxa of the left fifth pereopod. However, it is possible that the more filamentous terminal portion had been broken off. Variation in the development of the left sexual tube in species of *Nematopagurus* is not uncommon, thus the absence of a left tube in the KARUBAR specimen would not, of itself, exclude the specimen from *N. indicus*.

Nematopagurus sp.

Figs 20b-c, g, 40d-e

?*Nematopagurus gardineri* - HAIG & BALL, 1988: 185; ?not *Nematopagurus gardineri* Alcock, 1905a, b.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♀ (1.7 mm) (MNHN-Pg 5293).

DIAGNOSIS. — Shield (Fig. 20b) approximately as long as broad, smooth, but with few sparse tufts of setae. Rostrum broadly rounded, reaching level of lateral projections. Lateral projections each with marginal spinule. Ocular peduncles moderately stout; slightly longer than antennal peduncles but reaching only to distal 0.75 of ultimate segment of fully extended antennular peduncles, with tuft of stiff setae dorsally at base of dilated corneae. Ocular acicles moderately small, terminating subacutely and with strong laterally produced submarginal spine, giving bifid appearance (Fig. 20c). Antennal acicle somewhat arcuate, with terminal spine and stiff setae mesially, reaching distal half of ultimate peduncular segment; flagellum long, with 1 or 2 short setae every 2 to 4 articles.

Chelipeds similar in form, sculpture and length; right (Fig. 40d) stouter; with numerous long fine setae, particularly dorsally but not obscuring surface armature. Palm of right cheliped longer than broad and approximately equal to length of dactyl; dorsomesial margin with row of spines, dorsal surface with median row of spines not extending onto fixed finger; dorsolateral margin with row of spines extending only to proximal half of fixed finger; ventral surfaces of dactyl, palm and fixed finger with moderately long setae. Carpus about as long as merus and palm; dorsomesial margin with row of spines, dorsal surface with second longitudinal row of somewhat smaller spines laterally; 1 spine on dorsodistal margin. Merus with 1 small spine on each ventral margin distally; ventral surface with scattered low protuberances and few setae.

Left cheliped (Fig. 40e) with palm slightly shorter than dactyl; similar in armature and setation to that of right. Carpus with dorsomesial and dorsolateral row of spines; 1 spine at dorsodistal margin. Merus with 3 widely-spaced spinules on ventromesial margin; ventrolateral margin with 1 small spine distally.

Ambulatory legs with dactyls of second pair shorter than third; each with row of 8 corneous spines on ventral margin; all with sparse tufts of moderately long setae dorsally. Propodi with tufts of long stiff setae on dorsal surfaces. Carpi each with spine at dorsodistal angle and tuft of stiff setae on dorsal surface posteriorly. Meri unarmed, but with widely-spaced tufts of stiff setae dorsally and ventrally.

Telson with slightly asymmetrical posterior lobes separated by prominent median cleft; terminal margins with several small spines, strongest near outer angles.

COLOR (based on *N. gardineri* sensu HAIG & BALL, 1988). — Carapace with scattered red and white chromatophores on semi-transparent background. Antennules light reddish brown distally. Antennae reddish brown. Meri and carpi of chelipeds with large red spots on semi-transparent background. Carpi, propodi and dactyls of ambulatory legs with reddish brown longitudinal stripes on semi-transparent background.

HABITAT. — Questionably, gastropod shells with associated anemones.

DISTRIBUTION. — Kai Islands and Arafura Sea, Indonesia; 758-212 m.

REMARKS. — Although the KARUBAR specimen is a small female, lacking paired first pleopods, it agrees well with the general morphology of species of *Nematopagurus*. The sternal region of the fifth pereopods and anterior portion of the abdomen are damaged; however, upon close inspection, two openings in the ventral integument, corresponding in position to those of first pleopods can be seen. There is little doubt that it is correctly assigned to this genus, and it bears certain similarities to ALCOCK's (1905a, b) *N. gardineri*, particularly in the seemingly bifid structure of the ocular acicles. The acicles are not truly bifid, but the well developed submarginal spine is mesial in position and clearly visible dorsally (Fig. 20b, c) giving the impression of a bifid acicle. Additionally, ALCOCK specified that the ocular peduncles were equal in length to the anterior margin of the carapace, longer than the antennal peduncles and reaching to the distal fourth of the ultimate segment of the antennular peduncles. The KARUBAR specimen agrees in the ratios of ocular peduncle length to anterior shield margin and antennal peduncle, but not antennular. In contrast, ALCOCK described and illustrated the corneae as not dilated. The ocular peduncles of the KARUBAR specimen are much stouter than ALCOCK illustrated for *N. gardineri*, and the corneae are clearly dilated. His description of *N. gardineri* specifies a single spine at the dorsodistal marginal of the carpi of the ambulatory legs, but his figure (ALCOCK, 1905a, pl. 68, fig. 3; 1905b, pl. 12, fig. 2) shows two and one proximal spines on the denuded left second and third pereopods respectively; only a dorsodistal spine is present in the KARUBAR specimen. Although the chelipeds are provided with an abundance of long fine setae in the KARUBAR specimen, this pilosity does not begin to approach the density of the other KARUBAR specimen tentatively assigned to *N. indicus*. This disparity is in marked disagreement with ALCOCK's (1905a, b) observations.

Very few additional accounts of *N. gardineri* have been published. The first appears to have been KENSLEY's (1969) report of the species from the International Indian Ocean Expedition's (IIOE) "Anton Bruun" Stn 390 (29°35'S, 31°42'E). KENSLEY gave only a cryptic account of his male specimen, but his figure (KENSLEY, 1969, fig. 6e-h) illustrated a species agreeing, at least in armature of the chelipeds, with ALCOCK's description. However, KENSLEY illustrated a specimen with ocular peduncles broadly expanded distally and with dilated corneae. Although the type locality for *N. gardineri* in the Maldive Islands is in relatively close geographic proximity to KENSLEY's IIOE station, conspecificity of his and ALCOCK's (1905b) specimens can not be confirmed at this point.

MIYAKE (1978) subsequently identified a species from Japanese waters as *N. gardineri*. While his single male specimen from Sagami Bay agreed generally with most of the segmental ratios given by ALCOCK (1905a, b), it apparently differed substantively in having unequal chelipeds. MIYAKE (1978) reported that the right was "vastly larger" than the left. The ambulatory legs of MIYAKE's specimen were reported to have three spines "basally" (presumably intended to mean proximally) on the carpi of the second pair, and 11 or 12 spines on the ventral margins of the dactyls. It is very unlikely that MIYAKE's and ALCOCK's specimens are assignable to the same taxon, nor that either is conspecific with the KARUBAR specimen.

Although HAIG and BALL (1988) indicated that their three specimens, collected in the Arafura Sea during the "Alpha Helix" expedition, agreed with the original ALCOCK (1905a, b) descriptions in most characters, they too found exception in the shape of the ocular peduncles. Like the KARUBAR specimen, HAIG and BALL (1988) described their specimens as having peduncles "markedly expanded at the cornea." These authors also commented on MIYAKE's (1978) record, noting that he did not mention the form of the ocular peduncles. Apparently they overlooked his reference to grossly unequal chelipeds. Since HAIG and BALL's (1988) description was limited to notes on living color and the comments on the ocular peduncles referred to previously, it is not possible to ascertain whether or not their specimens and the KARUBAR female belong to the same taxon but, given the close proximity of the collection sites, it is probable. It is doubtful that either are conspecific with ALCOCK's (1905a, b) species.

Nematopagurus spinulosensoris McLaughlin & Brock, 1974

Figs 20d, h, 41a-b

Nematopagurus spinulosensoris McLaughlin & Brock, 1974: 246, figs 1-3. — McLAUGHLIN & LANE, 1975: 520, pls 1-3.

Nematopagurus spinulosensorius - TÜRKAY, 1986: 139 (misspelling).

Nematopagurus muricatus - THOMPSON, 1943: 424. — MIYAKE, 1978: 129; not *Nematopagurus muricatus* Henderson, 1888.

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Tanimbar Islands*: stn CP 45, 07°54'S, 132°47'E, 302-305 m, 29.10.1991: 1 ♀ (5.0 mm) (MNHN-Pg 5294). — Stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (3.0 mm) (POLIPI). — Stn CP 86, 09°26'S, 131°13'E, 225-223 m, 04.11.1991: 1 ♀ (5.6 mm) (MNHN-Pg 5295).

DIAGNOSIS. — Shield (Fig. 20d) longer than broad. Rostrum usually obtusely rounded, occasionally obtusely triangular. Ocular peduncles overreached by both antennular and antennal peduncles; corneae usually strongly dilated. Ocular acicles acutely triangular, moderately slender, with prominent longitudinal furrow and very strong submarginal spine.

Chelipeds subequal, right usually somewhat larger; chelae and carpi of both chelipeds with numerous sensory-modified spines on dorsal surfaces. Right cheliped (Fig. 41a) with dorsal surface of dactyl generally flattened, dorsomesial margin, or dorsal surface mesially, usually with irregular longitudinal row of unmodified small spines or tubercles. Palm with irregular single or double row of usually unmodified moderately strong spines on dorsomesial margin; dorsal surface with several irregular rows of customarily modified spines, extending onto fixed finger proximally; dorsolateral margin with single or double row of moderately strong, usually modified spines, extending onto fixed finger as single row of blunt unmodified spines or tubercles. Carpus with row of strong unmodified spines on dorsomesial margin; dorsal surface with irregular rows of moderately strong, generally modified spines; laterodistal margin with spine. Distal margin of merus usually with 2 or 3 strong spines; ventrolateral margin with row of strong spines mesiodistal margin and ventromesial face distally with few small spines.

Left cheliped (Fig. 41b) with short row of small unmodified spines or spinulose tubercles usually in dorsal midline of dactyl. Palm with single or double row of frequently modified spines on dorsomesial margin; dorsal midline with 2 or 3 irregular rows of usually modified spines extending onto fixed finger; dorsolateral margin with double or triple row of small modified spines proximally becoming single row of small unmodified spines or tubercles on fixed finger. Carpus with row of frequently unmodified spines on dorsomesial margin; dorsal surface with 2 or 3 irregular rows of modified spines proximally, tending to cluster distally, distal margin occasionally with 1 or 2 spines; dorsolateral margin with single or double row of commonly modified spines. Merus with 1-3 spines on distal margin; ventromesial and ventrolateral margins each with row of spines.

Second and third pereopods generally similar. Dactyls long, slender; ventral surfaces each with row of 10 to 13 strong corneous spines. Carpi each with row of strong spines on dorsal surfaces. Sternite of third pereopods with subsemicircular anterior lobe, anterior margin with long stiff setae.

Coxa of left fifth pereopod with vas deferens usually slightly protruded. Telson (Fig. 20h) with posterior lobes subtriangular or subquadrate, left usually slightly larger; separated by very shallow median cleft; terminal and usually also lateral margins weakly calcified, terminal margins rounded or somewhat oblique, each with numerous small calcareous spines marginally and several stronger calcareous acute or blunt spines submarginally; lateral margins unarmed or occasionally each with row of small calcareous spines or spinules.

COLOR. — *In life*: chelipeds and ambulatory legs generally vivid salmon-pink, bordering on iridescent; antennal flagella bright yellow.

In preservative: Shield pale orange or straw-colored; ocular peduncles light orange with dark orange ring proximally. Chelipeds very pale orange with white spines; carpi with darker red-orange proximally and ventrally. Ambulatory legs pale orange with lighter longitudinal stripes on dactyls and propodi; carpi pale orange with darker red-orange proximally; meri pale orange and white (McLAUGHLIN & BROCK, 1974).

HABITAT. — Unknown.

DISTRIBUTION. — Hawaiian Islands, Japan, Maldives, Indonesia; east coast of South Africa; 180 to 250 m.

AFFINITIES. — In having the dorsal surfaces of the chelae armed with numerous well-developed spines, *N. spinulosensoris* superficially resembles *N. muricatus*. However, neither *N. muricatus* nor any other known species of this genus are provided with the tear-drop sensory structures so characteristic of the spines of *N. spinulosensoris*.

REMARKS. — TÜRKAY (1986) reported that he had examined the specimens identified as *N. muricatus* by THOMPSON (1943) from the "John Murray" Expedition and by MIYAKE (1978) from Tosa Bay, Japan, and had found these to actually represent *N. spinulosensoris*. Apparently neither of these latter authors noticed the distinctive spines apparently unique to *N. spinulosensoris*.

Nematopagurus scutelliformis sp. nov.

Figs 21a-h, 41c-f

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 05, 05°49'S, 132°18'E, 296-299 m, 22.10.1991: 1 ♂ (4.4 mm) (SNHM 4811). — Stn CP 06, 05°49'S, 132°21'E, 298-287 m, 22.10.1991: 1 ♀ (6.1 mm) (MNHN-Pg 5296). — Stn CP 16, 05°17'S, 132°50'E, 315-349 m, 24.10.1991: 1 ♂ (5.1 mm) (MNHN-Pg 5297).

Tanimbar Islands: stn CP 46, 08°01'S, 132°51'E, 271-293 m, 29.10.1991: 1 ♂, 1 ♀ (2.3, 3.3 mm) (MNHN-Pg 5298). — Stn CP 83, 09°23'S, 131°00'E, 285-297 m, 4.11.1991: 1 ov. ♀ (6.9 mm) (USNM 276008). — Stn CP 84, 09°23'S, 131°09'E, 275-296 m, 4.11.1991: 1 ov. ♀ (3.6 mm) (POLIPI).

TYPES. — The male (5.1 mm) (MNHN-Pg 5297) from KARUBAR station CP 16 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 21a) as broad as long or broader; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with few tufts of setae.

Rostrum broadly rounded, not exceeding lateral projections. Lateral projections prominent, roundly triangular or subquadrate, each usually with small submarginal spine laterally.

Ocular peduncles short, 0.75 to 0.80 length of shield; dorsal surfaces each with median tuft of stiff setae at base of cornea, dorsomesial surface with few setae; corneae strongly dilated. Ocular acicles small, triangular; terminating subacutely, with deeply concave dorsal surface and prominent submarginal spine; separated basally by entire basal width of one acicle.

Antennular peduncles moderately short, exceeding distal margin of corneae by 0.25 to 0.75 length of ultimate segment. Ultimate segment with 2 or 3 tufts of setae on dorsolateral surface in distal half. Penultimate segment with few scattered setae. Basal segment with small spine on lateral face.

Antennal peduncles moderately short, overreaching distal margin of cornea by 0.20 to 0.25 length of ultimate segment. Fifth and fourth segments with few tufts of stiff setae. Third segment with small spine at ventrodiscal angle. Second segment with dorsolateral distal angle produced, terminating in simple spine, lateral and mesial margins with few stiff setae; dorsomesial distal angle with small spine. First segment frequently with tiny spinule on laterodistal margin. Antennal acicle moderately long, reaching to or beyond proximal half of ultimate peduncular segment; arcuate, terminating in acute spine; mesial margin with tufts of long stiff setae. Antennal flagella long, overreaching tip of right cheliped; occasionally few articles each with 1 or 2 very short setae or bristles, at least in proximal half.

Chelipeds subequal; right (Figs 21b, 41c, e) approximately as long, but slightly stronger than left, moderately elongate. Dactyl slightly shorter than palm; cutting edge with 3 strong calcareous teeth proximally, few corneous teeth distally, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with several low transverse scutes mesially and extending onto rounded dorsomesial margin, each with marginal row of short stiff setae, few tufts of longer setae adjacent to cutting edge; mesial face dorsally and ventral surface also with tufts of longer setae. Palm approximately as long as carpus; dorsomesial margin not delimited, but with 1 or 2 spines proximally; dorsal surface with 7 to 9 rows of partially to nearly complete transverse scutes continued onto lateral face proximally, each with marginal row of short stiff setae, 3 distal-most scutes interrupted at dorsolateral margin by distinct calcareous spine; proximal 0.75 to 0.80 of dorsal surface of fixed finger with transverse rows of scutes provided with marginal short stiff setae, each interrupted at dorsolateral margin by strong spine; distal 0.20 to 0.25 of dorsal surface nearly smooth, with only scattered tufts of setae; cutting edge with row of strong calcareous teeth in proximal 0.65, small calcareous teeth interspersed with corneous teeth distally, terminating in small corneous claw; ventral surfaces of palm and fixed finger smooth, with few scattered fine setae. Carpus slightly shorter than merus; dorsodistal margin with 1 small spine and row of uniformly short stiff setae; dorsomesial margin with row of strong spines; dorsal surface with transverse rows, each consisting of 2 or 3 scutes extending onto dorsal half of lateral face, and provided marginally with short stiff setae; dorsolateral margin not delimited; lateral, mesial and ventral surfaces with scattered tufts of setae. Merus subtriangular; dorsal margin with few transverse ridges and long stiff setae; lateral and mesial faces tufts of stiff setae; ventrolateral margin unarmed or with 1 small spine distally, frequently few transverse ridges and stiff setae in proximal 0.65; ventromesial margin 3 or 4 widely-spaced small spines, ventral surface with few low protuberances or ridges and tufts of stiff setae. Ischium with few stiff setae, occasionally also with 1 small spinulose tubercle on ventromesial margin near proximal angle.

Left cheliped (Figs 41d, f) moderately long, usually reaching nearly to tip of dactyl of right; moderately slender. Dactyl slightly longer than palm; cutting edge with row of small corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with tufts of long setae adjacent to cutting edge, few marginally setiferous scutes mesially, extending onto rounded dorsomesial margin; mesial face dorsally and ventral surface each with few long setae. Palm 0.65 to 0.80 length of carpus; dorsomesial margin not delimited, but with 1 or 2 spines proximally; dorsal surface, like that of right, with 7 to 9 transverse rows of nearly complete single scutes, each extending onto lateral face and provided with marginal row of short stiff setae, 3 distal-most interrupted at dorsolateral margin by spine; dorsal surface of fixed finger with several transverse scutes, each with marginal fringe of short stiff setae and terminating in spine at dorsolateral margin, distal quarter to third nearly smooth, but with scattered tufts of setae; cutting edge with row of small calcareous teeth interspersed with corneous teeth. Carpus slightly longer than merus; dorsodistal margin with 1 small spine and uniform row of short

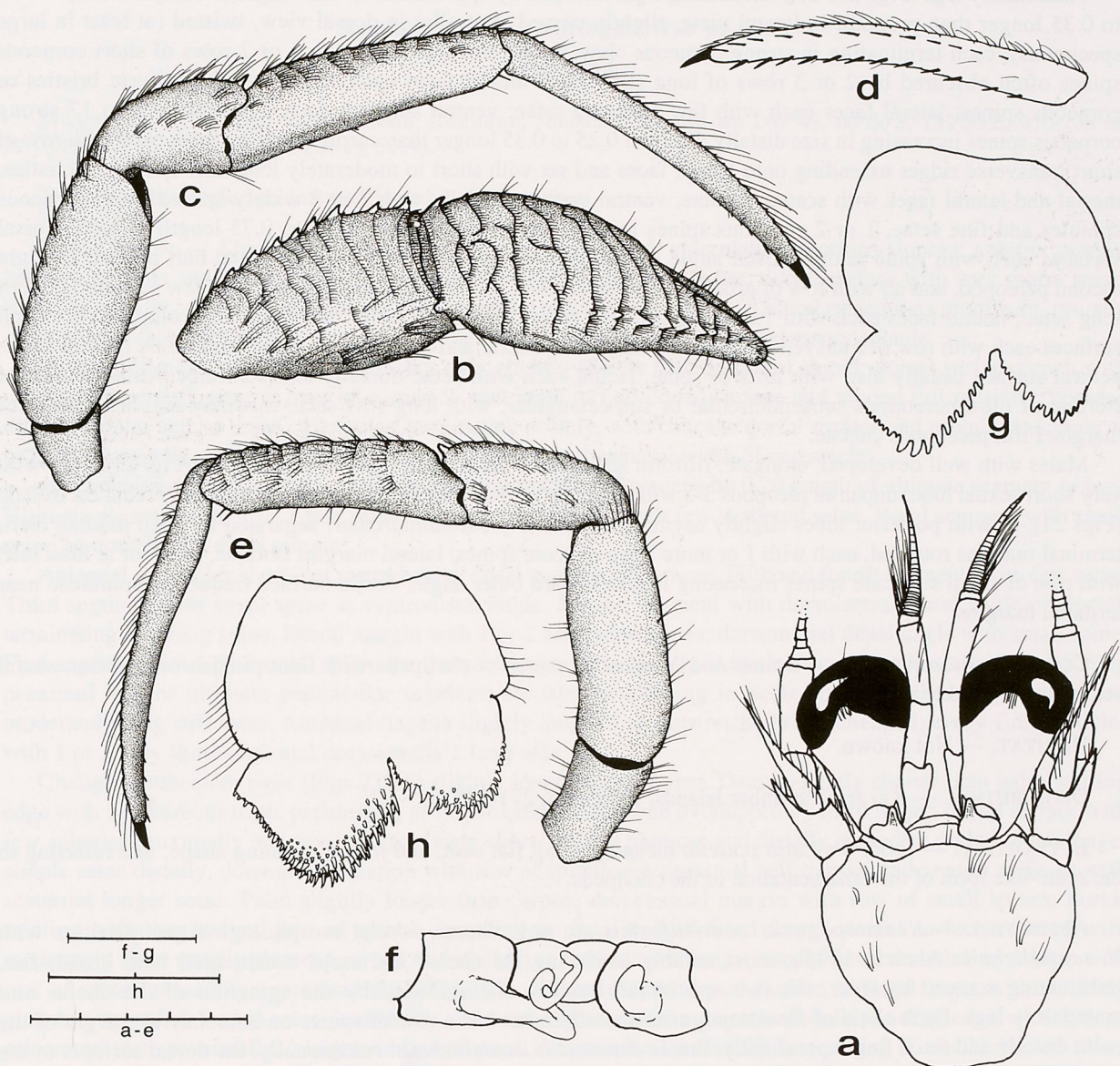


FIG. 21. — *Nematopagurus scutelliformis* sp. nov., a-g, holotype ♂ (5.1 mm) from KARUBAR Stn CP 16; h, paratype ov. ♀ (7.0 mm) from Stn CP 83: a, shield and cephalic appendages; b, right cheliped (lateral view); c, right second pereopod (lateral view); d, dactyl of right second pereopod (mesial view); e, left third pereopod (lateral view); f, coxae and sternite of fifth pereopods; g-h, telson. Scale equals 1.0 mm (f-g), 2.0 mm (h) and 5.0 mm (a-e).

stiff setae, dorsomesial margin with row of prominent spines, dorsolateral margin not delimited; dorsal surface with transverse rows each consisting of 2 or 3 individual marginally setiferous scutes and extending onto lateral face; mesial and ventral surfaces with tufts of stiff setae. Merus subtriangular; dorsal surface with transverse ridges and stiff setae, distal margin with row of moderately long stiff setae; lateral and mesial faces with tufts of stiff setae; ventral surface with few low protuberances and tufts of setae; ventromesial margin with row of 4 widely-spaced spines, decreasing in size proximally, ventrolateral margin with 1 small distal spine and few short sometimes spinulose ridges in proximal half. Ischium with scattered tufts of setae, and occasionally 1 spinulose tubercle on ventromesial margin near proximal angle.

Ambulatory legs (Figs 21c-e) overreaching right cheliped by approximately half length of dactyls. Dactyls 0.25 to 0.35 longer than propodi; in lateral view, slightly curved ventrally; in dorsal view, twisted (at least in large specimens); each terminating in strong corneous claw; dorsal surfaces each with 1 or 2 rows of short corneous spines often obscured by 2 or 3 rows of long stiff setae; mesial faces each with row of spiniform bristles or corneous spines; lateral faces each with few scattered setae; ventral surfaces each with row of 9 to 17 strong corneous spines increasing in size distally. Propodi 0.25 to 0.35 longer than carpi; dorsal surfaces each with row of short transverse ridges extending onto lateral faces and set with short to moderately long stiff spiniform bristles; mesial and lateral faces with scattered setae; ventral surfaces usually with 2 or 3 widely-spaced small corneous spinules and fine setae, 1 or 2 corneous spines at ventrodistal angle. Carpi 0.65 to 0.75 length of meri; dorsal surfaces each with spine at dorsodistal angle, occasionally 1 additional spine in proximal half at least on right second pereopod, and all with row of tufts of stiff setae; mesial and ventral surfaces each with few scattered tufts of long setae; lateral faces each with 1 to 3 rows of stiff setae, longest medially. Meri laterally compressed; dorsal surfaces each with row of transverse ridges and stiff setae; lateral and mesial faces usually with few tufts of setae; ventral surface usually also with tufts of setae. Ischia each with setae dorsally and ventrally. Anterior lobe of sternite of third pereopods subsemicircular or subrectangular, with long stiff setae medially and/or on anterior margin. Fifth pereopods chelate.

Males with well developed, elongate, filiform sexual tube on coxa of right fifth pereopod (Fig. 21f), left with very short sexual tube; unpaired pleopods 3-5 with exopods well developed, endopods substantially reduced. Telson (Figs 21g-h) with posterior lobes slightly asymmetrical, nearly subsemicircular; separated by deep median cleft; terminal margins rounded, each with 1 or more rows of acute spines; lateral margins oblique, each (or at least left) with row of small subacute spines increasing in size toward outer angle; dorsal surface frequently spinulose near terminal margins.

COLOR (in preservative). — Spines and margins of scutes of chelipeds with faint pinkish orange tint; scutal setae usually weakly iridescent.

HABITAT. — Not known.

DISTRIBUTION. — Kai and Tanimbar Islands, Indonesia; 271-349 m.

ETYMOLOGY. — From the Latin *scutella* meaning small flat dish, and *forma* meaning shape, and referring to the scute-like form of the ornamentation of the chelipeds.

AFFINITIES. — *Nematopagurus scutelliformis* sp. nov. shares several morphological peculiarities with *N. scutellichelis* Alcock, 1905b, most notably in having the chelae and carpi ornamented with broad, flat, imbricating scutes; however, the two species are readily distinguished by the spination of the chelae and ambulatory legs. Each chela of *Nematopagurus scutelliformis* has a row of spines on dorsolateral margin of the palm distally and fixed finger proximally, that is absent in *N. scutellichelis*. Additionally, the dorsal surfaces of the carpi of both ambulatory legs of *N. scutellichelis* are provided with a row of spines; the propodi are "ringed or scutellated, the squames and scutes being nude and polished" (ALCOCK, 1905b: 113). The carpi of these appendages in *N. scutelliformis*, although having numerous tufts of stiff setae, have only a dorsodistal spine and occasionally one proximal spine on the second right pereopod; the propodi have short transverse setiferous ridges dorsally that extend onto the lateral surfaces of the segments only slightly.

REMARKS. — Although *N. scutelliformis* is ostensibly very similar in appearance to *N. scutellichelis*, a species reported only from very deep water (in excess of 1500 m) off the Maldive Islands in the Indian Ocean, there is no doubt that the two taxa are distinct. Despite the fact that in some of the larger KARUBAR specimens, the spines of the right cheliped tend to be obscured by stiff setae, those of the left are very distinct in individuals of any size. It is improbable that ALCOCK (1905b) would have failed to observe such spines on the left chela in his specimen(s), which, from the carapace measurement given, appear to be in the size range of the KARUBAR specimens. However, even if he had, the differences in armature and ornamentation of the ambulatory legs provide additional differentiating characters.

Nematopagurus ostlingochirus sp. nov.

Figs 22a-i

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (1.2 mm) (MNHN-Pg 5299).

TYPE. — The single specimen collected is the holotype.

DESCRIPTION. — Shield (Fig. 22a) slightly longer than broad; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with very sparse setae. Rostrum broadly rounded, not reaching distal margins of lateral projections. Lateral projections prominent, roundly subquadrate, each with small submarginal spine laterally, left with additional accessory spinule.

Ocular peduncles moderately short, but only slightly shorter than length of shield; dorsal surfaces each with median tuft of stiff setae at base of cornea, 1 additional tuft on dorsal surface and second tuft mesially; corneae dilated. Ocular acicles small, triangular; terminating acutely, with concave dorsal surface and prominent simple or bifid submarginal spine; separated basally by slightly less than basal width of one acicle.

Antennular peduncles short, overreaching distal margins of corneae by 0.20 length of ultimate segment or less. Ultimate segment with 1 or 2 fine setae. Penultimate segment with few scattered setae. Basal segment with small spine on dorsolateral distal margin.

Antennal peduncles short, not overreaching distal margins of corneae. Fifth and fourth segments with few setae. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in strong spine, lateral margin with 1 or 2 accessory spines; dorsomesial distal angle with small spine. First segment with 1 or 2 small spines on ventrolateral margin distally. Antennal acicle moderately long, reaching proximal half of ultimate peduncular segment; arcuate, terminating in acute spine; mesial margin with few moderately long stiff setae. Antennal flagella slightly longer than outstretched right cheliped; every 1 or 2 articles with 1 or 2 very short setae and occasionally 1 long seta.

Chelipeds subequal; right (Figs 22b-c) slightly longer and stronger. Dactyl slightly shorter than palm; cutting edge with 5 calcareous teeth, terminating in small corneous claw and overlapped by fixed finger; dorsal surface with few spinules proximally and several moderately short, usually plumose and distally curved or curled setae, longer simple setae distally, dorsomesial margin with row of spinules in proximal half; mesial and ventral surfaces with scattered longer setae. Palm slightly longer than carpus; dorsomesial margin with row of small spines; dorsal midline with longitudinal row of spines extending to distal half of fixed finger, dorsal surface covered with moderately short usually plumose curved or curled setae and scattered longer simple setae; dorsolateral margin with row of spines extending approximately half length of fixed finger; dorsal surface of fixed finger with similarly plumose curved or curled setae proximally and scattered longer simple setae distally; cutting edge with 2 large calcareous teeth proximally, 1 large and several small calcareous teeth distally, terminating in small corneous claw; lateral and ventral surfaces of palm and fixed finger with scattered simple setae. Carpus approximately equal to length of merus; dorsodistal margin with 1 small spine, dorsomesial margin with row of spines; dorsal surface with scattered moderately long stiff setae and row of smaller spines approximating dorsolateral margin; lateral and mesial faces with few short transverse rows of stiff setae. Merus subtriangular; dorsodistal margin with row of stiff setae; dorsal margin and mesial and lateral faces with few long stiff setae; ventrolateral margin with 2 small spines distally; ventromesial margin 2 slightly stronger spines in distal half. Ischium with few setae dorsally and ventrally.

Left cheliped (Fig. 22d) long, reaching almost to tip of dactyl of right; moderately slender. Dactyl slightly shorter than palm; cutting edge with row of small corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with several small spines and few short plumose and curled setae in proximal half, scattered longer simple setae distally; mesial and ventral surfaces with few moderately long simple setae. Palm approximately 0.65 length of carpus; dorsomesial margin with row of spines; dorsal surface with longitudinal row of small spines in slightly raised midline, extending half length of fixed finger and partially obscured by short plumose curved or curled setae; dorsolateral margin with row of spines, extending to distal half

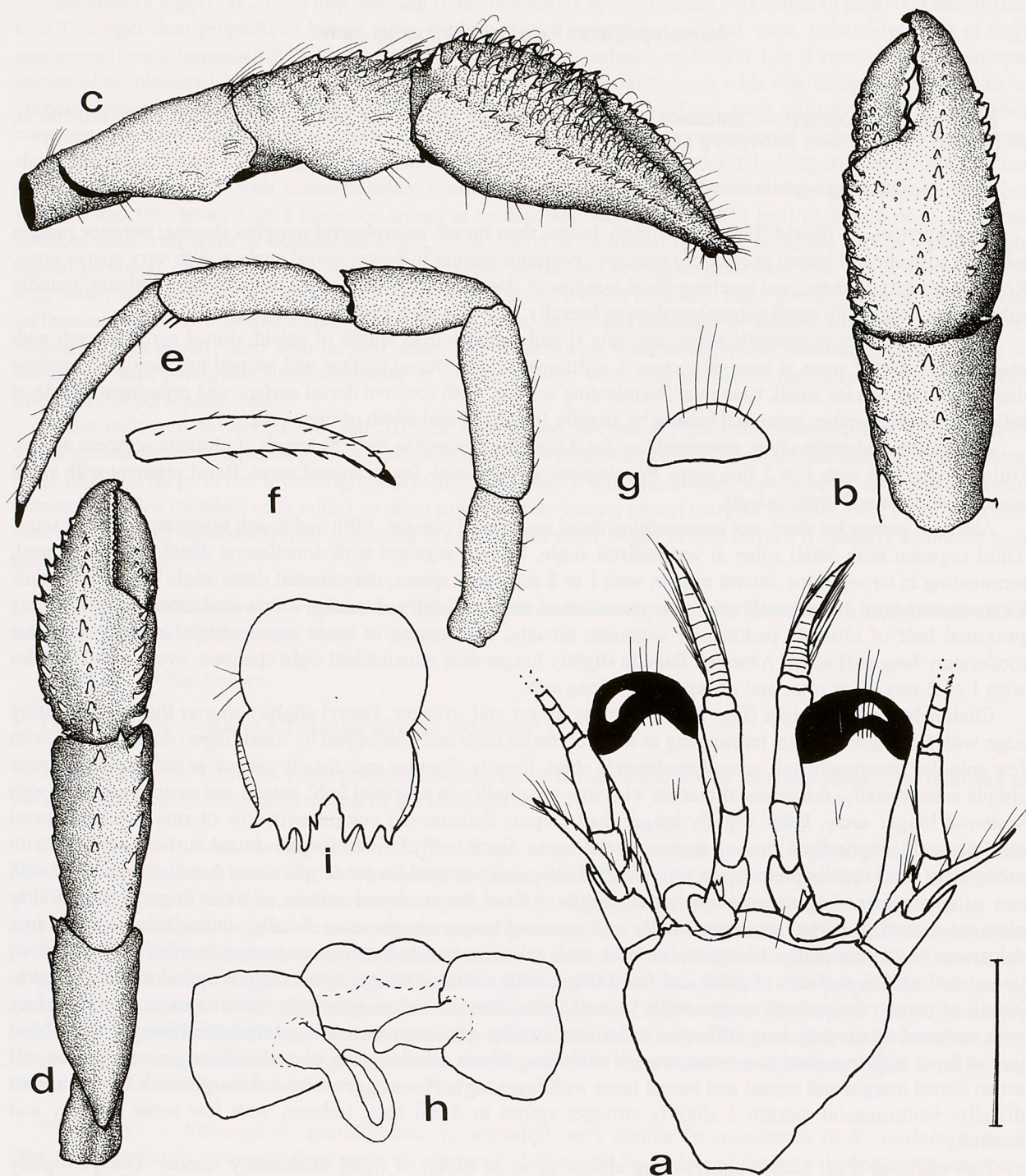


FIG. 22. — *Nematopagurus ostlingochirus* sp. nov., holotype ♂ (1.2 mm) from KARUBAR Stn DW 49: a, shield and cephalic appendages; b, chela and carpus of right cheliped (dorsal view; setae omitted); c, right cheliped (lateral view); d, left cheliped (dorsal view; setae omitted); e, left third pereopod (lateral view); f, dactyl of left third pereopod (mesial view); g, anterior lobe of sternite of third pereopods; h, coxae and sternite of fifth pereopods; i, telson. Scale equals 0.5 mm (g-i) and 1.0 mm (a-f).

of fixed finger and numerous longer but similarly plumose curled setae; cutting edge of fixed finger with row of small calcareous teeth. Carpus slightly longer than merus; dorsodistal margin with 1 small spine; dorsomesial and dorsolateral margins each with row of spines strongest mesially; mesial, lateral and ventral surfaces with few long stiff setae; ventrolateral distal angle with small spine. Merus subtriangular; dorsal surface with few stiff setae, particularly at distal margin; ventromesial and ventrolateral margins each with 2 strong spines in distal half. Ischium with few setae ventrally.

Only detached left third pereopod (Figs 22e-f) remains with holotype. Dactyl approximately 1.25 length of propodus; dorsal surface with few short setae; mesial face with row of 8 corneous spines dorsally; lateral face with few scattered setae; ventral margin with row of 5 corneous spines. Propodus somewhat longer than carpus; surfaces each with few setae; 2 small corneous spinules at ventrodistal angle. Carpus approximately 0.65 length of merus; dorsal and ventral surfaces with few setae, dorsodistal angle with small spine. Merus with few setae dorsally and ventrally. Ischium unarmed. Anterior lobe of sternite of third pereopods (Fig. 22g) narrowly subsemicircular, with few marginal setae. Fifth pereopods chelate.

Male with long right sexual tube (Fig. 22h) not noticeably filamentous terminally; left tube stout, moderately short, directed toward right coxa. Telson (Fig. 22i) with posterior lobes practically symmetrical, nearly subquadrate; separated by moderately deep median cleft; terminal margins straight, both with 3 large spines, left with additional smaller spine; lateral margins rounded, each with distinct chitinous plate.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — Known only from type locality in the Tanimbar Islands, Indonesia; 206-210 m.

ETYMOLOGY. — From the Greek *ostlingos* meaning curled hair, and *cheir* meaning hand, denoting the curling setae on the dorsal surfaces of the chelae of this species.

AFFINITIES. — In having a median row of spines on the dorsal surfaces of both chelae, *N. ostlingochirus* bears some similarity to both *N. indicus* and *N. gardineri*; however, the new species is easily distinguished by the distinctive setation of the chelae.

Nematopagurus alcocki sp. nov.

Figs 23a-i

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 22, 05°22'S, 133°01'E, 124-85 m, 25.10.1991: 1 ♀ (1.3 mm) (MNHN-Pg 5300); 1 ov. ♀ (1.7 mm) (MNHN-Pg 5301).

TYPES. — The ovigerous female (1.7 mm) (MNHN-Pg 5300) from KARUBAR station DW 22 is the holotype. The other female is a paratype.

DESCRIPTION. — Shield (Fig. 23a) as broad as long; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin roundly truncate; dorsal surface with very few tufts of setae. Rostrum broadly rounded, approximately equaling level of lateral projections. Lateral projections prominent, roundly triangular, each with small submarginal spine laterally.

Ocular peduncles moderately short, 0.80 to nearly entire length of shield; dorsal surfaces each usually with median tuft of stiff setae at base of cornea and 1 additional on dorsomesial surface; corneae strongly dilated. Ocular acicles small, triangular; terminating subacutely, with deeply concave dorsal surface and prominent submarginal spine; separated basally by slightly less to slightly more than basal width of one acicle.

Antennular peduncles short, overreaching distal margin of corneae by 0.10 to 0.25 length of ultimate segment. Ultimate segment with 1 or 2 setae on dorsolateral distal margin. Penultimate segment with few scattered setae. Basal segment with small spine on lateral face dorsally.

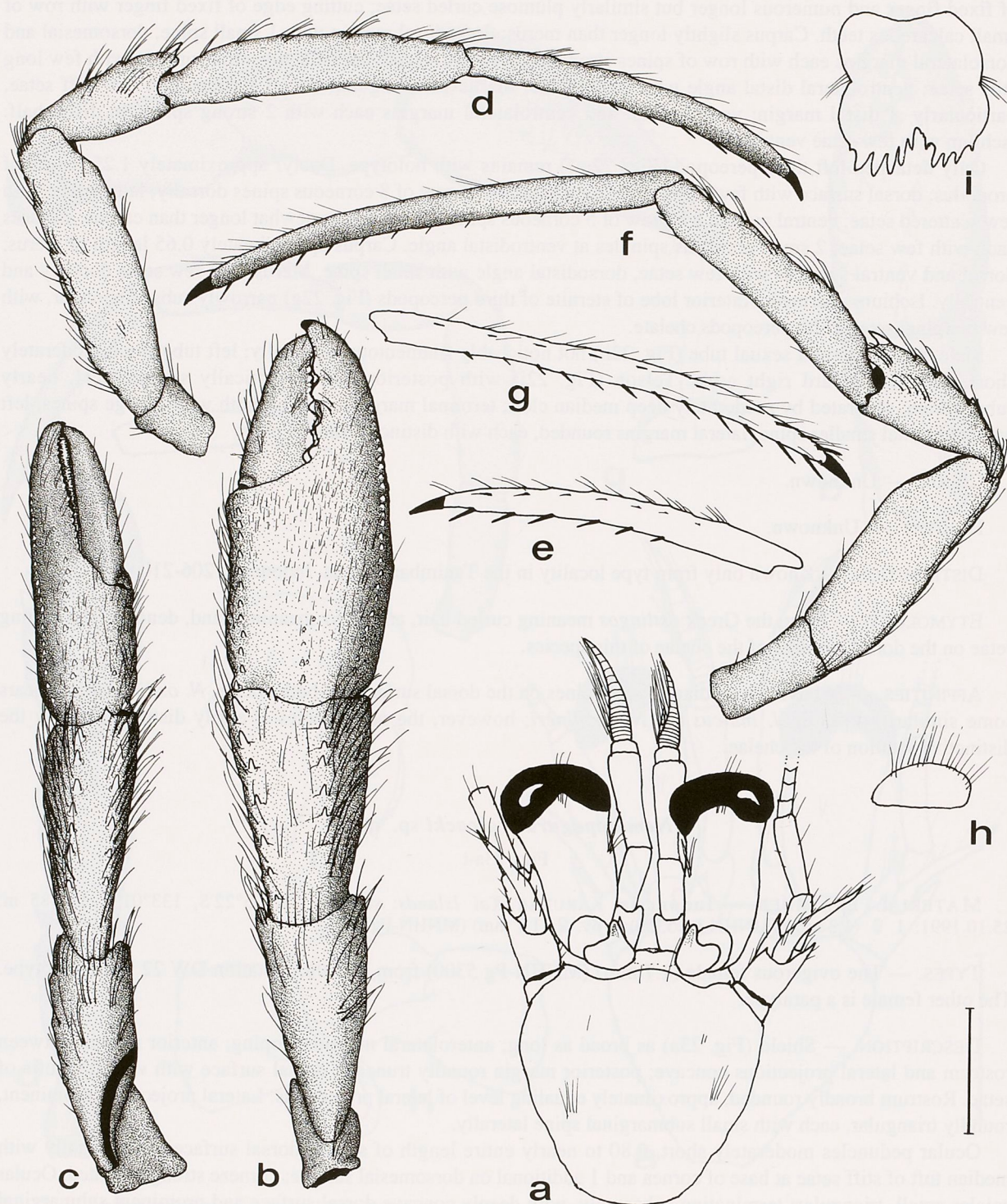


FIG. 23. — *Nematopagurus alcocki* sp. nov., holotype ♀ (1.7 mm) from KARUBAR Stn DW 22: a, shield and cephalic appendages; b, right cheliped (dorsal view); c, left cheliped (dorsal view); d, right second pereopod (lateral view); e, dactyl of right second pereopod (mesial view); f, left third pereopod (lateral view); g, dactyl of left third pereopod (mesial view); h, anterior lobe of sternite of third pereopods; i, telson. Scale equals 0.5 mm (h-i) and 1.0 mm (a-g).

Antennal peduncles short, not overreaching distal margins of corneae. Fifth and fourth segments with few stiff setae. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in simple spine, lateral and mesial margins with few stiff setae; dorsomesial distal angle with small spine. First segment with 2 small spines on ventrolateral margin distally. Antennal acicle moderately long, reaching beyond proximal half of ultimate peduncular segment; arcuate, terminating in acute spine; mesial margin with moderately long stiff setae. Antennal flagella long; occasionally few articles with 1 or 2 very short setae or bristles, at least in proximal half.

Chelipeds subequal; right (Fig. 23b) slightly longer and stronger. Dactyl somewhat shorter than palm; cutting edge with 3 strong calcareous teeth proximally and few calcareous teeth distally, terminating in small corneous claw and overlapped by fixed finger; dorsal surface with scattered short setae and longer setae on rounded dorsomesial margin, occasionally 1 small spinule proximally; mesial and ventral surfaces also with tufts of longer setae. Palm slightly shorter than carpus; dorsomesial margin with row of small or very small spines; dorsal midline with longitudinal row of small spines in proximal third, sometimes extending distally as row of tiny spinules, dorsal surface with numerous short setae, most abundant distally and laterally, dorsolateral margin with row of very small spines extending approximately half length of fixed finger; dorsal surface of fixed finger with short setae proximally and scattered longer setae distally; cutting edge with row of strong calcareous teeth in proximal 0.75, small calcareous teeth distally, terminating in small corneous claw; lateral and ventral surfaces of palm and fixed finger with scattered setae. Carpus slightly longer than merus; dorsodistal margin with 1 small spine, dorsomesial margin with row of spines; dorsal surface with scattered setae, dorsolateral margin with row of somewhat smaller spines; lateral and mesial faces with long stiff bristle-like and often somewhat iridescent setae. Merus subtriangular; dorsodistal margin with row of bristle-like setae, dorsal margin and mesial and lateral faces with short transverse ridges of long stiff bristle-like setae; ventrolateral margin with 1 small spine and 2 tiny spinules distally, stiff setae in proximal 0.65; ventromesial margin 1 or 2 small spines distally and 1 or 2 tuberculate protuberances proximally, ventral surface with few low protuberances or ridges and stiff setae. Ischium with few stiff setae.

Left cheliped (Fig. 23c) moderately long, but not reaching to tip of dactyl of right; moderately slender. Dactyl slightly longer than palm; cutting edge with row of small corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with few scattered setae; mesial and ventral surfaces with few long setae. Palm approximately 0.65 length of carpus; dorsomesial margin with 1 spine at proximal angle, few transverse ridges and stiff setae, and adjacent row of tiny spinules; dorsal surface with row of very small spines laterad of midline and extending onto fixed finger proximally and numerous short setae, dorsolateral margin with row of tiny spines, extending to distal half of fixed finger; cutting edge with row of small calcareous teeth. Carpus somewhat longer than merus; dorsodistal margin with 1 small spine, dorsomesial and dorsolateral margins each with row of moderately small spines; mesial and ventral surfaces with numerous short transverse ridges and bristle-like long setae; ventrolateral distal angle with small tubercle, ventral surface with few low tubercles and long setae. Merus subtriangular; dorsal surface with few transverse ridges and bristle-like setae, distal margin with row of moderately long similar setae; lateral and mesial faces with short transverse ridges and bristle-like setae, ventral surface with few low protuberances and tufts of setae; ventromesial and ventrolateral margins each with few small spines distally and low protuberances proximally. Ischium with few tufts of setae.

Ambulatory legs (Figs 23d-g) similar; dactyl of third left (third right missing in holotype) approximately 0.25 longer than dactyls of second; all terminating in small corneous claws; dorsal surfaces each with row of sparse tufts of moderately short setae and few corneous spines; mesial faces each with row of corneous spines dorsally; lateral faces each with few scattered setae; ventral surfaces each with row of 6 to 9 corneous spines increasing in size distally. Propodi 0.30 to 0.45 longer than carpi; dorsal surfaces each with row of tufts of long bristle-like setae and few corneous spinules; mesial and lateral faces with few scattered setae; ventral surfaces with 1 or 2 small corneous spinules at ventrodistal angle. Carpi 0.65 to 0.75 length of meri; dorsal surfaces each with spine at dorsodistal angle and 1 or 2 much smaller spines in proximal half, partially obscured by tuft of stiff bristle-like setae; lateral faces each with 1 or 3 short rows of bristle-like setae. Meri laterally compressed; dorsal surfaces each with row of short transverse ridges and bristle-like setae; lateral and mesial faces with few setae; ventral surfaces each with 1 small spine in distal third (second) or unarmed (third) and tufts of setae. Ischia each

with few setae dorsally and ventrally. Anterior lobe of sternite of third pereopods (Fig. 23h) roundly subrectangular, with long marginal setae. Fifth pereopods chelate.

Males unknown. Telson (Fig. 23i) with posterior lobes slightly asymmetrical, nearly subsemicircular; separated by moderately deep median cleft; terminal margins rounded or slightly oblique, each with 2 to 4 large and 2 smaller spines; lateral margins slightly oblique.

COLOR (in preservative). — Segments of chelipeds and few spines retain faint small spots or patches of light orange; bristle-like setae with yellowish tint.

DISTRIBUTION. — Known only from the type locality in Kai Islands, Indonesia; 85-124 m.

ETYMOLOGY. — This species is named for A. ALCOCK, noted carcinologist of the Indian Museum, whose monographic work on Indian Paguridea is still the cornerstone for regional studies.

AFFINITIES. — *Nematopagurus alcocki* appears most closely allied with *N. australis*, particularly in having long, stiff iridescent setae on the mesial and lateral faces of the carpi of both chelae, and a covering of short setae on the dorsal surfaces of the palms and fixed fingers. The ocular peduncles of HENDERSON's (1888) specimen from the Arafura Sea are a little more slender than seen in the specimens of *N. alcocki*, and the corneae only slightly dilated; however the peduncles of syntype from the Fiji Islands more closely approach those of the KARUBAR species. Nonetheless, the two species are immediately distinguished by the dactyls of the chelipeds. The dorsomesial margins of both dactyls are provided with a row of spines in *N. australis*, whereas they are completely unarmed or may have one very small spine proximally in *N. alcocki*. Other differences include the spination of the dorsal surface of the palm of *N. australis* that is lacking in *N. alcocki*, and the longer ocular peduncles of the former species. HENDERSON described the carpi of the ambulatory legs as slightly spinulose. Only a dorsodistal spine is actually present on each of these appendages, whereas the carpi of *N. alcocki* have one or two small spines proximally on the dorsal margins, in addition to the dorsodistal spine.

REMARKS. — Although this species is described from only female specimens, there can be little doubt as to the accuracy of its assignment to *Nematopagurus*. In addition to well developed paired first pleopods modified as gonopods in the holotype, *N. alcocki* has such additional generic characters as the small, deeply grooved ocular acicles, reduced, rounded rostrum and clearly exposed interocular lobes, subequal chelipeds, and elongate ambulatory legs with ventrally armed dactyls.

The paratype is an immature female, as the gonopores are quite small and the gonopods minute; only a rudimentary left second pleopod is apparent. The chelipeds of this specimen have similar patterns of spination to that described for the holotype; however, the spines are appreciably stronger. In contrast, the dorsal surfaces of the chelae are not as abundantly provided with short setae and the characteristic bristle-like longer setae are weaker and more sparse on both the chelipeds and ambulatory legs.

One additional female specimen (1.7 mm) (POLIPI) of *Nematopagurus* was found at stn DW 22, and probably also represents *N. alcocki*; however, it is missing the chelipeds, left ambulatory legs, including the coxa of the third, the coxae and sternite of the fifth pereopods, and the abdomen. This specimen is not considered a paratype, even though the carpi of both right ambulatory legs have a very small proximal spine on the dorsal margin, and the second has a tiny spine on the ventral margin of the merus.

Genus *AUSTRALEREMUS* McLaughlin 1981

Pylopagurus - FOREST & DE SAINT LAURENT, 1968: 145 (in part), not *Pylopagurus* A. Milne Edwards & Bouvier, 1891. — MIYAKE, 1978: 119 (in part). — McLAUGHLIN, 1981a: 2 (in part).
Australeremus McLaughlin, 1981a: 4. — McLAUGHLIN & GUNN, 1992: 68.

DIAGNOSIS. — Eleven pairs phyllobranchiate gills. Ocular acicles triangular. Basal antennular segment with strong lateral spine; ventrodistal margin produced into elongate lobe. Antennal peduncle with supernumerary

segmentation. Maxillule with external lobe of endopod well developed, not recurved. Third maxilliped with well developed crista dentata and very strong accessory tooth.

Right cheliped often not appreciably larger than left. Chela of right subrectangular to subtriangular; dorsal surface of palm circumscribed by row of dorsomesial, dorsoproximal and dorsolateral marginal spines; angle of propodal-carpal articulation approximately 15° from horizontal plane. Left chela with variable propodal-carpal angle of articulation; dactyl elongate and considerably narrower than fixed finger; dorsolateral margin of chela elevated, at least proximally, and frequently expanded. Fourth pereopods semichelate; propodal rasp consisting of single row of corneous scales.

Males without paired pleopods or sexual tubes; with 3 unpaired, unequally biramous left pleopods. Females with paired first pleopods modified as gonopods, with 4 unpaired biramous pleopods, second to fourth with both rami well developed, fifth with endopod reduced.

Abdomen frequently straight or only weakly flexed. Uropods symmetrical or asymmetrical. Telson with transverse suture, sometimes only weakly indicated; posterior lobes symmetrical or subequal, terminal margins straight, oblique or rounded, armed; lateral margins each with undifferentiated, usually weakly calcified or chitinous plate.

REMARKS. — McLAUGHLIN (1981a) chose the generic epithet in the belief that species of the genus all were endemic to the Southern Ocean. In their subsequent review of *Australeremus*, McLAUGHLIN and GUNN (1992) reassigned *Eupagurus triserratus* Ortmann, 1892, and *Pylopagurus serpulophilus* Miyake, 1978 (as a junior synonym) from Japan to the genus, thus giving it a broad, but disjunct distribution. The discovery, not only of *A. triserratus*, but of an additional new species in the Maluku region of Indonesia suggests that *Australeremus* may be far more ubiquitous than previously believed and simply overlooked by collectors. At least several species occupy habitats not routinely sampled, such as bryozoan and serpulid worm tubes.

Australeremus triserratus (Ortmann, 1892)

Figs 24a, c

Eupagurus triserratus Ortmann, 1892: 308, pl. 12, fig. 15.

?*Eupagurus tricarinatus* - BALSS, 1913: 58 (?not *Eupagurus tricarinatus* Stimpson, 1858).

Eupagurus triserratus (?) - SHINO, 1936: 184.

Eupagurus (*Eupagurus*) *triserratus* - MELIN, 1939: 29, figs 9, 10.

Pagurus triserratus - KIM, 1964: 5, pl. 1, fig. 6; 1970: 8; 1973: 225, 599, fig. 50, pl. 65, fig. 30.

Pylopagurus serpulophilus Miyake, 1978: 120, pl. 4, fig. 4; 1982: 120, pl. 40, fig. 5. — McLAUGHLIN, 1981a: 3.

Australeremus triserratus - McLAUGHLIN & GUNN, 1992: 87, fig. 14, pl. 1.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 50, $07^\circ 59'S$, $133^\circ 02'E$, 184-186 m, 29.10.1991: 1 ♂ (0.9 mm) (MNHN-Pg 5302).

DIAGNOSIS. — Shield (Fig. 24a) slightly to considerably longer than broad. Rostrum acutely triangular. Ocular peduncles slightly shorter than antennular peduncles. Ocular acicles acutely triangular, with strong submarginal spine.

Right cheliped (Fig. 24c) with row of spines on dorsomesial margin of dactyl, dorsal surface with scattered low or spinulose tubercles. Dorsomesial, dorsoproximal and dorsolateral margins of palm each with row of acute spines entirely circumscribing palm and fixed finger; dorsal surface slightly convex and with numerous blunt or spinulose tubercles, midline with single or occasionally double row of larger spines. Carpus often with appreciably concave mesial face; dorsomesial margin with row of spines at least in distal half, second row of smaller spines laterally. Merus with row of spines on ventrolateral margin distally, ventromesial margin with 3 or 4 spines proximally.

Left cheliped (missing in KARUBAR specimen) with propodal-carpal articulation 45° to 50° from horizontal plane. Dactyl dorsoventrally flattened, unarmed. Palm and fixed finger with row of strong spines on dorsolateral margin, dorsal surfaces generally flattened, armed with 2 irregular rows of tubercles or spinules. Carpus with row of acute spines on dorsal margin.

Ambulatory legs generally similar. Dactyls each with 7 to 11 corneous spines on ventral margin; propodi with low protuberances on dorsal surfaces. Carpi each with 1 spine at dorsodistal angle, second often also with 1 additional spine on dorsal surface proximally. Sternite of third pereopods with subsemioovate anterior lobe.

Uropods symmetrical. Telson (Fig. 24g) with terminal margins of posterior lobes straight or slightly oblique, armed with 2 to 4 strong spines and occasionally 1 or 2 small spines; lateral plates reduced.

COLOR (in preservative). — Ground color of body and legs light red-brown. Carapace with pair of dark red-brown spots in front and behind cervical groove. Antennal flagellum with light and dark red-brown segments alternatively. Chela and carpus dark red-brown; merus light red-brown with three dark colored cross-bands. Walking legs light red-brown; meri and dactyls each with two dark colored cross-bands; carpi and propodi each with one dark colored cross-band (after MIYAKE, 1978, pl. 4, fig. 4).

HABITAT. — Serpulid worm tubes, at least in part.

DISTRIBUTION. — Sagami Bay, Tanabe Bay, Amakusa, Japan; East China Sea; Bonin Islands; South China Sea; Tanimbar Islands, Indonesia; 60 - 400 m.

AFFINITIES. — Based upon the armature of the chelipeds and carpi of the ambulatory legs, McLAUGHLIN and GUNN (1992) suggested a possible relationship among the species, *A. triserratus*, *A. stewarti* (Filhol, 1883), and *A. eltaninae* McLaughlin & Gunn, 1992. However, a much closer kinship now appears to exist with *A. indonesiensis* sp. nov., as is discussed under that taxon.

REMARKS. — The diagnosis given is here for the species in general, not just as characterized by the very small KARUBAR specimen. This report of *A. triserratus* represents a considerable extension of the southern range of this species. McLAUGHLIN and GUNN (1992) earlier had documented its occurrence only as far south as the South China Sea southwest of Kaohsiuhg, Taiwan. Despite its small size and the absence of the left cheliped, the single specimen in the KARUBAR collection unquestionably represents *A. triserratus*. The right palm has the marginal encirclement of spines characteristic of *Australeremus* and the median row of spines on the dorsal surface indicative of *A. triserratus*.

Australeremus indonesiensis sp. nov.

Figs 24 b, d-f, h, 42a-b

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♀ (1.9 mm) (MNHN-Pg 5303). — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 26.10.1991: 1 ♀ (2.0 mm) (MNHN-Pg 5304).

TYPES. — The female (1.9 mm) (MNHN-Pg 5303) from KARUBAR station DW 18 is the holotype. The other female is a paratype.

DESCRIPTION. — Shield (Fig. 24b) longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with scattered tufts of moderately long setae. Rostrum triangular, with small terminal spine; reaching beyond bases of ocular acicles. Lateral projections obtusely or acutely triangular, with marginal or submarginal spine. Posterior carapace with few tufts of long setae mesially adjacent to cervical groove.

Ocular peduncles 0.75 to 0.85 length of shield, moderately slender, dorsal surfaces with few sparse tufts of setae; corneae slightly, if at all, dilated. Ocular acicles triangular, terminating subacutely and with strong submarginal spine; separated basally by approximate basal width of one acicle.

Antennular peduncles (when extended) overreaching ocular peduncles by third to half length of ultimate segment. Basal segment with spine at dorsolateral distal margin. Penultimate segment with scattered short setae. Ultimate segment usually with 1 long seta at dorsodistal margin and few much shorter setae on dorsal surface.

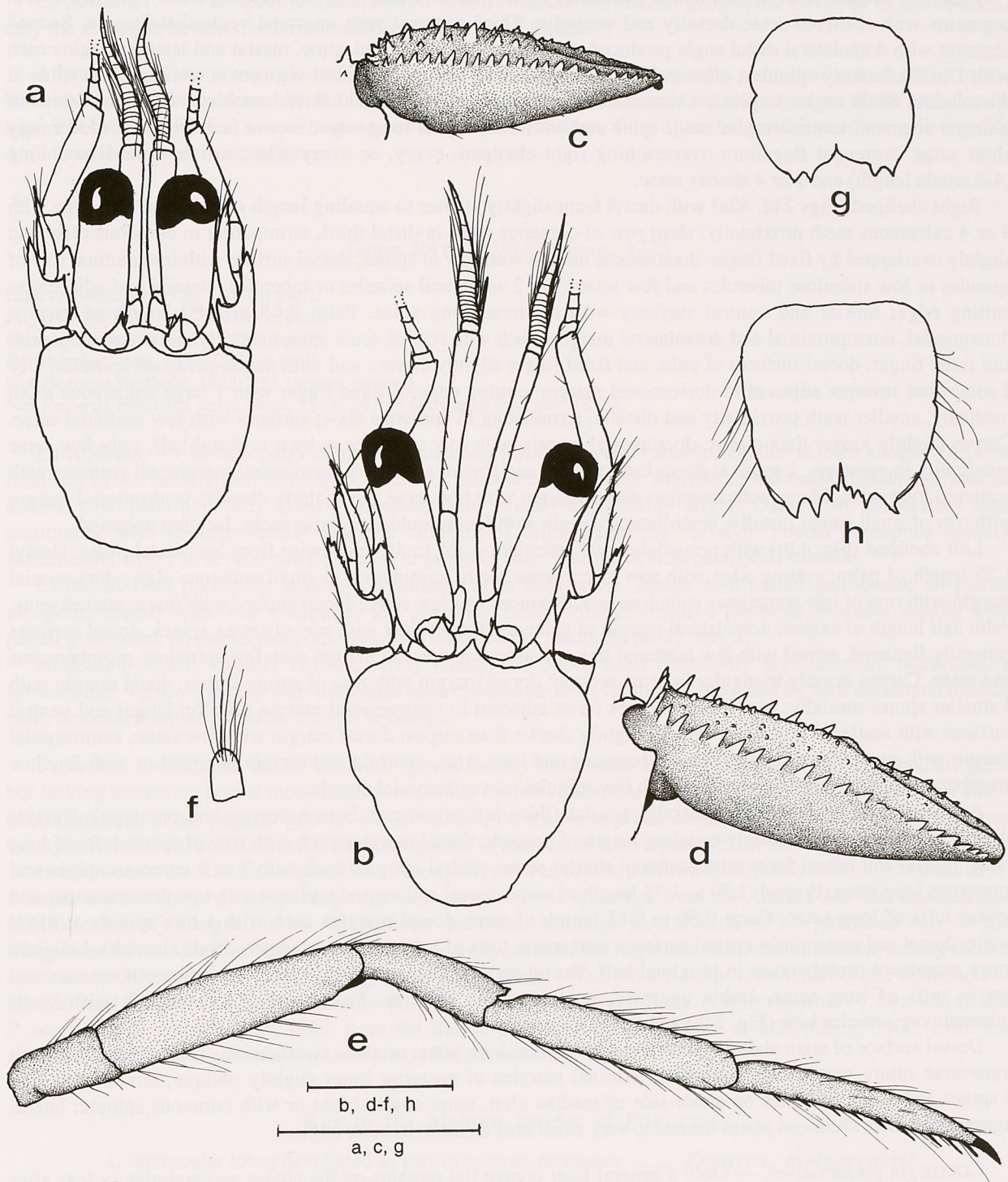


FIG. 24. — *Australeremus triserratus* (Ortmann, 1892), a, c, g, ♂ (0.9 mm) from KARUBAR Stn DW 50. — *Australeremus indonesiensis* sp. nov., b, d-f, h, holotype ♀ (1.9 mm) from Stn DW 18: a-b, shield and cephalic appendages; c-d, right chela (lateral view); e, right second pereopod (lateral view); f, anterior lobe of sternite of third pereopods; g-h, telson. Scales equal 0.5 mm (f-h) and 1.0 mm (a-e).

Antennal peduncles overreach ocular peduncles by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with scattered setae dorsally and ventrally. Third segment with unarmed ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute bifid spine, mesial and lateral margins each with 1 to 3 accessory spinules; dorsomesial distal angle with acute spine. First segment sometimes with spine at dorsolateral distal angle, 1 spine on ventrolateral margin distally. Antennal acicle reaching to proximal third of ultimate segment, terminating in small spine and with 1 to 4 quite long setae; mesial face with few moderately short setae. Antennal flagellum overreaching right cheliped; every, or every other, article with 1 to 3 long (4-6 article length) and 1 or 4 shorter setae.

Right cheliped (Figs 24d, 42a) with dactyl from slightly shorter to equaling length of palm; cutting edge with 3 or 4 calcareous teeth proximally, short row of corneous teeth in distal third, terminating in corneous claw and slightly overlapped by fixed finger; dorsomesial margin with row of spines, dorsal surface with longitudinal row of spinules or low spinulose tubercles and few setae, 1 or 2 additional spinules or tubercles laterally and adjacent to cutting edge; mesial and ventral surfaces with scattered long setae. Palm 0.65 to 0.80 length of carpus; dorsomesial, dorsoproximal and dorsolateral margins each with row of acute spines entirely circumscribing palm and fixed finger, dorsal surfaces of palm and fixed finger slightly convex and with numerous small spinules, 1 or 2 somewhat stronger adjacent to dorsomesial margin; cutting edge of fixed finger with 1 large calcareous tooth medianly, smaller teeth proximally and distally, terminating in corneous claw; surfaces with few scattered setae. Carpus slightly longer than merus; dorsomesial margin with row of spines at least in distal half, only few setae proximally in paratype, 1 spine at dorsodistal margin and row of spines on dorsolateral margin; all surfaces with scattered long setae. Merus subtriangular; dorsal margin with few setae, particularly distally; ventromesial margin with row of small spines distally, ventrolateral margin with few spinulose protuberances. Ischium unarmed.

Left cheliped (Fig. 42b) with propodal-carpal articulation 35° to 45° clockwise from horizontal plane. Dactyl 1.25 length of palm; cutting edge with row of corneous teeth, terminating in small corneous claw; dorsomesial margin with row of low sometimes spinulose protuberances and few setae, dorsal surface with few scattered setae. Palm half length of carpus; dorsolateral margin of palm and fixed finger with row of strong spines, dorsal surfaces generally flattened, armed with few scattered tiny spinules, dorsomesial margin with few spinulose protuberances and setae. Carpus acutely triangular in cross-section; dorsal margin with row of strong spines, distal margin with 2 smaller spines mesially; 1 or 2 blunt spines on or adjacent to ventromesial margin distally; lateral and ventral surfaces with scattered long setae. Merus slightly shorter than carpus; dorsal margin with few setae; ventromesial margin with row of small spines or protuberances and long setae, ventrolateral margin unarmed or with few low protuberances and long setae. Ischium with few spinules on ventromesial margin.

Ambulatory legs (Fig. 24e) generally similar (third left missing in both holotype and paratype). Dactyls slightly shorter to approximately equaling length of propodi; dorsal margins each with row of sparse tufts of long setae; mesial and lateral faces with scattered shorter setae; ventral margins each with 7 or 8 corneous spines and numerous long setae. Propodi 1.50 to 1.75 length of carpi; dorsal and ventral surfaces with low protuberances and sparse tufts of long setae. Carpi 0.50 to 0.65 length of meri; dorsal margins each with 1 tiny spinule at distal angle, dorsal and particularly ventral surfaces with sparse tufts of long setae, second pereopods also with 1 slightly more prominent protuberance in proximal half. Dorsal and ventral surfaces of meri with low protuberances and sparse tufts of long setae. Ischia unarmed, but with tufts of setae. Sternite of 3rd pereopods with small subsemioovate anterior lobe (Fig. 24h) and tuft of long setae.

Dorsal surface of sixth abdominal somite with several long setae; uropods symmetrical. Telson (Fig. 24h) with transverse suture very faintly indicated; terminal margins of posterior lobes slightly oblique, armed with 2 or 3 spines and 1 or 2 spinules on either side of median cleft, outer angles blunt or with corneous spinule; lateral margins rounded, chitinous plates limited to very small area adjacent to outer angle.

COLOR (in preservative). — Only a general faint orange tint remains on the chelae and ambulatory legs after four years in alcohol.

HABITAT. — Unknown.

DISTRIBUTION. — Presently known only from the Kai Islands, Indonesia; 205-289 m.

ETYMOLOGY. — The specific name, *indonesiensis*, reflects the general geographic environs of this species, only the second to be described from outside the "Southern" Ocean.

AFFINITIES. — As previously indicated, *A. indonesiensis* is morphologically most similar to *A. triserratus*. Both species are characterized by the lack of armature on the dorsal margins of the segments of the ambulatory legs. The lack of a median row of large spines on the dorsal surface of the right chela will immediately distinguish *A. indonesiensis* from *A. triserratus*.

Genus *PAGURUS* Fabricius, 1775

Cancer Linnaeus, 1758: 625 (in part).

Pagurus Fabricius, 1775: 410 (in part).

Eupagurus Brandt, 1851: 105 (in part).

Bernhardus Dana, 1851: 267 (in part).

Not *Pagurus* Berthold, 1827: 255 (nomen nudum).

Not *Pagurus* Fabricius sensu Dana, 1851: 267 (= *Dardanus* Paul'son, 1875).

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Rostrum variable. Ocular acicles simple, bifid or multifid. Crista dentata well developed, with 1 or more accessory teeth. Sternite of third maxillipeds unarmed or armed. Chelipeds generally grossly unequal, right usually appreciably larger. Dactyls of ambulatory legs commonly with spinose ventral margins. Sternite of third pereopods variable. Fourth pereopods usually semichelate, with 1 to several rows of scales in propodal rasp. Sternite of fifth pereopods variable.

Coxae of fifth pereopods generally symmetrical in both sexes. Males with paired gonopores; no paired pleopods, usually with 3 or 4 unpaired left pleopods, rarely without unpaired pleopods. Females usually with paired gonopores; no paired pleopods, usually 4 unpaired left pleopods, rarely only 3.

Abdomen usually spirally twisted, rarely straight. Uropods most commonly asymmetrical, occasionally symmetrical. Telson typically with transverse suture; posterior lobes frequently separated by well developed median cleft; terminal margins rounded, straight or oblique.

REMARKS. — *Pagurus* is the "catch-all" genus for any hermit crab having 11 pairs of phyllobranchiate gills, but lacking secondary sexual modifications or similar exclusive characters, and as such is the most specious, albeit heterogeneous, of all pagurid genera. However, despite the widespread occurrence of more than 150 species throughout the world's oceans, fewer than one quarter of those have been reported from the tropical Indo-Pacific.

In addition to the KARUBAR specimens, five species of *Pagurus* are known specifically from the Maluku area. A small male of *Pagurus compressipes* (Miers, 1884) was the specimen from the Arafura Sea that HENDERSON (1888) tentatively assigned to his "*Pagurodes*" *piliferus*. Although BUITENDIJK (1937) published only on the Diogenidae of the "*Snellius*" expedition, she did identify some of the Paguridae from that collection, among them a specimen of *P. hirtimanus* (Miers, 1880) from Wotap Island ("Tenimber Islands"), now part of the collection of the National Museum of Natural History (USNM 122050). HAIG and BALL (1988) reported *P. hirtimanus* and *P. moluccensis* Haig & Ball, 1988, from the Banda Islands, *P. hedleyi* Grant & McCulloch, 1906, from the Arafura Sea, and *P. pergranulatus* (Henderson, 1896) from Seram.

Key to the Maluku species of *Pagurus*

1. Interocular lobes developed as pair of spinose processes *Pagurus moluccensis**
- Interocular lobes not developed as pair of spinose processes 2
2. Ventromesial margins of carpus and/or merus of right cheliped strongly produced into ventrally directed "wing-like" lobe 3
- Ventromesial margins of carpus and/or merus of right cheliped not produced into ventrally directed "wing-like" lobe 4

3. Dorsomesial distal angle of right chela produced into distinct spinose or tuberculate lobe; dactyls of ambulatory legs longer than propodi; second pereopods each with dorsodistal and dorsoproximal spine *P. pergranulatus**
- Dorsomesial distal angle of right chela not produced into distinct spinose or tuberculate lobe; dactyls of ambulatory legs shorter than propodi; second pereopods each with only dorsodistal spine *P. hedleyi**
4. Dorsal surfaces of chelae armed with numerous very strong spines 5
- Dorsal surfaces of chela unarmed or armed only with granules, tubercles or small spines.... 6
5. Dactyl of fourth pereopod with multiple rows of corneous scales in propodal rasp; lateral face of propodus of left third pereopod with numerous short transverse rows of setae *P. haigae* sp. nov.
- Dactyls of fourth pereopods with single row of corneous scales in propodal rasp; lateral face of propodus of left third pereopod without numerous short transverse rows of setae ... *?Pagurus* sp.
6. Right cheliped not appreciably longer than left; dorsomesial and dorsolateral margins of chelae each forming low, but distinct ridge, dorsal surfaces armed with transverse ridges and setae *P. compressipes**
- Right cheliped appreciably longer than left; dorsomesial and dorsolateral margins of chelae not forming low, but distinct ridges, dorsal surfaces not armed with transverse ridges and setae 7
7. Dorsal surfaces of chelae with covering of dense short setae practically obscuring armature *P. hirtimanus**
- Dorsal surfaces of chelae without covering of dense short setae practically obscuring armature 8
8. Dorsal surface of right chela smooth, granular, minutely spinulose or with small simple tubercles; dactyls of ambulatory legs nearly twice length of propodi *P. kaiensis* sp. nov.
- Dorsal surface of right chela with numerous small spines and tubercles, latter usually with central corneous capsule; dactyls of ambulatory legs much less than twice length of propodi *P. capsularis* sp. nov.

Pagurus kaiensis sp. nov.

Figs 25a-l, 42e-f

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 14, 05°18'S, 132°38'E, 245-246 m, 24.10.1991: 1 ♂ (2.6 mm) (MNHN-Pg 5305). — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 24.10.1991: 1 ♀ (2.8 mm) (POLIPI). — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (8.4 mm) (MNHN-Pg 5306); 1 ♀ (3.0 mm) (MNHN-Pg 5307). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♀ (3.9 mm) (USNM 276015).

TYPES. — The male (8.4 mm) (MNHN-Pg 5306) from the KARUBAR station DW 18 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 25a) as long as broad or slightly broader; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced; posterior margin truncate; surface frequently with few scattered setae. Rostrum broadly triangular, terminating acutely or bluntly and often with terminal spine (but absent in holotype). Lateral projections obtusely triangular, with strong submarginal spine.

Ocular peduncles short, approximately 0.70 to 0.80 length of shield, appreciably broadened distally; corneae dilated. Ocular acicles narrowly triangular, terminating acutely and with very small submarginal spine; separated basally by basal width of one acicle.

Antennular peduncles overreaching corneae by 0.75 to entire length of ultimate segment. Ultimate segment with 1 long and few shorter setae on dorsal surface. Penultimate segment with few short setae ventrally. Basal segment with strong spine on laterodistal margin dorsally.

Antennal peduncle overreaching ocular peduncle (including cornea) by 0.50 to 0.65 length of ultimate segment; with supernumerary segment. Fifth and fourth segments with few scattered setae. Third segment with strong spine at ventrodistal angle. Second segment with dorsolateral distal angle very prominently produced, reaching to mid or distal portion of fourth segment and terminating in very strong spine, usually with 1 or 2 accessory spines on both mesial and lateral margins; dorsomesial distal angle with prominent, slender, acute spine. First segment frequently with very small spine on lateral margin distally, ventrolateral margin with 1 prominent spine. Antennal acicle long, reaching to distal half of ultimate peduncular segment, arcuate, terminating in acute spine, mesial margin with sparse row of setae. Antennal flagellum usually slightly shorter than outstretched right cheliped, with 1 to 3 short setae every 2 to 6 articles.

Maxillule with external lobe of endopod moderately well developed, not recurved. Ischium of third maxilliped with 1 accessory tooth on crista dentata. Sternite of third maxillipeds unarmed or with very small median spinule.

Chelipeds grossly unequal. Right cheliped (Fig. 42e) with dactyl somewhat shorter to approximately equaling length of palm; cutting edge with row of calcareous teeth, terminating in small calcareous claw; dorsal surface angularly convex, with scattered small spinules and few setae, midline with row of very small spines extending nearly to tip; dorsomesial margin with row of small spines; ventral surface with few setae. Palm 0.75 to approximately equaling length of carpus; dorsomesial margin with row of spinules and 1 more prominent tubercle at dorsomesial proximal angle, convex dorsal surface generally smooth, faintly granular, or minutely spinulose, but with weak longitudinal depression setting off distinctly spinulose or tuberculate mesial portion, dorsolateral margin with row of small spines, obsolete in proximal fourth or third but increasing slightly in size distally and extending almost to tip of fixed finger; mesial, lateral and ventral surfaces minutely spinulose or granular; cutting edge of fixed finger with row of small calcareous teeth and 1 more prominent tooth medially, terminating in small calcareous claw. Carpus approximately as long as merus; dorsomesial margin with irregular row of small to moderately strong spines; dorsal surface with 3 irregular rows of smaller spines; dorsolateral margin not delimited, dorsolateral surface with numerous short transverse spinulose ridges; distomesial and distolateral margins each with row of small spines; ventral surface tuberculate. Merus triangular; 1 spine on dorsodistal margin, dorsal surface with rows of short transverse spinulose ridges and short setae; ventromesial and ventrolateral margins each with row of small spines, usually more acute laterally; ventral surface spinulose or tuberculate. Ischium unarmed or with row of widely-spaced very small spinulose protuberances and few moderately long setae on ventral margin.

Left cheliped (Fig. 42f) with dactyl exceeding length of palm by 0.10 to 0.35 own length; cutting edge with row of very fine corneous teeth, terminating in small corneous claw; dorsomesial margin with row of spinules at least in proximal half, dorsal midline usually slightly elevated and often with row of spinules in proximal half; dorsal, mesial and ventral surfaces with scattered moderately long setae, most numerous distally and ventrally. Palm 0.40 to 0.65 length of carpus; triangular in cross-section, dorsal surface elevated in midline, but not forming distinct ridge or crest, with irregular double row of very small spines and tubercles, extending onto proximal half of fixed finger, dorsal surface of fixed finger frequently spinulose or weakly tuberculate; dorsolateral margin with row of small or very small spines, usually not extending to tip of fixed finger; dorsolateral and dorsomesial surfaces spinulose and strongly sloping ventrally, dorsomesial margin with irregular row of spinulose protuberances or small spines. Carpus approximately as long as merus; dorsolateral margin with row of acute spines, laterodistal margin with few spines or spinules dorsally; dorsodistal margin with strong usually double spine, dorsomesial margin with row of smaller spines or spinulose protuberances; dorsal, mesial and lateral faces often tuberculate and with scattered setae; ventromesial margin with row of widely-spaced low blunt or spinulose protuberances, ventrolateral margin with row of very small spinulose tubercles, ventral surface tuberculate. Merus with short transverse rows of setae on dorsal margin; ventromesial margin with row of small blunt spines,

ventrolateral margin with row of more acute spines; mesial, lateral and ventral surfaces with scattered setae. Ischium sometimes with row of small spinulose tubercles on ventromesial margin.

Ambulatory legs (Figs 25b-e) similar from left to right. Dactyls 1.65 to 1.85 longer than propodi; in dorsal view, straight or very slightly twisted; in lateral view, slightly arched; terminating in small corneous claws; dorsal

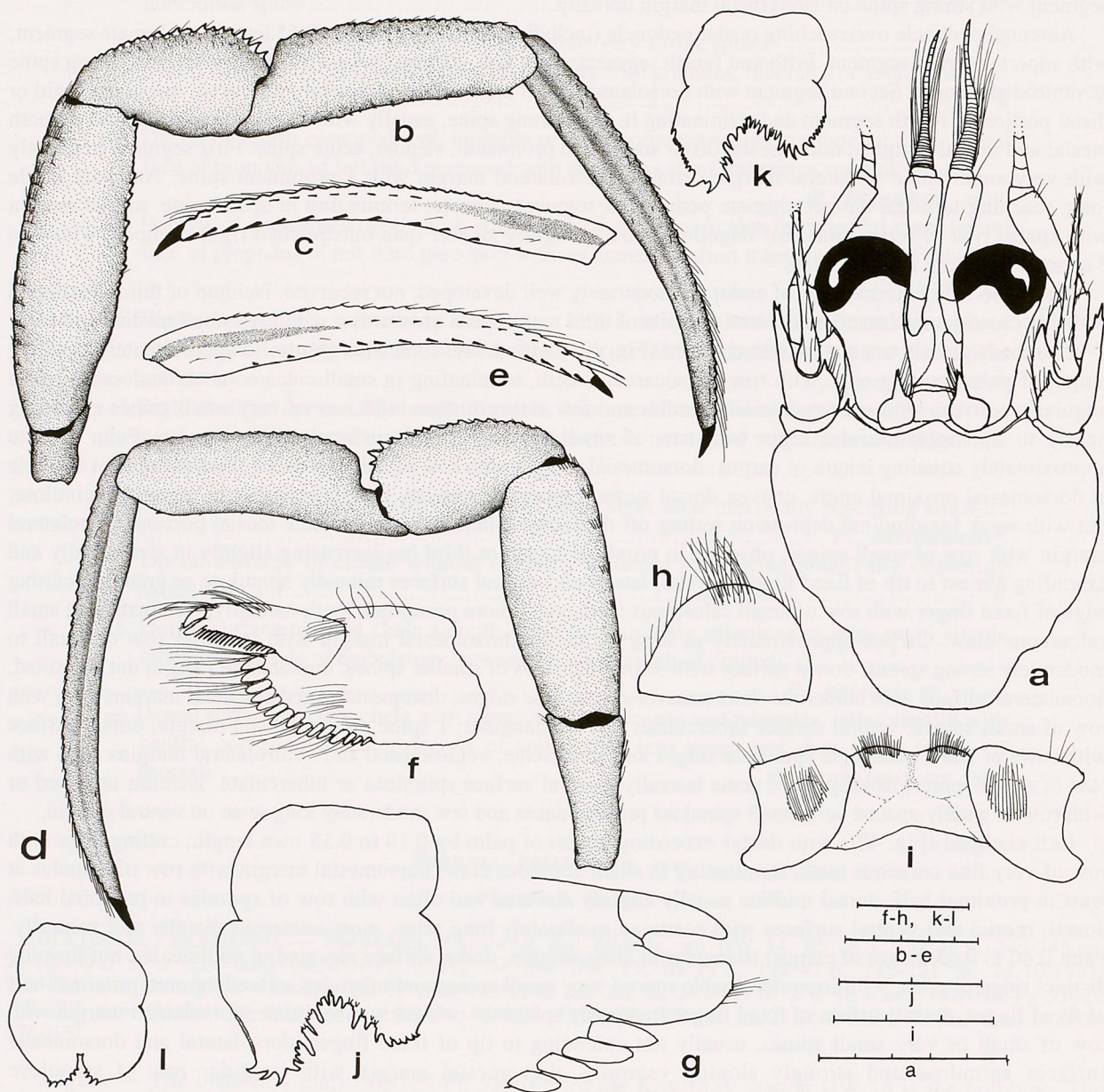


FIG. 25. — *Pagurus kaiensis* sp. nov., a-f, h-j, holotype ♂ (8.4 mm) from KARUBAR Stn DW 18; g, k, paratype ♀ (4.0 mm) from Stn CP 36. — l, *Pagurus compressipes* syntype ♂ (3.9 mm) (NHM 1881.31): a, shield and cephalic appendages; b, right second pereopod (lateral view); c, dactyl of right second pereopod (mesial view); d, left third pereopod (lateral view); e, dactyl of left third pereopod (mesial view); f, dactyl and propodus of left fourth pereopod (lateral view); g, tip of dactyl and preungual process of right fourth pereopod (lateral view); h, anterior lobe of sternite of third pereopods; i, coxae and sternite of fifth pereopods; j-l, telson. Scales equal 0.1 mm (g), 1.0 mm (f, h, k-l), 2.0 mm (j), 3.0 mm (i), and 5.0 mm (a-e).

margins each with row of low protuberances and stiff bristles, increasing in length distally; lateral and mesial faces each with shallow longitudinal sulcus at least in proximal half, lateral faces often also with dorsal and ventral row of fine setae, mesial faces each with short row of small corneous spinules dorsally and few setae ventrally; mesioventral or ventral surfaces each with 11 to 14 corneous spines, increasing in length distally. Propodi 1.30 to 1.50 longer than carpi; dorsal surfaces each with irregular row of spinulose protuberances or spinules, frequently accompanied by very short spiniform bristles; ventrodiscal margins each usually with 1 or 2 corneous spinules, ventral surface with row of quite small corneous spinules, more numerous and closely-spaced on second pereopods of holotype. Carpi 0.65 to 0.75 length of meri; each with row of small spines or spinulose tubercles becoming strongest at distal angles and accompanied by very short, spiniform bristles and sparse short setae. Meri each with series of transverse rows of short setae on dorsal surfaces; second pereopods each with 2 or 3 small spines on ventromesial and ventrolateral distal margins, narrow ventral surface with irregular double row of small spines, third unarmed. Ischia with few setae most abundant dorsally. Propodal rasp of fourth pereopods with single row of corneous scales; dactyl with prominent preungual process (Figs 25f-g) at base of claw. Sternite of third pereopods with few long setae on subsemiovate or subsemicircular anterior lobe (Fig. 25h).

Sternite of fifth pereopods (Fig. 25i) developed anteriorly as two subovate lobes separated by shallow median groove, anterior margins each with tuft of moderately dense setae. Males with paired gonopores partially obscured by row of moderately long setae; 3 unequally biramous unpaired pleopods, pleopods 3 and 4 with exopods moderately well developed, endopods reduced, pleopod 5 with exopod moderately well developed, endopod rudimentary or vestigial. Females with paired gonopores, 4 unpaired pleopods, pleopods 2 to 4 with both rami well developed, pleopod 5 with exopod well developed, endopod markedly reduced.

Uropods asymmetrical; exopods and endopods both with well developed rasps. Telson (Figs 25j-k) with transverse suture; posterior lobes strongly asymmetrical, separated by indistinct or very small median cleft; terminal margins oblique, with marginal and submarginal spines, strongest at outer angles; lateral margins sometimes with row of small spines, or at least left with short marginal chitinous plate.

COLOR (in preservative). — Distal halves of ocular peduncles and penultimate segments of antennular peduncles orange. Chelipeds with overall faint orange tint, appreciably faded on chelae, but darker on carpi and meri; meri also with splotches of white. Ambulatory legs each with longitudinal stripe of orange on lateral face of carpus and on lateral, mesial, and ventral surfaces of dactyl.

HABITAT. — Unknown.

DISTRIBUTION. — Kai Islands, Indonesia; 210-268 m.

ETYMOLOGY. — The specific epithet is derived from the Kai Islands, the type locality of this species.

AFFINITIES. — *Pagurus kaiensis* does not appear closely allied to any of the other regional *Pagurus* species. In small specimens, the general shape of the left chela approaches that of *P. hirtimanus*, but without the dense setation of that species. In having long ambulatory dactyls and a single row of scales in the propodal rasp, *P. kaiensis* resembles *P. compressipes*, but the two are immediately distinguished by the markedly different armatures of the chelipeds (Figs 42g-h) and telson (Fig. 25l) of the latter species.

Pagurus capsularis sp. nov.

Figs 26a-k

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (6.6 mm) (MNHN-Pg 5308). — Stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ♂ (3.2 mm) (MNHN-Pg 5309).

TYPES. — The male (6.6 mm) (MNHN-Pg 5308) from KARUBAR station DW 49 is the holotype. The other male is a paratype.

DESCRIPTION. — Shield (Fig. 26a) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate; surface with few tufts setae. Rostrum broadly triangular, terminating acutely or with terminal spine. Lateral projections obtusely triangular, with submarginal spine or spinule.

Ocular peduncles short, approximately 0.65 length of shield, slightly broader distally; corneae weakly dilated. Ocular acicles narrowly triangular, terminating acutely and with very small submarginal spine; separated basally by slightly more than half basal width of one acicle.

Antennular peduncles overreaching corneae by approximately 0.50 length of ultimate segment. Ultimate segment with 1 long and few shorter setae on dorsal surface. Penultimate segment with few short setae. Basal segment with numerous long stiff setae and strong spine on laterodistal margin dorsally.

Antennal peduncle reaching nearly to distal margin of cornea. Fifth and fourth segments with few scattered setae. Third segment with strong spine at ventrodistal angle obscured by tufts of long stiff setae. Second segment with dorsolateral distal angle very prominently produced, reaching to distal half of fourth segment, terminating in simple or bifid spine partially obscured by stiff setae; dorsomesial distal angle with acute spine, several long stiff setae on mesial margin. First segment with small spine on lateral margin distally, ventrolateral margin with 1 prominent spine. Antennal acicle moderately long, reaching to distal half of ultimate peduncular segment, but not overreaching distal margin of cornea; arcuate, terminating in acute spine, mesial margin with row of tufts of stiff setae. Antennal flagellum longer than outstretched right cheliped, with 1 to 3 short or long setae every 4 to 8 articles.

Maxillule with external lobe of endopod obsolete. Ischium of third maxilliped with 1 accessory tooth on crista dentata. Sternite of third maxillipeds unarmed.

Chelipeds grossly unequal. Right cheliped (Fig. 26b) (regenerating in paratype) with dactyl shorter than palm and overlapped by fixed finger; cutting edge with row of low broad calcareous teeth and adjacent row of tufts of short stiff setae; dorsal surface convex, with closely-spaced spinulose tubercles on mesial side of midline proximally, distally only with few tufts of setae; dorsomesial margin with row of small tuberculate spines, mesial surface with several low broad tubercles. Palm approximately equaling carpus in length; dorsomesial margin with row of small spines, convex dorsal surface with irregular rows of small spines and tubercles, 1 more prominent row of spines in midline, tubercles frequently with central corneous somewhat flask-shaped capsules (Fig. 26c); dorsal surface of fixed finger with row of spinules and double row of tufts of setae adjacent to cutting edge, latter with row of small calcareous teeth, terminating in strong calcareous claw; mesial face and lateral face dorsally with low unmodified tubercles or protuberances; all surfaces with scattered short setae. Carpus approximately as long as merus; dorsomesial margin with row of moderately strong spines and numerous long setae, dorsal surface with scattered setae, 1 irregular row of few spines adjacent to dorsomesial margin, 1 short row of quite small spines in midline and additional row adjacent to weakly delimited dorsolateral margin, distal margin with few spinules; mesial and lateral faces with scattered setae. Merus with few short transverse rows of setae; ventromesial margin with few small blunt spinules, but not ventrally produced into wing-like expansion; ventral surface with unmodified spinulose tubercles, ventrolateral margin with row of acute spines. Ischium unarmed.

Left cheliped (Fig. 26d) with dactyl exceeding length of palm by approximately third own length; cutting edge with row of corneous teeth, terminating in large corneous claw; dorsomesial margin not delimited; dorsal, mesial and ventral surfaces with rows of tufts of moderately long stiff setae. Palm approximately half length of carpus; triangular in cross-section, dorsal surface elevated in midline but not forming distinct ridge or crest, with row of tuberculate spines extending onto proximal half of fixed finger; dorsolateral margin with row of spines, dorsolateral and dorsomesial surfaces strongly sloping ventrally, each with covering of tubercles, most of which provided with central corneous somewhat flask-shaped structure, more numerous laterally but not encompassing entire dorsal surface of fixed finger, dorsomesial margin not delimited. Carpus approximately as long as merus; dorsolateral margin with row of acute spines, laterodistal margin with row of spines extending onto ventrolateral margin distally; dorsodistal margin with pair of strong spines, dorsomesial margin with row of equally strong spines; mesial, lateral and ventral surfaces with numerous low sometimes spinulose or spinose protuberances and tufts of long stiff setae. Merus with short transverse rows of stiff setae on dorsal margin; ventromesial margin with 1 prominent spine and few spinulose tubercles, partially masked by long stiff setae; ventrolateral margin with

row of very strong acute spines and long stiff setae, ventral surface with spinulose tubercles and tufts of long stiff setae; mesial and lateral with low protuberances and setae. Ischium unarmed.

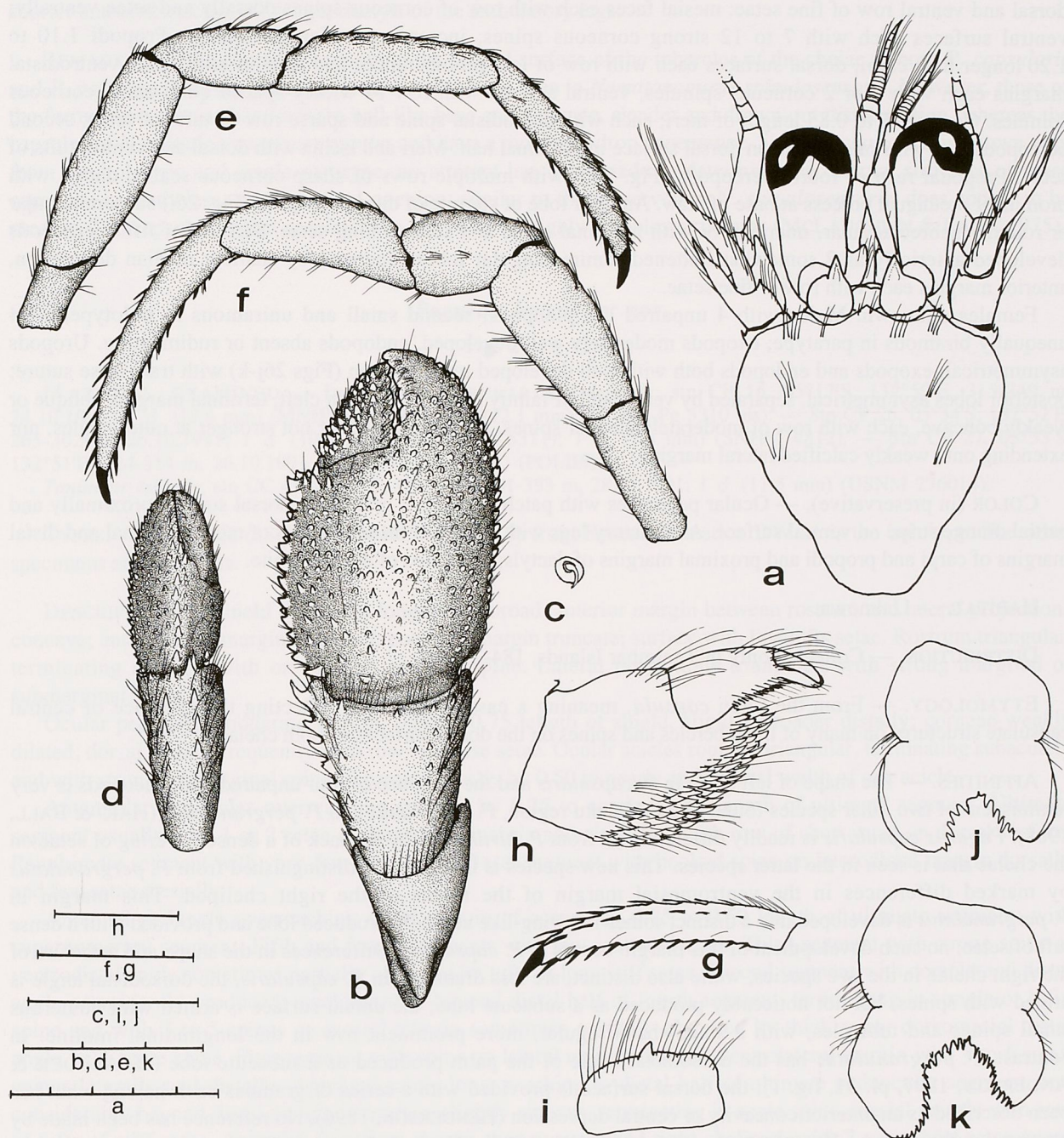


FIG. 26. — *Pagurus capsularis* sp. nov., a, f-h, k, paratype ♂ (6.6 mm) from KARUBAR Stn DW 49; b-e, i, j, holotype ♂ (3.2 mm) from Stn DW 50: a, shield and cephalic appendages; b, right cheliped (dorsal view); c, capsulate tubercle; d, chela and carpus of left cheliped (dorsal view); e, right second pereopod (lateral view); f, left third pereopod (lateral view); g, dactyl of left third pereopod (mesial view); h, dactyl and propodus of right fourth pereopod (lateral view); i, anterior lobe of sternite of third pereopods; j-k, telson. Scales equal 0.5 mm (c, i), 1.0 mm (h, j), 3.0 mm (b, d-e, k), and 5.0 mm (a, f-g).

Ambulatory legs (Figs 26e-g) similar from left to right. Dactyls 1.35 to 1.50 longer than propodi; in dorsal view, straight; in lateral view, slightly curved ventrally; terminating in moderately long corneous claws; dorsal margins each with setae proximally and row of corneous spines, increasing in length distally; lateral faces with dorsal and ventral row of fine setae; mesial faces each with row of corneous spines dorsally and setae ventrally; ventral surfaces each with 7 to 12 strong corneous spines, increasing in length distally. Propodi 1.10 to 1.20 longer than carpi; dorsal surfaces each with row of low protuberances and tufts of stiff setae; ventrodistal margins each with 1 or 2 corneous spinules, ventral surface with row of widely-spaced quite small corneous spinules. Carpi 0.75 to 0.85 length of meri; each with dorsodistal spine and sparse row of tufts of setae; second pereopods also with small spine on dorsal surface in proximal half. Meri and ischia with dorsal and ventral tufts of setae. Propodal rasp of fourth pereopods (Fig. 26h) with multiple rows of sharp corneous scales; dactyl with prominent preungual process at base of claw. Anterior lobe of sternite of third pereopods (Fig. 26i) subsemicircular or roundly subrectangular, unarmed or with marginal spine and several long setae. Sternite of fifth pereopods developed anteriorly as 2 somewhat flattened semirectangular lobes separated by shallow median depression, anterior margins each with row of fine setae.

Females unknown. Males with 4 unpaired left pleopods; second small and uniramous in holotype, all 4 unequally biramous in paratype; exopods moderately well developed, endopods absent or rudimentary. Uropods asymmetrical; exopods and endopods both with well developed rasps. Telson (Figs 26j-k) with transverse suture; posterior lobes asymmetrical, separated by very small or faintly indicated median cleft; terminal margins oblique or weakly concave, each with row of moderately slender spines, not reaching to, or not stronger at outer angles, nor extending onto weakly calcified lateral margins.

COLOR (in preservative). — Ocular peduncles with patch or band of orange on dorsal surface proximally and partial orange stripe on ventral surface. Ambulatory legs with orange at distal margins of meri, proximal and distal margins of carpi and propodi and proximal margins of dactyls; distal tips of dactyls white.

HABITAT. — Unknown.

DISTRIBUTION. — Collected only in Tanimbar Islands, 184-210 m.

ETYMOLOGY. — From the Latin *capsula*, meaning a case or box, and reflecting the presence of central capsulate structures on many of the tubercles and spines on the dorsal surfaces of both chelae.

AFFINITIES. — The shape of left chela in *P. capsularis* and the presence of four unpaired male pleopods is very reminiscent of two other species found in the Maluku region, *P. hirtimanus* and *P. pergranulatus* (HAIG & BALL, 1988). *Pagurus capsularis* is readily differentiated from *P. hirtimanus* by the lack of a dense covering of setae on the chelae that is seen in the latter species. This new species is immediately distinguished from *P. pergranulatus* by marked differences in the ventromesial margin of the merus of the right cheliped. This margin in *P. pergranulatus* is developed into a distinct somewhat wing-like ventrally produced lobe and provided with a dense tuft of setae; no such development of this margin occurs in *P. capsularis*. Differences in the shape and armature of the right chelae in the two species, while also distinct, are less dramatic. In *P. capsularis*, the dorsodistal angle is armed with spines, but not noticeably produced as a subacute lobe; the dorsal surface is armed with numerous small spines and tubercles, with a somewhat irregular, more prominent row in the longitudinal midline. In contrast, *P. pergranulatus* has the dorsodistal angle of the palm produced as a subacute lobe (cf. ALCOCK & ANDERSON, 1897, pl. 31, fig. 1); the dorsal surface is provided with a series of granules each having what has been described as an anterior concavity or central depression (HENDERSON, 1896). No reference has been made by previous authors (e.g., HENDERSON, 1896; ALCOCK, 1905b; HAIG & BALL, 1988) to distinctive capsulate structures on the tubercles of the chelae of *P. pergranulatus*; however, in the single specimen available for examination ("Soela" station T17/43, 19°47.4'S, 116°31.4'E, 56-57 m; MNT) structures similar to those described for *P. capsularis* were observed. While the residual color patterns of the "Soela" specimen agree with those given by HAIG and BALL (1988) for *P. pergranulatus*, both clearly differ from the remnants of color in the specimens of *P. capsularis*.

The presence of a median row of spines on the dorsal surface of the right chela and three irregular rows of spines on the carpus of *P. capsularis* suggests a similarity with *P. samoensis* (Ortmann, 1892), but the KARUBAR species differs from ORTMANN'S in having the dorsal surface of the right chela strongly convex, and having much shorter antennal acicles, but longer dactyls of the ambulatory legs.

REMARKS. — The capsules occupying the central surface of the tubercles of the chelae in both *P. capsularis* and *P. pergranulatus* are reminiscent of the structures seen in *Nematopagurus spinulosensoris*. However, those of the former two species have a more ball-like base and elongate, slender and drawn-out distal portion, whereas the capsules of *N. spinulosensoris* are stouter and have a more tear-drop appearance. Since *P. capsularis* is known only from the holotype and single paratype, no attempt has been made to determine the internal structure of these capsules; nevertheless, a subterminal opening, similar to that observed in *N. spinulosensoris*, does appear to be present. The capsules of that species were shown to be highly complex structures (McLAUGHLIN & LANE, 1975).

Pagurus haigae sp. nov.

Figs 27a-h, 43a-d

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn CP 16, 05°17'S, 132°50'E, 315-349 m, 24.10.1991: 1 ♂ (18.6 mm) (MNHN-Pg 5310); 1 ♀ (12.1 mm) (MNHN-Pg 5310 bis). — Stn CP 26, 05°34'S, 132°52'E, 265-302 m, 26.10.1991: 1 ♂ (10.1 mm) (MNHN-Pg 5311); 1 ♂ (7.3 mm) (SNHM 4812). — Stn CP 27, 05°33'S, 132°51'E, 304-314 m, 26.10.1991: 1 ♂ (14.1 mm, molt) (POLIPI).

Tanimbar Islands: stn CC 41, 07°45'S, 132°42'E, 401-393 m, 28.10.1991: 1 ♂ (11.5 mm) (USNM 276014).

TYPES. — The male (18.6 mm) (MNHN-Pg 5310) from KARUBAR station DW 16 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 27a) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced; posterior margin truncate; surface with few tufts setae. Rostrum triangular, terminating acutely, with or without terminal spine. Lateral projections triangular, with strong marginal or submarginal spine.

Ocular peduncles moderately short, 0.50 to 0.75 length of shield, slightly broader distally; corneae weakly dilated; dorsal surface frequently with row of sparse setae. Ocular acicles roundly triangular, terminating subacutely and with strong submarginal spine; separated basally by 0.50 to nearly entire basal width of one acicle.

Antennular peduncles overreaching corneae by 0.25 to nearly entire length of ultimate segment. Ultimate segment usually with 1 or 2 setae at dorsodistal margin and also often with row of short setae on dorsal surface. Penultimate segment with very few short setae. Basal segment with hooked spine on laterodistal margin dorsally and few setae mesially.

Antennal peduncle overreaching distal margin of cornea by 0.25 to 0.50 length of ultimate segment; with supernumerary segment. Fifth and fourth segments with few scattered setae. Third segment with strong spine at ventrodistal angle sometimes partially obscured by tufts of long stiff setae. Second segment with dorsolateral distal angle prominently produced, reaching to or beyond distal half of fourth segment, terminating in simple or bifid spine and with 3 to 5 spines on mesial margin sometimes partially obscured by thick setae; dorsomesial distal angle with acute spine. First segment with spine on lateral margin distally, ventrolateral margin with 4 to 6 small spines laterally and distally. Antennal acicle long, reaching to distal half of ultimate peduncular segment, and considerably beyond distal margin of cornea; slightly sinuous, terminating in acute spine, mesial margin with row of tufts of stiff setae. Antennal flagellum shorter than outstretched right cheliped, with 2 very short setae every article and 1 to 3 longer setae every 4 to 8 articles.

Maxillule with external lobe of endopod vestigial. Ischium of third maxilliped with 1 accessory tooth on crista dentata. Sternite of third maxillipeds with strong spine on either side of midline.

Chelipeds grossly unequal; spines of chelae and carpi usually with tiny corneous tips and most practically obscured by tufts of long thick setae. Right cheliped (Figs 43a, c) with dactyl equal to length of palm; cutting edge

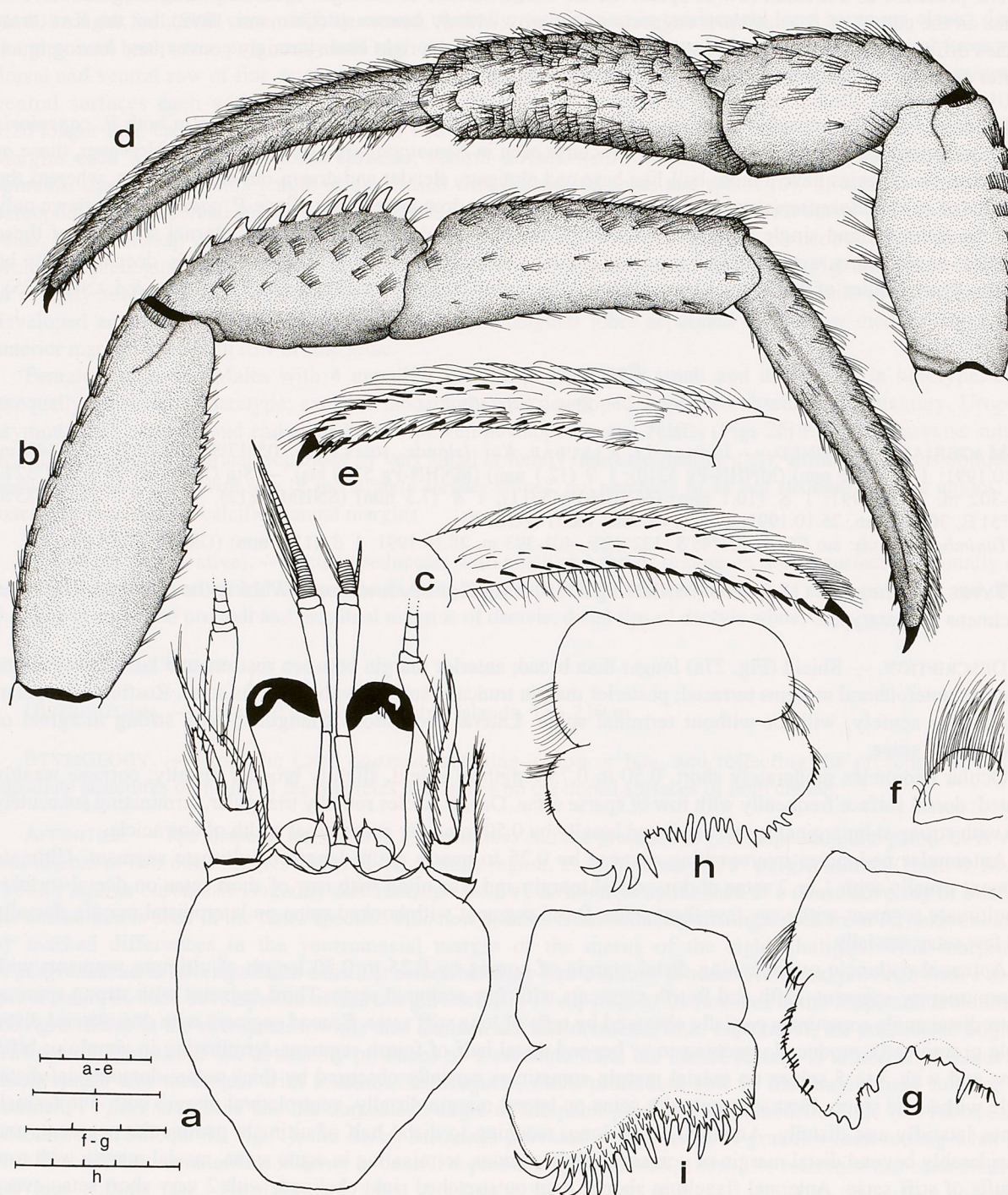


FIG. 27. — *Pagurus haigae* sp. nov., a-g, paratype ♀ (12.1 mm) from KARUBAR Stn CP 16; h, holotype ♂ (18.6 mm) from Stn CP 16. — i, *Pagurus yokoyai* Makarov, 1938, ♂ (8.5 mm) from Uchibo coast of Boso Peninsula, Japan, (CBM-ZC 1668): a, shield and cephalic appendages; b, right second pereopod (lateral view); c, dactyl of right second pereopod (mesial view); d, left third pereopod (lateral view); e, dactyl of left third pereopod (mesial view); f, anterior lobe of sternite of third pereopods; g-i, telson. Scales equal 2.0 mm (i), 3.0 mm (f-g), 5.0 mm (a-e, h).

with row of 4 strong calcareous teeth and short distal row of corneous teeth, terminating in corneous claw and slightly overlapped by fixed finger; dorsal surface convex, with median row of small spines decreasing in size distally but extending nearly to tip; dorsomesial margin with row of spines also decreasing in size distally; mesial and ventral surfaces with tufts of long thick setae. Palm 0.60 to 0.75 length of carpus; dorsomesial margin usually only weakly delimited by quasi double row of strong spines, frequently 1 more prominent spine or tubercle at dorsoproximal angle, convex dorsal surface with 8 or 9 irregular rows of strong spines; dorsolateral margin not distinctly delimited except on fixed finger; dorsal surface of fixed finger with median row of spines decreasing in size distally, cutting edge with few calcareous teeth, terminating in strong corneous claw; mesial, lateral and ventral surfaces with low sometimes spinulose protuberances and tufts of long thick setae. Carpus slightly shorter to as long as merus; dorsomesial margin with row of moderately strong spines, dorsal surface with few to numerous small spines or low sometimes spinulose protuberances and tufts of long thick setae, distal margin with row of spinules and few slightly larger spines; dorsolateral margin not delimited, lateral face with low sometimes spinulose protuberances and tufts of long setae, laterodistal margin with row of small spines; mesial face with few spines dorsally, scattered low protuberances and setae ventrally, mesiodistal margin with row of very small blunt spines; ventral surface with scattered setae. Merus subtriangular; dorsodistal margin with 2 to 4 slender spines, dorsal surface with few short transverse rows of setae; lateral face microscopically spinulose and with scattered fine setae, ventrolateral margin with row of small spines not extending to proximal margin but frequently terminating proximally in 1 or 2 larger blunt spines or tubercles; mesial face with numerous low protuberances and tufts of long setae, ventromesial margin with few small spines, sometimes 1 or 2 larger tubercles at proximal angle; ventral surface with scattered tufts of setae. Ischium unarmed, but with row of setae on distolateral and ventromesial margins.

Left cheliped (Figs 43b, d) with dactyl 1.75 to more than twice length of palm; cutting edge with row of corneous teeth, terminating in large corneous claw; dorsomesial margin not delimited or with 2 or 3 small spines proximally, dorsal midline unarmed or with few spinules or spinulose tubercles in proximal half; dorsal, mesial and ventral surfaces with rows of tufts of long thick setae. Palm slightly less than half length of carpus; triangular in cross-section, dorsal surface with row of strong spines decreasing in size distally, usually extending to distal half, occasionally nearly to tip, of fixed finger; dorsolateral margin with double row of strong spines, decreasing in size and becoming single row on fixed finger; dorsolateral and dorsomesial surfaces strongly sloping ventrally, lateral face with numerous strong spines; mesial face more frequently with smaller spines or spinulose tubercles, dorsomesial margin with row of 3 or 4 spines or tubercles; ventral surfaces of palm, fixed finger and dactyl all with tufts of long setae. Carpus approximately as long as merus; dorsolateral margin with row of acute spines, dorsodistal margin with 1 strong spine, dorsomesial margin with row of smaller spines, strongest proximally; laterodistal margin with few spines dorsally, lateral face with low frequently spinulose protuberances and long setae, ventrolateral margin with row of spines and moderately dense row of long setae; mesial faces with numerous tufts of long setae, ventromesial margin with 2 to 4 small, often blunt spines distally. Merus with short transverse rows of long setae on dorsal margin; mesial face with few low protuberances and setae, ventromesial margin with few small spines; lateral face spinulose, particularly ventrally, ventrolateral margin with row of very strong acute spines sometimes interspersed with shorter spines and row of long setae, frequently 1 or pair of stronger acute blunt spines on each margin proximally. Ischium with row of small spines on ventromesial margin.

Ambulatory legs (Figs 27b-e) with dactyls 1.20 to 1.45 longer than propodi; in dorsal view, very slightly twisted; in lateral view, slightly curved ventrally; terminating in moderately long corneous claws; dorsal margins each with 2 rows of long thick setae; lateral faces each with weak to prominent longitudinal sulcus and few setae (second and third right), moderately dense but randomly placed long setae on third left; mesial faces each with faint longitudinal sulcus (not shown in Figs 27c, e), second pair flanked dorsally and ventrally by long setae, sometimes also with dorsal row of corneous spines, third pair with row of corneous spines often interspersed with tufts of setae dorsally and medially; ventromesial surfaces each with 8 to 17 strong corneous spines, increasing in length distally, but partially obscured by thick setae. Propodi 1.10 to 1.35 longer than carpi; dorsal surfaces each with row of low transverse protuberances and tufts of setae; lateral faces each frequently with small tubercle at proximal margin medially or dorsally, second and third right pereopods each with 2 or 3 longitudinal rows of sparse tufts of setae, left third with entire surface covered (but not extremely densely) by short transverse rows of moderately short

stiff setae; mesial faces with few scattered setae; ventrodistal margins each with 1 or 2 small corneous spinules, ventral surfaces with row of tufts of setae, more numerous on left and much denser on third left. Carpi 0.75 to nearly equaling length of meri; second pereopods each with row of strong spines partially obscured by long setae on dorsal surface, third with dorsodistal spine, dorsal surface unarmed or often with 1 to several smaller spines partially obscured by row of tufts of setae; lateral faces also with 2 or 3 longitudinal rows of sparse tufts of setae. Meri each with several transverse rows of long setae dorsally and ventrally, second also with single or double row of small spines on ventral margin. Ischia with dorsal and ventral tufts of setae, second each frequently with row of small spines on ventral margin. Propodal rasp of fourth pereopods with triple row of corneous scales. Sternite of third pereopods with few long setae on subsemicircular anterior lobe (Fig. 27f). Sternite of fifth pereopods developed anteriorly as two somewhat flattened semirectangular lobes separated by shallow median depression, anterior margins each with row of fine setae.

Males with 3 unequally biramous unpaired pleopods, all with exopods moderately well developed, endopods rudimentary. Females with paired gonopores, 4 unpaired biramous pleopods. Uropods asymmetrical; exopods and endopods both with well developed rasps. Telson (Figs 27g-h) with transverse suture; posterior lobes somewhat asymmetrical, separated by small median cleft; terminal margins slightly to strongly oblique, each with row of 2 to 5 strong calcareous spines interspersed with smaller calcareous or corneous spines; lateral margins usually with few to numerous corneous spinules and occasionally calcareous spines.

COLOR (in preservative). — General overall orange tint; somewhat mottled on shield. Antennal flagella alternating series of 8 to 10 transparent articles followed by similar number of burnt-orange. Meri of chelipeds and ambulatory legs with darker orange, but with white band on distal margin dorsally and laterally.

HABITAT. — One specimen occupying *Natica* shell.

DISTRIBUTION. — Collected in Kai and Tanimbar Islands, 265 to 401 m.

ETYMOLOGY. — This species is dedicated to the late Janet HAIG, who contributed so much to our knowledge of anomuran fauna of the Indo-Pacific.

AFFINITIES. — *Pagurus haigae* appears most similar to *P. brachiomastus* (Thallwitz, 1892) and *P. yokoyai* Makarov, 1938. Like *P. haigae*, both of these species have strongly spinose and setose chelae; the carpi of the ambulatory legs each carry a row of spines on the dorsal surface. Other characters shared by *P. haigae* and *P. brachiomastus* include a pair of large tubercles on the ventral surface of the merus of the right cheliped, usually densely setose lateral faces of the dactyl and propodus of the third left pereopod, and light or white colored band on the distal portion of the meri of the chelipeds and ambulatory legs. However, the shortness of the dactyls and spinose upper margins of the propodi of the ambulatory legs of *P. brachiomastus*, as well as its longer more slender ocular peduncles, will immediately distinguish this species from *P. haigae*. As indicated by MIYAKE (1978 : 98, text-fig. 37c) the dense setation on the lateral faces of the dactyl and propodus of the third left pereopod is a character restricted to females of *P. brachiomastus*. No sexual dimorphism in this character was noted in the KARUBAR specimens of *P. haigae*.

It is with *P. yokoyai* that *P. haigae* shares the greatest morphological likeness, and it would be impossible to distinguish the two taxa based on the descriptions of YOKOYA (1933) (as *Eupagurus gracilipes* Yokoya, not *E. gracilipes* Stimpson, 1858) or MAKAROV (1938, 1962). MIYAKE's (1978) description provides much greater detail, but only on the basis of color patterns and the illustrated telson (Text-fig. 45b) would differentiation be feasible. Having compared the KARUBAR specimens of *P. haigae* with three male specimens of *P. yokoyai* there is no doubt that the taxa are distinct. In addition to differences in the telson armature of the two species (Figs 27g-i), the right cheliped of the latter species lacks the strong tuberculate spines on the ventromesial margin of the merus, the carpus is longer and narrower, and the spines of the dorsal surface of the chela are stronger. The left chela of *P. yokoyai* is usually narrower and has fewer but stronger spines; the carpus is also narrower and the dorsomesial margin more weakly armed. The second pereopods have five to eight corneous spines on the distal halves of the ventral margins of the dactyls, and a double row of corneous spines on the mesial face dorsally.

REMARKS. — YOKOYA's (1933) description of *Eupagurus gracilipes* consisted of little more than a few illustrations and remarks on its differences from *Pagurus pectinatus* (Stimpson, 1858). MAKAROV (1938, 1962) noted, in a footnote to his diagnosis of STIMPSON's (1858) *P. gracilipes* that, YOKOYA's (1933) name was preoccupied, and proposed that the species be called *P. yokoyai*. MAKAROV (1938, 1962) did suggest that *P. yokoyai* was probably more closely related to *P. brachiomastus* than to *P. pectinatus*, which, in fact is the case. *Pagurus haigae*, like *P. brachiomastus* and *P. yokoyai*, shares numerous characters with *P. pectinatus*, such as strongly spinose and setose chelae; however, the much more elongate ocular peduncles and stronger rostrum of the latter species clearly set it apart from the former three species.

MIYAKE's (1978, Text-fig. 44) illustration of *P. yokoyai* is indicated as a female, but with only three unpaired left pleopods. This is either an illustrator's error or the sex of the illustrated specimen is incorrect, as it is most unlikely that the second left pleopod would be absent in this *Pagurus* species. One of the three specimens examined [δ (8.5 mm) from Kushimoto, Wakayama, Japan] had well developed male gonopores, but four unpaired pleopods. However, there was no indication of rhizocephalan infestation that might have attributed to this apparent feminization.

?Pagurus sp.

Fig. 28a-d

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 22, 05°22'S, 133°01'E, 124-85 m, 25.10.1991: 1 δ (1.2 mm) (MNHN-Pg 5312).

DIAGNOSIS. — Shield (Fig. 28a) longer than broad. Rostrum obtusely triangular, reaching slightly beyond level of lateral projections. Lateral projections each with tiny submarginal spinule. Ocular peduncles moderately long; slightly shorter than extended antennal peduncles and reaching only to proximal half of ultimate segment of fully extended antennular peduncles, dorsal and mesial surfaces with few tufts of stiff setae; corneae not dilated. Ocular acicles moderately small, terminating subacutely and with strong submarginal spine. Antennal acicle reaching to base of cornea or slightly beyond; arcuate; with terminal spine and few tufts of stiff setae. Antennal flagella broken, but still reaching beyond distal margins of propodi of ambulatory legs, with 2 or 3 moderately long setae every 2 to 4 articles. Crista dentata well developed, with 1 accessory tooth. Sternite of third pereopods with slight median protuberance.

Right cheliped missing.

Left cheliped (Figs 28b-c) with palm slightly more than half length of dactyl. Dorsal surface of dactyl with row of widely-spaced small spines in midline. Palm subtriangular in cross-section; dorsal midline with row of spines extending to distal half of fixed finger; surface with numerous tufts of long setae, but not obscuring spines. Carpus with dorsomesial and dorsolateral row of few strong spines; ventrolateral distal angle with acute spine; tufts of long setae dorsally and ventrally. Merus with 2 strong spines on ventrolateral margin, 1 on ventromesial margin.

Ambulatory legs (Fig. 28d) (only second and third left) with dactyls only slightly longer than propodi; dorsal surfaces with tufts of setae; ventral margins each with row of 6 or 8 corneous spines. Propodi each with widely-spaced low protuberances and tufts of setae on dorsal surfaces; ventrodiscal angles each with corneous spine, ventral surfaces each with row of widely-spaced very small corneous spinules. Carpi each with dorsodistal spine and few low protuberances with tufts of setae on dorsal surface, second also with 1 spine proximally, partially obscured by setae. Meri with low protuberances and tufts of setae dorsally and ventrally; second also with spine on ventral margin in distal half. Fourth pereopods semichelate; propodal rasp with single row of corneous scales.

Male with 3 unequally biramous left pleopods (third to fifth). Telson (Fig. 28e) with distinct transverse suture; slightly asymmetrical posterior lobes separated by prominent median cleft; terminal margins somewhat oblique, each with 4 moderately strong spines; lateral margins each with weakly serrated chitinous marginal band.

COLOR. — Unknown.

HABITAT. — Unknown.

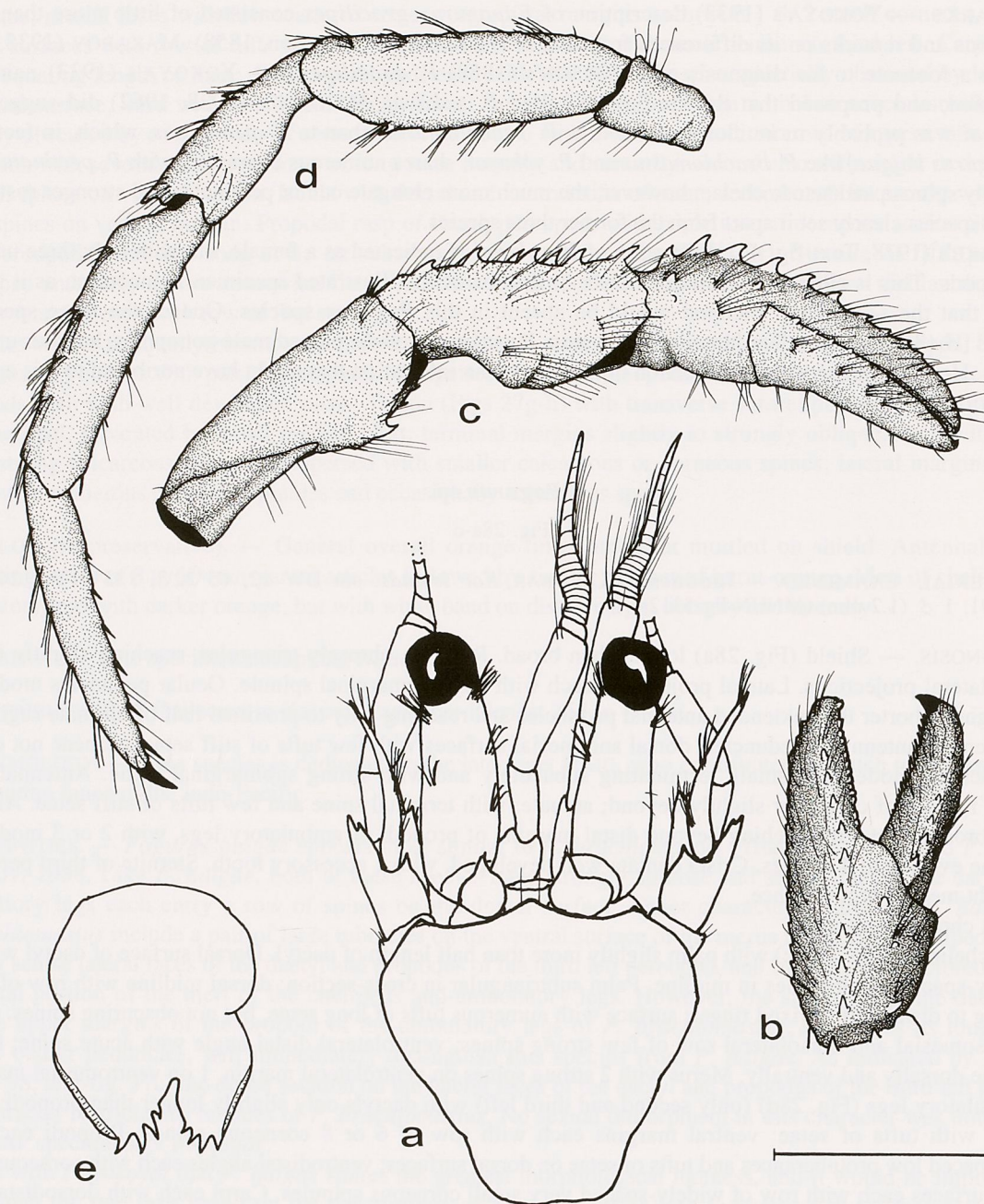


FIG. 28. — ?*Pagurus* sp. ♂ (1.2 mm) from KARUBAR Stn DW 22: **a**, shield and cephalic appendages; **b**, left chela (dorsal view); **c**, left cheliped (mesial view); **d**, left second pereopod (lateral view); **e**, telson. Scale equals 0.5 mm (e) and 1.0 mm (a-d).

DISTRIBUTION. — Known only from one station (DW 22) in Kai Islands, Indonesia; 124-85 m.

REMARKS. — This specimen is tentatively assigned to *Pagurus* as it lacks any secondary male sexual characters. The armature of the left cheliped is consistent with that seen in many *Pagurus* species, as is the structure and armature of the telson.

Genus *BATHYPAGUOPSIS* McLaughlin, 1994

Bathypaguopsis McLaughlin, 1994: 469.

DIAGNOSIS. — Thirteen pairs of trichobranchiate gills. Shield with central dorsal surface sometimes only weakly calcified; rostrum well developed. Ocular acicles triangular, dorsal surface flattened or slightly convex. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod articulated, not recurved. Ischium of third maxilliped with well developed crista dentata and 1 accessory tooth.

Right cheliped massive, chela operculate or nearly so; propodal-carpal articulation approximately 30° from perpendicular; dactyl articulating obliquely with palm. Left cheliped moderately elongate, slender; propodal-carpal articulation approximately 30° to 60° counterclockwise from perpendicular; dactyl and fixed finger opening obliquely. Ambulatory legs with dactyls and propodi similar. Fourth pereopods semichelate, propodal rasp consisting of 1 or more, sometimes incomplete, rows of scales.

Males with paired gonopores, each partially masked by tuft of stiff setae; no paired pleopods or sexual tubes. Four unpaired pleopods on left, with exopods only moderately well developed, endopods markedly reduced. Females with paired gonopores. No paired pleopods; left second to fifth unpaired, second to fourth with both rami well developed and egg-carrying, fifth reduced as in males.

Telson with transverse suture; posterior lobes subtriangular; terminal margins oblique, unarmed or spinulose.

Bathypaguopsis rahayuae sp. nov.

Figs 29a-h, 42c-d

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 14, 05°18'S, 132°38'E, 245-246 m, 24.10.1991: 1 ♂ (3.2 mm) (MNHN-Pg 5313).

TYPE. — The single specimen is the holotype.

DESCRIPTION. — Shield (Fig. 29a) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate. Rostrum prominent, triangular, acute, with terminal spinule. Lateral projections triangular, with small marginal spine. Posterior carapace with area between cardiac sulci and sulci cardiobranchialis weakly calcified.

Ocular peduncles slightly more than half shield length, dorsomesial surface with row of setae; corneae not dilated. Ocular acicles simple, triangular, with small marginal terminal spine; separated basally by width of rostrum, or approximately half basal width of one acicle.

Antennular peduncles moderately long, overreaching ocular peduncles by slightly less than entire length of ultimate segment. Basal segment with small acute spine on lateral surface dorsally. Penultimate segment with few scattered setae. Ultimate segment with few long setae on dorsal surface.

Antennal peduncles exceeding ocular peduncles by half length of ultimate segment, but reaching only to distal half of ultimate segment of antennular peduncle. Fifth and fourth segments with few scattered setae. Third segment with very strong spine at ventrodiscal margin. Second segment with dorsolateral distal angle produced into broad, triangular process, terminating in acute spine, mesial margin unarmed, lateral margin with 1 or 2 spines; dorsomesial distal angle with acute spine. First segment with small spine at laterodistal margin; ventral margin produced, with 1 spine laterally. Antennal acicle reaching beyond proximal margin of ultimate peduncular segment; slightly arcuate, with row of sparse tufts of setae on mesial margin and terminating in small spine. Antennal flagellum long, nearly overreaching outstretched right cheliped; every 1 or 2 articles usually with 2 or 3 very short (< 1 article length) setae, and often additional 1 or 2 longer setae every 2 to 5 articles.

Right cheliped (Figs 29b, 42c) massive, operculate. Dactyl broad, slightly shorter than palm; cutting edge with 1 very broad, faintly cusped, calcareous tooth, terminating in very small corneous claw; dorsal surface very slightly elevated in the midline proximally, with scattered low tubercles and few short transverse setal ridges in proximal

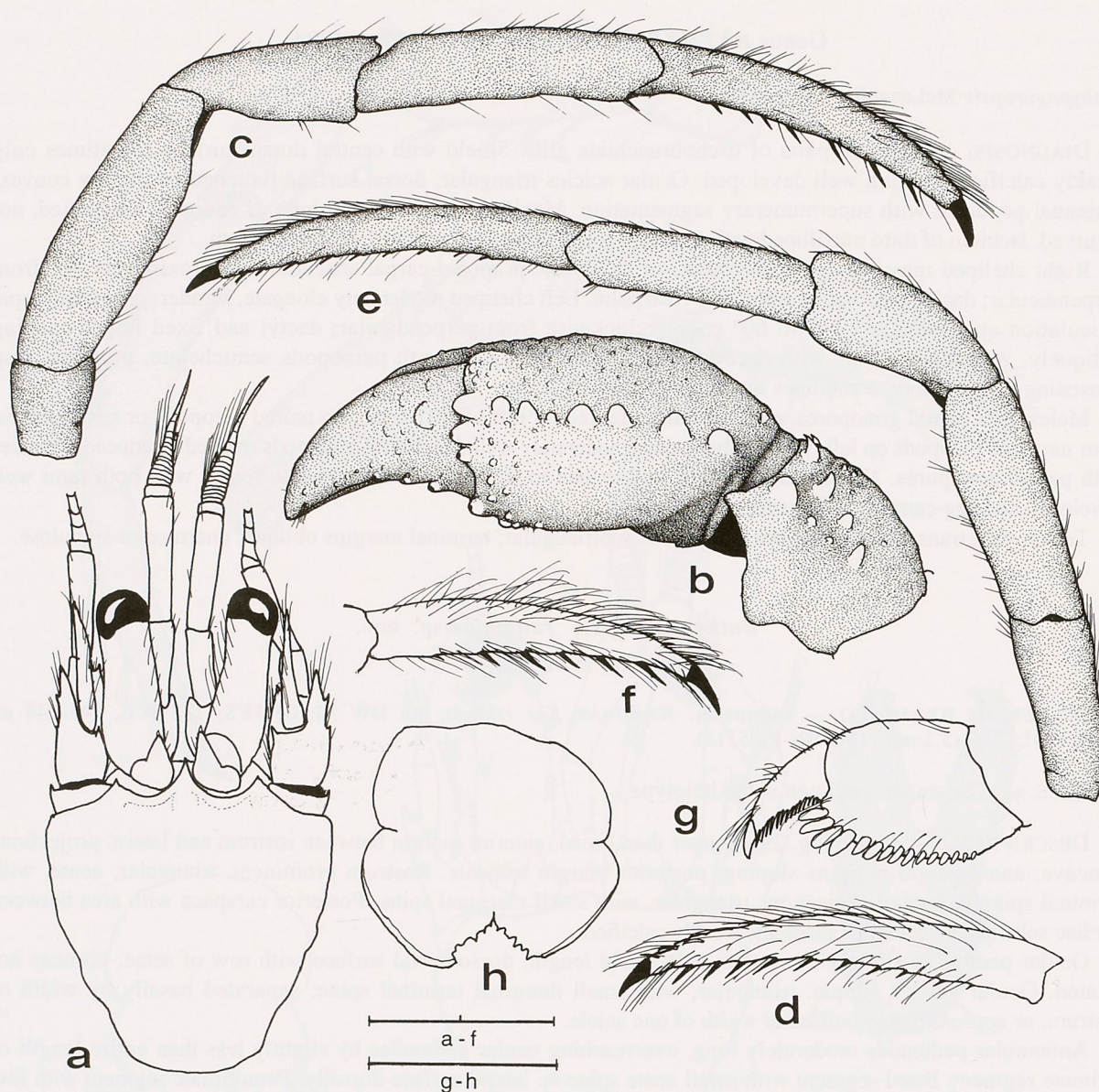


FIG. 29. — *Bathypaguropsis rahayuae* sp. nov., holotype ♂ (3.2 mm) from KARUBAR Stn DW 14: **a**, shield and cephalic appendages; **b**, carpus and chela of right cheliped (mesial view); **c**, right second pereopod (lateral view); **d**, dactyl of second left pereopod (mesial view); **e**, third left pereopod (lateral view); **f**, dactyl of third right pereopod (mesial view); **g**, propodus and dactyl of left fourth pereopod (lateral view); **h**, telson. Scales equal 1.0 mm (g-h) and 2.0 mm (a-f).

half, slightly pitted and with few tufts of setae distally; dorsomesial margin rounded, mesial face with low broad tubercles, 1 large blunt tubercle proximally; ventromesial margin with corneous-capped blunt tubercles. Palm with maximum breadth equal to length, nearly twice length of carpus; dorsomesial distal angle with prominent blunt spine, dorsomesial margin with row of rather widely-spaced blunt or subacute tuberculate spines; dorsal surface convex and covered with flattened granules and very low short ridges, with 1 rather inconspicuous tubercle at proximal margin; dorsolateral margin only faintly delimited by row of widely-spaced tiny spinules, slightly larger distally and on fixed finger; mesial face with scattered low spinules and spinulose tubercles or granules, particularly

in distal half, distal margin with 2 blunt corneous-capped spines dorsally and 1 at ventral angle; lateral face with scattered granules, low tubercles and/or short transverse ridges; ventral surface with several large, flattened, blister-like tubercles, often with corneous caps, few similar tubercles on ventral surface of fixed finger; cutting edge of fixed finger with 3 calcareous teeth, terminating in very small corneous claw. Carpus slightly shorter than merus, subquadrate when viewed dorsally; dorsomesial distal angle somewhat depressed but with adjacent large blunt spine, dorsomesial margin with 1 moderately strong and 2 smaller spines in slightly irregular row, 1 additional strong spine on dorsal surface mesially, remainder of dorsal surface with scattered spinules or low blunt or spinulose tubercles, primarily in distal half; distal margin with 4 small spines extending onto lateral face; dorsolateral margin not delimited, lateral and mesial surfaces with scattered minute spinulose tubercles or granules, ventral surface with rounded unarmed distal ridge. Merus broadly subtriangular, armed on ventral surface by short row of blunt tubercles on ventrolateral proximal margin and 2 tubercles in midline proximally. Ischium unarmed.

Left cheliped (Fig. 42d) not reaching to base of dactyl of right, slender; propodal carpal articulation approximately 35° counterclockwise from perpendicular. Dactyl slightly longer than palm; surfaces unarmed but with scattered tufts of short setae; cutting edges of dactyl and fixed finger each with row of small corneous teeth in distal 0.50 to 0.65; terminating in small corneous claws. Palm little more than half length of carpus; all surfaces unarmed, but with few scattered setae, particularly on fixed finger. Carpus slightly shorter than merus; dorsomesial margin with 1 small spine at distal angle and 2 widely-spaced very small spines marginally; 1 tiny spinule at dorsolateral distal angle, dorsolateral margin not delimited. Merus entirely unarmed. Ischium with 2 minute spinules on ventromesial margin distally.

Ambulatory legs (Figs 29c-f) similar, but with right slightly longer than left. Dactyls 1.20 to 1.25 length of propodi; in dorsal view, straight; dorsal margins each with row of tufts of long setae; mesial faces each with dorsal and ventral sparse row of moderately long setae; lateral faces each with 1 row of very sparse tufts of short setae; ventral margins each with row of 7 to 10 corneous spines and few tufts of setae. Propodi slightly longer than carpi; each with few scattered setae on dorsal surface; ventrodiscal angles each with 1 corneous spinule; mesial, lateral, and ventral surfaces with scattered setae. Carpi 0.75 to 0.80 length of meri; dorsodistal angles of right (only) each with very small spine, dorsal surfaces of all with few setae. Meri and ischia with scattered setae particularly on ventral margins. Fourth pereopods with propodal rasp (Fig. 29g) consisting of row of long corneous scales. Anterior lobe of sternite of third pereopods subrectangular, with central semicircle fringed with short setae.

Telson (Fig. 29h) with posterior lobes slightly asymmetrical, left larger; separated by moderate median cleft; terminal margins each with 5 very small spinules.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — Known only from the type locality in the Kai Islands, Indonesia; 245-246 m.

ETYMOLOGY. — This species is named for Dr D. L. RAHAYU, Indonesian Institute of Sciences, in recognition of her contributions to our knowledge of the regional hermit crab fauna.

AFFINITIES. — *Bathypaguropsis rahayuae* sp. nov. is the third species of this genus to be recognized, and despite the overall morphological similarities among the three taxa, it is most closely allied to *B. yaldwyni* McLaughlin, 1994. Although the ocular peduncles are shorter and the antennal acicles longer in *B. yaldwyni*, the general armature of the chelae and carpi of the chelipeds would be comparable if intraspecific variability in *B. rahayuae* was to approach that of *B. yaldwyni*. The terminal margins of the telson of *B. rahayuae* are armed with spinules as they are in *B. yaldwyni*, although the number in the single specimen of *B. rahayuae* is smaller. Nevertheless, the two species can be easily distinguished by the spines on the ventral margins of the ambulatory dactyls, 15 to 31 in *B. yaldwyni*, but only 7 to 10 in *B. rahayuae*. The smaller number of dactylar spines is similar to that of *B. marionensis* McLaughlin, 1994 (8 to 14); however, the strongly produced dorsomesial distal angle and more numerous marginal spines of the right chela, as well as the armed ventromesial margin of the left, clearly distinguish this species from *B. rahayuae*.

REMARKS. — McLAUGHLIN (1994) noted that one adult specimen of *B. yaldwyni* was parasitized by an unidentified rhizocephalan, and while female appearing pleopods were present, neither male nor female gonopores could be detected. The holotype of *B. rahayu* similarly had been infected by an unidentified rhizocephalan, but no evidence of structural alteration nor feminization has been observed. Only normal male gonopores are present.

Genus *PYLOPAGUOPSIS* Alcock, 1905

Pylopaguopsis Alcock, 1905b: 133. — DE SAINT LAURENT-DECHANCÉ, 1966b: 259. — McLAUGHLIN & HAIG, 1989: 125.
Galapagurus Boone, 1932: 12.

DIAGNOSIS. — Thirteen pairs of trichobranchiate gills. Shield with well developed rostrum. Ocular acicles triangular, sometimes slender. Antennal peduncles with supernumerary segmentation. Maxillule with external lobe of endopod very weakly to moderately well developed. Ischium of third maxilliped with 1 accessory tooth on well developed crista dentata.

Right cheliped usually massive, chela operculate or semioperate; dactyl frequently articulating obliquely with palm.

Left cheliped moderately elongate, slender; propodal-carpal articulation usually twisted counterclockwise 30-70° from perpendicular when viewed dorsally; dactyl and fixed finger opening obliquely. Ambulatory legs with dactyls and propodi of second pair (third pereopods) frequently dissimilar. Fourth pereopods semichelate; propodal rasp of 1 to 4 rows of corneous scales.

Females with paired gonopores; paired first pleopods modified as gonopods, second to fifth unpaired. Males with paired gonopores, no paired pleopods or sexual tubes, 3 unequally biramous left pleopods. Telson with transverse suture; posterior lobes often asymmetrical; terminal margins oblique, concave or horizontal, usually armed with 1 to many spines; lateral margins unarmed or with 1 to 3, or sometimes row of small spines.

REMARKS. — HAIG and BALL (1988) reported two undescribed species of *Pylopaguopsis* from the *Alpha Helix* expedition. Although both species, *P. lewinsohni* McLaughlin & Haig, 1989 and *P. fimbriata* McLaughlin & Haig, 1989, had been recognized much earlier, their actual publication had been unavoidably delayed. Neither species is represented in the KARUBAR material.

Key to the Indonesian species of *Pylopaguopsis*

1. Palm of right chela fringed with spines and long setae; carpus of fourth pereopod with dorsodistal spine *P. fimbriata**
- Palm of right chela not fringed with spines and long setae; carpus of fourth pereopod without dorsodistal spine 2
2. Left chela with 1 or more rows of spines on dorsal surface *P. laevispinosa*
- Left chela unarmed or with few scattered spinules or spinulose tubercles on dorsal surface ..
..... 3
3. Propodus of right third pereopod with 1 longitudinal sulcus on lateral face *P. zebra*
- Propodus of right third pereopod with 3 longitudinal sulci on lateral face
..... *P. lewinsohni**

Pylopaguopsis zebra (Henderson, 1893)

Figs 30a, c, 43e-f

Eupagurus zebra Henderson, 1893: 425, pl. 39, figs 12-15.

Pagurus zebra - MIYAKE, 1975: 260, pl. 116, fig. 2; 1978: (in part) 108, fig. 43; 1982: 225.

Pylopagurus zebra - McLAUGHLIN & HAIG, 1989: 143, figs 3b, 5b, 7b, 9b, 11b, 13b (for complete synonymy).

MATERIAL EXAMINED. — **Indonesia.** *Karubar, Kai Islands:* stn DW 15, 05°17'S, 132°41'E, 212-221 m, 24.10.1991: 1 ♀ (2.7 mm) (POLIPI). — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (1.8 mm) (USNM 275998).

Tanimbar Islands: stn DW 49, 08°00'S, 132°59'E, 206-209 m, 29.10.1991: 2 ♂, 1 ♀ (3.3-3.5 mm) (MNHN-Pg 5314).

DIAGNOSIS. — Shield (Fig. 30a) approximately as broad as long or slightly longer than broad. Rostrum prominent, acute, terminating in small spinule. Ocular peduncles overreached by antennular peduncles. Ocular acicles triangular, acute; separated basally by breadth of rostrum.

Right chela (Fig. 43e) with dactyl compressed dorsoventrally; dorsomesial margin expanded and armed with row of strong spines, dorsal surface with several spines at dorsomesial proximal angle, few also on dorsal surface. Palm with irregular single or double row of low spines or spinulose tubercles on dorsomesial margin, dorsolateral margin with row of strong spines; dorsal surface with few irregular rows of small spines or spinulose tubercles, extending onto fixed finger. Carpus trapezoidal (dorsal view), with regular or irregular rows of spines or spinulose tubercles on dorsal surface, few strong spines on dorsodistal margin; mesial face strongly produced ventrally, ventromesial margin tuberculate. Merus with row of strong conical spines on produced ventromesial margin; mesial, lateral and ventral surfaces usually tuberculate.

Left cheliped (Fig. 43f) long and slender, reaching almost to middle of palm of right. Palm and fingers twisted counterclockwise approximately 45° from perpendicular. Dactyl unarmed. Palm with scattered low protuberances, some occasionally slightly spinulose. Carpus with row of small to moderately strong spines on dorsomesial margin, 1 prominent spine on dorsolateral distal angle and 1 or more spines, spinules or low protuberances on dorsolateral margin. Merus with row of small spines on ventromesial margin; ventrolateral margin with row of acute spines.

Ambulatory legs with second pair (third pereopods) dissimilar. Dactyls each with row of corneous spines on mesial face close to dorsal margin; ventral margins each with row of 8-10 strong corneous spines. Propodi each with 1 or 2 corneous spinules at ventrodistal margin. Third right pereopod with dactyl longer than left, 1.50 to twice as deep; laterally compressed; lateral face with prominent longitudinal sulcus; ventral margin with row of 13 or 14 strong corneous spines. Propodus with distinct dorsolateral margin, lateral face with shallow longitudinal sulcus dorsally, surface broad and flattened medially. Carpi of both second and third pereopods each with small spine at dorsodistal margin. Meri unarmed or with small spine on ventrolateral distal margin. Sternite of third pereopods with long narrow anterior lobe slightly protruded medially. Propodal rasp of fourth pereopods with 1 row of sharp corneous scales.

Telson (Fig. 30c) with posterior lobes separated by broad median cleft; terminal margins oblique, each with 3 or 4 strong spines, lateral margins with narrow corneous plate.

COLOR (in preservative). — Ocular peduncles with 2 longitudinal red stripes dorsally and 1 ventrally on white base color. Right cheliped with base color of pinkish-white on palm and carpus, red on merus; palm and carpus with scattered red spots, usually associated with tufts of setae, carpus also with broad longitudinal red stripe on mesial face; merus with several narrow longitudinal white stripes. Left cheliped with base color of pinkish-white; palm with two longitudinal red stripes and 1 prominent red spot on dorsal surface; carpus and merus each with dorsal, lateral and mesial longitudinal red stripes. Ambulatory legs each with longitudinal red stripes on lateral and mesial faces of all segments, carpi also with dorsal red stripe.

HABITAT. — Unknown.

DISTRIBUTION. — Northwestern Australia, Indonesia; South Africa, Japan; 102-125 meters.

REMARKS. — The KARUBAR specimens differ from the lectotype and other specimens described by MCLAUGHLIN and HAIG (1989) in having the carpus of the left cheliped less strongly armed. In the present specimens, the telsons all have strongly oblique terminal margins. The telson of the lectotype was reported missing by MCLAUGHLIN and HAIG (1989); their illustrated specimen from Japan had horizontal terminal margins.

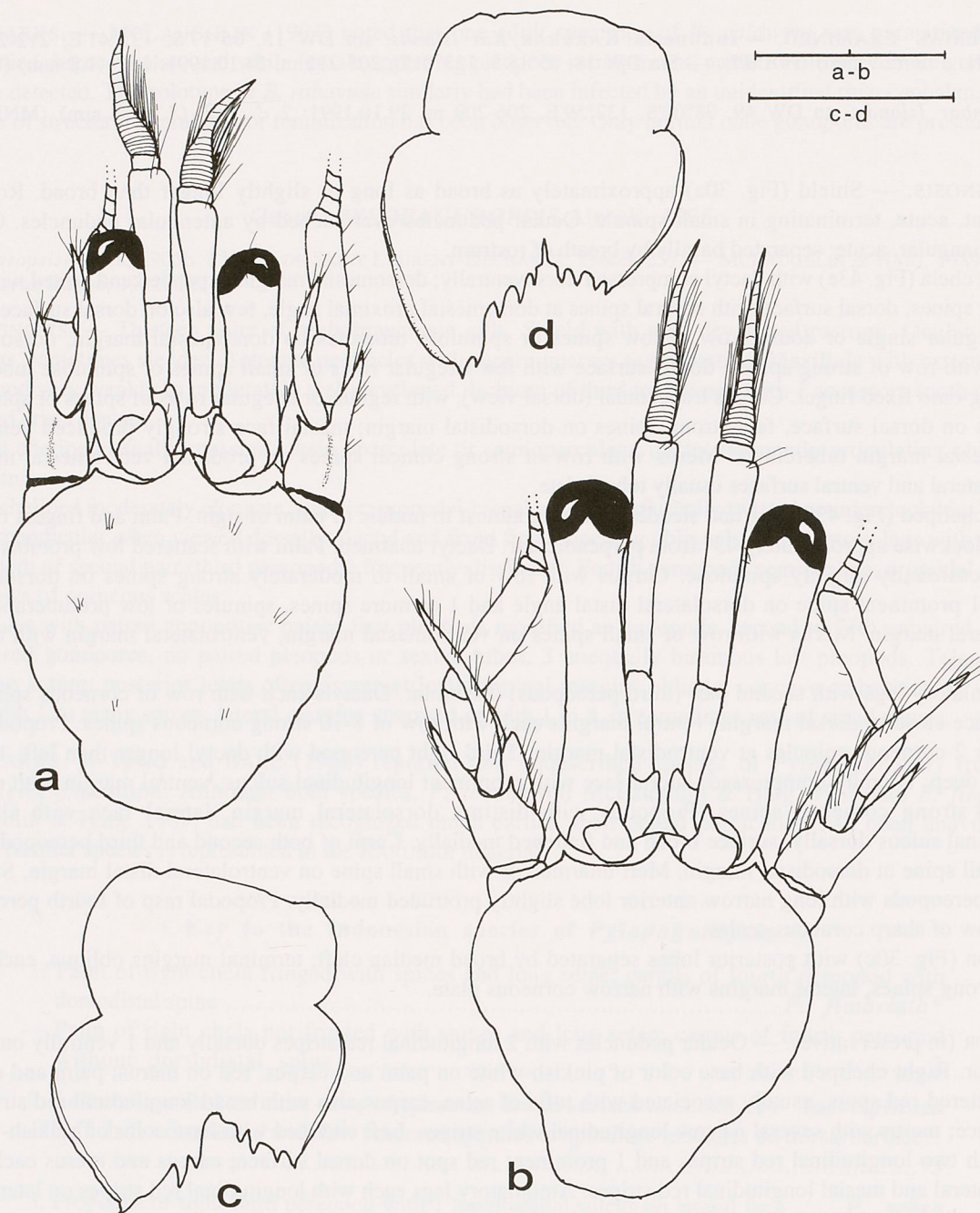


FIG. 30. — *Pylopaguropsis zebra* (Henderson, 1893), a, c, ♀ (3.3 mm) from KARUBAR Stn DW 49. — *Pylopaguropsis laevispinosa* McLaughlin & Haig, 1989, b, d, ♂ (3.2 mm) from Stn DW 22: **a-b**, shield and cephalic appendages; **c-d**, telson. Scales equal 1.0 mm (c-d) and 2.0 mm (a-b).

Pylopaguropsis laevispinosa McLaughlin & Haig, 1989

Figs 30b, d, 44a-b

Pylopaguropsis laevispinosa McLaughlin & Haig, 1989: 166, figs 4e, 6e, 8f, 10e, 12e, 13j, 2l.

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 22, 05°22'S, 133° 01'E, 85-124 m, 25.10.1991: 3 ♂ (1.2-3.3 mm) (MNHN-Pg 5315). — Stn DW 30, 05°39'S, 132°56'E, 111-118 m, 26.10.1991: 1 ♀ (2.3 mm) (MNHN-Pg 5316).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ov. ♀ (1.2 mm) (POLIPI).

DIAGNOSIS. — Shield (Fig. 30b) longer than broad. Rostrum obtusely triangular; terminating in small spinule. Ocular peduncles overreached by antennular peduncles. Ocular acicles triangular, acute; separated by slightly more than basal width of one acicle.

Right chela (Fig. 44a) somewhat dorsoventrally compressed; dactyl as long as palm or slightly shorter, articulation only slightly oblique; dorsomesial margin with row of strong spines, dorsal surface with scattered spines; ventromesial margin with row of spinulose tubercles. Palm with irregular single or double row of moderately strong spines on dorsomesial margin, dorsal surface of palm and fixed finger with numerous spines, sometimes forming irregular rows; dorsolateral margin with row of spines, strongest on fixed finger; ventral surface convex, tuberculate laterally and granular medially. Carpus with row of strong spines mesially and laterally on dorsal surface and irregular transverse row of strong spines on distal margin, extending onto mesial and lateral faces. Merus with row of acute spines on ventrolateral margin; ventromesial margin with row of acute spines, ventroproximal margin with prominent blunt tubercle.

Left cheliped (Fig. 44b) long, slender; chela twisted counterclockwise 30° to 40° from perpendicular. Dactyl with row of small spines on dorsal surface; dorsomesial margin with row of strong spines, not extending to tip. Palm with 2 irregular rows of strong spines in midline of sloping dorsal surface, 1 extending onto fixed finger as small spinulose tubercles, dorsal surface mesially and laterally each with row of moderately strong spines; ventral surface with 1 row of small spines laterally in distal portion of palm and proximal portion of fixed finger. Carpus with 2 rows of corneous-tipped spines on dorsal surface, strongest distally. Merus with row of strong acute spines on ventrolateral margin; ventromesial margin with row of smaller subacute spines, prominent spinulose tubercle at ventromesial proximal angle.

Ambulatory legs generally similar. Dactyls long and slender; ventral margins each with row of strong, corneous spinules. Propodi with lateral faces evenly convex, unarmed. Carpi each with dorsodistal spine and at least 2 or 3 (male) or row (female) of small spines (second) or with only dorsodistal spine (third). Sternite of third pereopods with anterior lobe subsemicircular. Propodal rasps of 4th pereopods with 1 row of corneous scales.

Telson (Fig. 30d) with asymmetrical posterior lobes separated by shallow median cleft; terminal margins oblique, each with few to several small spines, sometimes extending onto lateral margins, particularly on left.

COLOR (in preservative). — Shield orange tinged, rostral margin accentuated in dark orange. Ocular peduncles cream; acicles with margins accentuated in orange. Antennular peduncles cream, with faint yellowish brown in distal third of ultimate segment. Antennal peduncles with orange stripe on ultimate segment dorsally and on mesial face ventrally; fourth segment orange and white striped dorsally and white ventrally; acicle with broad orange longitudinal stripe on dorsal surface. Right cheliped with chela faint orange or cream-colored; carpus generally with faint orange hue, mesial, lateral and dorsal surfaces orange with white stripe proximally. Merus orange and white striped dorsally and on dorsal halves of mesial and lateral faces, ventral surface with faint orange hue. Left cheliped with chela very faint orange; carpus and merus with orange and white longitudinal stripes. Second and third pereopods with orange and white longitudinal stripes (MCLAUGHLIN & HAIG, 1989).

HABITAT. — Unknown.

DISTRIBUTION. — Okinawa and Indonesia; 3-125 m.

REMARKS. — *Pylopaguropsis laevispinosa* was described from two females collected in Okinawa, Ryukyu Islands. The present diagnosis has been modified to reflect the variations exhibited by large males of this species. The presence of *P. laevispinosa* in the Kai and Tanimbar Islands of Indonesia represents a major southern extension of the range of this species.

Genus *TOMOPAGUOPSIS* Alcock, 1905

Tomopaguopsis Alcock, 1905b: 136.

DIAGNOSIS. — Thirteen pairs of trichobranchiate gills. Shield with well developed rostrum. Ocular acicles triangular. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod well developed, recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth. Sternite of third maxillipeds with prominent spine on either side of midline.

Chelipeds subequal; right usually somewhat more robust. Ambulatory legs similar from left to right; carpus with or without dorsodistal spine. Fourth pereopod semichelate; propodal rasp with several rows of corneous scales. Fifth pereopods chelate.

Males with coxae of fifth pereopods symmetrical; paired gonopores; with or without paired first pleopods modified as gonopods, 4 unpaired unequally biramous left pleopods. Females with paired gonopores; no paired pleopods, 4 unpaired pleopods, second to fourth usually with both rami well developed, fifth reduced. Telson with transverse suture; posterior lobes separated by median cleft; terminal margins spinose.

TYPE SPECIES herein selected. — *Tomopaguopsis lantana* Alcock, 1905b.

REMARKS. — ALCOCK (1905b) established *Tomopaguopsis* to accommodate his new species *Tomopaguopsis lantana*, and *Eupagurus ?problematicus* A. Milne Edwards & Bouvier, 1893, an Atlantic species. In his original diagnosis of *Tomopaguopsis*, ALCOCK (1905b) reported that males were provided with a small pair of pleopods on the first abdominal somite. Although no mention was made of paired male pleopods in the original description of *E. ?problematicus*, ALCOCK's assignment of this taxon to *Tomopaguopsis* presumably was based on MILNE EDWARDS and BOUVIER's (1893: 153) subsequent remark: "Cette espèce se distingue des *Eupagurus* par ses pattes antérieures, dont les doigts sont mobiles dans un plan oblique, et par ses lamelles branchiales qui sont profondément bifides à l'extrémité. Ces deux caractères, et la plupart des autres, la rapprochent des *Parapagurus*, et l'on trouve même chez le mâle deux fausses pattes sexuelles antérieures, réduites à l'état de bourgeons très courts, ainsi que la trace d'une fausse patte sexuelle de la 2^{ème} paire".

The presence of paired first pleopods modified as gonopods in *Tomopaguopsis* was the character that ALCOCK (1905b) likened to the condition reported by MILNE EDWARDS and BOUVIER (1893) for their genus *Tomopagurus* A. Milne Edwards & Bouvier, 1893. However, PROVENZANO (in FOREST & DE SAINT LAURENT, 1968) noted that normal males of *Tomopagurus* lacked paired first pleopods, and proposed that the presence of paired first pleopods in the holotype of *Tomopagurus rubropunctatus* A. Milne Edwards & Bouvier, 1893, was due to the feminizing effect of a rhizocephalan of the genus *Peltogaster*; females of *Tomopagurus* were known to have paired first pleopods. DE SAINT LAURENT (1970b) suggested that variation in the presence of paired pleopods in both sexes probably occurred not only in *Tomopagurus* but in *Tomopaguopsis* as well. To demonstrate this variation in *Tomopaguopsis*, she referred to an undescribed species which lacked male gonopods; in *Tomopagurus* she cited the notation by PROVENZANO (in FOREST & DE SAINT LAURENT, 1968). McLAUGHLIN's (1981a) description of the new species, *Tomopagurus wassi* McLaughlin, a species lacking female paired first pleopods, and her (McLAUGHLIN, 1981b) description of feminization in a male of *Rhodochirus* McLaughlin, 1981a, supported DE SAINT LAURENT's suggestion for *Tomopagurus*. I have not reviewed the holotype of *Tomopaguopsis problematica*, but I have examined four male specimens (UMML 4975, 4978-80); all lack paired first pleopods. Similarly, males of *T. crinita* sp. nov. lack paired pleopods. In all other respects, males of both species clearly are assignable to *Tomopaguopsis*.

ALCOCK (1905b) did not designate a type species for *Tomopaguopsis*, and the only other report of *T. lantana* is that of KEMP and SEWELL (1912) who noted the collection of one additional specimen during the 1910-1911 cruise of R.I.M.S.S. "Investigator". Although *T. problematica* was listed first in ALCOCK's (1905b) remarks, and has been reported more frequently (e.g., WILLIAMS, 1984; ABELE & KIM, 1986) it is probable that his generic diagnosis was based principally on the Indian taxon. *Tomopaguopsis lantana*, therefore, is herein selected as the type species. Whether or not paired first pleopods in males of *Tomopaguopsis* is a normally variable condition will only be determined when several males of *T. lantana* have been examined.

Tomopaguropsis crinita sp. nov.

Figs 31a-g, 44c-d

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn CC 10, 05°21'S, 132°30'E, 329-389 m, 23.10.91: 1 ♂ (5.4 mm) (USNM 276012). — Stn DW 30, 05°39'S, 132°56'E, 111-118 m, 26.10.1991: 1 ♂ (3.7 mm) (USNM 276030). — Stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 ♀ (4.7 mm) (MNHN-Pg 5317).

Tanimbar Islands: stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 1 ♂ (4.1 mm) (MNHN-Pg 5318). — Stn DW 77, 08°57'S, 131°27'E, 346-352 m, 3.11.1991: 1 ♂ (4.3 mm) (MNHN-Pg 5319); 1 ♂ (2.4 mm) (POLIPI).

TYPES. — The male (4.3 mm) (MNHN-Pg 5319) from KARUBAR station DW 77 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 31a) subtriangular, longer than broad; anterior margin between rostrum and lateral projections weakly concave; anterior margins sloping; posterior margin truncate; dorsal surface frequently only weakly calcified in midline, somewhat rugose laterally and with few tufts of setae. Rostrum broadly triangular, produced slightly beyond bases of ocular acicles; with very small terminal spinule. Lateral projections triangular, terminating subacutely, unarmed or with tiny spinule.

Ocular peduncles short and moderately stout; dorsomesial surface with row of long setae; corneae small, not dilated. Ocular acicles elongate and subtriangular, dorsally rounded, with tuberculate terminal spine and few setae distally; approximate, or separated basally by less than 0.30 basal width of one acicle.

Antennular peduncles overreaching distal margins of corneae by 0.70 to entire length of ultimate segment. Ultimate segment with row of long setae on dorsodistal margin. Penultimate segment glabrous or with very few scattered setae. Basal segment with small spine on dorsolateral margin medially.

Antennal peduncles overreaching distal margins of corneae by 0.25 to 0.60 length of ultimate segment. Fifth segment with few setae. Fourth segment with spinule at dorsodistal margin. Third segment with strong ventrodistal spine and long setae. Second segment with dorsolateral distal angle produced, terminating in bifid or simple spine, dorsal surface and lateral margin with long setae; dorsomesial distal angle with small spine. First segment usually with small spine on dorsolateral distal margin; ventral margin produced, unarmed. Antennal acicle moderately long, reaching nearly to distal margin of ultimate peduncular segment or sometimes well beyond; slightly arcuate; mesial and lateral margins and dorsal surface distally with very long setae; terminating in simple spine. Antennal flagellum moderately long, frequently reaching beyond tips of outstretched chelipeds; each article with several very long (> 6 articles length) setae.

Chelipeds subequal, left occasionally longer, but right slightly more robust; dactyls and fixed fingers horizontal or arched ventrally. Right cheliped (Figs 31b, 44c) with dactyl slightly shorter to slightly longer than palm; dorsomesial margin not delimited; dorsal, mesial and ventral surfaces all with numerous tufts of long setae; cutting edge with 1 or 2 large calcareous teeth proximally, row of corneous teeth in distal half, terminating in corneous claw. Palm slightly shorter than carpus; usually with row of small spines on proximal 0.60 of dorsomesial margin, occasionally with only single spine at proximal angle; dorsal surfaces of palm and fixed finger with numerous rows of tufts of long setae and rarely 1 or 2 very small spinules in proximal third, dorsolateral margins not delimited; lateral and ventral surfaces with numerous tufts of long setae; cutting edge of fixed finger with calcareous teeth proximally and row of fused or individual corneous teeth distally. Carpus approximately equaling length of merus; dorsomesial margin with row of spines, strongest distally, dorsodistal margin usually with 1 or 2 spines or spinulose tubercles, dorsolateral margin not delimited; surfaces all with long or short transverse sometimes slightly protuberant rows of long setae. Merus with short transverse rows of long setae on dorsal margin; dorsodistal margin with 2 or 3 spines; lateral face usually with scattered low, sometimes spinulose protuberances and tufts of setae; ventromesial and ventrolateral distal angles each with 1 distal spine and occasionally second spinule or spinulose protuberance on margin distally. Ischium with tuberculate ridge on lateroproximal margin, laterodistal margin usually with 2 or 3 tiny spinules; ventromesial margin with few low protuberances and tufts of short setae.

Left cheliped (Figs 31c, 44d) with dactyl slightly shorter to slightly longer than palm; often short hiatus between dactyl and fixed finger proximally; dorsomesial margin of dactyl not delimited; dorsal, mesial and ventral

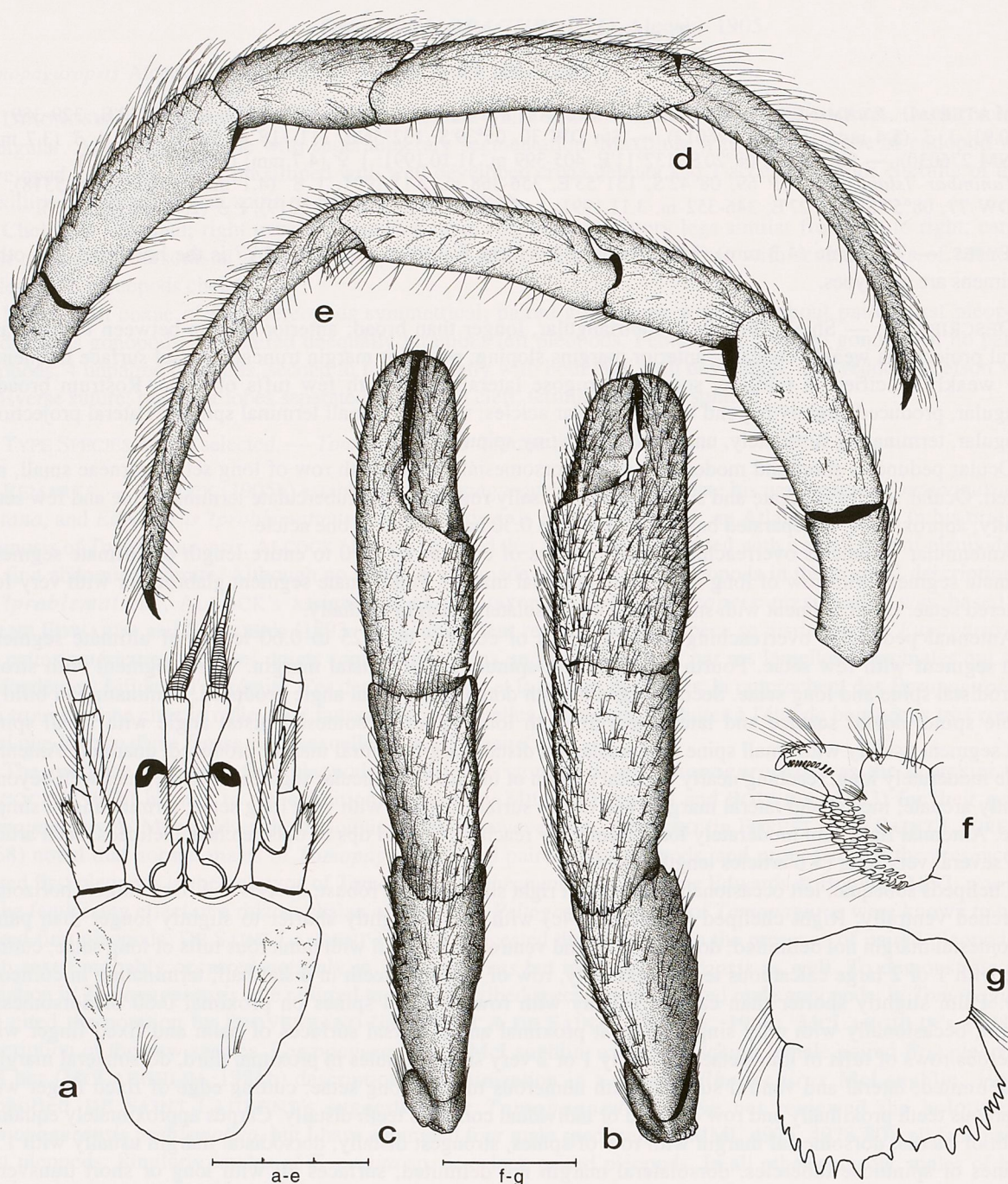


FIG. 31. — *Tomopaguropsis crinita* sp. nov., holotype ♂ (4.3 mm) from KARUBAR Stn DW 77: **a**, shield and cephalic appendages; **b**, right cheliped (dorsal view); **c**, left cheliped (dorsal view); **d**, right second pereopod (lateral view); **e**, left third pereopod (lateral view); **f**, dactyl and propodus of left fourth pereopod; **g**, telson. Scales equal 1.0 mm (f-g) and 3.0 mm (a-e).

surfaces all with numerous tufts of long setae; cutting edge with row of corneous teeth, terminating in corneous claw. Palm slightly shorter than carpus, dorsomesial margin with 1 spine at proximal angle and sometimes few

additional small spines on margin in proximal half, dorsal surfaces of palm and fixed finger with numerous irregular rows of long setae, dorsolateral margins not delimited; lateral and ventral surfaces with numerous tufts of long setae; cutting edge of fixed finger with row of very small calcareous teeth proximally, corneous teeth distally. Carpus approximately equaling length of merus; dorsodistal margin with 1 or 2 spines or spinules, dorsomesial distal angle with strong spine and 1 to 6 spines on dorsomesial margin, dorsolateral margin not delimited; surfaces with short transverse, sometimes slightly protuberant rows of long setae. Merus with short transverse, somewhat protuberant or spinulose rows of long setae on dorsal margin; dorsodistal margin with 1 or 2 small spines; ventromesial and ventrolateral distal angles each with 1 distal spine or spinule and occasionally second spinule or spinulose protuberance on margin distally; lateral surface frequently with low, sometimes spinulose protuberances in ventral half. Ischium with tuberculate ridge on lateroproximal margin, ventrolateral distal margin with 2 or 3 spinules; ventromesial margin with 1 or 2 spinulose protuberances and tufts of setae.

Ambulatory legs (Figs 31d-e) with dactyls 1.25 to nearly twice length of propodi; in dorsal view, slightly twisted; in lateral view, curved ventrally; all surfaces, but particularly dorsal and ventrolateral margins, with rows of long setae; mesial faces each with row of tufts of long setae; ventral margins also with 9 to 25 short, fine corneous spines. Propodi with transverse rows of long setae dorsally; scattered setae on mesial, lateral and ventral surfaces; ventromesial distal angles usually with 1 or 2 corneous spines. Carpi each frequently with spine at dorsodistal angle; surfaces, particularly dorsal and lateral, with numerous tufts of setae. Meri and ischia each with short transverse sometimes slightly protuberant rows of long setae particularly dorsally. Fourth pereopods without prominent preungual process at base of claw (Fig. 31f). Anterior lobe of sternite of third pereopods subquadrate, with convex median, marginally setose, elevation.

Abdomen of males with 4 unpaired, unequally biramous pleopods; endopods well developed, exopods approximately half length of endopods. Posterior margin of sixth abdominal somite with lateral angles each drawn out into prominent simple, bi- or trifold spine. Telson (Fig. 31g) with deep transverse suture; posterior lobes nearly symmetrical, separated by narrow to moderately broad median cleft; terminal margins rounded, armed with several blunt or acute, sometimes corneous-tipped spines, extending onto lateral margins.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the islands of Kai and Tanimbar, Indonesia; 111 - 346 m.

ETYMOLOGY. — From the Latin *crinitus* meaning long-haired, and referring to the very long setae of the antennal acicles, ocular peduncles, chelipeds and ambulatory legs of this species.

AFFINITIES. — In having quite dense setation on the chelipeds and ambulatory legs, as well as elongate and very prominent ocular acicles, *T. crinita* agrees with the description given by ALCOCK (1905b) for *T. lantana*. However, *T. crinita* lacks the rows of spinules on the chelae reported for *T. lantana*. ALCOCK's (1905b, pl. 13, fig. 4) depicts a dorsodistal spine on the carpus of each ambulatory leg of *T. lantana*; *T. crinita* lacks any carpal spine. In his generic diagnosis, ALCOCK attributed paired first pleopods modified as gonopods to males of *Tomopaguropsis*, and these are depicted for *T. lantana* (ALCOCK, 1905b, pl. 13, fig. 4a). As previously noted, male gonopods are not present in *T. crinita*, nor in the Atlantic species, *T. problematica*.

Tomopaguropsis miyakei sp. nov.

Figs 32a-h, 44e-f

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ♀ (2.2 mm) (MNHN-Pg 5320).

TYPE. — The single specimen is the holotype.

DESCRIPTION. — Shield (Fig. 32a) approximately as long as broad; anterior margin between rostrum and lateral projections weakly concave; anterior margins sloping; posterior margin truncate; dorsal surface only weakly calcified centrally, with few setae laterally. Rostrum triangular, produced slightly beyond bases of ocular acicles; with small terminal spine. Lateral projections broadly triangular, terminating subacutely, with spine or spinule.

Ocular peduncles moderately short; dorsomesial surface with few long setae; corneae not dilated. Ocular acicles rather short, subtriangular, dorsally rounded, with terminal spine and few setae distally; separated basally by more than half basal width of one acicle.

Antennular peduncles overreaching distal margins of corneae by approximately 0.75 length of ultimate segment. Ultimate segment with 1 or 2 long setae on dorsodistal margin and 2 or 3 on dorsal margin. Penultimate segment with few scattered setae. Basal segment with prominent spine on dorsolateral margin medially.

Antennal peduncles slightly overreaching distal margins of corneae. Fifth segment with few setae. Fourth segment with transverse row of long setae adjacent to dorsodistal margin. Third segment with strong ventrodiscal spine and long setae. Second segment with dorsolateral distal angle produced, terminating in simple spine, mesial margin with small spine, dorsal surface and lateral margin with long setae; dorsomesial distal angle with small spine. First segment with spine on dorsolateral distal margin; ventral margin produced and with 1 spine ventrolaterally. Antennal acicle moderately long, reaching nearly to distal margin of ultimate peduncular segment, slightly arcuate, mesial and lateral margin distally each with very long setae; terminating in simple spine. Antennal flagellum moderately long, reaching about to tips of outstretched chelipeds; each article with several very long setae, shortest proximally.

Chelipeds subequal, right somewhat longer and more robust; dactyls and fixed fingers weakly arched ventrally. Right cheliped (Figs 32b, 44e) with dactyl approximately equal to length of palm; dorsomesial margin not delimited; dorsal, mesial and ventral surfaces all with numerous tufts of long setae arising from small surface pits; cutting edge with 1 calcareous tooth proximally and row of corneous teeth in distal half, terminating in corneous claw. Palm about 0.75 length of carpus, dorsomesial margin with row of rather widely-spaced small spines on proximal 0.80 and second adjacent row, 1 distinct tubercle and 2 very small spinules in dorsal midline proximally; dorsal surfaces of palm and fixed finger with numerous tufts of long setae; dorsolateral margin rounded and with few tiny spinules on palm, but with row of small spines on proximal 0.75 of fixed finger; lateral and ventral surfaces with numerous tufts of long setae; cutting edge of fixed finger with 1 large calcareous tooth proximally and row of slender calcareous teeth interspersed with corneous teeth distally; 1 very prominent calcareous-tipped tubercle at proximal angle. Carpus approximately equaling length of merus; distal margin with few small spines dorsally and laterally; dorsomesial margin with row of moderately strong spines and adjacent mesial and lateral row of smaller spines and spinules; dorsolateral margin not delimited but dorsal surface laterally and lateral surface dorsally each with irregular transverse rows of spinulose protuberances and long setae; mesial and ventral surfaces with scattered long setae. Merus with sparse short setae on all surfaces; ventromesial margin with 2 very small spines distally and 2 larger spines proximally; ventrolateral margin with 1 spinule distally. Ischium with small spinulose tubercle on ventromesial margin.

Left cheliped (Figs 32c, 44f) with dactyl slightly longer than palm; dorsomesial margin of dactyl not delimited; surfaces all with few sparse tufts of long setae; cutting edge with row of corneous teeth; terminating in corneous claw and slightly overlapped by fixed finger. Palm approximately 0.75 length of carpus; widely-spaced double row of small spines on rounded dorsomesial margin; dorsal surfaces of palm and fixed finger with few small widely-spaced spines laterad of midline, strongest on fixed finger, and row of tiny spinules in region of rounded dorsolateral margin; surfaces all with scattered long setae; cutting edge of fixed finger with row of very small calcareous teeth proximally, corneous teeth distally. Carpus slightly shorter than merus; dorsomesial margin with irregular row of spines and few long setae, dorsolateral margin with irregular row of smaller spines; lateral face with few small spines at distal margin and 1 small spine centrally; 1 tiny spinule at ventrolateral distal angle; mesial and ventral surfaces with sparse tufts of setae. Merus with sparsely scattered setae on dorsal surface, lateral and mesial faces each with few low minutely spinulose protuberances and setae in ventral half; ventromesial margin with 1 small spine distally, 1 at midlength and cluster of 3 slightly larger spines proximally; ventrolateral margin with 1 distal spine. Ischium with 1 proximal and 1 distal small spine on ventromesial margin, distolateral margin with spinule dorsally.

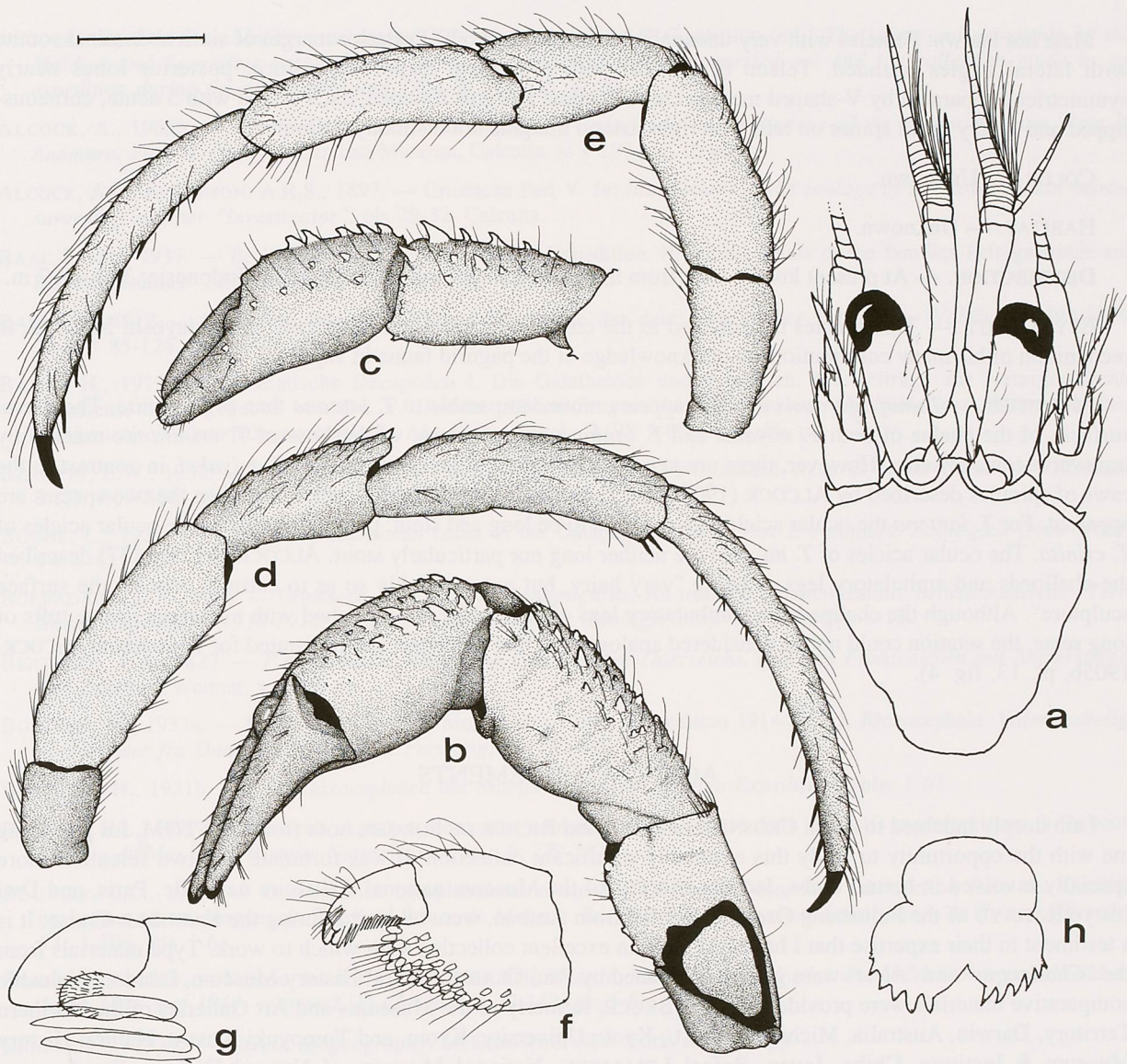


FIG. 32. — *Tomopaguropsis miyakei* sp. nov., holotype ♀ (2.2 mm) from KARUBAR Stn CP 35: a, shield and cephalic appendages; b, right cheliped (mesial view); c, carpus and chela of left cheliped (lateral view); d, right second pereopod (lateral view); e, left third pereopod (lateral view); f, dactyl and propodus of left fourth pereopod; g, tip of dactyl and preungual process of left fourth pereopod (lateral view); h, telson. Scale equal 0.1 mm (g), 0.5 mm (f), and 1.0 mm (a-e, h).

Ambulatory legs (Figs 32d-e) with dactyls 1.25 to 1.35 length of propodi; in dorsal view, slightly twisted; in lateral view, curved ventrally; all surfaces with sparse tufts of long rather stiff setae, most numerous dorsally; ventral margins few setae and 8 or 9 corneous spines. Propodi with numerous sparse tufts of long moderately stiff setae also most numerous dorsally; ventromesial distal angles each with 1 or 2 corneous spines. Carpi with spine at dorsodistal angle, second also with row of widely-spaced spinules on dorsal surface, both pairs with sparse tufts of setae dorsally and laterally. Meri and ischia each with dorsal and ventral row of low, sometimes spinulose protuberances and sparse setae. Anterior lobe of sternite of third pereopods subrectangular, with marginal setae. Fourth pereopods with moderately prominent preungual process at base of claw (Figs 32f-g).

Male not known. Females with very unequally biramous pleopods. Posterior margin of sixth abdominal somite with lateral angles rounded. Telson (Fig. 32h) with prominent transverse suture; posterior lobes nearly symmetrical, separated by V-shaped median cleft; terminal margins rounded, each armed with 5 acute, corneous-tipped and 2 very small spines on left, 5 on right, lateral margins not distinctly delimited.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the type locality in the Kai Islands of Indonesia; 390 - 502 m.

ETYMOLOGY. — This species is dedicated to the eminent Japanese carcinologist, Dr. Sadayoshi MIYAKE, in recognition of his many contributions to our knowledge of the pagurid fauna of Japan.

AFFINITIES. — *Tomopaguropsis miyakei* appears more comparable to *T. lantana* than to *T. crinita*. The dorsal surfaces of the chelae of both *T. miyakei* and *T. lantana* are spinulose, while those of *T. crinita* are marked by transverse rows of setae. However, there are very few spinules on the right chela of *T. miyakei*, in contrast to the rows of spinules described by ALCOCK (1905b) for *T. lantana*. Two other differences between the two species are apparent. For *T. lantana* the ocular acicles are reported to be long and stout, perhaps similar to the ocular acicles of *T. crinita*. The ocular acicles of *T. miyakei* are neither long nor particularly stout. ALCOCK (1905b: 137) described the chelipeds and ambulatory legs as being "very hairy, but not so thickly so as to entirely conceal the surface sculpture". Although the chelipeds and ambulatory legs of *T. miyakei* are furnished with numerous sparse tufts of long setae, the setation could not be considered analogous to that described and illustrated for *T. lantana* (ALCOCK, 1905b, pl. 13, fig. 4).

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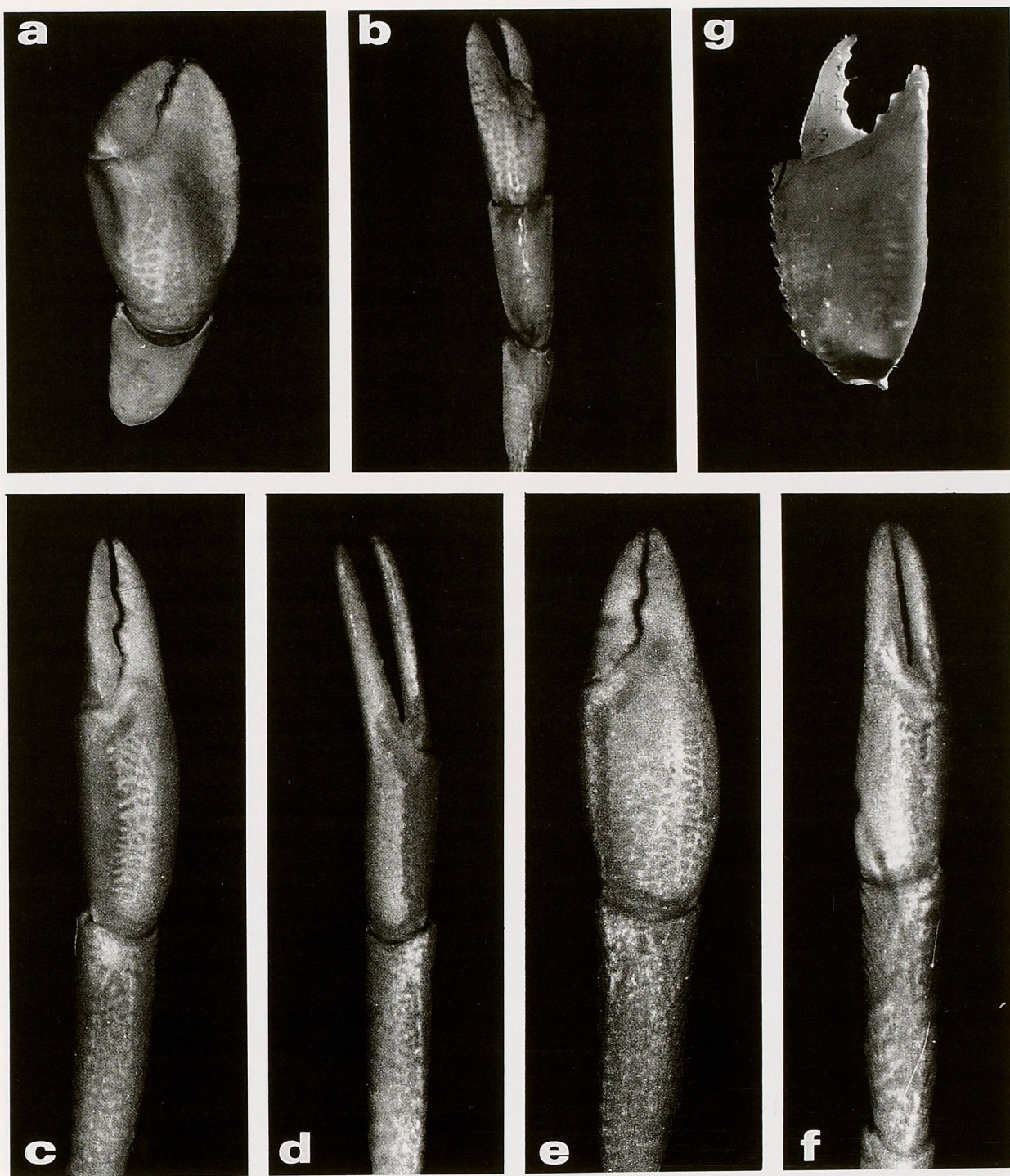


FIG. 33 a-b. — *Enneophyllus spinirostris* sp. nov., holotype ♂ (1.6 mm), KARUBAR Stn DW 49: **a**, carpus and chela of right cheliped; **b**, merus, carpus and chela of left cheliped.

FIG. 33 c-f. — *Enneopagurus garciagomezi* sp. nov., c-d, paratype ♂ (3.4 mm), KARUBAR Stn CP 71. — e-f, paratype ♀ (2.7 mm), KARUBAR Stn CP 75: **c**, **e**, carpus and chela of right cheliped; **d**, **f**, carpus and chela of left cheliped.

FIG. 33 g. — *Catapaguroides declivis* sp. nov., holotype ♂ (1.5 mm), KARUBAR Stn DW 49: chela of right cheliped.

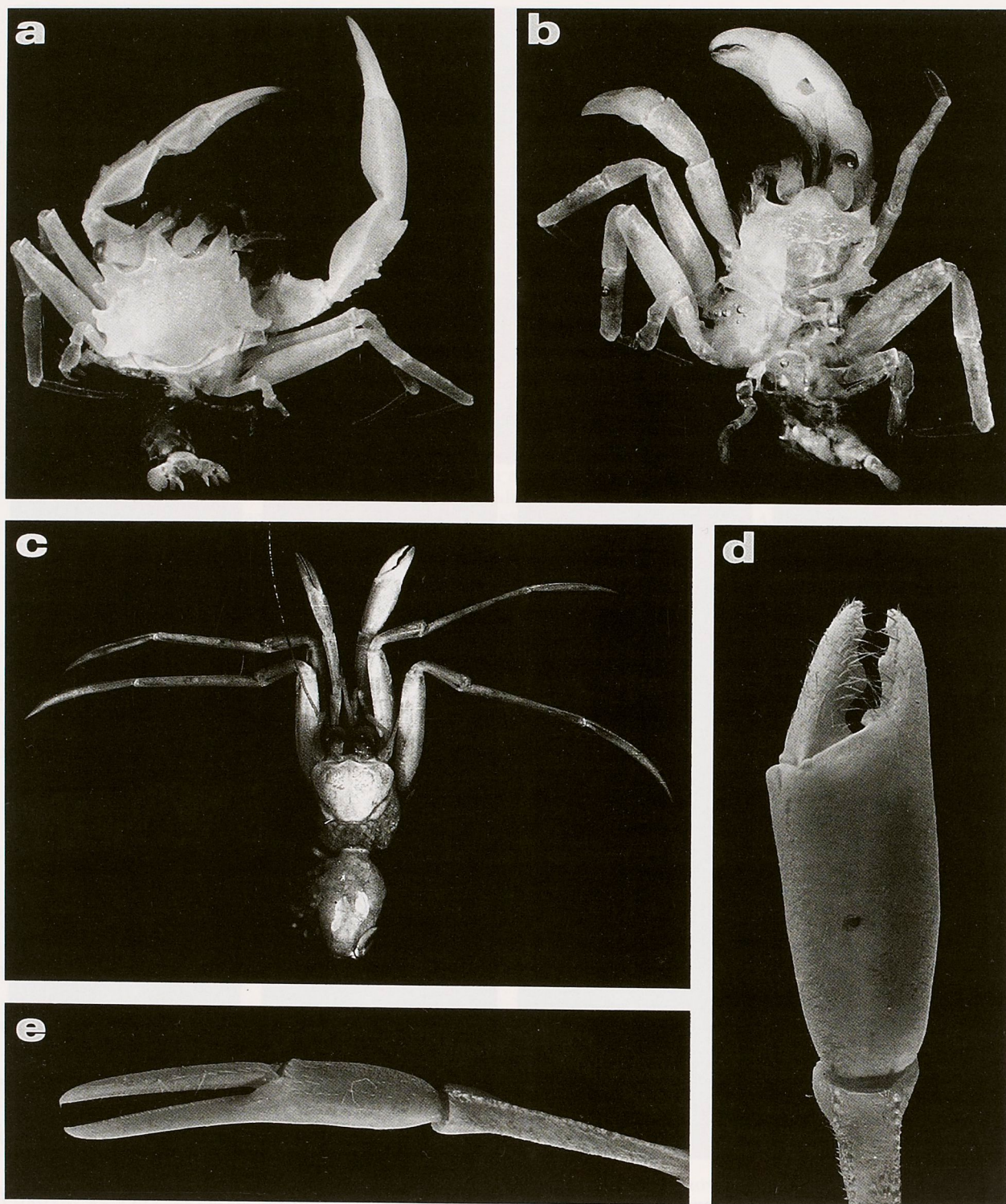


FIG. 34 a. — *Solitariopagurus tuerkayi* sp. nov., paratype ♂ (3.3 mm), KARUBAR Stn DW 50: whole animal.

FIG. 34 b. — *Porcellanopagurus jacquesi* sp. nov., holotype ♂ (2.8 mm), KARUBAR Stn DW 18: whole animal.

FIG. 34 c-e. — *Alainopaguroides lemaitrei* sp. nov., holotype ♂ (6.2 mm), KARUBAR Stn CP 59: c, whole animal; d, right chela; e, left chela and carpus.

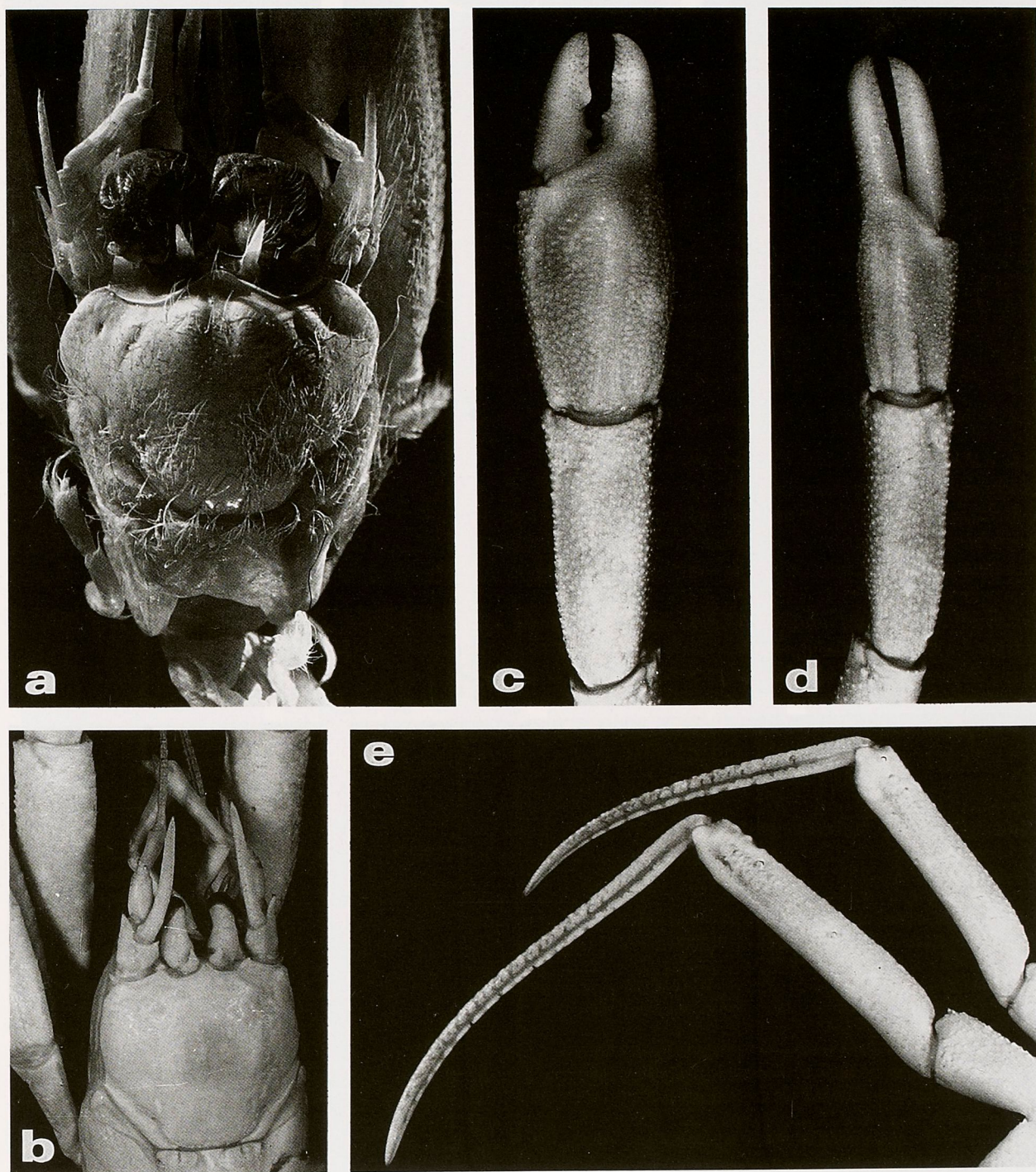


FIG. 35 a. — *Alainopaguroides lemaîtrei* sp. nov., holotype ♂ (6.2 mm), KARUBAR Stn CP 59, carapace and cephalic appendages.

FIG. 35 b-e. — *Paguroides inarmatus* Henderson, 1888, lectotype ♂ (7.0 mm), "Challenger" Stn 168: b, shield and cephalic appendages; c, right chela and carpus; d, left chela and carpus; e, dactyls and propodi of left second and third pereopods.

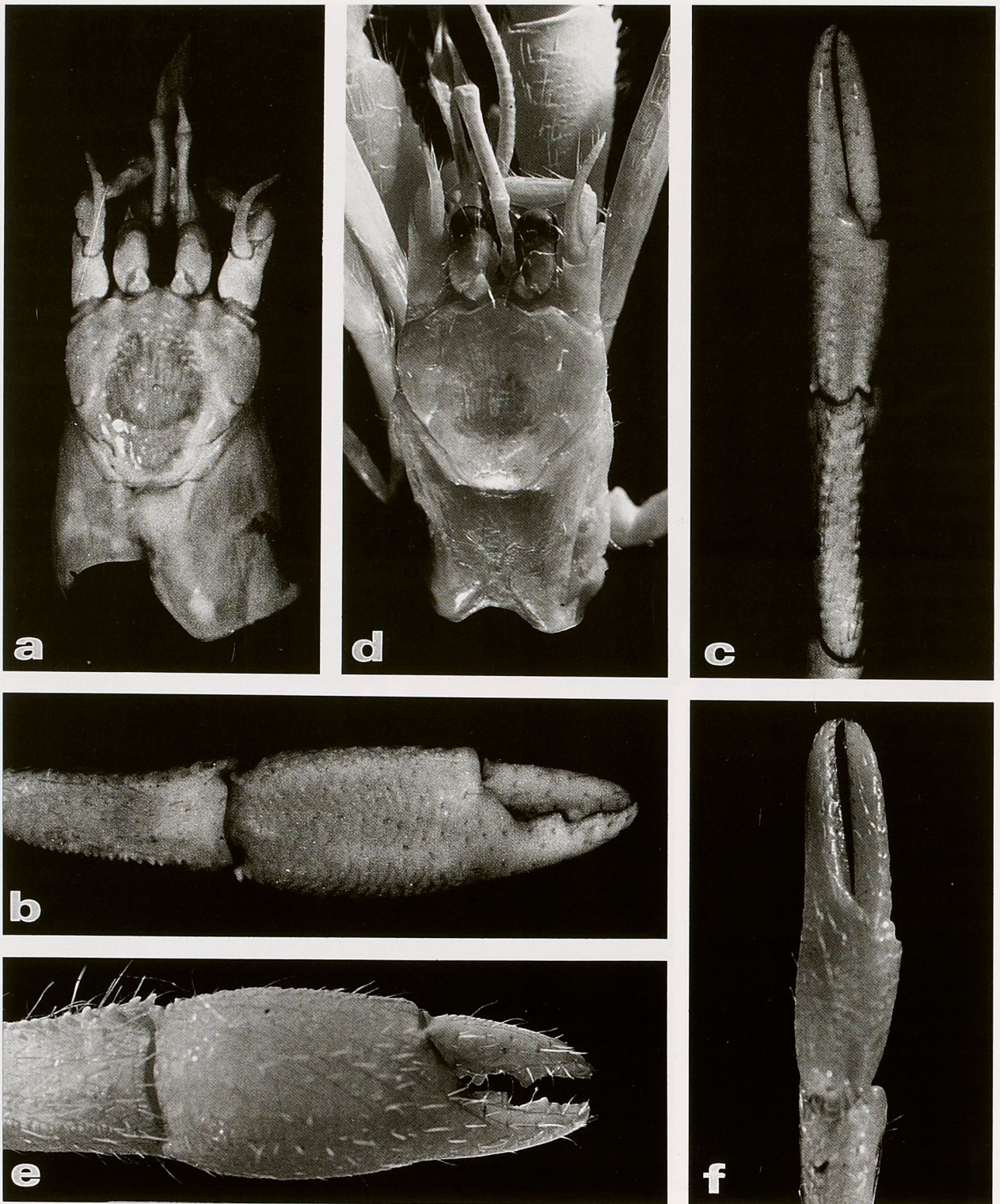


FIG. 36. — *Michelopagurus limatulus* (Henderson, 1888), new combination: a-c, holotype ♂ (3.1 mm), "Challenger" Stn 214 (NHM 88.33). — d-f, ♂ (2.8 mm), KARUBAR Stn CP 38: a, d, carapace and cephalic appendages; b, e, carpus (or part only) and chela of right cheliped; c, f, carpus (or part only) and chela of left cheliped.



FIG. 37 a-b. — *Pseudopagurodes piliferus* (Henderson, 1888), new combination, a-b, holotype ♀ (4.5 mm), "Challenger" Stn Tablas Islands (NHM 88.33): **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped.

FIG. 37 c-e. — *Michelopagurus chacei* sp. nov., c-e, holotype ♂ (2.5 mm) from KARUBAR Stn DW 13: **c**, shield and cephalic appendages; **d**, carpus and chela of right cheliped; **e**, carpus and chela of left cheliped.

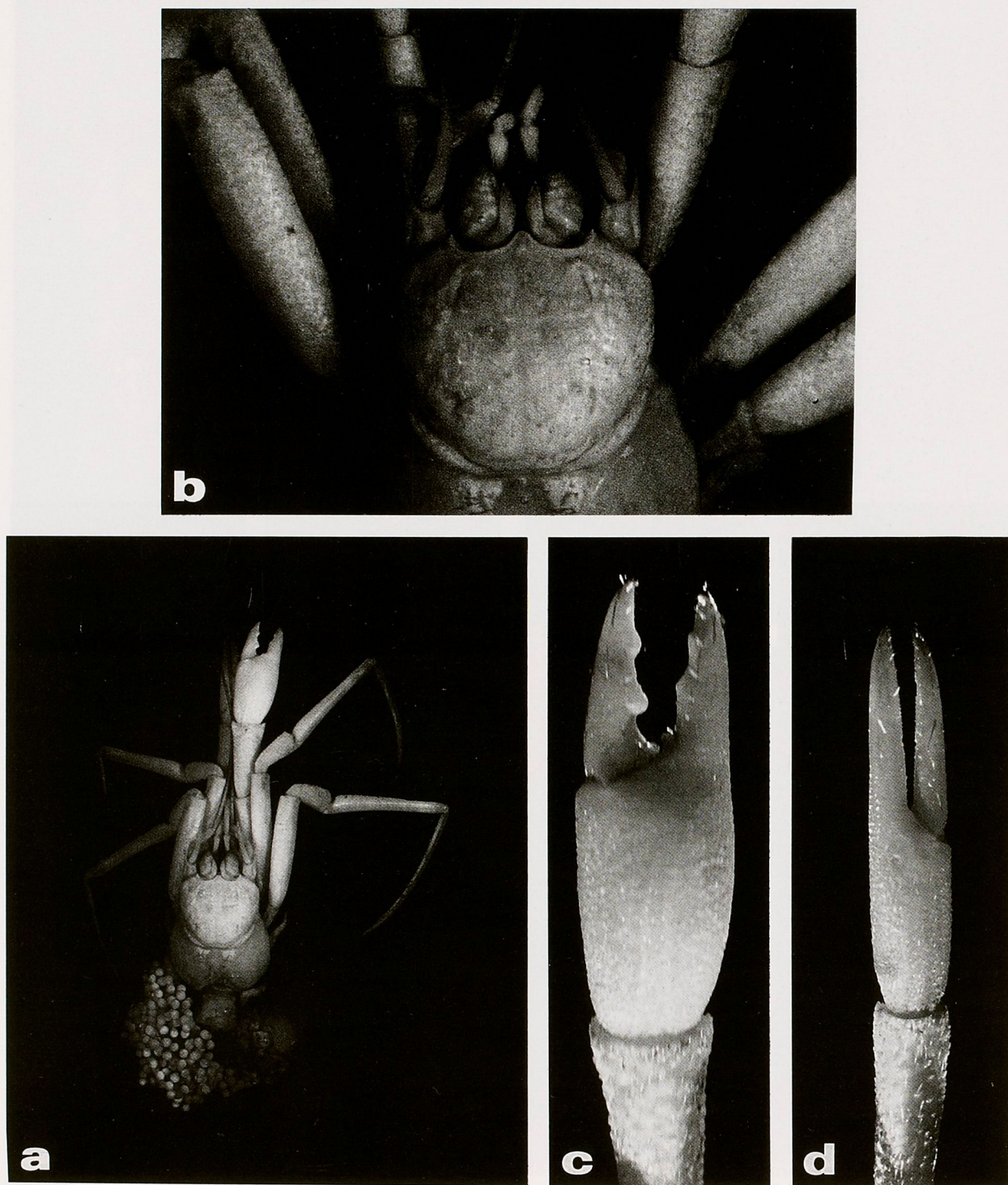


FIG. 38. — *Icelopagurus crosnieri* sp. nov., holotype ov. ♀ (4.3 mm), KARUBAR Stn CP 91: **a**, whole animal; **b**, enlarged shield and cephalic appendages; **c**, carpus and chela of right cheliped; **d**, carpus and chela of left cheliped.

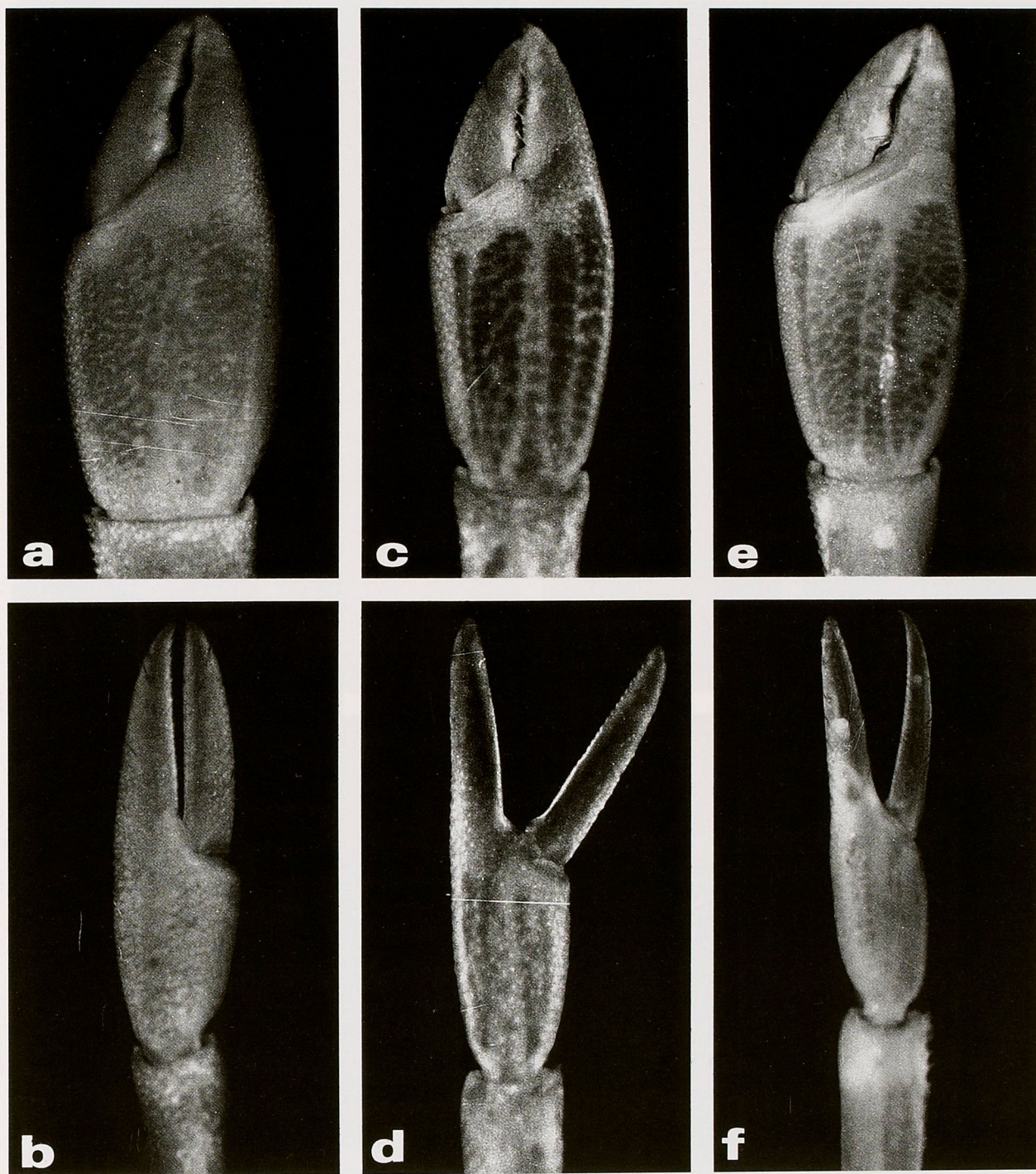


FIG. 39 a-b. — *Catapagurus oculocrassus* sp. nov., paratype ov. ♀ (2.7 mm), KARUBAR Stn CP 21: **a**, chela of right cheliped; **b**, chela of left cheliped.

FIG. 39 c-d. — *Catapagurus tanimbarensis* sp. nov., holotype ♀ (2.1 mm), KARUBAR Stn DW 49: **c**, chela of right cheliped; **d**, chela of left cheliped.

FIG. 39 e-f. — *Catapagurus holthuisi* sp. nov., holotype ov. ♀ (2.8 mm), KARUBAR Stn CP 77: **e**, chela of right cheliped; **f**, chela of left cheliped.



FIG. 40 a-c. — *Nematopagurus* cf. *indicus* Alcock, 1905, ♂ (5.2 mm), KARUBAR Stn DW 49: **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped; **c**, dactyls and propodi of left second and third pereopods.

FIG. 40 d-e. — *Nematopagurus* sp., ♀ (1.7 mm), KARUBAR Stn 18: **d**, chela of right cheliped; **e**, carpus and chela of left cheliped.

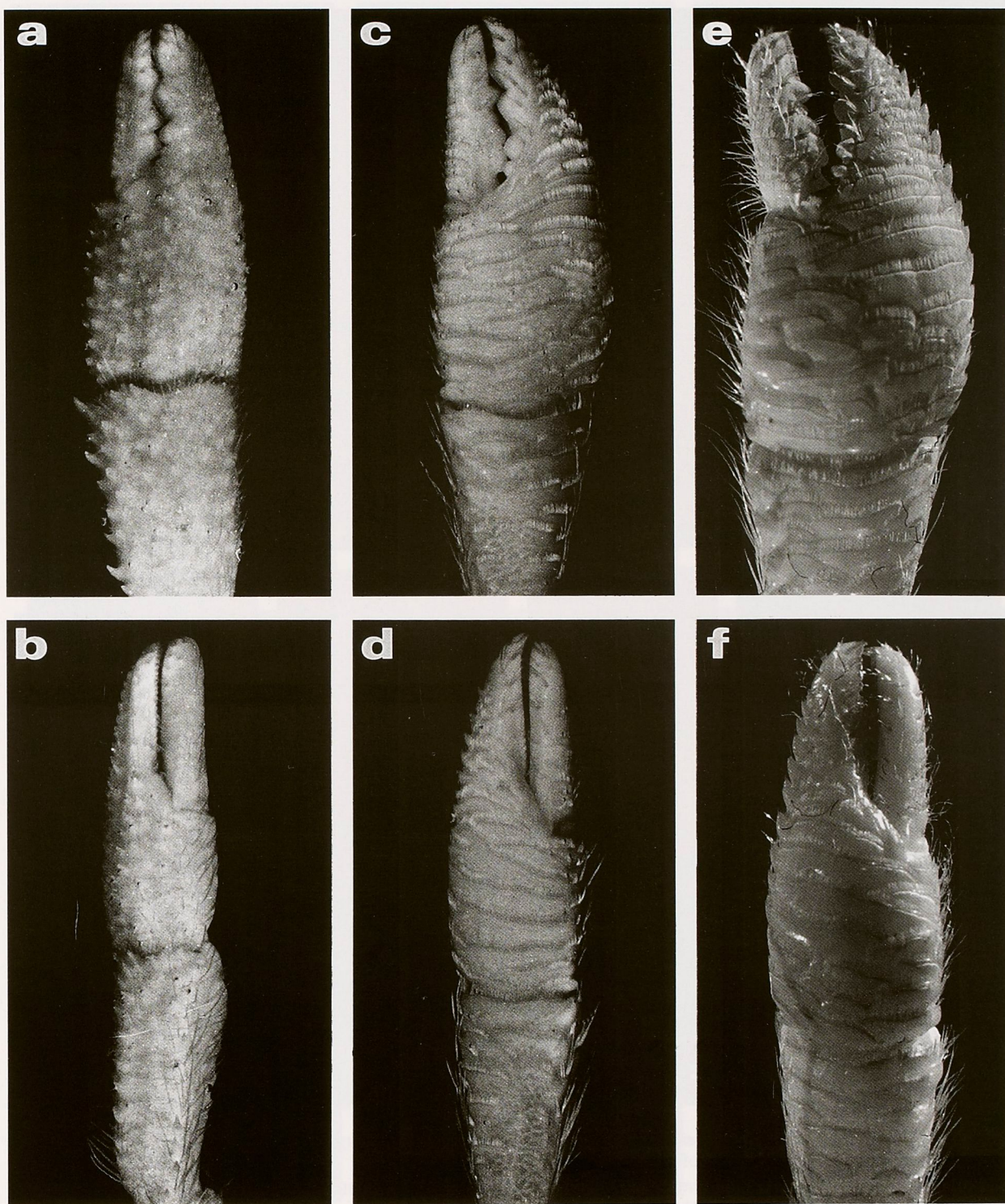


FIG. 41 a-b. — *Nematopagurus spinulosensoris* McLaughlin & Brock, 1974, ♀ (5.6 mm), KARUBAR Stn CP 86 **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped.

FIG. 41 c-f. — *Nematopagurus scutelliformis* sp. nov., c-d, paratype ♀ (7.0 mm), KARUBAR Stn CP 83; e-f, paratype, ♀ (6.9 mm), KARUBAR, st. CP 101: **c**, **e**, carpus and chela of right cheliped; **d**, **f**, carpus and chela of left cheliped.



FIG. 42 a-b. — *Australeremus indonesiensis* sp. nov., holotype ♀ (1.9 mm), KARUBAR Stn DW 18: a, carpus and chela of right cheliped; b, carpus and chela of left cheliped.

FIG. 42 c-d. — *Bathypaguropsis rahayuae* sp. nov., holotype ♂ (3.2 mm), KARUBAR Stn DW 14: c, carpus and chela of right cheliped; d, carpus and chela of left cheliped.

FIG. 42 e-f. — *Pagurus kaiensis* sp. nov., a-b, holotype ♂ (8.4 mm), KARUBAR Stn DW 18: e, chela of right cheliped; f, carpus and chela of left cheliped.

FIG. 42 g-h. — *Pagurus compressipes* (Miers, 1881), syntype ♂ (3.9 mm) NHM 1881.31: g, chela of right cheliped; h, chela of left cheliped.

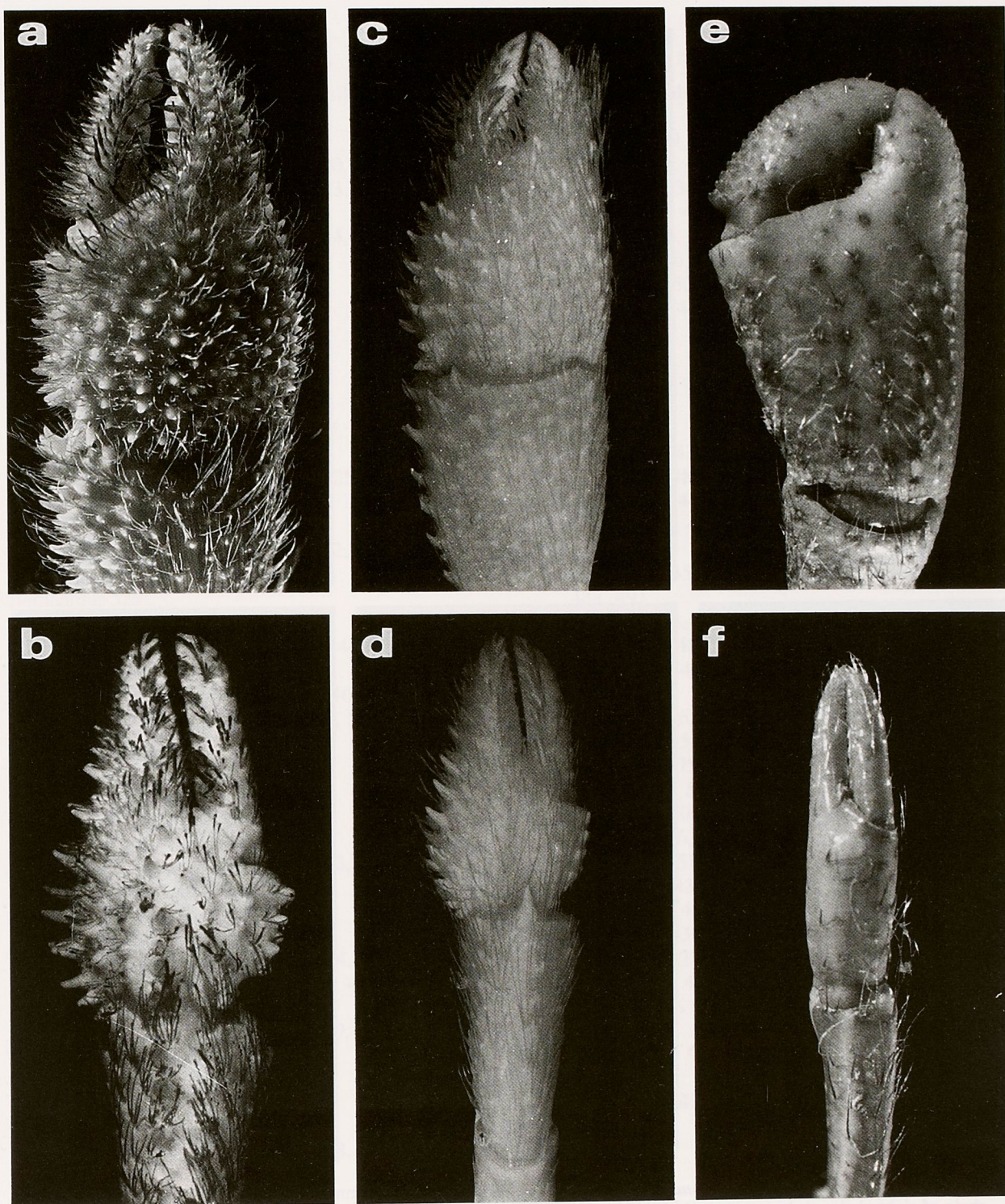


FIG. 43 a-d. — *Pagurus haigae* sp. nov., a-b, paratype ♀ (12.1 mm), KARUBAR Stn CP 16. — c-d, paratype ♂ (7.3 mm) from Stn CP 26: a, c, chela of right cheliped; b, d, chela of left cheliped.

FIG. 43 e-f. — *Pylopaguopsis zebra* (Henderson, 1893), ♀ (2.7 mm), KARUBAR Stn DW 15: e, chela of right cheliped; f, chela of left cheliped.

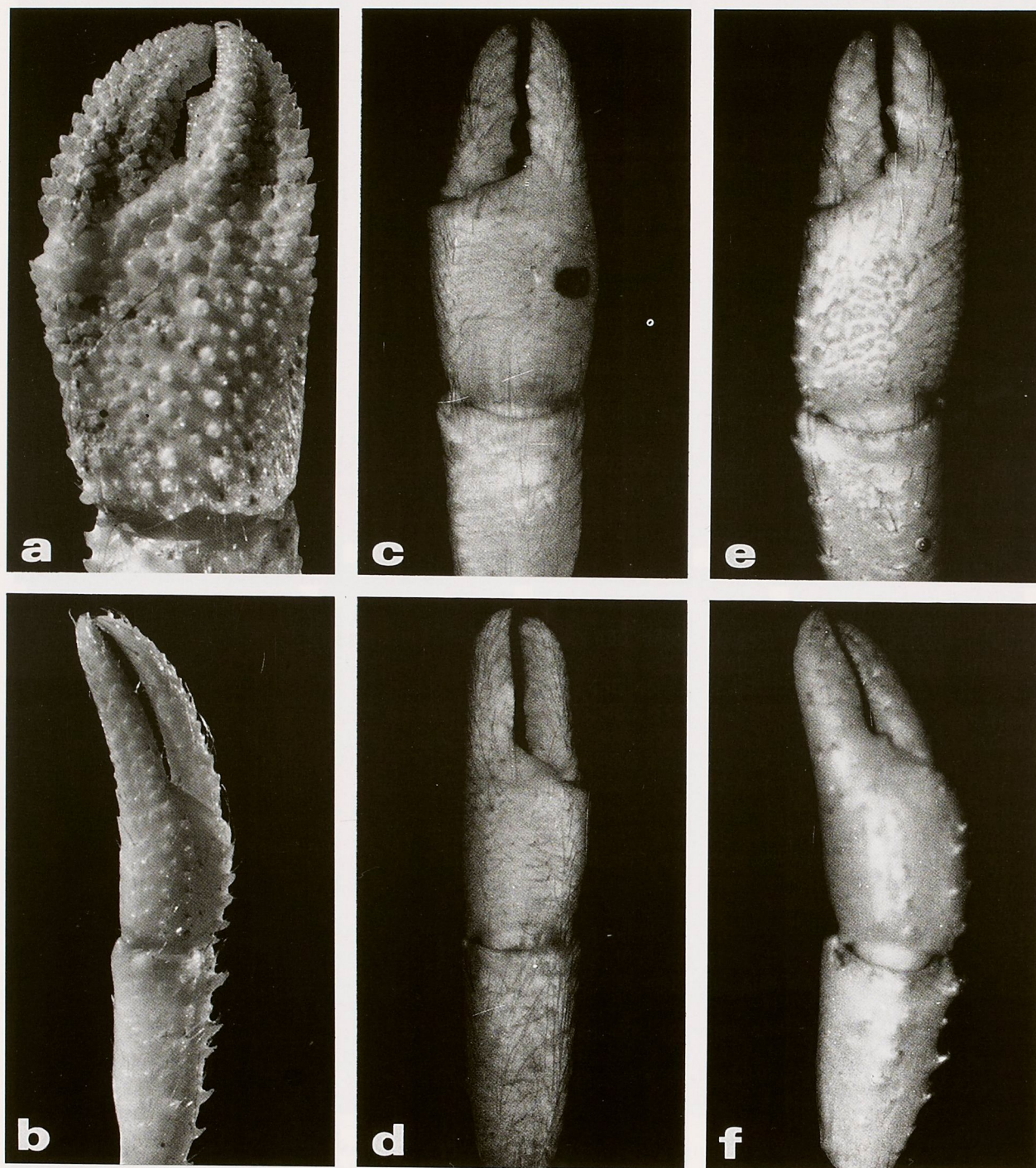


FIG. 44 a-b. — *Pylopaguropsis laevispinosa* McLaughlin & Haig, 1989, ♂ (3.2 mm), KARUBAR Stn DW 22: **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped.

FIG. 44 c-d. — *Tomopaguropsis crinita* sp. nov., paratype ♂ (5.4 mm), KARUBAR Stn CC 10: **c**, carpus and chela of right cheliped; **d**, carpus and chela of left cheliped.

FIG. 44 e-f. — *Tomopaguropsis miyakei* sp. nov., holotype ♀ (2.2 mm), KARUBAR Stn CP 35: **e**, carpus and chela of right cheliped; **f**, carpus and chela of left cheliped.

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