

## Crustacea Decapoda : Deep-water hermit crabs (Parapaguridae) from French Polynesia with descriptions of four new species

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### ABSTRACT

Parapagurid hermit crabs are reported for the first time from French Polynesia, based on a collection obtained during a deep-water trapping survey by the French government's Service Mixte de Contrôle Biologique des Armées. The collection contains nine species of the genus *Sympagurus* Smith, 1883, four of which are new, and one of *Strobopagurus* Lemaître, 1989. The material of the previously described species of *Sympagurus* found in French Polynesia is compared with types and supplemental specimens from other IndoPacific regions, and the species diagnosed in light of a recent re-evaluation of diagnostic characters in this genus. Based on examination of representative material of all *Sympagurus* species from the world oceans, three informal groups are proposed for the species. Group 1, including nine species, is defined by the presence of a slender, curved epistomial spine; Group 2, including ten species, is defined by the presence of a vestigial pleurobranch on each side of the last thoracic somite; and a heterogeneous Group 3, for the remaining 14 species and three subspecies, all of which lack a curved epistomial spine and vestigial pleurobranch on the last thoracic somite. A list of all known species of *Sympagurus* is presented, along with their geographic and bathymetric distributions.

### RÉSUMÉ

**Crustacea Decapoda : Pagures d'eau profonde (Parapaguridae) de la Polynésie française.  
Description de quatre espèces nouvelles.**

Des pagures appartenant à la famille des Parapaguridae sont signalés pour la première fois en Polynésie française. Ils ont été récoltés lors de pêches aux casier en eau profonde, effectuées par le Service Mixte de Contrôle Biologique des Armées. Les récoltes renferment neuf espèces du genre *Sympagurus* Smith, 1883, dont quatre sont nouvelles, et une espèce du genre *Strobopagurus* Lemaître, 1989. Les spécimens appartenant à des espèces déjà décrites du genre *Sympagurus* ont été comparés aux types et à des spécimens identifiés à ces espèces et provenant d'autres régions indopacifiques.



Les identifications ont été faites en tenant compte de la récente réévaluation des caractères spécifiques dans ce genre, établie récemment (LEMAITRE, 1989). En se basant sur l'examen de spécimens de toutes les espèces de *Sympagurus*, trois groupes d'espèces sont proposés. Le groupe 1, comprenant neuf espèces, se caractérise par la présence d'une épine épistomienne fine et recourbée; le groupe 2, comprenant 10 espèces, présente une pleurobranchie rudimentaire, de chaque côté du dernier somite thoracique; le groupe 3, hétérogène, renferme les 14 espèces restantes et trois sous-espèces qui, toutes, sont sans épine épistomienne courbe ni pleurobranchie rudimentaire sur le dernier somite thoracique. Une liste de toutes les espèces connues de *Sympagurus* est présentée, accompagnée de leurs distributions géographique et bathymétrique.

## INTRODUCTION

The deep-water hermit crab fauna of the vast IndoPacific region is incompletely known. Parapagurid hermit crabs, for example, a group represented throughout the world oceans and ranging from 55 to 5000 m in depth, have yet to be sampled from large areas of the Pacific (LEMAITRE, 1989, 1990a). This study is the first report of parapagurids from French Polynesia, and is based on collections obtained during deep-water trapping surveys in depths of 100 to 1120 m by the French government's Service Mixte de Contrôle Biologique des Armées (SMCB), under the direction of Mr Joseph POUPIN. The majority of the specimens were captured from 1986 to 1989 using baited cylindrical traps set in long-lines of 15 traps each. A detailed description of the survey and fishing techniques can be found in POUPIN *et al.* (1990). Of considerable value in this collection is the detailed, photographic information on coloration accompanying specimens of most species. The examination of this unique material revealed the existence of a total of 10 species, nine of which belong in the genus *Sympagurus* Smith, 1883, and one of *Strobopagurus* Lemaître, 1989. Of the species of *Sympagurus*, four are new to science, and five although previously described have been found to be poorly defined. The materials of these five species is compared with types and supplemental material from other Pacific regions, and the species diagnosed in light of a recent re-evaluation of the diagnostic characters in species of this genus (LEMAITRE, 1989). One specimen in this collection is tentatively assigned to the broadly distributed species *Strobopagurus gracilipes* (A. Milne Edwards, 1891).

With the addition of the four new species discovered, the genus *Sympagurus* now contains 32 species and three subspecies, of which 26 species and three subspecies are distributed in the Pacific and Indian Ocean regions. One of these species, *Sympagurus boletifer* de Saint Laurent, 1972, was erroneously reported by LEMAITRE (1989) as having a curved epistomial spine. A re-examination of specimens has shown that the epistomial spine in this species is straight. Another of the species placed by LEMAITRE in *Sympagurus*, *S. sinensis* (de Saint Laurent, 1972), was recently removed from this genus and placed in a new monotypic genus described as *Bivalvopagurus* (see LEMAITRE, 1993). Based on information from the literature, LEMAITRE (1989) retained *Parapagurus andersoni* Henderson, 1896, in *Parapagurus* Smith, 1879, *sensu stricto*. However, examination of material of this species deposited in The Natural History Museum, London, has shown that it actually belongs in *Sympagurus*.

The general hermit crab terminology employed follows MCLAUGHLIN (1974), and for the Parapaguridae, LEMAITRE (1989). The specimens examined are listed by geographic area, arranged from north to south. Longitudes and latitudes are cited in degrees and decimals, or degrees and fractions of minutes, following the format of the original station data. In cases where the original depth of stations is in fathoms (fms), the equivalent in meters (m) is given in parenthesis. The Pacific island names are according to MOTTELER (1986). In the material examined sections, the length of the shield (to the nearest 0.1 mm) is indicated in parenthesis, and measured from the tip of the rostrum to the midpoint of the posterior margin of the shield. The types and supplemental material used for this study were collected during various expeditions, including the British "*Challenger*"; the United States Fish Commission Steamer "*Albatross*"; the Dutch "*Siboga*"; the Danish "*Galathea*"; cruises of the "*Suroît*" in the N.E. of the Mozambique Channel (BENTHEDI); and cruises by the Muséum national d'Histoire naturelle and Institut français de Recherche scientifique pour le Développement en Coopération (ORSTOM), to study the bathyal fauna from the South Indo-West Pacific. The materials remain deposited in the following museums: The Natural History Museum [formerly British Museum (Natural History)], London (BMNH); Muséum national d'Histoire naturelle, Paris (MNHN); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); Zoölogisch Museum, Amsterdam (ZMA); Zoologisk Museum, Copenhagen (ZMK). All the



material from French Polynesia was collected by Mr Joseph POUPIN (SMCB). In order to observe the armature of the chelipeds in some species, the dense setae were removed by immersing the appendage for 5-10 minutes in full-strength commercial "Clorox", and subsequently cleaning the surfaces with a fine brush.

## SYSTEMATIC ACCOUNT

Family PARAPAGURIDAE Smith, 1882

Genus *STROBOPAGURUS* Lemaitre, 1989

*Strobopagurus* cf. *gracilipes* (A. Milne Edwards, 1891)

Figs 1-2

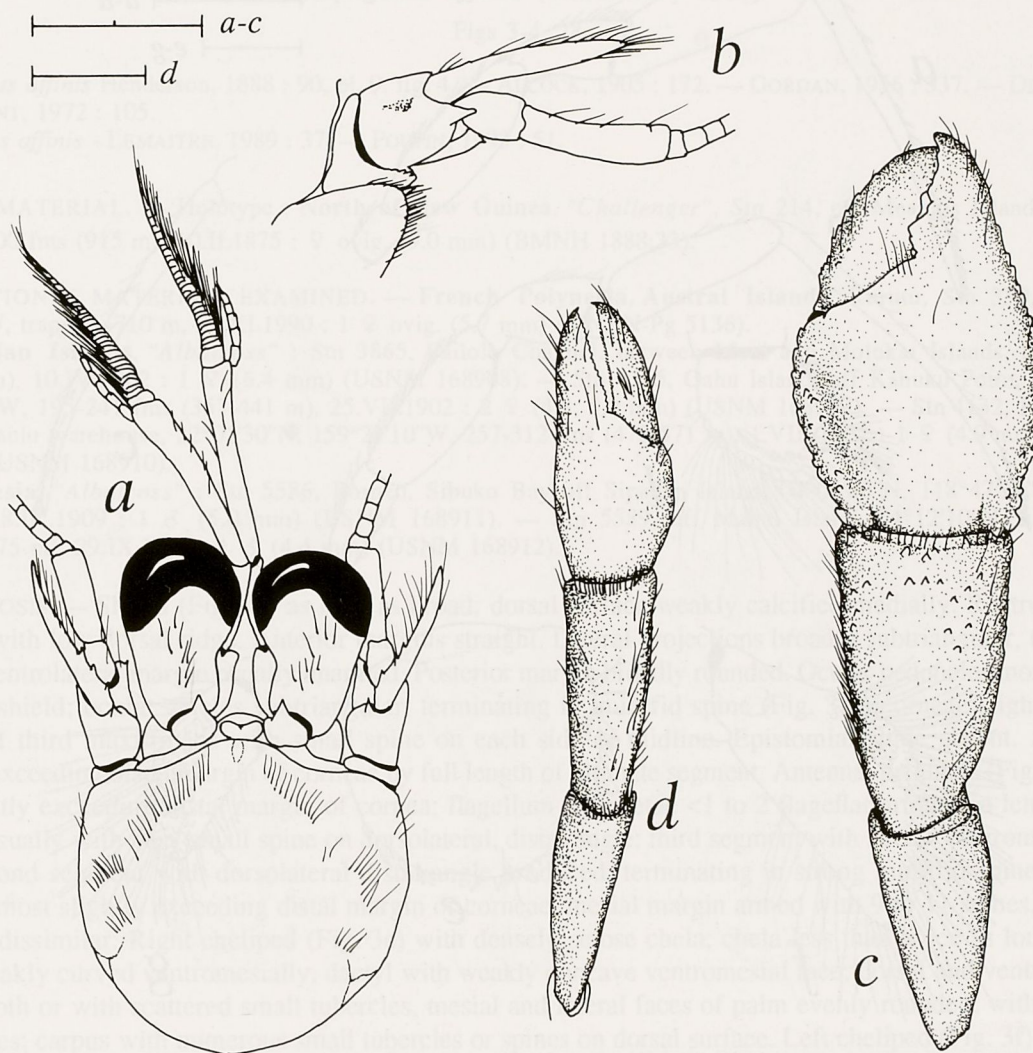


FIG. 1. — *Strobopagurus* cf. *gracilipes* (A. Milne Edwards, 1891), ♀ ovig. (3.7 mm), Society Islands, Stn D32 (MNHN-Pg 5135) : a, shield and cephalic appendages; b, right antennal peduncle, lateral view; c, right cheliped, dorsal view; d, left cheliped, dorsal view.

Scales equal 2 mm (a-c), and 1 mm (d).



*Sympagurus gracilipes* A. Milne Edwards, 1891 : 132.

*Parapagurus gracilipes* - FOREST, 1955 : 103, pl. 3, figs 8-11. — DE SAINT LAURENT, 1972 : 115.

*Strobopagurus gracilipes* - LEMAITRE, 1990b : 225, figs 3-5.

*Strobopagurus* cf. *sibogae* - POUPIN, 1993 : 51.

**MATERIAL EXAMINED.** — **French Polynesia. Society Islands.** Bora Bora, Stn D32, 16°28.37'S, 151°47.52'W, dredged, 562 m, 23.VI.1990 : 1 ♀ ovig. (3.7 mm) (MNHN-Pg 5135).

**DIAGNOSIS.** — See LEMAITRE (1990b : 225, figs 3-5).

**COLOR.** — Unknown.

**REMARKS.** — The female collected near Bora Bora is tentatively assigned to *Strobopagurus gracilipes* (A. Milne Edwards, 1891), a species previously reported in the Pacific only from Hawaii, and in the eastern

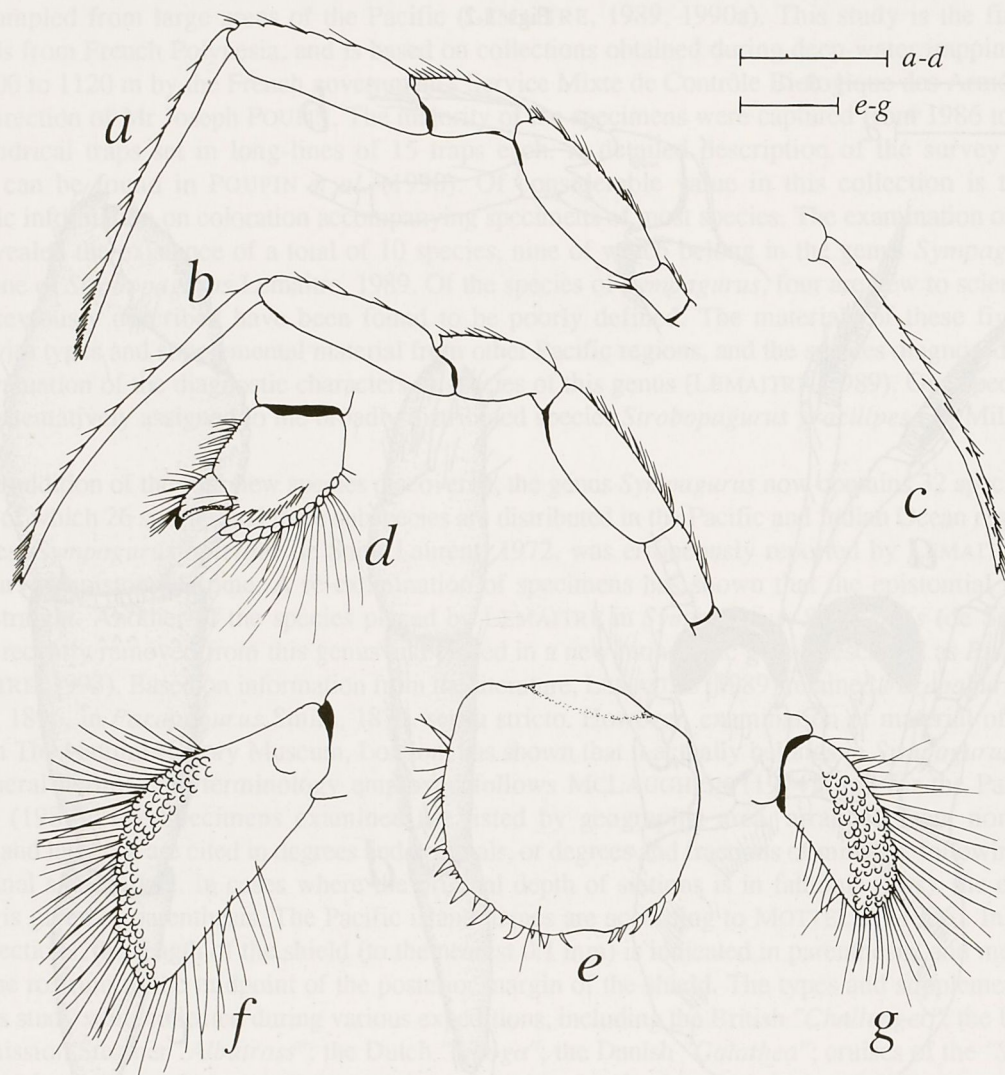


FIG. 2. — *Strobopagurus* cf. *gracilipes* (A. Milne Edwards, 1891), ♀ ovig. (3.7 mm), Society Islands, Stn D32 (MNHN-Pg 5135) : a, second left pereopod, lateral view; b, third left pereopod, lateral view; c, dactyl of same, mesial view; d, propodus and dactyl of left fourth pereopod, lateral view; e, telson, dorsal view; f, exopod of left uropod, dorsal view; g, exopod of right uropod, dorsal view.

Scales equal 3 mm (a-d), and 1 mm (e-g).



Atlantic from Portugal to Morocco, including the Azores, Canary and Cape Verde Islands (DE SAINT LAURENT, 1972; LEMAITRE, 1990b). The specimen agrees with A. MILNE EDWARDS'(1891) description and LEMAITRE's (1990b) supplemental diagnosis of *S. gracilipes*, except for the following : 1) the length of the antennal acicles does not exceed the corneae in the female from Bora Bora, whereas the acicles distinctly exceed the corneae in *S. gracilipes*; 2) the carpus of the left cheliped is unarmed in the female from Bora Bora, whereas the carpus is armed with dorsal and dorsodistal spines in *S. gracilipes*; and, 3) the relative lengths of the propodi of the walking legs are three times or less as long as broad in the female from Bora Bora, whereas the propodi are distinctly more than three times as long as broad in *S. gracilipes*. These differences possibly represent only intraspecific variations. However, the lack of sufficient material from the Pacific in general makes it difficult to ascertain this.

### Genus *SYMPAGURUS* Smith, 1883

#### *Sympagurus affinis* (Henderson, 1888)

Figs 3-4, 28a

*Parapagurus affinis* Henderson, 1888 : 90, pl. 9, fig. 4. — ALCOCK, 1905 : 172. — GORDAN, 1956 : 337. — DE SAINT LAURENT, 1972 : 105.  
*Sympagurus affinis* - LEMAITRE, 1989 : 37. — POUPIN, 1993 : 51.

TYPE MATERIAL. — Holotype : **North of New Guinea**, "Challenger", Stn 214, off Meangis Islands, 04°33'N, 127°6'E, 500 fms (915 m), 10.II.1875 : ♀ ovig. (9.0 mm) (BMNH 1888:33).

ADDITIONAL MATERIAL EXAMINED. — **French Polynesia. Austral Islands.** Rurutu, Stn 339, 22°28.4'S, 151°23.0'W, trapped, 710 m, 27.XI.1990 : 1 ♀ ovig. (5.7 mm) (MNHN-Pg 5136).

**Hawaiian Islands.** "Albatross" : Stn 3865, Pailolo Channel, between Maui and Molokai Islands, 256-283 fms (468-518 m), 10.IV.1902 : 1 ♀ (6.4 mm) (USNM 168908). — Stn 4115, Oahu Island, off Kahuku Point, 21°41'50"N, 158°08'50"W, 195-241 fms (357-441 m), 25.VII.1902 : 2 ♀ (4.8, 5.0 mm) (USNM 168909). — Stn 4132, Kauai Island, off Hanamaulu warehouse, 22°01'30"N, 159°21'10"W, 257-312 fms (470-571 m), 1.VIII.1902 : 1 ♀ (4.9 mm), 1 ♀ ovig. (4.9 mm) (USNM 168910).

**Indonesia.** "Albatross" : Stn 5586, Borneo, Sibuko Bay off Sipadan Island, 04°06'50"N, 118°47'20"E, 347 fms (635 m), 28.IX.1909 : 1 ♂ (5.0 mm) (USNM 168911). — Stn 5589, off Mabul Island, 04°12'10"N, 118°38'08"E, 260 fms (475 m), 29.IX.1909 : 1 ♂ (4.4 mm) (USNM 168912).

DIAGNOSIS. — Shield (Fig. 3a) as long as broad; dorsal surface weakly calcified medially. Rostrum broadly rounded, with low dorsal ridge. Anterior margins straight. Lateral projections broadly subtriangular, terminating bluntly. Ventrolateral margin usually unarmed. Posterior margin broadly rounded. Ocular peduncles more than half length of shield; ocular acicles subtriangular, terminating in multifid spine (Fig. 3b); corneae slightly dilated. Sternite of third maxillipeds with small spine on each side of midline. Epistomial spine absent. Antennular peduncle exceeding distal margin of corneae by full length of ultimate segment. Antennal peduncle (Fig. 3a, c-d) at most slightly exceeding distal margin of cornea; flagellum with setae <1 to 2 flagellar articles in length; fourth segment usually with very small spine on dorsolateral, distal angle; third segment with strong ventromesial distal spine; second segment with dorsolateral distal angle produced, terminating in strong multifid spine. Antennal acicles at most slightly exceeding distal margin of corneae, mesial margin armed with 9 to 11 spines. Chelipeds markedly dissimilar. Right cheliped (Fig. 3e) with densely setose chela; chela less than twice as long as wide, fingers weakly curved ventromesially, dactyl with weakly concave ventromesial face; dorsal and ventral faces of palm smooth or with scattered small tubercles, mesial and lateral faces of palm evenly rounded, with numerous small spines; carpus with numerous small tubercles or spines on dorsal surface. Left cheliped (Fig. 3f) with chela unarmed, usually well calcified; carpus with dorsodistal spine. Ambulatory legs (Fig. 4a-b) reaching to tip of extended right cheliped; dactyl about twice as long as propodus, with ventromesial row of about 10 corneous spines, and dorsal and dorsomesial rows of long, bristle-like setae; carpus with small dorsodistal spine; ischium and merus of second pereopod unarmed or with row of few small tubercles. Anterior lobe of sternite of third



pereopods unarmed. Fourth pereopod (Fig. 4c) with dactyl terminating in short, corneous claw; propodal rasp consisting of 1 row of ovate scales. Twelve pairs of gills; first 11 pairs trichobranchiate, twelfth pair consisting of vestigial pleurobranchs on last thoracic somite. Uropods (Fig. 4e-f) markedly asymmetrical. Telson (Fig. 4d) asymmetrical, with obsolete transverse suture separating anterior and posterior lobes; posterior lobes separated by U-shaped median cleft, terminal margins armed with corneous spines. Male first (Fig. 4g) gonopod with concave distal lobe; second gonopod (Fig. 4h) with distal segment nearly flat. Female with right second pleopod vestigial.

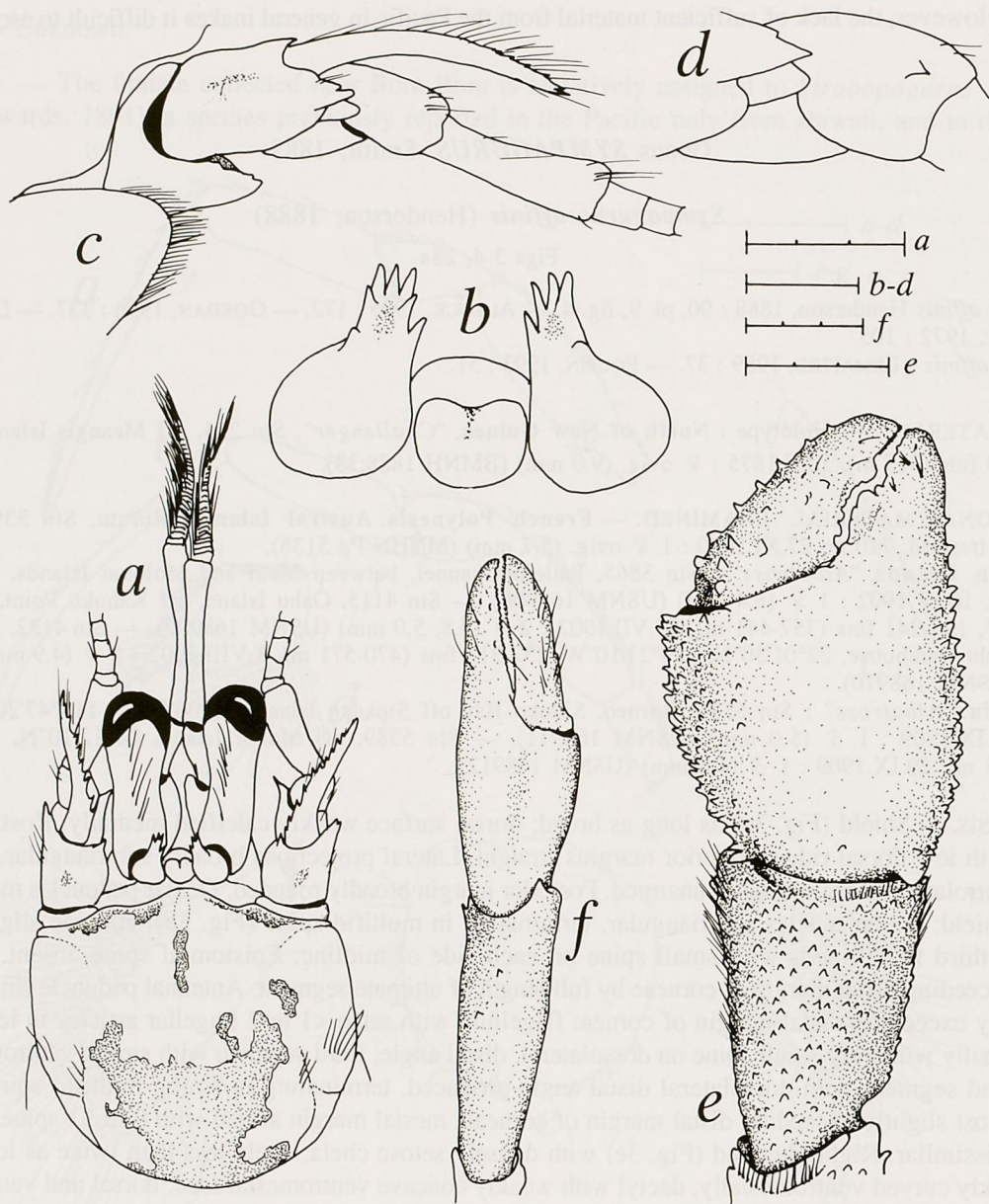


FIG. 3. — *Sympagurus affinis* (Henderson, 1888). a-c : ♀ ovig. (5.7 mm), Austral Islands, Rurutu, Stn 339 (MNHN-Pg 5136) : a, shield and cephalic appendages; b, ocular acicles, dorsal view; c, right antennal peduncle, lateral view. — d, ♀ (4.8 mm), Hawaiian Islands, "Albatross", Stn 4115 (USNM 168909) : supernumerary, third and fourth segments of right antennal peduncle, lateral view. — e-f, holotype ♀ ovig. (9.0 mm), Indonesia, "Challenger", Stn 214 (BMNH 1888:33) : e, right cheliped, dorsal view; f, left cheliped, dorsal view.

Scales equal 3 mm (a), 0.5 mm (b,d), 1 mm (c), and 3 mm (f,e).



COLOR (Fig. 28a). — Entire body cream yellow.

HABITAT AND SYMBIOTIC ASSOCIATIONS. — Gastropod shells usually with one actinian polyp attached.

DISTRIBUTION. — Indonesia, Philippines, Hawaii (DE SAINT LAURENT, 1972); Australia (LEMAITRE, unpublished); French Polynesia. Depth: 360 to 914 m.

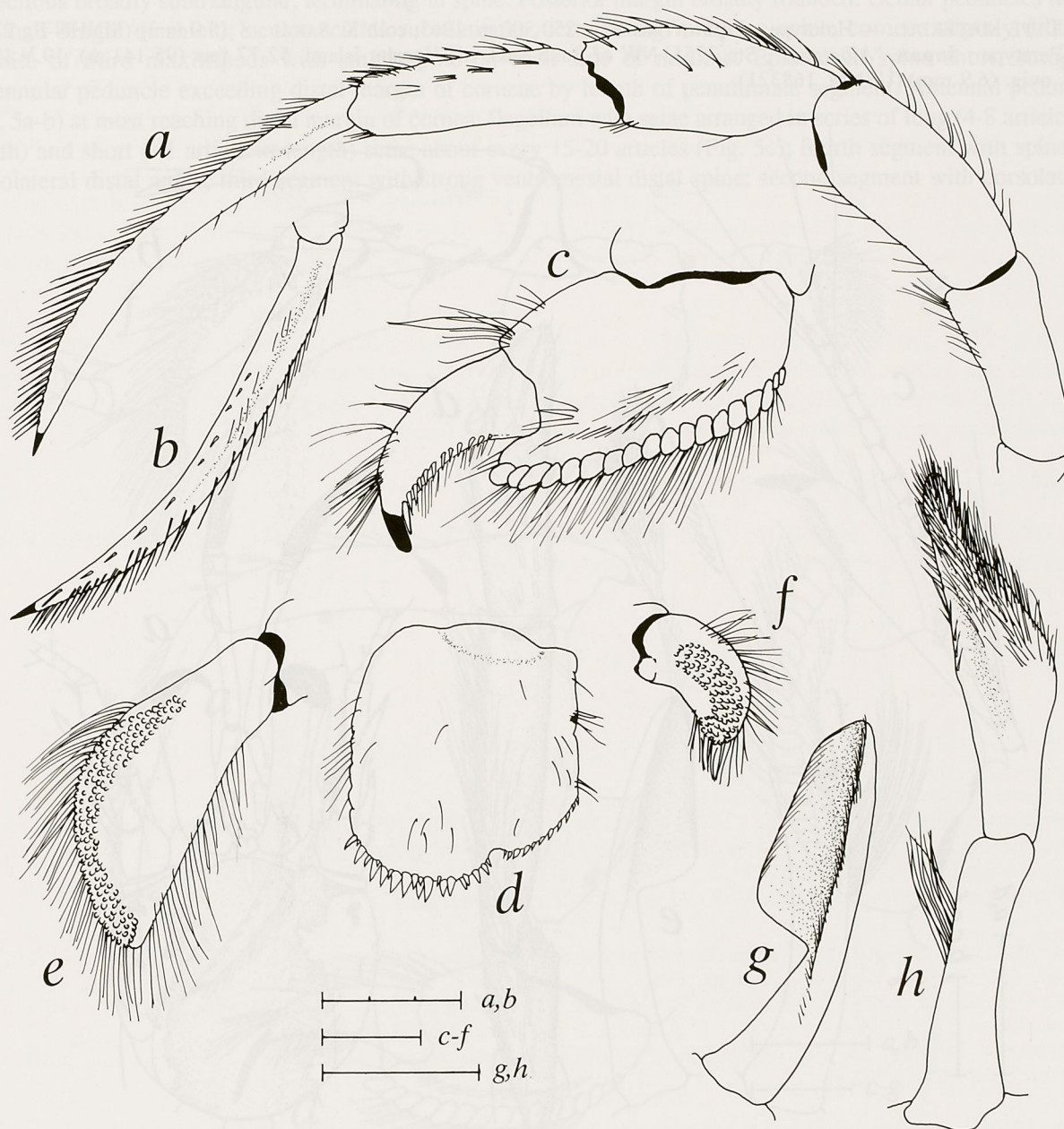


FIG. 4. — *Sympagurus affinis* (Henderson, 1888). a-f: ♀ ovig. (5.7 mm), Austral Islands, Stn 339 (MNHN-Pg 5136): a, third left pereopod, lateral view; b, dactyl of same, mesial view; c, propodus and dactyl of fourth left pereopod, lateral view; d, telson, dorsal view; e, exopod of left uropod, dorsal view; f, exopod of right uropod, dorsal view. — g-h, ♂ (5.0 mm), Borneo, "Albatross", Stn 5586 (USNM 168911): g, male left first gonopod, mesial view; h, male left second gonopod, anterior view.

Scales equal 3 mm (a,b), 0.5 mm (c), 1 mm (d,f), and 1 mm (g,h).



*Sympagurus boletifer* (de Saint Laurent, 1972)

Figs 5-6, 27a-b, 28b-c

*Parapagurus boletifer* de Saint Laurent, 1972 : 110, figs 5, 20. — MIYAKE, 1978 : 72; 1982 : 120, pl. 40, fig. 4. — BABA *et al.*, 1986 : 196, fig. 144.

*Sympagurus boletifer* - LEMAITRE, 1989 : 37. — POUPIN, 1993 : 51.

TYPE MATERIAL. — Holotype : **Japan**, Tosa Bay, 250-300 m, 1963, coll. K. SAKAI : ♂ (8.0 mm) (MNHN-Pg 2230).

Paratype : **Japan**, "Albatross", Stn 3755, NW of Suno Saki, off Honshu Island, 52-77 fms (95-141 m), 19.V.1900 : 1 ♀ ovig. (6.9 mm) (USNM 168321).

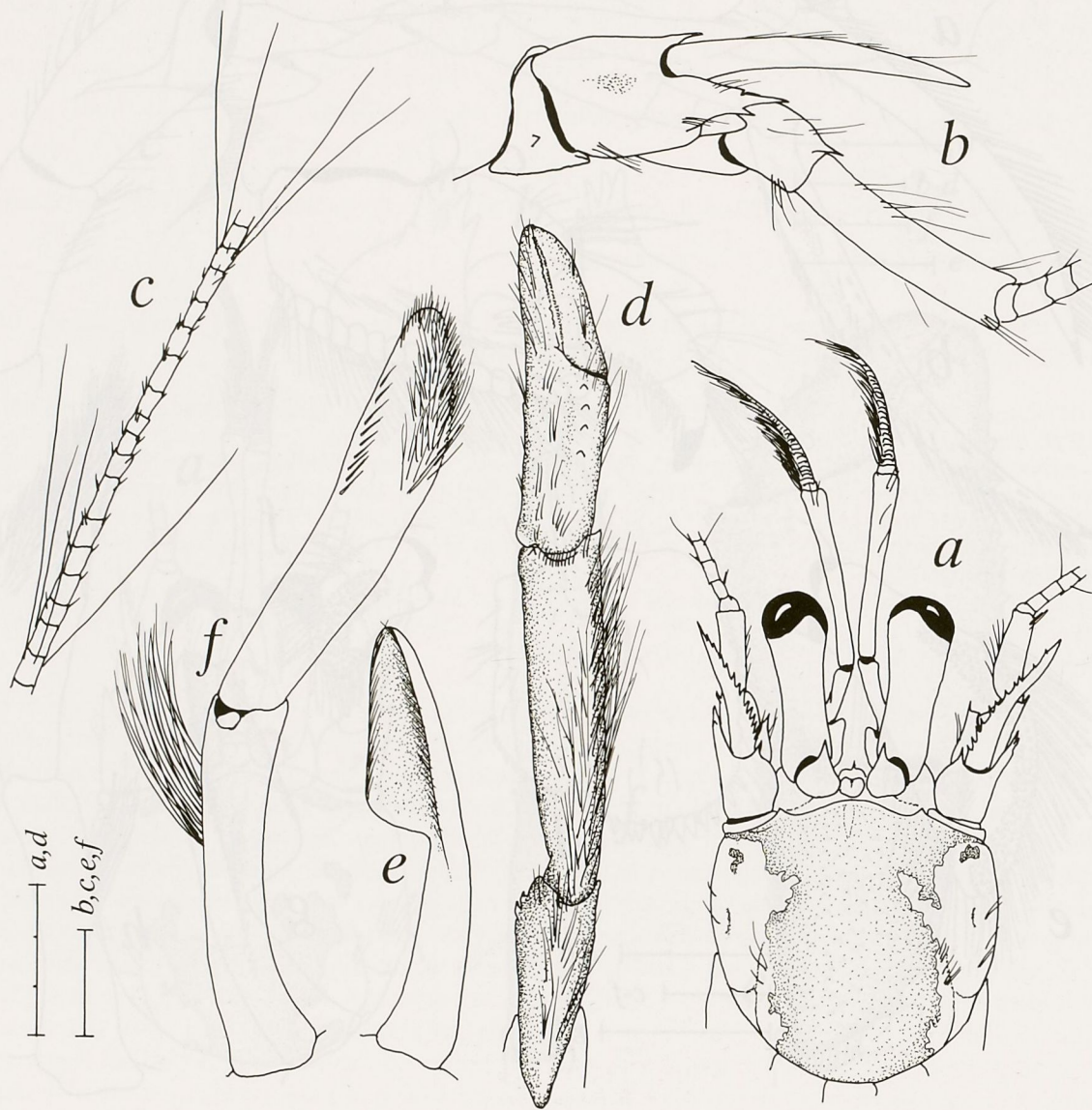


FIG. 5. — *Sympagurus boletifer* (de Saint Laurent, 1972). Austral Islands, Stn 344 : a, ♀ ovig. (5.5 mm) (MNHN-Pg 5137) : shield and cephalic appendages. — b-f, ♂ (5.7 mm) (MNHN-Pg 5137) : b, right antennal peduncle, lateral view; c, midportion of antennal flagellum; d, left cheliped, dorsal view; e, male first left gonopod, mesial view; f, male second left gonopod, anterior view.

Scales equal 3 mm (a,d), 1 mm (b), and 0.5 mm (c,e,f).



ADDITIONAL MATERIAL EXAMINED. — **French Polynesia. Austral Islands.** Raivavae, Stn 344, 23°53.3'S, 147°36.1'W, trapped, 350 m, 1.XII.1990 : 2 ♂ (5.3, 5.7 mm), 1 ♀ ovig. (5.5 mm) (MNHN-Pg 5137).

**Western Indian Ocean. Comoro Islands.** BENTHEDI : Stn 49F, Mayotte, Bovéni Passage, 300-450 m, 28.III.1977 : 1 ♂ (7.0 mm), 2 ♀ (6.1, 7.0 mm) (MNHN-Pg 5138).

DIAGNOSIS. — Shield (Fig. 5a) as long as broad; dorsal surface usually weakly calcified on half or more of surface; rostrum broadly rounded, little produced, with low dorsal ridge; anterior margins straight; lateral projections broadly subtriangular, terminating in spine. Posterior margin broadly rounded. Ocular peduncles more than half length of shield; ocular acicles subtriangular, terminating in strong spine; corneae slightly dilated. Sternite of third maxillipeds with small spine on each side of midline. Epistomial spine short, straight. Antennular peduncle exceeding distal margin of corneae by length of penultimate segment. Antennal peduncle (Fig. 5a-b) at most reaching distal margin of cornea; flagellum with setae arranged in series of long (4-8 articles in length) and short (~1 article in length) setae about every 15-20 articles (Fig. 5c); fourth segment with spine on dorsolateral distal angle; third segment with strong ventromesial distal spine; second segment with dorsolateral

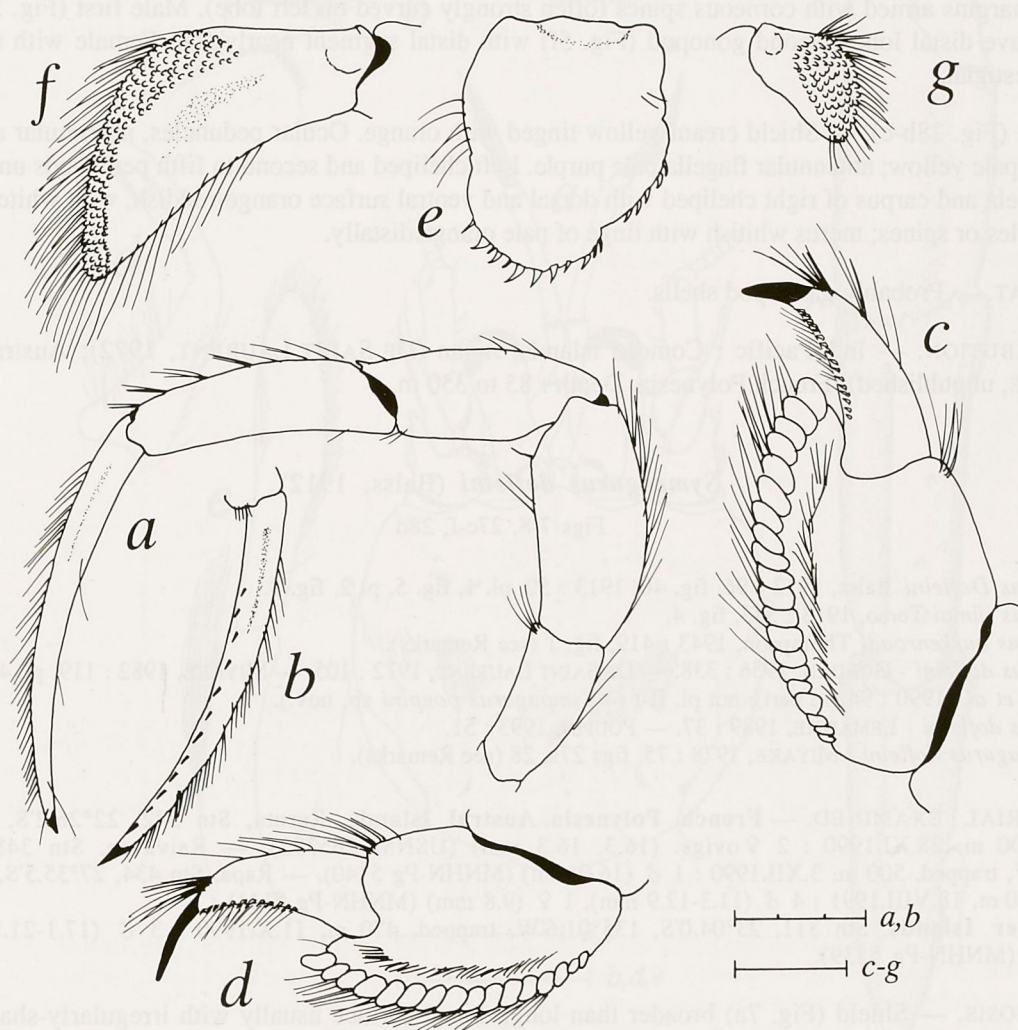


FIG. 6. — *Sympagurus boletifer* (de Saint Laurent, 1972). Austral Islands, Stn 344 : a-c, e-g, ♂ (5.7 mm) (MNHN-Pg 5137) : a, third left pereopod, lateral view; b, dactyl of same, mesial view; c, propodus and dactyl of left fourth pereopod (male), lateral view; e, telson, dorsal view; f, exopod of left uropod, dorsal view; g, exopod of right uropod, dorsal view. — d, ♀ ovig. (5.5 mm) (MNHN-Pg 5137) : propodus and dactyl of left fourth pereopod (female).

Scales equal 3 mm (a,b), and 1 mm (c,g).



distal angle produced, terminating in multifid spine (occasionally with additional small spine dorsally). Antennal acicles reaching distal margin of corneae, mesial margin armed with 11 to 14 spines. Chelipeds strongly dissimilar. Right cheliped (Fig. 27a-b, 28b-c) massive; chela about as broad as long, with dorsal surface covered with numerous spines and densely covered with plumose setae (especially on distal half and fingers); fingers curved ventromesially; ventral face of palm and fingers covered with numerous mushroom-like tubercles; palm with lateral margin well delimited by row of spines; carpus with numerous small tubercles or spines on dorsal surface. Left cheliped (Fig. 5d) usually well calcified; palm with dorsomesial row of small tubercles; carpus with dorsodistal spine. Ambulatory legs (Fig. 6a-b) reaching to tip of extended right cheliped; dactyl about twice as long as propodus, with ventromesial row of about 12 corneous spines, and dorsal and dorsomesial rows of long, bristle-like setae; carpus with small dorsodistal spine. Anterior lobe of sternite of third pereopods armed with spine. Fourth pereopod (Fig. 6c-d) with dactyl terminating in corneous claw (more slender and longer in females than in males); propodal rasp consisting of 1 row of ovate scales. Eleven pairs of phyllobranch or intermediate gills (see LEMAITRE, 1989). Telson (Fig. 6e) and uropods strongly asymmetrical; telson with weak transverse suture separating anterior and posterior lobes; posterior lobes of telson separated by V-shaped median cleft, terminal margins armed with corneous spines (often strongly curved on left lobe). Male first (Fig. 5e) gonopod with concave distal lobe; second gonopod (Fig. 5f) with distal segment nearly flat. Female with right second pleopod vestigial.

**COLOR** (Fig. 28b-c). — Shield cream yellow tinged with orange. Ocular peduncles, antennular and antennal peduncles pale yellow; antennular flagella pale purple. Left cheliped and second to fifth pereopods uniformly pale purple. Chela and carpus of right cheliped with dorsal and ventral surface orange-reddish, with white mushroom-like tubercles or spines; merus whitish with tinge of pale orange distally.

**HABITAT**. — Probably gastropod shells.

**DISTRIBUTION**. — IndoPacific : Comoro Islands; Japan (DE SAINT LAURENT, 1972); Australia, Hawaii (LEMAITRE, unpublished); French Polynesia. Depth : 85 to 350 m.

### *Sympagurus dofleini* (Balss, 1912)

Figs 7-8, 27c-f, 28d

*Parapagurus Dofleini* Balss, 1912 : 96, fig. 4b; 1913 : 50, pl. 1, fig. 5, pl. 2, fig. 3.

*Parapagurus iijimai* Terao, 1913 : 383, fig. 4.

?*Sympagurus burkenroadi* Thompson, 1943 : 419, fig. 1 (see Remarks).

*Parapagurus dofleini* - GORDAN, 1956 : 338. — DE SAINT LAURENT, 1972 : 105. — MIYAKE, 1982 : 119, pl. 40, fig. 3. —

POUPIN *et al.*, 1990 : 94 (in part), not pl. II-f (= *Sympagurus poupini* sp. nov.).

*Sympagurus dofleini* - LEMAITRE, 1989 : 37. — POUPIN, 1993 : 51.

?not *Parapagurus dofleini* - MIYAKE, 1978 : 75, figs 27a, 28 (see Remarks).

**MATERIAL EXAMINED**. — **French Polynesia. Austral Islands.** Rurutu, Stn 342, 22°26.2'S, 151°23.6'W, trapped, 600 m, 28.XI.1990 : 2 ♀ ovigs. (16.3, 16.3 mm) (USNM 265392). — Raivavae, Stn 348, 23°49.5'S, 147°42.1'W, trapped, 500 m, 3.XII.1990 : 1 ♂ (16.0 mm) (MNHN-Pg 5140). — Rapa, Stn 434, 27°35.5'S, 144°15.8'W, trapped, 720 m, 18.VIII.1991 : 4 ♂ (11.3-12.9 mm), 1 ♀ (9.8 mm) (MNHN-Pg 5141).

**Gambier Islands.** Stn 311, 23°04.0'S, 135°01.6'W, trapped, 470 m, 11.X.1990 : 3 ♂ (17.1-21.8 mm), 1 ♀ (19.5 mm) (MNHN-Pg 5139).

**DIAGNOSIS**. — Shield (Fig. 7a) broader than long; dorsal surface usually with irregularly-shaped, weakly calcified areas. Rostrum broadly triangular, with low dorsal ridge. Anterior margins straight. Lateral projections broadly subtriangular, terminating acutely or bluntly. Posterior margin broadly rounded or often nearly semicircular. Ocular peduncles less than half length of shield; ocular acicles subtriangular, terminating in strong spine (occasionally bifid on one side); corneae slightly dilated. Sternite of third maxillipeds with small spine on each side of midline. Epistomial spine short, straight. Antennular peduncle exceeding distal margin of corneae by



about 0.3 length of penultimate segment. Antennal peduncle (Fig. 7a-b) exceeding distal margin of cornea by about 0.5 length of fifth segment; flagellum long, articles with scattered short setae less than half length of 1 article; fourth segment unarmed; third segment with strong ventromesial distal spine (often bifid or trifid). Antennal acicles usually slightly exceeding distal margin of corneae, mesial margin armed with 10 to 18 small spines. Chelipeds dissimilar, slender, with dense setae obscuring surfaces (Fig. 27e). Right cheliped (Fig. 27c-f) with chela at least twice as long as wide ( $\sim 2.5$  times as long as wide in males,  $\sim 2$  times as long as wide in females); palm with well defined lateral margin, mesial face rounded and with small spines; dorsal surface unarmed, ventral surface covered with numerous small tubercles or spines; carpus with numerous small tubercles or spines on dorsal and ventral surfaces. Left cheliped (Fig. 7c) evenly calcified, chela unarmed; carpus with

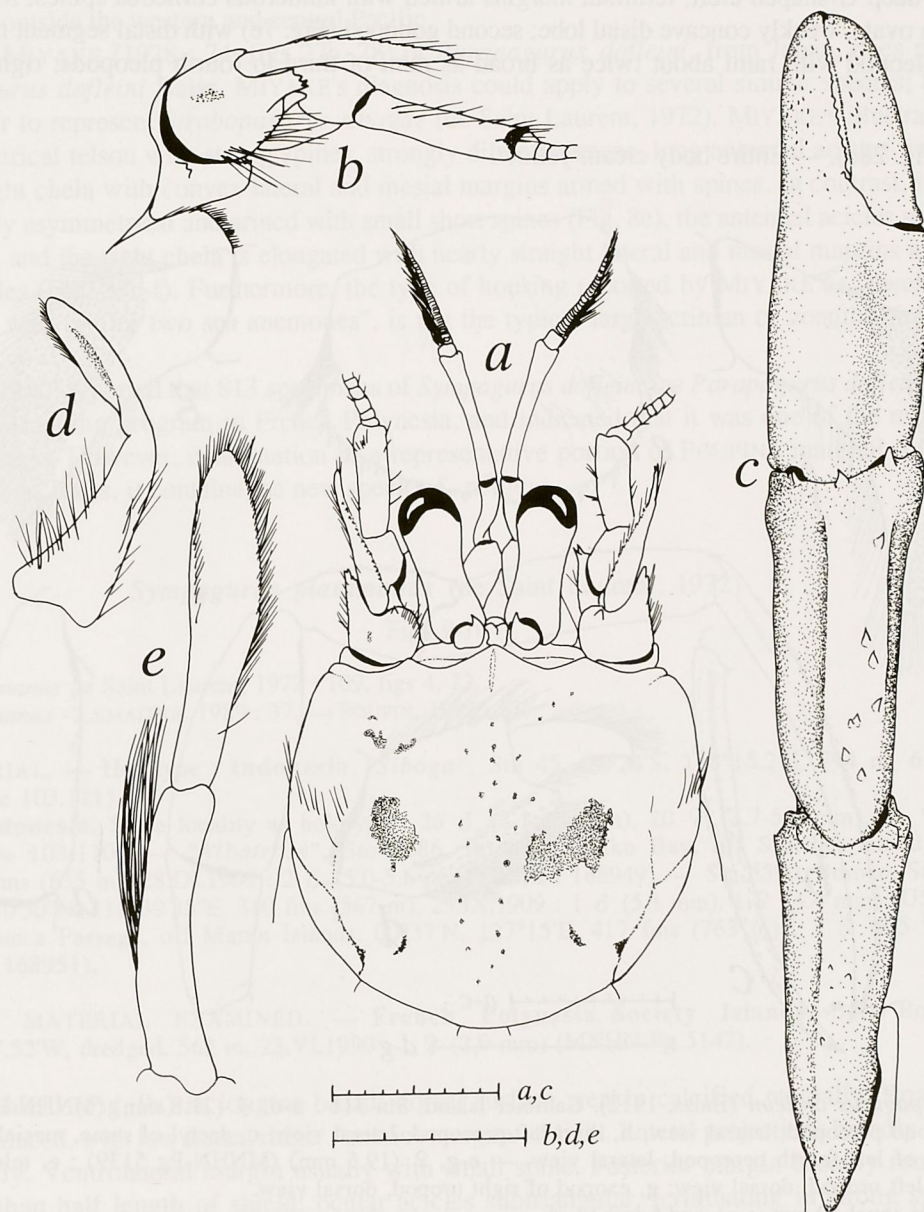


FIG. 7. — *Sympagurus dofleini* (Balss, 1912), ♂ (21.8 mm), Gambier Island, Stn 311 (MNHN-Pg 5139) : a, shield and cephalic appendages; b, right antennal peduncle, lateral view; c, denuded left cheliped, dorsal view; d, male first left gonopod, mesial view; e, male second left gonopod, anterior view.

Scales equal 10 mm (a,c), and 4 mm (b,d,e).



irregular row of small spines on broad, usually crest-like dorsal surface. Ambulatory legs (Fig. 8a-c) long, slender, reaching to tip of extended right cheliped; dactyl  $\sim 1.3$  times as long as propodus (second pereopod), or  $\sim 1.7$  times as long as propodus (third pereopod); dactyls with irregular row of 20-45 small corneous spines on ventromesial margin; carpi each with small dorsodistal spine; merus and ischium of second pereopod with irregular rows of small spines on ventral margin. Anterior lobe of sternite of third pereopods unarmed, or with 1 or 2 spines. Fourth pereopod (Fig. 8d) with propodal rasp consisting of 3 to 4 irregular rows of conical scales. Twelve pairs of gills; first 11 pairs intermediate (see LEMAITRE, 1989 : 8), twelfth pair consisting of vestigial pleurobranchs on last thoracic somite. Uropods (Fig. 8f-g) distinctly asymmetrical. Telson (Fig. 8e) weakly asymmetrical, about as long as broad; anterior lobes each with fringe of long, often bristle-like setae on ventrolateral margin; posterior lobes separated by deep U-shaped cleft, terminal margins armed with numerous corneous spines. Male first gonopod (Fig. 7d) with ovate, weakly concave distal lobe; second gonopod (Fig. 7e) with distal segment nearly flat. Female second left pleopod with rami about twice as broad as rami of third to fourth pleopods; right second pleopod vestigial.

COLOR (Fig. 28d). — Entire body cream yellow.

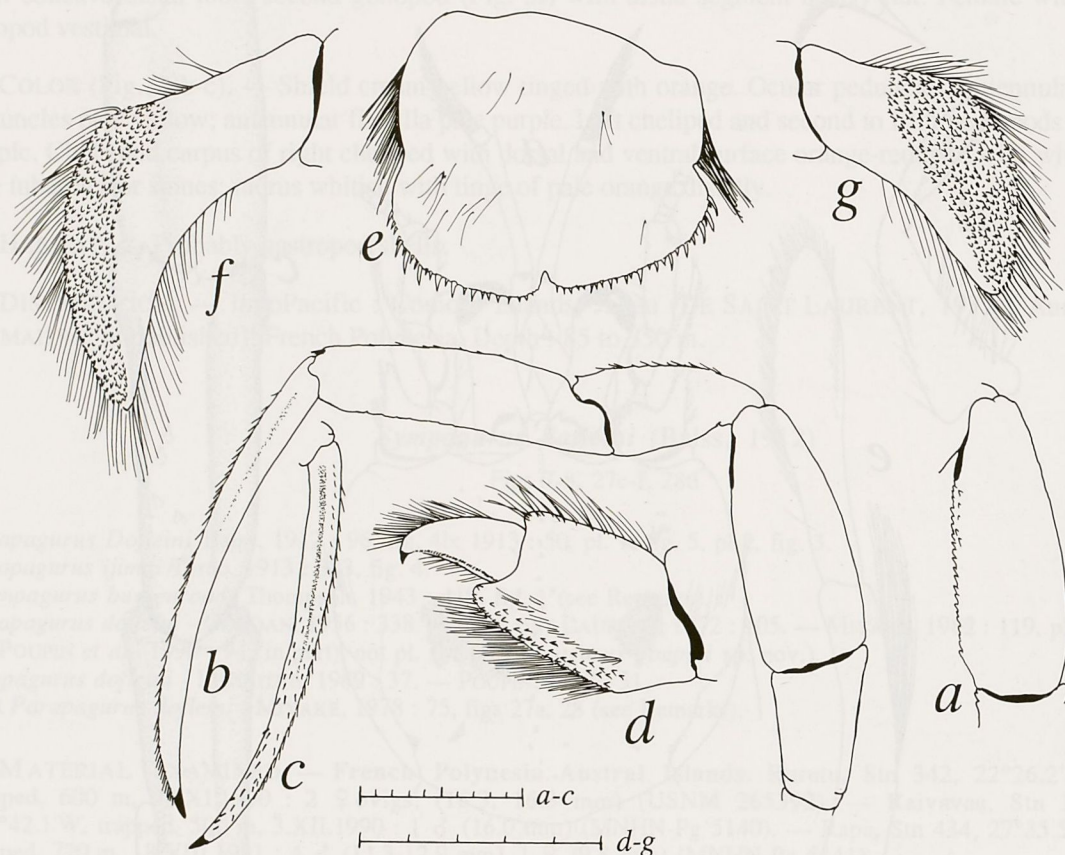


FIG. 8. — *Sympagurus dofleini* (Balss, 1912). Gambier Island, Stn 311 : a-d, ♂ (21.8 mm) (MNHN-Pg 5139) : a, merus of left second pereopod, lateral view; b, third left pereopod, lateral view; c, dactyl of same, mesial view; d, propodus and dactyl of left fourth pereopod, lateral view. — e-g, ♀ (19.5 mm) (MNHN-Pg 5139) : e, telson, dorsal view; f, exopod of left uropod, dorsal view; g, exopod of right uropod, dorsal view. Scales equal 10 mm (a-c), and 5 mm (d-g).

HABITAT AND SYMBIOTIC ASSOCIATIONS. — This species is commonly found using actinians for housing (see FAUTIN-DUNN *et al.*, 1980). However, the specimens from French Polynesia were all found inhabiting an unidentified zoanthid.



DISTRIBUTION. — Western and central Pacific : Borneo, Japan (Sagami Bay), Guam, Hawaii (BALSS, 1913; TERA0, 1913; DE SAINT LAURENT, 1972; FAUTIN-DUNN *et al.*, 1980); Australia (LEMAITRE, unpublished), and French Polynesia. Indian Ocean? (see Remarks) : Zanzibar (THOMPSON, 1943). Depth : 350 to 900 m.

REMARKS. — (See also *Sympagurus poupini* sp. nov.). As pointed out by DE SAINT LAURENT (1972), the description and figures of *Parapagurus ijimai* Terao, 1913, clearly indicate that this taxon is a junior synonym of *Sympagurus dofleini* (Balss, 1912). *Sympagurus burkenroadi* Thompson, 1943, described from Zanzibar, in the western Indian Ocean, was also considered by DE SAINT LAURENT (1972) as a junior synonym of BALSS' *S. dofleini*. From THOMPSON's (1943) description and figures of *S. burkenroadi* this taxon can only questionably be synonymized with BALSS' *S. dofleini*. During a review of the materials of *Sympagurus* species, *S. dofleini* was not found to occur outside the western and central Pacific.

The report by MIYAKE (1978 : 74, figs 27a, 28) of *Parapagurus dofleini*, from Japan, does not appear to represent *Sympagurus dofleini* Balss. MIYAKE's diagnosis could apply to several similar species; however, his illustrations appear to represent *Strobopagurus sibogae* (de Saint Laurent, 1972). MIYAKE's illustrations show a markedly asymmetrical telson with strong spines, strongly dilated corneae, long antennal acicles well exceeding the eyes, and a right chela with convex lateral and mesial margins armed with spines. In contrast, in *S. dofleini*, the telson is weakly asymmetrical and armed with small short spines (Fig. 8e), the antennal acicles slightly exceed the eyes (Fig. 7a), and the right chela is elongated with nearly straight lateral and mesial margins armed at most with small tubercles (Fig. 27c-f). Furthermore, the type of housing reported by MIYAKE as "dwelling shells ... usually encrusted with one or two sea anemones", is not the typical large actinian or zoanthid inhabited by *S. dofleini*.

POUPIN *et al.* (1990) reported that 813 specimens of *Sympagurus dofleini* (as *Parapagurus dofleini*) were found during the SMCB trapping program in French Polynesia, and indicated that it was one of the most frequently captured invertebrates. However, examination of a representative portion of POUPIN's material revealed that in addition to *S. dofleini* Balss, it contains the new species *S. poupini*.

### *Sympagurus planimanus* (de Saint Laurent, 1972)

Figs 9-10

*Parapagurus planimanus* de Saint Laurent, 1972 : 109, figs 4, 22.

*Sympagurus planimanus* - LEMAITRE, 1989 : 37. — POUPIN, 1993 : 51.

TYPE MATERIAL. — Holotype : **Indonesia**. "Siboga", Stn 45, 07°24'S, 118°15.2'E, 794 m, 6.IV.1899 : ♂ (6.3 mm) (ZMA De 103.111).

Paratypes : **Indonesia**. Same locality as holotype : 26 ♂ (3.1-6.1 mm), 20 ♀ (3.7-5.1 mm), 16 ♀ ovigs (3.6-5.1 mm) (ZMA De 103.110). — "Albatross", Stn 5586, Borneo, Sibuko Bay, off Sipadan Island, 04°06'50"N, 118°47'20"E, 347 fms (635 m), 28.IX.1909 : 2 ♂ (5.0-5.6 mm) (USNM 168949). — Stn 5590, Borneo, Sibuko Bay, off Mabul Island, 04°10'50"N, 118°39'35"E, 310 fms (567 m), 29.IX.1909 : 1 ♂ (5.1 mm), 1 ♀ (4.4 mm) (USNM 168950). — Stn 5618, Molucca Passage, off Maren Islands, 00°37'N, 127°15'E, 417 fms (763 m) : 3 ♂ (3.5-5.5 mm), 1 ♀ (3.6 mm) (USNM 168951).

ADDITIONAL MATERIAL EXAMINED. — **French Polynesia. Society Islands**. Bora Bora, Stn D32, 16°28.37'S, 151°47.52'W, dredged, 562 m, 23.VI.1990 : 1 ♀ (2.9 mm) (MNHN-Pg 5142).

DIAGNOSIS. — Shield (Fig. 9a) as long as broad; dorsal surface weakly calcified medially. Rostrum broadly rounded, little produced, with low dorsal ridge. Anterior margins straight. Lateral projections broadly subtriangular, terminating bluntly. Ventrolateral margin usually with small spine. Posterior margin broadly rounded. Ocular peduncles more than half length of shield; ocular acicles subtriangular, terminating in strong spine; corneae slightly dilated. Sternite of third maxillipeds with small spine on each side of midline. Epistomial spine absent. Antennular peduncle exceeding distal margin of corneae by length of penultimate segment. Antennal peduncle (Fig. 9a-b) at most exceeding distal margin of cornea by 0.25 length of fifth segment; flagellum with numerous setae 1-3 flagellar articles in length; fourth segment with spine on dorsolateral, distal angle; third segment with



strong ventromesial distal spine; second segment with dorsolateral distal angle produced, terminating in strong spine. Antennal acicles reaching distal margin of corneae, mesial margin armed with 7 to 10 spines. Chelipeds dissimilar, with moderately dense setation. Right cheliped (Fig. 9c-e) with chela less than twice as long as wide, fingers strongly curved ventromesially, dactyl with concave ventromesial face; dorsal and ventral faces of palm smooth; palm with distinct dorsomesial and lateral margins each formed by row of spines, and rounded mesial face with low tubercles; carpus with numerous small tubercles or spines on dorsal surface. Left cheliped (Fig. 9f) with chela unarmed, usually well calcified; carpus with dorsodistal spine. Ambulatory legs (Fig. 10a-b) reaching to tip of extended right cheliped; dactyl about twice as long as propodus, with ventromesial row of about 5 well

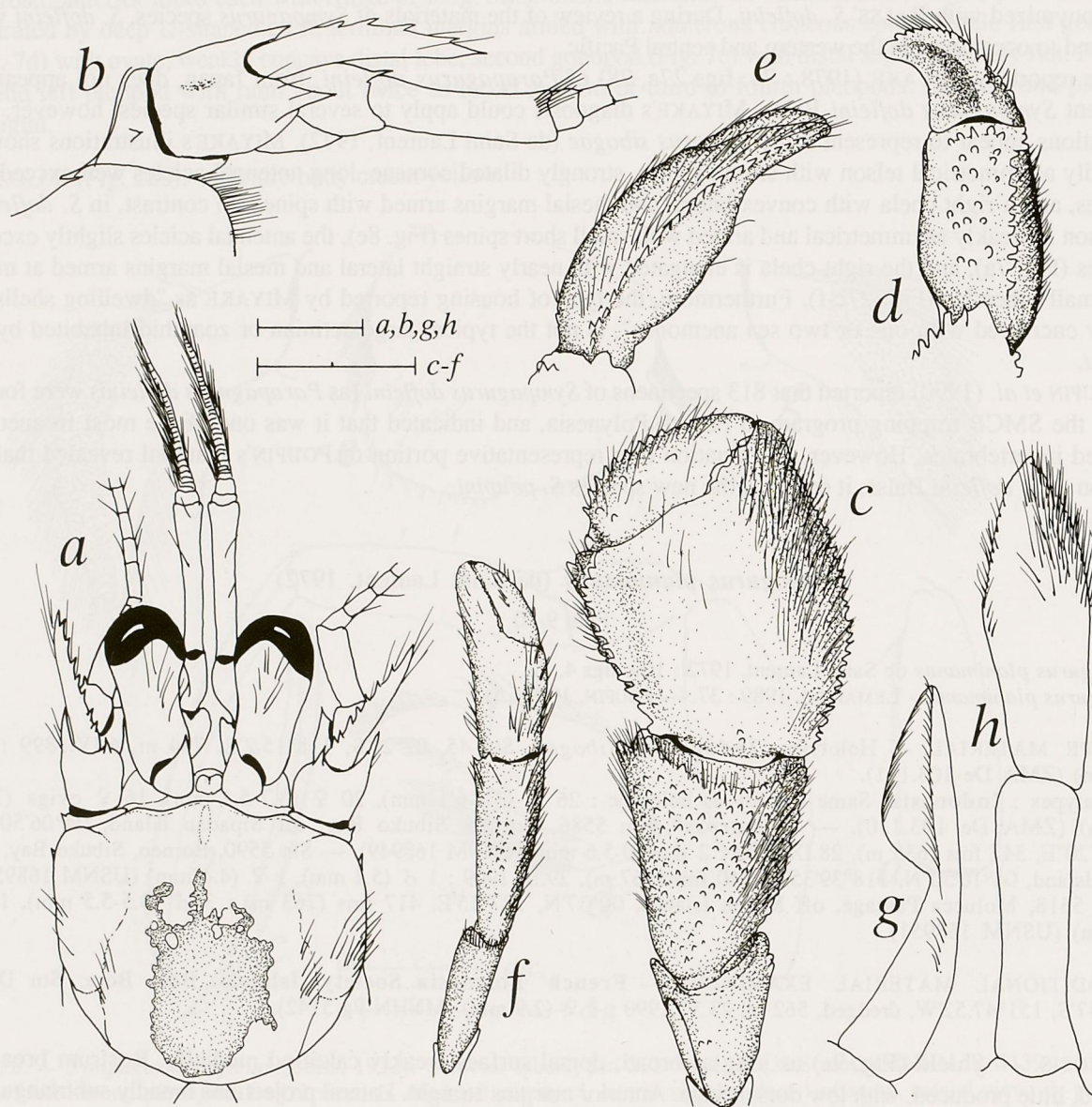


FIG. 9. — *Sympagurus planimanus* (de Saint Laurent, 1972). a-f, ♀ (2.9 mm), Society Islands, Stn D 32 (MNHN-Pg 5142) : a, shield and cephalic appendages; b, right antennal peduncle, lateral view; c, right cheliped, dorsal view; d, chela of same, mesial view; e, same, lateral view; f, left cheliped, dorsal view. — g-h, ♂ (5.1 mm), Borneo, "Albatross", Stn 5590 (USNM 168950) : g, male first left gonopod, mesial view; h, male second left gonopod, anterior view.

Scales equal 1 mm (a), 0.5 mm (b,g,h), and 2 mm (c-f).



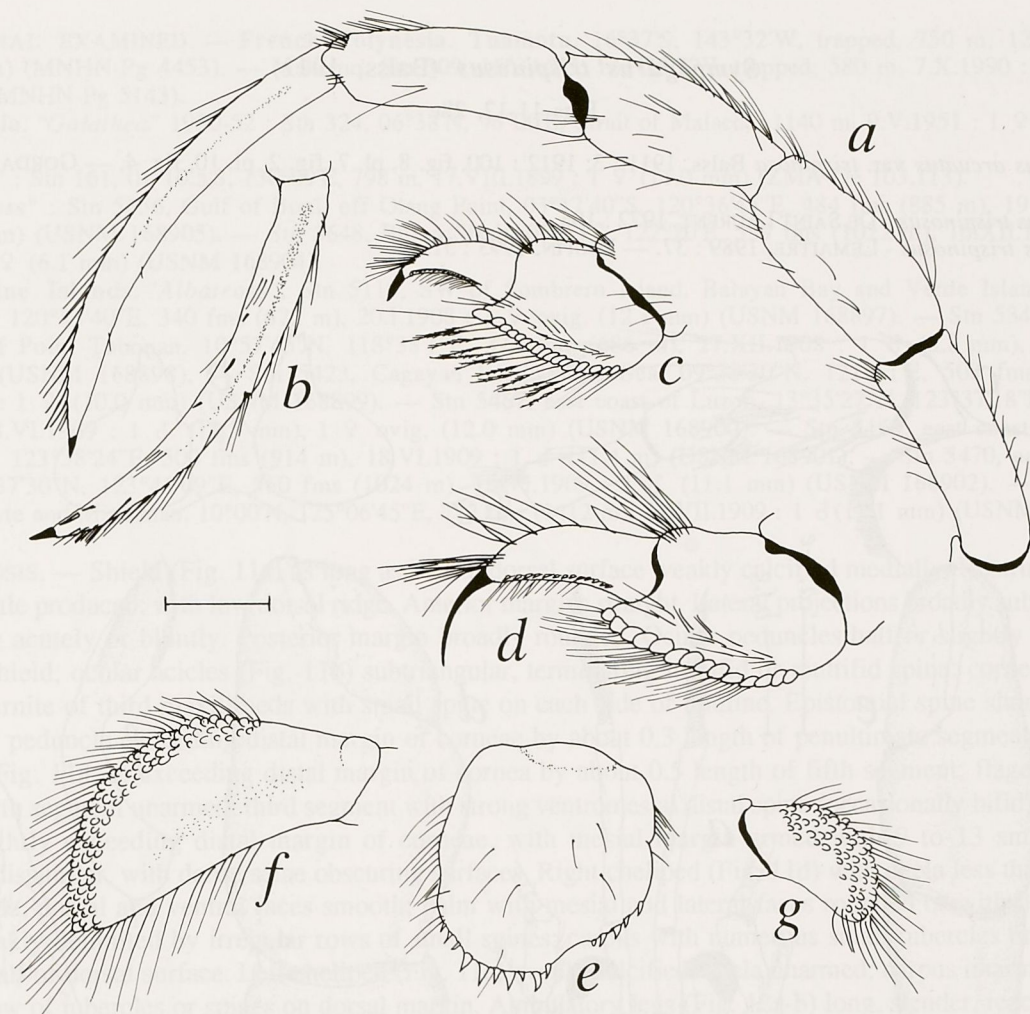


FIG. 10. — *Sympagurus planimanus* (de Saint Laurent, 1972). a-c, e-g, ♀ (2.9 mm), Society Islands, Stn D32 (MNHN-Pg 5132) : a, third left pereopod, lateral view; b, dactyl of same, mesial view; c, propodus and dactyl of left fourth pereopod (male), lateral view; e, telson, dorsal view; f, exopod of left uropod, dorsal view; g, exopod of right uropod, dorsal view. — d, paratype ♀ (4.2 mm), southeastern Indian Ocean (ZMA De 103.110) : propodus and dactyl of left fourth pereopod (female), lateral view.

Scale equals 1 mm (a,b), and 0.5 mm (c-g).

spaced corneous spinules, and dorsal and dorsomesial rows of long, bristle-like setae; carpus with small dorsodistal spine. Anterior lobe of sternite of third pereopods unarmed. Fourth pereopod (Fig. 10c-d) with long, curved corneous claw in large females (shield length > 4.0 mm); propodal rasp consisting of 1 row of ovate scales. Twelve pairs of gills; first 11 pairs trichobranchiate, twelfth pair consisting of vestigial pleurobranches on last thoracic somite. Uropods (Fig. 10f-g) markedly asymmetrical. Telson (Fig. 10e) asymmetrical, with weak median cleft separating anterior and posterior lobes; posterior lobes separated by broad, shallow sinus, terminal margins armed with corneous spines. Male first (Fig. 9g) gonopod with concave distal lobe; second gonopod (Fig. 9h) with distal segment nearly flat. Female with right second pleopod vestigial.

COLOR. — Unknown.

HABITAT. — Gastropod shells.

DISTRIBUTION. — Indonesia, China Sea (DE SAINT LAURENT, 1972), and French Polynesia. Depth: 100 to 600 m.



*Sympagurus trispinosus* (Balss, 1911)

Figs 11-12, 28e

*Parapagurus arcuatus* var. *trispinosa* Balss, 1911 : 3; 1912 : 100, fig. 8, pl. 7, fig. 2, pl. 10, fig. 4. — GORDAN, 1956 : 338.

*Parapagurus trispinosus* - DE SAINT LAURENT, 1972 : 105.

*Sympagurus trispinosus* - LEMAITRE, 1989 : 37. — POUPIN, 1993 : 51.

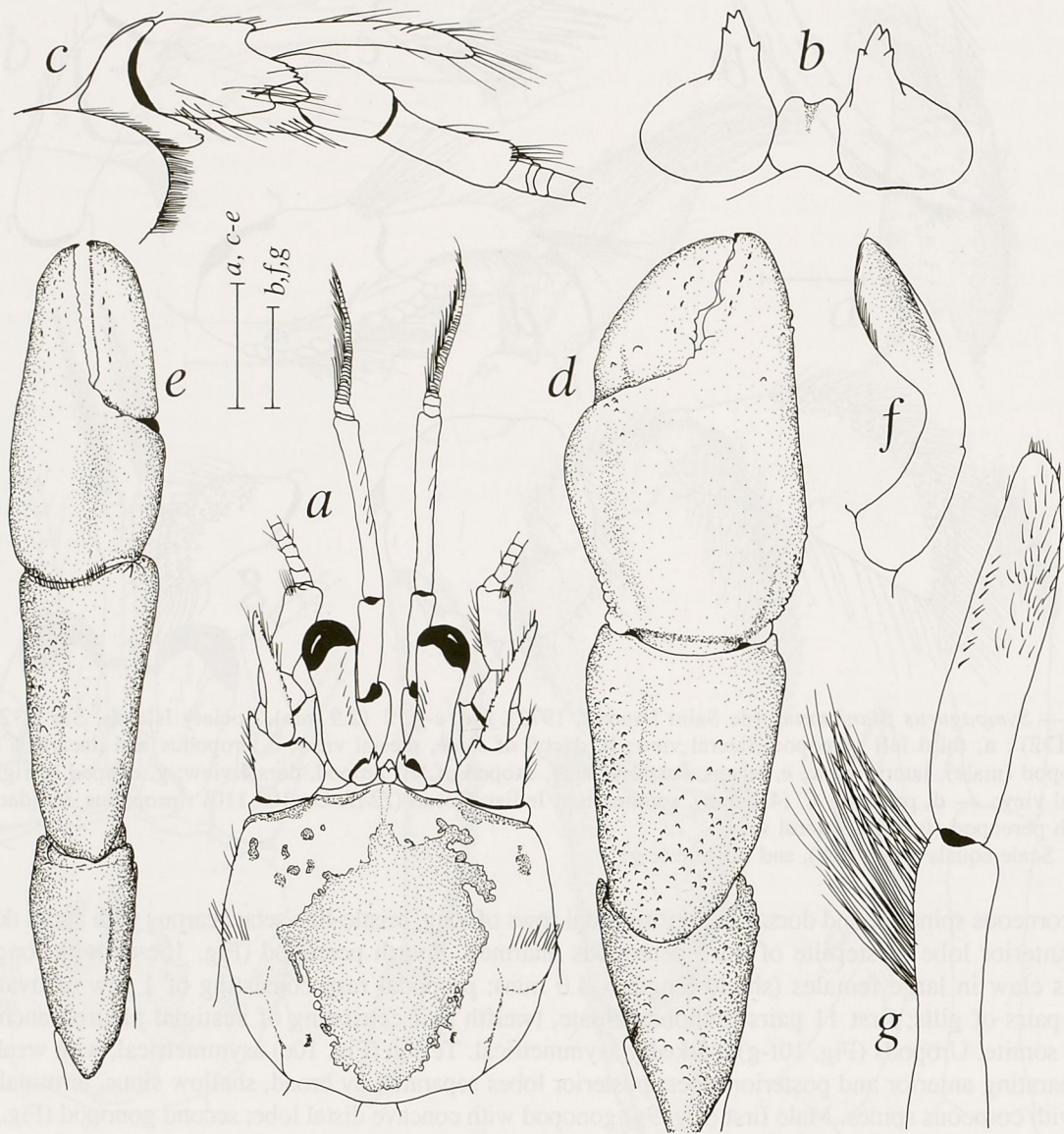


FIG. 11. — *Sympagurus trispinosus* (Balss, 1911). a, c-e, ♀ ovig. (11.9 mm), Tuamotu, Stn 309 (MNHN-Pg 5143) : a, shield and cephalic appendages; c, right antennal peduncle, lateral view; d, right cheliped, dorsal view; e, left cheliped, dorsal view. — f-g, ♂ (11.1 mm), Philippine Islands, "Albatross", Stn 5470 (USNM 168902) : f, male first left gonopod, mesial view; g, male second left gonopod, anterior view. — b, ♂ (12.5 mm), Philippine Islands, "Albatross", Stn 5467 (USNM 168900) : ocular acicles, dorsal view.

Scales equal 5 mm (a,d,e), 1 mm (b,f,g), and 2.5 mm (c).



**MATERIAL EXAMINED.** — **French Polynesia. Tuamotu.** 16°37'S, 143°32'W, trapped, 750 m, 12.XI.1988 : 1 ♀ (9.3 mm) (MNHN-Pg 4453). — Makemo, Stn 309, 16°34.2'S, 143°38.7'W, trapped, 580 m, 7.X.1990 : 1 ♀ ovig. (11.9 mm) (MNHN-Pg 5143).

**Indonesia. "Galathea"** 1950-52 : Stn 324, 06°38'N, 96°00'E, Strait of Malacca, 1140 m, 9.V.1951 : 1 ♀ (4.3 mm), (ZMK).

"*Siboga*" : Stn 161, 01°10.5'S, 130°09'E, 798 m, 17.VIII.1899 : 1 ♀ (11.0 mm) (ZMA De 103.113).

"*Albatross*" : Stn 5656, Gulf of Boni, off Olang Point, 03°17'40"S, 120°36'45"E, 484 fms (885 m), 19.XII.1909 : 1 ♀ (7.5 mm) (USNM 168905). — Stn 5648, Buton Strait, 05°33'S, 122°20'E, 559 fms (1022 m), 16.XII.1909 : 1 ♂ (10.0 mm), ♀ (6.1 mm) (USNM 168904).

**Philippine Islands. "Albatross"**, Stn 5115, SW of Sombrero Island, Balayan Bay and Verde Island Passage, 13°37'11"N, 120°43'40"E, 340 fms (622 m), 20.I.1908 : 1 ♀ ovig. (12.1 mm) (USNM 168897). — Stn 5348, Palawan Passage, off Point Tabonan, 10°57'45"N, 118°38'1"E, 375 fms (686 m), 27.XII.1908 : 1 ♂ (8.8 mm), 1 ♀ ovig. (13.9 mm) (USNM 168898). — Stn 5423, Cagayan Island, Jolo Sea, 09°38'30"N, 121°11'E, 508 fms (929 m), 31.III.1909 : 1 ♀ (10.0 mm) (USNM 168899). — Stn 5467, east coast of Luzon, 13°35'27"N, 123°37'18"E, 480 fms (878 m), 18.VI.1909 : 1 ♂ (12.5 mm), 1 ♀ ovig. (12.0 mm) (USNM 168900). — Stn 5469, east coast of Luzon, 13°36'48"N, 123°38'24"E, 500 fms (914 m), 18.VI.1909 : 1 ♂ (11.4 mm) (USNM 168901). — Stn 5470, east coast of Luzon, 13°37'30"N, 123°41'09"E, 560 fms (1024 m), 18.VI.1909 : 1 ♂ (11.1 mm) (USNM 168902). — Stn 5488, between Leyte and Mindanao, 10°00'N, 125°06'45"E, 772 fms (1412 m), 31.VII.1909 : 1 ♂ (11.1 mm) (USNM 168903).

**DIAGNOSIS.** — Shield (Fig. 11a) as long as broad; dorsal surface weakly calcified medially. Rostrum broadly rounded, little produced, with low dorsal ridge. Anterior margins straight. Lateral projections broadly subtriangular, terminating acutely or bluntly. Posterior margin broadly rounded. Ocular peduncles half or slightly more than length of shield; ocular acicles (Fig. 11b) subtriangular, terminating in bifid or multifid spine; corneae slightly dilated. Sternite of third maxillipeds with small spine on each side of midline. Epistomial spine short, straight. Antennular peduncle exceeding distal margin of corneae by about 0.3 length of penultimate segment. Antennal peduncle (Fig. 11a, c) exceeding distal margin of cornea by about 0.5 length of fifth segment; flagellum long, naked; fourth segment unarmed; third segment with strong ventromesial distal spine (occasionally bifid). Antennal acicles slightly exceeding distal margin of corneae, with mesial margin armed with 9 to 13 small spines. Chelipeds dissimilar, with dense setae obscuring surfaces. Right cheliped (Fig. 11d) with chela less than twice as long as wide, dorsal and ventral faces smooth; palm with mesial and lateral faces rounded or with dorsolateral margin weakly delimited by irregular rows of small spines; carpus with numerous small tubercles or spines on proximal half of dorsal surface. Left cheliped (Fig. 11e) evenly calcified, chela unarmed; carpus unarmed or with irregular row of tubercles or spines on dorsal margin. Ambulatory legs (Fig. 12a-b) long, slender, reaching to tip of extended right cheliped; dactyl ~1.7 times as long as propodus, with row of about 18 corneous spines on ventromesial margin, and with several short, oblique rows of bristles on mesial face distally; carpus with small dorsodistal spine; ischium and merus of second pereopod with row of small often obsolete spines on ventral margin. Anterior lobe of sternite of third pereopods unarmed, or with 1 spine. Fourth pereopod (Fig. 12c) with propodal rasp consisting of 3 to 4 irregular rows of conical scales. Twelve pairs of gills; first 11 pairs intermediate in shape (see LEMAITRE, 1989 : 8), twelfth pair consisting of vestigial pleurobranchs on last thoracic somite. Uropods (Fig. 12e-f) markedly asymmetrical. Telson (Fig. 12d) asymmetrical; anterior lobes each with fringe of long setae on ventrolateral margin; posterior lobes separated by broad, shallow median cleft, terminal margins armed with numerous corneous spines. Male first gonopod (Fig. 11f) with ovate, weakly concave distal lobe; second gonopod (Fig. 11g) with distal segment nearly flat. Female second left pleopod with rami about twice as broad as rami of third and fourth pleopods; right second pleopod vestigial.

**COLOR** (Fig. 28e). — Body cream yellow.

**HABITAT AND SYMBIOTIC ASSOCIATIONS.** — One of the specimens from French Polynesia was found inhabiting a gastropod shell with an unidentified actinian. This species associates with actinians that secrete a chitinous pseudoshell (see FAUTIN-DUNN *et al.*, 1980).

**DISTRIBUTION.** — IndoPacific : Zanzibar (BALSS, 1911); South Africa, Indonesia (DE SAINT LAURENT, 1972); Guam (FAUTIN-DUNN *et al.*, 1980); Philippines, Australia (LEMAITRE, unpublished); and French Polynesia. Depth : 580 to 1412 m.



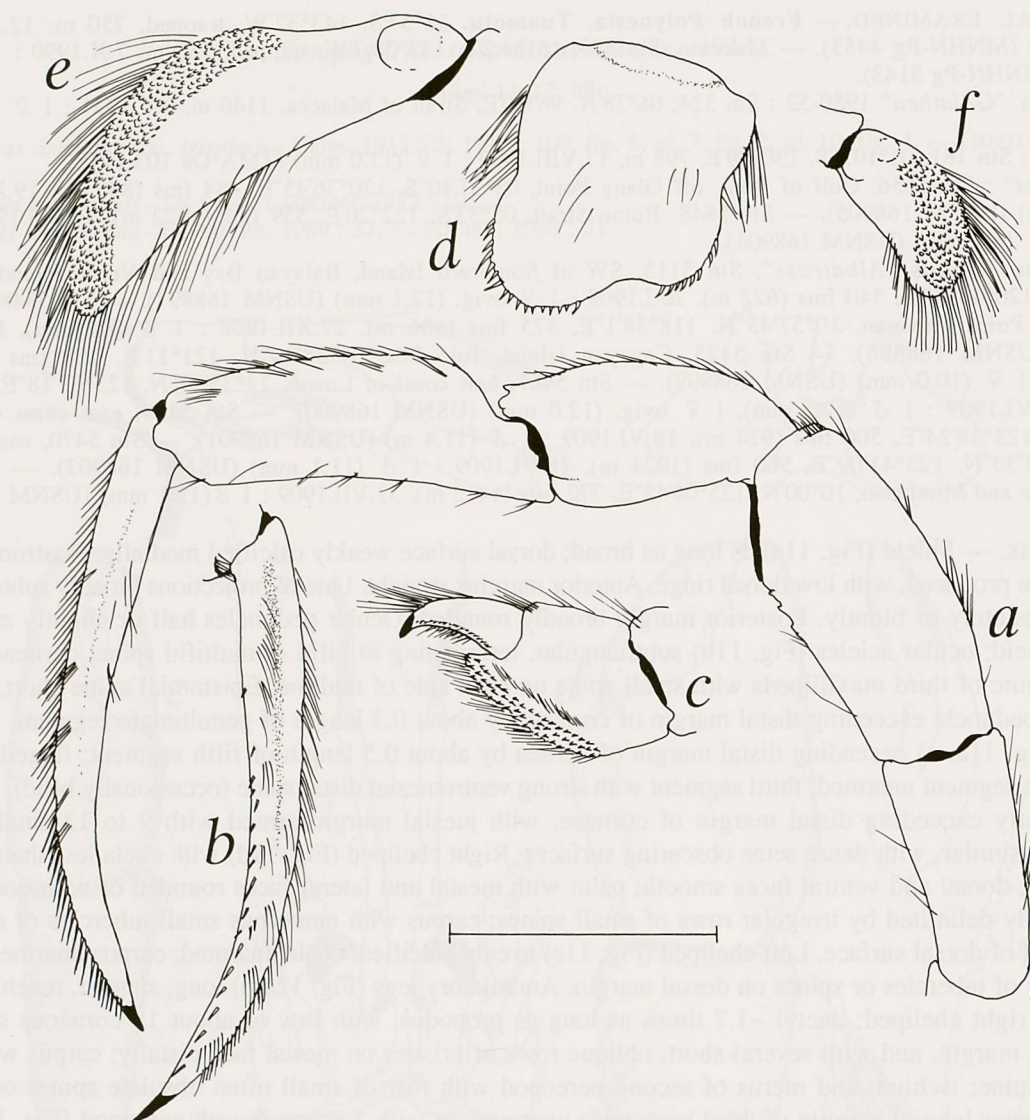


FIG. 12. — *Sympagurus trispinosus* (Balss, 1911), ♀ ovig. (11.9 mm), Tuamotu, Stn 309 (MNHN-Pg 5143) : a, third left pereopod, lateral view; b, dactyl of same, mesial view; c, propodus and dactyl of left fourth pereopod, lateral view; d, telson, dorsal view; e, exopod of left uropod, dorsal view; f, exopod of right uropod, dorsal view.

Scale equals 10 mm (a,b), and 5 mm (c-f).

*Sympagurus wallisi* sp. nov.

Figs 13-15, 27h-i, 28f

TYPE MATERIAL. — Holotype : **French Polynesia. Tuamotu.** Vanavana, Stn 331, 20°45.7'S, 139°10.1'W, trapped, 240 m, 28.X.1990, ♂ (11.0 mm) (MNHN-Pg 5144)

Paratypes : **French Polynesia. Tuamotu.** Takapoto, 14°40'S, 145°15.2'W, 250 m, 7.VI.1989 : 1 ♂ (10.4 mm), 1 ♀ (5.6 mm), 1 ♀ ovig. (12.2 mm) (MNHN-Pg 5157). — Makemo, Stn 308, 16° 34.5'S, 143°39.9'W, trapped, 280 m, 7.X.1990 : 1 ♂ (12.5 mm), 1 ♀ ovig. (8.0 mm) (MNHN-Pg 5145). — Vanavana, Stn 331, 20°45.7'S, 139°10.1'W, trapped, 240 m, 28.X.1990 : 8 ♂ (4.6-11.4 mm), 1 ♀ (4.6 mm), 5 ♀ ovigs (7.3-9.9 mm) (MNHN-Pg 5146). — Fangataufa, Stn 231, 22°12.0'S, 138°45.9'W, trapped, 270 m, 21.V.1990 : 3 ♂ (11.5-11.9 mm), 2 ♀ (11.4, 11.8 mm) (USNM 265393). — Fangataufa, Stn 322, 22°12.9'S, 138°43.1'W, trapped, 250 m, 23.X.1990 : 2 ♂ (8.2, 10.0 mm) (MNHN-Pg 5147).



DESCRIPTION. — Shield (Fig. 13a) approximately as broad as long; dorsal surface weakly calcified on more than half of surface, with scattered short setae, and low blister-like tubercles medially. Rostrum broadly rounded, often obsolete, with short mid-dorsal ridge. Anterior margins sinuose. Lateral projections subtriangular, with terminal spine. Anterolateral margins sloping. Posterior margin broadly rounded. Anterodistal margin of branchiostegite rounded, unarmed, setose.

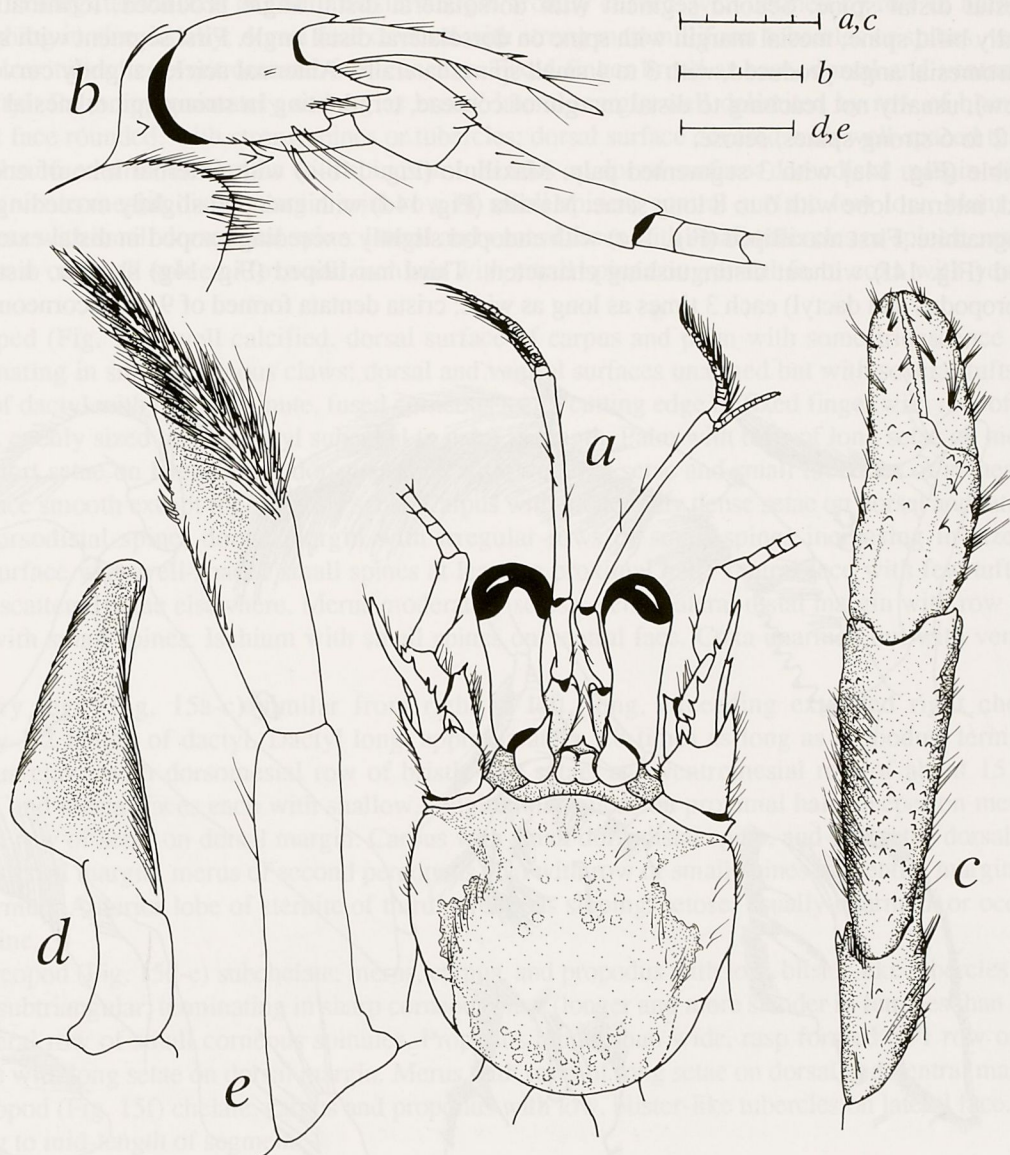


FIG. 13. — *Sympagurus wallisi* sp. nov., holotype ♂ (11.0 mm), Tuamotu, Stn 331 (MNHN-Pg 5144) : a, shield and cephalic appendages; b, right antennal peduncle, lateral view; c, left cheliped, dorsal view; d, male first left gonopod, mesial view; e, male second left gonopod, anterior view.

Scales equal 5 mm (a,c), 2 mm (b), and 1 mm (d,e).

Ocular peduncles more than half length of shield, naked. Cornea slightly dilated. Ocular acicles subtriangular, terminating in strong spine; separated basally by approximately basal width of 1 acicle.

Antennular peduncle long, slender, exceeding distal margin of corneae by nearly entire length of ultimate segment; ventral flagellum with 11 to 12 articles. Ultimate segment at least twice or more as long as penultimate



segment, with scattered setae. Basal segment with strong ventromesial spine; lateral face with distal subrectangular lobe armed or with 3 to 4 small spines, and strong spine proximally.

Antennal peduncle (Fig. 13a-b) exceeding distal margin of cornea by approximately 0.3 length of fifth segment. Flagellum long, exceeding extended right cheliped and ambulatory legs, articles with very short, inconspicuous setae. Fifth segment unarmed, with few setae on lateral, and row of bristle-like setae on mesial margin. Fourth segment armed with strong spine on dorsolateral distal angle. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, occasionally bifid spine; mesial margin with spine on dorsolateral distal angle. First segment with spine on lateral face; ventromesial angle produced, with 3 to 4 small spines laterally. Antennal acicles slightly curved outward (in dorsal view), usually not reaching to distal margin of corneae, terminating in strong spine; mesial margin armed with row 2 to 6 strong spines, setose.

Mandible (Fig. 14a) with 3-segmented palp. Maxillule (Fig. 14b-c) with external lobe of endopod weakly developed, internal lobe with 6 to 8 long setae. Maxilla (Fig. 14d) with endopod slightly exceeding distal margin of scaphognathite. First maxilliped (Fig. 14e) with endopod slightly exceeding exopod in distal extension. Second maxilliped (Fig. 14f) without distinguishing characters. Third maxilliped (Fig. 14g) slender, distal 3 segments (carpus, propodus and dactyl) each 3 times as long as wide; crista dentata formed of 9 to 10 corneous-tipped teeth;

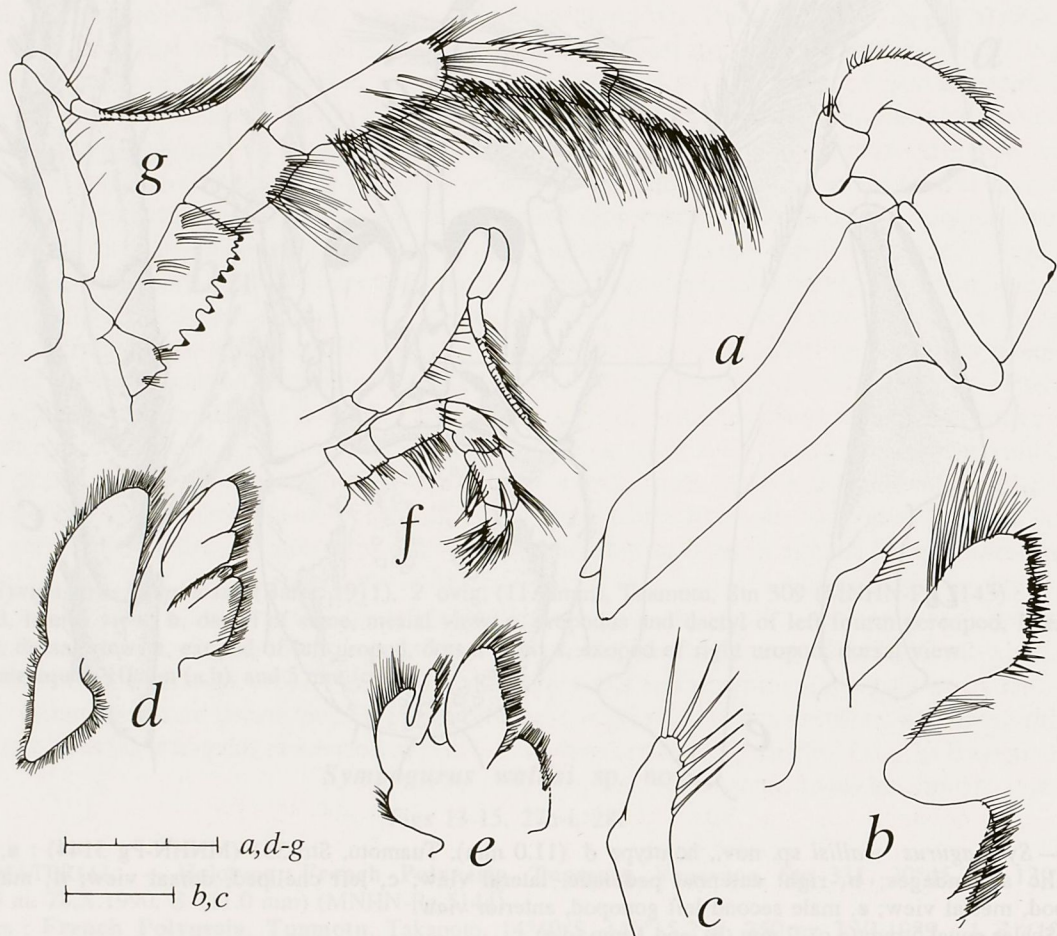


FIG. 14. — *Sympagurus wallisi* sp. nov., paratype ♂ (10.3 mm), Tuamotu, Stn 331 (MNHN-Pg 5146). Left mouthparts, internal view: a, mandible; b, maxillule; c, distal end of endopod of same; d, maxilla; e, first maxilliped; f, second maxilliped; g, third maxilliped.

Scales equal 3 mm (a,d-g), 1 mm (b), and 0.5 mm (c).



coxa and basis each with small mesial tooth. Sternite of third maxillipeds with small spine on each side of midline. Epistome with strong, straight spine. Labral spine present.

Chelipeds markedly dissimilar. Right cheliped (Fig. 27h-i, 28f) massive, with scattered short setae; dorsal surface of palm and carpus with some iridescence medially. Fingers curved ventromesially, terminating in small, usually blunt corneous claw; cutting edges with irregularly sized calcareous teeth; dorsal and ventral faces each with row of 3 to 4 tufts of setae parallel to cutting edge. Dactyl subequal in length to palm, and set at strongly oblique angle to longitudinal axis of palm; mesial margin broadly curved, well defined by row of blunt or sharp spines diminishing in size distally; dorsal face covered with strong mammilliform tubercles or spines, ventral face covered with low tubercles, ventromesial face concave. Fixed finger broad at base, dorsal and ventral surfaces similar to dactyl. Palm approximately as long as broad, lateral margin well delimited by row of blunt to sharp spines; mesial face rounded, with strong spines or tubercles; dorsal surface covered with well-spaced tubercles or spines; ventral surface smooth. Carpus with spines or tubercles on dorsal surface; dorsodistal margin with row of strong spines; ventromesial distal margin with row of small spines; ventral surface few low, blunt spines or tubercles. Merus with small dorsodistal spine; lateral and ventral faces with small tubercles or spines; ventromesial margin with row of small spines. Coxa and ischium with small spines on ventral face; coxa with ventromesial row of setae.

Left cheliped (Fig. 13c) well calcified, dorsal surface of carpus and palm with some iridescence medially. Fingers terminating in small corneous claws; dorsal and ventral surfaces unarmed but with several tufts of setae; cutting edge of dactyl with row of minute, fused corneous teeth; cutting edge of fixed finger with row of regularly spaced, small, evenly sized teeth. Dactyl subequal to palm in length. Palm with tufts of long setae on mesial face, and tufts of short setae on lateral face; dorsal surface with scattered setae and small tubercles or spines on distal half; ventral face smooth except for scattered setae. Carpus with moderately dense setae on dorsal and lateral faces, and strong dorsodistal spine; dorsal margin with irregular rows of small spines increasing in size distally; dorsolateral surface with well-spaced small spines at least on proximal half; ventral face with few tufts of setae medially and scattered setae elsewhere. Merus moderately setose, ventrolateral distal margin with row of spines; ventral face with small spines. Ischium with small spines on ventral face. Coxa unarmed but with ventromesial row of setae.

Ambulatory legs (Fig. 15a-c) similar from right to left, long, exceeding extended right cheliped by approximately 1/2 length of dactyl. Dactyl long, approximately 1.8 times as long as propodus, terminating in sharp corneous claw; with dorsomesial row of bristle-like setae, and ventromesial row of about 15 corneous spines; lateral and mesial faces each with shallow, longitudinal sulcus on proximal half (deeper on mesial face). Propodus with row of setae on dorsal margin. Carpus with small dorsodistal spine, and few setae dorsally. Merus with setae on dorsal margin; merus of second pereopods also with row of small spines on ventral margin. Ischium and coxa unarmed. Anterior lobe of sternite of third pereopods sloping, setose, usually unarmed, or occasionally with small spine.

Fourth pereopod (Fig. 15d-e) subchelate; merus, carpus, and propodus with low, blister-like tubercles on lateral faces. Dactyl subtriangular, terminating in sharp corneous claw (longer and more slender in females than in males), and ventrolateral row of small corneous spinules. Propodus longer than wide, rasp formed of 1 row of rounded scales. Carpus with long setae on dorsal margin. Merus with rows of long setae on dorsal and ventral margins.

Fifth pereopod (Fig. 15f) chelate, carpus and propodus with low, blister-like tubercles on lateral face. Propodal rasp extending to mid-length of segment.

Eleven pairs of intermediate branchiae (flattened branches weakly divided distally).

Uropods and telson (Fig. 15g) markedly asymmetrical. Telson with weak transverse suture; dorsal surface with numerous low, blister-like tubercles; posterior lobes separated by narrow cleft, terminal margin of lobes armed with corneous spines.

Male with paired first and second gonopods well developed. First gonopod (Fig. 13d) with concave distal lobe. Second gonopod (Fig. 13e) with low, blister-like tubercles on posterior face of distal and basal segments; distal segment setose on distomesial face, with short, bristle-like setae on lateral margin; basal segment with few setae on posterior face. Female with vestigial second right pleopod.



COLOR (Fig. 28f). — Shield orange-brown medially, cream yellow elsewhere. Ocular peduncles amber, cornea black centrally. Cephalic appendages and ocular acicles whitish. Right cheliped with white tubercles and spines on reddish to dark-pink background (bases of tubercles or spines darker than remaining surfaces); mesial face of palm and entire dorsal surface of carpus with darker coloration than other surfaces of cheliped. Left cheliped with chela red-spotted (spots at bases of tufts of setae) on whitish background; carpus with spines on reddish background. Second to fifth pereopods more or less uniformly pinkish.

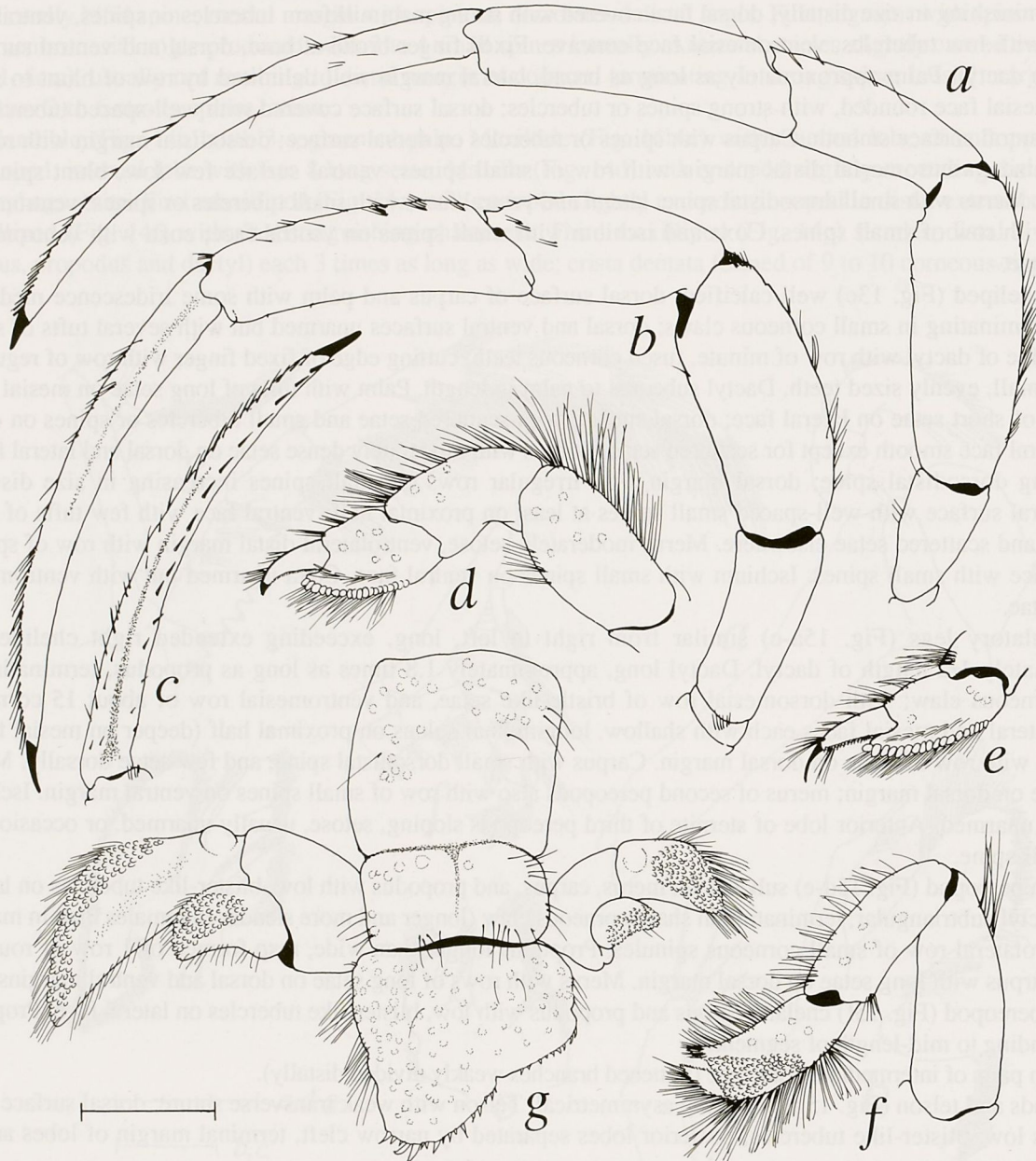


FIG. 15. — *Sympagurus wallisi* sp. nov. a-d, f-g, holotype ♂ (11.0 mm), Tuamotu, Stn 331 (MNHN-Pg 5144a) : a, second left pereopod, lateral view; b, third left pereopod, lateral view; c, dactyl of same, mesial view; d, fourth left pereopod (male), lateral view; f, fifth left pereopod, lateral view; g, tergite of sixth abdominal somite, telson and uropods, dorsal view. — e, paratype ♀ (11.4 mm), Tuamotu, Stn 231 (USNM 265393) : propodus and dactyl of left fourth pereopod (female), lateral view.

Scale equals 6 mm (a-c), and 3 mm (d-f).



HABITAT AND SYMBIOTIC ASSOCIATIONS. — Found inhabiting gastropod shells with a small unidentified actinian growing on the shell.

DISTRIBUTION. — Known so far only from French Polynesia. Depth : 240 to 280 m.

ETYMOLOGY. — The specific name is given in honor of Captain Samuel WALLIS, English navigator who commanded the first European expedition to reach the Tuamotu and Tahiti on board the "*Dolphin*" in the year 1767.

REMARKS. — This species most closely resembles *Sympagurus bougainvillei* sp. nov., and *S. diogenes* Whitelegge, 1900. The three can easily be separated by marked differences in coloration, most evident in the chelipeds and second and third pereopods. In *S. wallisi*, the dorsal surface of the right cheliped has a red to pinkish color (darker on carpus) with white tubercles or spines, the left cheliped is white with red spots, and the walking legs are pink (Fig. 28f). In *S. bougainvillei*, the dorsal surface of the cheliped and the walking legs are pink with small red spots; the carpus of the chelipeds and walking legs each have a large red spot on the mesial face and on the lateral face of the left cheliped and walking legs (Fig. 28g). In *S. diogenes*, the right and left chelipeds have white fingers, the dorsal surface of each palm is red or orange, usually iridescent, and fading to white laterally; the walking legs are orange fading to white towards the dactyls, and the carpi each have a narrow, dark red band proximally (MIYAKE, 1978 : 74, pl. 4, fig. 5; 1982 : 118, pl. 40, fig. 2; BABA *et al.*, 1986 : 196, fig. 145).

In the absence of coloration the three species can be separated (with caution) by the armature of the carpus and chela of the right cheliped (see Fig. 27g-j). In general, the armature of the right cheliped is strongest in *S. wallisi*, and weakest in *S. diogenes*. In *S. wallisi*, the dorsal surfaces of the fingers of the right chela are covered with strong mammilliform spines. The dorsal surfaces of the right fingers in *S. bougainvillei* have well-spaced small tubercles or spines, and in *S. diogenes*, at most, minute tubercles. In *S. wallisi*, the dorsodistal margin of the carpus has a row of strong spines, whereas in *S. bougainvillei* and *S. diogenes* the spines are small.

*Sympagurus bougainvillei* sp. nov.

Figs 16-19, 27j, 28g

TYPE MATERIAL. — Holotype : **French Polynesia. Tuamotu.** Makemo, Stn 308, 16°34.5'S, 143°39.9'W, trapped, 280 m, 7.X.1990, ♂ (11.9 mm) (MNHN-Pg 5148).

Paratypes : **Tuamotu.** Same locality as holotype : 2 ♂ (11.8-12.2 mm) (USNM 265394). — **Marquesas Islands,** Tahuata, Stn 300, 09°54.5'S, 139°07.9'W, trapped, 190 m, 1.IX.1990 : 1 ♂ (11.7 mm) (MNHN-Pg 5149).

DESCRIPTION. — Shield (Fig. 16a) approximately as broad as long; dorsal surface weakly calcified on more than half of surface, with scattered short setae, and inconspicuous, low blister-like tubercles. Rostrum broadly rounded, with short mid-dorsal ridge. Anterior margins weakly concave. Lateral projections subtriangular, with small subterminal spine. Anterolateral margins sloping. Posterior margin broadly rounded. Anterodistal margin of branchiostegite rounded, unarmed, setose.

Ocular peduncles more than half length of shield, with few setae on dorsal face. Cornea slightly dilated. Ocular acicles subtriangular, terminating in strong spine; separated basally approximately by slightly less than basal width of 1 acicle.

Antennular peduncle long, slender, exceeding distal margin of corneae by nearly entire length of ultimate segment, with few setae on dorsal face; ventral flagellum with 11 to 13 articles. Ultimate segment at least twice as long as penultimate, with scattered setae. Basal segment with strong ventromesial spine; lateral face with distal subrectangular lobe armed or with 1 to 3 small spines, and strong spine proximally.

Antennal peduncle (Fig. 16a-b) slightly exceeding distal margin of cornea. Flagellum long, exceeding extended right cheliped, articles with few short setae. Fifth segment unarmed, with few setae laterally, and row of bristle-like setae on mesial margin. Fourth segment with strong spine on dorsolateral distal angle. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, usually bifid spine often having small spine dorsally; mesial margin with spine on dorsolateral distal angle. First



segment with small spine on lateral face; ventromesial angle produced, with 3 to 4 small spines laterally. Antennal acicles slightly curved outward (in dorsal view), reaching distal margin of corneae, terminating in strong spine; mesial margin setose, armed with row 6 to 8 strong spines.

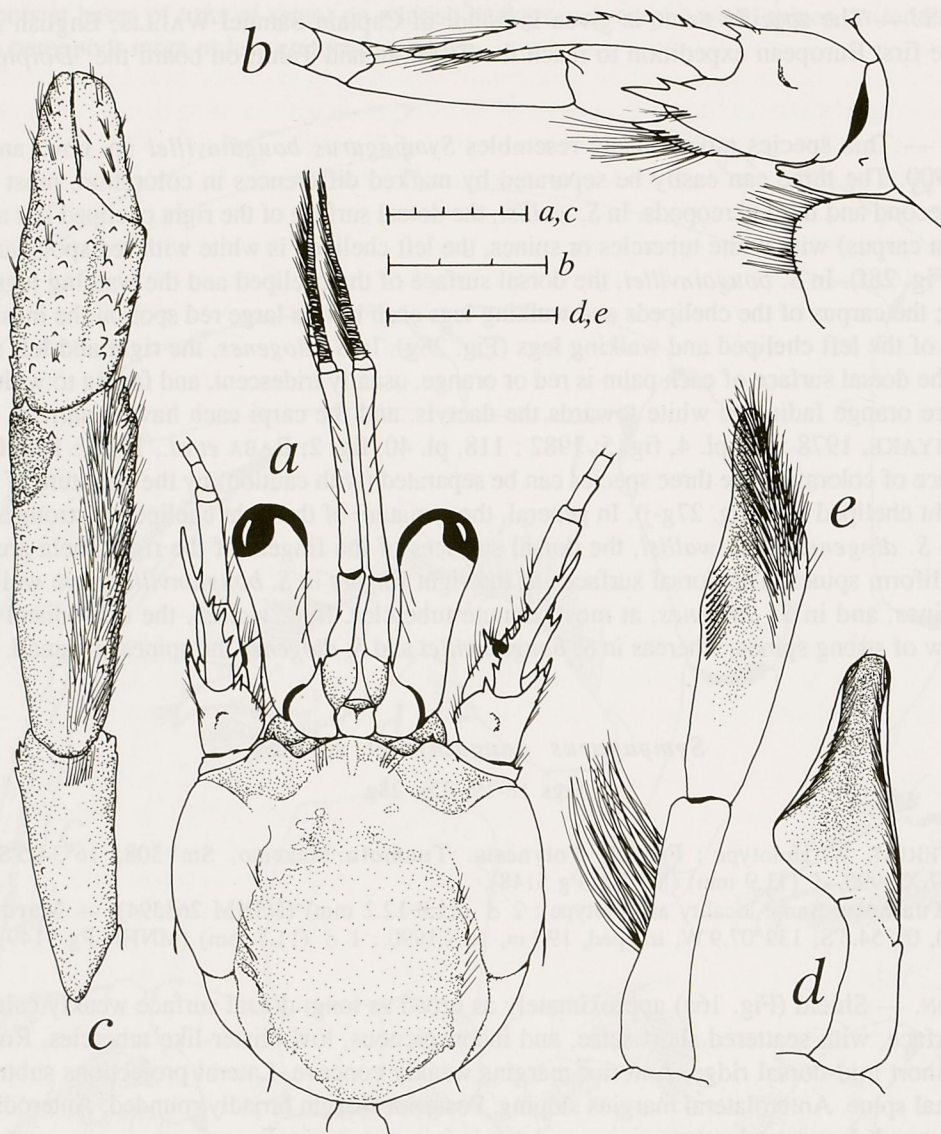


FIG. 16. — *Sympagurus bougainvillei* sp. nov., holotype ♂ (11.9 mm), Tuamotu, Stn 308 (MNHN-Pg 5148) : a, shield and cephalic appendages; b, left antennal peduncle, lateral view; c, left cheliped, dorsal view; d, male first left gonopod, mesial view; e, male second left gonopod, anterior view.

Scales equal 5 mm (a,c), 3 mm (b), and 2 mm (d,e).

Mandible (Fig. 17a) with 3-segmented palp. Maxillule (Fig. 17b-c) with external lobe of endopod weakly to moderately developed, internal lobe with 5 to 8 long setae. Maxilla (Fig. 17d) with endopod exceeding distal margin of scaphognathite. First maxilliped (Fig. 17e) with endopod exceeding exopod in distal extension. Second maxilliped (Fig. 17f) without distinguishing characters. Third maxilliped (Fig. 17g) slender, distal 3 segments each 3 times as long as wide; crista dentata with 9 to 11 corneous-tipped teeth; coxa and basis each with small mesial tooth. Sternite of third maxillipeds with small spine on each side of midline. Epistomial spine absent. Labral spine present.



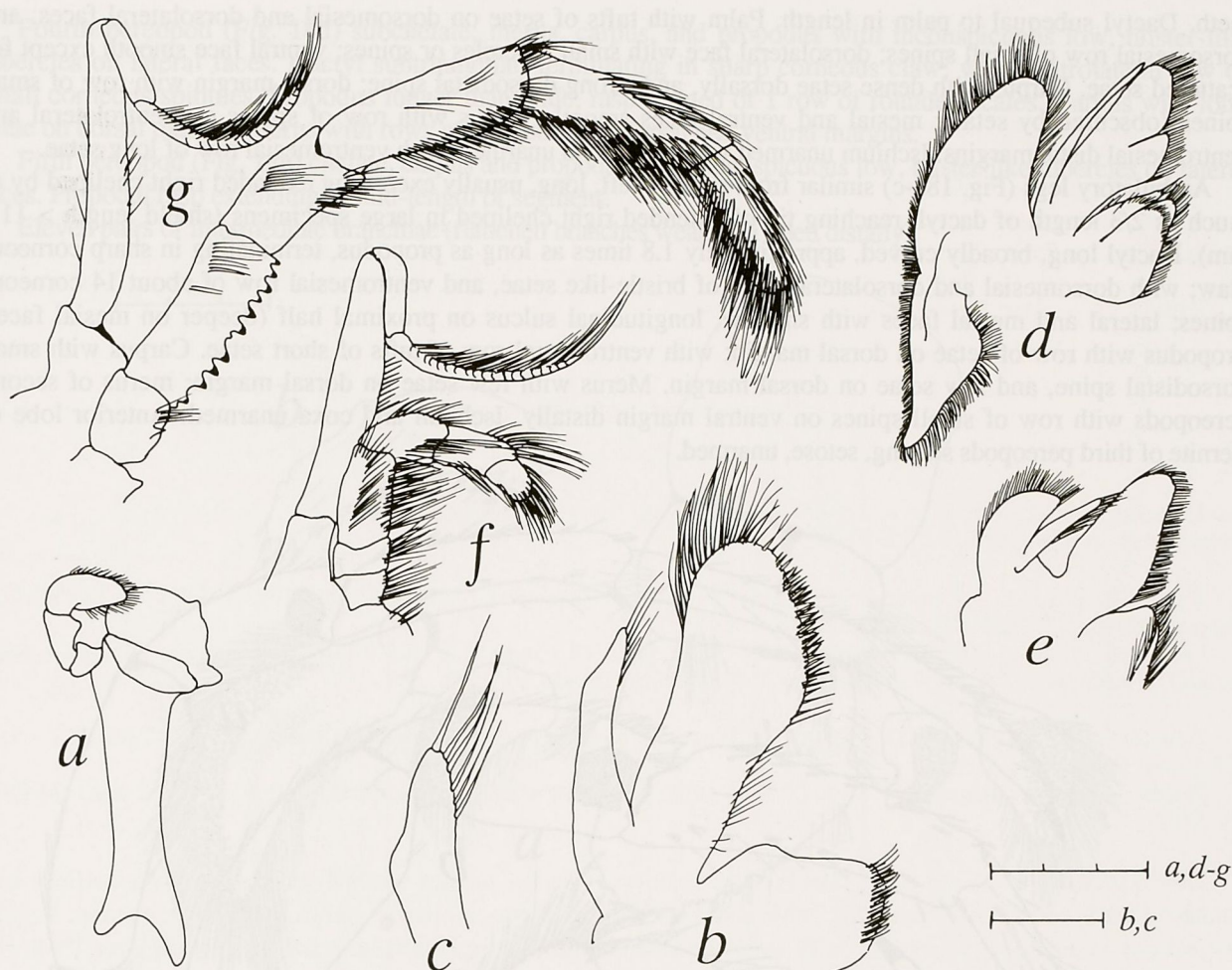


FIG. 17. — *Sympagurus bougainvillei* sp. nov., holotype ♂ (11.9 mm), Tuamotu, Stn 308 (MNHN-Pg 5148). Left mouthparts, internal view : a, mandible; b, maxillule; c, distal end of endopod of same; d, maxilla; e, first maxilliped; f, second maxilliped; g, third maxilliped.

Scales equal 3 mm (a,d-g), 1 mm (b), and 0.5 mm (c).

Chelipeds markedly dissimilar. Right cheliped (Fig. 27j, 28g) massive, chela sparsely setose, carpus with dense short setae dorsally. Fingers curved ventromesially, terminating in small, usually blunt corneous claw; cutting edges with 2 large calcareous teeth and small, subequal teeth; dorsal and ventral faces with well-spaced small spines, and scattered tufts of setae; with row of tufts of short setae close to, and parallel to cutting edge on dorsal and ventral faces. Dactyl subequal in length to palm, set at strongly oblique angle to longitudinal axis of palm; mesial margin broadly curved, well defined by row of spines; ventromesial face concave, ventral face smooth. Fixed finger broad at base. Palm approximately as long as broad, or slightly longer than broad in large specimens (shield length > 11.0 mm); lateral margin well delimited by row of spines; mesial face rounded, with well-spaced spines or tubercles; dorsal surface covered with well-spaced, small spines; ventral surface smooth. Carpus covered with small spines or tubercles on all faces; dorsodistal and ventromesial distal margins each with row of small spines. Merus with lateral and ventral surfaces covered with small tubercles or spines; ventromesial distal margin with row of spines. Coxa and ischium with small spines on ventral face; coxa with ventromesial row of long setae.

Left cheliped (Fig. 16c) well calcified. Fingers terminating in small corneous claws; dorsal and ventral surfaces unarmed except for tufts of setae; cutting edge of dactyl with row of minute, fused corneous teeth; cutting edge of fixed finger with row of regularly-spaced, small, evenly-sized calcareous teeth interspersed with small corneous



teeth. Dactyl subequal to palm in length. Palm with tufts of setae on dorsomesial and dorsolateral faces, and dorsomesial row of small spines; dorsolateral face with small tubercles or spines; ventral face smooth except for scattered setae. Carpus with dense setae dorsally, and strong dorsodistal spine; dorsal margin with row of small spines (obscured by setae); mesial and ventral faces smooth. Merus with row of spines on ventrolateral and ventromesial distal margins. Ischium unarmed ventrally. Coxa unarmed, with ventromesial row of long setae.

Ambulatory legs (Fig. 18a-c) similar from right to left, long, usually exceeding extended right cheliped by as much as  $2/3$  length of dactyl, reaching tip of extended right cheliped in large specimens (shield length  $> 11.0$  mm). Dactyl long, broadly curved, approximately 1.8 times as long as propodus, terminating in sharp corneous claw; with dorsomesial and dorsolateral rows of bristle-like setae, and ventromesial row of about 14 corneous spines; lateral and mesial faces with shallow, longitudinal sulcus on proximal half (deeper on mesial face). Propodus with row of setae on dorsal margin; with ventrolateral row of tufts of short setae. Carpus with small dorsodistal spine, and few setae on dorsal margin. Merus with few setae on dorsal margin; merus of second pereopods with row of small spines on ventral margin distally. Ischium and coxa unarmed. Anterior lobe of sternite of third pereopods sloping, setose, unarmed.

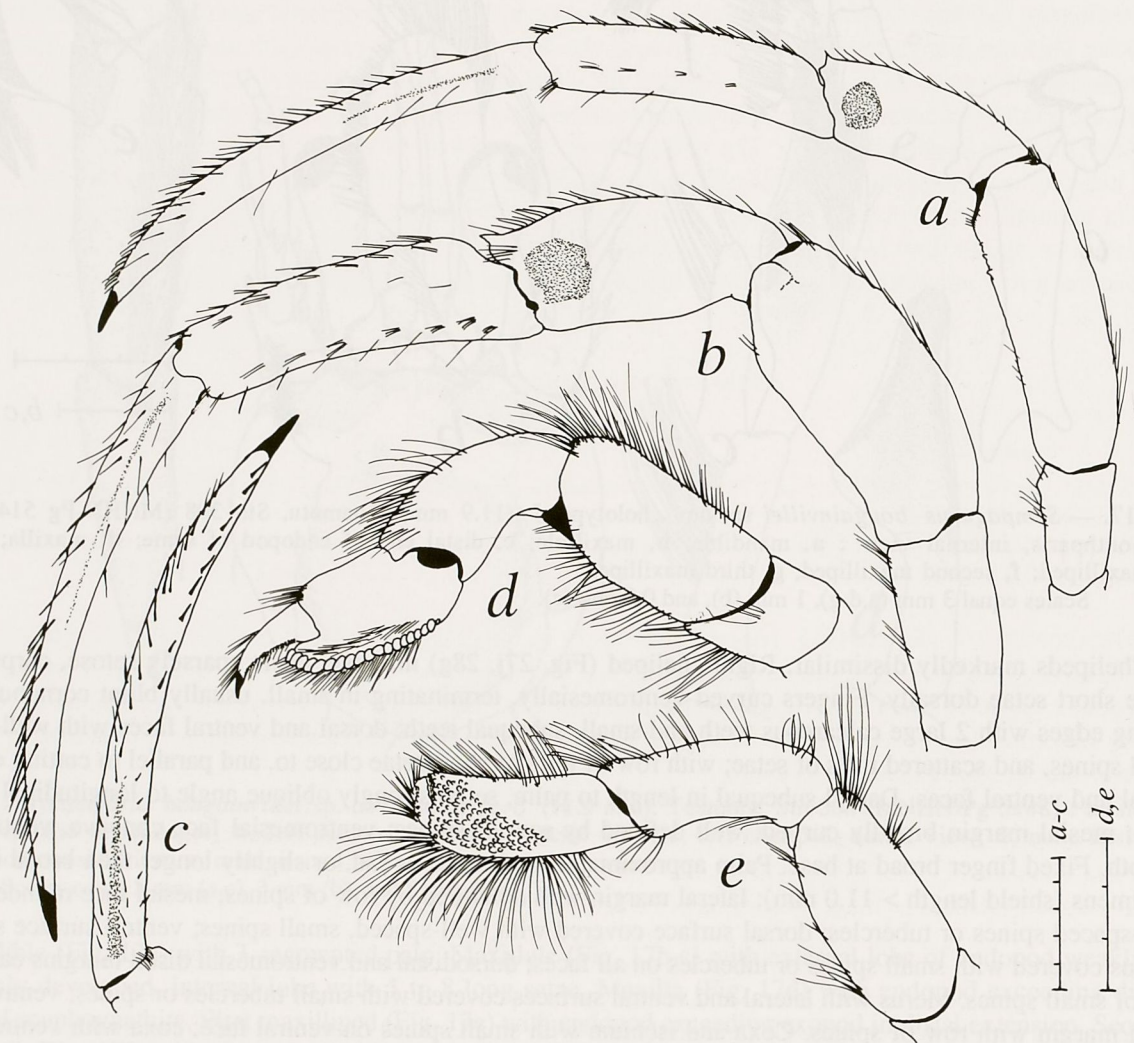


FIG. 18. — *Sympagurus bougainvillei* sp. nov., holotype ♂ (11.9 mm), Tuamotu, Stn 308 (MNHN-Pg 5148) : a, second left pereopod, lateral view; b, third left pereopod, lateral view; c, dactyl of same, mesial view; d, fourth left pereopod, lateral view; e, fifth left pereopod, lateral view.

Scales equal 5 mm (a-c), and 3 mm (d,e). Stippled area shown in "a" and "b" indicates red color pattern.



Fourth pereopod (Fig. 18d) subchelate; merus, carpus, and propodus with inconspicuous low, blister-like tubercles on lateral faces. Dactyl subtriangular, terminating in sharp corneous claw; with ventrolateral row of small corneous spinules. Propodus longer than wide, rasp formed of 1 row of rounded scales. Carpus with long setae on dorsal margin. Merus with rows of long setae on dorsal and ventral margins.

Fifth pereopod (Fig. 18e) chelate, carpus and propodus with inconspicuous low, blister-like tubercles on lateral faces. Propodal rasp extending to mid-length of segment.

Eleven pairs of intermediate branchiae (flattened branches weakly divided distally).

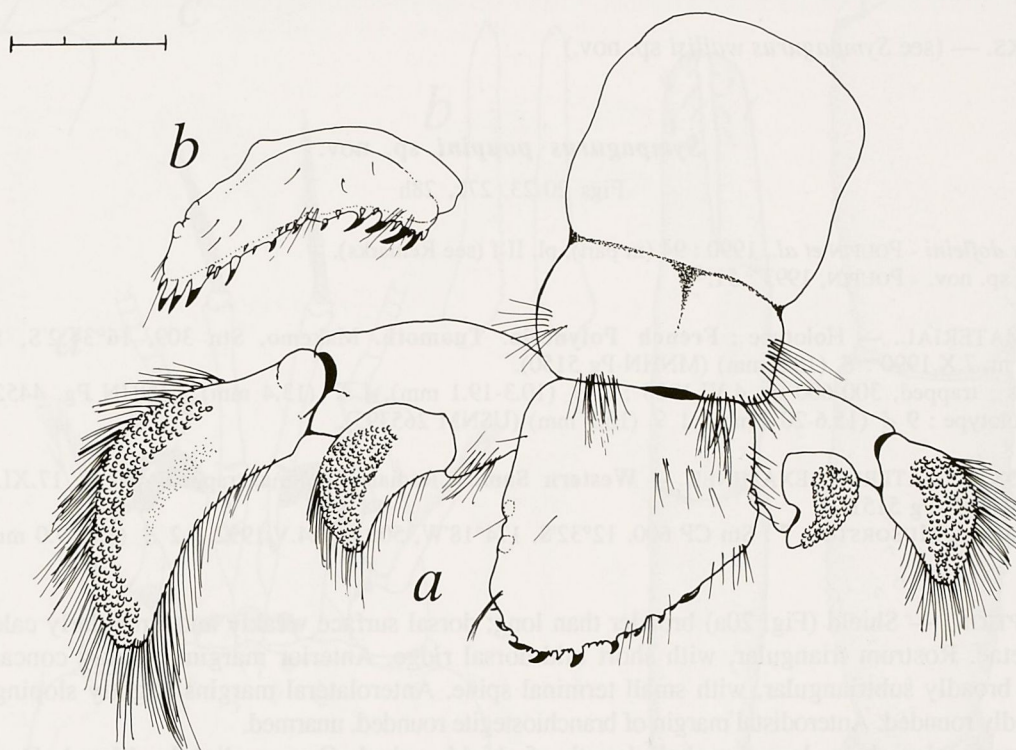


FIG. 19. — *Sympagurus bougainvillei* sp. nov., holotype ♂ (11.9 mm), Tuamotu, Stn 308 (MNHN-Pg 5148) : a, tergite of sixth abdominal somite, telson and uropods, dorsal view; b, telson, posterior view.

Scale equals 3 mm.

Uropods and telson (Fig. 19) markedly asymmetrical. Telson with weak (often obsolete) transverse suture; dorsal surface with inconspicuous low, blister-like tubercles; posterior lobes separated by narrow cleft, terminal margins of lobes armed with strongly curved corneous spines, curved ventrally and laterally, spines on right lobe often not entirely visible in dorsal view.

Male with paired first and second gonopods well developed. First gonopod (fig. 16d) with concave distal lobe. Second gonopod (Fig. 16e) with low, blister-like tubercles on posterior face of distal and basal segments; distal segment setose on distomesial face, and long, bristle-like setae on mid-lateral margin; basal segment with long setae on posterior face. Female with vestigial second right pleopod.

COLOR (Fig. 28g). — Shield white except for light orange region medially; with orange-red spots more numerous on calcified surfaces. Ocular peduncles light orange, cornea with light blue tinge. Cephalic appendages and ocular acicles whitish or light orange. Right cheliped with chela and merus white with small orange spots; carpus orange with large, dark, orange-red spot on mesial face distally. Left cheliped with chela, carpus, and merus white with small orange spots; carpus with large dark orange spot on lateral and mesial faces distally. Second to fifth pereopods white with small orange spots; carpi with large, dark orange-red spot on lateral and mesial faces distally. Abdominal tergites and telson with small orange spots.



HABITAT AND SYMBIOTIC ASSOCIATIONS. — Found inhabiting gastropod shells with an unidentified actinian growing on the shell.

DISTRIBUTION. — Known so far only from French Polynesia. Depth : 190 to 280 m.

ETYMOLOGY. — The specific name is in honor of Captain Louis Antoine DE BOUGAINVILLE, French navigator and explorer who reached the Tuamotus and Tahiti on board "*La Boudeuse*", just a few months after the English Captain Samuel WALLIS.

REMARKS. — (see *Sympagurus wallisi* sp. nov.)

*Sympagurus poupini* sp. nov.

Figs 20-23, 27k, 28h

*Parapagurus dofleini* - POUPIN *et al.*, 1990 : 94 (in part), pl. II-f (see Remarks).

*Sympagurus* sp. nov. - POUPIN, 1993 : 51.

TYPE MATERIAL. — Holotype : **French Polynesia. Tuamotu.** Makemo, Stn 309, 16°34,2'S, 143°38,7'W, trapped, 580 m, 7.X.1990 : ♂ (18.5 mm) (MNHN-Pg 5150).

Paratypes : trapped, 300-600 m, 4.VI.1988 : 3 ♂ (10.3-19.1 mm), 1 ♀ (13.4 mm) (MNHN Pg. 4452). — Same locality as holotype : 9 ♂ (15.6-20.2 mm), 1 ♀ (15.5 mm) (USNM 265395).

ADDITIONAL MATERIAL EXAMINED. — **Western Samoa.** Radiale Apolima, trapped, 400 m, 17.XI.1977 : 1 ♂ (21.1 mm) (MNHN-Pg 5151).

**Wallis Island.** MUSORSTOM 7 : Stn CP 600, 12°32'S, 174°18'W, 500 m, 24.V.1992, : 2 ♂ (8.6, 9.0 mm) (MNHN-Pg 5152).

DESCRIPTION. — Shield (Fig. 20a) broader than long; dorsal surface weakly and irregularly calcified, with scattered setae. Rostrum triangular, with short mid-dorsal ridge. Anterior margins weakly concave. Lateral projections broadly subtriangular, with small terminal spine. Anterolateral margins slightly sloping. Posterior margin broadly rounded. Anterodistal margin of branchiostegite rounded, unarmed.

Ocular peduncles short, less than half length of shield, naked. Cornea slightly dilated. Ocular acicles subtriangular, terminating in strong spine; separated basally by approximately basal width of 1 acicle.

Antennular peduncle long, slender, exceeding distal margin of cornea by length of ultimate segment; ventral flagellum with 8 articles. Ultimate segment approximately 1.5 times or more as long as penultimate segment, with scattered setae. Basal segment with strong ventromesial spine on lateral face, distal subrectangular lobe unarmed or with 1 small spine and strong spine proximally.

Antennal peduncle (Fig. 20a, c) exceeding distal margin of cornea by about 0.3 length of fifth segment. Flagellum long, reaching to tip of fingers of extended right cheliped, naked or with scattered short setae. Fifth segment unarmed, with few setae on lateral and mesial margins. Fourth segment unarmed. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, multifid spine (usually trifid); mesial margin unarmed, dorsolateral distal angle setose. First segment unarmed; ventromesial angle produced, with 3-4 small spines laterally. Antennal acicles (Fig. 20a-b) nearly straight, exceeding distal margin of cornea by about 0.5 length of acicle, terminating in strong spine; mesial margin armed with row small blunt or sharp spines, setose.

Mandible (Fig. 21a) with 3-segmented palp. Maxillule (Fig. 21b-c) with external lobe of endopod weakly developed, internal lobe with 4 long setae. Maxilla (Fig. 21d) with endopod slightly exceeding distal margin of scaphognathite. First maxilliped (Fig. 21e) with endopod slightly exceeding exopod in distal extension. Second maxilliped (Fig. 21f) without distinguishing characters. Third maxilliped (Fig. 21g) with crista dentata of 11 corneous-tipped teeth increasing in size proximally; basis with mesial tooth; coxa with 2 small spines mesially. Sternite of third maxillipeds with small spine on each side of midline. Epistome unarmed or with short, straight spine. Labral spine present.



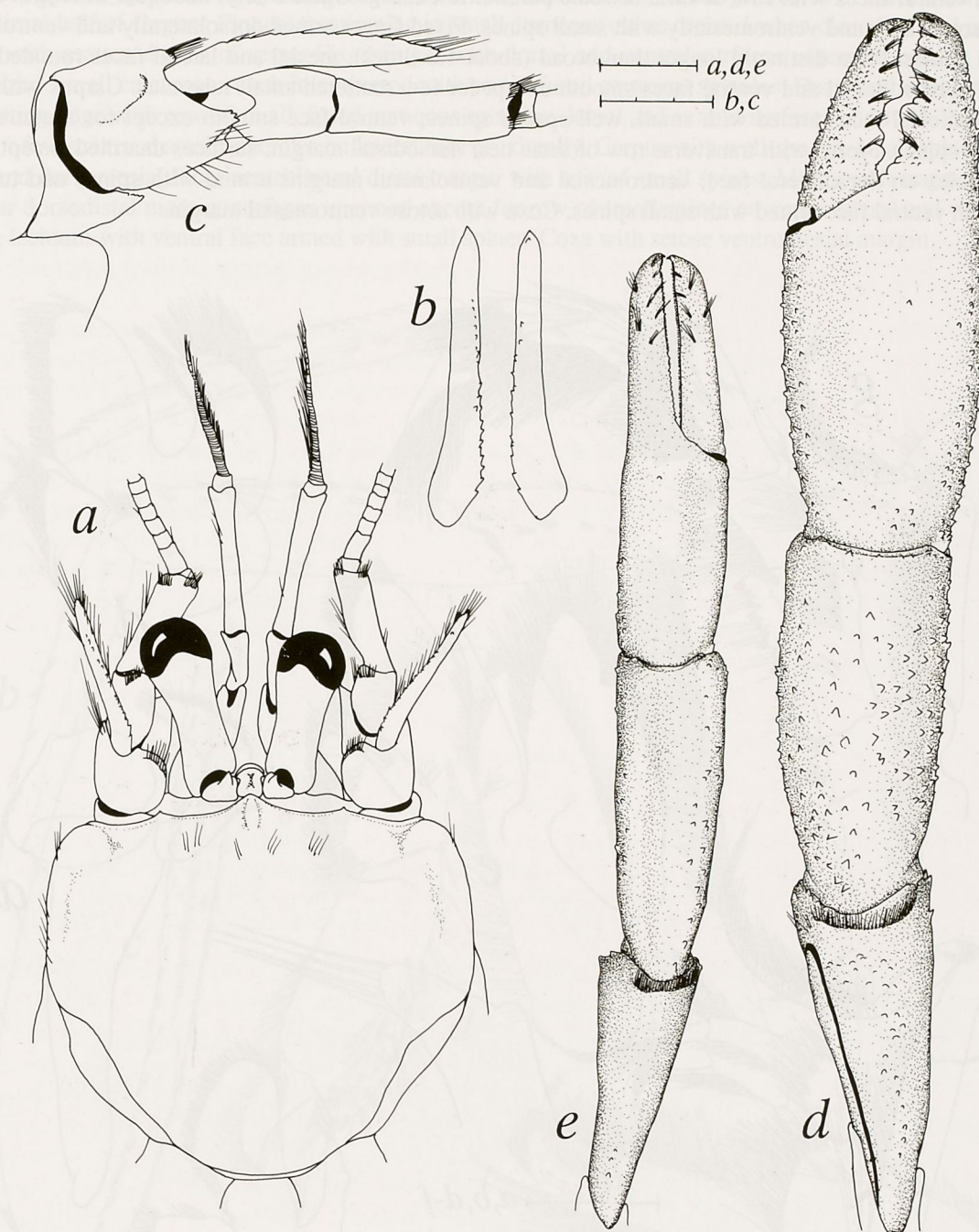


FIG. 20. — *Sympagurus poupini* sp. nov., Tuamotu, Stn 309. a-c, holotype ♂ (18.5 mm) (MNHN-Pg 5150) : a, shield and cephalic appendages; b, antennal acicles, dorsal view; c, right antennal peduncle, lateral view. — d-e, paratype ♂ (15.9 mm) (USNM 265395) : d, denuded right cheliped, dorsal view; e, denuded left cheliped, dorsal view.

Scales equal 5 mm (a,d,e), and 3 mm (b,c).

Chelipeds markedly dissimilar. Right cheliped (Fig. 20d, 27k, 28h) elongated, covered with dense setae obscuring surfaces of merus, carpus, palm, and proximal half of fingers. Fingers inwardly curved at tips, and terminating in small corneous claw crossed when closed; cutting edges with irregularly sized calcareous teeth;



dorsal and ventral faces with row of tufts of setae parallel to cutting edges. Dactyl subequal in length to palm, armed dorsomesially and ventromesially with small spines. Fixed finger armed dorsolaterally and ventrolaterally with small spines. Palm distinctly longer than broad (about 1.6 times), mesial and lateral faces rounded, armed with small spines; dorsal and ventral faces smooth except for few scattered small tubercles. Carpus with dorsal, lateral, and mesial faces armed with small, well-spaced spines; ventral face smooth except for scattered small tubercles or spines. Merus with transverse row of setae near dorsodistal margin; surfaces unarmed except for few small tubercles on dorsolateral face; ventromesial and ventrolateral margins armed with spines and tubercles. Ischium with ventral face armed with small spines. Coxa with setose ventromesial margin.

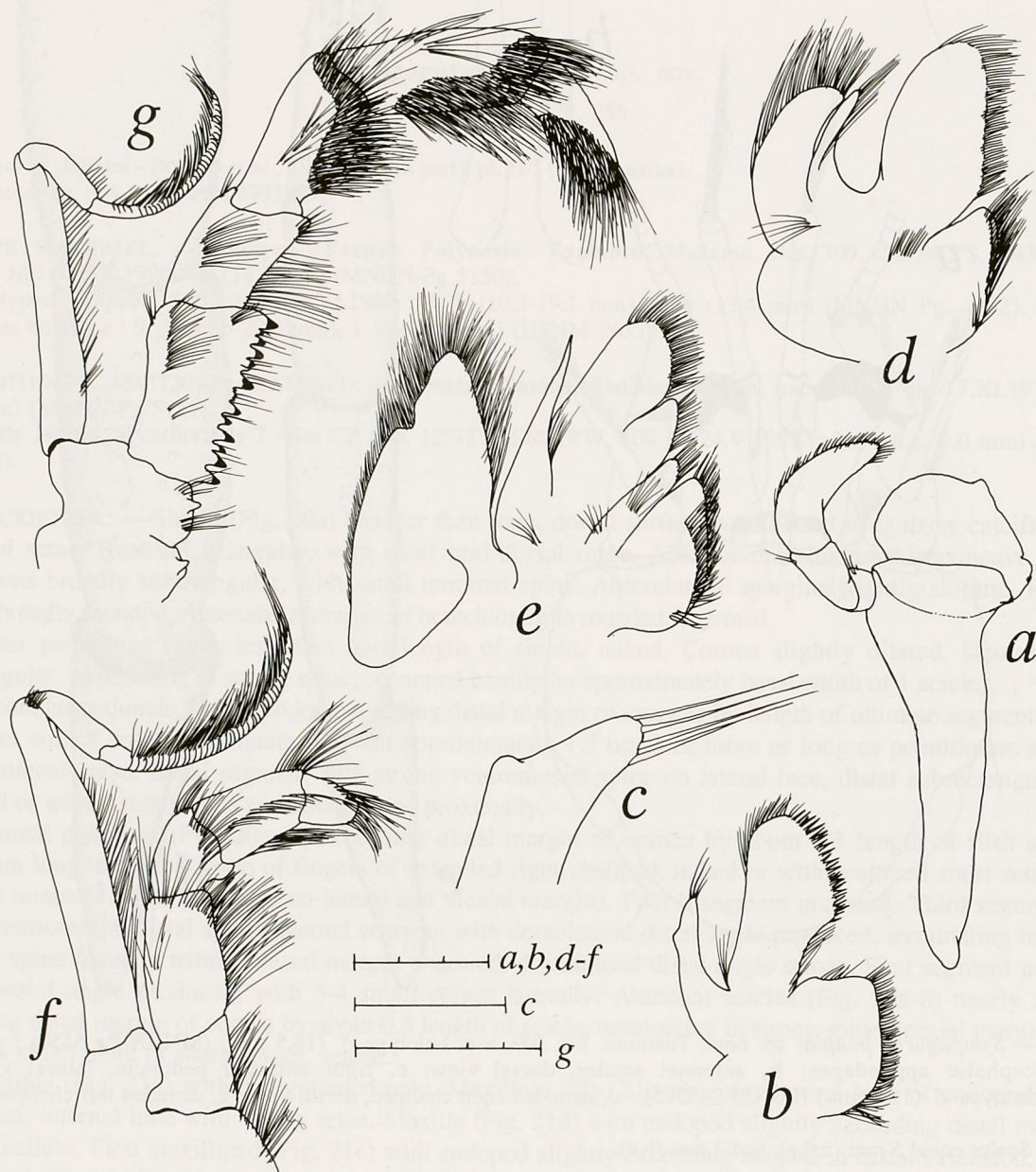


FIG. 21. — *Sympagurus poupini* sp. nov., holotype ♂ (18.5 mm), Tuamotu, Stn 309 (MNHN-Pg 5150). Left mouthparts, internal view : a, mandible; b, maxillule; c, distal end of endopod of same; d, maxilla; e, first maxilliped; f, second maxilliped; g, third maxilliped.

Scales equal 3 mm (a,b,d-f), 1 mm (c), and 5 mm (g).



Left cheliped (Fig. 20e) evenly calcified, covered with dense setae obscuring surfaces of merus, carpus, palm, and proximal half of fingers. Fingers terminating in small corneous claws crossed when closed; dorsal and ventral surfaces with scattered tufts of setae. Fixed finger with dorsal and ventral surfaces unarmed; cutting edge with evenly-sized, small calcareous teeth interspersed with small, fused corneous spinules. Dactyl subequal in length to palm; cutting edge with row of small, fused corneous spinules; dorsal and ventral surfaces unarmed. Palm smooth, except for few scattered small tubercles on lateral face proximally. Carpus with well-spaced, small spines on dorsal margin and dorsomesial face; ventrolateral distal margin with row of small spines. Merus with transverse row of setae near dorsodistal margin; surfaces unarmed except for row of small spines on ventrolateral and ventromesial margins. Ischium with ventral face armed with small spines. Coxa with setose ventromesial margin.

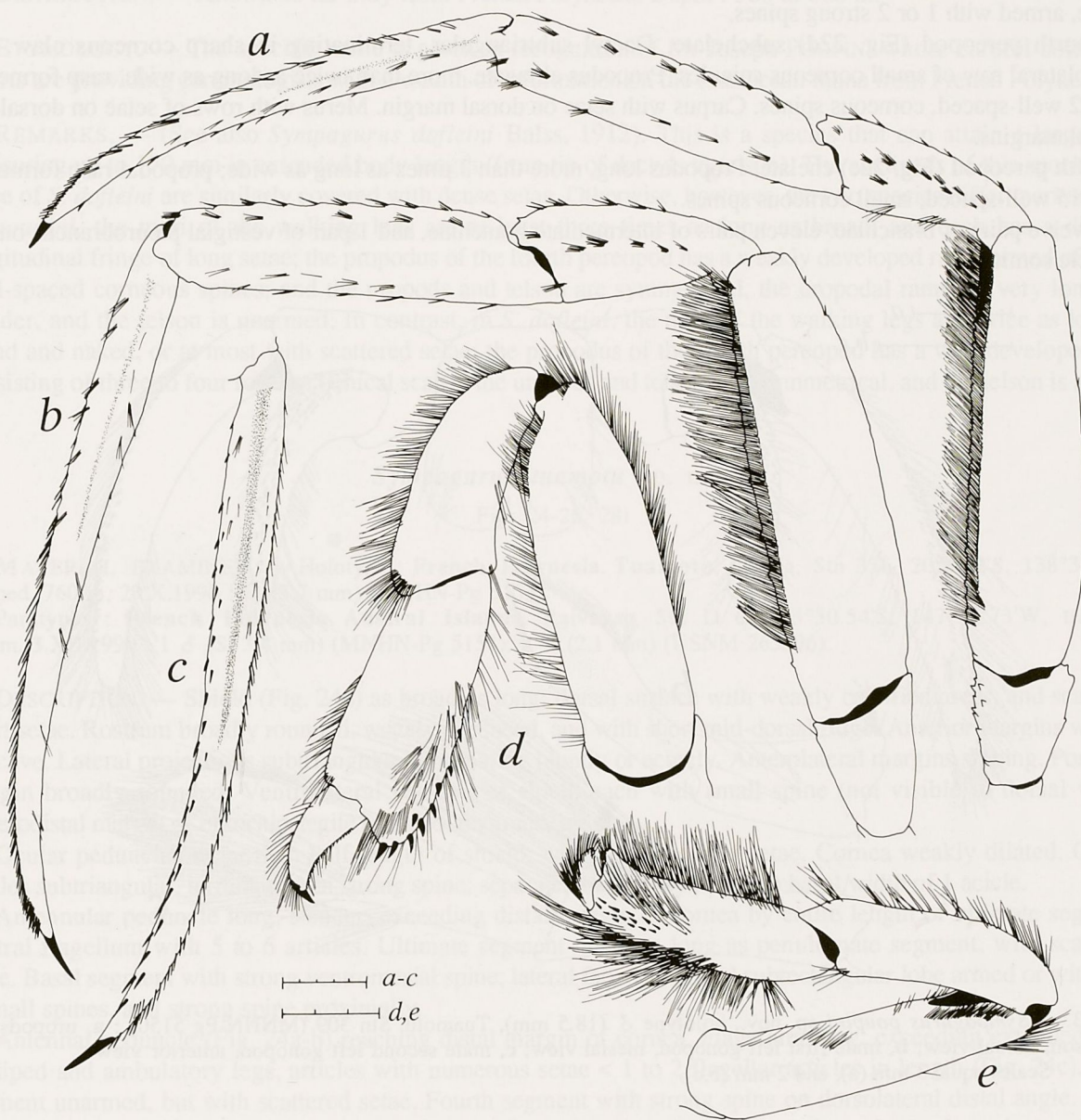


FIG. 22. — *Sympagurus poupini* sp. nov., holotype ♂ (18.5 mm), Tuamotu, Stn 309 (MNHN-Pg 5150) : a, second left pereopod, lateral view; b, third left pereopod, lateral view; c, dactyl of same, mesial view; d, fourth left pereopod, lateral view; e, fifth left pereopod, lateral view.

Scales equal 5 mm (a-c), and 3 mm (d,e).



Ambulatory legs (Fig. 22a-c) similar from right to left, long, reaching to tips of fingers of extended right cheliped. Dactyl long, approximately 1.7 times as long as propodus (second pereopod), or 2.2 times as long as propodus (third pereopod), terminating in sharp corneous claw; ventral margin armed with irregular row of about 25 to 30 small corneous spines; dorsal margin with row of bristle-like setae; lateral and mesial faces with shallow, longitudinal sulcus on proximal half (deeper on mesial face). Propodi with row of short bristles-like setae on dorsal and ventral margins, and dorsolateral and ventrolateral rows of tufts of short setae. Carpus with small dorsodistal spine, row of bristle-like setae dorsally, and row of tufts of short setae medially on lateral face. Merus with short setae on dorsal margin, distinct ventrolateral fringe of long setae, and row of blunt to sharp tubercles on ventral margin (tubercles more numerous on second pereopod). Ischium armed with spines on ventral face (second pereopod), or unarmed (third pereopod). Coxae unarmed. Anterior lobe of sternite of third pereopods sloping, setose, armed with 1 or 2 strong spines.

Fourth pereopod (Fig. 22d) subchelate. Dactyl subtriangular, terminating in sharp corneous claw, and ventrolateral row of small corneous spinules. Propodus elongate, more than twice as long as wide, rasp formed of 7 to 12 well-spaced, corneous spines. Carpus with setae on dorsal margin. Merus with rows of setae on dorsal and ventral margins.

Fifth pereopod (Fig. 22e) chelate. Propodus long, more than 3 times as long as wide; propodal rasp formed of 10 to 15 well-spaced, small corneous spines.

Twelve pairs of branchiae: eleven pairs of intermediate branchiae, and 1 pair of vestigial pleurobranchs on last thoracic somite.

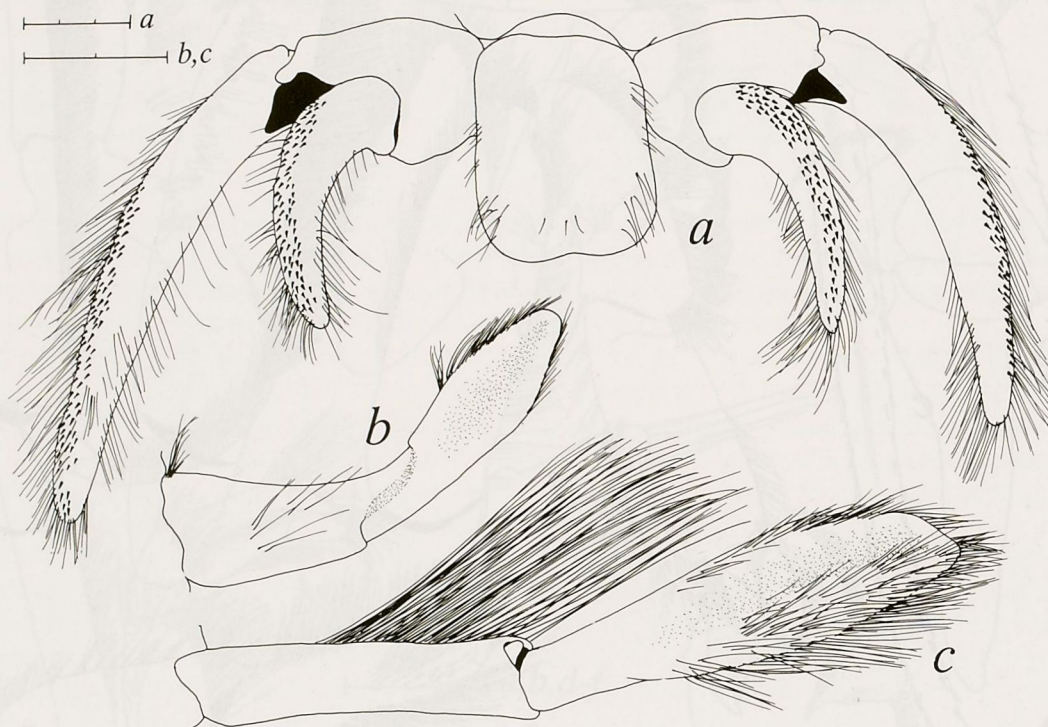


FIG. 23. — *Sympagurus poupini* sp. nov., holotype ♂ (18.5 mm), Tuamotu, Stn 309 (MNHN-Pg 5150) : a, uropods and telson, dorsal view; b, male first left gonopod, mesial view; c, male second left gonopod, anterior view. Scales equal 3 mm (a), and 2 mm (b,c).

Uropods and telson (Fig. 23a) symmetrical or nearly so. Uropods with endopod and exopod very elongated, exopod approximately 7.5 times as long as wide, endopod approximately 4.5 as long as wide; rasps of exopod and endopod formed of 3 to 4 rows of small corneous spines. Telson lacking transverse suture, dorsal surface with scattered setae; posterior margin faintly bilobed, unarmed.



Male with paired first and second gonopods well developed. First gonopod (Fig. 23b) with moderately concave distal lobe. Second gonopod (Fig. 23c) usually with small exopod on left side; distal segment setose on lateral and mesial margins. Female often with paired rudimentary first pleopods; with vestigial second right pleopod.

COLOR (Fig. 28h). — Overall color cream yellow. Dactyls and propodi of walking legs with white stripe faintly visible.

HABITAT AND SYMBIOTIC ASSOCIATIONS. — All specimens found living with an undetermined species of actinian entirely covering the abdomen of the hermit crab.

DISTRIBUTION. — Known so far only from French Polynesia. Depth : 300 to 600 m.

ETYMOLOGY. — The specific name is given in recognition of Mr Joseph POUPIN, whose careful collecting efforts are providing carcinologists with a wealth of information on the crustacean fauna from French Polynesia.

REMARKS. — (See also *Sympagurus dofleini* Balss, 1912). This is a species that can attain a large size, measuring up to 170 mm in extended body length (from tip of dactyls to telson). The chelipeds of this species and those of *S. dofleini* are similarly covered with dense setae. Otherwise, however, the two species differ markedly. In *S. poupini*, the meri of the walking legs are at least three times as long as broad, and each has a distinct longitudinal fringe of long setae; the propodus of the fourth pereopod has a weakly developed rasp formed of a few well-spaced corneous spines; and the uropods and telson are symmetrical, the uropodal rami are very long and slender, and the telson is unarmed. In contrast, in *S. dofleini*, the meri of the walking legs are twice as long as broad and naked, or at most with scattered setae; the propodus of the fourth pereopod has a well developed rasp consisting of three to four rows of conical scales; the uropods and telson are asymmetrical, and the telson is armed.

*Sympagurus tuamotu* sp. nov.

Figs 24-26, 28i

MATERIAL EXAMINED. — Holotype : **French Polynesia. Tuamotu.** Tureia, Stn 336, 20°46.2'S, 138°34.6'W, trapped, 760 m, 29.X.1990 : ♀ (3.7 mm) (MNHN-Pg 5153).

Paratypes : **French Polynesia. Austral Islands.** Raivavae, Stn D 66, 23°50.54'S, 147°42.73'W, trapped, 400 m, 3.XII.1990 : 1 ♂ (Sl 3.4 mm) (MNHN-Pg 5154); 1 ♀ (2.1 mm) (USNM 265396).

DESCRIPTION. — Shield (Fig. 24a) as broad as long; dorsal surface with weakly calcified areas, and scattered short setae. Rostrum broadly rounded, weakly produced, and with short mid-dorsal ridge. Anterior margins weakly concave. Lateral projections subtriangular, terminating bluntly or acutely. Anterolateral margins sloping. Posterior margin broadly rounded. Ventrolateral margins of shield each with small spine (not visible in dorsal view). Anterodistal margin of branchiostegite rounded, unarmed, setose.

Ocular peduncles more than half length of shield, with dorsal row of setae. Cornea weakly dilated. Ocular acicles subtriangular, terminating in strong spine; separated basally by less than basal width of 1 acicle.

Antennular peduncle long, slender, exceeding distal margin of cornea by entire length of ultimate segment; ventral flagellum with 5 to 6 articles. Ultimate segment twice as long as penultimate segment, with scattered setae. Basal segment with strong ventromesial spine; lateral face with distal subrectangular lobe armed or with 1 or 2 small spines, and strong spine proximally.

Antennal peduncle (Fig. 24a-b) reaching distal margin of cornea. Flagellum long, exceeding extended right cheliped and ambulatory legs, articles with numerous setae < 1 to 2 flagellar articles in length (Fig. 24c). Fifth segment unarmed, but with scattered setae. Fourth segment with strong spine on dorsolateral distal angle. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, simple or trifid spine (occasionally with 1-3 small spines dorsally); mesial margin with spine on dorsolateral distal angle. First segment with 1 or 2 small spines on lateral face; ventromesial angle produced, with 3 to 4 small spines laterally. Antennal acicles slightly curved outward (in dorsal view), at most



slightly exceeding distal margins of corneae, terminating in strong spine; mesial margin armed with row 11 to 12 spines (6-8 spines in small specimens shield length < 2.1 mm), setose.

Mandible (Fig. 25a) with 3-segmented palp. Maxillule (Fig. 25b) with external lobe of endopod weakly developed, internal lobe with 3 long, well-spaced setae. Maxilla (Fig. 25c) with endopod exceeding distal margin of scaphognathite. First maxilliped (Fig. 25d) with endopod exceeding exopod in distal extension. Second maxilliped (Fig. 25e) without distinguishing characters. Third maxilliped (Fig. 25f) with crista dentata of 7 corneous-tipped teeth; coxa with 2 teeth mesially, basis with 1 tooth mesially. Sternite of third maxillipeds with small spine on each side of midline. Epistome with long, slender spine strongly curved upward.

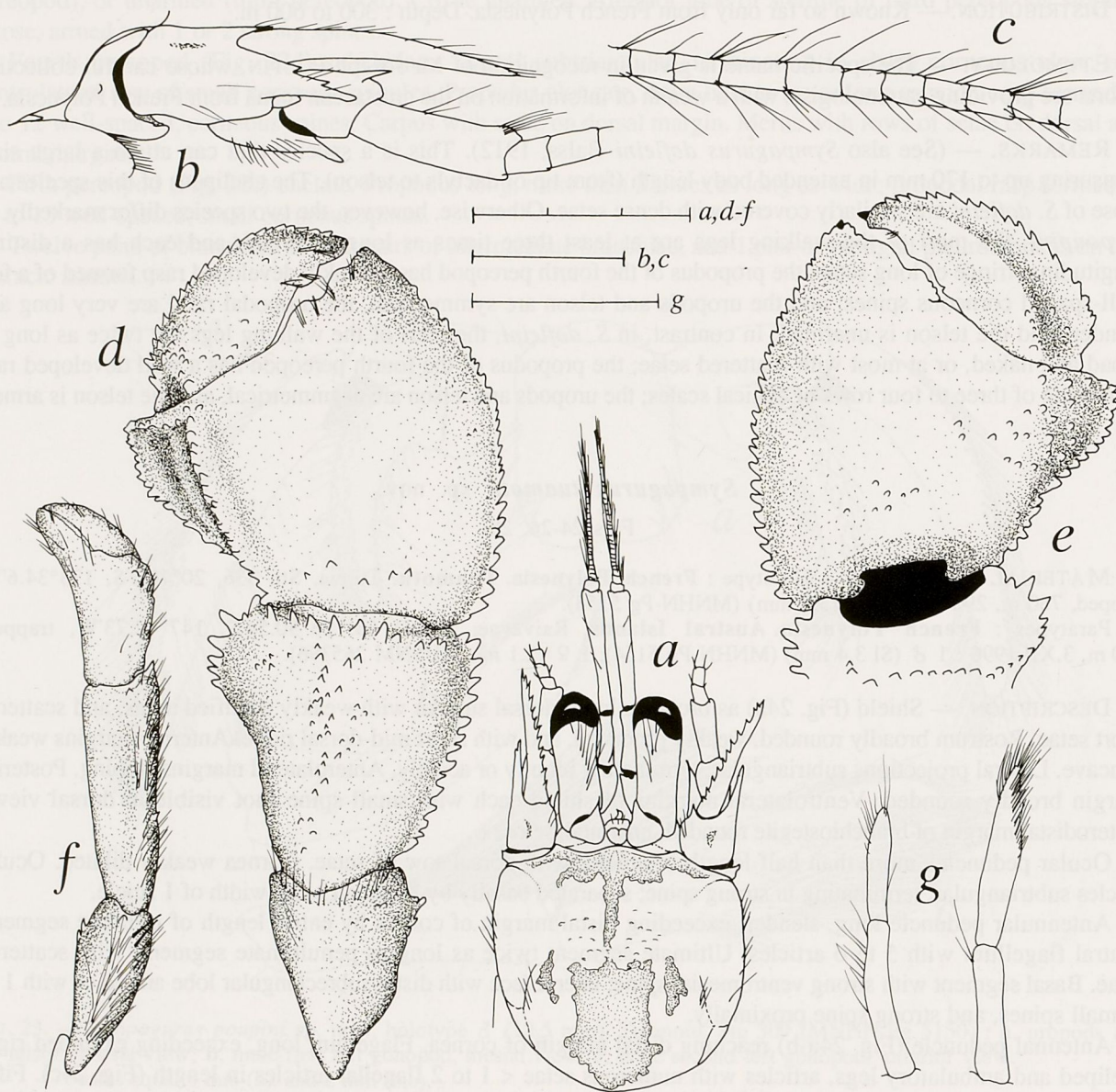


FIG. 24. — *Sympagurus tuamotu* sp. nov. a-e, holotype ♀ (3.7 mm), Tuamotu, Stn 336 (MNHN-Pg 5153) : a, shield and cephalic appendages; b, right antennal peduncle, lateral view; c, midportion of antennal flagellum; d, right cheliped, dorsal view; e, chela of same, ventral view. — f-g, paratype ♂ (3.4 mm), Austral Islands, Stn D 66 (MNHN-Pg 5154) : f, left cheliped, dorsal view; g, male second gonopods (left on left, right on right), anterior view.

Scales equal 3 mm (a,d-f), 1 mm (b,c), and 1 mm (g).



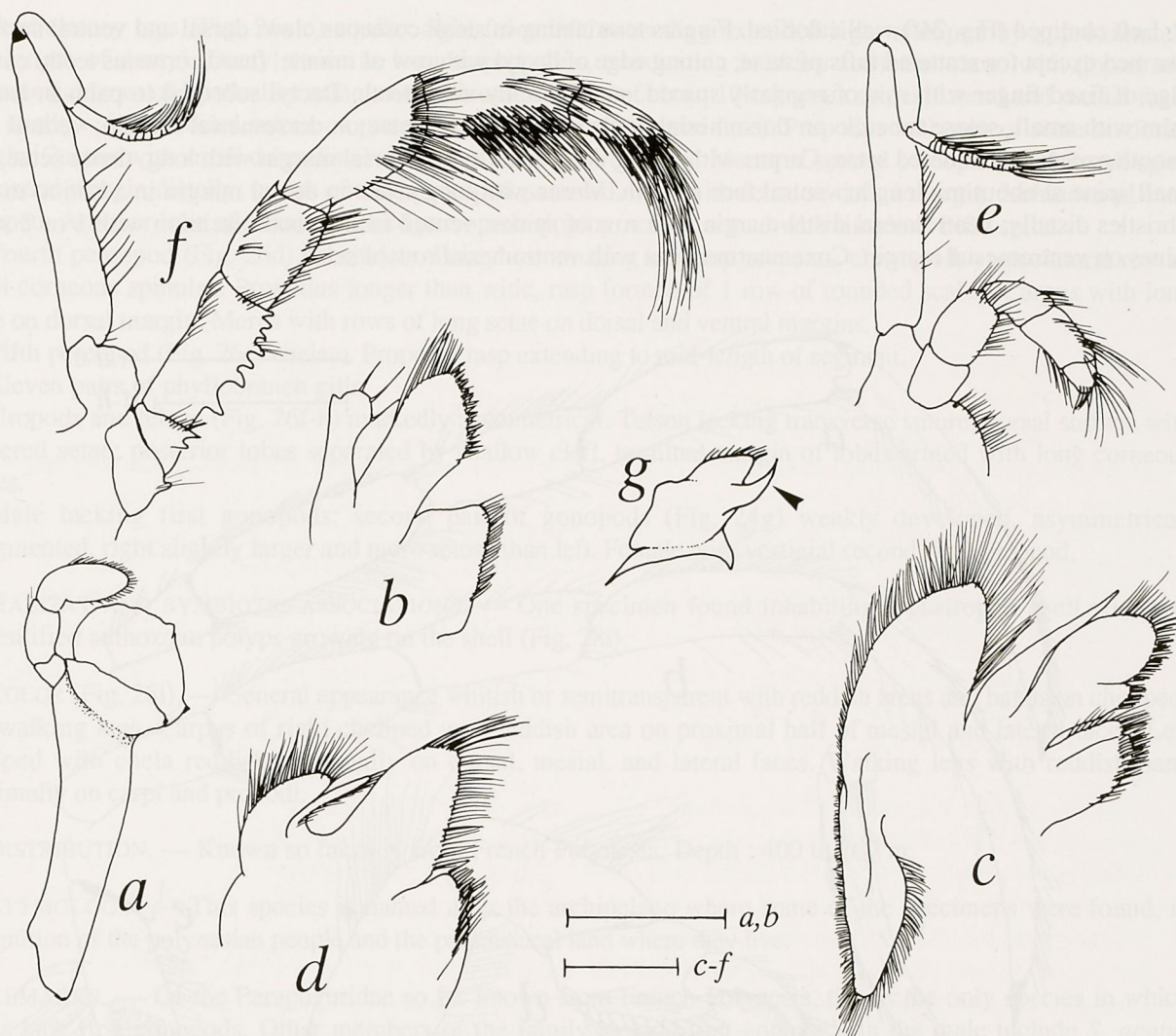


FIG. 25. — *Sympagurus tuamotu* sp. nov., paratype ♂ (3.4 mm), Austral Islands, Stn D 66 (MNHN-Pg 5154). Left mouthparts, internal view : a, mandible; b, maxillule; c, maxilla; d, first maxilliped; e, second maxilliped; f, third maxilliped; g, epistome, dorsolateral view, showing epistomial spine (arrow).

Scales equal 1 mm (a,b), and 0.5 mm (c-f).

Chelipeds markedly dissimilar. Right cheliped (Fig. 24d-e, 28i) massive, with dense, plumose setae on distal half of chela. Fingers curved ventromesially, terminating in small, usually blunt corneous claw; cutting edges with irregularly-sized calcareous teeth. Dactyl slightly longer than length of mesial margin of palm, and set at strongly oblique angle to longitudinal axis of palm; mesial margin broadly curved, well defined by row of blunt or sharp spines diminishing in size distally; dorsal face with scattered small tubercles, ventral face smooth, ventromesial face concave. Fixed finger broad at base, dorsal and ventral faces smooth. Palm broader than long, lateral margin well delimited by row of blunt to sharp spines; mesial face strongly concave, expanded distally, smooth or with scattered small tubercles; dorsomesial and ventromesial margins well delimited by row of blunt or sharp spines; dorsal surface smooth except for few small tubercles proximally; ventral surface smooth except for few small tubercles distolaterally. Carpus with lateral margin well delimited by row of spines; dorsal face with irregular rows of small spines; dorsodistal margin with row of spines; ventromesial distal margin mesially expanded, with row of spines; ventral face with scattered small tubercles. Merus with dorsal surface unarmed except for few bristle-like setae, distally; ventromesial margin with row of small spines. Ischium with ventromesial row of small spines. Coxa with row of small spines on ventrodistal margin, and ventromesial row of setae.



Left cheliped (Fig. 24f) well calcified. Fingers terminating in small corneous claw; dorsal and ventral surfaces unarmed except for scattered tufts of setae; cutting edge of dactyl with row of minute, fused corneous teeth; cutting edge of fixed finger with row of regularly spaced, small, evenly-sized teeth. Dactyl subequal to palm in length. Palm with small, setose tubercle on dorsomesial angle, and scattered setae on dorsomesial margin; ventral face smooth except for scattered setae. Carpus with strong dorsodistal spine; dorsal margin with long, dense setae, and small spine at about midlength; ventral face smooth. Merus with long setae on dorsal margin in addition to 2 to 4 bristles distally; ventrolateral distal margin with row of spines; ventral face smooth. Ischium with 1 or 2 small spines on ventromesial margin. Coxa unarmed, but with ventromesial row of setae.

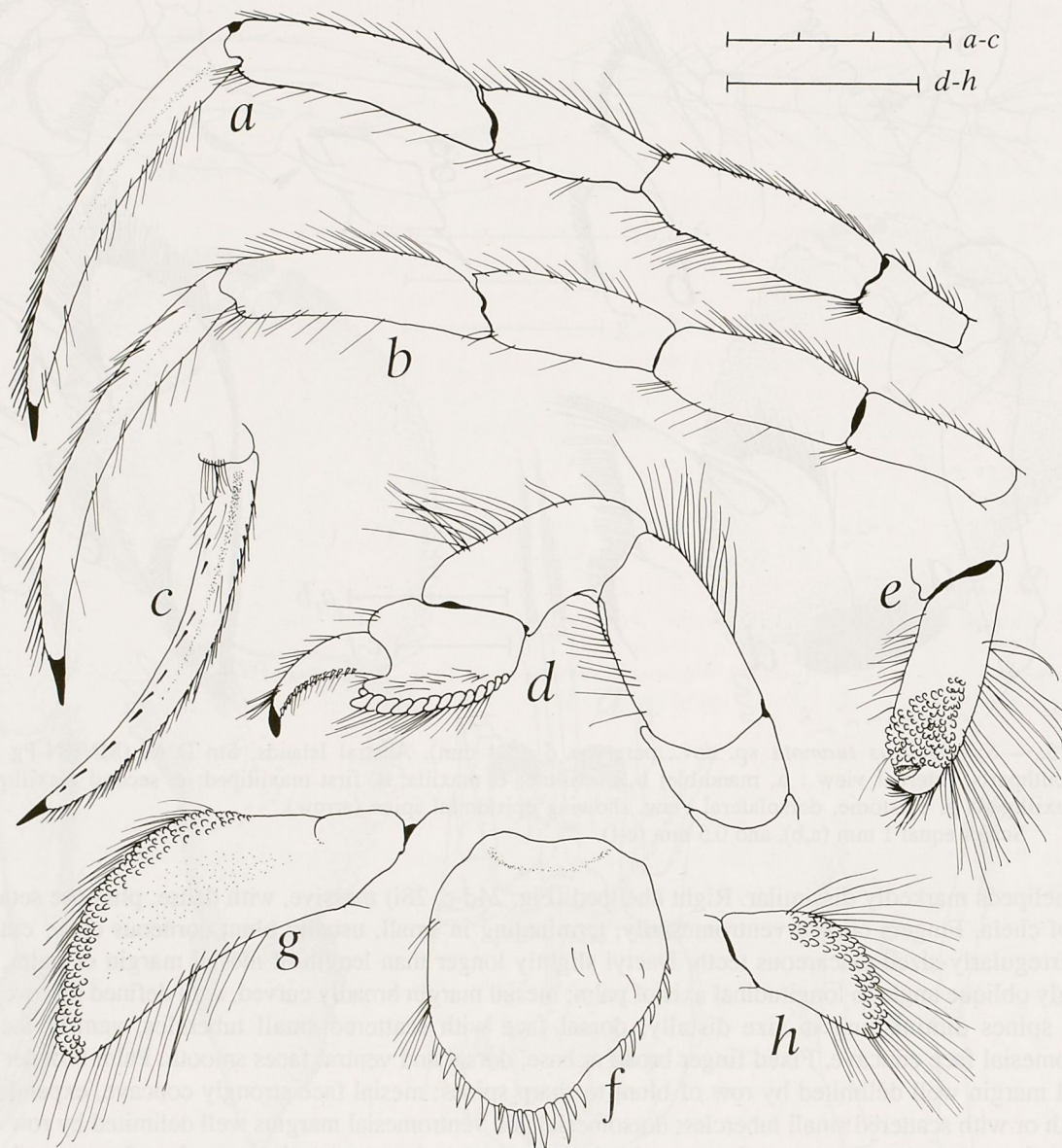


FIG. 26. — *Sympagurus tuamotu* sp. nov., holotype ♀ (3.7 mm), Tuamotu, Stn 336 (MNHN-Pg 5153) : a, second left pereopod, lateral view; b, third left pereopod, lateral view; c, dactyl of same, mesial view; d, fourth left pereopod, lateral view; e, propodus and dactyl of fifth left pereopod, lateral view; f, telson, dorsal view; g, exopod of left uropod, dorsal view; h, exopod of right uropod, dorsal view.

Scales equal 3 mm (a-c), and 1 mm (d-h).



Ambulatory legs (Fig. 26a-c) similar right from left, exceeding extended right cheliped by approximately 0.25 length of dactyl. Dactyl twice as long as propodus, terminating in sharp corneous claw; with dorsal and dorsomesial rows of bristle-like setae, and ventromesial row of about 10 corneous spines; lateral and mesial faces with shallow, longitudinal sulcus on proximal half (deeper on mesial face). Propodus with row of setae on dorsal margin. Carpus with small dorsodistal spine, and long setae dorsally. Merus of second pereopods with small spine on ventral margin distally, merus of third pereopod unarmed, both with setae on dorsal margin. Ischium and coxa unarmed. Anterior lobe of sternite of third pereopods sloping, setose, armed with simple or bifid spine.

Fourth pereopod (Fig. 26d) subchelate. Dactyl terminating in sharp corneous claw; with ventrolateral row of small corneous spinules. Propodus longer than wide, rasp formed of 1 row of rounded scales. Carpus with long setae on dorsal margin. Merus with rows of long setae on dorsal and ventral margins.

Fifth pereopod (Fig. 26e) chelate. Propodal rasp extending to mid-length of segment.

Eleven pairs of phyllobranch gills.

Uropods and telson (Fig. 26f-h) markedly asymmetrical. Telson lacking transverse suture; dorsal surface with scattered setae; posterior lobes separated by shallow cleft, terminal margin of lobes armed with long corneous spines.

Male lacking first gonopods; second pair of gonopods (Fig. 24g) weakly developed, asymmetrical, 2-segmented, right slightly larger and more setose than left. Female with vestigial second right pleopod.

HABITAT AND SYMBIOTIC ASSOCIATIONS. — One specimen found inhabiting a gastropod shell with two unidentified anthozoan polyps growing on the shell (Fig. 28i).

COLOR (Fig. 28i). — General appearance whitish or semitransparent with reddish areas and bands on chelipeds and walking legs. Carpus of right cheliped with reddish area on proximal half of mesial and lateral faces. Left cheliped with chela reddish proximally on dorsal, mesial, and lateral faces. Walking legs with reddish band proximally on carpi and propodi.

DISTRIBUTION. — Known so far only from French Polynesia. Depth : 400 to 760 m.

ETYMOLOGY. — This species is named after the archipelago where some of the specimens were found, in recognition of the polynesian people and the paradisiacal land where they live.

REMARKS. — Of the Parapaguridae so far known from French Polynesia, this is the only species in which males lack first gonopods. Other members of the family lacking first gonopods in the male include *S. acutus* de Saint Laurent, 1972, *S. a. bicarinatus* de Saint Laurent, 1972, *S. a. hirsutus* de Saint Laurent, 1972, *S. haigae* de Saint Laurent, 1972, *S. hobbiti* (Macpherson, 1983), *S. orientalis* de Saint Laurent, 1972, and *S. ruticheles* (A. Milne Edwards, 1891).

#### INTERSPECIFIC RELATIONSHIPS OF *SYMPAGURUS* SPECIES

In reinstating the genus *Sympagurus* Smith, 1883, LEMAITRE (1989) noted its heterogeneity, and suggested a number of characters that could be used to evaluate the species. Examination of representative material of all species of *Sympagurus* from throughout the world has shown that they can be arranged in at least three informal groups of species. Although the phylogenetic significance of such grouping is uncertain at this time, this arrangement serves at least as an aid in identifying the species.

Group 1 is defined by the presence of a slender epistomial spine that is strongly curved upward (e.g. Fig. 25g); it includes nine species (asterisks indicate species found in French Polynesia) :

*Sympagurus africanus* (de Saint Laurent, 1972); eastern Atlantic and southwestern Indian Ocean; 235 to 555 m.

*Sympagurus bicristatus* (A. Milne Edwards, 1880); western and eastern Atlantic; 270 to 1070 m.

*Sympagurus gracilis* (Henderson, 1888), western and eastern Atlantic; 146 to 634 m.



- Sympagurus haigae* (de Saint Laurent, 1972); eastern Pacific; 55 to 923 m.  
*Sympagurus indicus* (Alcock, 1905); IndoPacific; 380 to 1000 m.  
*Sympagurus minutus* (Henderson, 1896); IndoPacific; 800 to 2300 m.  
*Sympagurus monstrosus* (Alcock, 1894); IndoPacific; 200 to 1000 m.  
*Sympagurus orientalis* (de Saint Laurent, 1972); IndoPacific; 300 to 575 m.  
 \**Sympagurus tuamotu* sp. nov.; Pacific (French Polynesia); 400 to 760 m.

Group 2 is defined by the presence of a vestigial pleurobranch on each side of the last thoracic somite (see LEMAITRE, 1989 : 10, fig. 2G), and includes ten species :

- Sympagurus acinops* Lemaître, 1989; western and eastern Atlantic; 1246 to 2537 m.  
 \**Sympagurus affinis* (Henderson, 1888); IndoPacific; 360 to 914 m.  
*Sympagurus andersoni* (Henderson, 1896), new combination; IndoPacific; 700 to 1300 m.  
*Sympagurus brevipes* (de Saint Laurent, 1972); IndoPacific; 200 to 600 m.  
*Sympagurus dimorphus* (Studer, 1883); southern hemisphere from 22° to 57°S; 110 to 1995 m.  
 \**Sympagurus dofleini* (Balss, 1912); western and central Pacific, questionably the western Indian Ocean; 350 to 900 m.  
*Sympagurus pictus* Smith, 1883; western Atlantic; 180 to 2322 m.  
 \**Sympagurus planimanus* (de Saint Laurent, 1972); IndoPacific; 100 to 600 m.  
 \**Sympagurus poupini* sp. nov.; Pacific (French Polynesia, Western Samoa, Wallis Island); 300 to 600 m.  
 \**Sympagurus trispinosus* (Balss, 1911); IndoPacific; 580 to 1412 m.

Group 3, a heterogeneous group, includes the remaining 14 species and three subspecies, which have not been found to share any particular character. Although some members of this group have an epistomial spine, it is always straight, not curved upwardly, and all lack vestigial pleurobranches on the last thoracic somite. This group includes :

- Sympagurus acutus acutus* (de Saint Laurent, 1972); IndoPacific; 160 to 560 m.  
*Sympagurus acutus bicarinatus* (de Saint Laurent, 1972); Pacific (Philippines); 1070 m.  
*Sympagurus acutus hirsutus* (de Saint Laurent, 1972); IndoPacific; 240 to 400 m.  
 \**Sympagurus boletifer* (de Saint Laurent, 1972); IndoPacific; 85 to 350 m.  
 \**Sympagurus bougainvillei* sp. nov.; Pacific (French Polynesia); 190 to 280 m.  
*Sympagurus chuni* (Balss, 1911); western Indian Ocean; 638 to 977 m.  
*Sympagurus curvispina* (de Saint Laurent, 1974); Indian Ocean (Amsterdam Island); 50 to 60 m.  
*Sympagurus diogenes* Whitelegge, 1900; IndoPacific; 60 to 180 m.  
*Sympagurus hobbiti* (Macpherson, 1983); southeastern Atlantic; 250 m.  
*Sympagurus macrocerus* (Forest, 1955); eastern Atlantic; 128 to 280 m.  
*Sympagurus pacificus* Edmondson, 1925; Pacific (Hawaii); 366 m.  
*Sympagurus pilimanus* (A. Milne Edwards, 1880); western Atlantic; 36 to 2034 m.  
*Sympagurus rugosus* (de Saint Laurent, 1972); Pacific (Hawaii); 240 to 270 m.  
*Sympagurus ruticheles* (A. Milne Edwards, 1891); Pacific (Hawaiian Islands), and eastern Atlantic; 200 to 1440 m.  
*Sympagurus spinimanus* (Balss, 1911); western Indian Ocean; 277 m.  
*Sympagurus tuberculosus* (de Saint Laurent, 1972); Pacific (Hawaii); 220 to 300 m.  
 \**Sympagurus wallisi* sp. nov.; Pacific (French Polynesia); 240 to 280 m.

The polarity of the characters used to define these three groups is unclear. The presence of an epistomial spine (as defined by LEMAITRE, 1989 : 8, fig. 1A) in many parapagurids is a unique condition among all hermit crabs, except for one species of the family Pylochelidae, *Parapylocheles scorpio* (Alcock, 1894). In this pylochelid, the epistome is armed with three short, straight spines (see FOREST, 1987, fig. 4b). In parapagurids the epistome can be armed or unarmed, depending on the species. The epistome can have a curved spine such as in species of Group 1, or a straight spine such as in some species of Groups 2 and 3. In species of Group 1, the curved epistomial spine is invariably present in all specimens. In species of Groups 2 and 3, the occurrence of an epistomial spine can vary considerably within the same species, and in some species is always absent.



The presence of an armed epistome in a species (*P. scorio*) of pylochelid, a group traditionally considered primitive (e.g. BOAS, 1926; RUSSELL, 1962), could be cited as evidence of the plesiomorphic nature of this condition. However, given FOREST's (1987) recent contention that pylochelids are probably not a primitive but an advanced group, such assumption is questionable.

Similarly, the presence in species of Group 2 of a vestigial pleurobranch on each side of the last thoracic somite, is a unique condition among all hermit crabs. Species of Groups 1 and 3 lack the vestigial pleurobranchs. Presumably, the evolutionary process leading to the loss of branchiae on the last thoracic somite in species of Group 2, is not complete. A full determination of the phylogenetic significance of this grouping will have to await a detailed character analysis of all members of the genus *Sympagurus* and family Parapaguridae.

### ACKNOWLEDGMENTS

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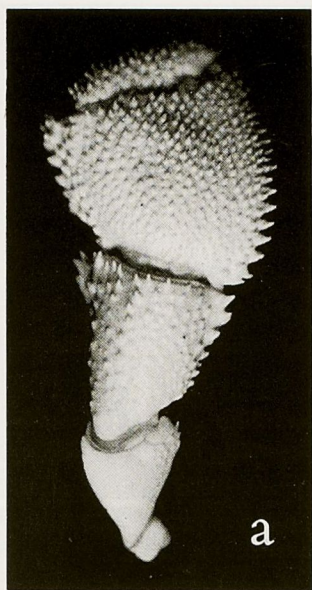
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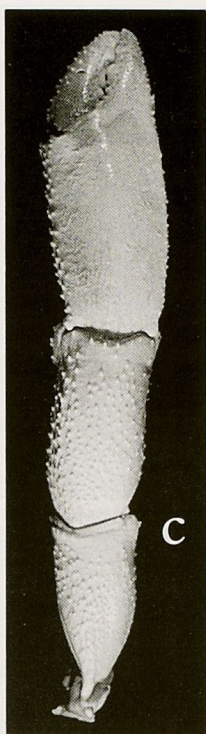
FIG. 27. — Right cheliped. **a-b** : *Sympagurus boletifer* (de Saint Laurent, 1972), ♂ (5.7 mm), Austral Islands, Stn 344 (MNHN-Pg 5137) : **a**, dorsal view; **b**, ventral view. — **c-f** : *Sympagurus dofleini* (Balss, 1912), Tuamotu, Stn 311 (MNHN-Pg 5139) : **c**, ♂ (21.6 mm), denuded, dorsal view; **d**, same, mesial view; **e**, ♂ (21.8 mm), dorsal view; **f**, ♀ (19.5 mm), denuded, dorsal view. — **g** : *Sympagurus diogenes* Whitelegge, 1900, ♂ (12.2 mm), southeastern Australia (USNM 64604) : dorsal view. — **h-i** : *Sympagurus wallisi* sp. nov., ♂ (12.5 mm), Tuamotu, Stn 308 (MNHN-Pg 5145) : **h**, dorsal view; **i**, mesial view. — **j** : *Sympagurus bougainvillei* sp. nov., holotype ♂ (11.9 mm), Tuamotu, Stn 308 (MNHN-Pg 5148) : dorsal view. — **k** : *Sympagurus poupini* sp. nov., ♂ (20.0 mm), Tuamotu, Stn 309 (USNM 265395) : dorsal view.

a,b: x 4.7; c,d: x 1.2; e: x 1.1; f: x 1.3; g: x 1.3; h,i: x 3.1; j: x 3.2; k: x 2.

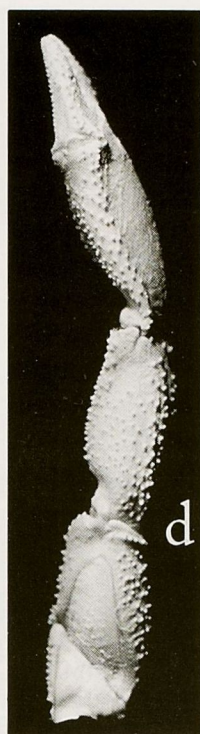




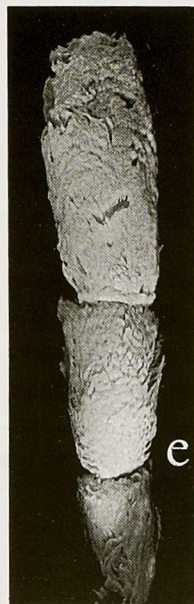
a



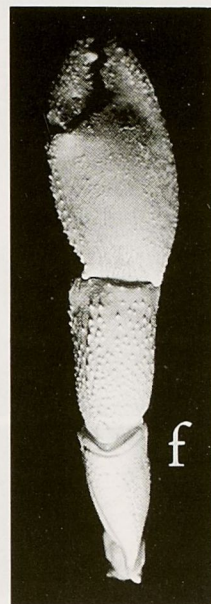
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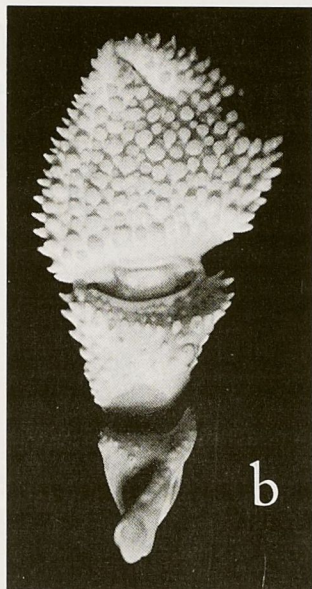
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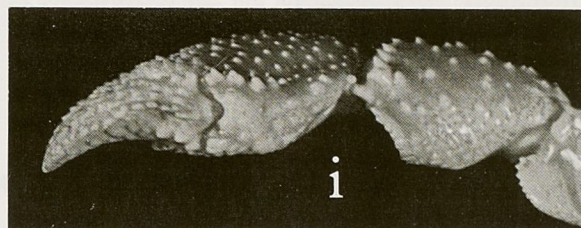
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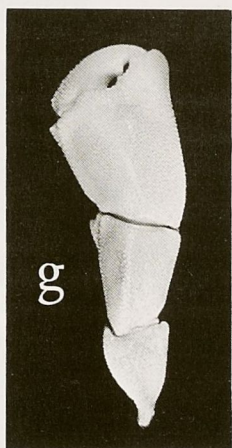
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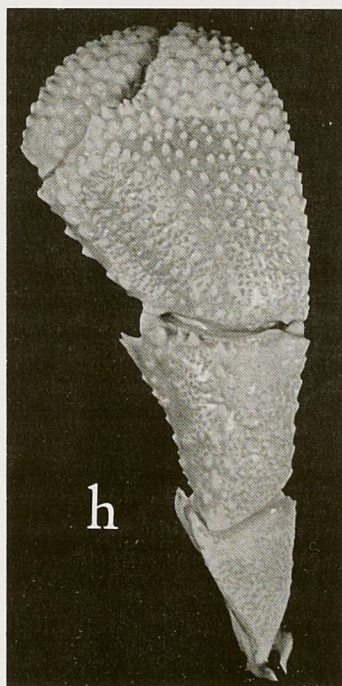
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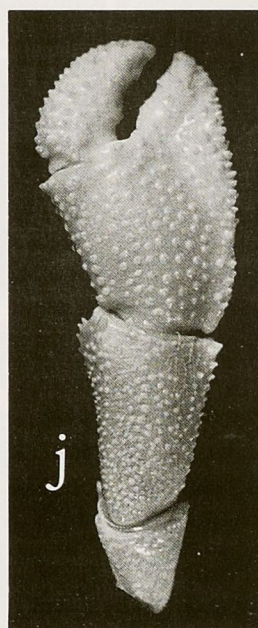
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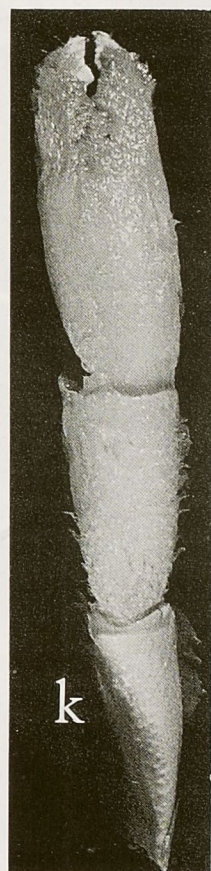
g



h



j



k



FIG. 28. — **a**, *Sympagurus affinis* (Henderson, 1888), Rurutu, Stn 339 (MNHN-Pg 5136). — **b-c**, *Sympagurus boletifer* (de Saint Laurent, 1972), Austral Islands, Stn 344 (MNHN-Pg 5137) : **b**, dorsal view; **c**, anterior portion, ventral view. — **d**, *Sympagurus dofleini* (Balss, 1912), specimen shown along side of zoanthid symbiont, Gambier Islands, Stn 311 (MNHN-Pg 5139). — **e**, *Sympagurus trispinosus* (Balss, 1911), Tuamotu, Stn. 309 (MNHN-Pg 5143). — **f**, *Sympagurus wallisi* sp. nov., dorsal view, Tuamotu, Stn 231 (USNM 265393). — **g**, *Sympagurus bougainvillei* sp. nov., anterior portion, dorsal view, Tuamotu, Stn 308 (USNM 265394). **h**, *Sympagurus poupini* sp. nov., specimen in actinian symbiont, Tuamotu, Stn 250. — **i**, *Sympagurus tuamotu* sp. nov., holotype specimen in shell with two anthozoan polyps, dorsal view, Tuamotu, Stn 336 (MNHN-Pg 5153).

[All photographs by J. POUPIN (SMCB)]



