7

Crustacea Decapoda: *Porcellanopagurus* Filhol and *Solitariopagurus* Türkay (Paguridae), from the New Caledonian area, Vanuatu and the Marquesas: new records, new species

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ABSTRACT

The very interesting and rather specialized hermit crab genera *Porcellanopagurus* and *Solitariopagurus* are represented in collections from the MUSORSTOM cruises to New Caledonia and the Marquesas by four species of the former and three of the latter. Among the species of *Porcellanopagurus*, three species, *P. tridentatus* Whitelegge, *P. filholi* de Saint Laurent & McLaughlin, and *P. chiltoni* de Saint Laurent & McLaughlin have heretofore been reported only from Australia and New Zealand; *P. haptodactylus* sp. nov. is a distinctive species, new to science. *Solitariopagurus triprobolus* Poupin & McLaughlin is reported for the first time beyond the islands of French Polynesia, and the range of *S. tuerkayi* McLaughlin is extended from the Kai and Tanimbar Island of Indonesia to New Caledonia, Vanuatu and Okinawa. A new species, *S. trullirostris* sp. nov., is described from New Caledonia and the Marquesas. The similarities and differences of the two genera are elucidated, and an apparently rare attribute, a terminal anus, common to some species of both is discussed.

The new species are fully described and illustrated, while diagnoses and illustrations of principal diagnostic characters are provided for the previously described species. Keys to the Indo- and western Pacific species of *Porcellanopagurus* and to the genus *Solitariopagurus* are included.

RÉSUMÉ

Crustacea Decapoda : *Porcellanopagurus* Filhol et *Solitariopagurus* Türkay (Paguridae) de la région néo-calédonienne, de Vanuatu, et des îles Marquises : nouvelles observations et nouvelles espèces.

Les genres très intéressants et plutôt spécialisés de bernard-l'ermite *Porcellanopagurus* et *Solitariopagurus* sont représentés, dans les collections rassemblées lors des campagnes MUSORSTOM en Nouvelle-Calédonie et aux îles Marquises, par quatre espèces appartenant au premier genre et trois au second. Parmi les espèces de *Porcellanopagurus*,

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trois espèces, *P. tridentatus* Whitelegge, *P. filholi* de Saint Laurent & McLaughlin, et *P. chiltoni* de Saint Laurent & McLaughlin n'avaient été récoltées, jusqu'à présent, qu'en Australie et en Nouvelle-Zélande. La quatrième espèce, *P. haptodactylus* sp. nov., est une espèce distincte, nouvelle pour la Science. *Solitariopagurus triprobolus* Poupin & McLaughlin est signalé pour la première fois en dehors de la Polynésie française, et la répartition de *S. tuerkayi* McLaughlin est étendue des îles Kai et Tanimbar, en Indonésie, à la Nouvelle-Calédonie, au Vanuatu et à Okinawa. Une espèce nouvelle, *S. trullirostris* sp. nov., est décrite de la Nouvelle-Calédonie et des îles Marquises. Les similarités et différences des deux genres sont mises en lumière et un caractère apparemment rare, un anus terminal, commun à quelques espèces des deux genres, est discuté.

Les espèces nouvelles sont décrites et illustrées en détail, tandis que des diagnoses et des illustrations des principaux caractères diagnostiques des espèces déjà décrites sont publiées. Des clés d'identification pour les espèces indo-ouest pacifiques de *Porcellanopagurus* et pour les espèces du genre *Solitariopagurus* sont proposées.

INTRODUCTION

The genera *Porcellanopagurus* Filhol, 1885a, and *Solitariopagurus* Türkay, 1986, have been distinguished from other pagurid genera principally by their broad, vaulted carapaces, each provided with prominent lateral carapace projections. In contrast to most other pagurid genera, it is the cephalothorax that provides the most reliable diagnostic characters, e.g., size, shape and development of the rostrums, lateral projections and lateral carapace lobes. Phylogenetically, *Porcellanopagurus* and *Solitariopagurus* have been considered classic examples of carcinization in the Anomura (e.g., BORRADAILE, 1916b; WOLFF, 1961; TÜRKAY, 1986), although the carcinization hypothesis has recently been disputed by McLAUGHLIN & LEMAITRE (1997, in press). *Porcellanopagurus* also has aroused behavioral and ecological interest because females have been reported as carrying their eggs dorsally, and species of this genus utilize limpet or halves of bivalve shells as protective coverings. *Solitariopagurus* is a more recently recognized genus, with fewer representatives; however, females similarly appear to carry their eggs dorsally, and for at least two species the protective covering of choice is a bivalve shell.

A seemingly rare morphological attribute shared by species of *Porcellanopagurus* and *Solitariopagurus*, but overlooked until now, sets these genera apart, not only from most other hermit crabs, but from the vast majority of decapods as well. In their description of *Porcellanopagurus adelocercus* McLaughlin & Hogarth, 1998, these authors commented that the telson was separated from the tergite of the sixth abdominal somite by membranous tissue, and that the amount of separation increased with increased animal size. Additionally, although they did not comment, they illustrated (McLAUGHLIN & HOGARTH, 1998, fig. 29) the very unusual condition of a terminal anus. In the new species of both *Porcellanopagurus* and *Solitariopagurus* described herein, the anal opening is also terminal. In these two taxa, the telson similarly would seem to be separated by some distance from the posterior margin of the tergite of the sixth abdominal somite, and carried ventrally under the abdomen. Thus it might appear that the terminal position of the anus could be a function of this correspondingly distinctive telsonal development. However, in the course of examining the three other species of *Porcellanopagurus* occurring in New Caledonia and the Marquesas, as well as both *Solitariopagurus tuerkayi* McLaughlin, 1997, and *S. triprobolus* Poupin & McLaughlin, 1996, the terminal, or nearly terminal, anal position appears to be characteristic of both genera and not simply correlated with the positioning of the telson.

Although the two genera are, in other morphological aspects, superficially also very similar, several aspects of their morphology immediately demarcate them. The most obvious are the lateral carapace projections. In *Porcellanopagurus* (Fig. 1a) two pairs of lobes develop from the lateral margins of the shield, anterior to the cervical groove; a pair of prominent posterior carapace lobes develop directly behind the cervical groove, connected usually by a narrow median element. In contrast, three pairs of lobes develop anterior to the cervical groove in *Solitariopagurus* (Fig. 1b) while the posterior lobes are represented by a moderately broad median and two small lateral elements. McLAUGHLIN (1997) referred to the *linea transversalis* of *S. tuerkayi* as being represented by a well calcified transverse rod. In reality, the *linea transversalis*, a chitinous hinge (cf. PILGRIM, 1973) separating the posterior margin of the shield from the median portion of the posterior carapace, is rarely visible externally in *Solitariopagurus* species. McLAUGHLIN's (1997) *linea transversalis* is actually the median element of the posterior carapace lobes of that species.

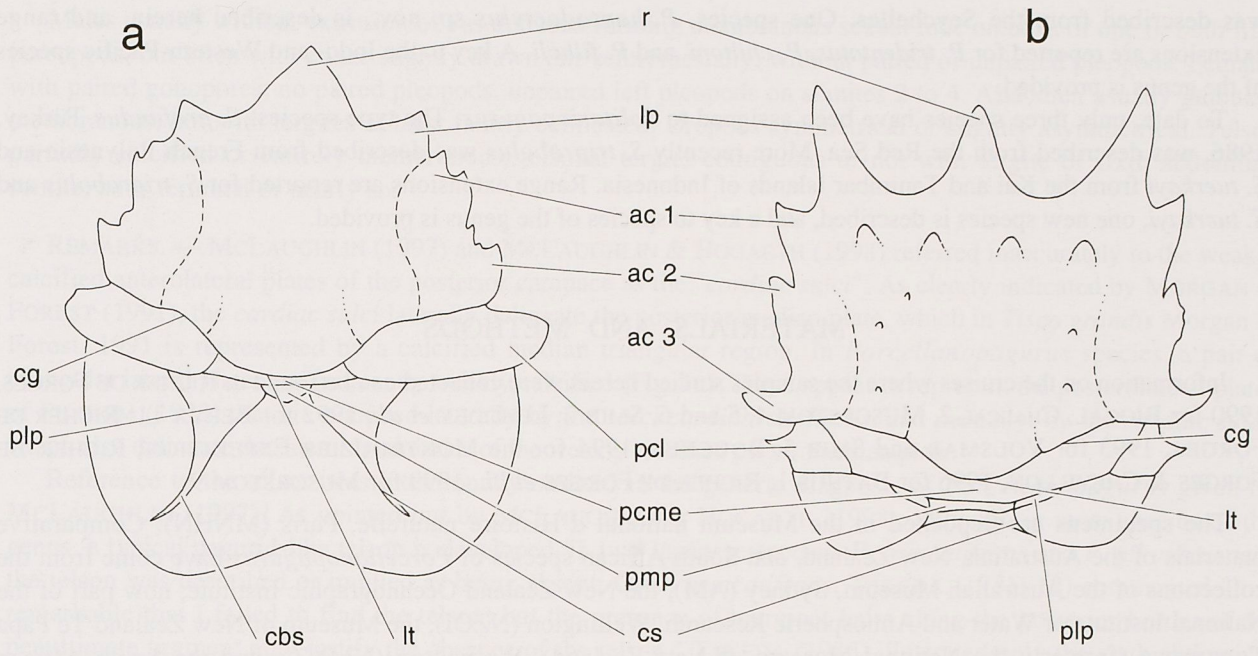

FIG. 1. — Diagrammatic cephalothorax: **a**, *Porcellanopagurus edwardsi* Filhol, 1885; **b**, *Solitariopagurus triprobolus* Poupin & McLaughlin, 1996.

ac 1: anterior carapace lobe 1; **ac 2**: anterior carapace lobe 2; **ac 3**: anterior carapace lobe 3; **cs**: *cardiac sulcus*; **cbs**: *sulcus cardiobranchialis*; **cg**: cervical groove; **lp**: lateral projection; **lt**: location of *linea transversalis*; **pcl**: posterior carapace lateral lobe or element; **pcme**: posterior carapace median element; **plp**: posterolateral plate; **pmp**: posteromedian plate; **r**: rostrum.

A less obvious, but equally significant difference is the gill number. Eleven pairs of biserial phyllobranchiate gills are present in species of *Porcellanopagurus* but only ten pairs in *Solitariopagurus* species. Pleopods are entirely absent in males of both genera; however, different levels of secondary sexual modification occur. In some *Porcellanopagurus* species, one or both coxae of the fifth pereopods may be somewhat drawn out or elongated, and rarely a very slight extrusion of the vas deferens produces a short right sexual tube (cf. MCLAUGHLIN & HOGARTH, 1998). In contrast, species of *Solitariopagurus* all have very well developed male sexual tubes. These tubes appear also to be true coxal extensions but with development comparable to that seen in certain species of the coenobitid genus *Coenobita* Latreille, 1829. At least in *S. triprobolus*, the tubes exhibit a slight amount of calcification, whereas in *S. trullirostris* sp. nov. they are membranous. Females of both genera have only three unpaired pleopods, pseudo-dorsally positioned (cf. MCLAUGHLIN & HOGARTH, 1998). However, females of *Porcellanopagurus* have paired gonopores, while females of *Solitariopagurus* have a single left gonopore. Although the use of halves of bivalves shells as carcinoecia, is common to species of both genera, the structure of the fourth pereopods in *Porcellanopagurus* species is usually semichelate, and that of the fifth, chelate. In contrast both the fourth and fifth pereopods of species of *Solitariopagurus* are subchelate.

Currently 12 species are assigned to *Porcellanopagurus*. These include four from the north and central western Pacific: *P. japonicus* Balss, 1913 and *P. truncatifrons* Takeda, 1981, from Japan, *P. nihonkaiensis* Takeda, 1985, from the Ogasawara Islands, and *P. belauensis* Suzuki & Takeda, 1987, from the Palau Islands. The description of one additional new species from Guam is in preparation (KROPP & ELDREDGE, personal communication). Two species have been described from the eastern Pacific: *P. platei* Lenz, 1902, from Juan Fernandez Island (incorrectly reported as Eastern Island by de SAINT LAURENT and MCLAUGHLIN, 2000), and *P. foresti* Zarenkov, 1990 from the Sala-y-Gómez Ridge. Four species have been reported from Australian-New Zealand waters: *P. edwardsi* Filhol, 1885, *P. tridentatus* Whitelegge, 1900, *Porcellanopagurus filholi* de Saint Laurent & McLaughlin, 2000, and *Porcellanopagurus chiltoni* de Saint Laurent & McLaughlin, 2000. *Porcellanopagurus jacquesi* McLaughlin, 1997, was recently described from the Kai Islands of Indonesia, and in the Indian Ocean, *P. adelocercus*, a dwarf species,

was described from the Seychelles. One species, *P. haptodactylus* sp. nov., is described herein, and range extensions are reported for *P. tridentatus*, *P. chiltoni* and *P. filholi*. A key to the Indo- and Western-Pacific species of the genus is provided.

To date, only three species have been assigned to *Solitariopagurus*. The type species, *S. profundus* Türkay, 1986, was described from the Red Sea. More recently *S. triprobolus* was described from French Polynesia and *S. tuerkayi* from the Kai and Tanimbar Islands of Indonesia. Range extensions are reported for *S. triprobolus* and *S. tuerkayi*, one new species is described, and a key to species of the genus is provided.

MATERIALS AND METHODS

Information on the cruises where the samples studied herein were collected can be found in RICHER DE FORGES, 1990 for BIOCAL, CHALCAL 2, MUSORSTOM 4, 5 and 6, SMIB 2; LEHODEY *et al.*, 1992 for BERYX 11; RICHER DE FORGES, 1993 for VOLSMAR and SMIB 5; BOUCHET, 1994 for the MONTROUZIER EXPEDITION; RICHER DE FORGES & CHEVILLON, 1996 for BATHUS 1; RICHER DE FORGES *et al.*, 1999 for MUSORSTOM 9.

The specimens are deposited in the Muséum national d'Histoire naturelle, Paris (MNHN). Comparative materials of the Australian, New Zealand, and South African species of *Porcellanopagurus* have come from the collections of the Australian Museum, Sydney (AM), the New Zealand Oceanographic Institute, now part of the National Institute of Water and Atmospheric Research, Wellington (NZOI), the Museum of New Zealand Te Papa Tongarewa (formerly the National Museum of New Zealand), Wellington (NMNZ), and the South African Museum, Cape Town (SAM). One additional specimen of *Solitariopagurus tuerkayi* from Okinawa is deposited in the collections of the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

In the lists of material examined the capital letters preceding the station numbers refer to the gear used: **CC** otter trawl (shrimps), **CP** beam trawl, **DR** rock dredge, **DC** Charcot dredge; **DW** Warén dredge, while the abbreviation **ov.** indicates ovigerous female.

General terminology follows that of MCLAUGHLIN (1974); the terms semi- and subchelate are used according to the definition of MCLAUGHLIN (1997), and gill type as defined by MCLAUGHLIN & DE SAINT LAURENT (1998). Terminology for the carapace grooves, linea, and sulci follows that given by PILGRIM (1973) and MORGAN & FOREST (1991). One measurement, shield length, indicative of animal size, is given in parentheses following the number and sex of the specimens.

SYSTEMATIC ACCOUNT

PORCELLANOPAGURUS Filhol, 1885

Porcellanopagurus Filhol, 1885a: 47; 1885b: 23; 1885c: 410. — BORRADAILE, 1916b: 111. — BENNETT, 1932: 520. — FOREST, 1951a: 82; 1951b: 182. — WOLFF, 1961: 28. — MIYAKE, 1978: 117. — TÜRKAY, 1986: 140. — MCLAUGHLIN, 1997: 464. — DE SAINT LAURENT & MCLAUGHLIN, 2000: 105.

TYPE SPECIES. — *Porcellanopagurus edwardsi* Filhol, 1885, by monotypy. Genus masculine.

DIAGNOSIS. — Eleven pairs of biserial phyllobranchiate gills. Anterior carapace vaulted and well calcified; lateral margins of shield developed into two pairs of blunt or spinose lobes. Rostrum and lateral projections widely separated. Anterolateral plates of posterior carapace calcified anteriorly and usually drawn out into projecting lobes; remainder of carapace membranous or with areas of some calcification. Ocular acicles reduced, simple; obscured from dorsal view. Maxillule with external lobe of endopod slightly produced, not recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth.

Chelipeds unequal; propodal-carpal articulation of right with considerable clockwise rotation. Ambulatory legs generally similar. Fourth pereopods usually semichelate; with single row of scales in propodal rasp. Fifth pereopods chelate.

Males usually without extrusion of vas deferens forming membranous sexual tube on coxa of one or both fifth pereopods, but often with coxae slightly drawn out ventromesially; without paired or unpaired pleopods. Females with paired gonopores; no paired pleopods, unpaired left pleopods on somites 2 to 4. Abdomen usually globular, membranous, but with tergites at least faintly delineated. Uropods symmetrical or slightly asymmetrical. Telson partially calcified or entirely membranous, telsonal tergite contiguous or not with tergite of sixth abdominal somite; anus terminal or nearly so.

REMARKS. — MCLAUGHLIN (1997) and MCLAUGHLIN & HOGARTH (1998) referred inaccurately to the weakly calcified anterolateral plates of the posterior carapace as the "*cardiac sulci*". As clearly indicated by MORGAN & FOREST (1991), the *cardiac sulci* laterally delineate the posterior median plate, which in *Tisea grandis* Morgan & Forest, 1991 is represented by a calcified median triangular region. In *Porcellanopagurus* species, a pair of triangular lateral plates are frequently weakly calcified (Fig. 1a). These appear to represent the posterolateral plates of PILGRIM (1973) that are bounded laterally by the *sulci cardiobranchialis*, and mesially, by the *cardiac sulci*, which also delineate the lateral boundaries of the weakly calcified posteromedian plate.

Reference to the telson was intentionally omitted in the generic diagnosis of *Porcellanopagurus* given by MCLAUGHLIN (1997). As pointed out by MCLAUGHLIN & HOGARTH (1998), although in most species of the genus, a typical pagurid-like telson is developed, in two Japanese species, *P. truncatifrons* and *P. nihonkaiensis*, the telson was described or implied as being absent. Of *P. truncatifrons*, TAKEDA (1981: 12) commented "It is remarkable that I failed to find the telson, but the presence of marginal hairs along the posterior border of the penultimate segment may justify the absence of the telson." TAKEDA (1985) illustrated only the sixth abdominal somite and uropods, but made no comment about the missing telson in *P. nihonkaiensis*. MCLAUGHLIN & HOGARTH (1998), in their description of *P. adelocercus*, noted the fact that while the telson would also appear to be lacking if a specimen was viewed only dorsally, a membranous telson, apparently not contiguous with the sixth abdominal somite could be detected ventrally. A similar condition occurs in *P. haptodactylus* sp. nov., and such well may prove to be the case for the two Japanese species.

Key to the Indo- and Western Pacific species of *Porcellanopagurus*

1. Rostrum truncate **2**
— Rostrum triangular or subtriangular **4**

2. Second lateral carapace lobe fringed with long setae **3**
— Second lateral carapace not fringed with long setae ..... ***P. adelocercus***

3. First lateral carapace lobe with distal and median spinule; rostrum usually trilobed. Dactyls of ambulatory legs each with 10 or 11 corneous spines on ventral margin ..... ***P. haptodactylus*** sp. nov.
— First lateral carapace lobe with only distal spinule; rostrum not trilobed. Dactyls of ambulatory legs each with 7 corneous spines on ventral margin ..... ***P. truncatifrons***

4. Posterolateral projection of carapace acute, spinulose or spinose **5**
— Posterolateral projection of carapace bluntly rounded **8**

5. Rostrum obtusely triangular; shield length (including rostrum) slightly less to slightly more than shield width (including lateral projections) **6**
— Rostrum acutely triangular; shield length (including rostrum) considerably less than shield width (including lateral projections) ..... ***P. filholi***

6. Midpoint of rostrum distinctly produced, often giving quasi trilobed appearance **7**
— Midpoint of rostrum not distinctly produced, not giving quasi trilobed appearance ..... ***P. jacquesi***

7. Ventromesial surfaces of palms of both chelae thickly set with tufts of long setae. Propodi of ambulatory legs longer than dactyls ..... ***P. japonicus***

— Ventromesial surfaces of palms of both chelae not thickly set with tufts of long setae. Propodi of ambulatory legs approximately equal to length of dactyls ..... ***P. tridentatus***

8. Tergite of sixth abdominal somite divided into 4 subequal lobes **9**
— Tergite of sixth abdominal somite divided into 2 subequal lobes ..... ***P. nihonkaiensis***

9. Second lateral carapace lobes well developed, produced distinctly beyond lateral level of first **10**
— Second lateral carapace lobes not well developed, not produced distinctly beyond lateral level of first ..... ***P. chiltoni***

10. Ambulatory legs stout; propodi and carpi each with irregular rows of prominent often spinulose protuberances ..... ***P. edwardsi***
— Ambulatory legs slender; propodi and carpi without irregular rows of prominent often spinulose protuberances ..... ***P. belauensis***

Porcellanopagurus haptodactylus sp. nov.

Fig. 2

MATERIAL EXAMINED. — **New Caledonia**. MONTROUZIER EXPEDITION: stn 1250, Touho, 20°46.7'S, 165°13.7'E, 3-6 m, vase sableuse, 1.09.1993: 1 ♀ (1.4 mm) (MNHN-Pg 5861). — Stn 1318, Koumac, 20°41.4'S, 164°14.8'E, 20-30 m, reef outer slope, 24.10.1993: 1 ♂ (2.3 mm) (MNHN-Pg 5862).

TYPES. — The male from Stn 1318 is the holotype; the female from Touho is the allotype.

DESCRIPTION. — Anterior carapace (Fig. 2a) with shield length slightly shorter than maximum breadth; anterior margin between rostrum and lateral projections slightly concave; lateral carapace margins each with short acute spine in distal 0.35 of first lobe; roundly triangular, unarmed lobe at mid-length; moderately short, blunt, subacute or denticulate lobe posterior to cervical groove, median element very narrow; dorsal surface of shield strongly calcified, posterolateral regions weakly delineated; posterior margin truncate. Posterolateral plates weakly calcified, *cardiac sulci* and *sulci cardiobranchialis* extending nearly to posterior carapace margin; posteromedian plate not noticeably delineated. Rostrum well developed, broad, truncate or prominently trilobed (Fig. 2a-b), reaching considerably beyond bases of ocular peduncles. Lateral projections triangular; well developed but produced only to mid-rostral length.

Ocular peduncles short, stout, less than half length of shield, with submedian constriction; corneas slightly dilated, diameter approximately 0.5 length of peduncle. Ocular acicles very small, acutely triangular.

Antennular peduncles when fully extended, overreaching ocular peduncles by approximately 0.5 length of penultimate segment. Ultimate segment with few setae dorsally. Basal segment unarmed.

Antennal peduncles overreaching ocular peduncles by approximately 0.5 length of ultimate segment. Fifth and fourth segments with few scattered, short setae. Third segment unarmed. Second segment with dorsolateral distal angle produced, terminating acutely; dorsomesial distal angle rounded. First segment produced, unarmed or with tiny terminal spinule. Antennal acicle reaching to or beyond distal margin of fourth peduncular segment, terminating acutely and with few moderately long setae. Antennal flagella missing.

Thoracic sternites 3-8 (Fig. 2c) unarmed. Sternite of third maxillipeds (third thoracic) bluntly triangular on either side of median concavity. Sternite of chelipeds with left side enlarged, partially fused with sternite of second pereopods. Sternite of second pereopods broad, plate-like, with incomplete median longitudinal groove. Sternite of third pereopods with subrectangular anterior lobe. Sternite of fourth pereopods concealed from direct ventral view by sternite of third. Sternite of fifth pereopods narrow, well separated from preceding sternites.

Right cheliped (Fig. 2d) stout; longer and considerably stronger than left. Dactyl slightly shorter than palm; articulating obliquely; cutting edge with 3 or 4 calcareous teeth; terminating in small calcareous claw, slightly overlapped by fixed finger; dorsal surface convex, unarmed or minutely granular, dorsomesial margin with very low, minutely spinulose or denticulate ridge; ventral surface with few tufts of setae. Palm longer than carpus; somewhat

swollen dorsoventrally; dorsal surface convex, dorsomesial and dorsolateral margins slightly elevated, unarmed or minutely spinulose or scalloped; fixed finger with few tufts of short setae dorsally and ventrally; cutting edge with 2-4 distinct calcareous teeth. Carpus slightly longer than merus; dorsomesial and dorsolateral margins not distinctly delimited; lateral and mesial surfaces with low, weakly rugose or microscopically spinulose, transverse ridges extending onto dorsal surface. Merus broadly subtriangular; dorsal margin with several transverse ridges and

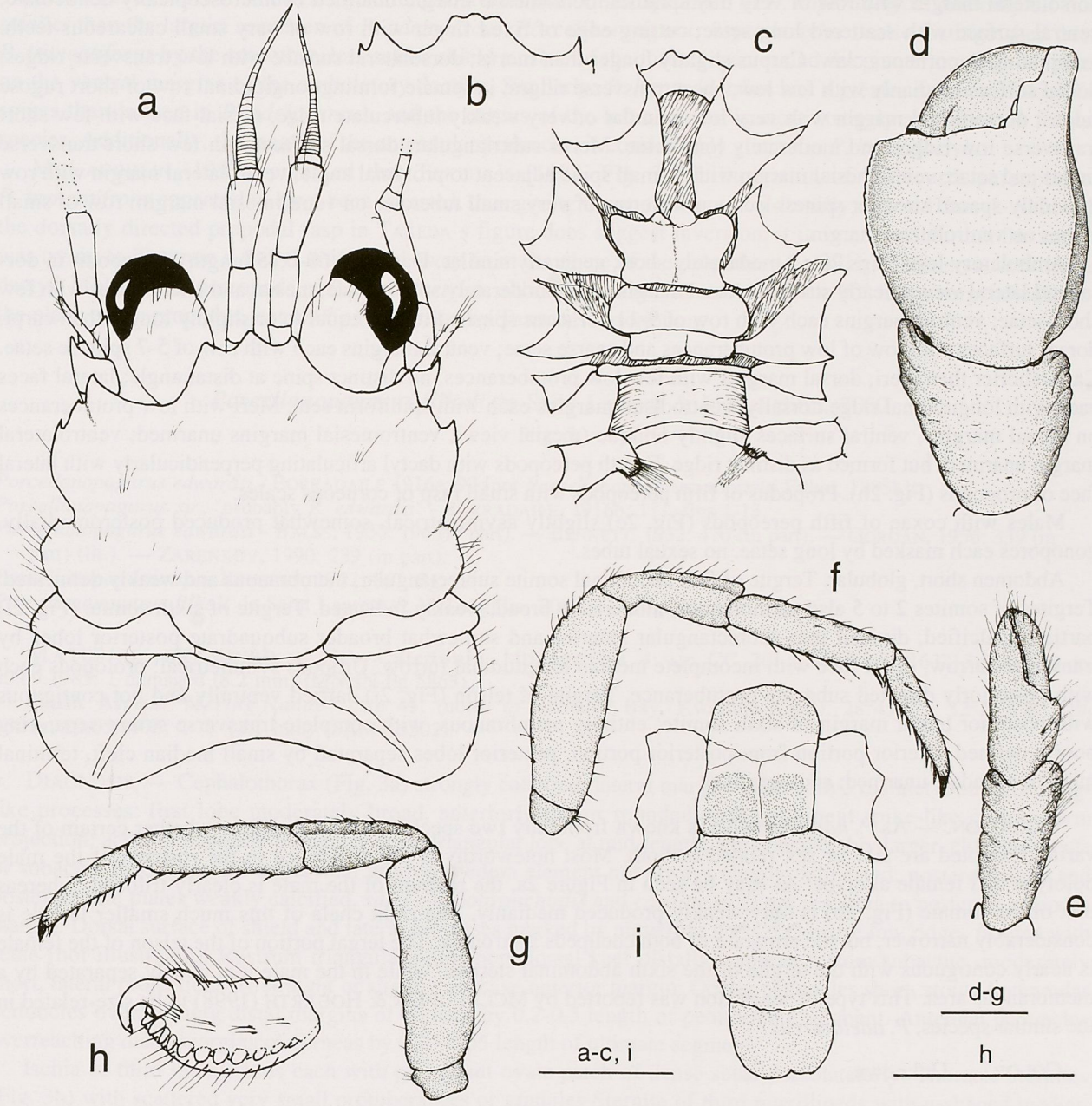

FIG. 2. — *Porcellanopagurus haptodactylus* sp. nov. a, c-i, holotype ♂ (2.3 mm) from Montrouzier Expedition Stn 1318; b, allotype (1.4 mm) from Montrouzier Expedition Stn 1250: **a**, cephalothorax and cephalic appendages (aesthetascs omitted); **b**, rostrum and anterior margin of shield; **c**, thorax (ventral view); **d**, carpus and chela of right cheliped (dorsolateral view); **e**, carpus and chela of left cheliped (dorsal view); **f**, right second pereopod (lateral view); **g**, left third pereopod (lateral view); **h**, propodus and dactyl of left fourth pereopod (lateral view); **i**, tergite of sixth abdominal somite, uropodal protopods, and telson. Scales equal 1 mm (a-g, i) and 0.5 mm (h).

few setae; ventromesial margin with 1 prominent tubercle or subacute spine at proximal angle; ventrolateral margin with row of few to several acute spines. Ischium with row of small spinules on ventromesial margin.

Left cheliped (Fig. 2e) with dactyl approximately 1.25 length of palm; cutting edge with row of corneous teeth; terminating in corneous claw and very slightly overlapped by fixed finger; dorsal surface unarmed or minutely granular, dorsomesial margin not delimited or microscopically serrate; mesial and ventral surfaces with numerous long setae. Palm approximately 0.5 length of carpus; dorsal surface smooth or microscopically granular, dorsolateral margin with row of very tiny spinules, dorsomesial margin unarmed or microscopically denticulate; ventral surface with scattered long setae; cutting edge of fixed finger with row of very small calcareous teeth, terminating in corneous claw. Carpus slightly longer than merus; dorsolateral surface with low transverse ridges, dorsal surface medianly with few low, short transverse ridges, in female forming longitudinal row of short rugose ridges; dorsomesial margin with very low granular or very weakly tuberculate ridge, mesial face with few short transverse low ridges and moderately long setae. Merus subtriangular; dorsal surface with few short transverse ridges and setae; ventromesial margin with 1 small spine adjacent to proximal angle; ventrolateral margin with row of widely-spaced stronger spines. Ischium with row of very small tubercles on ventromesial margin; row of small spines on ventrolateral margin.

Ambulatory legs (Figs 2f-g) moderately short; generally similar. Dactyls 0.60-0.75 length of propodi; in dorsal and lateral views, nearly straight; dorsal margins with moderately sparse setae; mesial and lateral faces with few short setae; ventral margins each with row of 9-11 corneous spines. Propodi equal to or slightly longer than carpi; dorsal surfaces with row of low protuberances and sparse setae; ventral margins each with row of 5-7 spinose setae. Carpi shorter than meri; dorsal margins with few low protuberances, no distinct spine at distal angle; lateral faces each with longitudinal ridge dorsally; ventrodistal margins each with spiniform seta. Meri with low protuberances on dorsal margins, ventral surfaces slightly oblique (mesial view), ventromesial margins unarmed; ventrolateral margin unarmed, but formed as distinct ridge. Fourth pereopods with dactyl articulating perpendicularly with lateral face of propodus (Fig. 2h). Propodus of fifth pereopods with small rasp of corneous scales.

Males with coxae of fifth pereopods (Fig. 2c) slightly asymmetrical, somewhat produced posteromedially, gonopores each masked by long setae, no sexual tubes.

Abdomen short, globular. Tergite of first abdominal somite subrectangular, membranous and weakly delineated. Tergites of somites 2 to 5 also membranous, moderately broad, weakly indicated. Tergite of sixth somite (Fig. 2i) partially calcified, divided into subrectangular anterior and somewhat broader subquadrate posterior lobes by transverse furrow, distal lobe with incomplete median longitudinal furrow. Uropods symmetrical; protopods each with posteriorly directed subacute protuberance. Tergite of telson (Fig. 2i) carried ventrally and not contiguous with posterior tergal margin of sixth somite; entirely membranous, with complete transverse suture separating poorly defined anterior portion from posterior portion; posterior lobes separated by small median cleft, terminal margins rounded, unarmed; anus terminal.

VARIATION. — As *P. haptodactylus* is known from only two specimens, it is not clear whether certain of the variations noted are size or sex related or both. Most noteworthy is the difference in the rostrum of the male holotype and female allotype. As may be seen in Figure 2a, the rostrum of the male is clearly trilobed, whereas that of the female (Fig. 2b) is only weakly produced medianly. The right chela of this much smaller female is considerably narrower, but the armature of both chelipeds is stronger. The tergal portion of the telson of the female is nearly contiguous with the tergite of the sixth abdominal sternite, while in the male it is widely separated by a membranous area. This type of separation was reported by McLAUGHLIN & HOGARTH (1998) to be size-related in the similar species, *P. adelocercus*.

COLOR. — Unknown.

HABITAT. — One specimen was accompanied by part of a bivalve mollusk shell.

DISTRIBUTION. — Known only from New Caledonia (East coast: Touho; West coast: Koumac); 3-30 m.

ETYMOLOGY. — The specific name is taken from the Greek *hapto* meaning grasp, and *daktylos*, meaning finger and denotes the very characteristic articulations of the dactyls of the fourth pereopods, clearly adapted for grasping the crab's carcinoecium.

REMARKS. — *Porcellanopagurus haptodactylus* is most closely allied to *P. truncatifrons* and *P. adelocercus*, sharing with both a truncated rostrum. While the rostrum of the holotype male more closely resembles that of *P. adelocercus* in being distinctly trilobed, the rostrum of the allotype female more closely approaches that of *P. truncatifrons*. It is probable that these rostral differences are size related, as McLAUGHLIN & HOGARTH (1998) reported similar size-related rostral differences in the rostrums of *P. adelocercus*. From the limited data available, it would appear that the truncate rostrum of *P. truncatifrons* does not represent a subadult developmental condition. TAKEDA's (1981) specimen has a shield length greater than either specimen of *P. haptodactylus* and only 0.1 mm smaller than the largest specimen of *P. adelocercus*. *Porcellanopagurus haptodactylus* is also distinguished from *P. truncatifrons* by the smoother, less setose shield surface of the former species and the greater number of spines on the ventral margins of the ambulatory dactyls. Similarly, *P. haptodactylus* has a greater number of dactylar spines than is seen in *P. adelocercus*, and the carpus of the left cheliped is more strongly armed in the former species. Additionally, the length of the antennular peduncles is considerably greater in *P. haptodactylus*.

McLAUGHLIN (1997) remarked that TAKEDA's [1981, Fig. 3(3)] illustration of the fourth pereopod of *P. truncatifrons* appeared to have been inverted, thus giving the appearance of a dorsally directed dactyl. Although the dorsally directed propodal rasp in TAKEDA's figure does suggest inversion, it is very possible that the author was trying to illustrate a dactyl articulated away from the plane of the propodus. A similar condition is seen in the dactyls of the fourth pereopods of *P. haptodactylus*, although the dactylar articulation is 90° from (perpendicular to) the plane of the propodus, not 180° as suggested by TAKEDA's description.

Porcellanopagurus filholi de Saint Laurent & McLaughlin, 2000

Fig. 3

Porcellanopagurus edwardsi - BORRADAILE 1916a: 97 [not *Porcellanopagurus edwardsi* Filhol, 1885b].
Porcellanopagurus sp., "probably *P. edwardsi*" - BORRADAILE, 1916b: 111, figs 1-13.
Porcellanopagurus edwardsi - BALSS, 1930: 196 (in part). — BENNETT, 1932: 470 (in part). — GORDAN, 1956: 339 (in part) (lit.). — ZARENKOV, 1990: 239 (in part).
Porcellanopagurus sp. - KENSLEY, 1977: 167, fig. 2.
Porcellanopagurus filholi de Saint Laurent & McLaughlin, 2000: 114, fig. 36, pl. 3, fig. 3.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn CC 201, 18°55.8'S, 163°13.8'E, 490 m, 20.09.1985: 1 damaged (8.2 mm) (MNHN-Pg 5863).
South Africa. *"Mering Naude"*: stn 43, (north of Richards Bay, KwaZulu-Natal), 28°45.5'S, 32°24.5'E, 420-360 m, 29.05.1975: 1 ♀ (3.1 mm) (SAM 15302).

DIAGNOSIS. — Cephalothorax (Fig. 3a) strongly calcified; lateral margins each with 3 distinct lobular or wing-like processes: first lobe moderately broad, anteriorly flat or rounded with prominent spike-like or spiniform projection; acute or subacute triangular or subtriangular lobe at mid-length; and considerably larger, elongate, acute or subacute lobe posterior to cervical groove, median element not always clearly delineated; posteromedian and posterolateral plates weakly calcified, *sulci cardiobranchialis* and *cardiac sulci* not reaching to posterior carapace margin. Dorsal surface of shield and lateral processes marked by numerous short transverse low ridges fringed with setae (not illustrated). Rostrum triangular with short dorsal keel distally, separated from subacute, moderately short, lateral projections by straight or slightly concave anterior margin. Ocular peduncles short, stout. Antennular peduncles overreaching distal margins of corneas by 0.2-0.5 length of penultimate segment. Antennal peduncles overreaching distal margins of corneas by 0.25-0.65 length of ultimate segment.

Ischia of third maxillipeds each with prominent ovate patch of dense setae dorsolaterally. Thoracic sternites (Fig. 3b) with scattered very small protuberances or granules Sternite of third maxillipeds with u-shaped median cleft, flanked on both sides by pair of widely-separated small spines. Sternite of chelipeds with left side markedly larger, partially fused with subrectangular sternite of second pereopods. Sternite of third pereopods incompletely divided into anterior and posterior lobes. Sternite of fourth pereopods hidden from view beneath sternite of third. Sternite of fifth pereopods slender, rod-like, widely separated from fourth.

Chelipeds very unequal, right much stronger, although not appreciably longer. Dactyl of right cheliped with row of small granules or denticles in proximal 0.65 of dorsomesial margin; dorsal surface rounded, granular or minutely tuberculate and with sparse tufts of moderate to long setae, with short subacute ridge proximally. Palm with convex dorsal surface minutely granular, particularly in mesial half and with numerous sparse tufts of moderately long setae, dorsomesial margin with low ridge of tiny tubercles or simply crenulations, dorsolateral margin with distinct low ridge of crenulations or granules, becoming somewhat more prominent on fixed finger. Carpus somewhat roundly elevated in dorsal midline with several short transverse piliferous ridges, dorsomesial and dorsolateral margins and mesial and lateral faces each with transverse piliferous crenulated low ridges. Merus with row of moderately small spines on ventromesial and ventrolateral margins, ventral surface with very dense patch setae in mesial half.

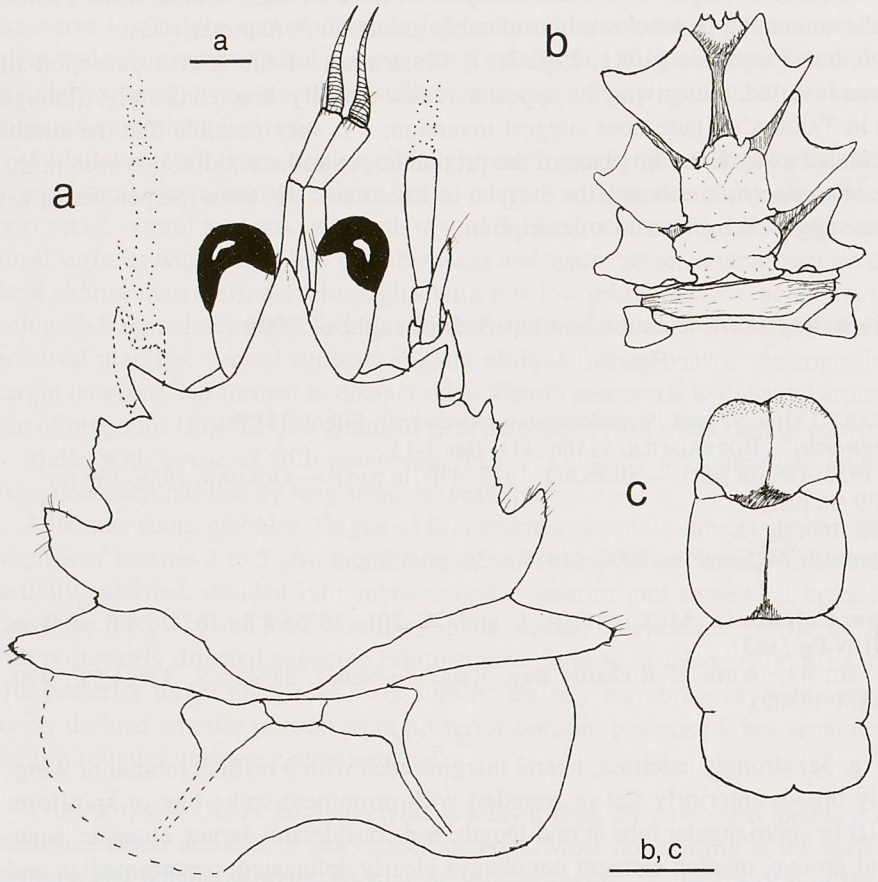

FIG. 3. — *Porcellanopagurus filholi* de Saint Laurent & McLaughlin, 2000. a, c, damaged ♂ (8.2 mm) from MUSORSTOM 4, Stn 201; b, ♀ (3.1 mm) from *"Mering Naude"* Stn 43: **a**, cephalothorax and cephalic appendages (aesthetascs omitted); **b**, thorax (ventral view); **c**, tergite of sixth abdominal somite and telson. Scales = 1 mm.

Left cheliped with surfaces of dactyl unarmed but with sparse tufts of setae adjacent to cutting edge and ventrally. Palm with minutely granular dorsal surface; dorsolateral margin only weakly delimited by very low granular ridge, not extending onto fixed finger; dorsomesial margin with granular ridge. Carpus with several transverse, weakly raised piliferous ridges; dorsomesial and dorsolateral margins each with low, transverse, somewhat crenulated ridges and sparse tufts of setae. Merus with row of small spines in proximal 0.65 of ventromesial margin; ventrolateral margin with row of smaller, more widely-spaced spines.

Ambulatory legs generally similar. Dorsal margins of dactyls each with sparse setae (second) or transverse rows of moderately long setae (third); ventral margins each with row of 8-13 corneous spines. Propodi with short somewhat denticulate ridges forming irregular longitudinal rows on dorsal surface and lateral and mesial faces dorsally, ventral margin with single or double row of long spiniform setae. Carpi each with dorsodistal spine, rows of denticulate protuberances on dorsal faces; lateral faces each with protuberances forming distinct ridge near mid-width and with few lower denticulate protuberances ventrally. Meri each with row of very small spines on ventrolateral margins; ventromesial margins minutely granular.

Males with coxae of fifth pereopods roundly subquadrate, gonopores each encircled by tuft of long setae. Tergite of sixth abdominal somite (Fig. 3c) divided into anterior and posterior halves by prominent transverse furrow, with small area of calcification laterally. Anterior and posterior portions each divided by longitudinal median furrow.

Telson (Fig. 3c) with small lateral indentations; posterior lobes separated by very minute median cleft, terminal margins rounded; anus opening very slightly anterior to terminal telson margins.

COLOR. — Ambulatory legs with broad red bands on cream background; carapace, rostral apex and ocular peduncles with red patches (after KENSLEY, 1977).

HABITAT. — Commonly found utilizing halves of bivalve shells, and occasionally limpets. Animals have been found with the telson and endopods of the uropods securely lodged in the umbos of the bivalves.

DISTRIBUTION. — Eastern South Africa, eastern Australia, New Zealand from north of Three Kings Islands south to off the Canterbury Bight, and east to the Chatham Islands, New Caledonia; 64-1392 m, possibly as deep as 1430 m.

REMARKS. — As pointed out by DE SAINT LAURENT & MCLAUGHLIN (2000), *Porcellanopagurus filholi* has, for many years, been confounded with *P. edwardsi*. *Porcellanopagurus filholi* is most easily disitnguished from *P. edwardsi* by the bilobed first lateral carapace process, and shorter, stouter ambulatory legs of the latter species.

Porcellanopagurus sp. of KENSLEY (1977), a female with regenerating chelipeds has been reexamined and can be assigned to *P. filholi*. Although KENSLEY cited the specimen as a male in his material examined, in his station data it is listed as a female, and his discussion and illustration correctly indicate female. This specimen, from north of Richards Bay, KwaZulu-Natal, South Africa, extends the range of this species.

Porcellanopagurus tridentatus Whitelegge, 1900

Fig. 4

Porcellano-pagurus tridentatus Whitelegge, 1900: 181, figs 13-13b.
Porcellanopagurus tridentatus - TAKEDA, 1985: 141. — TÜRKAY, 1986: 140. — SUZUKI & TAKEDA, 1987: 17. — ZARENKOV, 1990: 239. — DE SAINT LAURENT & MCLAUGHLIN, 2000: 106, fig. 33.
Not *Porcellanopagurus tridentatus* - CHILTON, 1911: 352 (= *Porcellanopagurus chiltoni* de Saint Laurent & McLaughlin, 2000).

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 64, 24°48'S, 168°09'E, 250 m, 3.09.1985: 2 ♂ (2.7, 3.7 mm), 1 ov. ♀ (3.2 mm) (MNHN-Pg 5864).

MUSORSTOM 4: stn DW 230, 22°52.5'S, 167°11.8'E, 390-420 m, 30.09.1985: 1 ♀ (3.4 mm), 1 ov. ♀ (5.3 mm) (MNHN-Pg 5865).

SMIB 2: stn DW 3, 22°56.0'S, 167°14.8'E, 428 m, 17.09.1986: 1 ♂ (5.8 mm) (NHM 1999.2169).

CHALCAL 2: stn CP 18, 24°47.0'S, 168°09.4'E, 274 m, 20.10.1986: 1 ♂ (4.7 mm), 1 ov. ♀ (4.3 mm) (USNM 276173). — Stn DW 69, 24°43.7'S, 168°07.9'E, 260 m, 27.10.1986: 1 ♀ (3.8 mm) (MNHN-Pg 5866). — Stn DW 71, 22°42.3'S, 168°09.5'E, 230 m, 27.10.1986: 1 ♂ (4.2 mm) (MNHN-Pg 5867).

BATHUS 2: stn DW 729, 22°52'S, 167°11'E, 400 m, 12.05.1993: 1 ♀ (5.3 mm) (MNHN-Pg 5868). — Stn DW 730, 23°02'S, 166°58'E, 397-400 m, 12.05.1993: 1 ♀ (3.0 mm) (MNHN-Pg 5869).

Chesterfield Islands. MUSORSTOM 5: stn DC 361, 19°52.5'S, 158°38.1'E, 400 m, 19.10.1986: 1 ♂ (6.8 mm) (MNHN-Pg 5870). — Stn DC 379, 19°53.2'S, 158°39.5'E, 370-400 m, 20.10.1986: 1 ov. ♀ (6.7 mm) (MNHN-Pg 5871).

DIAGNOSIS. — Anterior carapace (Fig. 4a) broad, smooth, with few scattered tufts of short setae; lateral margins each with slender acute spine on triangular or rounded first lateral lobe, slightly smaller spine distally and often 3 or 4 spinules laterally on short subtriangular prominence of second lateral lobe, and moderately strong subtriangular, spinulose projection posterior to cervical groove, median element very narrow; posteromedian plate partially calcified, posterolateral plates distinct, weakly calcified, *sulci cardiobranchialis* and *cardiac sulci* extending nearly to posterior carapace margin. Rostrum very broadly triangular and usually weakly trilobed, reaching nearly to mid-length of ocular peduncles, broad basally, narrowing abruptly in distal 0.24-0.35, terminating subacutely. Lateral projections prominent, acute, forwardly or slightly anterolaterally directed. Ocular peduncles moderately short and stout; corneas slightly dilated. Antennular peduncles when fully extended overreaching distal margins of corneas by approximately 0.25 length of penultimate segment. Antennal peduncles overreaching distal margins of corneas by 0.5-0.65 length of fifth segment.

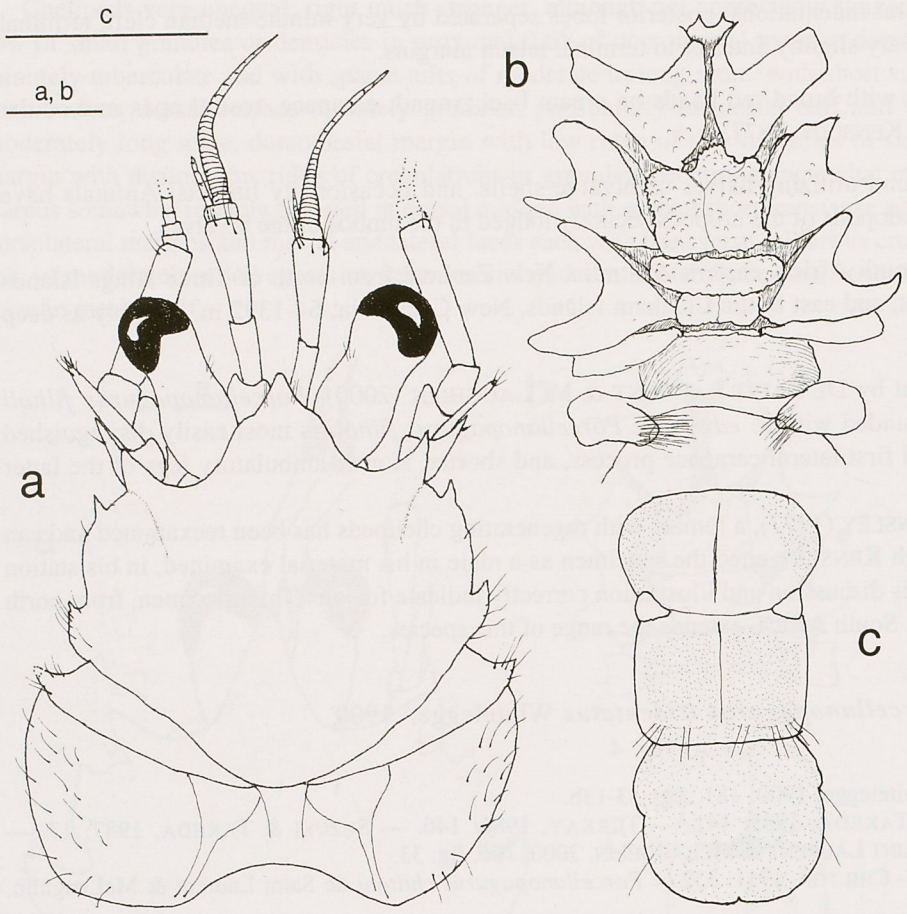

FIG. 4. — *Porcellanopagurus tridentatus* Whitelegge, 1900. a-c, ♂ (3.7 mm) from BIOCAL Stn DW 64: **a**, cephalothorax and cephalic appendages (aesthetascs omitted); **b**, thorax (ventral view); **c**, tergite of sixth abdominal somite and telson. Scales = 1 mm.

Ischium of third maxilliped without distinctive tuft of setae dorsolaterally. Thoracic sternites (Fig. 4b) with numerous scattered tubercles. Sternite of third maxillipeds with acute spine on either side of broad, u-shaped median cleft. Sternite of chelipeds largest on left side; incompletely fused to subquadrate sternite of second pereopods. Sternite of third pereopods with elongate subrectangular anterior lobe and shorter subrectangular posterior lobe. Sternite of fourth pereopods very slender, often obscured from view beneath third. Sternite of fifth pereopods slender, rod-shaped, well separated from fourth.

Right cheliped stout, considerably stronger, but not appreciably longer than left. Dactyl articulating somewhat obliquely with palm; dorsal and mesial surfaces rounded, granular or minutely tuberculate. Dorsomesial margin of palm with low tuberculate or granular ridge, dorsal surface granular or minutely tuberculate and with few scattered setae, dorsolateral margin with very faint granular ridge. Carpus trapezoidal, dorsomesial and dorsolateral margins and mesial and lateral faces dorsally with series of low, transverse protuberant ridges, strongest mesially. Merus without distinctive tuft of setae on ventromesial margin; ventrolateral and ventromesial margins each with row of small spines, strongest laterally.

Left cheliped with slight granular ridge on proximal half of dorsomesial margin of dactyl, dorsal surface with few very small tubercles in midline proximally. Palm with granular or minutely spinulose dorsal surface, dorsolateral margin with faint ridge. Carpus with mesial and lateral faces marked by low transverse ridges, forming longitudinal row on both dorsomesial and dorsolateral margins, strongest dorsomesially; dorsal surface with low, short transverse, sometimes granular or spinulose ridges. Merus with spinose ventromesial margin.

Ambulatory legs generally similar. Dactyls slightly shorter to slightly longer than propodi; each with 9-12 corneous spines on ventral margin. Propodi with low, sometimes spinulose protuberances on dorsal surfaces; lateral faces with short or very short transverse protuberances or ridges; ventral margins each with row of 5 or 6 spinose setae, longest distally. Carpi each with 1 or 2 irregular rows of blunt or spinulose protuberances on dorsal surfaces, dorsodistal spine sometimes slightly better developed; lateral faces each with prominent denticulate ridge in dorsal half and smaller ridges or low protuberances ventral. Meri each with row of spinules on ventromesial and ventrolateral margins, strongest laterally.

Coxae of fifth pereopods in males drawn out posteromedially and fringed with setae, but no membranous sexual tubes developed. Sixth abdominal somite (Fig. 4c) with prominent transverse suture at mid-length; anterior and

posterior lobes each incompletely divided by longitudinal grooves; marginal areas of anterior lobes and median portions of posterior lobes membranous; terminal margin entire. Telson (Fig. 4c) membranous; with slight lateral indentations; posterior lobes indicated by very slight median cleft; terminal margins unarmed; anus opening just anterior to terminal margins.

COLOR. — Unknown.

HABITAT. — Although most New Caledonian specimens were without any protective covering, three specimens carried limpet shells, while another utilized a bivalve shell.

DISTRIBUTION. — Eastern Australia, Norfolk and Kermadec Islands; New Caledonia; 99-250 m in Australian and New Zealand waters, 250-428 m in New Caledonia.

REMARKS. — DE SAINT LAURENT & MCLAUGHLIN (2000) discussed at length the inaccuracies in WHITELEGGE's (1900) original description as well as CHILTON's (1911) misidentification of material as *P. tridentatus*. DE SAINT LAURENT & MCLAUGHLIN (2000) described CHILTON's specimens as the new species, *P. chiltoni* de Saint Laurent & McLaughlin. The New Caledonia specimens differ from the lectotype of *P. tridentatus*, and from the other specimens examined by DE SAINT LAURENT & MCLAUGHLIN in having longer and slightly thinner ocular peduncles, and slightly longer antennular peduncles. One specimen showed only a hint of the somewhat trilobed rostrum characteristic of this species.

Porcellanopagurus chiltoni de Saint Laurent & McLaughlin, 2000

Fig. 5

Porcellanopagurus tridentatus - CHILTON, 1911: 352 (not *Porcellanopagurus tridentatus* Whitelegge, 1900).
Porcellanopagurus chiltoni de Saint Laurent & McLaughlin, 2000: 107, fig. 34.

MATERIAL EXAMINED. — **New Caledonia**. VOLSMAR: stn DW 48, 21°00.1'S, 170°03'E, 200 m, 4.07.1989: 1 ♂ (2.9 mm) (MNHN-Pg 5872).
SMIB 5: stn DW 99, 23°24.7'S, 168°05.4'E, 58 m, 14.09.1989: 1 ♂ (2.1 mm) (MNHN-Pg 5873).

DIAGNOSIS. — Cephalothorax (Fig. 5a) usually with denticulate scale-like protuberances, particularly on rostrum and laterally and anteriorly on shield. First lateral carapace lobe weakly produced, with small acute, subacute or blunt spine; second lateral carapace lobe not produced beyond lateral level of first, subtriangular, marginally denticulate; slightly stronger subtriangular, subacute projection posterior to cervical groove, median element very narrow; posteromedian plate not delineated, posterolateral plates weakly calcified, *sulci cardiobranchialis* and *cardiac sulci* reaching nearly to posterior carapace margin. Rostrum very broadly triangular, weakly, subacutely or acutely trilobed, reaching beyond mid-length of ocular peduncles. Lateral projections moderately short, subtriangular, anterolaterally directed, terminally acute or blunt. Ocular peduncles short, stout; with weak constriction adjacent to corneas. Antennular peduncles when fully extended overreach distal margins of corneas by slightly less to slightly more than full length of ultimate segment. Antennal peduncles overreaching distal margins of corneas by 0.25-0.75 length of ultimate segment.

Ischia of third maxillipeds usually without distinctive tuft of setae dorsolaterally. Thoracic sternites (Fig. 5b) slightly granular. Sternite of third maxillipeds bilobed, with anterior margins straight; small spinule on either side of v-shaped median cleft. Sternite of chelipeds with left side larger, incompletely fused to roundly subquadrate sternite of second pereopods. Sternite of third pereopods incompletely divided into anterior and posterior lobes; anterior lobe more elongate, posterior lobe with median indentation on posterior margin. Sternite of fourth pereopods very narrow. Sternite of fifth pereopods rod-shaped; considerably distant from fourth.

Right cheliped stout, considerably stronger than left. Dactyl with dorsal and mesial surfaces rounded, granular or minutely tuberculate, dorsomesial margin sometimes defined by faint ridge. Palm with dorsomesial margin marked by low tubercles or granules forming slightly elevated ridge, dorsal surface granular or tuberculate, sometimes with few scattered setae, dorsolateral margin with crenulate, granular, or minutely tuberculate ridge.

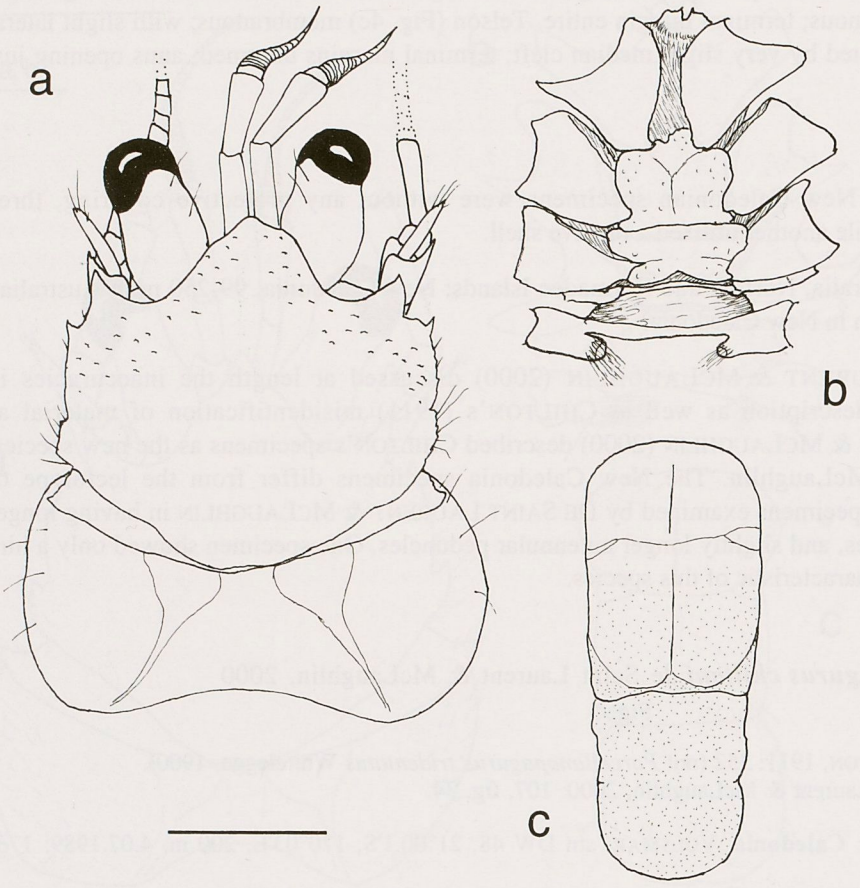

FIG. 5. — *Porcellanopagurus chiltoni* de Saint Laurent & McLaughlin, 2000. a-c, ♂ (2.1 mm) from SMIB 5 Stn DW 99: **a**, cephalothorax and cephalic appendages (aesthetascs omitted); **b**, thorax (ventral view); **c**, tergite of sixth abdominal somite and telson. Scale = 1 mm (a-b) and 0.5 mm (c).

Dorsomesial and dorsolateral margins of carpus and mesial and lateral faces dorsally with series of low transverse scale-like, granular or spinulose protuberant ridges, strongest mesially. Merus with few tiny spinules or tubercles on dorsodistal margin; without distinctive tuft of setae on ventromesial margin; ventrolateral and ventromesial margins each with row of subacute spines.

Left cheliped with row of very small tubercles on dorsomesial margin of dactyl; dorsal midline with short longitudinal row of tiny tubercles. Palm with covering of low tubercles or granules on dorsal surface not extending to distal half of fixed finger; dorsomesial and dorsolateral margins each with low spinulose or crenulate ridge. Carpus with transverse ridges forming longitudinal row on dorsomesial margin, dorsal surface with numerous scale-like tuberculate or spinulose, protuberant short ridges; mesial and lateral faces with low transverse ridges. Merus with row of subacute tubercles on ventromesial margin; ventrolateral margin with irregular double row of blunt or subacute spines or tubercles.

Ambulatory legs generally similar. Dactyls 0.75-0.85 length of propodi; dorsal surfaces with low protuberances and sparse setae; ventral margins each with 8-11 corneous spines. Propodi with numerous low, sometimes spinulose, protuberances on dorsal surfaces; ventral margins each with row of 5 or 6 long spiniform setae, and usually additional pair at ventrodistal margin. Carpi each with 1 or 2 irregular rows of spinulose protuberances on dorsal surface, no distinct dorsodistal spine; lateral faces each with prominent tuberculate or spinulose ridge in dorsal half and row of smaller ridges or low protuberances ventrally. Meri with ventromesial margins unarmed or granular; ventrolateral margins with 1 or 2 rows of spines or spinules.

Coxae of fifth pereopods in males slightly drawn out posteromedially and fringed with setae, but no sexual tubes developed. Sixth abdominal somite (Fig. 5c) with prominent transverse suture at or near mid-length; anterior and posterior lobes each incompletely divided by longitudinal groove; posterior lobes with subtriangular or ovate terminal margins and adjacent, sometimes well-calcified accessory plates. Telson (Fig. 5c) longer than broad, often membranous, with slight transverse indentation; rounded terminal margins with very slight median indentation; anus opening ventral to, but very near, terminal margin.

COLOR. — Unknown.

HABITAT. — Reportedly living under stones between the tidemarks in Kermadec Islands, and carrying half of a bivalve shell "or a vacant *Siphonaria* or limpet shell" (CHILTON, 1911).

DISTRIBUTION. — Kermadec Islands, New Zealand, intertidal; New Caledonia, 58–200 m.

REMARKS. — *Porcellanopagurus chiltoni* was described by DE SAINT LAURENT & MCLAUGHLIN (2000) from three specimens collected intertidally from the Kermadec Islands, New Zealand. As noted by these authors, this species bears considerable resemblance to *P. tridentatus*, but is distinguished by its longer antennular peduncles, shorter and stouter ocular peduncles, and most particularly by the distinct ovate appearance of the posterior lobes of the sixth abdominal tergite. Both species are reported for the Kermadec region, but with a distinct bathymetric separation. Although in New Caledonia *Porcellanopagurus chiltoni* occurs at considerably greater depths, i.e. 58-200 m, *P. tridentatus* similarly occupies a greater depth zone (250-428 m). Thus the bathymetric separation of the species appears to be maintained.

SOLITARIOPAGURUS Türkay, 1986

Solitariopagurus Türkay, 1986: 139. — POUPIN & MCLAUGHLIN, 1996: 212. — MCLAUGHLIN, 1997: 461.

TYPE SPECIES. — By original designation: *Solitariopagurus profundus* Türkay, 1986.

DIAGNOSIS. — Ten pairs of biserial phyllobranchiate gills. Anterior carapace vaulted and strongly calcified; lateral margins of shield developed into 3 blunt or spiniform lobes, posterior carapace lobe consisting of elongate median and small lateral elements; posterolateral and posteromedian plates usually well calcified; *sulci cardiobranchialis* and *cardiac sulci* usually not readily distinguishable. Rostrum and lateral projections widely separated. Ocular acicles reduced, simple; hidden from dorsal view. Maxillule with external lobe of endopod obsolete or absent. Third maxilliped with well developed crista dentata and 1 accessory tooth.

Right cheliped much stronger, but not appreciably longer than left. Ambulatory legs similar. Fourth and fifth pereopods subchelate.

Males with stout, moderately long, unequal sexual tubes developed as extensions of coxae of both fifth pereopods, right longest; each with long setae subterminally and terminally; no paired or unpaired pleopods. Females with single gonopore posteriorly on coxa of left third pereopod; no paired pleopods; unpaired left uniramous pleopods on abdominal somites 2-4.

Abdomen reduced; tergal plate of first somite chitinous or very faintly calcified; tergal plate of second weakly delineated; tergal plates of somites 3-5 clearly defined, chitinous or very weakly calcified; tergite of sixth somite weakly calcified, subdivided into narrow anterior transverse rod, and posterior pair of broad plates incompletely divided by median groove. Uropods symmetrical; protopods each with very prominent, posteriorly directed spine; exopods each with large, circular rasp of corneous scales; endopods each with ovate rasp of corneous scales. Telson with transverse suture or at least with distinct to weakly indicated mid-lateral indentation; terminal margin entire. Anus terminal or nearly so.

Key to the species of *Solitariopagurus*

1. Dorsal surface of carapace with transverse row of 4 distinct tubercles or spines proximal to anterior margin **2**
— Dorsal surface of carapace without transverse row of 4 distinct tubercles or spines proximal to anterior margin ..... ***S. profundus***

2. Rostrum triangular, terminating acutely or subacutely **3**
— Rostrum broad, "trowel-shaped" ..... ***S. trullirostris*** sp. nov.

3. Antennular peduncles overreaching ocular peduncles by 0.35–0.75 length of penultimate segment. Carpi of chelipeds, with slightly elevated and weakly armed longitudinal median crests on dorsal surfaces ..... ***S. triprobolus***

— Antennular peduncles overreaching ocular peduncles by length of ultimate segment or only slightly more. Carpi of chelipeds with row of spines or tubercles on prominent longitudinal crests on dorsal surfaces ..... ***S. tuerkayi***

Solitariopagurus trullirostris sp. nov.

Fig. 6

MATERIAL EXAMINED. — **New Caledonia**. Mbere Reef, 22°19.9'S, 166°13.2'E, 30 m, 7.01.1993: 1 ♂ (2.1 mm), 1 ov. ♀ (3.3 mm) (MNHN-Pg 5874).

Marquesas Islands. MUSORSTOM 9: stn DR 1259, 09°25.6'S, 140°08.3'W, 90-180 m, 3.09.1997: 1 immature ♀ (1.6 mm) (MNHN-Pg 5875).

TYPES. — The ovigerous female from Mbere Reef is the holotype; the male from the same locality is the allotype.

DESCRIPTION. — Shield (Fig. 6a) length shorter than breadth; anterior margin between rostrum and lateral projections straight or only very slightly concave; dorsal surface well calcified, with transverse row of 4 broad tubercles proximal to anterior margin; lateral margins each with relatively short, but prominent spiniform first lobe adjacent to anterolateral angle, broad, sometimes weakly bilobed second lobe at mid-length, and moderately slender subacute, somewhat hooked lobe adjacent to cervical groove; posterior margin roundly truncate. Posterior carapace with median element of posterior lobe moderately narrow, lateral elements subrectangular, unarmed; small posteromedian and posterolateral plates well calcified. Rostrum broad, roundly subacute, usually reaching to proximal 0.25 of ocular peduncles; slightly upturned, with elevated lateral margins. Lateral projections narrowly triangular; not as long as rostrum, directed anterolaterally.

Ocular peduncles laterally directed, slightly less than half shield length, with 3 prominent protuberances (not developed in immature specimen); corneas slightly dilated, diameter approximately 0.25 length of peduncle. Ocular acicles small, acutely triangular.

Antennular peduncles when fully extended exceeding length of ocular peduncles by almost entire length of ultimate segment. Ultimate segment with 2 or 3 long plumose setae on dorsodistal margin. Penultimate segment with few scattered short setae. Basal segment with tiny spinule on distolateral margin. Epistomial plate well calcified, broad, with pair of large subacute projections.

Antennal peduncles slightly shorter than ocular peduncles, and appreciably shorter than antennular peduncles. Fifth and fourth segments with few scattered, very short setae. Third segment unarmed. Second segment with dorsolateral distal angle produced, terminating in small spine or spinule; dorsomesial distal angle rounded. First segment with row of tubercles on ventrolateral margin. Antennal acicle moderately short, reaching nearly to or slightly beyond distal margin of fourth peduncular segment, terminating in tiny spinule, with 1 or 2 minute spinules on lateral margin. Antennal flagellum long, overreaching outstretched chelipeds, 1 or 2 short setae every 2 to 6 articles.

Thoracic sternites (Fig. 6b) smooth. Sternite of third maxillipeds produced into acute spinose process on either side of midline. Sternite of chelipeds moderately broad, subtriangular, surface concave, with blunt projection on either side of deep median groove. Sternite of second pereopods broad, plate-like, with faint median longitudinal groove. Sternite of third pereopods with narrowly subrectangular anterior lobe.

Right cheliped (Fig. 6c) elongate; considerably stronger but not appreciably longer than left; propodal-carpal articulation perpendicular. Dactyl slightly shorter than palm; cutting edge smooth or serrate and with 2 prominent calcareous teeth; terminating in small calcareous claw, slightly overlapped by fixed finger; dorsal surface convex, smooth or minutely granular, dorsomesial margin minutely serrate or tuberculate; ventral surface smooth or

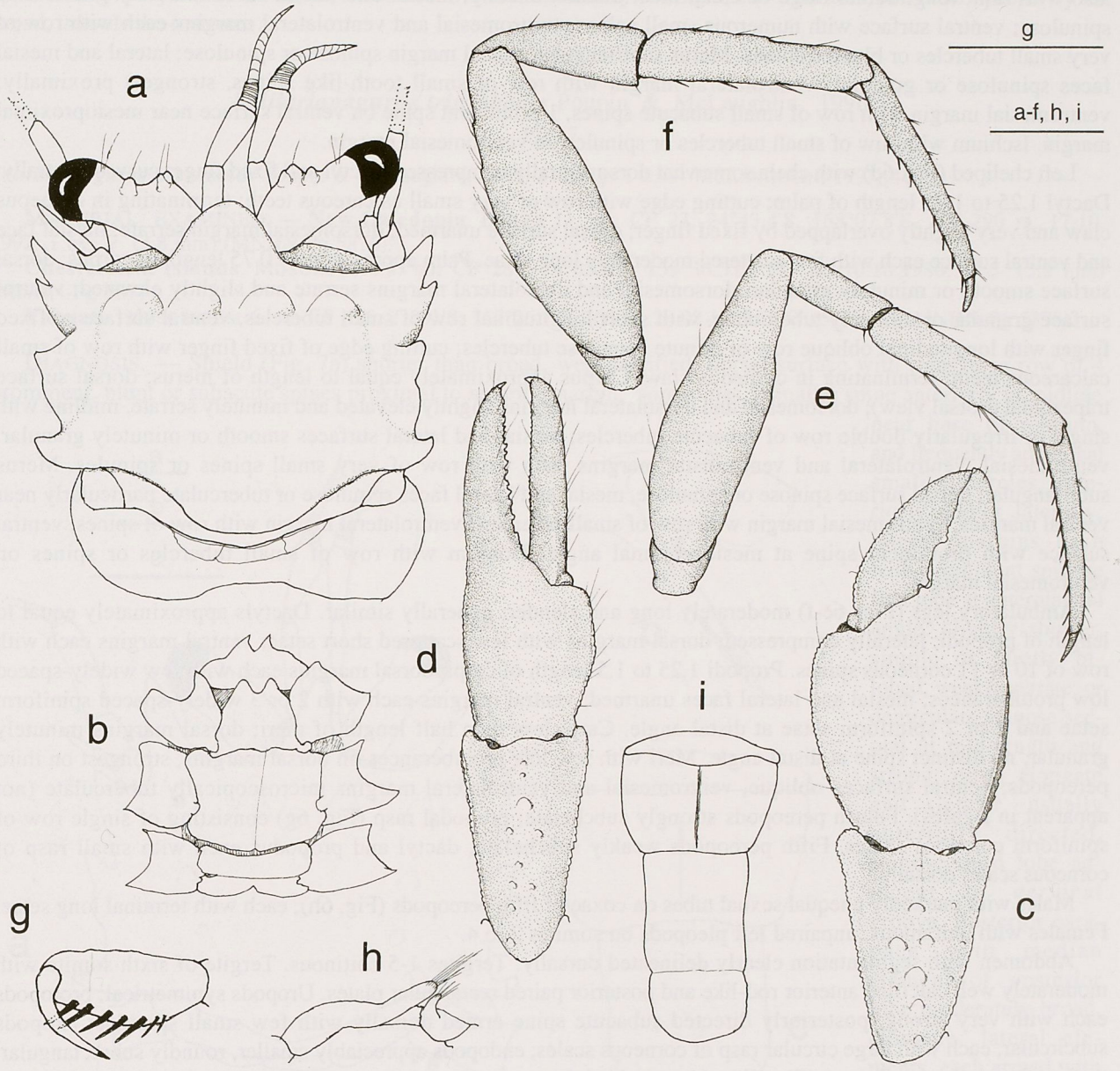

FIG. 6. — *Solitariopagurus trullirostris* sp. nov. a-i, holotype ♂ (2.1 mm) from Mbere Reef: **a**, cephalothorax and cephalic appendages (aesthetascs omitted); **b**, thorax (ventral view); **c**, carpus and chela of right cheliped (dorsolateral view); **d**, carpus and chela of left cheliped (dorsal view); **e**, right second pereopod (lateral view); **f**, right third pereopod (lateral view); **g**, propodus and dactyl of left fourth pereopod (lateral view); **h**, coxae and sternite of fifth pereopods; **i**, tergite of sixth abdominal somite and telson. Scales equal 1 mm (a-h), and 0.5 mm (i).

microscopically granular. Palm equal to or slightly longer than carpus; somewhat dorsoventrally compressed; dorsal surface convex, smooth or minutely granular; spinulose or serrate dorsomesial and dorsolateral margins slightly elevated; fixed finger also with smooth or minutely granular dorsal surface; cutting edge with 1 large and several smaller calcareous teeth; ventral surface of fixed finger with obliquely longitudinal spinulose or tuberculate ridge extending onto palm as row of distinct small spines; mesial face minutely spinulose. Carpus equal to or slightly longer than merus; trapezoidal (in dorsal view), with spinulose or tuberculate dorsomesial and dorsolateral margins slightly elevated; dorsal surface with irregular double median row of spinulose tubercles or blunt spines,

also with faint longitudinal ridge or crest, most distinct distally; mesial and lateral faces minutely granular or spinulose; ventral surface with numerous small spines, ventromesial and ventrolateral margins each with row of very small tubercles or blunted spines. Merus subtriangular; dorsal margin spinose or spinulose; lateral and mesial faces spinulose or granular; ventrolateral margin with row of small tooth-like spines, strongest proximally; ventromesial margin with row of small subacute spines, 1 prominent spine on ventral surface near mesioproximal margin. Ischium with row of small tubercles or spinules on ventromesial margin.

Left cheliped (Fig. 6d) with chela somewhat dorsoventrally compressed; dactyl and fixed finger curved ventrally. Dactyl 1.25 to 1.75 length of palm; cutting edge with row of very small calcareous teeth; terminating in corneous claw and very slightly overlapped by fixed finger; dorsal surface unarmed; dorsomesial margin serrate; mesial face and ventral surface each with few scattered moderately long setae. Palm approximately 0.75 length of carpus; dorsal surface smooth or minutely granular, dorsomesial and dorsolateral margins serrate and slightly elevated; ventral surface granular or minutely tuberculate, with short longitudinal row of small tubercles, ventral surface of fixed finger with longitudinal oblique row of minute spinulose tubercles; cutting edge of fixed finger with row of small calcareous teeth; terminating in corneous claw. Carpus approximately equal to length of merus; dorsal surface trapezoidal (dorsal view); dorsomesial and dorsolateral margins slightly elevated and minutely serrate, midline with single or irregularly double row of subacute tubercles; mesial and lateral surfaces smooth or minutely granular, ventromesial, ventrolateral and ventrodistal margins each with row of very small spines or spinules. Merus subtriangular; dorsal surface spinose or spinulose, mesial and lateral faces spinulose or tuberculate particularly near ventral margins; ventromesial margin with row of small tubercles; ventrolateral margin with row of spines, ventral surface with prominent spine at mesioproximal angle. Ischium with row of small tubercles or spines on ventromesial margin.

Ambulatory legs (Figs 6e-f) moderately long and slender; generally similar. Dactyls approximately equal to length of propodi; laterally compressed; dorsal margins with few scattered short setae; ventral margins each with row of 10 or 11 corneous spines. Propodi 1.25 to 1.5 length of carpi; dorsal margins each with few widely-spaced low protuberances; mesial and lateral faces unarmed; ventral margins each with 2 or 3 widely-spaced spiniform setae and 1 or 2 spiniform setae at distal angle. Carpi less than half length of meri; dorsal margins minutely granular, no distinct spine at distal angle. Meri with few low protuberances on dorsal margins, strongest on third pereopods; ventral surfaces oblique, ventromesial and ventrolateral margins microscopically tuberculate (not apparent in figures). Fourth pereopods strongly subchelate; propodal rasp (Fig. 6g) consisting of single row of spiniform corneous scales. Fifth pereopods weakly subchelate; dactyl and propodus each with small rasp of corneous scales dorsally.

Males with markedly unequal sexual tubes on coxae of fifth pereopods (Fig. 6h); each with terminal long setae. Females with uniramous, unpaired left pleopods on somites 2 to 4.

Abdomen with segmentation clearly delineated dorsally. Tergites 1-5 chitinous. Tergite of sixth somite with moderately well calcified anterior rod-like and posterior paired rectangular plates. Uropods symmetrical; protopods each with very strong, posteriorly directed subacute spine armed dorsally with few small spinules; exopods subcircular, each with large circular rasp of corneous scales; endopods appreciably smaller, roundly subrectangular, each with small rasp. Telson (Fig. 6i) with anterior lobes appearing to becoming more elongate with increasing size; complete, but very faint transverse suture separating membranous anterior and posterior lobes; terminal margin entire, with rounded external angles; anus terminal.

COLOR. — Unknown.

HABITAT. — Utilizing half of bivalve shell.

DISTRIBUTION. — Presently known from Mbere Reef in New Caledonia, and one locality in the Marquesas; 30-90, possibly as deep as 180 m.

ETYMOLOGY. — The specific name is taken from the Latin *trulla*, meaning trowel, and *rostrum*, and denotes the broad, trowel-like rostrum of this species.

REMARKS. — *Solitariopagurus trullirostris* sp. nov. shares with *S. triprobolus* and *S. tuerkayi* the distinctive character of four prominent tubercles on the anterior portion of the shield, an attribute that sets all three species

apart from *S. profundus*. However, *S. trullirostris* is immediately distinguished from all three other species by its broad, trowel-like rostrum.

Solitariopagurus triprobolus Poupin & McLaughlin, 1996

Fig. 7

Solitariopagurus triprobolus Poupin & McLaughlin, 1996: 212, figs 1-2. — McLaughlin, 1997: 464.

Material examined. — **New Caledonia**. Beryx 11: stn CP 23, 24°43.4'S, 168°07.8'E, 270-290 m, 17.10.1992: 1 ov. ♀ (3.8 mm) (MNHN-Pg 5876).

Chesterfield Islands. Musorstom 5: stn CP 287, 24°05.4'S, 159°36.5'E, 270 m, 10.10.1986: 1 ♂ (5.2 mm) (MNHN-Pg 5877).

Vanuatu. Musorstom 6: stn CP 455, 21°01'S, 167°26.1'E, 260 m, 20.02.1989: 1 ♀ (5.7 mm) (MNHN-Pg 5878).

Diagnosis. — Shield (Fig. 7a) shorter than broad, well calcified; dorsal surface with transverse row of 4 prominent, blunt or subacute spines proximal to anterior margin, sometimes 1 smaller spine anteriorly in midline near base of rostrum, and frequently additional small tubercles anteriorly and/or laterally; lateral margins each with prominent spinose first lobe at anterolateral angle, slightly shorter, simple or faintly bilobed, weakly serrate, or denticulate spinose second at mid-length and strong, often elongate and slender, usually anteriorly directed, spinose third lobe adjacent to cervical groove. Posterior carapace with median element of posterior lobe moderately broad, elongate, lateral elements, each armed with spine and/or projecting laterally as short, spinose process; posterolateral and posteromedian plates small, weakly to moderately well calcified. Rostrum triangular, elongate, usually reaching to distal half of ocular peduncles. Lateral projections extremely well developed, often reaching to or beyond tip of rostrum, directed anteriorly. Ocular peduncles moderately short. Antennular peduncles overreaching distal margins of corneas by at least 0.35 length of penultimate segment. Antennal peduncles overreaching distal margins of corneas by at least 0.25 length of ultimate segment. Sternite of chelipeds subtriangular, with terminal notch or indentation medially.

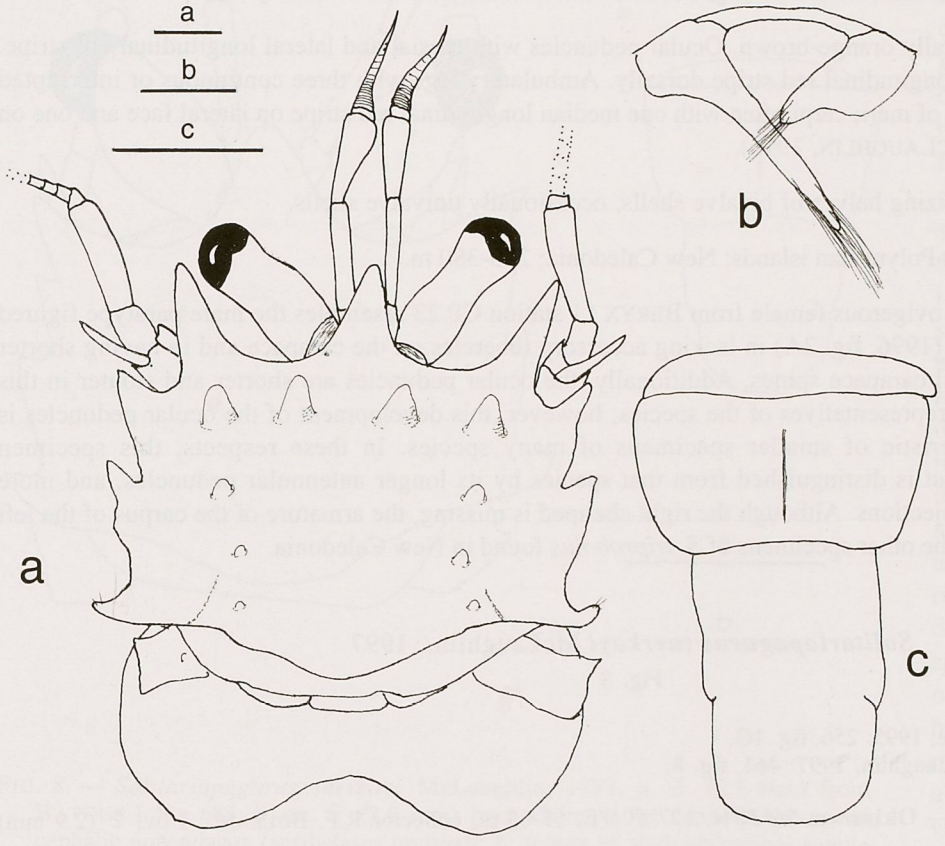

Fig. 7. — *Solitariopagurus triprobolus* Poupin & McLaughlin, 1996. a-c, ♂ (5.2 mm) from Musorstom 5 Stn CP 287: **a**, cephalothorax and cephalic appendages (aesthetascs omitted); **b**, coxae and sternite of fifth pereopods; **c**, tergite of sixth abdominal somite and telson. Scales = 1 mm.

Right cheliped stronger, but not appreciably longer than left. Dorsal surfaces of palm, fixed finger and dactyl, smooth or minutely granular. Carpus trapezoidal (in dorsal view), dorsomesial and dorsolateral distal angles frequently produced as wing-like projections; dorsal surface often with scattered small tubercles or spinules, also with median or submedian longitudinal row of tubercles, strongest in proximal half.

Left cheliped with dorsal surfaces of palm, fixed finger and dactyl smooth or minutely granular. Carpus frequently with scattered tubercles on dorsal surface; dorsomesial and dorsolateral distal angles often produced as wing-like projections, with raised, serrate dorsomesial and dorsolateral margins, midline with longitudinal row of simple or multidenticulate, spinulose tubercles or small spines, at least proximally.

Ambulatory legs long and slender; dactyls usually distinctly shorter than propodi, each with row of 9-17 corneous spines on ventral margin. Propodi with minutely granular or spinulose dorsal and ventral surfaces; ventral margins with 3 widely-spaced spiniform setae. Carpi with minutely granular or spinulose dorsal surfaces; lateral faces each with median longitudinal ridge and often longitudinal band of minute spinules. Meri with minutely granular of spinulose dorsal and ventral margins. Fourth pereopods each with row of 6-8 club-shaped corneous scales on ventral margin of propodus.

Male sexual tubes (Fig. 7b) weakly calcified. Telson (Fig. 7c) with anterior portion moderate to elongate; transverse suture weakly delineated; terminal margin entire, rounded; anus terminal or nearly so.

COLOR. — Overall generally orange-brown. Ocular peduncles with mesial and lateral longitudinal red stripe. Antennular peduncles with longitudinal red stripe dorsally. Ambulatory legs with three continuous or interrupted red stripes on lateral surfaces of meri; carpi often with one median longitudinal red stripe on lateral face and one on dorsal surface (POUPIN & McLAUGHLIN, 1996).

HABITAT. — Usually utilizing halves of bivalve shells, occasionally univalve shells.

DISTRIBUTION. — French Polynesian islands; New Caledonia; 200-380 m.

REMARKS. — The small, ovigerous female from BERYX 11 station CP 23 resembles the male paratype figured by POUPIN & McLAUGHLIN (1996, fig. 2A) in lacking accessory tubercles on the carapace and in having shorter lateral projections and lateral carapace spines. Additionally, the ocular peduncles are shorter and stouter in this specimen than seen in most representatives of the species; however, this development of the ocular peduncles is not an uncommon characteristic of smaller specimens of many species. In these respects, this specimen approximates *S. tuerkayi*; but is distinguished from that species by its longer antennular peduncles, and more anteriorly directed lateral projections. Although the right cheliped is missing, the armature of the carpus of the left cheliped agrees with that of the other specimens of *S. triprobolus* found in New Caledonia.

Solitariopagurus tuerkayi McLaughlin, 1997

Fig. 8

Porcellanopagurus sp. - TUDGE, 1995: 256, fig. 1G.
Solitariopagurus tuerkayi McLaughlin, 1997: 461, fig. 8.

MATERIAL EXAMINED. — **Okinawa**. 26°30'N, 127°50.9'E, 61-65 m, collector R.F. BOLLAND: 1 ov. ♀ (2.9 mm) (USNM 276172).
New Caledonia. BATHUS 1: stn 684, 20°34'S, 165°07'E, 110-130 m, 16.03.1993, 1 ♂ (2.1 mm) (MNHN-Pg 5879).

DIAGNOSIS. — Shield (Fig. 8a) length shorter than breadth; dorsal surface with transverse row of 4 moderately low, narrow to broad tubercles proximal to anterior margin; posterolateral region weakly delineated and usually somewhat globular; lateral margins each with relatively short, but prominent spinose first lobe adjacent to anterolateral angle, slender or broad, simple or weakly bilobed, acute or subacute spinose second lobe at mid-length, and short, broad or moderately slender spinose third lobe adjacent to cervical groove; posterior margin broadly rounded. Posterior carapace (damaged in New Caledonia specimen) with posterior lobe consisting of

moderately slender median element and pair of unarmed lateral elements, sometimes projecting as short blunt or spinose processes; posterolateral and posteromedian plates not delineated or sometimes very weakly calcified. Rostrum elongate, usually reaching to proximal half of ocular peduncles; broad, usually terminating bluntly. Lateral projections triangular; moderately elongate, slightly shorter to slightly longer than rostrum, directed anterolaterally. Ocular peduncles short or moderately short, corneas somewhat dilated. Antennular peduncles when fully extended, elongate, overreaching ocular peduncles by full length of ultimate segment to 0.25 of penultimate segment. Antennal peduncles overreaching ocular peduncles by 0.1 to 0.5 length of ultimate segment.

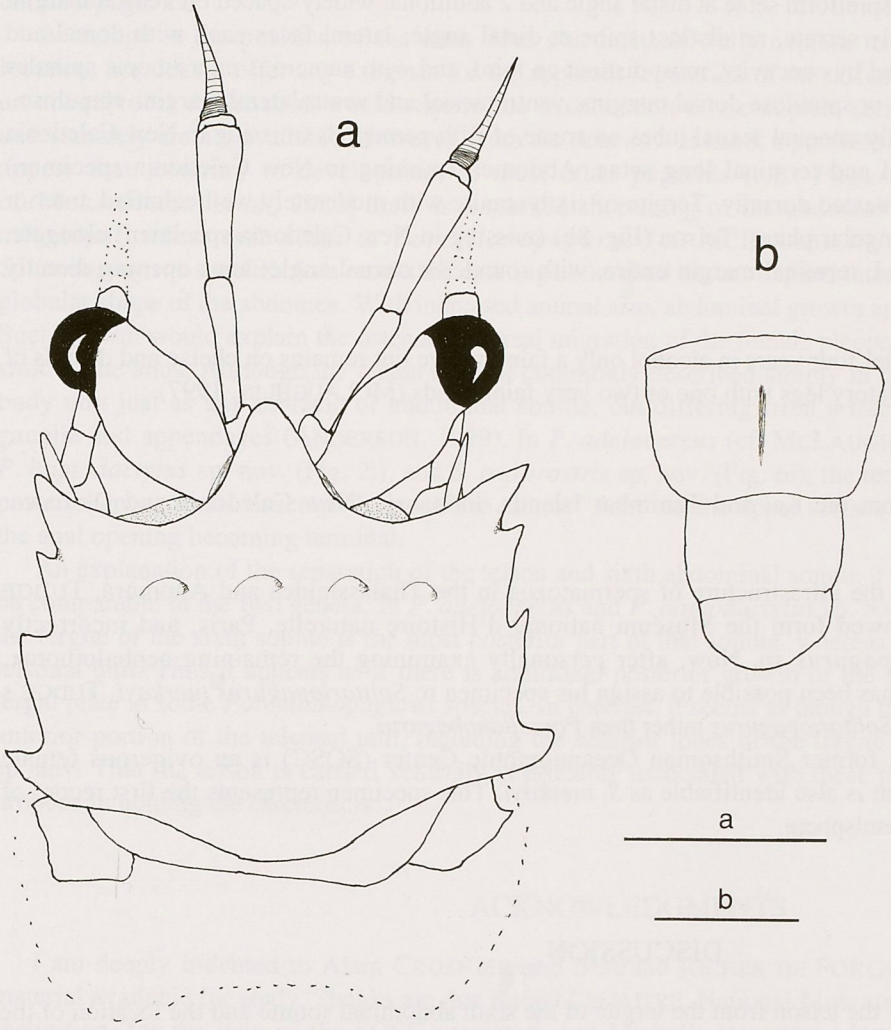

FIG. 8. — *Solitariopagurus tuerkayi* McLaughlin, 1997. a, ♂ (2.1 mm) from BATHUS 1 Stn 684; b, ov. ♀ (2.9 mm) from Okinawa: **a**, cephalothorax and cephalic appendages (aesthetascs omitted); **b**, tergite of sixth abdominal somite and telson. Scales = 1 mm (a) and 0.5 mm (b).

Right cheliped elongate; considerably stronger than left. Dactyl with dorsal surface convex, smooth or minutely granular, dorsomesial margin minutely serrate; ventral surface smooth or microscopically granular. Palm with dorsal surface convex, smooth or minutely granular; spinulose or serrate dorsomesial and dorsolateral margins slightly elevated; fixed finger also with smooth or minutely granular dorsal surface; ventral surface of fixed finger with obliquely longitudinal and microscopically tuberculate ridge extending onto palm in distal half. Carpus with spinulose dorsomesial and dorsolateral margins slightly elevated; dorsal surface with scattered small tubercles or spinules, also with longitudinal median ridge or crest, most distinct distally and armed with spinules or tuberculate spines, one strongest in proximal half; mesial and lateral faces minutely granular or spinulose; ventromesial and ventrolateral margins each with row of very small tubercles or blunted spines. Merus with row of small spines on ventrolateral margin strongest proximally; ventromesial margin with row of small spines distally, 3 or 4 very prominent spines proximally.

Left cheliped with dorsal and ventral surfaces of dactyl unarmed; dorsomesial margin serrate, at least in proximal half. Palm with dorsal surface smooth or minutely granular, dorsomesial and dorsolateral margins serrate and slightly elevated; ventral surface granular or minutely tuberculate, with short distal longitudinal row of small tubercles extending onto proximal half of fixed finger. Carpus with few scattered very small tubercles or spinules; dorsomesial and dorsolateral margins raised and serrate, midline with somewhat elevated crest armed with row of

simple or multidenticulate spinulose tubercles or small spines, strongest proximally, and with 1 very prominent tuberculate spine at mid-length; mesial, lateral, and ventral surfaces spinulose or tuberculate, ventrodistal margin with row of tubercles. Merus with row of small spinules, becoming strong spines proximally on ventromesial margin; ventrolateral margin minutely spinulose distally becoming row of stronger spines in proximal half.

Ambulatory legs moderately long and slender; generally similar. Dactyls approximately equal to length of propodi; dorsal margins with few scattered short setae; ventral margins each with row of 9 to 12 corneous spines. Propodi with serrate dorsal margins; mesial and lateral faces minutely spinulose, particularly ventrally; ventral margins each with 1 or 2 corneous spiniform setae at distal angle and 2 additional widely-spaced on ventral margin. Carpi with dorsal margins minutely serrate, no distinct spine at distal angle; lateral faces each with dorsal and median longitudinal ridges separated by concavity, most distinct on third, and with numerous microscopic spinules in ventral halves. Meri with serrate or spinulose dorsal margins; ventromesial and ventrolateral margins spinulose.

Males with subequal or markedly unequal sexual tubes on coxae of fifth pereopods (missing in New Caledonia specimen); each with subterminal and terminal long setae. Abdomen (missing in New Caledonia specimen) reduced, segmentation clearly delineated dorsally. Tergite of sixth somite with moderately well calcified anterior rod-like and posterior paired rectangular plates. Telson (Fig. 8b) (missing in New Caledonia specimen) elongate; transverse suture clearly delineated; terminal margin entire, with rounded external angle; anus opening directly beneath terminal margin.

COLOR (in preservative). — After four years in alcohol only a faint orange tint remains on chelae and dactyls of ambulatory legs; propodi of ambulatory legs with one or two very faint bands (McLAUGHLIN, 1997).

HABITAT. — Unknown.

DISTRIBUTION. — Known from the Kai and Tanimbar Islands, Indonesia, New Caledonia and Okinawa; 61-212 m.

REMARKS. — In his study of the ultrastructure of spermatozoa in the Thalassinidea and Anomura, TUDGE (1995) utilized a specimen borrowed form the Muséum national d'Histoire naturelle, Paris, and incorrectly identified for him as *Porcellanopagurus* sp. Now, after personally examining the remaining cephalothorax, chelipeds and ambulatory legs, it has been possible to assign his specimen to *Solitariopagurus tuerkayi*. TUDGE's findings should now be referred to *Solitariopagurus* rather than *Porcellanopagurus*.

Among the collections of the former Smithsonian Oceanographic Center (SOSC) is an ovigerous female specimen collected in Okinawa that is also identifiable as *S. tuerkayi*. This specimen represents the first record of *Solitariopagurus* in the northern hemisphere.

DISCUSSION

The matter of the separation of the telson from the tergite of the sixth abdominal somite and the location of the anal opening require further commentary. In the course of crustacean development, somite addition occurs between the dignathan head and the telson (e.g. CALMAN,1909; ANDERSON, 1979). The telson is, by that criterion, not considered a true somite (McLAUGHLIN, 1980). However, SHAROV (1966) and BOWMAN (1971) contended that two types of non-homologous telsons occurred in crustaceans, one in which no appendages were present and the anus was subterminal, and a second in which the anus was terminal and caudal rami were present. These authors considered that the latter type of telson was actually a terminal (anal) body somite. Although SCHMINKE (1976), argued rather convincingly that BOWMAN's (1971) interpretation of the telson was incorrect, SCHRAM (1986) continued to make the distinction. According to BOWMAN (1971), while the anus may open distally on the ventral surface of the telson in decapods, no decapod has a terminal anus. To the contrary, in some species of *Porcellanopagurus* and *Solitariopagurus* the anus is clearly terminal, while nearly so in others. Consequently by SHAROV (1966), BOWMAN (1971) and SCHRAM's (1986) definition, the telson in at least certain species in these two genera would be the seventh, and anal, body somite, albeit lacking appendages. While SCHMINKE (1976) did

not address the condition in decapods, he did suggest that the position of the anus was not an important feature for the definition of the telson. As he noted, a change in the position of the anus is not an uncommon phenomenon and might even change within the same animal during the course of its development. ROBERTS (1972) clearly indicated in his description of the larval stages of *Porcellanopagurus edwardsi* that the anus was located anteriorly on the ventral surface of the telson. MCLAUGHLIN (in press) reported that the telson was still in an anteroventral position in the megalopa of this species, but shifted to a slightly more posterior position in the first crab stage. Thus it is obvious that a positional change does occur in *Porcellanopagurus*, and presumably does as well in *Solitariopagurus*.

A change in the position of the anus does not, in itself, fully explain its unusual migration to a terminal location, nor does it offer any exegesis for the apparent separation of the telson from the sixth somite. To submit an unequivocal explanation would require the examination of a complete series of juvenile crab stages, which unfortunately are not available. However, from the data now at hand, a possible scenario can be put forth. It would appear that, contrary to development in most other pagurids [e.g., *Pagurus kennerlyi* (Stimpson, 1864), cf. MCLAUGHLIN *et al.*, 1989] there is a marked shortening of the abdomen that accompanies the molt from megalopa to first crab stage in *Porcellanopagurus* (cf. MCLAUGHLIN, in press) and presumably also *Solitariopagurus* species. As a result, the existing abdominal tissues expand laterally, which accounts for the semi-globular shape of the abdomen. With increased animal size, abdominal growth appears to be somewhat volumetric. Such growth would explain the ostensible dorsal migration of the female pleopods and perhaps even the posterior shift of the anus. Although the telson is most commonly described simply in terms of its tergal structure, it is a body unit just as any thoracic or abdominal somite, but differing from a true somite in the absence of paired ganglia and appendages (ANDERSON, 1979). In *P. adelocercus* (cf. MCLAUGHLIN & HOGARTH, 1998, fig. 29), *P. haptodactylus* sp. nov. (Fig. 2i), and *S. trullirostris* sp. nov. (Fig. 6i), the tergite of the telson is no longer the posterior-most dorsal structure. It appears to almost "float" on the upper surface of an extended telsonal unit, with the anal opening becoming terminal.

An explanation of the separation of the telson and sixth abdominal somite it less straightforward, and may not be comparable in the two genera. In *P. adelocercus* and *P. haptodactylus* sp. nov. there is no clear indication that the tergite of the sixth somite is the most posterior part of that somite, whereas there is a clear delineation of the telsonal unit. Thus it appears as if there is additional posterior growth of the sixth somite beyond the calcified tergal plate in some *Porcellanopagurus* species. In contrast, it seems as though the additional growth occurs in the anterior portion of the telsonal unit, including the anterior lobes of the tergite in *Solitariopagurus trullirostris* sp. nov. That the telson is carried ventrally is probably associated with these phenomena and the actions of the uropods in holding the carcinoecia.

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REFERENCES

ANDERSON, D.T., 1979. — Embryos, fate maps, and the phylogeny of arthropods. *In*: A.P. GUPTA (ed.), *Arthropod Phylogeny*. Van Nostrand Reinhold Co. New York. Pp. 59-105, figs 2.1-2.22.

BALSS, H., 1913. — Ostasiatische Decapoden I. Die Galatheiden und Paguriden. *In*: Beiträge zur Naturgeschichte Ostasiens, herausgegeben von Dr. F. DOFLEIN. *Abhandlungen der math.-phys. Klasse der K. Bayerischen Akademie der Wissenschaften*, Supplement **2** (9): 1-85, figs 1-56, pls 1-2.

BALSS, H., 1930. — Zoologische Ergebnisse der Reisen von Dr. Kohl-Larsen nach den subantarktischen inseln bei Neuseeland und nach Sudgeorgien. Die Dekapoden (Crustaceen). *Senckenbergiana*, **12**: 195-210.

BENNETT, E.W., 1932. — Porcellanids and *Porcellanopagurus* from New Zealand. *Records of the Canterbury Museum*, **3** (7): 469-481, pl. 60.

BORRADAILE, L.A., 1916a. — Crustacea. Part 1. Decapoda. *British Antarctic ("Terra Nova") Expedition, 1910.* Natural History Report. Zoology, **3** (2): 75-110, figs 1-16.

BORRADAILE, L.A., 1916b. — Crustacea. Part II. *Porcellanopagurus*: An instance of carcinization. *British Antarctic ("Terra Nova") Expedition, 1910.* Natural History Report. Zoology, **3** (3): 111-126, figs 1-13.

BOUCHET, P., 1994. — Atelier Biodiversité récifale. Expédition Montrouzier. Touho-Koumac, Nouvelle Calédonie, 23 août-5 novembre 1993. *Rapports de Missions. Sciences de la Mer. Biologie marine. Centre ORSTOM de Nouméa*, (24), 63 pp.

BOWMAN, T.E., 1971. — The case of the nonubiquitous telson and the fraudulent furca. *Crustaceana*, **21** (2): 165-175, figs 1-9.

CALMAN, W.T., 1909. — Pt 7, Appendiculata, Fascicle 3, Crustacea. *In*: R. LANKESTER (ed.), *A Treatise on Zoology*. Adam & Charles Black, London. Reprinted A. Asher & Co. Amsterdam, 1964. i-viii + 346 pp., 194 figs.

CHILTON, C., 1911. — The Crustacea of the Kermadec Islands. *Transactions and Proceedings of the New Zealand Institute*, **43**: 544-573.

FILHOL, H., 1885a. — Description d'un nouveau genre de Crustacés provenant de la Nouvelle-Zélande. *Bulletin de la Société Philomatique de Paris*, (7) **9**: 47-48.

FILHOL, H., 1885b. — Considérations relatives à la faune des Crustacés de la Nouvelle-Zélande. *Bibliothèque de l'École des Hautes Études, Section des Sciences Naturelles*, **30** (2): 3-60.

FOREST, J., 1951a. — Contribution à l'étude du genre *Porcellanopagurus* Filhol (Paguridae). 1. Description de *P. edwardsi* Filhol. *Bulletin du Muséum national d'Histoire naturelle*, (2) **23**: 82-90, figs 1-12.

FOREST, J., 1951b. — Contribution à l'étude du genre *Porcellanopagurus* Filhol (Paguridae). 2. Remarques systématiques et biologiques. *Bulletin du Muséum national d'Histoire naturelle*, (2) **23**: 181-186.

GORDAN, J., 1956. — A bibliography of pagurid crabs, exclusive of Alcock, 1905. *Bulletin of the American Museum of Natural History*, **108**: 253-352.

KENSLEY, B., 1977. — The South African Museum's Meiring Naude Cruises Part 2. Crustacea, Decapoda, Anomura and Brachyura. *Annals of the South African Museum*, **72** (9): 161-188, figs 1-17.

LENZ, H., 1902. — Die Crustaceen der Sammlung Plate. (Decapoda und Stomatopoda). *Zoologischer Jahrbücher. Jena. Abt. Systematik (Ökologie), Geographie und Biologie*, Supplement, **5**: 731-772.

LATREILLE, P.A., 1829. — *Les Crustacés, les Arachnides et les Insectes, distribués en familles naturelles, ouvrage formant les tomes 4 et 5 de celui de M. le baron Cuvier sur le règne animal.* Ed. 2, Déterville, Paris. 584 pp.

LEHODEY, P., RICHER DE FORGES, B., NAUGES, C., GRANDPERRIN, R. & RIVATON, J., 1993. — Campagne BERYX 11 de pêche au chalut sur six monts sous-marins du Sud-Est de la Zone Économique de Nouvelle-Calédonie (N.O. "Alis", 13 au 23 octobre 1992). *Rapports de missions. Science de la mer. Biologie marine. Centre ORSTOM de Nouméa*, (22), 93 pp.

MCLAUGHLIN, P.A., 1974. — The hermit crabs (Crustacea Decapoda, Paguridea) of northwestern North America. *Zoologische Verhandelingen*, **130**: 1-396, figs 1-101, pl. 1.

MCLAUGHLIN, P.A., 1980. — *Comparative Morphology of Recent Crustacea.* W.H. Freeman and Company, San Francisco, CA. 177 pp., 53 figs.

MCLAUGHLIN, P.A., 1997. — Crustacea Decapoda: Hermit crabs of the family Paguridae from the KARUBAR cruise in Indonesia. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, vol. 16. *Mémoires du Muséum national d'Histoire naturelle*, **172**: 433-572, figs 1-44.

MCLAUGHLIN, P.A., in press. — Megalopal and early crab stages of *Porcellanopagurus edwardsi* Filhol (Decapoda: Anomura: Paguridea). *Proceedings of the Biological Society of Washington.*

MCLAUGHLIN, P.A. & HOGARTH, P.J., 1998. — Hermit crabs (Decapoda: Anomura: Paguridea) from the Seychelles. *Zoologische Verhandelingen*, **318**: 1-48, figs 1-52, pls 1-2.

McLAUGHLIN, P.A. & LEMAITRE, R., 1997. — Carcinization - fact or fiction? I. Evidence from adult morphology. *Contributions to Zoology, Amsterdam*, **67** (2): 79-123, figs 1-13.

McLAUGHLIN, P.A. & LEMAITRE, R., in press. — Aspects of evolution in the anomuran superfamily Paguroidea. One larval prospective. *In*: P.F. CLARK (ed.), Proceedings of the 2nd Larval Conference, 6-9 September 1999, Lisbon, Portugal. *Invertebrate Reproduction and Development*.

McLAUGHLIN, P.A. & SAINT LAURENT, M. DE, 1998. — A new genus for four species of hermit crabs heretofore assigned to the genus *Pagurus* Fabricius (Decapoda: Anomura: Paguridae). *Proceedings of the Biological Society of Washington*, **111** (1): 158-187, figs 1-12.

McLAUGHLIN, P.A., GORE, R.H. & BUCE, W.R., 1989. — Studies on the *provenzanoi* and other pagurid groups: III. The larval and early juvenile stages of *Pagurus kennerlyi* (Stimpson) (Decapoda: Anomura: Paguridae), reared in the laboratory. *Journal of Crustacean Biology*, **9** (4): 626-644, figs 1-9.

MIYAKE, S., 1978. — *The crustacean Anomura of Sagami Bay*. 1-200 (English) + 1-161 (Japanese) pp., figs 1-72, pls 1-4. Hoikusha Publishing Co. Tokyo.

MORGAN, G.J. & FOREST, J., 1991. — A new genus and species of hermit crab (Crustacea, Anomura, Diogenidae) from the Timor Sea, north Australia. *Bulletin du Muséum national d'Histoire naturelle*, (4), section A, **13** (1-2): 189-202, figs 1-22.

PILGRIM, R.L.C., 1973. — Axial skeleton and musculature in the thorax of the hermit crab, *Pagurus bernhardus* [Anomura: Paguridae]. *Journal of the Marine Biological Association of the United Kingdom*, **53**: 363-396, figs 1-9.

POUPIN, J. & McLAUGHLIN, P.A., 1996. — A new species of *Solitariopagurus* Türkay (Decapoda: Anomura: Paguridae) from French Polynesia. *Bulletin du Muséum national d'Histoire naturelle, Paris*, (4), section A, **18** (1-2): 211-224, figs 1-4.

RICHER DE FORGES, B., 1990. — Les campagnes d'exploration de la faune bathyale dans la zone économique de la Nouvelle-Calédonie. *In*: A. CROSNIER (ed.), Résultats des Campagnes MUSORSTOM, Vol. 6. *Mémoires du Muséum national d'Histoire naturelle*, (A), **145**: 9-54.

RICHER DE FORGES, B., 1993. — Campagnes d'exploration de la faune bathyale faites depuis mai 1989 dans la zone économique de la Nouvelle-Calédonie. Liste des stations. *In*: A. CROSNIER (ed.), Résultats des Campagnes MUSORSTOM, vol. 10. *Mémoires du Muséum national d'Histoire naturelle*, (A), **156**: 27-32.

RICHER DE FORGES, B. & CHEVILLON, C., 1996. — Les campagnes d'échantillonnage du benthos bathyal en Nouvelle-Calédonie, en 1993 et 1994 (BATHUS 1 à 4, SMIB 8 et HALIPRO 1). *In*: A. CROSNIER (ed.), Résultats des Campagnes MUSORSTOM, vol. 15. *Mémoires du Muséum national d'Histoire naturelle*, **168**: 33-53.

RICHER DE FORGES, B., POUPIN, J. & LABOUTE, P., 1999. — La campagne MUSORSTOM 9 dans l'archipel des îles Marquises (Polynésie française). Compte rendu et liste des stations. *In*: A. CROSNIER (ed.), Résultats des Campagnes MUSORSTOM, Vol. 20. *Mémoires du Muséum national d'Histoire naturelle*, **180**: 9-29.

ROBERTS, P.E., 1972. — Larvae of *Porcellanopagurus edwardsi* Filhol, 1885 (Crustacea: Decapoda: Paguridae) from Perseverance Harbour, Campbell Island. *Journal of the Royal Society of New Zealand*, **2** (3): 383-391, figs 1-36.

SAINT LAURENT, M. DE & McLAUGHLIN P.A., 2000. — Superfamily Paguroidea, family Paguridae. *In*: FOREST, J., SAINT LAURENT, M. DE, McLAUGHLIN, P.A., & LEMAITRE, R., Marine Fauna of New Zealand: Paguroidea (Decapoda: Anomura) exclusive of the Lithodidae. *NIWA Biodiversity Memoir*, **114**: 104-209, figs 33-66, pls 2-4.

SCHMINKE, H.K., 1976. — The ubiquitous telson and the deceptive furca. *Crustaceana*, **30** (3): 292-300, figs 1-13.

SCHRAM, F.R., 1986. — *Crustacea*. Oxford University Press, Oxford, New York. xiv + 606 pp., 263 figs.

SHAROV, A.G., 1966. — *Basic arthropodan stock, with special reference to insects*. Pergamon Press, Oxford. xii + 271 pp.

STIMPSON, W., 1864. — Descriptions of new species of marine invertebrates from Puget Sound, collected by the naturalists of the North-west Boundary Commission, A.H. Campbell, Esq., Commissioner. *Proceedings of the Academy of Natural Sciences of Philadelphia*, (2) **1864**: 153-161.

SUZUKI, H. & TAKEDA, M., 1987. — Occurrence of a new hermit crab of the genus *Porcellanopagurus* (Decapoda, Paguridae) in the sea adjacent to the Palau Islands. *Proceedings of the Japanese Society of Systematic Zoology*, **36**: 17-24, figs 1-3.

TAKEDA, M., 1981. — A new hermit crab of the genus *Porcellanopagurus* from the Ogasawara Islands. *Bulletin of the Biogeographical Society of Japan*, **36** (2): 8-13, figs 1-3.

TAKEDA, M., 1985. — Occurrence of a new hermit crab of the genus *Porcellanopagurus* in the Sea of Japan. *Memoirs of the National Science Museum, Tokyo*, **18**: 141-144, figs 1-2.

TUDGE, C.C., 1995. — Ultrastructure and phylogeny of the spermatozoa of the infraorders Thalassinidea and Anomura (Decapoda, Crustacea). *In*: B.G.M. JAMIESON, J. AUSIO and J.-L. JUSTINE (eds), Advances in spermatozoal phylogeny and taxonomy. *Mémoires du Muséum national d'Histoire naturelle*, **166**: 251-263, figs 1-3.

TÜRKAY, M., 1986. — Crustacea Decapoda Reptantia der Tiefsee des Roten Meeres. *Senckenbergiana Maritima*, **18** (3/6): 123-185, figs 1-57, pls 1-4.

WHITELEGGE, T., 1900. — Scientific results of the trawling expedition of HMS "Thetis", off the coast of New South Wales, February and March, 1898. *Australian Museum Memoirs*, **4**: 135-199, pls 32-35.

WOLFF, T., 1961. — Description of a remarkable deep-sea hermit crab with notes on the evolution of the Paguridae. *Galathea Report*, **4**: 11-32, figs 1-11.

ZARENKOV, N.A., 1990. — Decapoda (Stenopodidea, Brachyura, Anomura) of the Nazca and Sala-y-Gomes [sic] underwater ridges. *Trudy Instituta Okeanologii*, **124**: 234-244, figs 1-14 (In Russian).