

A new species and new records of palicoid crabs (Crustacea, Decapoda, Brachyura, Palicoidea, Palicidae, Crossotonotidae) from the Indo-West Pacific region

Peter CASTRO

California State Polytechnic University, Biological Sciences Department,
Pomona, California 91768 (USA)
pcastro@csupomona.edu

Castro P. 2010. — A new species and new records of palicoid crabs (Crustacea, Decapoda, Brachyura, Palicoidea, Palicidae, Crossotonotidae) from the Indo-West Pacific region. *Zoosystema* 32 (1): 73-86.

ABSTRACT

Material from recent expeditions has provided an opportunity to update the revision of the Indo-West Pacific species of the families Palicidae Bouvier, 1898, and Crossotonotidae A. Milne-Edwards, 1873 (Crustacea, Brachyura, Palicoidea). A species of *Neopalicus* Moosa & Serène, 1981 from the Austral Islands, French Polynesia was found to be new to science. The new species can be separated from the two previously described species of *Neopalicus* in the morphologies of its rostrum, suborbital borders, and the abdomen and first pleopods of the male. The male of a species previously known only from the female holotype, *Paliculus foliatus* Castro, 2000 is also described. Six species of Palicidae and three species of Crossotonotidae are recorded for the first time from the Philippines. One species of Palicidae is a new record for the Solomon Islands in the western Pacific, one species each of Palicidae and Crossotonotidae are new records for Vanuatu in the western Pacific, while 10 species of Palicidae are first-time records for Tonga in the southwestern Pacific at the extreme eastern margin of the Indo-Australian Plate.

KEY WORDS

Crustacea,
Decapoda,
Brachyura,
Palicoidea,
Palicidae,
Crossotonotidae,
French Polynesia,
Philippines,
Solomon Islands,
Tonga,
Vanuatu,
new species,
new records.

RÉSUMÉ

Espèce nouvelle et signalements nouveaux de Palicoidea (Crustacea, Decapoda, Brachyura, Palicoidea, Palicidae, Crossotonotidae) dans l'Indo-ouest Pacifique.

Le matériel récolté au cours de récentes campagnes permet une mise à jour de la révision des familles de Palicidae Bouvier, 1898, et de Crossotonotidae A. Milne-Edwards, 1873 (Crustacea, Brachyura, Palicoidea) provenant de l'Indo-ouest Pacifique. Une espèce nouvelle de *Neopalicus* Moosa & Serène, 1981, des îles Australes en Polynésie française, est établie. Cette espèce nouvelle peut être séparée des deux espèces connues de *Neopalicus* par la morphologie du rostre, du bord suborbitaire, de l'abdomen et du premier pléopode mâle. Le mâle d'une espèce auparavant connue par le seul holotype femelle, est également décrit. De nouveaux signalements de six espèces de Palicidae et de trois espèces de Crossotonotidae sont rapportés pour les Philippines. Une espèce de Palicidae est signalée pour la première fois des îles Salomon dans le Pacifique occidental, une espèce de Palicidae et une espèce de Crossotonotidae sont signalées pour la première fois du Vanuatu dans le Pacifique occidental, et 10 espèces de Palicidae sont également signalées pour la première fois de Tonga dans le Pacifique sud-ouest, à l'extrémité orientale de la plaque indo-australienne.

MOTS CLÉS

Crustacea,
Decapoda,
Brachyura,
Palicoidea,
Palicidae,
Crossotonotidae,
Polynésie française,
Philippines,
îles Salomon,
Tonga,
Vanuatu,
espèce nouvelle,
signalements nouveaux.

INTRODUCTION

Expeditions undertaken after the revision (Castro 2000) of the Indo-West Pacific species of the family Palicidae Bouvier, 1898, provided valuable material that has allowed an updating of the taxonomy of the group and extending the geographical distribution of many species. The Atelier LIFOU 2000, a biodiversity workshop in the Loyalty Is, and the PANGLAO 2004 expedition to the Philippines provided male specimens of *Paliculus foliatus* Castro, 2000, a species which was described from only a single female specimen. Material from the BORDAU 2 expedition to Tonga in 2000, at the extreme eastern margin of the Indo-Australian Plate, resulted in 10 species of deep-water palicids being recorded from this region for the first time. No other palicoid crabs had been previously listed from Tonga. The 2002 BENTHAUS expedition to the Austral Is, French Polynesia resulted in the discovery of an undescribed species of *Neopalicus* Moosa & Serène, 1981. The material obtained by the PANGLAO 2004 and PANGLAO 2005 expeditions and by earlier collections from Panglao I. resulted in four species of palicids and three species of crossotonotids being

recorded for the first time from the Philippines. It is the first record of the family Crossotonotidae Moosa & Serène, 1981 from the Philippines. Castro (2000) previously listed 11 species of palicids representing six genera (*Miropalicus* Castro, 2000, *Neopalicus* Moosa & Serène, 1981, *Paliculus* Castro, 2000, *Parapalicus* Moosa & Serène, 1981, *Pseudopalicus* Moosa & Serène, 1981, *Rectopalicus* Castro, 2000) from the Philippines. Material from the BORDAU 2 expedition to Tonga, at the extreme eastern margin of the Indo-Australian Plate, resulted in 10 species of deep-water palicids being recorded from this region for the first time. No other palicoid crabs had been previously listed from Tonga. Material from the SALOMONBOA 3 expedition to the Solomon Islands in the southwestern Pacific in 2007 included the first record of the family Palicidae from this island group.

The family Palicidae Bouvier, 1898 previously included only the genera *Crossotonotus* A. Milne-Edwards, 1873, and *Pleurophricus* A. Milne-Edwards, 1873, both restricted to the Indo-West Pacific region. These two genera are now recognized as a separate family, the Crossotonotidae, which together with the Palicidae constitute the superfamily Palicoidea

Bouvier, 1898 (see Ng *et al.* 2008; De Grave *et al.* 2009). Among other differences, the last pair of pereopods is conspicuously reduced and dorsal to the articulations to the arthroal cavity of the preceding ambulatory legs in the Palicidae, whereas in the Crossotonotidae the last pair of pereopods is shorter but morphologically similar to the preceding ambulatory legs and articulates approximately at the same level as these pereopods.

MATERIAL AND METHODS

Morphological descriptions follow for the most part the terminology used by Castro (2000: figs 1, 2). Pereopods are referred to by the abbreviations P1 (chelipeds) and P2 to P5 (ambulatory legs); the first and second pairs of male pleopods (gonopods) by G1 and G2 respectively. The measurements provided are of the carapace length (cl) and width (cw) in millimetres respectively. Carapace length was measured across the carapace from the middle portion of the frontal margin to the middle portion of the posterior margin; the width across the widest breadth of the carapace including anterolateral teeth. In their descriptions, paired appendages (including the G1 and G2) are referred to in the singular for simplicity. Information on stations, including collecting gear, of the BORDAU 2 expedition to Tonga is available on line (<http://www.tropicaldeepsabenthos.org>).

Specimens are deposited in the Muséum national d'Histoire naturelle, Paris (MNHN) and the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore.

SYSTEMATICS

Superfamily PALICOIDEA Bouvier, 1898

Family PALICIDAE Bouvier, 1898

Genus *Miropalicus* Castro, 2000

Miropalicus Castro, 2000: 520.

TYPE SPECIES. — *Palicus vietnamensis* Zarenkov, 1968, by original designation.

Miropalicus vietnamensis (Zarenkov, 1968)

Palicus vietnamensis Zarenkov, 1968: 762, fig. 2A–Γ.

Parapalicus vietnamensis – Moosa & Serène 1981: 26, 27.

Miropalicus vietnamensis – Castro 2000: 522, 587, 588, figs 29, 30a, 59, 60f.

MATERIAL EXAMINED. — **Tonga.** BORDAU 2, stn CP 1511, 21°08'S, 175°22'W, 384–402 m, 31.V.2000, 3 ♂♂, 2 pre-adult ♀♀, 1 ♀. (MNHN-B31939). — Stn CP 1520, 21°25'S, 175°03'W, 447–450 m, 1.VI.2000, 1 ♂ (MNHN-B31940). — Stn CP 1572, 19°42'S, 174°31'W, 391–402 m, 11.VI.2000, 1 ♂, 1 ♀ (MNHN-B31941). — Stn CP 1578, 19°42'S, 174°25'W, 329–331 m, 11.VI.2000, 1 pre-adult ♀ (MNHN-B31942).

DISTRIBUTION. — Southwestern Pacific from the Philippines and the South China Sea (type locality: South China Sea off Vietnam) to New Caledonia and the Loyalty Is (Castro 2000: table 6, fig. 59), and now Tonga. Depth: 24–710 m (Castro 2000: table 5).

Genus *Neopalicus* Moosa & Serène, 1981

Neopalicus Moosa & Serène, 1981: 41. — Castro 2000: 548.

TYPE SPECIES. — *Cymopolia jukesii* White, 1847, by original designation.

Neopalicus simulus n. sp.

(Fig. 1)

HOLOTYPE. — **French Polynesia.** Austral Is, BENTHAUS, stn CP 1907, ♂ holotype, cl 4.7 mm, cw 5.3 mm (MNHN-B29134).

PARATYPES. — **French Polynesia.** Austral Is, BENTHAUS, stn CP 1880, Marotiri Is, 27°55'S, 143°29.4'W, 90–94 m, 6.XI.2002, 1 ♀, cl 4.6 mm, cw 4.9 mm (MNHN-B29132). — Stn CP 1881, Marotiri Is, 27°54.6'S, 143°28.5'W, 112–121 m, 6.XI.2002, 1 ovig. ♀, cl 4.5 mm, cw 4.9 mm (MNHN-B29133). — Stn CP 1913, Récif Neilson, 27°01.5'S, 146°00.3'W, 120 m, 11.XI.2002, 1 ovig. ♀, cl 5.5 mm, cw 5.9 mm (MNHN-B29135). — Stn CP 1920, Récif Neilson, 27°03.6'S, 146°03.8'W, 120–200 m, 11.XI.2002, 1 pre-adult ♂, cl 3.6 mm, cw 3.7 mm, 2 ♂♂, cl 4.3 mm, cw 4.8 mm, cl 5.1 mm, cw 6.0 mm (MNHN-B 29136). — Stn CP 1923, Récif Neilson, 27°01.3'S, 146°05.3'W, 360–840 m, 11.XI.2002, 1 ♂, cl 3.2 mm, cw 3.8 mm (MNHN-B29137).

TYPE LOCALITY. — French Polynesia, Austral Is, Rapa I., Banc Nord-Est, BENTHAUS, stn CP 1907, 27°25.4'S, 144°02.6'W, 120-125 m.

ETYMOLOGY. — From *simulus*, diminutive of *simus*, Latin for “flat” or “pug nosed,” in reference to the short, rounded, non-bilobed rostrum that is diagnostic of the species.

DISTRIBUTION. — Known only from the Austral Is, French Polynesia. Depth: 90-200 m and from a station (CP 1923) 360-840 m deep.

DESCRIPTION

Carapace (Fig. 1A, B) subquadrate, nearly as wide as long (cw/cl = 1.0-1.3); dorsal surface covered with fine granules, horizontal rows of large, low granular bosses. Confluence of branchial, mesogastric regions depressed; depression along median portion of frontal region. Short, simple (non-bilobed) rostrum. Anterolateral borders of carapace each with 2 large, truncated teeth, first (anteriormost) largest, most conspicuous. Posterior border with short, rounded tubercles (one at each end, 3 median), setae absent. Frontal border of carapace with single, rounded lobe. Borders between frontal lobe, supraorbital borders sinuous, ending in sharp angle, forming deep V-shaped fissure before supraorbital border (Fig. 1A, B). Supraorbital borders each with 2 rounded lobes. Postorbital angles short, not extending beyond dorsal border of retracted eye, nearly straight. Cornea of eyes dorso-ventrally depressed, wider than base of eye peduncle. Each peduncle with 3 dorsal tubercles: anterior, distal, crest-like (depressed); median tubercle smaller than other 2 tubercles; large, rounded tubercle on distal extension nearly encircled by cornea.

Suborbital borders (Fig. 1C) slightly convex; smooth. Pterygostomial lobes project ventrally, forming flat, rounded structure posterior to each inner suborbital lobe.

Basal antennal article (Fig. 1C) slender, rectangular, with short, wing-like extension; flagellum long, with few, simple setae. Epistome expanded dorso-ventrally, forming broad, semicircular, nearly flat surface; thin, carina-like process across median portion with two median teeth.

Inner margins of ischium of third maxillipeds straight; surface coarsely granular, upper margins

rounded. Merus much narrower than ischium; straight-edged.

Chelipeds (P1) unequal in both sexes; propodus of larger cheliped of males much higher, thicker than smaller cheliped (Fig. 1A). Dorsal, outer margins of cheliped propodus with 2 high, rounded tubercles (except larger cheliped of males, which is smooth), inner surface with dense clusters of plumose setae in males, bare in females; fingers with cutting edges or rounded teeth. Carpus short, smooth; meri slender, smooth.

Ambulatory legs (P2-P4) dorso-ventrally flattened; P2 shorter than P3, P4; P3 nearly as long as P4 (Fig. 1A). Upper, lower margins of merus with short rounded tubercles; distalmost tubercle on each anterior margin wider at base, higher, directed distally. Anterior margins of carpus with tubercles. Dorsal surface of P3, P4 propodi, dactyli with many plumose setae; margins of P3, P4 propodi entire, anterior margins each with wide, convex carina-like extension; dactyli long, slender, entire margins. P5 short (0.7-0.9 cl), dorsal to P4 (Fig. 1A); merus slender, with microscopic tubercles along posterior margins, scattered simple setae; propodus with 4 or 5 short spines along posterior margin; dactylus with 3 or 4 short spines along posterior margin, terminal pointed tooth.

Abdomen of mature males elongated, with all somites freely articulating, smooth, without transverse ridges. Penis showing coxo-sternal condition. G1 (Fig. 1D) long, slender, with sinuous basal part; distal part with small teeth, simple, uniramous apex. G2 much shorter than G1.

Abdomen of mature females with all somites freely articulating. Transversal ridge along each somite 1-4, less pronounced in somite 5. Vulvae small, round, with simple margins, on thoracic sternite 6 but displaced to median plate of sternum.

REMARKS

The new species clearly belongs to *Neopalicus* as redescribed by Castro (2000: 548). The genus until now consisted of two species, *N. contractus* (Rathbun, 1902) and *N. jukesii* (White, 1847). *Neopalicus simulus* n. sp. shares with these two species a subquadrate carapace with horizontal rows of large and low bosses on its dorsal surface;

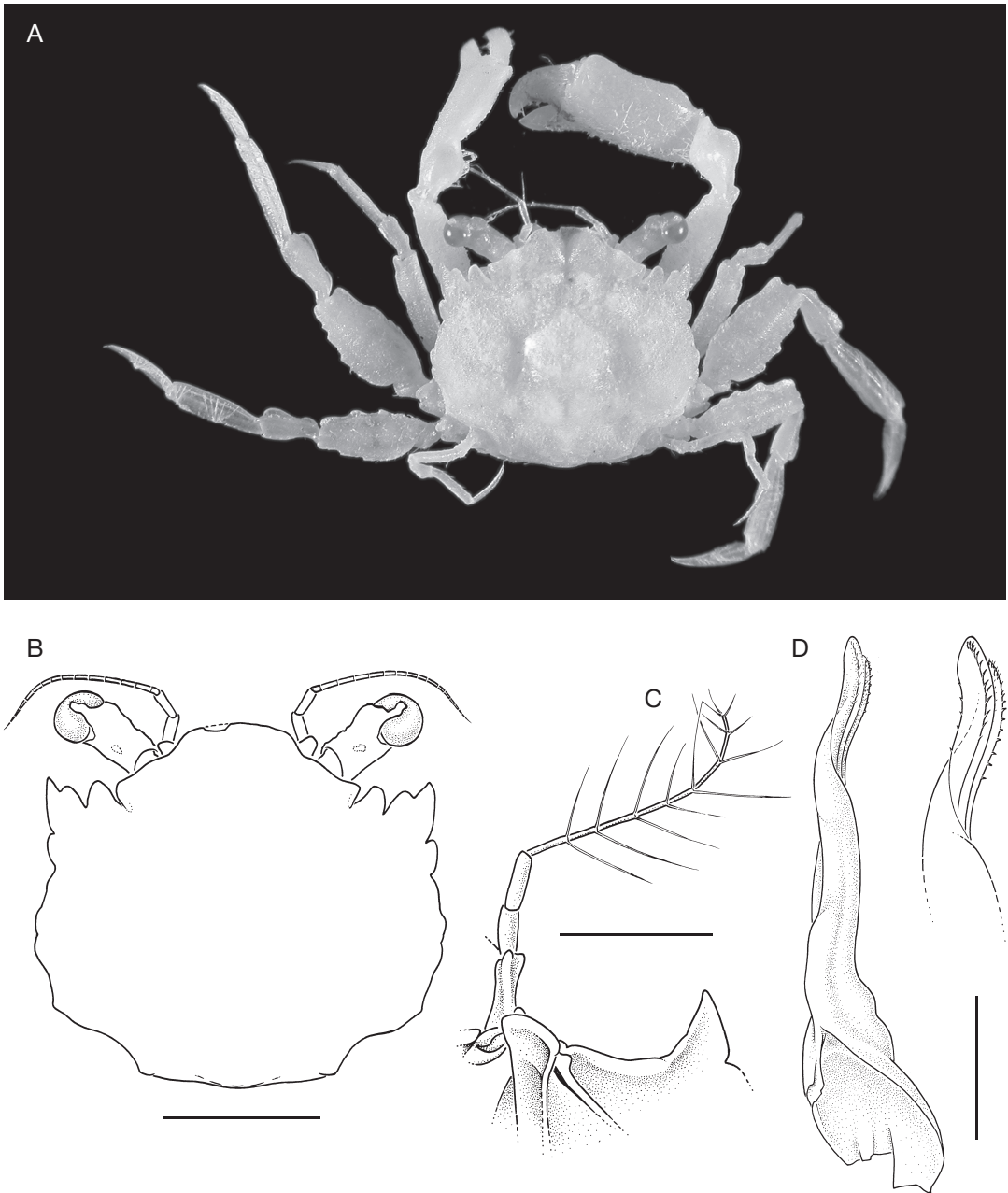


FIG. 1. — *Neopalicus simulus* n. sp., ♂ holotype, cl 4.7 mm, cw 5.3 mm, Banc Nord-Est, Rapa I., French Polynesia, BENTHAUS, stn CP 1907 (MNHN-B29134): **A, B**, dorsal surface of carapace; **C**, suborbital border; **D**, left G1, dorsal view. Scale bars: B, 2 mm; C, 1 mm; D, 0.5 mm.

two large truncated teeth along each anterolateral border; large eyes with eye peduncles each having three dorsal tubercles; supraorbital borders with two

rounded lobes; basal antennal article with a short, wing-like expansion; P2-P4 with dorso-ventrally flattened (not filiform) carpi, propodi, and dactyli;

anterior margins of the P3 and P4 propodi each with a wide and convex extension; posterior margins of the dactyli entire; posterior margins of the P5 propodus spinous; abdomen of males elongated, all somites freely articulating; G1 long and slender, basal portion sinuous; abdomen of adult females with all somites freely articulating.

Diagnostic characters of *N. simulus* n. sp. are the presence of a short, non-bilobed rostrum (bilobed in *N. contractus* and *N. jukesii*; see Castro 2000: figs 39, 40), a smooth suborbital border (two triangular, dentiform lobes in *N. contractus* and *N. jukesii*; see Castro 2000: fig. 40a, b), abdomen of mature males with smooth somites (transverse ridges in *N. contractus* and *N. jukesii*), and the simple, uniramous distal end of the G1 (biramous in *N. contractus* and *N. jukesii*; see Castro 2000: fig. 41). The inner surface of the cheliped propodus of the male has dense clusters of plumose setae (barely visible in Figure 1A) as in *N. jukesii* (see Holthuis 1977: fig. 2c, as *Palicus carinipes* (Paulson, 1875)) but unlike *N. contractus*, which lacks setae.

Neopalicus contractus is known from locations across the Indian Ocean (type locality: Maldivic Islands), western Pacific Ocean from the Philippines to New Caledonia, and the Marshall Islands in the central Pacific (Castro 2000: table 6, fig. 49). *Neopalicus jukesii* (type locality: Queensland, Australia) shows a geographical distribution similar to that of *N. contractus* except that it is also known from the Red Sea and Japan but not from the central Pacific (Castro 2000: table 6, fig. 49). Both species inhabit, sometimes sympatrically, coarse sand in relatively shallow water (44–80 m in *N. contractus*, 10–146 m in *N. jukesii*; Castro 2000: table 5) adjacent to coral reefs. In contrast, *N. simulus* n. sp. is known from rocky bottoms containing coral rubble at depths of 90–200 m (one male [MNHN-B29137], however, was obtained from material dredged at 360–840 m) from the Austral Is, French Polynesia, southeastern Pacific. It is the only known species of *Neopalicus* in the southeastern Pacific.

Neopalicus simulus n. sp. is only known from small individuals, the maximum size recorded among the eight known specimens was only 5.5 mm (cw), an ovigerous female. All three large females showed the

large, wide abdomen characteristic of adult female palicoids, two of the three were ovigerous. This is in sharp contrast to *N. contractus* and *N. jukesii*, where the largest females ever recorded were 18.6 mm and 15.1 mm (cw) respectively (Castro 2000) and where females of comparable size are pre-adults, and hence with a narrow, thin abdomen.

Genus *Paliculus* Castro, 2000

Paliculus Castro, 2000: 525.

TYPE SPECIES. — *Palicus kyusyuenensis* Yokoya, 1933, by original designation.

Paliculus foliatus Castro, 2000

(Fig. 2)

Paliculus foliatus Castro, 2000: 530, 588, fig. 32.

MATERIAL EXAMINED. — **Loyalty Is.** Atelier LIFOU 2000, Lifou I., stn 1453, Baie du Santal, aspirate near large coral heads, 20°54.6'S, 167°02.1'E, 21–30 m, XI.2000, 1 ♂ (MNHN-B28016). — Stn 1453, Baie du Santal, 20°54.6'S, 167°02.1'E, aspirate, 21–30 m, XI.2000, 1 ♂, 1 ♀ (MNHN-B28012). — Stn 1436, Baie du Santal, 20°55.5'S, 167°04.2'E, aspirate, 10–30 m, 10.XI.2000, 1 ♀, cl 5.1 mm, cw 5.2 mm (MNHN-B28011); 2 ♀♀ (MNHN-B27998). — Stn 1449, Baie du Santal, 20°45.8'S, 167°01.65'E, brushing of hard surface, 17 m, 17.XI.2000, 1 pre-adult ♀ (MNHN-B27984). **Philippines.** PANGLAO 2004, Bohol I., Panglao I., stn B10, Momo Beach, 09°36.393'N, 123°45.639'E, 3–14 m, 10.VI.2004, 1 ♀ (ZRC 2008.0944). — Stn B41, floor of large cave, 09°30.9'N, 123°40.8'E, 17–19 m, 4.VII.2004, 1 ♀ (ZRC 2008.0945).

DISTRIBUTION. — New Caledonia, Loyalty Is (Castro 2000: table 6), and now the Philippines. Depth: 3–30 m (Castro 2000: table 5).

REMARKS

Paliculus foliatus was described from a single female specimen. The discovery of two male specimens now permits the description of the male.

DESCRIPTION OF MALE

Carapace as in females (Fig. 2A; Castro 2000: fig. 32), subquadrate, depressed, with 4 narrow, pointed anterolateral teeth on each side. Dorsal surface

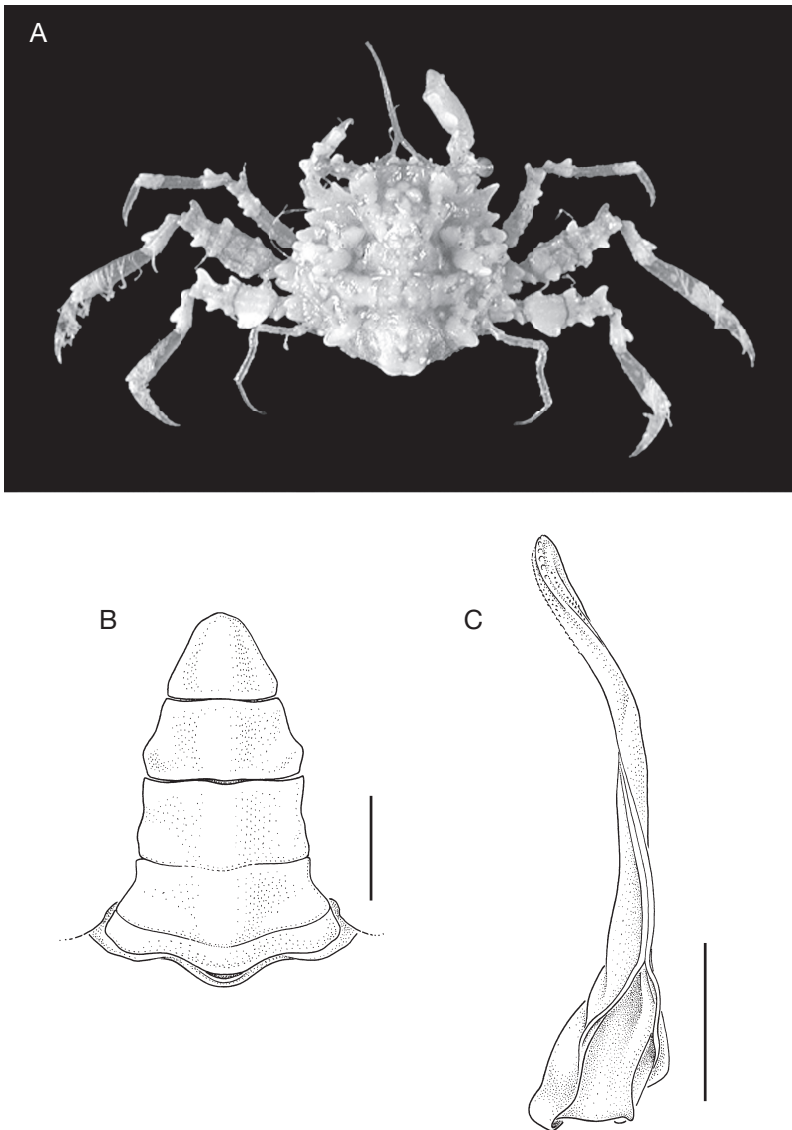


FIG. 2. — *Paliculus foliatus* Castro 2000: **A**, ♀, cl 4.5 mm, cw 4.5 mm, Philippines, Panglao I., PANGLAO 2004, stn B10, 3-14 m (ZRC 2008.0944); **B, C**, ♂, cl 4.8 mm, cw 5.0 mm, Baie du Santal, aspirate near large coral heads, Lifou I., Loyalty Is, Atelier LIFOU 2000, stn 1453 (MNHN-B28016); **B**, abdomen; **C**, left G1, dorsal view. Scale bars: B, 1 mm; C, 0.5 mm.

covered with rounded tubercles, granular bosses on metagastric region; depressed area along confluence of branchial, mesogastric regions; posterior border medially pointed, with 4 conspicuous tubercles. Supraorbital borders each with pointed median lobe. Postorbital angle long, outwardly projecting.

Suborbital borders each limited by conspicuous, ventrally projecting pterygostomial lobe, broad, rounded outer lobe.

Dorsal borders of cheliped (P1) propodus with conspicuous, rounded tubercle. Borders of meri, carpi of ambulatory legs (P2-P4) with dorso-

ventrally flattened, rounded tubercles. Basal antennal article with slightly expanded outer margin, 3 rounded tubercles along expanded margin. Epistome narrow, vertically inclined, with no apparent teeth. P2-P4 slender but with flattened, non-filiform propodi. Upper, lower borders of meri with thin, rounded tubercles; distalmost tubercle on each anterior border much wider at base, higher; similar thin, rounded tubercles on anterior borders of propodi; meri with long plumose setae. P2 shorter, more slender than P3, P4. P5 short (0.7 cl), dorsal to P4; propodus with 4 low tubercles, 3 of which topped by short spine; dactylus with 4 short, thin spines along posterior border, terminal pointed tooth.

Abdomen (Fig. 2B) narrow, with somites 3-5 fused but articulations still visible, remaining somites freely articulating. G1 (Fig. 2C) with sinuous basal part; distal part simple, with sub-acute apex, rows of small teeth. G2 much shorter than G1.

REMARKS

Paliculus foliatus was described from a small (cl 5.0 mm, cw 5.0 mm), ovigerous female collected from an unknown depth at Touho, northeastern coast of New Caledonia (Castro 2000: 530). Diagnostic of the species is a depressed, leaf-like carapace covered dorsally with many conspicuous, spherical tubercles and granular bosses, a cryptic appearance which is unique among known palicids (Fig. 2A; Castro 2000: fig. 32a). Also characteristic are dorso-ventrally flattened, rounded tubercles along the margins of the ambulatory legs (P2-P4) (Fig. 3; Castro 2000: fig. 32c), which complement the cryptic appearance of the carapace.

The aspiration and brushing of coral and rock surfaces in relatively shallow water at Lifou I., Loyalty Is, east of New Caledonia, during the Atelier LIFOU 2000 resulted in the collection of five females (one pre-adult and four adults, of which one was ovigerous) and two males. The largest specimen was a female (cl 5.1 mm, cw 5.2 mm, MNHN-B28011). The specimens were obtained from three stations at depths of 10-30 m. The species is also recorded for the first time from the Philippines, where two females were collected from depths of 3-19 m.

Paliculus foliatus, now known from the Philippines, New Caledonia, and the Loyalty Is (Castro 2000: table 6), most probably has a wider geographical distribution. Its very small size and cryptic morphology make detection and collection difficult. It appears to be restricted to hard substrates in coral reefs and marine caves.

Paliculus kyusyuensis (Yokoya, 1933)

Paliculus kyusyuensis Yokoya, 1933: 206, 217, fig. 70.

Paliculus kyusyuensis – Castro 2000: 527, 587, 588, figs 30b, 31, 56.

MATERIAL EXAMINED. — **Philippines.** PANGLAO 2004, Bohol I., Panglao I., stn T2, coarse sand, 09°32.356'N, 123°47.845'E, 152 m, 31.V.2004, 1 ♂, 7 ♀♀ (ZRC 2008.0946); 1 ♀ (photographed) (ZRC 2008.1073). — Stn T9, fine sand and seagrass, off San Isidro, 09°33.501'N, 123°49.497'E, 97-120 m, 14.VI.2004, 2 ♀♀ (ZRC 2008.0947); 2 ovig. ♀♀ (ZRC 2008.0948). — Stn B12, Doljo Point, reef slope, 9°35.6'N, 123°43.2'E, 24-27 m, 14.VI.2004, 1 pre-adult (ZRC 2008.1074). — Stn T27, between Panglao and Pamilacan islands, fine sand and mud, 9°33.4'N, 123°51.0'E, 106-137 m, 25.VI.2004, 1 ♀ (ZRC 2008.1075). — Stn T34, between Ligaong and Pamilacan, sand, 09°31.331'N, 123°51.364'E, 145-163 m, 3.VII.2004, 1 ♂, 1 ♀ (ZRC 2008.0949); 2 pre-adult ♀♀, 3 ovig. ♀♀ (ZRC 2008.0950). — Stn T36, west Pamilacan I., Cervera Shoal, 9°29.3'N, 123°51.5'E, 95-128 m, 4.VII.2004, 1 ♂, 1 ♀ (MNHN-B29753), 1 ♀ (ZRC 2008.1076). — Stn T39, west Pamilacan I., Cervera Shoal, muddy sand, 09°30.1'N, 123°50.4'E, 100-138 m, 6.VII.2004, 1 ♂, 2 ♀♀ (ZRC 2008.1077). **Tonga.** BORDAU 2, stn CP 1575, 19°42'S, 174°21'W, 232-295 m, 11.VI.2000, 1 ♂ (MNHN-B28520).

DISTRIBUTION. — Wide Indo-West Pacific distribution (Castro 2000: table 6, fig. 56): Madagascar, southern Japan (type locality: Koshiki Is, southwest of Kyushu), Indonesia, New Caledonia (including the Chesterfield Is), Wallis I., and now the Philippines and Tonga. Depth: 24-710 m (Castro 2000: table 5).

Genus *Palicoides* Moosa & Serène, 1981

Palicoides Moosa & Serène, 1981: 45. — Castro 2000: 558.

TYPE SPECIES. — *Cymopolia whitei* Miers, 1884, by original designation.

Palicoides longimanus (Miyake, 1936)

Cymopolia longimana Miyake, 1936: 495, fig. 1, pl. 35, figs 3, 4.

Palicoides longimanus – Castro 2000: 561, 587, 588, figs 42a, 43a, 50, 61d.

MATERIAL EXAMINED. — **Philippines.** PANGLAO 2004, Bohol I., Panglao I., stn S26, Ubajan, 09°41.545'N, 123°51.030'E, 21 m, 23.VI.2004, 1 pre-adult (ZRC 2008.0951). — Stn S32, Looc, 09°35.795'N, 123°44.580'E, 2-3 m, 26.VI.2004, 2 pre-adults (ZRC 2008.0952).

Vanuatu. SANTO 2006, stn FS82, Tutuba I., 15°32.3'S, 167°17.4'E, 8-20 m, 15.X.2006, 1 ♀ (MNHN-B31963).

DISTRIBUTION. — Southern Japan (type locality: Yaeyama Is, Ryukyu Is), Indonesia, New Caledonia (including Chesterfield Is), Loyalty Is, Marshall Is (Castro 2000: table 6, fig. 50), and now the Philippines and Vanuatu. Depth: 2-57 m (Castro 2000: table 5).

Palicoides whitei (Miers, 1884)

Cymopolia whitei Miers, 1884: 551, pl. 49, figs C, c.

Palicoides whitei – Castro 2000: 565, 587, 588, figs 42b, 43b-d, 50, 61e.

MATERIAL EXAMINED. — **Philippines.** SANTO 2006, stn DB12, east of Aoré I., 15°36.6'S, 167°10.1'E, sand with dead corals, 10-18 m, 13.IX.2006, 3 pre-adults (MNHN-B32006).

DISTRIBUTION. — Wide Indo-West Pacific distribution (Castro 2000: table 6, fig. 50), from Indian Ocean (type locality: Seychelles) to the western Pacific from Japan to New Caledonia, now also from the Philippines. Depth: 7-70 m (Castro 2000: table 5).

REMARKS

Three pre-adults, although small (cl 2.4-2.5, cw 2.4-2.6), show some the characters diagnostic to *Palicoides whitei*, which can be easily confused with its close congeneric *P. longimanus* even as adults: front with two broad lobes separated by a notch that is wider and deeper than in *P. longimanus*, and distalmost tubercle on the eye peduncle being pointed, reaching almost the same height of the crescent-shaped process diagnostic of the genus (round and short in *P. longimanus*) (Castro 2000: 564). Other diagnostic characters (morphology of the G1, and female abdomen), however, can be

observed only in adults. The lobes on the supraorbital and suborbital borders appear to be less developed than in adults.

Genus *Parapalicus* Moosa & Serène, 1981

Parapalicus Moosa & Serène, 1981: 25. — Castro 2000: 486.

TYPE SPECIES. — *Palicus trituberculatus* Chen, 1981, by original designation.

Parapalicus ambonensis Moosa & Serène, 1981

Parapalicus ambonensis Moosa & Serène, 1981: 29, figs 2a, 3a, pl. 1D. — Castro 2000: 489, 587, 588, figs 16, 19a, 58.

MATERIAL EXAMINED. — **Philippines.** PANGLAO 2004, Bohol I., Panglao I., stn T2, 09°32.356'N, 123°47.845'E, 152 m, 31.V.2004, 1 ♀ (MNHN-B 29749). — Stn T9, off San Isidro, 09°33.501'N, 123°49.497'E, fine sand and seagrass, 97-120 m, 14.VI.2004, 1 ♀ (ZRC 2008.0957). — Stn T39, west Pamilacan I., Cervera Shoal, muddy sand, 09°30.1'N, 123°50.4'E, 100-138 m, 6.VII.2004, 1 ovig. ♀ (ZRC 2008.1079).

Tonga. BORDAU 2, stn CP 1541, 21°15'S, 175°14'W, 319-333 m, 5.VI.2000, 1 ♀ (MNHN-B31943). — Stn CP 1576, 19°42'S, 174°18'W, 253-263 m, 11.VI.2000, 1 ♂, 1 ♀ (MNHN-B31944). — Stn DW 1587, 18°37'S, 173°54'W, 309-400 m, 13.VI.2000, 1 ♀ (MNHN-B31945). — Stn DW 1589, 18°39'S, 173°54'W, 281 m, 13.VI.2000, 1 ♂, 1 ♀ (MNHN-B31946). — Stn DW 1602, 20°49'S, 174°57'W, 263-320 m, 15.VI.2000, 1 ♀ (MNHN-B31947).

DISTRIBUTION. — Andaman Sea coast of Thailand, western Pacific Ocean from Indonesia (type locality: Moluccas, Indonesia) to Futuna I. (Castro 2000: table 6, fig. 58), and now the Philippines and Tonga. Depth: 60-440 m (Castro 2000: table 5).

Parapalicus armatus Castro, 2000

Parapalicus armatus Castro, 2000: 492, 587, 588, figs 17, 19b, 57.

MATERIAL EXAMINED. — **Tonga.** BORDAU 2, stn CP1525, 21°17'S, 174°59'W, 349-351 m, 2.VI.2000, 1 ♂ (MNHN-B31948). — Stn CP1541, 21°15'S, 175°14'W, 319-333 m, 5.VI.2000, 1 ♀ (photographed)

(MNHN-B31949). — Stn CP1541, 21°15'S, 175°14'W, 319-333 m, 5.VI.2000, 2 ♂♂ (MNHN-B31950).

DISTRIBUTION. — Vanuatu (type locality) and Loyalty Is (Castro 2000: table 6, fig. 57) and now Tonga. Depth: 60-440 m (Castro 2000: table 5).

Parapalicus aff. *piruensis* Moosa & Serène, 1981

MATERIAL EXAMINED. — **Philippines.** PANGLAO 2004, Bohol I., Panglao I., stn T2, Bolod, 09°32.4'N, 123°47.3'E, 83-102 m, 30.V.2004, 1 pre-adult ♀ (ZRC 2008.0954). — Stn T4, Bolod, 9°33.0'N, 123°48.5'E, 82 m, 1.VI.2004, 1 ovig. ♀ (ZRC 2008.1078). — Stn T6, Bohol Island, west of Baclayon, 9°35.1'N, 123°51.2'E, coarse muddy sand, 34-82 m, 2.VI.2004, 3 ovig. ♀, 1 pre-adult ♂ (ZRC 2008.1085). — Stn T9, off San Isidro, 09°33.501'N, 123°49.497'E, fine sand and seagrass, 97-120 m, 14.VI.2004, 1 ovig. ♀, (ZRC 2008.1083). PANGLAO 2005, Bohol Sea, stn DW 2400, 09°32.5'N, 123°41.8'E, 111-163 m, 31.V.2005, 1 ♂ feminised by sacculinid (ZRC 2008.1080). — Stn CP 2408, 09°43.5'N, 123°41.1'E, 137-153 m, 1.VI.2005, 1 ♀ (ZRC 2008.1081).

REMARKS

Five specimens from five stations in the Philippines (ZRC 2008.0954, 2008.1078, 2008.1081, 2008.1083, 2008.1085) are close to *Parapalicus piruensis* Moosa & Serène, 1981, known from Indonesia, New Caledonia and Fiji (Castro 2000: table 6, fig. 58). All specimens share some characters of the general morphology of the carapace and ambulatory legs with *P. piruensis*: finely granular carapace; triangular and acute-tipped anterolateral teeth; suborbital borders each with a wide, V-shaped gap between the inner and outer suborbital lobes, the outer lobe much smaller than the inner lobe; and short ambulatory legs (Moosa & Serène 1981: fig. 2b, pl. 1C; Castro 2000: fig. 26b). The outer orbital teeth, however, are obtuse (triangular and acute-tipped in *P. piruensis*), and the cheliped propodus has two conspicuous and triangular proximal tubercles (smooth in *P. piruensis*). The only male specimen in the collection was feminised by a sacculinid. The large, rounded feminised abdomen has two elongated anterior tubercles on somite 3 (a characteristic of *P. piruensis*; Castro 2000: fig. 25a), but a triangular tooth medially that is absent in

P. piruensis. The G1 is reduced, with a slightly sinuous proximal part, a straight distal part, and a truncated apex that has a small triangular tooth (a biramous, curved, truncated apex in *P. piruensis*; Castro 2000: fig. 25b-d). The morphology of the G1 is unique for *Parapalicus* but its reduction in size and relative simplicity could probably be the result of feminisation.

Four specimens collected from another station in the Philippines (ZRC 2008.1085) are also close to *P. piruensis*: a finely granular carapace; triangular and acute-tipped anterolateral and outer orbital teeth; suborbital borders each with a wide, V-shaped gap between the inner and outer suborbital lobes, the outer lobe much smaller than the inner lobe; and short ambulatory legs. The cheliped propodus, however, has one short tubercle (in contrast to two conspicuous and triangular tubercles in the other five specimens of *P. aff. piruensis* from the Philippines) by having distinctive lobes on the supraorbital borders. There is only one male specimen, a pre-adult with the abdomen missing. The G1 are not fully developed, being soft and straight, not spiral or sinuous as in other species of *Parapalicus*. Each G1 has three short, obtuse distal processes, very different from the G1 of *P. piruensis* (see Castro 2000: fig. 25b-d).

It is opted not to describe the nine specimens on hand as new species because of the absence of normal male specimens because the morphologies of the G1 and the male abdomen are essential in the characterization of *Parapalicus* species.

Parapalicus clinodentatus Castro, 2000

Parapalicus clinodentatus Castro, 2000: 495, 587, 588, figs 18, 19c, 57.

MATERIAL EXAMINED. — **Tonga.** BORDAU 2, stn CP 1511, 21°08'S, 175°22'W, 384-402 m, 31.V.2000, 1 ♂ (MNHN-B31951). — Stn CP 1541, 21°15'S, 175°14'W, 319-333 m, 5.VI.2000, 2 ovig. ♀♀ (MNHN-B31952). — Stn CP 1641, 21°09'S, 175°22'W, 395 m, 21.VI.2000, 8 ♂♂, 1 ♀ (MNHN-B31953).

DISTRIBUTION. — Vanuatu (type locality), New Caledonia, Fiji (Castro 2000: table 6, fig. 57) and now Tonga. Depth: 282-950 m (Castro 2000: table 5).

Parapalicus unidentatus (Zarenkov, 1968)

Palicus unidentatus Zarenkov, 1968: 763, fig. 3A-G.

Parapalicus unidentatus – Castro 2000: 519, 587, 588, figs 26d, 58.

MATERIAL EXAMINED. — **Solomon Islands**. SALOMONBOA 3, stn CP 2844, 10°26'0"S, 161°24'0"E, 190-232 m, 23.IX.2007, 11 ♂♂, 8 pre-adult ♀♀, 17 ♀♀ (MNHN-B32007).

DISTRIBUTION. — South China Sea (type locality), Philippines, Indonesia (Castro 2000: table 6, fig. 58), and now the Solomon Islands. Depth: 160-811 m (Castro 2000: table 5).

Genus *Pseudopalicus* Moosa & Serène, 1981

Pseudopalicus Moosa & Serène, 1981: 35. — Castro 2000: 448.

TYPE SPECIES. — *Palicus serripes* Alcock & Anderson, 1895, by original designation.

Pseudopalicus oahuensis (Rathbun, 1906)

Palicus oahuensis Rathbun, 1906: 836, fig. 2, pl. 7, fig. 4.

Pseudopalicus oahuensis – Castro 2000: 465, 587, 588, figs 4e-f, 12a, 54, 60c.

MATERIAL EXAMINED. — **Tonga**. BORDAU 2, stn CP 1510, 21°05'S, 175°23'W, 461-497 m, 31.V.2000, 1 pre-adult ♀ (photographed) (MNHN-B31954); 1 ♀ (MNHN-B31955); 2 ♂♂, 1 pre-adult ♀, 2 ovig. ♀♀ (MNHN-B31956).

DISTRIBUTION. — Across the Pacific Ocean from Taiwan to New Caledonia, Hawaiian Is (type locality), French Polynesia (Castro 2000: table 6, fig. 54), and now Tonga. Depth: 200-680 m (Castro 2000: table 5).

Pseudopalicus pictus Castro, 2000

Pseudopalicus pictus Castro, 2000: 476, 587, 588, figs 11, 12d, 54, 60e.

MATERIAL EXAMINED. — **Tonga**. BORDAU 2, stn CP 1522, 21°19'S, 175°00'W, 229-232 m, 2.VI.2000, 2 ♀♀ (MNHN-B31957).

DISTRIBUTION. — Vanuatu, French Polynesia (type locality) (Castro 2000: table 6, fig. 54) and now Tonga. Depth: 95-400 m (Castro 2000: table 5).

Pseudopalicus serripes
(Alcock & Anderson, 1895)

Cymopolia serripes Alcock & Anderson, 1895: 208.

Pseudopalicus serripes – Moosa & Serène 1981: 37, fig. 5, pl. 2A. — Castro 2000: 473, 587, 588, figs 4d, 8a, 9b, 12c, 52.

MATERIAL EXAMINED. — **Tonga**. BORDAU 2, stn DW 1513, 21°19'S, 175°01'W, 190-221 m, 1.VI.2000, 1 ♂ (MNHN-B31958).

DISTRIBUTION. — Wide Indo-West Pacific distribution (Castro 2000: table 6, fig. 52) from western and central Indian Ocean (type locality: southeastern India) and western Pacific Ocean from Japan to Futuna I., and now Tonga. Depth: 30-221 m (Castro 2000: table 5).

Pseudopalicus undulatus Castro, 2000

Pseudopalicus undulatus Castro, 2000: 483, 587, 588, figs 12f, 14, 53.

MATERIAL EXAMINED. — **Tonga**. BORDAU 2, stn CP1640, 21°09'S, 175°24'W, 564-569 m, 21.VI.2000, 1 ovig. ♀ (MNHN-B31959).

DISTRIBUTION. — Western Pacific Ocean from Japan to Fiji (type locality: Tanimbar Is, Indonesia) (Castro 2000: table 6, fig. 53), and now Tonga. Depth: 170-569 m (Castro 2000: table 5).

Genus *Rectopalicus* Castro, 2000

Rectopalicus Castro, 2000: 533.

TYPE SPECIES. — *Palicus woodmasoni* Alcock, 1900, by original designation.

Rectopalicus amphiceros Castro, 2000

Rectopalicus amphiceros Castro, 2000: 358, 587, 588, fig. 35.

MATERIAL EXAMINED. — **Philippines**. PANGLAO 2004, Bohol I., Panglao I., stn T1, Bolod, 09°32.382'N,

123°47.262'E, 83-102 m, 30.V.2004, 1 ♀, cl 4.4 mm, cw 4.6 mm (ZRC 2008.1085).

DISTRIBUTION. — New Caledonia (type locality) and now from the Philippines (Castro 2000: table 6). Depth: 83-110 m (Castro 2000: table 5).

REMARKS

Rectopalicus amphiros was described from one male and one pre-adult female. The discovery of an adult female, slightly smaller than the male holotype, now permits the description of some features of adult females. The female specimen unfortunately lacks the abdomen.

The carapace and pereopods of the adult female (ZRC 2008.1) are as in the holotype male (Castro 2000: fig. 35a-c) and pre-adult female paratype. The vulvae are relatively large, round, with simple margins, and on thoracic sternite 6. They are displaced to the median plate of the sternum. The sterno-thoracic cavity is typical of adult female palicids, being very broad and extending to just below the posterior margin of the third maxillipeds.

Rectopalicus woodmasoni (Alcock, 1900)

Palicus Wood-Masoni Alcock, 1900: 795.

Pseudopalicus woodmasoni – Moosa & Serène 1981: 35.

Rectopalicus woodmasoni – Castro 2000: 535, 587, 588, figs 8c, 34, 37c, 53.

MATERIAL EXAMINED. — **Tonga**. BORDAU 2, stn DW 1535, 21°43'S, 175°18'W, 268 m, 4.VI.2000, 1 ♀ (photographed) (MNHN-B31960).

DISTRIBUTION. — Andaman Sea (type locality: Andaman Is), western Pacific Ocean from Japan to New Caledonia (Castro 2000: table 6, fig. 53) and now Tonga. Depth: 85-430 m (Castro 2000: table 5).

Family CROSSOTONOTIDAE Moosa & Serène, 1981

Genus *Crossotonotus* A. Milne-Edwards, 1873

Crossotonotus A. Milne-Edwards, 1873: 258 [82]. — Castro 2000: 569.

TYPE SPECIES. — *Crossotonotus compressipes* A. Milne-Edwards, 1873, by monotypy.

Crossotonotus ceramensis Moosa & Serène, 1981

Crossotonotus ceramensis Moosa & Serène, 1981: 54, figs 12c, d, 13b, pl. 3C. — Castro 2000: 578, 587, 588.

MATERIAL EXAMINED. — **Philippines**. PANGLAO 2004, Bohol I., Panglao I., stn L40, Tangnan, 09°37.3'N, 123°46.5'E, 100-120 m, 24.VI.2004, 1 ♂, cl 4.5 mm, cw 5.1 mm (ZRC 2008.1087).

DISTRIBUTION. — Previously known only from Ceram, Indonesia (Castro 2000: table 6) and now from the Philippines. Depth: 26-120 m (Castro 2000: table 5).

Crossotonotus compressipes A. Milne-Edwards, 1873

Crossotonotus compressipes A. Milne-Edwards, 1873: 259 [83]. — Castro 2000: 571, 587, 588, figs 44, 51.

MATERIAL EXAMINED. — **Philippines**. PANGLAO 2004, Bohol I., Panglao I., stn S7, Sungcolan Bay, 09°38.5'N, 123°49.2'E, sand with seagrass, 1-4 m, 9.VI.2004, 1 ovig. ♀ (ZRC 2008.0964). — Stn S13, Baclayon Takot, 09°37.097'N, 123°52.587'E, 8-15 m, 15.VI.2004, 1 ♀ (ZRC 2008.0965). — Stn T13, Cortes, 09°40.513'N, 123°49.531'E, 90-100 m, 17.VI.2004, 2 ♂♂ (ZRC 2008.0966). — Stn L40, Tangnan, 09°37.3'N, 123°46.5'E, 100-120 m, 24.VI.2004, 1 ♂, 1 ♀ (ZRC 2008.0967).

DISTRIBUTION. — Western Pacific from Japan to New Caledonia and Queensland, Australia, Samoa in the central Pacific (Castro 2000: table 6, fig. 51), and now the Philippines. Depth: shallow water to 120 m (Castro 2000: table 5).

Crossotonotus spinipes (De Man, 1888)

Pleurophricus spinipes De Man, 1888: 344, pl. 15, figs 1, 1a-c.

Manella brevimana – Moosa & Serène 1981: 54, figs 12a, b, 13a.

Crossotonotus spinipes – Castro 2000: 574, 587, 588, figs 45, 46, 51, 61f.

MATERIAL EXAMINED. — **Philippines**. Bohol, Balicasag I., off Panglao I., tangle nets of local fishermen,

50-500 m, 28.XI.2001, 1 ♀ (ZRC 2001.0927). — 200-300 m, VI.2002, 1 ♂ (ZRC 2002.0670). — VII.2003, 1 ♂, 2 ♀♀ (ZRC 2008.1088). — L11, 25.X.2003 (ZRC 2008.1089). — V.2004, 1 ♂ (ZRC 2008.1090). — 25.III.2003, 1 ♀, 1 pre-adult (ZRC 2008.1091). — VII.2004-V.2005, 1 ♂, 4 pre-adults (ZRC 2008.1092).

PANGLAO 2004, Bohol I., Panglao I., stn PN1, 28.V.2004, 3 ♂♂ (ZRC 2008.1093). — Stn B2, Alona, 09°32.972'N, 123°46.547'E, 5 m, 31.V.2004, 1 pre-adult (ZRC 2008.1094); 1 pre-adult (ZRC 2008.1095). — Stn B4, BBC Point, 09°33.168'N, 123°48.299'E, 24 m, 1.VI.2004, 1 ♀ (MNHN-B29754), 1 ♂ (ZRC 2008.1096). — Stn B5, Biking, 09°35.196'N, 123°50.438'E, 4 m, 2.VI.2004, 1 pre-adult (ZRC 2008.1097). — Stn B6, Balicasag I., Black Forest, 09°31.144'N, 123°41.252'E, 12-14 m, 4.VI.2004, 1 ♀ (ZRC 2008.1098). — Stn B7, Catarman, reef slope with caves, 9°35.9'N, 123°51.8'E, 4-30 m, 5.VI.2004, 1 ♂ (photographed) (ZRC 2008.1099). — Stn B9, Napaling, 9°33.1'N, 123°44.0'E, caves in the reef wall, 8-10 m, 8.VI.2004, 1 ♂ (ZRC 2008.1100). — Stn P4, Napaling, caves in the reef wall, 9°33.1'N, 123°44.0'E, 8-10 m, 8.VI.2004, 1 ♂ (photographed) (ZRC 2006.0174). — Stn R30, Napaling, 09°37.049'N, 123°46.273'E, 15-37 m, 8.VI.2004, 2 pre-adults (ZRC 2008.1101). — Stn B15, Sungcolan, 9°38.8'N, 123°49.2'E, 2-4 m, 16.VI.2004, 1 pre-adult (ZRC 2008.1102). — Stn B16, Bingag, 9°37.6'N, 123°47.3'E, 20 m, 17.VI.2004, 1 pre-adult (ZRC 2008.1103); 1 pre-adult (ZRC 2008.1104). — Stn S21, Bohol I., Manga, reef slope with silt, 9°41.7'N, 123°50.9'E, 4-12 m, 20.VI.2004, 1 juv. (ZRC 2008.1105). — Stn B19, Pamilacan Island, reef slope with caves, 9°29.4'N, 123°56.0'E, 17 m, 21.VI.2004, 1 pre-adult (ZRC 2008.1106). — Stn B20, Bohol I., Ubajan, 9°41.5'N, 123°51.0'E, 2-8 m, 23.VI.2004, 1 ♂, 3 pre-adults (ZRC 2008.1107). — Stn B23, Balicasag, Black Forest, 9°31.1'N, 123°41.3'E, 20-25 m, 25.VI.2004, 1 pre-adult (ZRC 2008.1108). — Stn B24, Pamilacan I., 09°29.377'N, 123°56.046'E, 16 m, 25.VI.2004, 1 pre-adult (ZRC 2008.1109). — Stn B41, Balicasag reef, 09°30.932'N, 123°40.791'E, 17-19 m, 4.VII.2004, 2 ♂♂ (ZRC 2008.1110). — Stn L46, Balicasag I., 9°30.9'N, 123°41.2'E, 90-110 m, 4.VII.2004, 1 pre-adult (ZRC 2008.1111).

Vanuatu. SANTO 2006, stn DB63, southeast Aésé I., 15°26.9'S, 167°15.8'E, 21 m, 25.IX.2006, 1 pre-adult ♀ (photographed) (MNHN-B31964). — Stn LM19, east Malo I., 15°38.5'S, 167°15.1'E, intertidal, 5.X.2006, 1 pre-adult ♀ (photographed) (MNHN-B31965). — Stn EP36, Aoré I., Aimbue Bay, 15°33.1/33.3'S, 167°12.4/12.7'E, tangle net, 20-60 m, 15.X.2006, 1 ovig. ♀ (photographed) (MNHN-B32311).

Unknown location, 18.X.1994, 1 ♂ (photographed) (ZRC 2008.1159).

DISTRIBUTION. — Wide Indo-West Pacific distribution from the Red Sea and the western Indian Ocean to the

Hawaiian Islands and Samoa (type locality: Ambon, Indonesia) (Castro 2000: table 6, fig. 51) and now the Philippines and Vanuatu. Depth: intertidal to 146 m (Castro 2000: table 5).

Acknowledgements

Research was conducted while the author was supported by a visiting professorship from the Département Milieux et Peuplements aquatiques, MNHN and a visiting fellowship from the Raffles Museum of Biodiversity Research, National University of Singapore. I thank J.-F. Dejouannet (IRD, Paris) for the preparation of the illustrations, D. Guinot (Département Milieux et Peuplements aquatiques, MNHN), B. Richer de Forges (Kiwa Consulting, Nouméa, New Caledonia), and R. Cleva (Département Milieux et peuplements aquatiques, MNHN) for their valuable help, and S. H. Tan (National University of Singapore) for making available a photograph taken during the PANGLAO 2004 expedition. The Vanuatu material was collected during the SANTO 2006 expedition organized by MNHN, Pro Natura International (PNI), and IRD. The expedition was supported by the Stavros Niarchos Foundation, and its marine part, with a Census of Marine Life's CReefs label, by grants from the Total and Sloan foundations and the National Geographic Committee for Research and Exploration. The expedition operated under a permit granted to P. Bouchet (MNHN) by the Environment Unit of the Government of Vanuatu.

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*Submitted on 18 September 2008;
accepted on 15 June 2009.*