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## Additional records of the pagurid hermit crab genus *Trichopagurus* de Saint Laurent, 1968 (Crustacea: Decapoda: Anomura), with description of a new species from the Philippines

TOMOYUKI KOMAI

<sup>1</sup>Natural History Museum and Institute, Chiba, 955-2 Aoba-cho, Chuo-ku, Chiba, 260-8682 Japan. E-mail: komai@chiba-muse.or.jp

### Abstract

The pagurid hermit crab genus *Trichopagurus* de Saint Laurent, 1968 is currently represented by three shallow water species from the tropical Indo-West Pacific region. In this paper, three species of the genus, including one new species, are reported. *Trichopagurus tenuidactylus* n. sp. is described on the basis of a single ovigerous female from the Bohol Sea, the Philippines, and compared with two close relatives, *T. asper* Komai & Poupin, 2012 and *T. macrochela* Komai & Osawa, 2005. New locality records are provided for *T. macrochela* (the Philippines) and *T. trichophthalmus* (Forest, 1954) (Taiwan and Marianas). An identification key to the four species of the genus is presented.

**Key words:** *Trichopagurus tenuidactylus*, identification key

### Introduction

Studies on pagurid hermit crabs in the last decade, focusing on shallow waters in the tropical Indo-West Pacific, have shown the existence of a far richer fauna than expected, and the discovery of new species and new locality records are still continuing (e.g., Osawa & Takeda 2004; Asakura 2005, 2010; Komai & Osawa 2005, 2006, 2007, 2009; 2012; Osawa *et al.* 2006; Komai 2006, 2009; 2010; Komai & Takada 2006; Osawa & Komai 2007; Osawa & Okuno 2007; McLaughlin & Rahayu 2008; Osawa & Fujita 2008; Siddiqui & Komai 2008; Komai & Okuno 2009; Komai *et al.* 2010; McLaughlin & Okuno 2010; Komai & Osawa 2012; Komai & Poupin 2012, 2013; Komai & Rahayu 2013a, 2013b). The present work deals with species of *Trichopagurus* de Saint Laurent, 1968, based on material recently collected from various western Pacific localities.

Prior to the review by Komai & Osawa (2005), *Trichopagurus* had been represented only by its type species, *T. trichophthalmus* (Forest, 1954), but currently three species are known in the genus (McLaughlin *et al.* 2010). Diagnostic characters of the genus include the possession of 11 pairs of biserial gills, the presence of a moderately short to long right sexual tube in males and the lack of paired first pleopods modified as gonopods in females. *Trichopagurus trichophthalmus* is widely distributed in the tropical Indo-West Pacific, while the other two species, *T. macrochela* Komai & Osawa, 2005 and *T. asper* Komai & Poupin, 2012 are known from limited areas, i.e., Japan and Palau, and the Comoro Islands, respectively. The present paper serves to describe a new species, *T. tenuidactylus*, from Bohol, the Philippines, and to provide additional records for *T. macrochela* and *T. trichophthalmus*. Superficially this new species resembles *T. asper* and *T. macrochela* but can be distinguished by some subtle morphological characters.

Material examined in this study is deposited in the Florida Museum of Natural History, University of Florida, Gainesville (FMNH), USA, National Museum of Manila (NMCR), the Philippines, the Natural History Museum and Institute, Chiba (CBM), Japan, and the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore (ZRC), Singapore. General terminology follows McLaughlin *et al.* (2007), except for numbering of thoracomeres. Shield length (sl), measured from the tip of the rostrum to the midpoint of the posterior margin of the shield, indicates specimen size. Others abbreviations are: coll., collected by; stn, station.

## Taxonomy

### Family Paguridae

#### Genus *Trichopagurus* de Saint Laurent, 1968

##### *Trichopagurus tenuidactylus* n. sp.

(Figs. 1–3)

**Material examined.** Holotype: PANGLAO 2004, stn L41, off Panglao Island, Bohol, Philippines, 09°31.3'N, 123°41.2'E, 90–100 m, 1 July 2004, ovigerous female (sl 1.4 mm), NMCR 39078.

**Description.** Eleven pairs of biserial gills.

Shield (Fig. 1A) 1.1 times longer than wide; anterior margin between rostrum and lateral projections slightly concave; anterolateral margins sloping; posterior margin roundly truncate; dorsal surface weakly convex, with some tufts of short setae laterally; no paragastric groove delineated. Rostrum triangular, reaching midlength of ocular acicles, tip rounded. Lateral projections obsolete, with small submarginal spine.

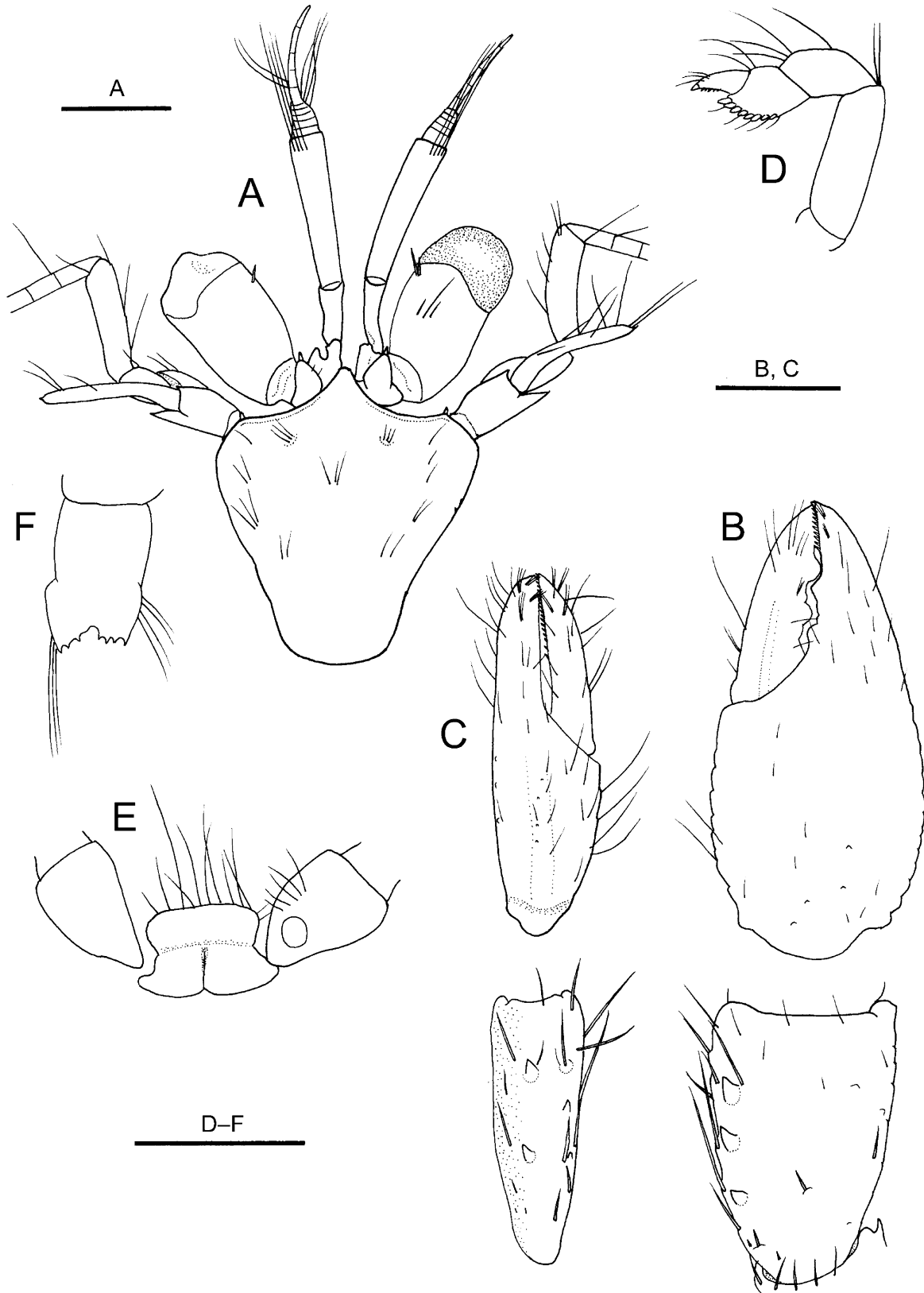
Ocular peduncles (including cornea) (Fig. 1A) stout, about 0.7 times shield length; slightly narrowing basally; cornea not dilated, corneal width about half of peduncular length; dorsal surface with tuft of short stiff setae near base of cornea mesially and 1 tuft of longer setae medially. Ocular acicles subtriangular, moderately widely separated, each with small submarginal spine terminally; dorsal surface flat.

Antennular peduncles (Fig. 1A) slender, when fully extended, overreaching distal corneal margins by half length of ultimate segment. Ultimate segment approximately twice length of penultimate segment, slightly widened distally, with tuft of long setae at dorsodistal lateral angle. Penultimate segment short, without setae. Basal segment with distolateral margin distinctly produced as short process, statocyst lobe weakly inflated, unarmed laterally.

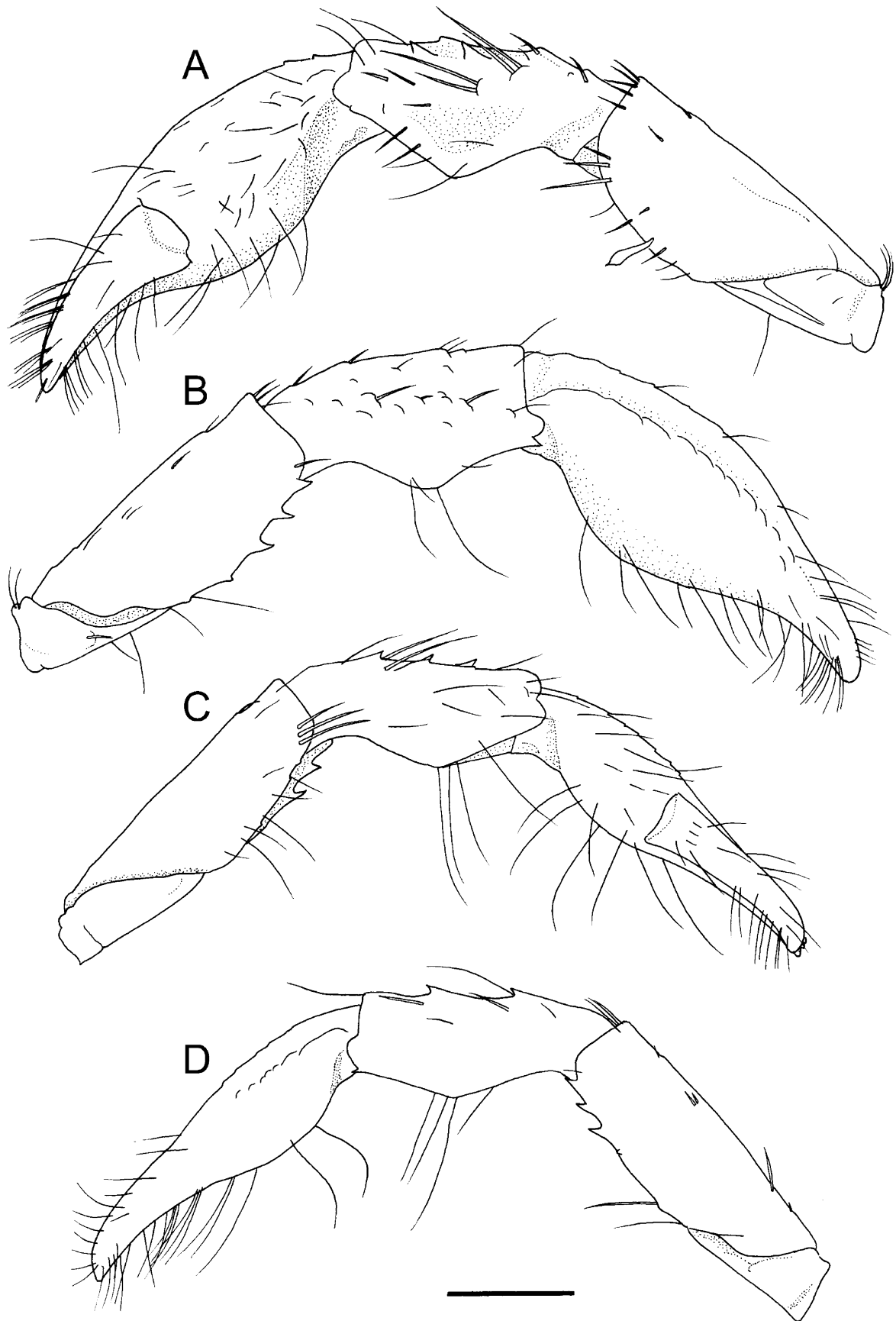
Antennal peduncles (Fig. 1A) slightly overreaching distal corneal margins. Fifth and fourth segments with few stiff setae. Third segment with spinule at ventromesial distal margin (not visible in dorsal view). Second segment with dorsolateral distal angle produced, slightly falling short of midlength of fourth segment, terminating in simple, acute spine; dorsomesial distal angle with small spine; mesial and lateral faces glabrous. First segment with minute spine on lateral face; ventromesial distal margin somewhat produced anteriorly, spineless. Antennal acicle overreaching base of cornea but not reaching distal corneal margin, terminating in small spine; dorsomesial margin with sparse moderately long setae. Antennal flagellum more than 5.0 length of shield, distinctly overreaching extended right cheliped; each article with 3–5 very short to moderately long setae on distal margin.

Mouthparts not dissected. Third maxilliped moderately slender; carpus unarmed on dorsodistal margin; merus with strong dorsodistal spine and small ventromesial spine; ischium with well-developed crista dentata composed of very small corneous teeth and 1 accessory tooth; basis-ischium fusion incomplete; basis unarmed on ventromesial margin; exopod reaching midlength of carpus.

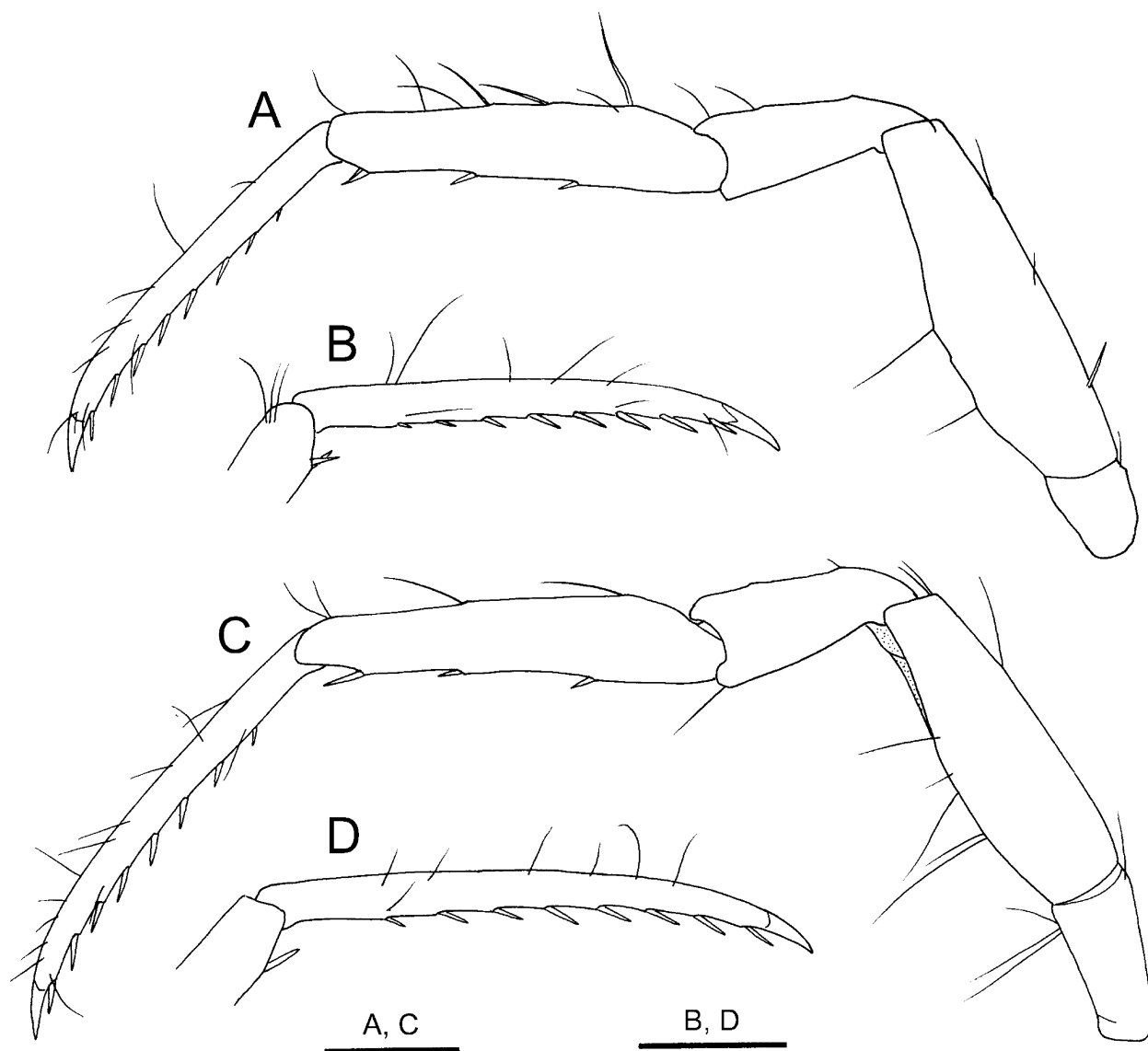
Chelipeds (Figs. 1B, C; 2A–D) strongly unequal and dissimilar. Right cheliped (Figs. 1B; 2A, B) moderately large. Chela suboval in dorsal view, about 2.5 times as long as wide (greatest width at midlength of palm). Dactylus about 0.8 length of palm, slightly curved ventrally; dorsal surface with sparse microscopic granules, dorsomesial margin not delimited, all surfaces with sparse short setae; cutting edge with 2 large, blunt calcareous teeth in proximal 0.7 and row of minute corneous teeth in distal 0.3, terminating in small corneous claw. Palm subequal in length to carpus, with sparse short setae on surfaces; dorsomesial margin not delimited, dorsolateral margin delimited by irregularly interrupted carina extending onto midlength of fixed finger; dorsal surface gently convex, with few, minute tubercles proximally; lateral and ventromesial faces almost smooth; ventral surface convex, smooth, with scattered moderately long setae. Fixed finger with scattered short setae on dorsal surface; cutting edge with 2 obtuse teeth in proximal half and row of minute corneous teeth in distal 0.4, terminating in small corneous claw. Carpus somewhat flattened dorsoventrally, slightly widened distally, slightly shorter than merus; dorsomesial margin not delimited, with 3 moderately large spines and 1 low proximal protuberance, with short to long stiff setae; dorsolateral margin not delimited; dorsal surface slightly convex transversely, with few short, sometimes spiniform setae; lateral surface with some low, short ridges sometimes bearing short stiff setae, ventrolateral distal angle with 1 small spine; mesial surface slightly concave, with few low protuberances and several short to long stiff setae; ventral surface generally convex, but anterior half forming shallow concavity to



**FIGURE 1.** *Trichopagurus tenuidactylus* n. sp., holotype, ovigerous female (sl 1.4 mm), NMCR 39078. A, shield and cephalic appendages, dorsal view (left cornea shrunk; antennal flagella omitted); B, chela and carpus of right cheliped, dorsal view; C, chela and carpus of left cheliped, dorsal view; D, left fourth pereopod, lateral view; E, coxae of third pereopods and sixth thoracic sternite, ventral view; F, telson, dorsal view. Scale bars: 0.5 mm.



**FIGURE 2.** *Trichopagurus tenuidactylus* n. sp., holotype, ovigerous female (sl 1.4 mm), NMCR 39078. A, right cheliped, mesial view; B, same, lateral view; C, left cheliped, mesial view; D, same, lateral view. Scale bar: 0.5 mm.



**FIGURE 3.** *Trichopagurus tenuidactylus* n. sp., holotype, ovigerous female (sl 1.4 mm), NMCR 39078. A, left second pereopod, lateral view; B, same, dactylus, mesial view; C, right second pereopod, lateral view; D, same, mesial view. Scale bars: 0.5 mm.

accommodate flexed palm. Merus with few tufts of short stiff setae on dorsal surface laterally, dorsodistal margin unarmed; lateral and mesial faces almost smooth, ventrolateral margin with 3 small spines in distal half, ventromesial margin unarmed but with row of short stiff setae and 1 capsule-like seta at midlength; ventral surface gently convex, with few long setae. Ischium unarmed, with few short stiff setae on surfaces. Coxa unarmed.

Left cheliped (Figs. 1C; 2C, D) moderately slender. Chela about 3.0 times longer than wide (greatest width at base of fingers). Dactylus about 1.3 times as long as palm; dorsomesial margin not delimited, surfaces nearly smooth, unarmed, with tufts of short to moderately long setae; cutting edge with row of minute, corneous teeth in distal 0.6, terminating in small corneous claw. Palm about 0.7 times as long as carpus; dorsal surface slightly elevated in midline, bearing several minute granules and sparse short setae; dorsolateral margin delimited by low, interrupted ridge not extending onto fixed finger, dorsomesial margin not delimited; lateral surface smooth; mesial surface with scattered short to long setae; ventral surface convex, with sparse long setae. Cutting edge of fixed finger with row of minute corneous teeth in distal 0.4. Carpus distinctly shorter than merus; dorsolateral margin with 2 small spines and few bristle-like setae, dorsomesial margin with row of bristle-like setae and 1 small spine located at midlength; lateral surface with few short setae dorsally, ventrolateral distal angle with 1 tiny spine; mesial surface with scattered long setae; ventral surface convex, with few long setae. Merus with few tufts of short

stiff setae on dorsal surface, dorsodistal margin unarmed; lateral face smooth, ventrolateral margin with 3 small spines in distal 0.3; mesial face with stiff, sometimes bristle-like setae ventrally, ventromesial margin unarmed; ventral surface with few setae. Ischium unarmed, with few setae. Coxa unarmed.

Ambulatory legs (Fig. 3A, C) moderately long and slender, right second overreaching tip of extended right cheliped. Dactyli (Fig. 3B, D) very slender, 11 (second) or 14 (third) times longer than wide, about 1.1 (second) or 1.2 (third) times longer than propodus, in dorsal view straight, in lateral view nearly straight with slight curve in distal half; dorsal margins each with row of sparse setae becoming shorter distally; lateral and mesial faces non-sulcate; mesial faces unarmed (second) or armed with 1 minute corneous spinule dorsally (third); ventral margins each with 8 long, slender corneous spines. Propodi distinctly longer than carpi, slightly narrowing distally; dorsal surfaces each with moderately long stiff setae; lateral and mesial faces glabrous; ventral surfaces each with 2 widely spaced, slender corneous spines, distal margin with pair of slender corneous spines. Carpi unarmed dorsally, with few short setae on dorsal margin. Meri somewhat widened; dorsal and ventral margins spine-less, with few long stiff setae. Ischia unarmed. Female with unpaired left gonopore (Fig. 1E).

Fourth pereopods (Fig. 1D) semichelate. Dactyli nearly straight, each with row of minute corneous teeth on ventral margin, terminating in tiny corneous claw; no preungual process. Propodal rasp consisting of single row of small corneous scales.

Fifth pereopods chelate.

Third thoracic sternite with anterior margin slightly produced medially, unarmed. Sixth thoracic sternite (Fig. 1E) with anterior lobe transversely oblong, with row of moderately short setae on anterior margin. Eighth thoracic sternite composed of 2 rounded, widely separated lobes.

Pleon dextrally twisted. Female with 4 unpaired pleopods; second to fourth pleopods slightly unequally biramous, fifth much smaller than preceding pleopods, uniramous. Uropods markedly asymmetrical; protopods unarmed.

Telson (Fig. 1F) with slight lateral indentations slightly posterior to midlength; posterior lobes slightly asymmetrical, subtriangular, terminal margins slightly oblique, each with row of 3 or 4 spinules, posterolateral margins each with fringe of long setae.

Male unknown.

**Coloration in life.** Not known.

**Distribution.** Known only from the type locality, off Panglao Islands, the Philippines, at depths of 90–100 m.

**Remarks.** Although only a single female specimen is available for study, the new species is assigned to *Trichopagurus* on the basis of strong similarities to *T. asper* and *T. macrochela*. In particular, the presence of a prominent fringe of long setae on the lateral margins of the posterior lobes of the telson is the character that is known so far only for species of *Trichopagurus* in the Paguridae (Komai & Osawa 2005; Komai & Poupin 2012; personal observation).

*Trichopagurus tenuidactylus* **n. sp.** is closer to *T. asper* and *T. macrochela* in having a dorsoventrally flattened carpus of the right cheliped and the less setose ocular peduncles and ambulatory legs. The new species appears unique in the genus in having very slender dactyli of the third pereopods (about 14 times as long as wide versus less than 11 times as long). Furthermore, the relatively slender ultimate segment of the antennular peduncle, the smooth dorsal surface of the palm of the right cheliped and the presence of dorsomesial spines on the carpus of the right cheliped distinguish *T. tenuidactylus* **n. sp.** from *T. asper* (in the latter species, the right palm has scattered tubercles; the carpus of the right cheliped lacks dorsomesial spines). The new species differs from *T. macrochela* in having dorsal spines on the carpus of the left cheliped (*T. macrochela*, with the carpus of the left cheliped unarmed on the dorsal surface).

The three previously known congeneric species have been all collected from intertidal to shallow subtidal depths in coral reefs (Komai & Osawa 2005; Komai & Poupin 2012; this study), but the present new species is the first example of the genus collected from the sublittoral depths of 90–100 m.

In the holotype, there is one capsule-like structure on the ventromesial margin of the merus of the right cheliped. The occurrence of similar capsule-like structure on the cheliped meri are known in *T. asper*, though Komai & Poupin (2012) presumed these structures might represent egg sacs of other invertebrates or parasites.

**Etymology.** From the combination of the Latin *tenuis* (= narrow) and *dactylus* (claw), in reference to the very slender dactylus of the third pereopods in the new species.

## *Trichopagurus macrochela* Komai & Osawa, 2005

*Trichopagurus trichophthalmus*. — Baba 1982: 68 (part).

*Trichopagurus macrochela* Komai & Osawa, 2005: 3, figs. 1–3. — McLaughlin *et al.* 2010: 36.

**Material examined. Japan.** Fuki, Kuroshima Island, Yaeyama Islands, Ryukyu Islands, 2 m, lagoon, 3 September 1998, coll. Keiichi Nomura, 1 ovigerous female (sl 1.9 mm), CBM-ZC 8942; Kikai Island, Amami Islands, intertidal, 25 May 2005, coll. T. Komai, 1 female (sl 1.8 mm), CBM-ZC 9557.

**Philippines.** PANGLAO 2004, stn B9, Napaling, Panglao Island, Bohol, Philippines, 09°33.1'N, 123°44.0'E, 8–10 m, caves in reef wall, 8 June 2004, 1 ovigerous female (sl 1.4 mm); stn B18, Sungcolan Bay, Panglao Island, 09°38.5'N, 123°49.7'E, 3–5 m, blocks dispersed among sea grass, 20 June 2004, 3 males (sl 1.4–2.0 mm), 1 female (sl 2.1 mm), 1 ovigerous female (sl 2.0 mm).

**Distribution.** Previously known from southern Japan and Yap, Palau (Komai & Osawa 2005); intertidal to 10 m. Herein newly recorded from the Philippines.

## *Trichopagurus trichophthalmus* (Forest, 1954)

*Catapaguroides ? trichophthalmus* Forest, 1954: 74, figs. 20–24.

*Trichopagurus trichophthalmus*. — de Saint Laurent 1968: 927; 1970: 212, figs. 1–16. — Baba 1982: 68 (part). — Komai & Osawa 2005: 11, figs. 4–6. — McLaughlin *et al.* 2010: 36.

**Material examined. Japan.** Apo-gama Cave, Onna Village, Okinawa Island, 30 m, 13 April 2009, SCUBA diving, coll. Yusuke Yamada, 1 ovigerous female (sl 1.3 mm), CBM-ZC 9640.

**Taiwan.** Shangjianwan, Kenting, 3–8 m, fore reef of nearshore fringing reef, 29 October 2000, coll. Gustav Paulay, 1 ovigerous female (sl 1.8 mm), FMNH 3769.

**Marianas.** Camel Rock, Guam, 15 m, 8 May 2001, coll. R. Riston-Williams, 1 female (sl 1.5 mm), FMNH 1402.

**French Polynesia.** Point Faaupo, Moorea, Society Islands, 0–2 m, under rocks, 21 October 2001, coll. G. Paulay, 1 male (sl 2.0 mm), 3 females (sl 1.4–2.0 mm), FMNH 1756.

**Distribution.** Widely distributed in the tropical Indo-West Pacific; intertidal to subtidal. Newly recorded from Taiwan and Marianas.

## Key to species of *Trichopagurus*

In the following key, non-dichotomous characters are included with brackets.

1. Chelipeds and ambulatory legs distinctly setose. Carpus of right cheliped subcylindrical, dorsomesial margin not delimited. [Carpus of left cheliped with dorsomesial spines] . . . . . *T. trichophthalmus* (Forest, 1954)
- Chelipeds and ambulatory legs only sparsely setose. Carpus of right cheliped flattened dorsoventrally. . . . . 2
2. Palm of right cheliped with scattered low tubercles on dorsal surface. Carpus without spines on dorsomesial margin. [Carpus of left cheliped with spines on dorsolateral and dorsomesial margins] . . . . . *T. asper* Komai & Poupin, 2012
- Palm of right cheliped almost smooth on dorsal surface, carpus with spines on dorsomesial margin . . . . . 3
3. Carpus of left cheliped without conspicuous spines on dorsal surface. Dactylus of left third pereopod moderately slender, 10–11 times longer than broad . . . . . *T. macrochela* Komai & Osawa, 2005
- Carpus of left cheliped armed with spines on dorsolateral and dorsomesial margins. Dactylus of left third pereopod very slender, about 14 times longer than broad. . . . . *T. tenuidactylus* **n. sp.**

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