



Two new species of the genus *Munnogonium* (Isopoda: Asellota: Paramunnidae) from Argentina

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Abstract

Two new species of paramunnid isopods from Argentina are described: *Munnogonium quequensis* n. sp. from Buenos Aires Province (Quequén) and *M. diplonychia* n. sp. from Patagonia (Comodoro Rivadavia, Rada Tilly and Puerto Deseado). Both species are distinguished from their congeners by having a tight tuft of setae on the frontal margin. These setae have been discovered after examining the specimens under scanning electron microscope; under dissecting microscope they look like a short blunt median projection. *M. diplonychia* n. sp. differs from *M. quequensis* n. sp. by having bifid claws on pereopods II–IV. Eighty of the 92 specimens of *M. quequensis* n. sp. examined were found attached to the sea star *Astropecten brasiliensis*, a fact that suggests an association between these two species.

Key words: taxonomy, *Munnogonium*, new species, South-West Atlantic

Introduction

Several paramunnid species have been assigned indiscriminately to the genera *Munnogonium* George & Strömberg, 1968 and *Austrosignum* Hodgson, 1910. Bowman and Schultz (1974) established the characters to differentiate both genera and transferred some species originally placed in *Austrosignum* to the genus *Munnogonium*. More recently, Just and Wilson (2007) revised these two genera and emended their diagnoses. At present the genus *Munnogonium* comprises five species distributed in temperate and cold waters of both hemispheres; viz.: *M. erratum* (Schultz, 1964), *M. falklandicum* (Nordenstam, 1933), *M. globifrons* (Menzies, 1962), *M. tillerae* (Menzies & Barnard, 1959) and *M. waldronense* George & Strömberg, 1968.

Herein we describe two new species of the genus *Munnogonium* from Argentina: *M. quequensis* n. sp. collected in Quequén (Buenos Aires Province) and *M. diplonychia* n. sp. collected in Comodoro Rivadavia / Rada Tilly (Chubut Province) and Puerto Deseado (Santa Cruz Province).

Material and methods

Samples were collected with a Rauschert sledge equipped with a 1 mm mesh size. Specimens were sieved with a 250 µm mesh, fixed with 10 % sea water buffered formalin and transferred to 70 % ethanol.

Some specimens of *M. quequensis* n. sp. and *M. diplonychia* n. sp. were stained with Chlorazole Black E[®], and the appendages were dissected and temporarily mounted in glycerin. Drawings of the whole animal and dissected appendages were prepared using a Carl Zeiss (Axioskop) compound microscope equipped with a camera lucida. Line drawings were rendered in digital format using a Wacom tablet and the Adobe Illustrator program after Coleman (2003). For SEM photographs, the specimens were cleaned with 0.5 % nonionic detergent Triton[®] X100 and ultrasound. After that, they were dehydrated through a graded series of ethanol ending in 100 %, critical point dried, gold-palladium sputter coated, and examined under a Philips XL30 TMP microscope.

Type and reference material have been deposited in the invertebrate collection of the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN-In).

The total length of the body, the width and length of the head, and the length of the pereonites, free pleonite and pleotelson, were measured according to Just and Wilson (2004, 2006). The descriptions were prepared using the DELTA database (Dallwitz 1980, Dallwitz *et al.* 2000a, b). The “Implicit Attributes” herein considered are those listed by Just and Wilson (2007).

Taxonomy

Paramunnidae Vanhöffen, 1914

Munnogonium George & Strömberg, 1968

Type species. *Munnogonium waldronense* George & Strömberg, 1968

Diagnosis. (Emended after Just and Wilson, 2007). *Body* ovate. *Head* frontal margin not projecting, with or without a tight tuft of setae (at low resolution the tuft of setae looks like a short blunt median projection). *Pereonites* dorsally smooth. *Pleotelson* lateral margins smooth. *Eyestalks* vestigial, not longer than wide (except in the males of *M. quequensis* n. sp.), downward pointed. *Antennula* article 1 at least twice length of eyestalk. *Mandible palp* absent. *Pereopod I* carpus triangular with 3 straight, subequal robust setae on posterior margin; propodus with simple setae on posterior margin (*M. quequensis* n. sp. also with 1 robust seta). *Pereopod II* carpus and propodus with several long, very slender robust setae on posterior margin. *Uropod* endopod straight, apex truncate.

Munnogonium quequensis n. sp.

Figures 1–7

Etymology. The specific epithet is a toponym referring to Quequén, the locality where the type material was collected.

Type locality. Quequén (Buenos Aires Province), 15 Dec 2005. Sta. 4, 38°42.83'S, 58°41.90'W, 45 m. All specimens were found clinging tightly on the aboral surface of the sea star *Astropecten brasiliensis* Müller & Troschel, 1842.

Material examined. *Holotype.* Brooding ♀, 1.93 mm (MACN-In 39184), here designated.

Paratypes. Same data as holotype: 20 brooding ♀, 9 non brooding ♀, 50 ♂ (MACN-In 39185).

Other material examined. Quequén (Buenos Aires Province), 15 Dec 2005: Sta. 2, 38°41.45'S, 58°42.10'W, 39 m: 1 ♂ (MACN-In 39186). Sta. 5, 38°43.65'S, 58°41.85'W, 47 m: 4 ♂, 4 brooding ♀, 1 non brooding ♀ (MACN-In 39187). Sta. 6, 38°46.58'S, 58°41.80'W, 54 m: 1 ♂ (MACN-In 39188). Sta. 12, 38°50.56'S, 58°41.08'W, 57 m: 1 brooding ♀ (MACN-In 39189).

Description. *Body* width 0.46 length in female (0.38 in male), widest at pereonite 3 in both sexes. *Head* length 0.48 width; length posterior to eyestalks 0.46 anterior length (0.7 in male). *Frontal margin* broadly rounded with tuft of setae medially (at low resolution this tuft of setae looks like a short blunt median projection), without angular lateral margins adjacent to antennae. *Eyestalks* vestigial, length 1.0 width in female (1.5 in male), long axis angling forward at approximately 25° in female (30° in male), with 4 ocelli.

Pereonites 1–4 lateral margins not projecting, coxae not visible in dorsal view; pereonite 1, in female greatest sagittal length 1.87 midline length, in male 2.0 midline length. All pereonites lateral margins rounded.

Pleon length 2.06 width in female (2.01 in male). *Pleonite 1* width 0.86 distance between uropods, length 0.68 width. *Pleotelson* lateral margin rounded and smooth with short proximal neck, lacking inflection between proximal and lateral margins; ventral length proximal to pleopods 0.17 total pleotelson length (see Fig. 1A); posterior margin apex pointed, evenly curving into lateral margin.

Antennula article 1 extending beyond eyestalk apex and pereonite 1 lateral margin; article 1 tubular, length and width subequal to article 2; article 3 twice longer than article 5, articles 4 and 6 shorter than articles 3 and 5.

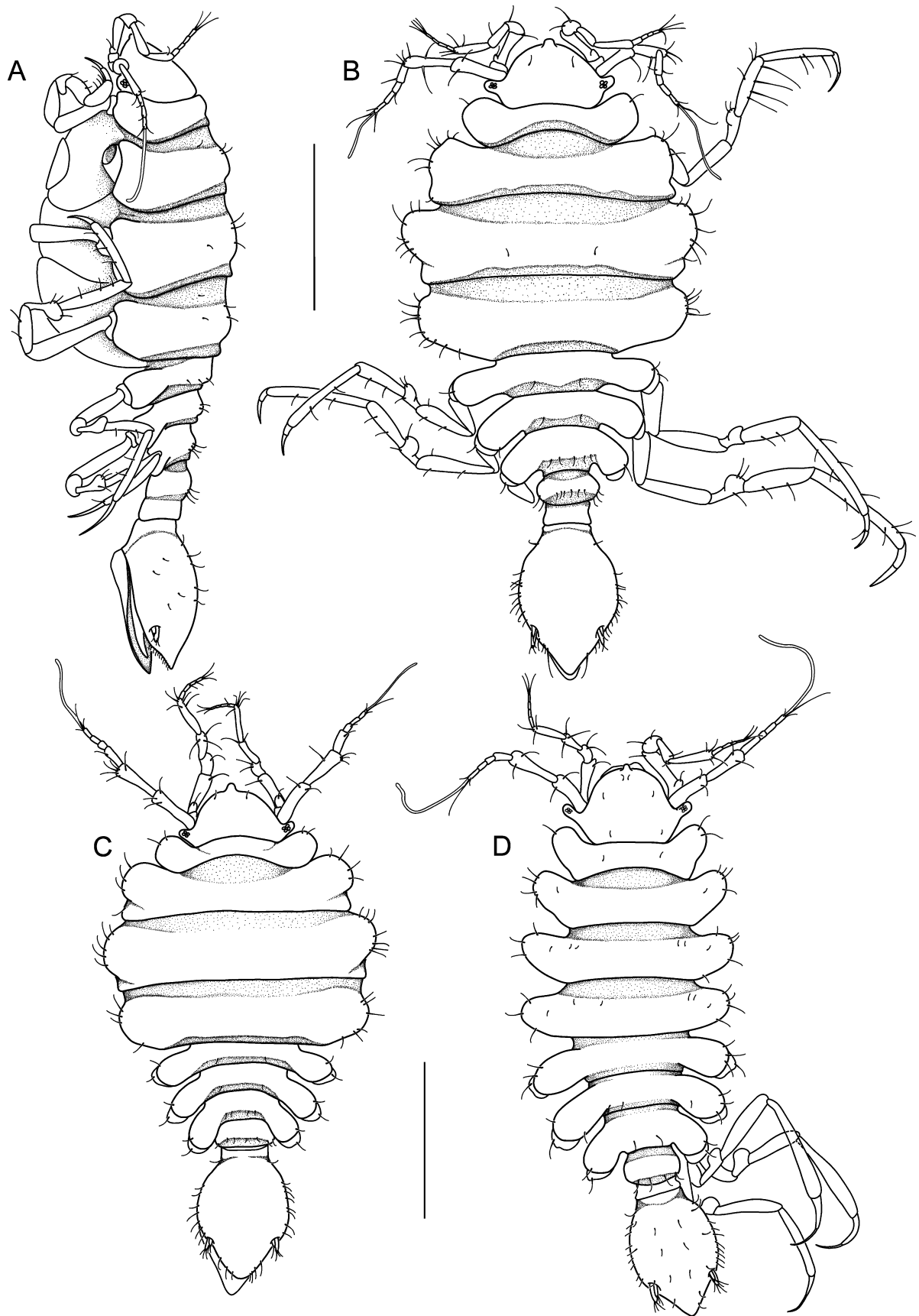


FIGURE 1. *Munnogonium quequensis* n. sp. Holotype female (MACN-In 39184). A, B, habitus in lateral and dorsal views, respectively. Paratype female (MACN-In 39185-a). C, habitus, dorsal view. Paratype male (MACN-In 39185-b). D, habitus, dorsal view. Scale bars: 0.5 mm (A, B and C, D share scale).

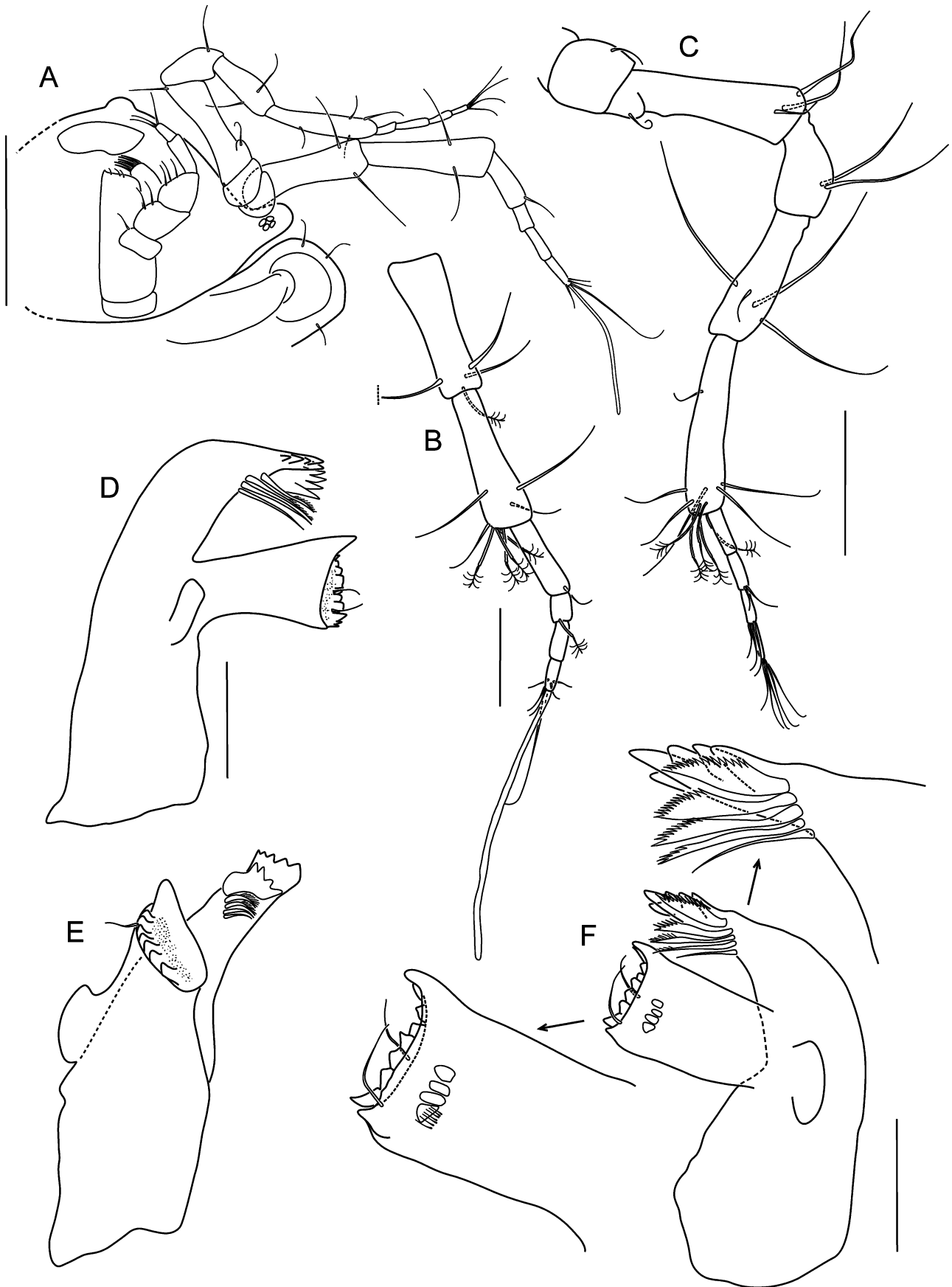


FIGURE 2. *Mummogonium quequensis* n. sp. Holotype female (MACN-In 39184). A, head, ventral view. Paratype female (MACN-In 39185-c). B, antennula. C, antenna. D, E, left mandible in different views. F, right mandible with details of incisor and molar processes. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D, F, 0.05 mm (D, E share the same scale).

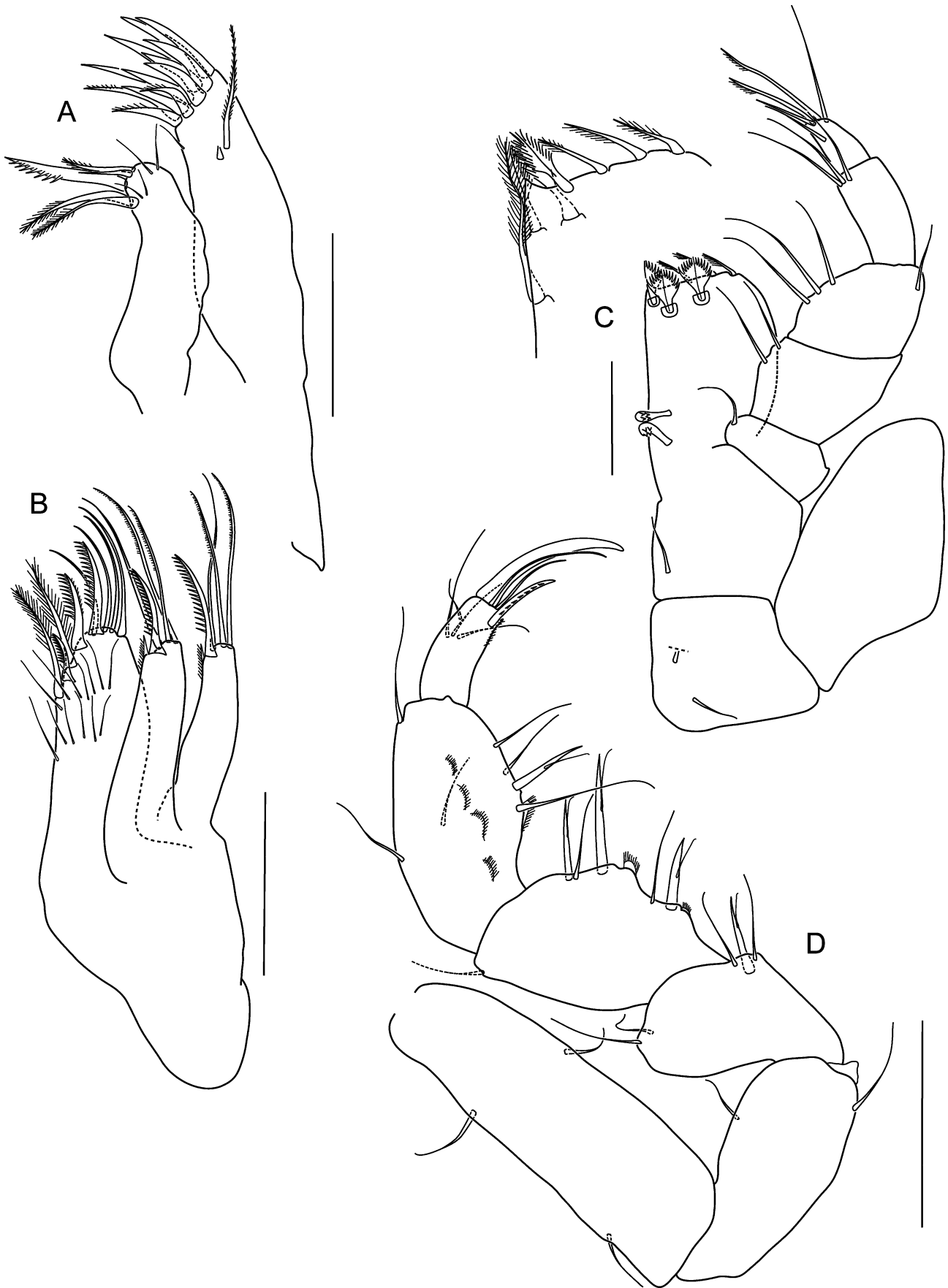


FIGURE 3. *Munnogonium quequensis* n. sp. Paratype female (MACN-In 39185-c). A, maxillula. B, maxilla. C, maxilliped with detail of the endite. D, pereopod I. Scale bars: A–C, 0.05 mm; D, 0.1 mm.

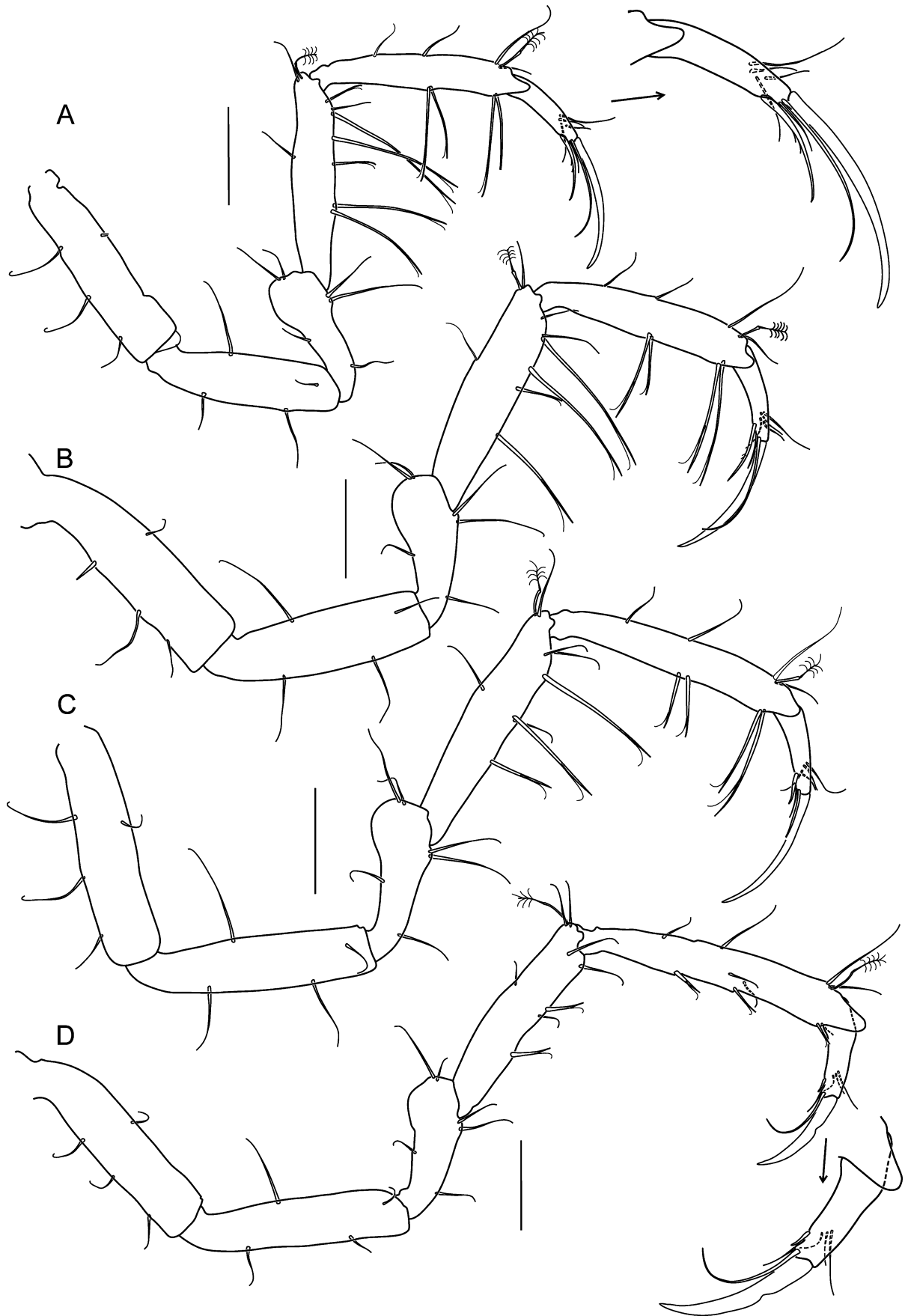


FIGURE 4. *Munnogonium quequensis* n. sp. Paratype female (MACN-In 39185-c). A–D, pereopods II–V, respectively. Detail of the dactylus is shown for pereopods II and V. Scale bars: 0.1 mm.

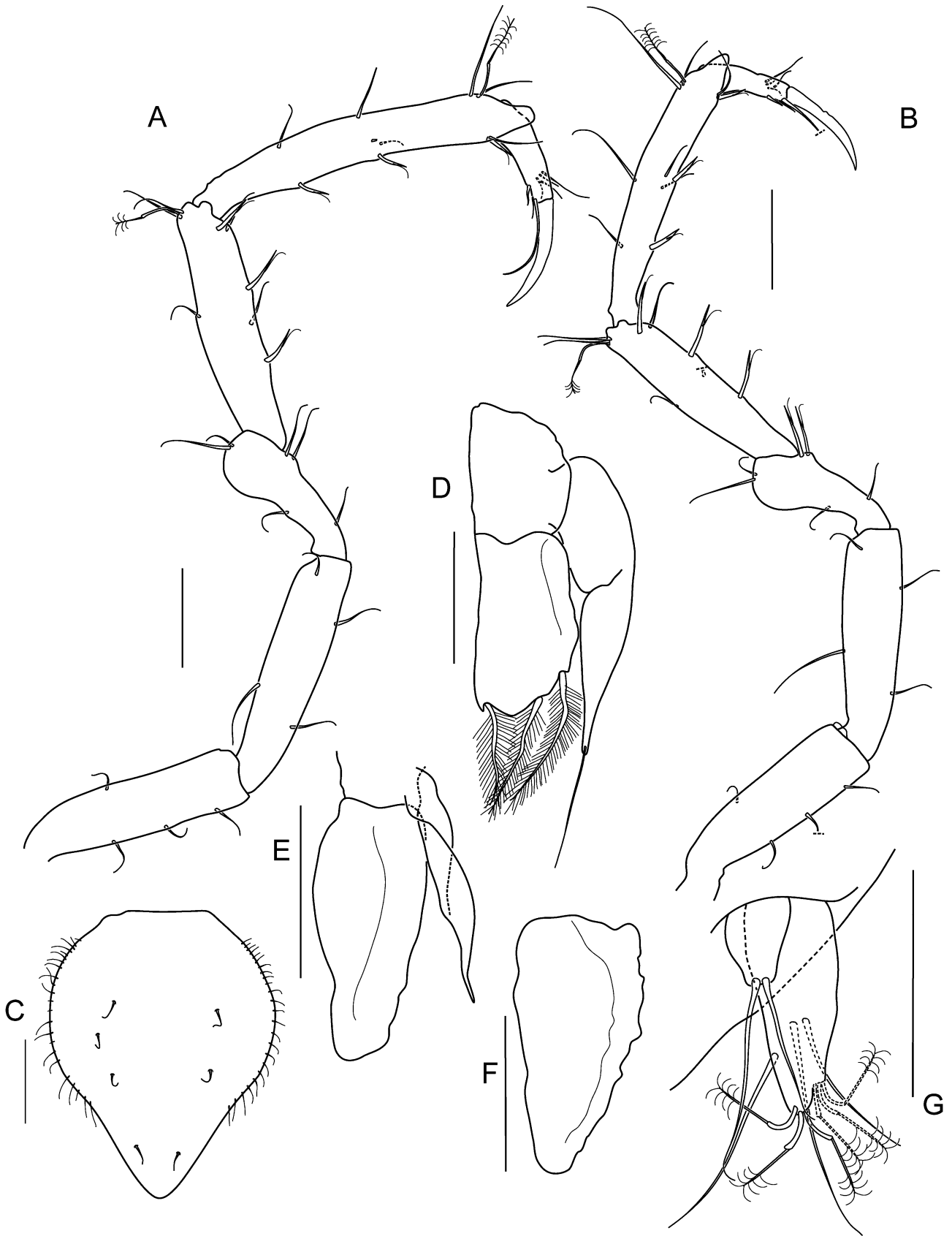


FIGURE 5. *Munnogonium quequensis* n. sp. Paratype female (MACN-In 39185-c). A, B, pereopods VI and VII, respectively. C, Operculum. D–F, pleopods III–V, respectively. G, uropod. Scale bars: A–F, 0.1 mm; G, 0.05 mm.

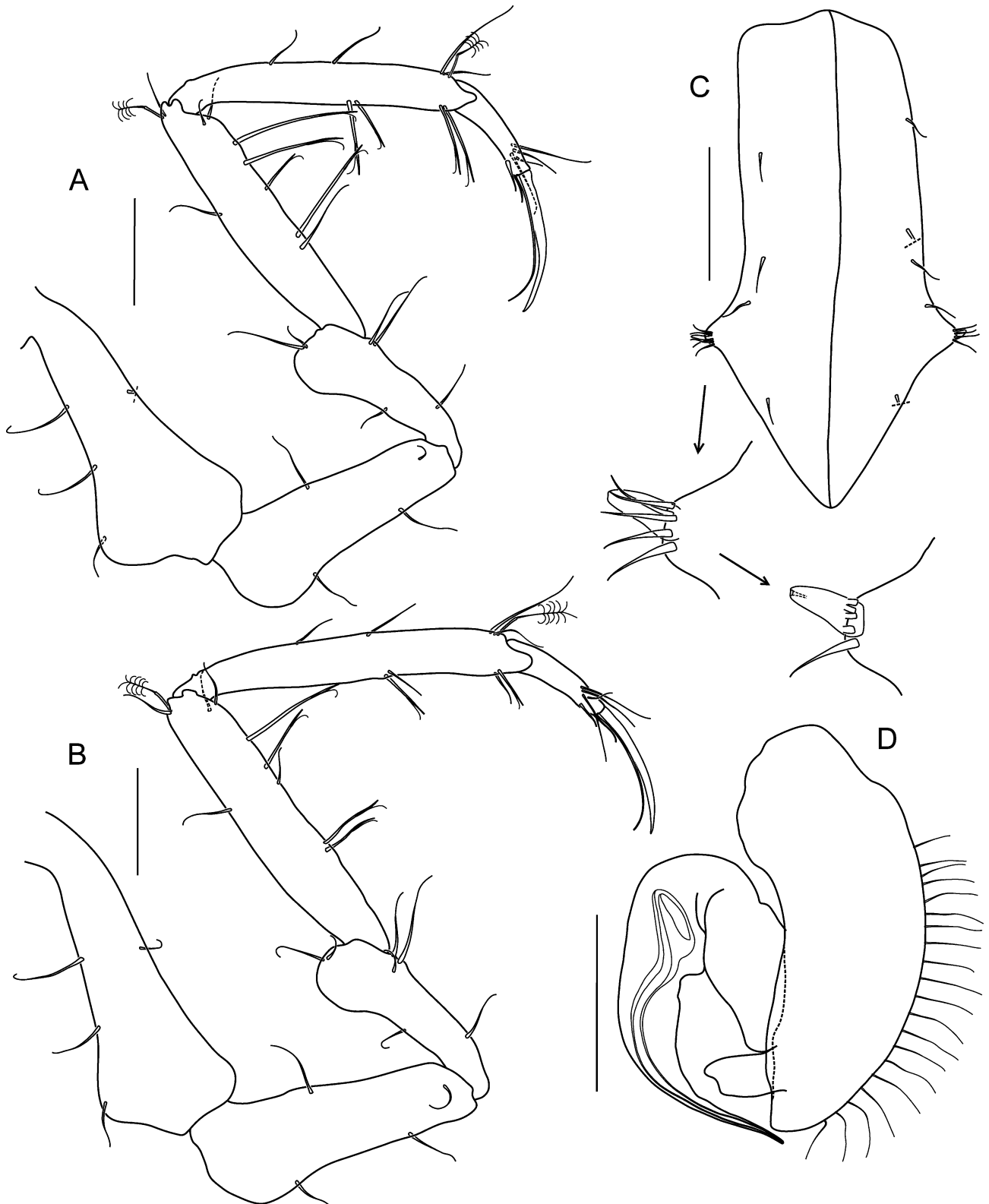


FIGURE 6. *Munnogonium quequensis* n. sp. Paratype male (MACN-In 39185-d). A, B, pereopods II and III, respectively. C, pleopod I with details of lateral lobe and thick seta. D, pleopod II. Scale bars: 0.1 mm.

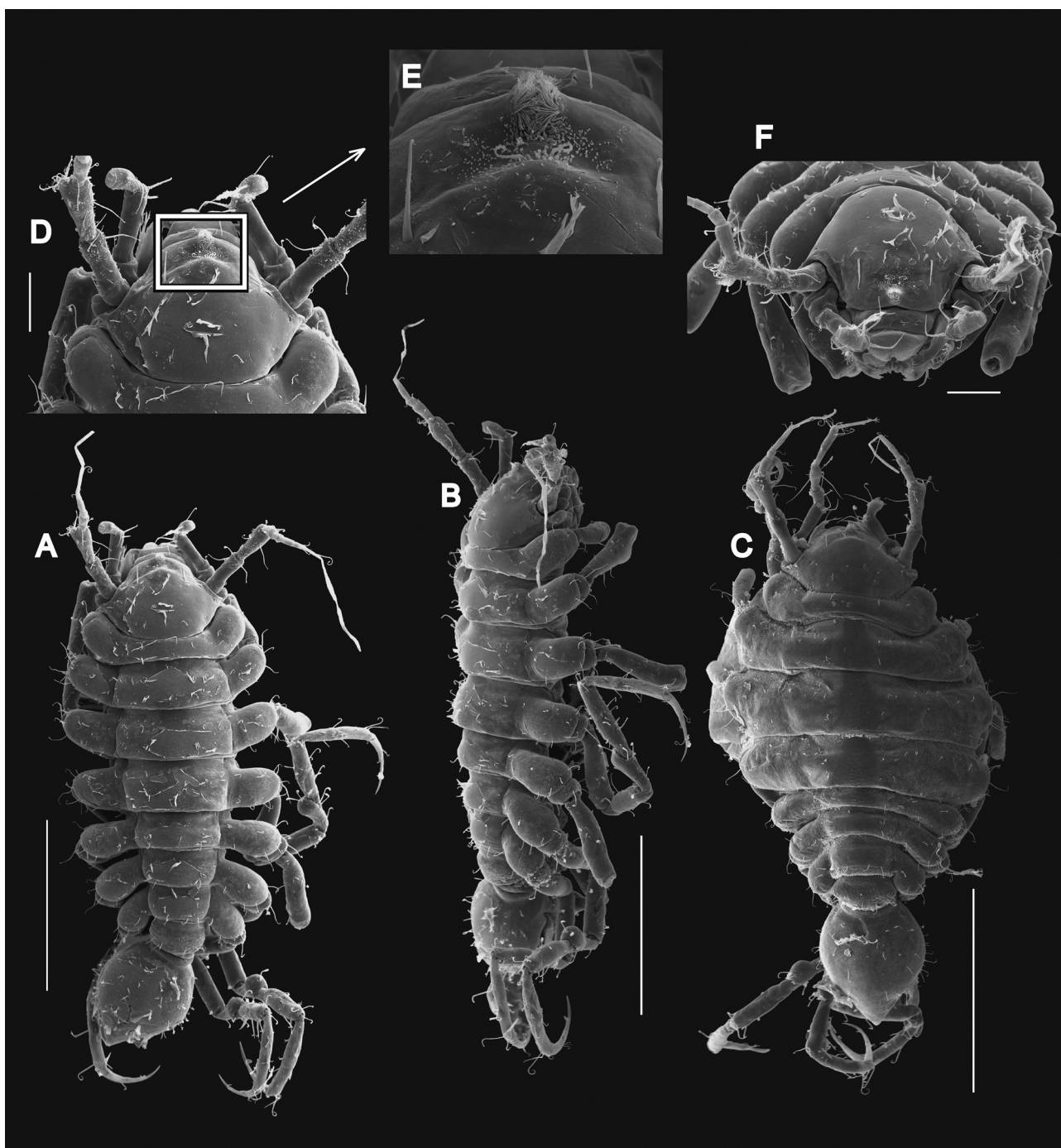


FIGURE 7. *Munnogonium quequensis* n. sp. SEM photos. Paratype male (MACN-In 39185-e). A, B, habitus in dorsal and ventral views, respectively. D, head in dorsal view. E, detail of anterior margin of head (square shown in D). F, head in frontal view. Paratype female (MACN-In 39185-f). C, habitus in dorsal view. Scale bars: A–C, 0.5 mm; D, F, 0.1 mm.

Antenna article 3 in ventral view tubular, width 0.33 length; article 5 1.25 longer than article 4; flagellum with 4 articles, proximal article subequal to distal ones.

Mandible molar process distally flared, triturative surface oval-shaped. *Maxilliped* palp article 1 with small lateral tooth.

Pereopod I basis dorsal margin smooth, length 3 width; merus ventral margin with 1 robust seta distally; carpus triangular, distal width 0.75 ventral margin length, ventral margin with 3 robust setae and crenate ridges; propodus narrowing distally, with 1 robust seta and 1 crenate ridge on ventral margin. *Pereopods II–IV* carpus and propodus ventral margins with row of elongate stiff robust setae; dactylus dorsal and ventral claws thin, elongate, dorsal claw longer than dactylus, ventral claw nearly as long as dactylus in pereopods II and III, but much shorter

than dactylus in pereopod IV. *Pereopods V–VII* carpus and propodus ventral margins with short robust setae; dactylus dorsal claw thick and robust, subequal in length to dactylus; ventral claw minute, seta-like. *Pereopods II* and *III* of male with distoventral bulge on basis and proximoventral bulge on ischium (Fig. 6A, B).

Female operculum width 0.78 length, distal part tapering with concave distolateral margins. *Male pleopod I* lateral lobes distinctly projecting from midlateral margin, width 0.4 distance to midline, apex with tuft of simple setae and 1 thick seta with distal pore; distal projection length 0.33 pleopod total length, forming acute angle, with rounded apices.

Uropods dorsal and adjacent to lateral margins of pleotelson.

Size. Largest female 1.93 mm, largest male 2.05 mm.

Distribution. Known only from its type locality. The type specimens of *M. quequensis* **n. sp.** were found clinging tightly on the aboral surface of the sea star *Astropecten brasiliensis* Müller & Troschel, 1842. Both the asellotes and the sea stars were covered by mucus.

Remarks. In the male of *M. quequensis* **n. sp.**, pereopods II and III are sexually dimorphic. The large adult males have a distoventral bulge on the basis and a proximoventral bulge on the ischium of these two pereopods (Fig. 6A, B). In small adult males only the pereopod II is sexually dimorphic, while in the juvenile males neither the pereopods II nor III show such bulges on the basis and ischium.

The material examined of *M. quequensis* **n. sp.** contained some specimens that were more elongated than others, i.e. their segments were greatly separated and the articular membranes everted. This is especially noticeable between the pleonite 1 and pleotelson (compare Fig. 1B and 1C), but is probably an artefact caused by fixation.

***Munnogonium diplonychia* n. sp.**

Figures 8–12

Etymology. The specific epithet is derived from the Greek *diploous*, double and *onychia*, claws, in reference to the bifid claws of the pereopods II–IV.

Type locality. Puerto Deseado (Santa Cruz Province), 23 Jan 2007, Sta. 20, 47°43.76'S, 65°50.26'W, 15 m.

Material examined. *Holotype.* Brooding ♀, 1.25 mm (MACN-In 39190), here designated.

Paratypes. Same data as holotype: 14 brooding ♀, 5 ♀ and 11 ♂ (MACN-In 39191).

Other material. Puerto Deseado (Santa Cruz Province), 23 Jan 2007, Sta. 1, 47°39.55'S, 65°47.47'W, 15 m: 1 brooding ♀ (MACN-In 39192). Sta. 3, 47°40.14'S, 65°47.62'W, 16 m: 7 brooding ♀ (MACN-In 39193). Sta. 15, 47°48.89'S, 65°51.25'W, 15 m: 6 ♀, 6 ♂ (MACN-In 39194). Sta. 17, 47°45.37'S, 65°50.75'W, 20 m: 1 brooding ♀ (MACN-In 39195). Sta. 19, 47°42.58'S, 65°49.12'W, ca. 15 m: 1 brooding ♀ (MACN-In 39196). Sta. 23, 47°43.56'S, 65°49.27'W, 15 m: 8 brooding ♀, 1 ♂ and 2 juvs (MACN-In 39197). Sta. 24, 47°43.58'S, 65°49.13'W, 15 m: 4 brooding ♀, 1 ♂, 3 juvs (MACN-In 39198). Puerto Deseado (Santa Cruz Province), 07 Feb 2006. Sta. 10, 47°45.76'S, 65°53.90'W, less than 10 m: 1 brooding ♀ (MACN-In 39199). Comodoro Rivadavia (Chubut Province), 05 Feb 2006. Sta. 4, 45°51.44'S, 67°27.82'W, 9 m: 1 brooding ♀ (MACN-In 39200). Sta. 5, 45°51.63'S, 67°27.23'W, 13 m: 6 brooding ♀, 9 ♂ and 2 juvs (MACN-In 39201). Sta. 6, 45°51.36'S, 67°27.13'W, 13.8 m: 1 ♀ (MACN-In 39202). Sta. 11, 45°51.44'S, 67°27.77'W, 9 m: 1 brooding ♀, 3 ♂ and 1 juv. (MACN-In 39203). Rada Tilly (Chubut Province), 09 Feb 2006, Sta. 23, 45°55.39'S, 67°32.13'W, ca. 10 m: 1 brooding ♀ (MACN-In 39204).

Description. *Body* width 0.53 length in female (0.38 in male), widest at pereonite 3 in both sexes. *Head* length 0.54 width; length posterior to eyestalks 0.52 anterior length (0.46 in male). *Frontal margin* broadly rounded with tuft of setae medially (at low resolution this tuft of setae looks like a short blunt median projection), without angular lateral margins adjacent to antennae. *Eyestalks* vestigial, length 1.0 width in female (0.75 in male), long axis angling forward at approximately 20° in female (17° in male), with 4 ocelli.

Pereonites 1–4 lateral margins not projecting, coxae not visible in dorsal view; pereonite 1 in female greatest sagittal length 2.83 midline length, in male 1.66 midline length. All pereonites lateral margins rounded.

Pleon length 1.77 width in female (1.67 in male). *Pleonite 1* width 0.8 distance between uropods, length 0.5 width. *Pleotelson* lateral margin rounded and smooth, lacking inflection between lateral and proximal margins; ventral length proximal to pleopods 0.15 total pleotelson length (see Figs. 8A, 11C); posterior margin apex pointed, evenly curving into lateral margin.

Antennula article 1 extending beyond eyestalk apex and reaching to pereonite 1 lateral margin, shorter than article 2, tubular and subequal in width to article 2; articles 4–6 subequal in length, all shorter than article 3.

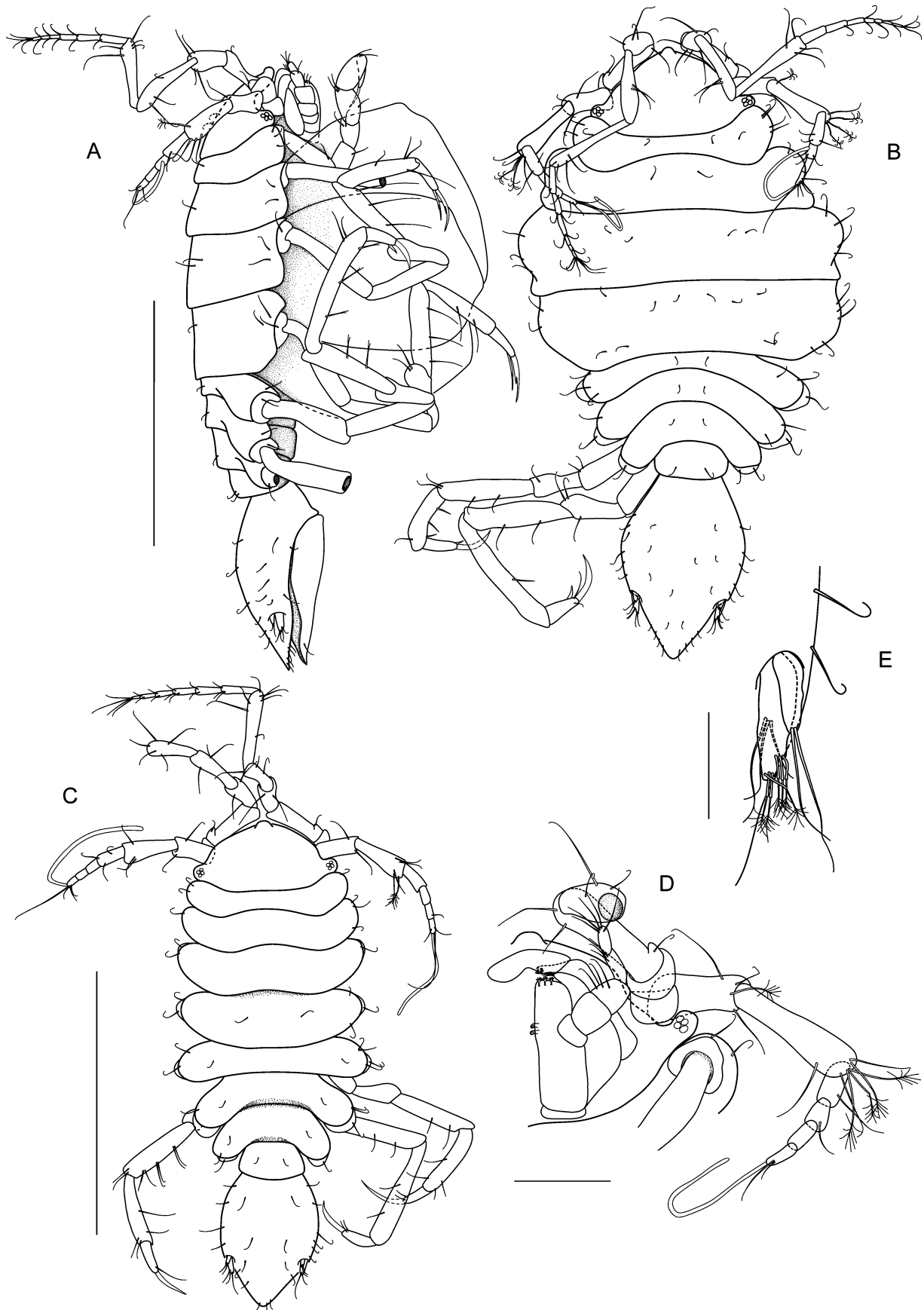


FIGURE 8. *Munnogonium diplonychia* n. sp. Holotype female (MACN-In 39190). A, B, habitus in lateral and dorsal views, respectively. D, head, ventral view. E, uropod. Paratype male (MACN-In 39191-a). C, habitus, dorsal view. Scale bars: A–C, 0.5 mm; D, 0.1 mm; E, 0.05 mm. (A, B share the same scale).

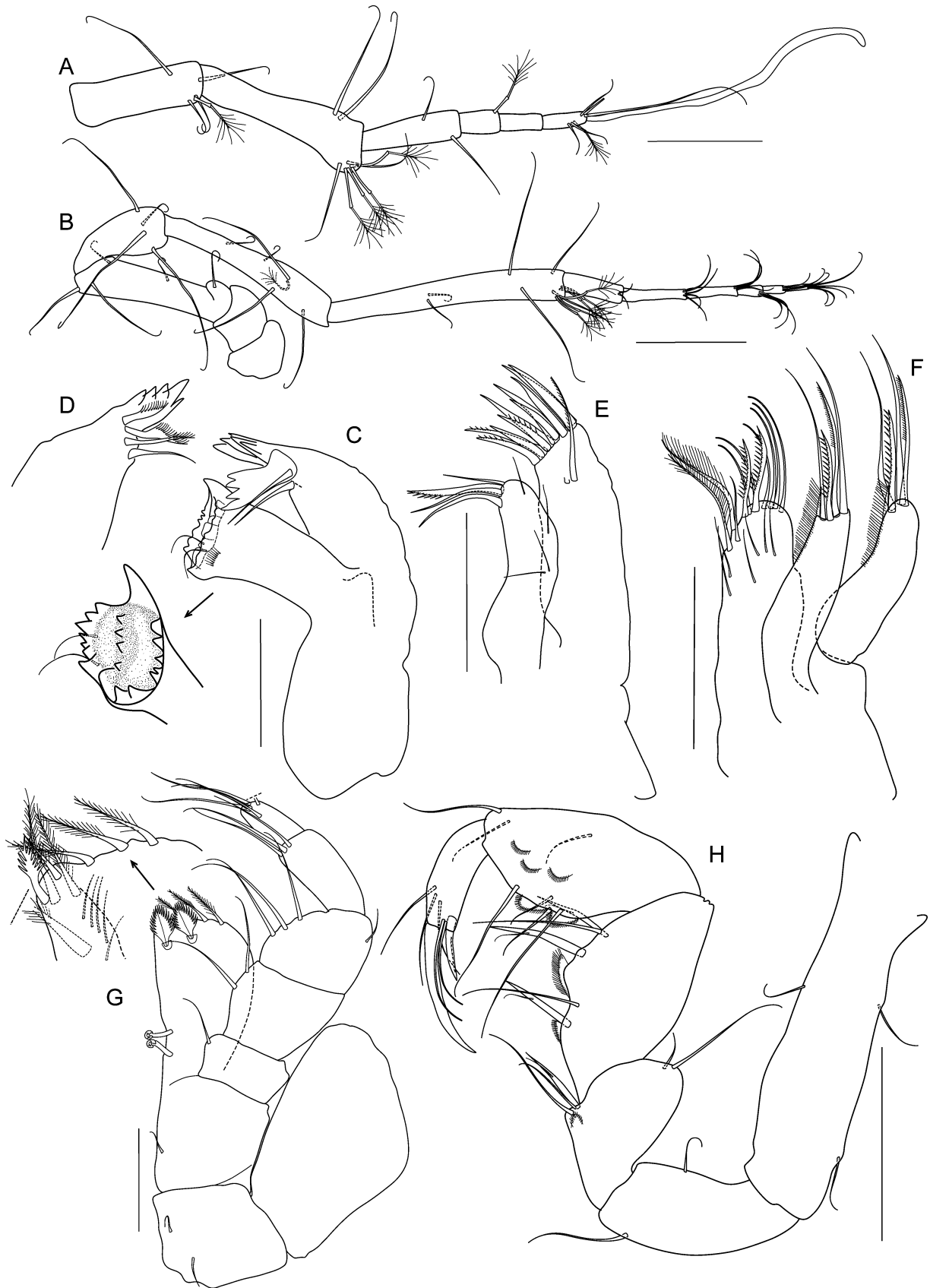


FIGURE 9. *Munnogonium diplonychia* n. sp. Paratype female (MACN-In 39191-b). A, antennula. B, antenna. C, left mandible with detail of molar process. D, right mandible, detail of incisor process only. E, maxillula. F, maxilla. G, maxilliped with detail of the endite. H, pereopod I. Scale bars: A, B, H, 0.1 mm; C–G, 0.05 mm.



FIGURE 10. *Munnogonium diplonychia* n. sp. Paratype female (MACN-In 39191-b). A–D, pereopods II–V, respectively. Scale bars: 0.1 mm.

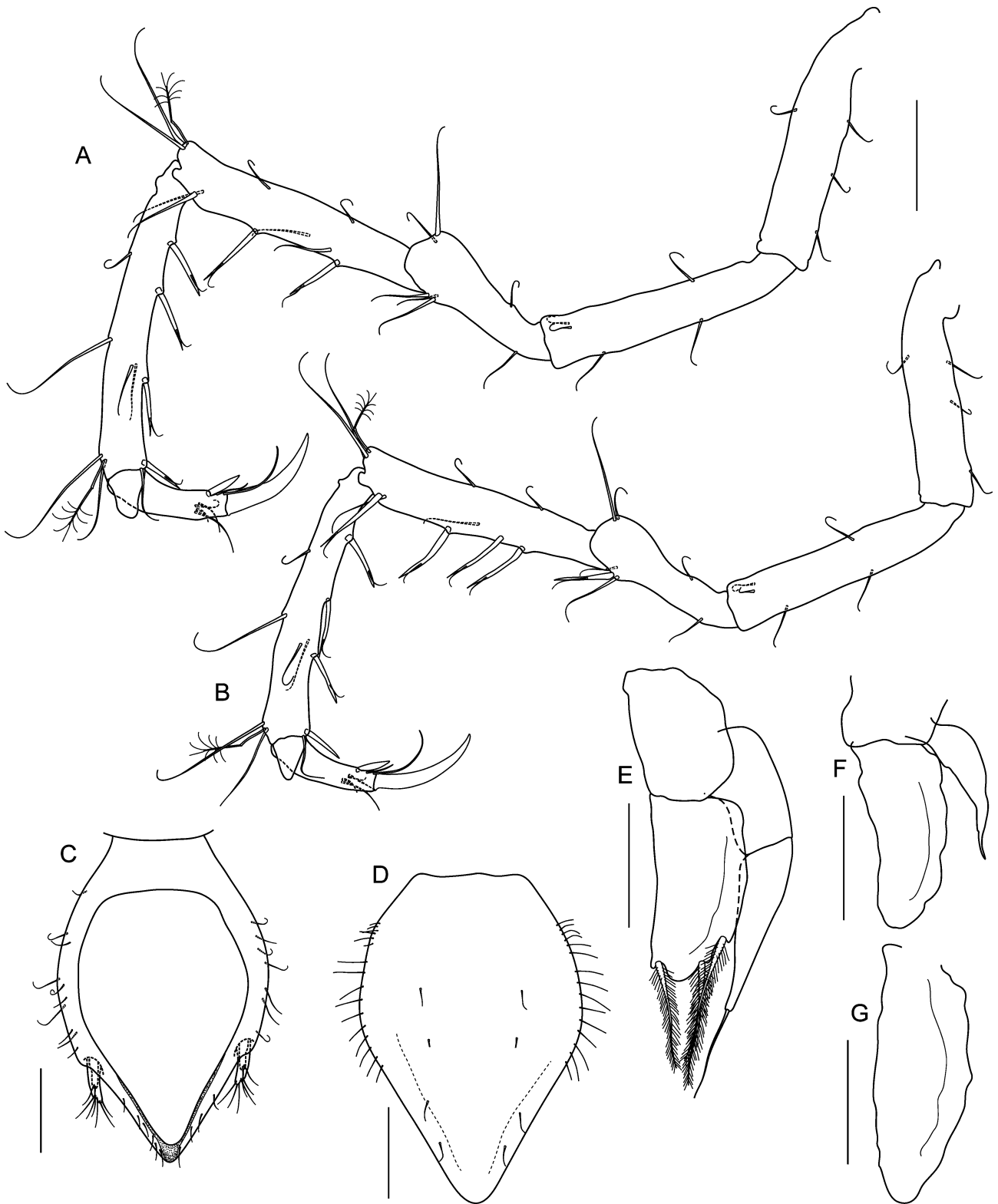


FIGURE 11. *Munnogonium diplonychia* n. sp. Paratype female (MACN-In 39191-b). A, B, pereopods VI and VII, respectively. C, pleotelson, ventral view. D, operculum. E–G, pleopods III–V, respectively. Scale bars: 0.1 mm. (A, B share the same scale).



FIGURE 12. *Munnogonium diplonychia* n. sp. Paratype male (MACN-In 39191-c). A, B, dactyli of pereopods II and IV, respectively. C, pereopod V. D, pleopod I with details of lateral lobe and thick seta. E, pleopod II. Scale bars: A, B, 0.05 mm; C–E, 0.1 mm.

Antenna article 3 in ventral view tubular, width 0.25 length, article 5 1.84 longer than article 4; flagellum with 6 articles, proximal article subequal to distal ones.

Mandible molar process distally flared, tritritative surface oval-shaped.

Pereopod I basis dorsal margin smooth, length 3.8 width; merus ventral margin with 1 robust seta distally;

carpus triangular, distal width 0.61 ventral margin length, ventral margin with 3 subequal robust setae and crenate ridges; propodus narrowing distally, with crenate ridge. *Pereopods II–IV* carpus and propodus ventral margins with row of elongate stiff robust setae; dactylus dorsal and ventral claws thin, elongate and bifid, both claws longer than dactylus (in males dorsal claw simple and ventral claw shorter than dactylus). *Pereopods V–VII* carpus and propodus ventral margins with short robust setae, dactylus dorsal and ventral claws thick and robust, dorsal claw near length of dactylus, ventral claw much shorter than dactylus.

Female operculum width 0.68 length, distal part tapering with concave distolateral margins. *Male pleopod I* lateral lobes distinctly projecting from midlateral margin, width 0.4 distance to midline, apex with tuft of simple setae and 1 thick seta with distal pore; distal projection length 0.31 pleopod total length, forming acute angle, with rounded apices.

Uropods dorsal and adjacent to lateral margins of pleotelson.

Size. Largest female 1.53 mm, largest male 1.27 mm.

Distribution. From Comodoro Rivadavia / Rada Tilly (Chubut Province) to Puerto Deseado (Santa Cruz Province).

Remarks. In *Munnogonium diplonychia* **n. sp.** the chaetotaxy of pereopods II–IV differs from that of pereopods V–VII, both in females and males (see Table 1). This bipartite arrangement has not been reported for any other species of the genus. Bifid claws are an easy-to-use character, although high magnification is required to observe them.

TABLE 1. *Munnogonium diplonychia* **n. sp.** Chaetotaxy of the pereopods II–VII.

	Pereopods II–IV	Pereopods V–VII
Carpus and propodus ventral margins with	elongate robust setae in both sexes.	short robust setae in both sexes.
Dactylus dorsal and ventral claws	In females, both claws bifid, thin and longer than dactylus. In males, dorsal claw simple and longer than dactylus, ventral claw bifid and shorter than dactylus.	In both sexes both claws simple and thick; dorsal claw almost as long as dactylus and ventral claw much shorter than dactylus.

Discussion

Munnogonium quequensis **n. sp.** and *M. diplonychia* **n. sp.** are distinguished from the remaining five species of the genus by having a tuft of setae on the anterior margin of the head. These two new species mainly differ from each other by the following characters (those of *M. diplonychia* in parentheses): antenna flagellum of 4 articles (6 articles); pereopod I propodus with 1 robust seta (without robust seta); claws of all pereopods simple (claws of pereopods II–IV bifid); and pleotelson with a proximal neck (pleotelson without such basal constriction).

So far, three species of the genus *Munnogonium* have been reported from the southern tip of South America, viz.: *M. falklandicum* (Nordenstam, 1933) described from the Malvinas Islands, *M. globifrons* (Menzies, 1962) described from the Magellan Strait and *M. tillerae* (Menzies & Barnard, 1959) described from California and reported from the Magellan Strait by Winkler (1994).

According to Nordenstam (1933) *Munnogonium falklandicum* has elongate stiff robust setae on the carpus and propodus of the pereopods II, VI and VII (pereopods III–V are missing in the female described by Nordenstam. We can assume, however, that these pereopods are also furnished with elongate stiff robust setae). In contrast, in *M. quequensis* **n. sp.** and *M. diplonychia* these carpal/propodal elongate setae are present on the pereopods II–IV only. Regarding the claws, Jean Just (pers. comm.) has had the opportunity to examine the female of *M. falklandicum* described by Nordenstam and he confirmed to us that this specimen has simple (not bifid) claws on the pereopod II.

M. globifrons was briefly described by Menzies (1962) and a redescription of this species is badly needed. Regarding, the specimens of *M. tillerae* from the Magellan Strait, Winkler (1994) wrote “it seems that this species [*M. tillerae*] occurs in the Magellan Strait” and pointed out that the setae on the propodus and carpus of the pereopods II–VI are longer than those illustrated by Bowman & Schultz (1974). These, together with the fact that the type locality of *M. tillerae* is southern California, hints at the possibility of a misidentification of the Magellan specimens.

In the Argentine Sea, two biogeographic provinces have been recognized as the Argentine Biogeographic Province (ABP) and the Magellan Bioeographic Province (MBP) (see López Gappa *et al.* 2006, and references therein). Except for *M. quequensis* n. sp., all other species of *Munnogonium* have been reported from the MBP (Fig. 13). *M. quequensis* n. sp. is reported from only one locality of the ABP, and most specimens (80 of the 92 specimens collected) were found attached to the surface of the asteroid *Astropecten brasiliensis*. Associations between isopods and echinoderms have previously been mentioned by many authors (Hatch 1947; Harty 1979; Setubal Pires 1995; Doti *et al.* 2008, and references therein).

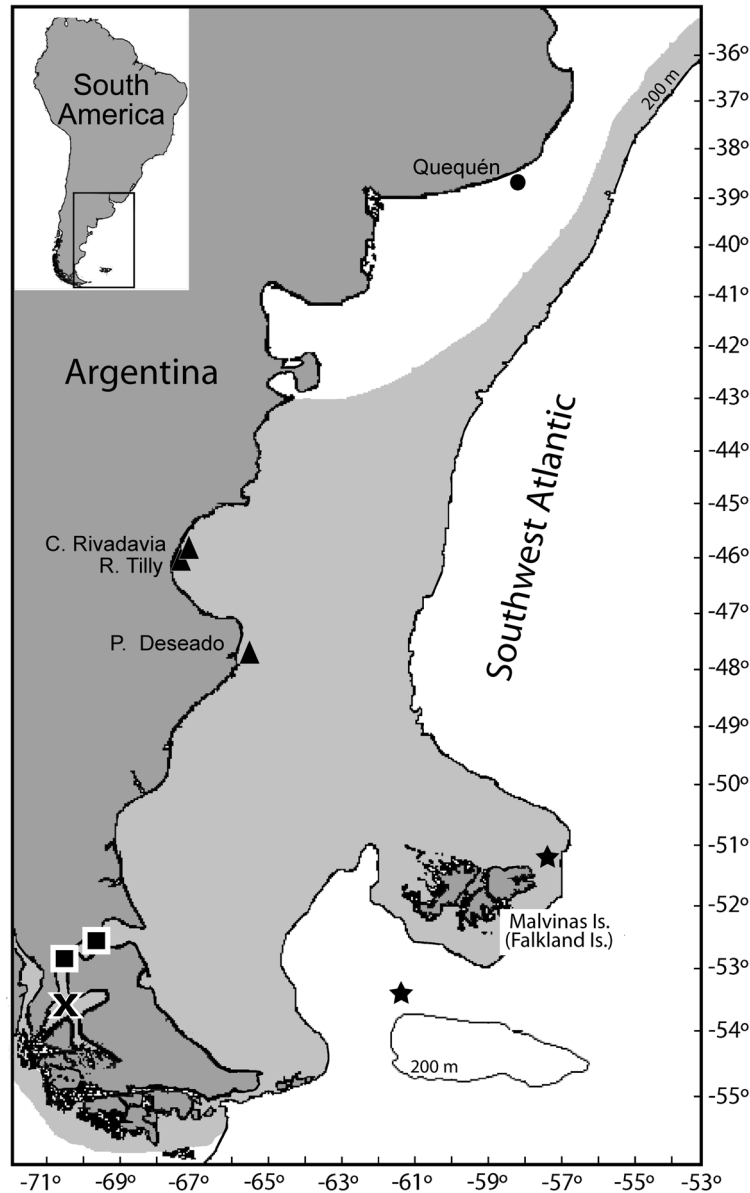


FIGURE 13. Distribution of the *Munnogonium* species in the South Atlantic Ocean. (circle) *M. quequensis* n. sp.; (triangle) *M. diplonychia* n. sp.; (star) *M. falklandicum* (Nordenstam, 1933); (square) *M. tillerae* (Menzies & Barnard, 1959); (cross) *M. globifrons* (Menzies, 1962). The shadow area represents the Magellan Biogeographic Province (MBP).

In some asellote species, the terminal males show a pronounced sexual dimorphism. Usually such dimorphic males have some pereonites or appendages enlarged (see Just & Wilson, 2004; Cunha & Wilson, 2006; Doti & Wilson, 2010; Riehl *et al.* 2012). Within Paramunnidae, the most common changes in these final males are in the pereonite 1, whose lateral parts are enlarged, and in the pereopod I which become more robust (Just & Wilson, 2004). Of the two new species described herein, only *M. quequensis* depicted sexual dimorphism. In this species, however, the pereonite 1 and its corresponding pereopod I are not displaying any change. In contrast, the basis and ischium of the pereopods II and III are enlarged (see remarks of *M. quequensis*). It is noteworthy that Bowman and

Schultz (1974) and Wilson (1997) reported a similar sexual dimorphism in the pereopod II of *Munnogonium tillerae* and *M. cf. tillerae*, respectively.

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