

*Claudicuma (Cumacea, Crustacea): First record from the marine environment, description of the second species of the genus and phylogenetic remarks*

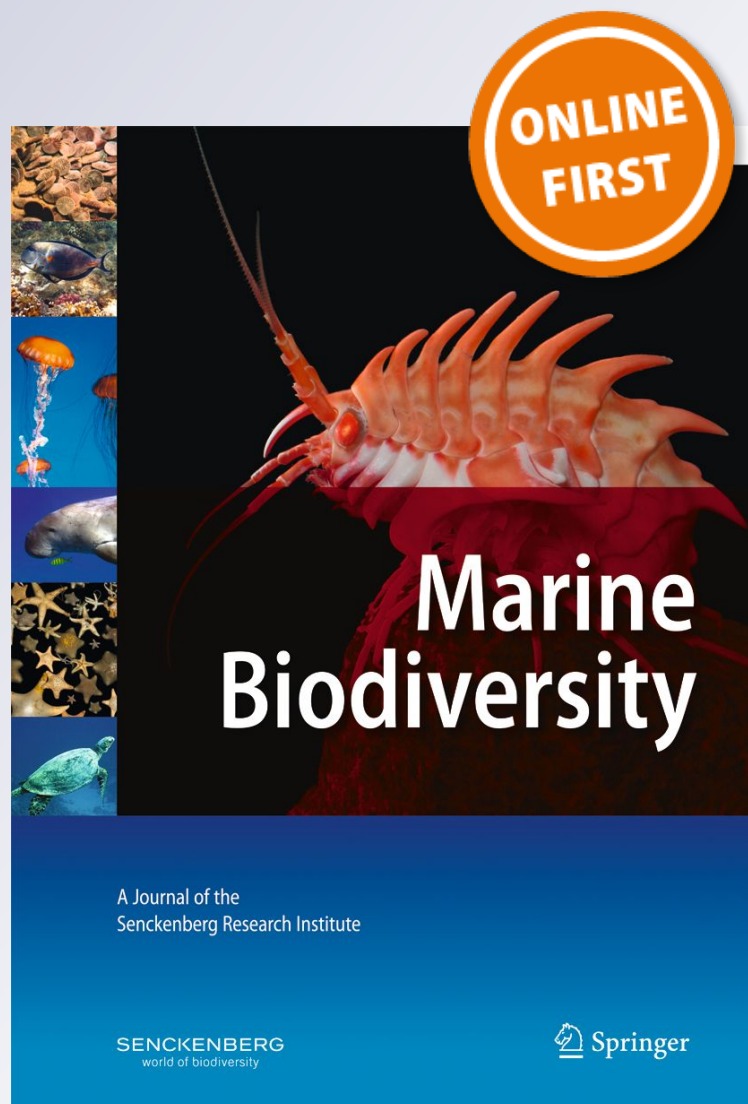
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# *Claudicuma* (Cumacea, Crustacea): First record from the marine environment, description of the second species of the genus and phylogenetic remarks

Daniel Roccatagliata<sup>1,2</sup> Received: 20 November 2016 / Revised: 19 March 2017 / Accepted: 21 March 2017  
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**Abstract** The genus *Claudicuma* was erected to accommodate *C. platense*, a species reported from freshwater and very low-salinity areas at the Río de la Plata, Argentina. Unexpectedly, a large number of the second species of this genus, *C. gosztonyii* n. sp., was recently collected in the Patagonian Atlantic coast, from the intertidal zone to 13 m of depth. This news species differs from *C. platense*, mainly in the chaetotaxia of the male second antenna, the acuteness of female pseudorostrum, and the proportions of female uropods. The ovigerous female of *C. gosztonyii* n. sp. has both degenerated mouthparts and an empty gut, facts that suggest that this is not a feeding instar. The second antennae of the adult male are presumably used to clasp the female. The genus *Claudicuma* is compared to *Picrocuma*, *Pseudopicrocuma*, *Bathypicrocuma*, *Thalycrocuma*, *Atlantocuma*, *Almyracuma* and *Spilocuma*, whose males also have short, clasping or vestigial second antennae. *Claudicuma* differs from all these genera by the coalescence of pereonites 2 and 3 in ovigerous females. The diagnosis of the genus *Claudicuma* is emended and its phylogenetic position discussed.

**Keywords** *Claudicuma* · Cumacea · Argentina · New species · First marine record

## Introduction

Jaume and Boxshall (2008) stated that although many cumaceans are found in estuaries and coastal lagoons, only 21 are recognized as genuine non-marine species. These authors reported that 19 of them belong to the family Pseudocumatidae and are mostly concentrated in the Ponto-Caspian region, whereas the remaining two belong to the family Nannastacidae and inhabit river basins in North and South America. These two species, *Almyracuma proximoculi* Jones and Burbanck, 1959 and *Claudicuma platense* Roccatagliata, 1981, seem able to survive in waters of raised salinity but neither of them have been recorded in full-salinity marine environments. Most recently, Petrescu and Heard (2004) described a second species of *Almyracuma* (*A. bacescui*) from the Gulf of Mexico, which also occurs in a wide range of salinities (from <1 to 30 ‰).

In the present paper, a full marine new species of the genus *Claudicuma* is described, based on a large number of specimens collected on the Argentine Patagonian coast. The second antennae of the adult male of *Claudicuma* are short and robust, and most probably used to clasp the female during mating. The affinities of *Claudicuma* with other genera whose males has short, clasping or vestigial second antennae (*Picrocuma*, *Pseudopicrocuma*, *Bathypicrocuma*, *Thalycrocuma*, *Atlantocuma*, *Almyracuma* and *Spilocuma*) are discussed.

The taxonomic position of the above-mentioned genera is unstable, and some of them were assigned to different families. In particular, the genus *Picrocuma* was firstly described in the family Bodotriidae and later transferred to Nannastacidae (see Hale 1936, 1945). However, Băcescu (1988) considered it again

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as a member of Bodotriidae, a criterion also followed by Tafe and Greenwood (1996) and Mühlenhardt-Siegel (2003). A similar situation exists for the genus *Atlantocuma*. Băcescu and Muradian (1974) erected this genus but were uncertain about its systematic position. More recently, the genus *Atlantocuma* was assigned to the family Bodotriidae by Băcescu (1988), whereas it was included to the family Nannastacidae by Jones (1984), Ledoyer (1988, 1993), Corbera et al. (2008), Akiyama (2012) and Gerken (2012). What is more, the genera *Picrocuma* and *Atlantocuma* are not included in the phylogenetic study on the family Bodotriidae presented by Haye (2007). Regardless of their unresolved taxonomic position, in the present contribution these two genera are provisionally considered as members of the family Nannastacidae.

The genus *Picrocuma* contains three shallow water species: *P. poecilotum*, *P. crudgingtoni* from Australia and *P. rectangularis* from Indonesia (Hale 1936, 1945; Tafe and Greenwood 1996; Mühlenhardt-Siegel 2003). The genus *Spilocuma* has two species, *S. salomani* and *S. watlingi*, both recorded from the shallow waters of the Gulf of Mexico (Watling 1977, Omholt and Heard 1979). Corbera et al. (2008) created the genus *Thalycrocuma* for the reception of *T. sarradini* from the hydrothermal vent field (Mid-Atlantic Ridge), and more recently Mühlenhardt-Siegel (2012) described a second species, *T. barbatulum*, from Angola Basin. Besides, Akiyama (2012) erected *Pseudopicrocuma* to accommodate *P. japonicus* from Japan, and Mühlenhardt-Siegel (2012) established the new genus *Bathypicrocuma* for the reception of *B. ifremer* from Angola Basin. Finally, the genus *Atlantocuma* is widely spread and includes seven bathyal and abyssal species (see Gerken 2012, Akiyama 2012 and references therein).

## Material and methods

The material was fixed in 5% seawater formalin (buffered with sodium borate) at the field, and later transferred to ethanol 70% in the laboratory. Selected specimens were stained with *Chlorazole Black E*, and their appendages dissected and mounted in glycerin to retain the possibility of manipulation. Illustrations were made with the aid of a drawing tube, attached both to a Leica MZ8 dissecting microscope and a Carl Zeiss Axioskop compound microscope. All dissected appendages were finally dismantled from the temporary slides and stored together with other body remains in ethanol 70%. Material for scanning electron microscopy (SEM) was rinsed in 0.5% nonionic detergent Triton X100, and the detritus removed with the help of an ultrasonic cleaner and/or a fine brush. After that, the specimens were dehydrated through a graded series of ethanol, critical point-dried, and sputtered with gold palladium. Finally, the specimens were examined under a Philips XL30 TMP microscope.

Body lengths were measured from the tip of the pseudorostrum to the end of the pleotelson (uropod excluded). In the descriptions of the appendages, the term “remaining articles together” stands for the ischium to dactylus length, not including terminal setae.

For the definitions of the different types of setae, see Alberico and Roccatagliata (2008).

The holotype male and the paratype female used to draw the habitus were not dissected. For the illustrations of the appendages, additional paratypes were used. When there was a slight discrepancy between two dissected males (or females), the data of the second paratype was added in the text between parentheses. Types and many reference specimens were deposited in the invertebrate collection of the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN).

## Material examined

GOLFO NUEVO, Chubut, Atila Gosztonyi and Luisa Kuba colls., fish stomach contents: 33 specimens (in poor condition). PUERTO MADRYN, Chubut, B. Doti, I. Chiesa and D. Roccatagliata colls., 03 Feb 2006: in front of the Centro Nacional Patagónico (CENPAT), intertidal zone, small dredge, 359 specimens (HOLOTYPE MACN-In. 41006, PARATYPES MACN-In. 41007a–f). Sta. 3, 42°46.324'S, 65°01.361'W, 10 m, small dredge, 9 specimens (MACN-In. 41008). Sta. 5, 42°46.465'S, 65°01.278'W, 5 m, small grab, 125 specimens (MACN-In. 41009). Sta. 6, 42°46.555'S, 65°01.054'W, 5 m, small dredge, 64 specimens (MACN-In. 41010). COMODORO RIVADAVIA, Chubut, B. Doti, I. Chiesa and D. Roccatagliata colls., 05 Feb 2006: Sta. 3, 45°51.495'S, 67°27.917'W, 10 m, small dredge, 42 specimens (MACN-In. 41011). Sta. 4, 45°51.441'S, 67°27.816'W, 9 m, small dredge, 99 specimens (MACN-In. 41012). Sta. 8, 45°50.442'S, 67°27.655'W, 7.8 m, small grab, 96 specimens (MACN-In. 41013). Sta. 9–10, 45°50.565'S, 67°27.610'W, 8.6 m, Rauschert sledge, 102 specimens (MACN-In. 41014). Sta. 11–12, 45°51.444'S, 67°27.769'W, 9 m, Rauschert sledge, 177 specimens (MACN-In. 41015). RADA TILLY, Chubut, B. Doti, I. Chiesa and D. Roccatagliata colls., 09 Feb 2006: Sta. 4, 45°55.300'S, 67°31.687'W, 10 m, Rauschert sledge, 2 specimens (MACN-In. 41016). Sta. 14, 45°55.310'S, 67°31.883'W, 10 m, small grab, 11 specimens (MACN-In. 41017). Sta. 15, 45°55.723'S 67°31.924'W, 10 m, small dredge, 22 specimens (MACN-In. 41018). Sta. 23, 45°55.389'S, 67°32.128'W, 10 m, small dredge, 19 specimens (MACN-In. 41019). Sta. 27, 45°55.316'S, 67°31.701'W, 10 m, small dredge, 483 specimens (MACN-In. 41020). Sta. 30, 45°55.298'S, 67°31.825'W, 10 m, small grab, 25 specimens (MACN-In. 41021).

Family Nannastacidae Bate, 1866.

Genus *Claudicuma* Roccatagliata, 1981.

Diagnosis (emended from Roccatagliata, 1981).

Ovigerous female with mouth part degenerated (mandibles decalcified, setae on mandibles and maxillae 1 and 2 reduced or lacking); second and third pereonites partially fused. Male second antenna modified as claspers: peduncle of five articles, flagellum short and robust. Well-developed exopods on maxilliped 3, pereopods 1–2 (females) and pereopods 1–3 (males). In both sexes: second pereonites the largest; branchial lobes on maxilliped 1 reduced or absent; maxilliped 3 pediform (not markedly differing from pereopod 1); uropod endopod uni-articulate.

Species included: *Claudicum platense* Roccatagliata, 1981; *Claudicum gosztonyii* n. sp.

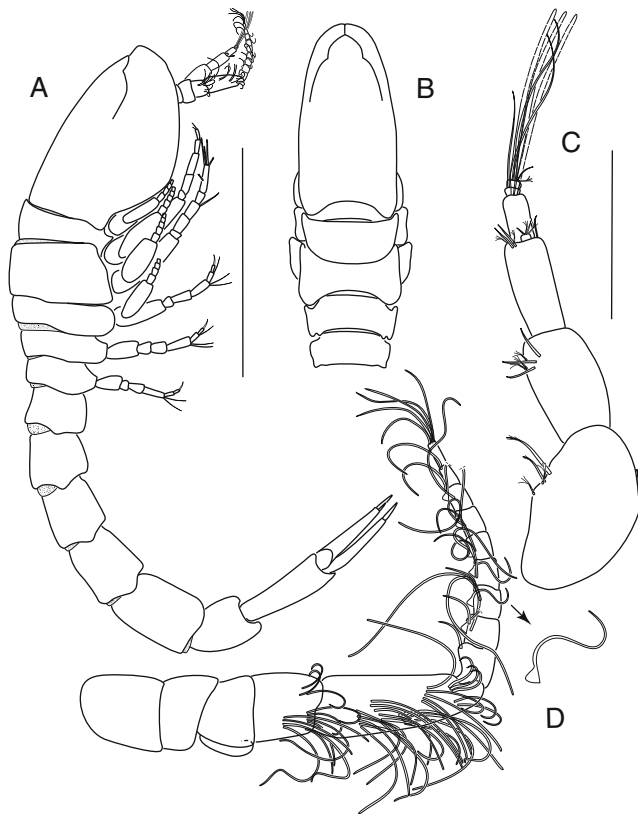
*Claudicum gosztonyii* n. sp.

Description of the adult male (based on the holotype MACN-In. 41006, paratypes MACN-In. 41007c, 41007e).

Total length: 1.46 mm.

Integument transparent.

Carapace (Figs. 1A, B, 2A) smooth, without ridges, 0.26 total body length, width 0.6 carapace length. Pseudorostrum 0.5 as long as ocular lobe. Ocular lobe large, wider than long, corneal lenses absent but refringent elements (crystalline bodies?) visible under cuticle. Antennal notch and anterolateral angle absent. Pereon approximately as long as carapace, second



**Fig. 1** *Claudicum gosztonyii* n. sp. Adult male. A, B (MACN-In. 41006). A, Habitus in lateral view. B, Cephalothorax in dorsal view. C, D (MACN-In. 41007c). C, First antenna. D, Second antenna and detail of a ribbon-like seta with triangular base. Scale bars: A, B, 0.5 mm (same scale); C, D, 0.1 mm (same scale)

pereonite the largest. Abdomen approximately as long as cephalothorax.

First antenna (Fig. 1C). Peduncle of three articles, first article the largest, third article 0.9 as long as second, all three with simple setae and broom setae distally. Main flagellum of three articles, first article half as long as third article of peduncle, second and third articles small; first article with two aesthetascs, second article with one simple seta, third article with one aesthetasc, four simple setae and one broom seta; aesthetascs almost three times as long as main flagellum. Accessory flagellum with simple and broom setae.

Second antenna (Fig. 1D) clasping form. Peduncle, fifth article the longest, fourth and fifth articles with many ribbon-like setae (only some drawn), which are arranged in transverse rows and extend along distal half of fourth article and distal 4/5 of fifth article. Flagellum short and robust, about as long as last three peduncle articles together, of nine articles; articles 2–7 with a ribbon-like seta having triangular base (see details in Figs. 1D, 2A); all articles with one to five ordinary, without triangular base, ribbon-like setae (for the sake of clarity only some of them are drawn).

Mandible as in *Claudicum platense*, i.e., left mandible with a *lacinia mobilis* and three large setae, right mandible with four large setae and lacking *lacinia mobilis*.

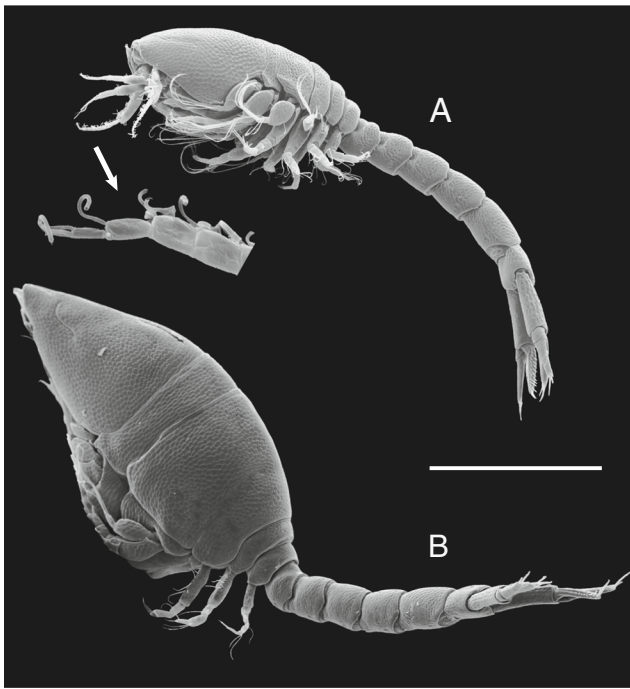
First maxilla as in *Claudicum platense*, i.e., outer and inner endites with 12 and 3 setae, respectively, and a backwardly directed palp-bearing 2 unequal setae.

Second maxilla (Fig. 3A). Outer endite with five setae (two serrate, three simple), inner endite with four setae (three serrate, one simple).

First maxilliped (Fig. 3B) composed of four flat articles and an epipodite. Basis, endite with one retinaculum and five setae distally. Merus with one seta on inner distal corner and two contiguous distal setae on ventral surface. Carpus with four thick setae on inner margin, three setae immediately behind and five setae somewhat farther from inner margin. Propodus as a rounded plate, with a short setae (remains of dactylus?) distally. Epipodite without gills.

Second maxilliped (Fig. 3C). Basis 0.9 as long as remaining articles together, with a large setulate seta on inner distal angle. Ischium present. Merus with a large setulate seta at midway along article. Merus with four (three) straight simple setae on inner margin and one setulate seta on outer distal angle. Propodus slightly longer than carpus and slightly shorter than merus, with four simple setae on inner margin and one simple seta on outer distal angle. Dactylus with some short simple setae, claw as long as article.

Third maxilliped (Fig. 3D) pediform. Basis 1.4 as long as remaining articles together; inner and outer margins with one large setulate distal seta, respectively. Merus with one simple seta on inner distal margin. Carpus 1.4 as long as merus, with two (one) simple setae on inner margin and one simple seta on outer distal corner. Propodus with three (two) simple setae on



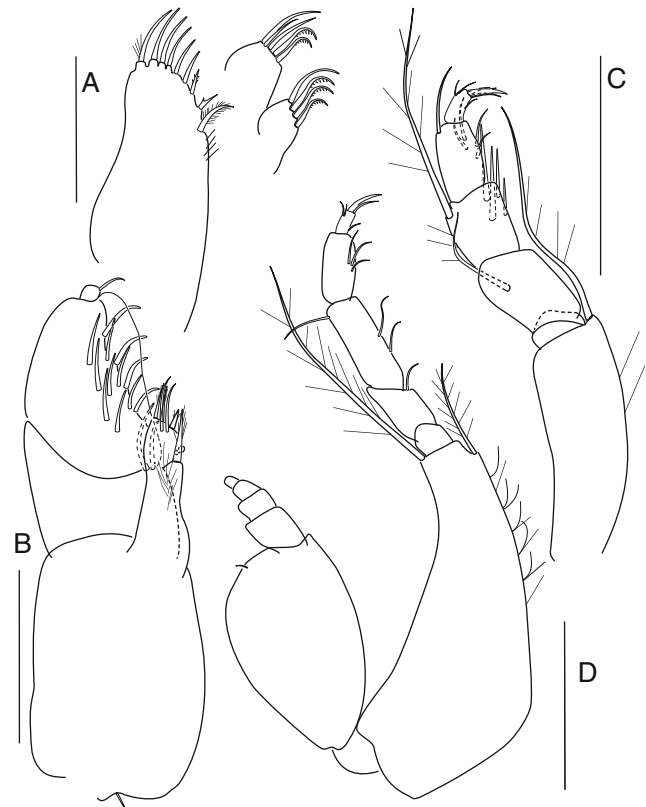
**Fig. 2** *Claudicuma gosztonyii* n. sp. SEM photographs. A, Habitus of adult male in lateral view and detail of the second antenna flagellum (MACN-In. 41007e). B, Habitus of ovigerous female in lateral view (MACN-In. 41007d). Scale bar: 0.5 mm

inner margin. Dactylus 0.4 as long as propodus, with a claw longer than article and a few simple setae. Exopod, peduncle expanded with one small seta (a large plumose seta in other specimens examined) on outer margin, flagellum of four articles (setae omitted).

First pereopod (Fig. 4A). Basis 1.3 as long as remaining articles together, with two small simple setae distally. Merus with one simple seta on inner distal margin. Carpus 1.1 as long as merus, with one simple seta on outer distal margin. Dactylus 0.6 as long as propodus, with a claw longer than article and a few simple setae. Exopod, flagellum of five articles (setae omitted).

Second pereopod (Fig. 4B). Basis 0.75 as long as remaining articles together, with one simple seta on outer distal angle. Merus slightly longer than carpus with one simple seta on inner margin. Carpus with three cuspidate and two serrate setae distally. Propodus and dactylus combined slightly shorter than ischium, merus and carpus combined. Dactylus with one cuspidate seta on inner margin and five cuspidate setae distally. Exopod, flagellum of four (five) articles (setae omitted).

Third pereopod (Fig. 4C). Basis slightly shorter than remaining articles together, with one small simple seta on inner distal article. Ischium and merus with two simple setae distally. Carpus second longest article, with one simple seta on inner margin and three simple setae distally. Propodus with one simple seta distally. Dactylus with claw and two simple setae. Exopod, flagellum of four articles (setae omitted).



**Fig. 3** *Claudicuma gosztonyii* n. sp. Adult male (MACN-In. 41007c). A, Second maxilla, endites drawn apart. B, First maxilliped. C, Second maxilliped. D, Third maxilliped. Scales bars: A, 0.05 mm; B–D, 0.1 mm

Fourth pereopod (Fig. 4D). As third pereopod except for: basis thicker, 0.7 as long as remaining articles together, with simple setae on outer margin. Exopod absent.

Fifth pereopod (Fig. 5A). As third pereopod except for: basis 0.55 as long as remaining articles together, with simple setae on outer margin. Exopod absent.

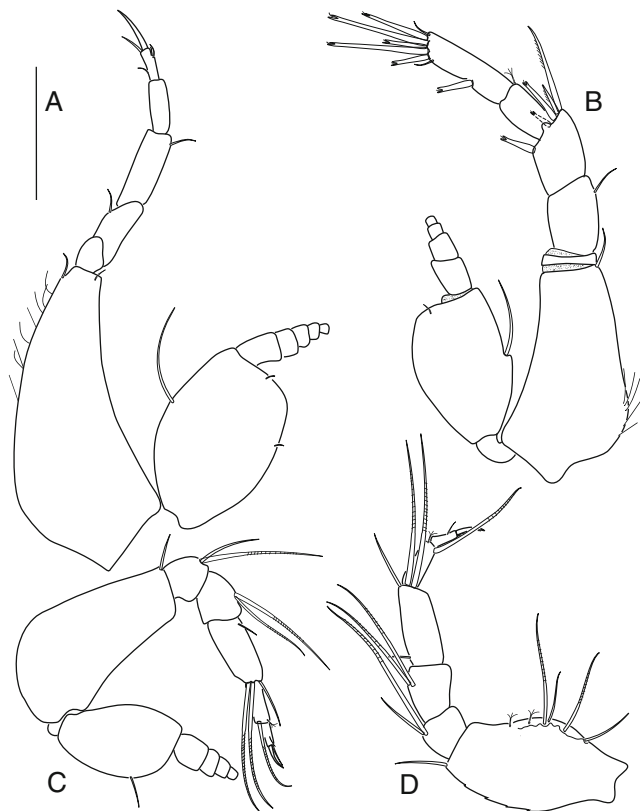
Uropod (Fig. 5B). Peduncle 1.3 times as long as last abdominal segment. Rami subequal, 0.8 as long as peduncle. Endopod with ten serrulate setae on inner margin, and one cuspidate seta (1/3 as long as article) distally. Exopod with one feeble simple seta on inner margin subterminally, and two unequal cuspidate setae distally (larger one 1/3 as long as article).

Description of the adult female (with fully developed marsupium; paratypes MACN-In. 41007a, 41007b, 41007d).

Total length: 2.20 mm.

Integument transparent.

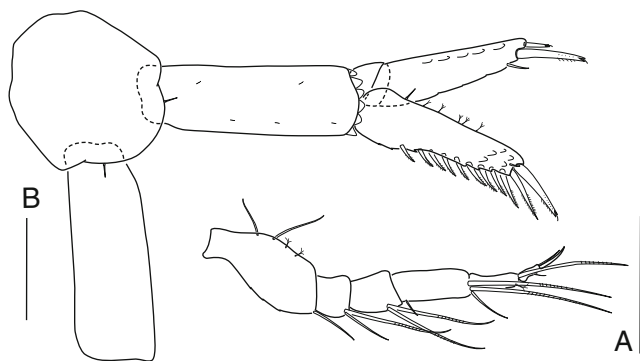
Carapace (Figs. 6A, B, 2B) smooth, without ridges, tapering in dorsal view, 0.3 total body length, width 3/4 its length. Pseudorostrum 1.5 times as long as ocular lobe. Ocular lobe wider than long, corneal lenses absent. Antennal notch shallow. Pereon longer than carapace. Second and third pereonites partially fused (margins of pereonites visible only laterally), together approximately twice as long as first pereonite. Abdomen short, 0.7 as long as cephalothorax. Brood chamber significantly increasing in volume by the deeply invagination of the thoracic



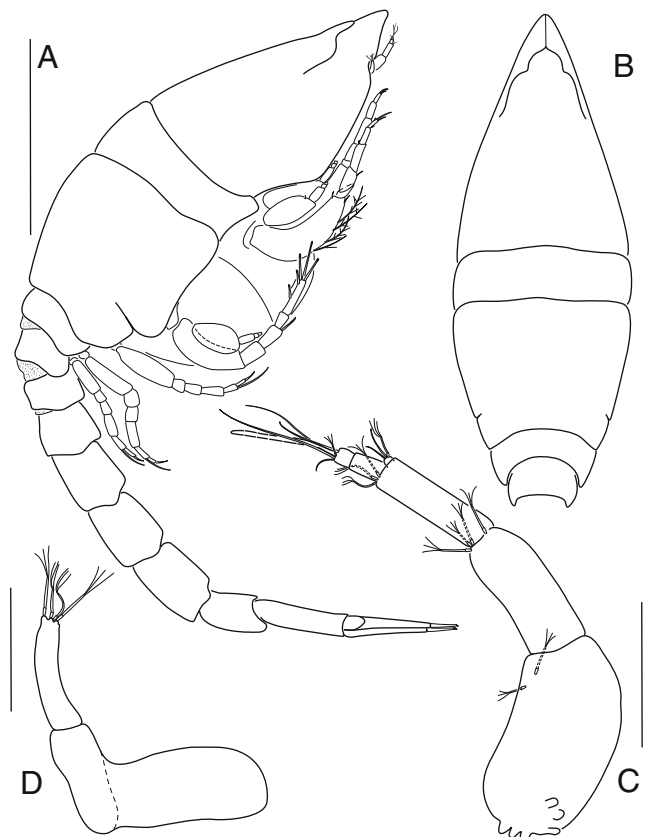
**Fig. 4** *Claudicuma gosztonyii* n. sp. Adult male (MACN-In. 41007c). A, First pereopod. B, Second pereopod. C, Third pereopod. D, Fourth pereopod. Scale bar: A–D, 0.1 mm (same scale)

sternites (eggs mass occupies most of the cephalothorax). Gut displaced dorsally, no digestive content present inside it.

First antenna (Fig. 6C). Peduncle of three articles, first article the largest, third article 0.9 as long as second, all three with broom setae distally. Main flagellum of two articles, first article 0.3 as long as third article of peduncle, glabrous; second article  $\frac{1}{2}$  as long as first, with one aesthetasc, four simple setae and one broom seta; aesthetasc more than two times as long as main flagellum. Accessory flagellum minute with simple and broom setae.



**Fig. 5** *Claudicuma gosztonyii* n. sp. Adult male (MACN-In. 41007c). A, fifth pereopod. B, last pleonite and right uropod. Scales bars: A, B: 0.1 mm



**Fig. 6** *Claudicuma gosztonyii* n. sp. Ovigerous female. A, B (MACN-In. 41007a). A, Habitus in lateral view. B, Cephalothorax in dorsal view. C, D (MACN-In. 41007b). C, First antenna. D, Second antenna. Scale bars: A, B, 0.5 mm (same scale); C, D, 0.05 mm

Second antenna (Fig. 6D). First and second articles partially fused, and arranged at right angle each other. Third article with four broom setae distally.

Mouthparts degenerated. Mandible entirely decalcified and soft, lacking setae. First maxilla (Fig. 7A), distal setae replaced by small projections. Second maxilla (Fig. 7B), protopodite distal setae reduced in size and number, endites distal setae replaced by 1–2 small projections.

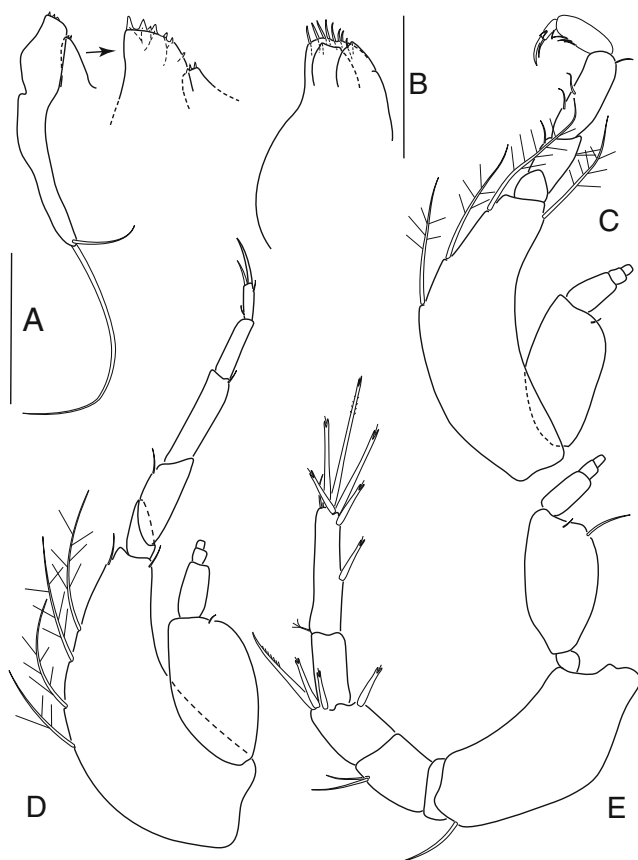
First maxilliped as in male except for: basis, endite distal setae reduced in size; merus lacking inner distal seta; carpus, inner margin setae not thicker than the other ones.

Second maxilliped as in male except for: basis arched, somewhat more robust.

Third maxilliped (Fig. 7C). As in male except for: basis 1.3 as long as remaining articles together, inner margin with three setulate setae. Exopod, peduncle less expanded, flagellum of three articles (setae omitted).

First pereopod (Fig. 7D). As in male except for: basis 1.1 as long as remaining articles together, inner margin with four setulate setae on inner margin. Exopod, peduncle less expanded, flagellum of three articles (seta omitted).

Second pereopod (Fig. 7E). As in male except for: basis 0.70 as long as remaining articles together. Merus with two



**Fig. 7** *Claudicuma gosztonyii* n. sp. Ovigerous female (MACN-In. 41007b). A, First maxilla. B, Second maxilla. C, Third maxilliped. D, First pereopod. E, Second pereopod. Scale bars: A, 0.05 mm; B, 0.025 mm; C–E, 0.1 mm (same scale)

simple setae on inner margin. Carpus with one serrate and three cuspidate setae distally. Propodus and dactylus combined 1.15 times as long as ischium, merus and carpus combined. Exopod, peduncle less expanded, flagellum of three articles.

Third pereopod (Fig. 8A). As in male except for: basis profusely setose, exopod lacking.

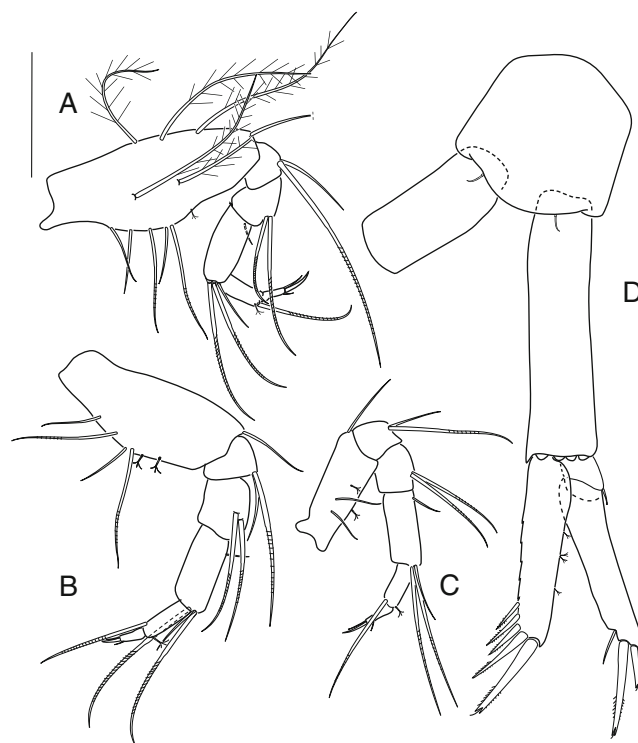
Fourth and fifth pereopods (Figs. 8B, C). As in male.

Uropod (Fig. 8D). Peduncle 1.6 times as long as last abdominal segment. Endopod 0.9 as long as exopod, with 4–6 serrulate setae on inner margin and one cuspidate seta (0.5 as long as article) distally. Exopod 0.8 as long as peduncle, with one feeble simple seta on inner margin subterminally, and two unequal cuspidate setae (larger one half as long as article) distally.

Etymology: this species is named after Dr. Atila Gosztonyi, who let me know about this new species.

## Remarks

*Claudicuma gosztonyii* n. sp. resembles *C. platense*, a species found in the Río de la Plata; however, it can be easily distinguished from the latter by the following characters: (1) Female pseudorostrum pointed (less acute in *C. platense*). (2) First antenna with one aesthetasc, distinctly longer than flagellum,



**Fig. 8** *Claudicuma gosztonyii* n. sp. Ovigerous female (MACN-In. 41007b). A, Third pereopod. B, Fourth pereopod. C, Fifth pereopod. D, Last pleonite and right uropod. Scale bars: A–D, 0.1 mm (A–C, same scale)

apically (two aesthetascs apically, approximately as long as flagellum, in *C. platense*). (3) Male second antenna, ribbon-like setae extending along distal half and distal four-fifth of the articles 4 and 5, respectively; flagellum of nine articles (ribbon-like setae of articles 4 and 5 on distal end only, flagellum of eight articles, in *C. platense*). (4) Second maxilla, inner and outer endites with four and five setae, respectively (five and eight setae, respectively, in *C. platense*). (5) Pereopods 3–5, carpus with two long setae distally (one long distal seta in *C. platense*). (6) Uropod, female peduncle 1.6 times, males peduncle 1.3 times, as long as the last abdominal segment (peduncle 1.75 and 1.5 as long as the last abdominal segment, respectively, in *C. platense*); female endopod with 4–6 serrate setae on inner margin (nine serrate setae in *C. platense*); exopod in both sexes with one feeble subterminal seta on inner margin (absent in *C. platense*).

## Distribution

*Claudicuma gosztonyii* n. sp. was collected in Puerto Madryn, Comodoro Rivadavia and Rada Tilly (Atlantic coast, Argentina), from intertidal to 16 m of depth.

## Discussion

The ovigerous female of *Claudicuma gosztonyii* n. sp. has both degenerated mouthparts (mandibles, first and second



**Table 1** Selected characters to distinguish *Claudicuma* from allied genera. Abbreviations: M3, third maxilliped; P1, first pereopod, P2, second pereopod, etc.; r: reduced exopod. References: Akiyama 2012; Corbera et al. 2008; Gerken, 2012; Hale 1936, 1945; Jones 1984; Jones and Burbanck 1959; Ledoyer 1988, 1993; Mühlenthal-Siegel 2003, 2005, 2012; Omholt and Heard 1979; Petrescu and Heard 2004; Roccatagliata, 1981; Tafe and Greenwood 1996; Watling 1977

	<i>Claudicuma</i>	<i>Picrocuma</i>	<i>Pseudopicrocuma</i>	<i>Bathypicrocuma</i>	<i>Thalycrocuma</i>	<i>Atlantocuma</i>	<i>Almyracuma</i>	<i>Spilocuma</i>
Ovigerous female: pereonites 2–3 fused	Yes	No	No	?	No	No	No	No
Male second antennae (flagellum shorter than peduncle)	Yes	Yes	Yes	?	Yes	Yes	Vestigial (1-jointed)	Yes
Peduncle of male first antennae with sensory setae	No	No	Yes	No	Yes	No	No	No
Mouthparts degenerated in adult females	Yes	?	Yes	?	?	Yes	No	No
Maxilla with row of 8–15 setae on inner margin	No	?	Yes	?	?	Yes	No	Yes
Branchial lobes (Maxilliped 1)	Absent/vestigial	?	Absent	?	?	Absent/vestigial	Vestigial	Well-developed
Exopods (female)	M3, P1–2	M3, P1–3	M3, P1–3	M3, P1–2	M3, P1–2	M3, P1	M3, P1–2	M3, P1–3, P4r
Exopods (male)	M3, P1–3	M3, P1–3	M3, P1–3	M3, P1–3	M3, P1–2	M3, P1–4 <sup>1</sup>	M3, P1–2	M3, P1–3, P4r
Maxilliped 3 pediforme (similar to pereopod 1)	Yes	Yes	Yes	?	No	Yes	Yes	Yes
Maxilliped 3 and pereopod 1 more robust in males than in females	No	No	No	No	No	No	Yes	No
Endopod uropod	1-Articulate	1-Articulate	1-Articulate	1-Articulate	1-Articulate	1-Articulate	1-Articulate	2-Articulate
Habitat	Marine, brackish and freshwater/shallow environments	Marine/shallow environments	Deep sea	Deep sea	Deep sea	Deep sea	Brackish and freshwater/shallow environments	Marine/shallow environments

<sup>1</sup> The fourth pereopod of the male of *A. elongatum* Ledoyer, 1993 lacks exopod

maxillae) and an empty gut, suggesting no feeding. The same condition was previously observed in the ovigerous female of *Claudicuma platense* and also in four deep-sea species currently placed in the family Nannastacidae: *Pseudopicrocuma japonicus*, *Atlantocuma gamoi*, *Atlantocuma ojii* and *Atlantocuma confunda* (see Roccatagliata 1981, Akiyama 2012, Gerken 2012). Further research is needed to elucidate how this condition could have evolved in species with such dissimilar vertical distributions.

Although in most cumaceans the male's second antennae reach the end the body or slightly beyond it, among the Nannastacidae, the males of *Claudicuma*, *Picrocuma*, *Pseudopicrocuma*, *Bathypicrocuma*, *Thalycrocuma*, *Atlantocuma*, *Platycuma* and *Cumellopsis* (in part, see Jones 1984, p. 245) have short second antennae. Furthermore, in the genus *Almyracuma*, both the female and the male have vestigial unarticulate antennae, a character that is unique among cumaceans. Besides, the flagellum of the male second antennae of *Claudicuma*, *Picrocuma*, *Pseudopicrocuma* and *Thalycrocuma* is shorter than the peduncle, and most likely these antennae are used for clasping the female during mating. However, as the species of *Pseudopicrocuma* and *Thalycrocuma* inhabit deep-sea waters and those of *Picrocuma* and *Claudicuma* are found in shallow waters, these clasping antennae seem to have arisen more than one time in the family Nannastacidae.

*Claudicuma* appears to be most closely related to the marine genera *Picrocuma* and *Pseudopicrocuma* than to the brackish-freshwater *Almyracuma*. The finding of a second species of the genus *Claudicuma* in a full-salinity marine environment reinforces the hypothesis.

Duncan (1983, 1984) proposed that the male of *Almyracuma proximoculi* could have evolved through progenesis (i.e., by precocious sexual maturation). In this regard, the males of *Claudicuma*, *Picrocuma* and the bodotriid *Spilocuma*, which are distinctly smaller than the females, may be other examples of progenetic development.

In most cumaceans, the protopod of the second maxilla generally has a row of setae on the inner margin. These setae are armed on either side of the shaft with regularly and closely spaced fine setules, which give them a feather-like appearance (referred as "filtratory setae" by Dennell 1936 and "plumose setae" by Garm 2004). However, among the members of the family Nannastacidae, this row of setae is missing in *Campylaspis* and related genera, all of which are predators, and also in the genera *Almyracuma* and *Claudicuma* that feed on detritus and/or algae (see Table 1; Zimmer 1941, Jones and Burbanck 1959, Roccatagliata 1981).

The adult males of the family Bodotriidae usually bear five pairs of pleopods, a feature that can be interpreted as plesiomorphic (see Haye 2007). However, as the male of the bodotriid genus *Spilocuma* lacks pleopods, its distinction from the genera of Nannastacidae is problematic. In this regard, in

Table 1, this genus as well as most of the nannastacid with short or vestigial antenna are included. This table reveals that some significant information is missing in many genera. This is due in part to the difficulty of obtaining deep-sea material, frequently including only one sex or a few immature specimens. Among the shallow-water genera, in particular for *Picrocuma*, information about the mouthparts and the branchial apparatus is greatly needed. Lastly, the genera *Cumellopsis* and *Platycuma* were excluded from Table 1. For *Cumellopsis*, it is impossible to give a satisfactory diagnosis (see Jones 1984), whereas the species of *Platycuma* are easily identified by the spirally coiled gut.

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