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Redescription of the rare amphipod crustacean *Pseudaeginella montoucheti* (Quitete, 1971) from Brazil

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Abstract

Pseudaeginella montoucheti (Quitete, 1971) is redescribed based on newly collected specimens from red and brown algae and tubiculous polychaete colony that were obtained from shallow waters at Tamboretes Archipelago, Balneário Barra do Sul and Sepultura Beach, Bombinhas, Santa Catarina State, Brazil. Of 10 species of *Pseudaeginella* so far reported, *P. montoucheti* is closest to *P. sanctipauli* Laubitz, 1995, but differs from the latter by having more numerous body spines including ventro-lateral ones over gills on pereonites 3 and 4, and the antenna 1 length measuring half body length. An identification key for *Pseudaeginella* species and a checklist of Caprellidea occurring along the Brazilian coasts are also presented.

Keywords

Amphipoda, *Pseudaeginella montoucheti* (Quitete, 1971), Redescription, Santa Catarina, Brazil

Introduction

The knowledge on ecology and biology of Brazilian caprellids is restricted to some areas and substrata, mainly those living on macroalgae from southeastern and southern coast (Masunari 1982; Dutra 1988; Arenzon and Bond-Buckup 1991; Wakabara et al. 1991; Dubiaski-Silva and Masunari 1995; Mittmann and Müller 1998; Jacobucci et al. 2002; Jacobucci et al. 2006; Leite et al. 2007; Dubiaski-Silva and Masunari 2008). In the same way, taxonomic studies about Brazilian caprellids are also limited to few descriptions of new species (McCain 1968; Quitete 1971a, b, 1972; Serejo 1998; Guerra-García 2003a; Rayol and Serejo 2003) and two redescriptions (Serejo 1997; Masunari and Takeuchi 2006).

Of 19 species of caprellids so far recorded from Brazilian coasts (Table 1), *Pseudaeginella montoucheti* was firstly described as *Fallotritella montoucheti* Quitete, 1971 (Quitete 1971a), based on specimens collected from Pernambuco State, northeastern Brazil. In the middle of 1990's, Laubitz (1995) synonymed the genus *Fallotritella* with the genus *Pseudaeginella*, leading to change subsequently into *Pseudaeginella montoucheti* (Quitete, 1971). The present study redescribes *Pseudaeginella montoucheti* based on individuals from Santa Catarina State, southern Brazil with the special reference to characteristics of mouthpart and appendages. Additionally, a key for the species of the genus *Pseudaeginella* and a checklist of Caprellidea occurring along the Brazilian coasts are also presented.

Materials and methods

Collections were conducted at two Islands - Pássaros Island (26°22'S, 48°31'W) and Araras Island (26°27'S, 48°34'W) – in Tamboretes Archipelago, municipality of Balneário Barra do Sul (16th May 2009) and at Sepultura Beach, Bombinhas (30th June 2011) Santa Catarina State, southern Brazil. Caprellideans were found in the phytal of the red algae *Amphiroa beauvoisii* Lamouroux and *Spyridia aculeata* (Schimper) Kützing, of the brown alga *Sargassum cymosum* C. Agardh, 1820 and as the associate fauna of a tubiculous polychaete colony; these communities were living over rocky surface in infralittoral depths, from 0.5 to 7.0 m. The biological substrates were carefully wrapped up in a plastic bag and scraped from the rocky surface with a spatula by scuba divers. In laboratory, the plastic bag content was very kindly washed in dilute formalin. The deposited material was sieved, sorted and caprellids were fixed and preserved in ethyl alcohol 70%.

From a total of 54 examined specimens (31 males and 23 females), several specimens of male and female were selected to be dissected under stereomicroscope. The dissected material was mounted in polyvinyl lactophenol. All figures were drawn with the aid of a *camera lucida*. Specimens are deposited in Museum of Natural History of Capão da Imbuia (MHNCI) and in Center for Zoological Studies (CEZ), from Institute of Biology, Federal University of Rio de Janeiro.

Results

Family Caprellidae Leach, 1814
Genus *Pseudaeginella* Mayer, 1890

***Pseudaeginella montoucheti* (Quitete, 1971)**
http://species-id.net/wiki/Pseudaeginella_montoucheti
Figs 1–4

Fallotritella montoucheti: Quitete 1971a, p.189–192, figs. 1–2
Pseudaeginella montoucheti – Laubitz, 1995, p.88.

Material examined. MHNCI 2844 One female from the phytal of red alga *Spyridia aculeata*, 7 m deep, Araras Island (26°27'S, 48°34'W), Tamboretes Archipelago, Santa Catarina, Brazil, 16th May, 2009.

MHNCI 2845 One male and two females from the phytal of the calcareous red alga *Amphiroa beauvoisii*, 4 m deep.

MHNCI 2846 Three males and two females from the phytal of *Amphiroa beauvoisii*, 1.5 m deep, Pássaros Island (26°22'S, 48°31'W), Tamboretes Archipelago, Santa Catarina, Brazil, 16th May, 2009.

MHNCI 2847 Four males and two females from the phytal of brown alga *Sargassum cymosum*, Bombinhas (27°08'28"S, 48°28'42"W), Santa Catarina, Brazil, 30th June, 2011.

CEZ 968 Holotype male from of *Sargassum,* Itamaracá, Pernambuco, Brazil 5th August, 1968. Collector: Dr. Pierre Montouchet.

CEZ 971 Two paratypes males and three paratypes females from of *Sargassum*, Mar Grande, Bahia, Brazil, 22th January, 1968. Collector: Dr. Pierre Montouchet.

CEZ 972 12 paratypes males and eight paratypes females from of *Sargassum*, Itamaracá, Pernambuco, Brazil 5th August, 1968. Collector: Dr. Pierre Montouchet.

CEZ 973 Seven paratypes males and four paratypes females from of *Sargassum*, Mar Grande, Bahia, Brazil, 22th January, 1968. Collector: Dr. Pierre Montouchet.

CEZ 974 One paratype male and one paratype female from of *Sargassum*, Guarapari, Espírito Santo, Brazil, 6th September, 1968. Collector: Dr. Pierre Montouchet.

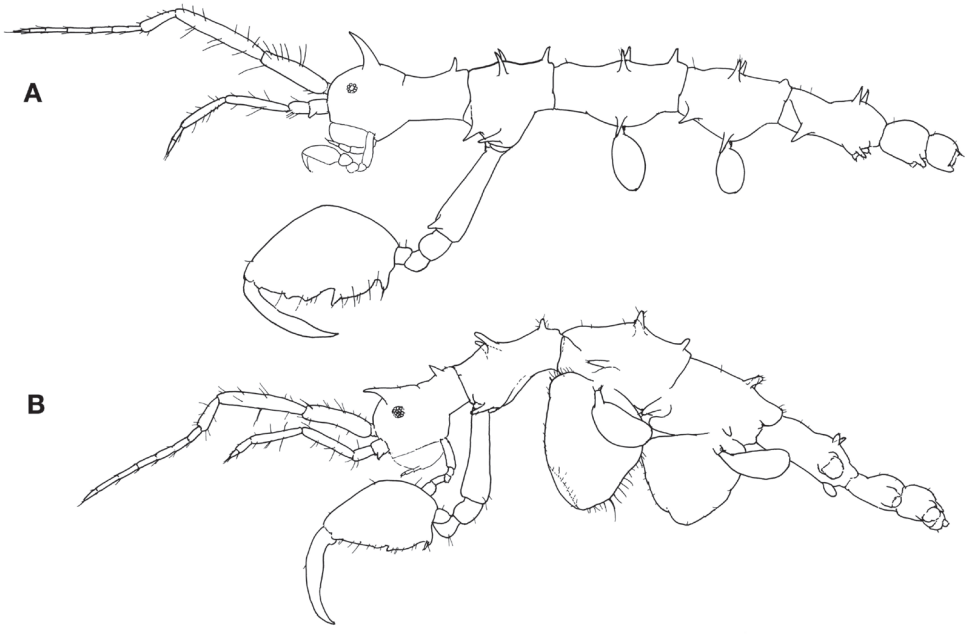

Figure 1. *Pseudaeginella montoucheti* (Quitete, 1971). **A** male, lateral view **B** female, lateral view. Scale bar: 1.0 mm.

Table 1. Checklist of the Brazilian Caprellidae with their distribution in Brazil

Species	Distribution in Brazil (references)
Caprellidae ***Caprella*** **Lamarck, 1801**	
Caprella aculeata (Dana, 1853)	Rio de Janeiro (Wakabara and Serejo 1998)
Caprella andreae Mayer, 1890	Torres and Tramandaí, RS (Arenzon and Bond-Buckup 1991)
Caprella danilevskii Czerniavski, 1868	Ubatuba, SP (Jacobucci et al. 2002; Cunha et al. 2008), Paranaguá, PR (Dutra 1988), Matinhos, PR (Dubiaski and Masunari 1995), Bombinhas, SC (Dubiaski-Silva and Masunari 2008)
Caprella dilatata Krøyer, 1843	Arraial do Cabo, RJ (Serejo 1998), Ubatuba, SP (Jacobucci et al. 2002), Santos, SP (Jacobi 1987), Peruíbe, SP (Jacobucci et al. 2006), Penha, SC (Masunari and Takeuchi 2006)
Caprella equilibra Say, 1818	Ubatuba, SP (Jacobucci et al. 2002; Cunha et al. 2008), São Sebastião, SP (Flynn and Valério-Berardo 2009), Peruíbe, SP (Jacobucci et al. 2006), Bombinhas, SC (Dubiaski-Silva and Masunari 2008)
Caprella globiceps Dana, 1853	Rio de Janeiro (Wakabara and Serejo 1998)
Caprella penantis Leach, 1814	Paranaguá, PR (Dutra 1988), Matinhos, PR (Dubiaski and Masunari 1995), Bombinhas, SC (Dubiaski-Silva and Masunari 2008), Governador Celso Ramos, SC (Mittmann and Müller 1998)
Caprella scaura Templeton, 1836	Arraial do Cabo, RJ (Serejo 1998), Ubatuba, SP (Jacobucci et al. 2002; Leite et al. 2007; Cunha et al. 2008), São Sebastião, SP (Flynn and Valério-Berardo 2009), Peruíbe, SP (Jacobucci et al. 2006), Bombinhas, SC (Dubiaski-Silva and Masunari 2008)
Hemiaegina **Mayer, 1890**	
Hemiaegina minuta Mayer, 1890 *(= Hemiaegina costai* Quitete, 1972*)*	Bahia and Pernambuco States (Quitete 1972; Serejo 1997)
Liropus **Mayer, 1890**	
Liropus nelsonae Guerra-García, 2003	7°58'S, 34°17'W – 7°50'S, 34°17'W (Guerra-García 2003a)
Monoliropus **Mayer, 1903**	
Monoliropus enodis Rayol & Serejo, 2003	Guanabara Bay, RJ (Rayol and Serejo 2003)
Orthoprotella **Mayer, 1903**	
Orthoprotella melloi Quitete, 1975	Pernambuco State (Quitete 1975)
Paracaprella **Mayer, 1890**	
Paracaprella digitimanus Quitete, 1971	1°21'S, 43°50'W (Quitete 1971b)
Paracaprella pusilla Mayer, 1890	Arraial do Cabo, RJ (Serejo 1998), Ubatuba, SP (Leite et al. 2007), São Sebastião, SP (Flynn and Valério-Berardo 2009)
Paracaprella tenuis Mayer, 1903	Ubatuba SP (Cunha et al. 2008), Bombinhas, SC (Dubiaski-Silva and Masunari 2008)
Parvipalpus **Mayer, 1890**	

Species	Distribution in Brazil (references)
Parvipalpus colemani Guerra-García, 2003	7°58'S, 34°17'W – 7°50'S, 34°17'W (Guerra-García 2003a)
***Pseudaeginella* Mayer, 1890** *Pseudaeginella montoucheti* (Quitete, 1971)	Itamaracá, PE, Mar Grande and Olivença, BA, Guarapari and Vitória, ES (Quitete 1971a), Arraial do Cabo, RJ (Serejo 1998), Ubatuba, SP (Jacobucci et al. 2002; Cunha et al. 2008), Pássaros Island (26°22'S, 48°31'W) and Araras Island (26°27'S, 48°34'W), Balneário Barra do Sul, SC (present study)
Phtisicidae ***Phtisica* Slabber, 1769**	
Phtisica marina Slabber, 1769	Arraial do Cabo, RJ (Serejo 1998), Peruíbe, SP (Jacobucci et al. 2006)
Phtisica verae Quitete, 1979	Rio de Janeiro State (Quitete 1979)

BA, Bahia State; ES, Espírito Santo State; PE, Pernambuco State; RJ, Rio de Janeiro State; SC, Santa Catarina State; SP, São Paulo State

Male (Fig. 1A). Body length 3.0 mm. Pereonites 3 and 4 the longest, followed by pereonites 2 and 5. Head and pereonite 1 (suture clearly present) concave along dorsal margin, head with an anteriorly curved mid-dorsal projection, pereonite 1 with a small postero-dorsal projection. Pereonite 2 with paired mid-dorsal projections, 1 postero-dorsal projection, paired antero-lateral projections and paired mid-lateral projections. Pereonite 3 with paired mid-dorsal projections, 1 postero-dorsal projection and paired mid-lateral projections. Pereonite 4 with paired mid-dorsal projections, 1 weak postero-dorsal projection, paired antero-lateral projections and paired mid-lateral projections. Pereonite 5 with paired mid-dorsal projections, paired antero-lateral projections and paired mid-lateral projection near the swollen basal part of pereopod 5. Pereonite 6 with paired postero-lateral projections near the basal part of pereopod 6.

Antennae (Figs. 2A, 2B). Antenna 1 about half body length. Peduncular articles with ca. 10 to 20 simple setae of varied length; peduncular article 2 the longest followed by article 1. Flagellum 6-articulate with 4/5 of peduncular length. Antenna 2 about 4/5 of antenna 1 length, without swimming setae; peduncular setose in varied length; flagellum with 8 and 6 simple setae in the proximal and distal articles.

Mouthparts (Figs. 3A–G). Upper lip notched, forming rounded projections. Right mandible with incisor with 5 teeth and followed by lacinia mobilis with 5 teeth and 3 trapezoid plates; palp article 2 with 1 lateral seta; palp article 3 setal formula 1–6–1 with a distal knob. Left mandible incisor with 5 teeth followed by 3 trapezoid plates; palp article 2 with 1 lateral seta; palp article 3 setal formula 1–6–1 with a distal knob. Lower inner lips round and fused each other, outer lobes round with 1 apical seta. Maxilla 1 outer plate with 6 stout apical setal-teeth; palp distal margin with 4 setae. Maxilla 2 inner plate triangular with 4 apical setae; outer plate elongate with about 4 apical setae. Maxilliped basal endite (inner plate) with 2 setae on outer margin; ischial endite (outer plate) oval, 2 times longer than inner plate, with 4 or 5 setae on inner

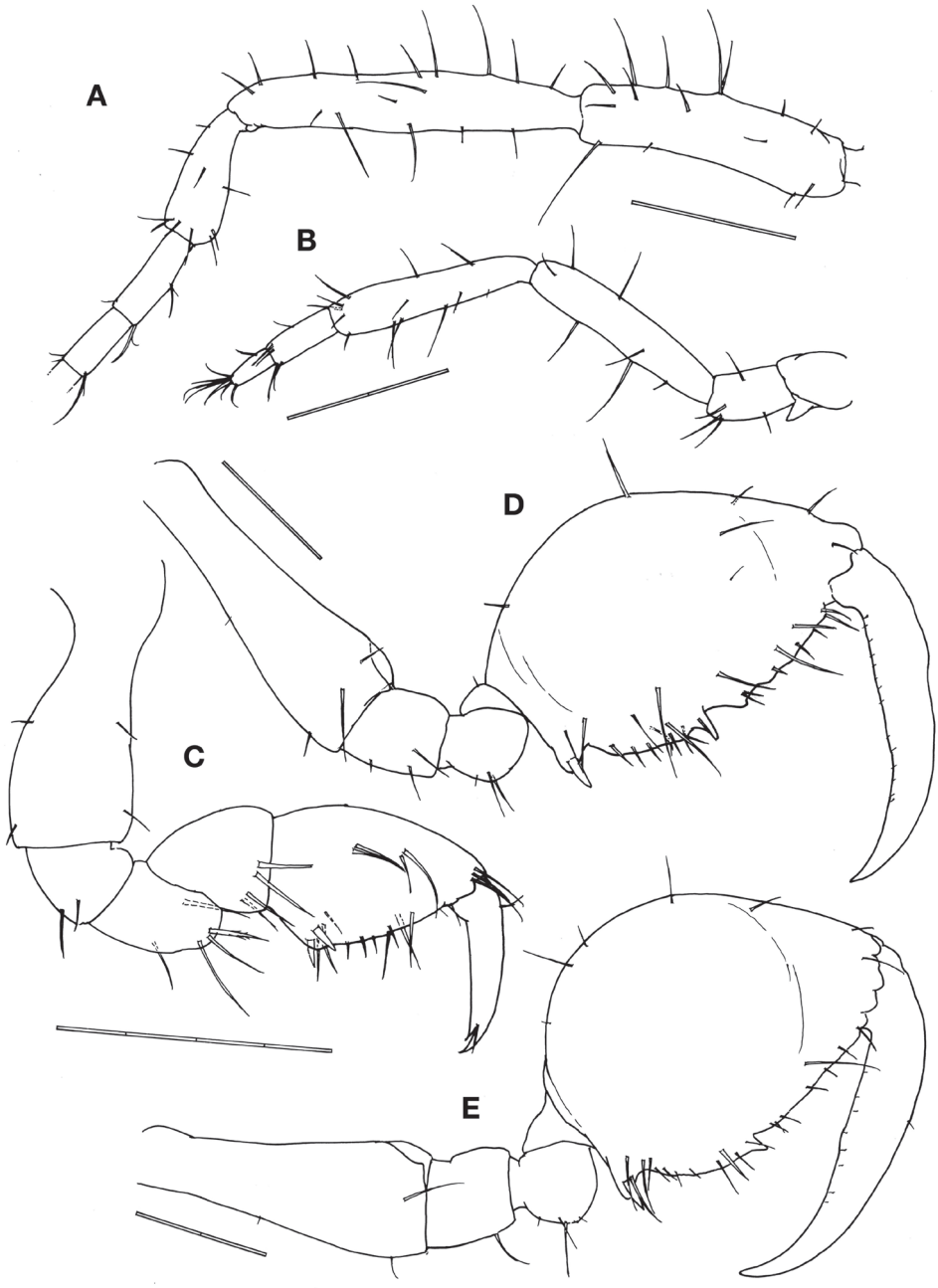

Figure 2. *Pseudaeginella montoucheti* (Quitete, 1971). **A–D** male. **A** antenna 1 **B** antenna 2 **C** gnathopod 1 **D** gnathopod 2. **E** female gnathopod 2. Scale bars: **A–E:** 0.2 mm.

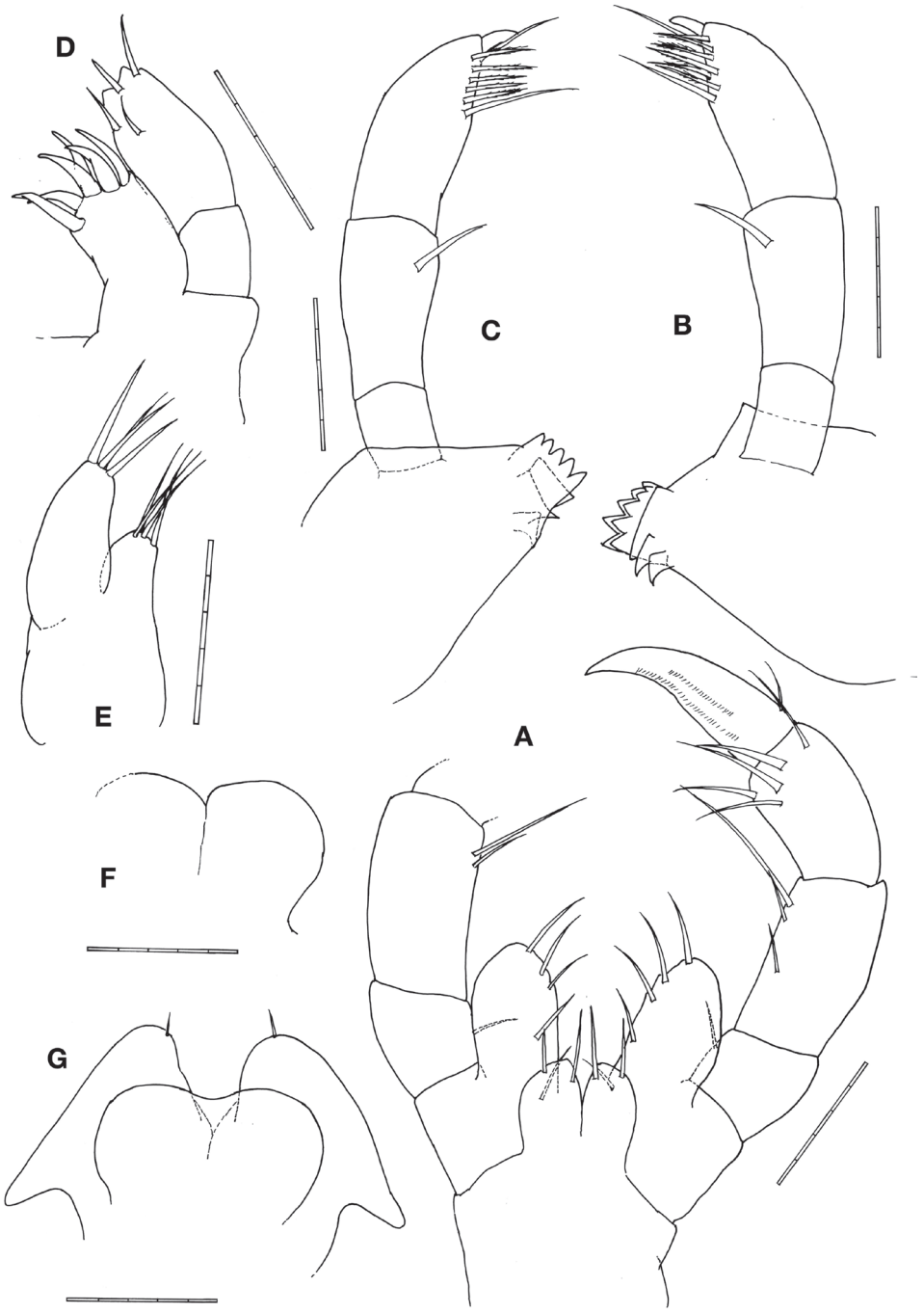

Figure 3. *Pseudaeginella montoucheti* (Quitete, 1971). Male. **A** maxilliped **B** left mandible **C** right mandible **D** maxilla 1 **E** maxilla 2 **F** upper lip **G** lower lip. Scale bars: **A–G:** 0.05 mm.

margin; palp article 2 with 2 or 3 setae on inner margin; palp article 3 with 5 distal setae; palp article 4 (dactylus) weakly falcate.

Gnathopod 1 basis as long as ischium, merus and carpus combined, covered by sparse setae of varied length; propodus subtriangular, palm with a pair of proximal stout setae (grasping spines) and a row of 8 simple setae; dactylus with sparse and short setae, inner margin smooth with a teeth subdistally (Fig. 2C).

Gnathopod 2 inserted in the pereonite 2 at 2/5 from anterior margin (Fig. 1A); coxa vestigial; basis 1.3 times of pereonite 2 length, with a spiny projection near antero-distal corner; ischium rectangular; merus rounded; carpus triangular and provided with scarce simple setae; propodus oval, ratio between width: length = 0.57, inner margin provided with 1 stout setae proximally, 3 triangular projections medially and distally and numerous setae: few simple setae on the outer margin; dactylus shorter than palm and slightly curved with a row of setulae alongside the inner margin (Fig. 2D).

Gill 3 length 2/5 of corresponding pereonite, elliptical (Fig. 1A), pereopod 3 tiny with 2 simple setae apically (Fig. 4A). Gill 4 length 1/3 of corresponding pereonite, elliptical (Fig. 1A), pereopod 4 similar to pereopod 3 (Fig. 4B).

Pereopod 5 basis to carpus furnished with 3–10 setae of varied length; palm of propodus very slightly concave with 2 setae proximally and a row of 7 robust setae alongside; dactylus slightly curved (Fig. 4C). Pereopods 6 and 7 similar to pereopod 5 in feature but increasing in size (Figs. 4D, 4E).

Penes length about 2 times width (Fig. 4F).

Abdomen with a pair of lateral lobes and dorsal lobe with a pair of dorsal setae (Fig. 4F).

Female. Body length 3.1 mm (Fig. 1B). Pereonites 3 and 4 subequal and the longest, followed by pereonite 2. Clear suture between head and pereonite 1, head with 1 anteriorly curved mid-dorsal projection. Antenna 1 flagellum 7-articulate. Pereonite 1 with 1 postero-dorsal projection. Pereonite 2 with paired mid-dorsal projections, 1 postero-dorsal projection and paired antero-lateral projections. Pereonite 3 with paired mid-dorsal projections, 1 postero-dorsal projection, paired mid-lateral projections and paired postero-lateral projections. Pereonite 4 with paired mid-dorsal projections and paired mid-lateral projections. Pereonite 5 with paired mid-dorsal projections. Gnathopod 2 propodus length 1.5 times width (Fig. 2E), with grasping spine proximally followed by a serrated margin; two smooth triangular projections medially.

Intraspecific variation. In adult males and females including those collected by Quitete (Quitete, 1971a) in Pernambuco State, the number of articles in the flagellum of antenna 1 varies from 5 to 7 during growth. The size reduction of the mid-dorsal projections on pereonites 3 and 5 mentioned by this author was only found among specimens studied by her. Setal formula for terminal article of mandibular palp can be 1–5-1 or 1–6-1. The body spination is rather constant among individuals summing up 30 spines in males.

Type locality. Itamaracá, Pernambuco State, Brazil.

Distribution. Western South Atlantic. Brazil. Itamaracá, Pernambuco State; Olivença, Ilhéus, Bahia State; Vitória and Guarapari, Espírito Santo State (Quitete 1971a).

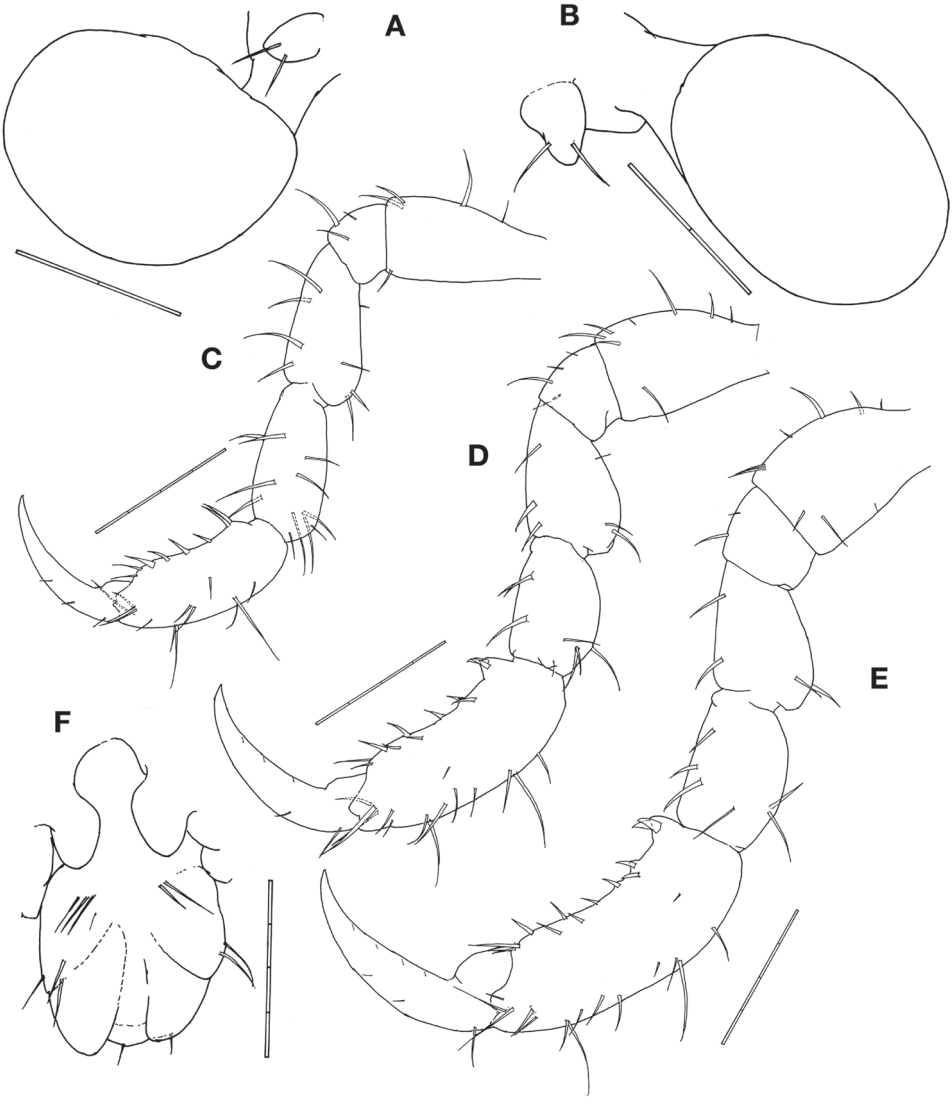

Figure 4. *Pseudaeginella montoucheti* (Quitete, 1971). Male. **A** pereopod 3 and gill 3 **B** pereopod 4 and gill 4 **C** pereopod 5 **D** pereopod 6 **E** pereopod 7 **F** abdomen (ventral view). Scale bars: **A,B**: 0.1 mm. **C–F**: 0.2 mm.

Ubatuba, São Paulo State (23°32'S, 45°10'W – 23°30'S, 45°08'W) (Jacobucci et al. 2002, 2009). Paranaguá Bay, Paraná State (25°31'S, 48 °30'W) (Neves 2006). Tamboretes Archipelago: Pássaros Island (26°22'S, 48°31'W) and Araras Island (26°27'S, 48°34'W), Balneário Barra do Sul and Bombinhas Beach, Bombinhas, Santa Catarina State (present study).

Habitats. Amongst thallii of the brown seaweed *Sargassum* sp. (Quitete 1971a and present paper), *Sargassum cymosum* (Jacobucci et al. 2002) and *Sargassum filipendula*

(Jacobucci et al. 2009); on boat hulls and floating piers (Neves 2006); amongst thallii of the red algae *Amphiroa beauvoisii* and *Spyridia aculeata* and tubular branches of polychaete colony (present paper).

Remarks. Takeuchi (1993) proposed a classification with four families, Caprellidae, Caprogammaridae, Paracercopidae, and Phtisicidae for the Amphipoda Caprellidea (Cyamidae excluded) based on the cladistic analysis. *Fallotritella* and *Pseudaeginella* were set under the Caprellidae. At the same time, Laubitz (1993) proposed a classification with eight families, Caprellidae, Caprellinoididae, Caprogammaridae, Cyamidae, Paracercopidae, Pariambidae, Phtisicidae and Protellidae. In her classification system, *Fallotritella* and *Pseudaeginella* were included in Caprellinoididae which is considered to be more related to Paracercopidae and Phtisicidae than to Caprellidae.

The above treatment of *Fallotritella* and *Pseudaeginella* performed by Takeuchi (1993) was followed by Myers and Lowry (2003) and Vassilenko (2006). In the higher classification system of Myers and Lowry (2003) based on cladistic analysis of corophiid amphipods, Caprellidae, Caprogammaridae and Cyamidae are included among the Caprelloidea. The Caprellidae of Myers and Lowry (2003) is composed of two subfamilies, Caprellinae and Phtisicidae. *Fallotritella* and *Pseudaeginella* with ca. 50 genera constitute the Caprellinae under the Caprellidae (Myers and Lowry 2003). Vassilenko (2006) reviewed the recent studies dealing her support to Takeuchi's (1993) treatment more than to Laubitz (1993) concerning to the phylogeny of the Caprellidea.

The genus *Fallotritella* was established based on *Fallotritella biscaynensis* McCain, 1968 collected from Florida, U.S.A, Antigua & Barbuda and St. Lucia (McCain 1968), just prior to Quitete (1971a). The suggestion of synonymy of these two genus, i.e., *Pseudaeginella* and *Fallotritella* was mentioned under remarks of *Pseudaeginella* by McCain (1968). The lack of reference materials of *Pseudaeginella tristanensis* (Stebbing, 1888), the type species of *Pseudaeginella,* has been led to the presumption towards absence of pereopods 3 and 4 in *Pseudaeginella*. At the same time, *F. biscaynensis* was recorded to possess 1-articulate pereopods 3 and 4 in the generic description for *Fallotritella*. He also noted that, in case of presence of pereopods 3 and 4 in the two known species of *Pseudaeginella, Fallotritella* would fall as junior synonym of *Pseudaeginella* (see McCain 1968, p. 100). Almost 30 years later, Laubitz (1995) examined individuals of *Pseudaeginella tristanensis* collected from Amsterdam Islands in the southern Indian Ocean and reported the synonymy of these two genera based on the presence of minute pereopods 3 and 4 on these specimens.

Pseudaeginella montoucheti (Quitete, 1971) is a tiny caprellidean that measures less than 3.5 mm in body length (see Fig. 1). Within this genus, *P. montoucheti* is the second spiniest species (total of 30 spines on the head and pereonites 1–7 of males) and only surpassed by *P. sanctipauli* that has a total of 33 spines on body surface. In the drawing of *P. montoucheti* from Pernambuco State performed by Quitete (1971a) the following body projections are missing in male: a pair of dorsal projections instead of one dorsal spine medially on pereonite 5 and ventro-lateral projections over the insertion of pereopod 5 and 6 on pereonite 5 and 6, respectively. In spite of the wide distribution, *P. montoucheti* showed a relatively low intraspecific variation in its external morphology.

Although restricted to the Atlantic coast of Brazil, the present study showed that *P. montoucheti* is distributed along more than 2,600 km, from tropical (Itamaracá Island, Pernambuco State, 7°44'S, 34°49'W) to subtropical (municipalities of Barra do Sul, 26°27'S, 48°34'W and Bombinhas, 27°08'S, 48°28'W, Santa Catarina State) latitudes. Recently, *Caprella dilatata* Krøyer, 1843 was also reported showing wide distribution from Sao Paulo State, Brazil (Jacobucci et al. 2002) to Mar del Cobo and Mar del Plata Harbour, Argentina along the south Atlantic coast of South America (Masunari and Takeuchi 2006).

Pseudaeginella Mayer, 1890 is currently composed of 10 species: *P. antiguae* Barnard, 1932 from Antigua and Barbuda, *P. biscaynensis* (McCain, 1968) from Florida, U.S.A., *P. campbellensis* Guerra-García, 2003b from subantarctic islands of New Zealand, *P. colombiensis* Guerra-García, Krapp-Schickel & Müller, 2006 from Colombia, *P. inae* Krapp-Schickel & Guerra-García, 2005 from Indonesia, *P. montoucheti* (Quitete, 1971) from Brazil, *P. polynesica* (Müller, 1990) from Bora Bora and Moorea, French Polynesia, *P. sanctipauli* Laubitz, 1995 from St. Paul and Amsterdam Islands, France, *P. tristanensis* (Stebbing, 1888) from Tristan da Cunha, and *P. vaderi* Guerra-García, 2004 from Australia.

Of 10 species of *Pseudaeginella*, the closest species to *P. montoucheti* can be considered *P. sanctipauli* that was described from St. Paul and Amsterdam Islands, South Indian Ocean (Laubitz 1995), since both are the spiniest species within the genus. On the other hand, *Pseudaeginella montoucheti* can be distinguished from *P. sanctipauli* by the spinier body, antenna 1 length equals half body in males, and presence of ventrolateral spines over gills on pereonites 3 and 4.

A key to the species of *Pseudaeginella* is presented below; it was mainly based on the characteristics of body somites because these can be observed without dissections of mouthparts.

Key to species of the genus *Pseudaeginella*

1a	Antenna 1 longer than half of body length	**2**
1b	Antenna 1 equal or shorter than half of body length	**5**
2a	Basis of gnathopod 2 longer than propodus length	***P. sanctipauli*** **(Fig. 5A)**
2b	Basis of gnathopod 2 shorter than propodus length	**3**
3a	Basis of gnathopod 2 approximately the length of pereonite 2	***P. biscaynensis*** **(Fig. 5B)**
3b	Basis of gnathopod 2 longer than pereonite 2 length	**4**
4a	Pereonites 2, 3, 4 and 5 with lateral projections near the insertion of gnathopod 2, gills and pereopods 5	***P. colombiensis*** **(Fig. 5C)**
4b	Pereonites 2, 3, 4 and 5 without lateral projections	***P. polynesica*** **(Fig. 5D)**
5a	Pereonites with dorsal projections	**6**
5b	Pereonites without any dorsal projections	**8**
6a	Basis of gnathopod 2 provided with a rounded projection proximally	***P. campbellensis*** **(Fig. 5E)**
6b	Basis of gnathopod 2 without any projection	**7**

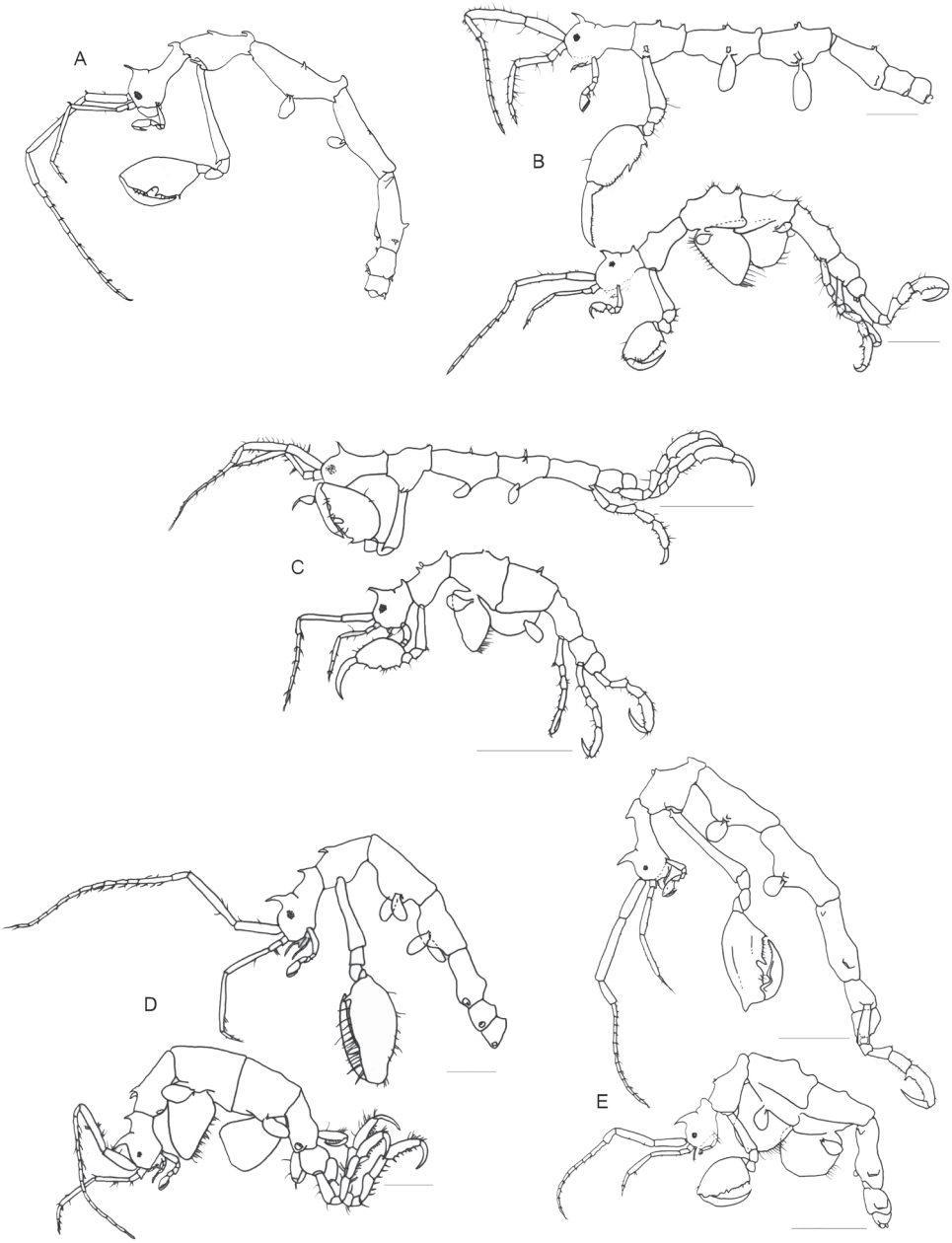

Figure 5. *Pseudaeginella* spp**. A** *Pseudaeginella sanctipauli* Laubitz, 1995 (Redraw from Laubitz 1995) **B** *Pseudaeginella biscaynensis* (McCain, 1968) (Redraw from Guerra-García 2002. Scale bar 0.05 mm) **C** *Pseudaeginella colombiensis* Guerra-García, Krapp-Schickel & Müller, 2006 (Redraw from Guerra-García et al. 2006. Scale bar 1 mm) **D** *Pseudaeginella polynesica* (Müller, 1990. Scale bar 500 μm) (Redraw from Müller 1990) **E** *Pseudaeginella campbellensis* Guerra-García, 2003 (Redraw from Guerra-García 2003. Scale bar 1 mm).

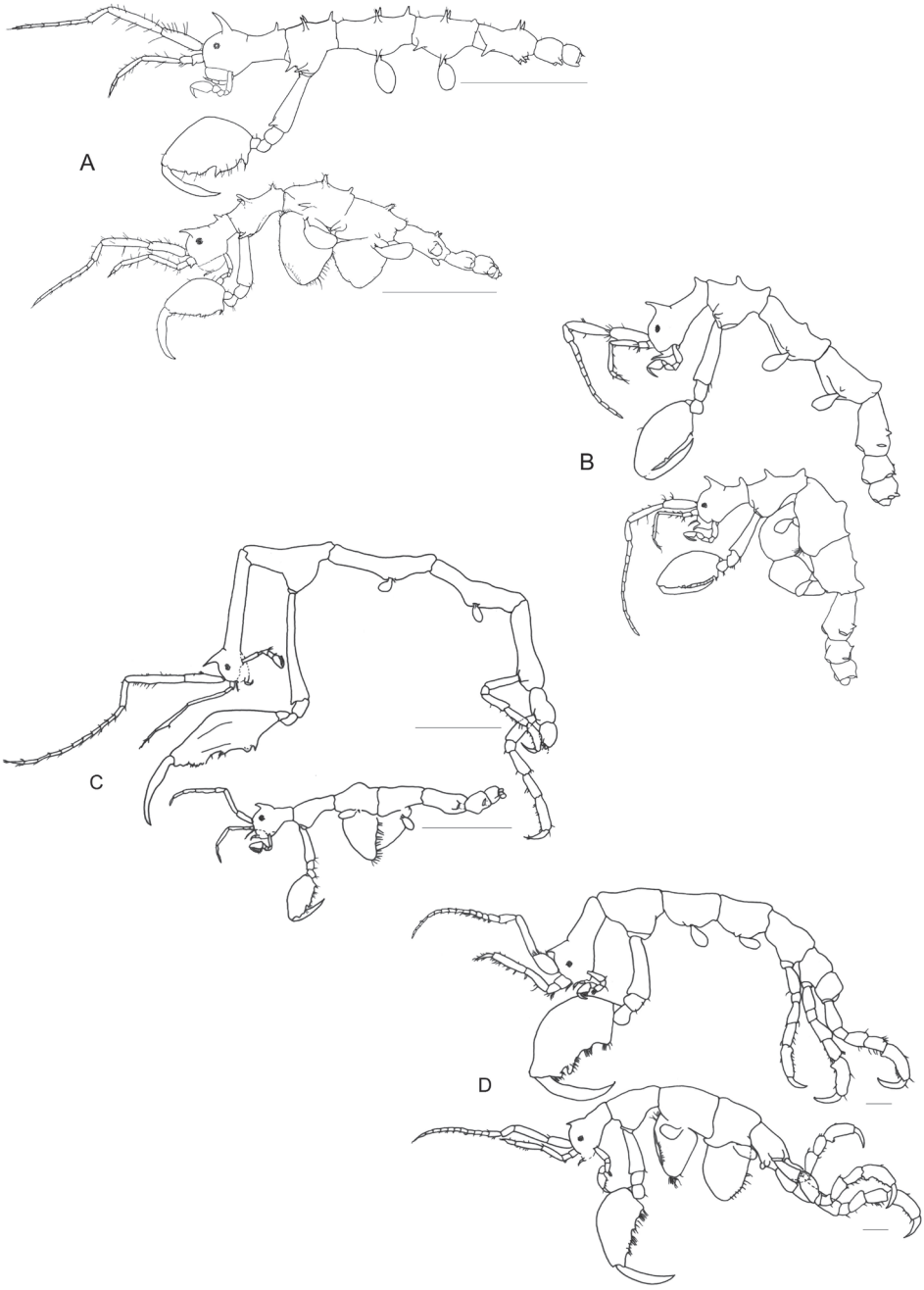

Figure 6. *Pseudaeginella* spp**. A** *Pseudaeginella montoucheti* (Quitete, 1971). Scale bar 1 mm **B** *Pseudaeginella tristanensis* (Stebbing, 1888) (Redraw from Laubitz 1995) **C** *Pseudaeginella vaderi* Guerra-García, 2004 (Redraw from Guerra-García 2004. Scale bar 1 mm) **D** *Pseudaeginella inae* Krapp-Schickel & Guerra-García, 2005 (Redraw from Krapp-Schickel and Guerra-García 2005. Scale bar 1 mm).

7a Pereonites 4 and 5 with a paired antero-lateral projections, body somites with a total of more than 30 projections ..... ***P. montoucheti*** **(Fig. 6A)**

7b Pereonites 4 and 5 without any antero-lateral projections, body somites with a total of less than 30 projections ..... ***P. tristanensis*** **(Fig. 6B)**

8a Basal article of antenna 2 peduncle with a distal projection, well marked suture between head and pereonite 1 ..... ***P. vaderi*** **(Fig. 6C)**

8b Basal article of antenna 2 peduncle without any projection, discrete suture between head and pereonite 1 ..... ***P. inae*** **(Fig. 6D)**

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RESEARCH ARTICLE

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Protura of Italy, with a key to species and their distribution

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Abstract

The Italian Protura were studied basing on 5103 specimens from 198 sampling areas, along with bibliographic data from 49 collecting sites. 17 out of the 20 Italian regions are covered. As a result, 40 species have been identified (belonging to 8 genera and 4 families), 6 of which are new records for the Italian fauna. A key to the Italian species is reported, followed by a series of distribution maps and brief remarks for some of them. A preliminary biogeographical overview allowed us to delineate the chorological categories of these species, 10 of which are actually known only in Italy. The comparison with the species richness known for some best studied Central and Eastern European Countries leads us to speculate that widening our research, Italian Protura check-list will be much implemented.

Keywords

Protura, Italy, distribution, key to species

Introduction

Protura is a group of Hexapoda which has been discovered recently: the first species described is *Acerentomon doderoi*, collected from soil samples taken from the grounds of a small villa actually in the center of Genoa (Silvestri 1907). More detailed data about such taxon are provided in the two years immediately following by Berlese (1908a, 1908b, 1909).

Knowledge of Protura has rapidly increased all over the world thanks to the careful research of many specialists. Just to mention the main publications, in 1964 Tuxen published his valuable book about the Protura of the World; Nosek's monograph on European Protura was printed in 1973; a year later Imadaté's volume about Japanese species was released (1974); while the impressive monograph about Chinese Protura was published more recently (Yin 1999).

The European research about this group, although with some exceptions, was concentrated in Central and Eastern Countries due to the work of some Authors such as Nosek, Rusek, Tuxen and, more recently, Szeptycki and Shrubovych.

In Italy, knowledge regarding Protura (see species list for detailed bibliographic references) can be summarized with the identification of 31 species belonging to the Italian fauna by the national check-list (Dallai et al. 1995). The same number of species emerges by an overview of the most recent Catalogue of the World Protura (Szeptycki 2007).

With this paper we hope to lay the foundations for the advancement and improvement of studies regarding this little known taxon in Italy as well in the Mediterranean Region, one of the biodiversity hotspots on the planet, reaching the highest peaks of diversity of soil-borne organisms (e.g. Blondel et al. 2010).

Materials and methods

Many of the Protura examined in this paper were collected by colleagues and given us in tubes containing 70% ethanol. However, we have obtained some specimens by extraction from soil or litter samples by Berlese-Tullgren funnels (2.5 mm mesh size). Specimens were incubated at 40–50° C for 24 hours in lactic acid to clarify, mounted on slides in Marc André medium and were observed and identified by an interference contrast microscope.

In total 5103 specimens from 198 sampling areas were examined. 3929 specimens were identified to species level (Table 1).

In our analysis we also considered the data taken from 49 Italian collecting sites known in literature. 17 out of 20 Italian regions are covered, missing specimens from Molise, Campania and Calabria (Southern part of the peninsula).

Key to genera of Italian Protura

This key and the following ones to species are based, and adapted to the Italian fauna, on Nosek (1973) and Szeptycki (1980, 1985, 1986, 1991).

1 Tracheal system present (meso and metanotum with spiracles); all three pairs of abdominal legs two segmented, with terminal vescicle and with 5 setae on each ..... **Eosentomidae – Genus *Eosentomon***

– Spiracles absent..... **Acerentomoidea 2**

2 Only the first pair of abdominal legs with a terminal vescicle and 4 setae; pairs II and III unsegmented with 2–3 setae; abdominal segment VIII with a more or less developed striate band ..... **Acerentomidae 4**

– First two pairs of abdominal legs with terminal vescicle; third pair unsegmented **3**

3 Maxillary gland with a long dilatated sausage–like part; pseudoculus pear–like with a long and broad S shaped median opening; 8 setae in the anterior row of abdominal tergites II–VII..... ..... **Hesperentomidae – *Ionescuellum condei* (Nosek, 1965)**

– At most 4 setae in the anterior row of abdominal tergites II–VII; maxillary gland with heart–shaped or circular dilatation; pseudoculi without median opening ..... **Protentomidae 7**

4 Abdominal legs II and III with 3 setae (a longer median one and two shorter sub–apical)..... **Genus *Acerentulus***

– Abdominal legs II and III with 2 setae **5**

5 Abdominal legs II and III with 2 setae of the same length; maxillary gland with racemose appendix; sensillum of labial palp broad ..... **Genus *Acerella***

– Subapical seta of abdominal legs II and III shorter than the median one..... **6**

6 Abdominal legs II and III with a long median seta and a very short subapical one; pseudoculi small; striate band of tergite VIII complete; maxillary gland with a rather large calyx, heart shaped; tuft of setae on labial palp strongly reduced; anterior row of abdominal sternites I–VII with 3 setae; sternite VIII with a single row of 4 setae ..... **Genus *Gracilentulus***

– Subapical seta of abdominal legs II and III half the length of the median one or less; head with a rostrum (from very short to long); anterior row of abdominal sternites I–VII with a variable number (≥ 3) of setae ..... **Genus *Acerentomon***

7 Pseudoculus with a large triangular proximal prolongation; the "lever" of the same length as the pseudoculus itself and of almost the same width distally; the comb on tergite VIII with distinct teeth..... **Genus *Proturentomon***

– Pseudoculus often more elliptical and proximal prolongation usually narrower parallel sided; the comb on tergite VIII with very fine teeth or toothless ... . **Genus *Protentomon***

Keys to species of Italian Protura

Since this key could lead to a misidentification of similar Palearctic species not already detected in Italy, we suggest a careful examination of the species' descriptions (and redescriptions) to verify the identification accuracy and also to refer to the keys to species of other European Countries (e.g. those cited at the beginning of the key to genera) as well as to the monographic papers published on certain genera (e.g. Rusek 1975; Szeptycki 1993).

Genus *Eosentomon*

1 Tergite VII with 6 anterior setae....**2**
– Tergite VII with 4 anterior setae....**3**
2 Head with only posterior additional seta; seta p2' on nota shorter than p3' .. ....***Eosentomon transitorium*** **Berlese, 1909**
– Head with only posterior additional seta; seta p2' roughly the same length of p3' .... ***Eosentomon germanicum*** **Prell, 1912**
3 Tergites IV–VI missing seta p4'; chaetotaxy of sternite XII 8/7 ....***Eosentomon foroiuliense*** **Torti & Nosek, 1984**
– Tergites IV–VI with seta p4'; chaetotaxy of sternite XII 8/4....**4**
4 Tergites II–VI missing seta p3'....***Eosentomon romanum*** **Nosek, 1969**
– Tergites II–VI with seta p3'; head with both anterior and posterior additional setae; seta p2' on nota subequal or longer than p3' **5**
5 On tergite VII seta p1' situated at the same level and near the base of p2..... .... ***Eosentomon delicatum*** **Gisin, 1945**
– On tergite VII seta p1' placed close to the posterior border and p2' in a cavity on the hind margin....**6**
6 Sensillum c' behind the line α6–δ5; body length 750 μm; pseudoculus fairly big (PR = 7.5).... ***Eosentomon noseki*** **Tuxen, 1982**
– Sensillum c' proximally to line α6–δ5; body length 1610 μm; PR = 8.6–11.6....***Eosentomon armatum*** **Stach, 1926**

Genus *Acerentulus*

1 Sensillum a long reaching nearly or passing seta γ3; sensillum b subequal or shorter than c....**4**
– Sensillum a of medium length or short, not reaching or barely reaching seta γ3...**2**
2 Sensillum b subequal or shorter than c....**3**
– Sensillum b much longer than c, reaching the empodium..... ....***Acerentulus traegardhi*** **Ionescu, 1937**
3 Tergites II–VI without seta p1' ....***Acerentulus cunhai*** **Condé, 1950**
– Tergites II–VI with seta p1'....***Acerentulus tuxeni*** **Rusek, 1966**
4 Sensillum a' broad, relatively short, not reaching the base of b' **5**
– Sensillum a' broad, long, reaching the base of b'....**8**
5 Seta p3' missing in tergite VII....**6**
– Seta p3' present in tergite VII **7**
6 Seta a1 missing in tergite VII ....***Acerentulus exiguus*** **Condé, 1944**
– Seta a1 present in VII .....***Acerentulus apuliacus*** **Rusek & Stumpp, 1988**
7 Setae a1 and p1' missing in tergite VII.....***Acerentulus gisini*** **Condé, 1952**
– Setae a1 and p1' present in tergite VII....***Acerentulus confinis*** **(Berlese, 1908)**
8 Setae a1 and p1' missing in tergite VII....**9**
– Tergite VII: seta a1 present, p1' missing..***Acerentulus terricola*** **Rusek, 1965**

9 Seta p1 present in tergite VIII; sternite XI with 4 setae .....
.....***Acerentulus condei*** **Nosek, 1983**
Seta p1 missing in tergite VIII; sternite XI with 6 setae.....
.....***Acerentulus alpinus*** **Gisin, 1945**

Genus *Acerella*

1 Sensillum t2 nearly 3 times the length of t1***Acerella tiarnea*** **(Berlese, 1908)**
– Sensillum t2 one and a half to twice the length of t1.....
.....***Acerella muscorum*** **(Ionescu, 1930)**

Genus *Gracilentulus*

1 Sensillum b not reaching seta γ3 .....**2**
– Sensillum b passing seta γ3 .....***Gracilentulus gracilis*** **(Berlese, 1908)**
2 Chaetotaxy of tergites II–VI 7/16; TR = 2,7 .....
..... ***Gracilentulus sardinianus*** **Nosek, 1979**
– Chaetotaxy of tergites II–VI 8/14; TR = 3,3 .....
..... ***Gracilentulus meridianus*** **(Condé, 1945)**

Genus *Acerentomon*

1 Chaetotaxy of sternite VIII 4/0.....**2**
– Chaetotaxy of sternite VIII 4/2.....**3**
2 Seta x present; rostrum very long, LR = 3,3 ...***Acerentomon noseki*** **Torti, 1981**
– Seta x absent; rostrum short, LR ≥ 6 .....**4**
3 Seta x present; rostrum long, LR = 3,5–4,7.....**7**
– Seta x absent; rostrum of medium length, LR = 4,5–5 .....
.....***Acerentomon affine*** **Bagnall, 1912**
4 Rostrum short, LR nearly 6 .....**5**
Rostrum very short, LR ≥ 9 .....**6**
5 Sensillum b extremely broad, not spindle–shaped and shorter than c; a long and reaching the base of e; pleural pectines strongly developed .....
.....***Acerentomon meridionale*** **Nosek, 1960**
– Sensillum b broad, spear shaped, almost reaching seta γ4 and longer than c; a short, barely reaching the base of d; pleural pectines only on segments VI–VII .....***Acerentomon balcanicum*** **Ionescu, 1933**
6 Comb VIII with 10–14 teeth; pleural pectin VI with a row of long teeth; ratio of sensilla a:b = 1,1 .....***Acerentomon microrhinus*** **Berlese, 1909**
– Comb VIII with 17–20 teeth; pleural pectin VI strongly reduced to a group of 4 distinct teeth; ratio of sensilla a:b = 0,8.....
.....***Acerentomon condei*** **Nosek & Dallai, 1982**
7 Sensillum b thin and small, distinctly shorter than c.....**8**

– Sensillum b distinctly broad, subequal or longer than c **10**
8 Head with additional setae..... ***Acerentomon gallicum*** **Ionescu, 1933**
– Head without additional setae **9**
9 Sensillum a short, barely reaching d; pleural line VI with a fine serration..... ..... ***Acerentomon italicum*** **Nosek, 1969**
– Sensillum a long, extending beyond the base of d, sometimes even reaching e; pleural line VI with a row of conspicuous teeth..... ..... ***Acerentomon fageticola*** **Rusek, 1966**
10 Seta p3' present in tergite VII ..... ***Acerentomon doderoi*** **Silvestri, 1907**
– Seta p3' missing in tergite VII..... **11**
11 Comb VIII with 14–16 long teeth, the median ones smaller; body length about 1600 μm..... ***Acerentomon maius*** **Berlese, 1908**
– Comb VIII with 9–12 pointed teeth; body length 1980–2370 μm..... ..... ***Acerentomon baldense*** **Torti, 1986**

Genus *Proturentomon*

1 Chaetotaxy of tergites I–VI 0/12..... ***Proturentomon noseki*** **(Rusek, 1975)**
– Chaetotaxy of tergites II–VI 2/12 ..... **2**
2 Chaetotaxy of tegites I and VIII 2/10 and 6/12, respectively; sensillum b distinctly shorter than c ..... ***Proturentomon minimum*** **Berlese, 1908**
– Chaetotaxy of tegites I and VIII 2/12 and 6/14, respectively; sensillum b subequal or longer than c..... **3**
3 Body length 690 μm; comb on tergite VIII with 8 teeth..... ..... ***Proturentomon condei*** **Nosek, 1967**
– Body length 500 μm; comb on tergite VIII with 4 long and thin teeth..... ..... ***Proturentomon pilosum*** **(Rusek, 1975)**

Genus *Protentomon*

1 Tergites II–VI without the anterior row of setae; sternite XI with 4 setae..... ..... ***Protentomon perpusillum*** **(Berlese, 1909)**
– Tergites II–VI with 2 setae in the anterior row; sternite XI with 6 setae .... ***Protentomon berlesei*** **Nosek, 1969**

Italian Protura

This section provides summaries on species known to date belonging to Italian fauna. For each one the amount of material examined (PI = pre-imago, MJ = maturus junior, LII = larva II, LI = larva I, undet = undetermined), a short description of the global distribution from Szeptycki (2007) and, when necessary, some remarks are given. For the new recorded Italian species more geographical details (locality, province and region)

Table 1. Number of Protura specimens examined from each Italian region.

Regions	Nr of specimens (bibliographic data excluded)	Nr of specimens identifiable to species level (bibliographic data excluded)
Aosta Valley	134	94
Piedmont	748	546
Lombardy	214	189
Trentino-Alto Adige	40	20
Veneto	193	161
Friuli-Venezia Giulia	68	58
Liguria	2878	2158
Emilia-Romagna	149	143
Tuscany	264	228
Marches	3	2
Umbria	45	46
Lazio	64	51
Abruzzo	22	16
Molise	-	-
Campania	-	-
Apulia	16	7
Basilicata	67	45
Calabria	-	-
Sicily	33	26
Sardinia	165	139
Total	**5103**	**3929**

are given. The maps (Figs 1–25) show the collecting areas in Italy: blue dots represent collecting sites known only in literature, while the red ones correspond to samples personally analyzed by the authors.

ORDO: ACERENTOMATA
Familia: Hesperentomidae Price, 1960

***Ionescuellum condei* (Nosek, 1965)**
http://species-id.net/wiki/Ionescuellum_condei
Fig. 1

Material examined. 4 ♂♂, 4 ♀♀.

Distribution. Austria, Italy.

Remarks. First Italian record in Torti (1981a). Some generic records from Lombardy (N Italy) of *Hesperentomon* sp. in Dematteis (1971, 1972) could be attributed to this species.

Figure 1. *Ionescuellum condei*: collecting sites in Italy (red dots: samples personally analyzed by the authors).

Familia: Protentomidae Ewing, 1936

***Protentomon berlesei* Nosek, 1969**
http://species-id.net/wiki/Protentomon_berlesei
Fig. 2

Material examined. 2 ♂♂, 2 ♀♀.

Type area. Veneto, Colli Euganei near Padua.

Distribution. Italy.

Remarks. For nearly 40 years since its description (Nosek 1969), only two specimens (holotype and paratype) from Veneto (NE Italy) belonging to this species were known. In 2007 two of us (Galli and Torti) published a short note about a third specimen from Liguria (NW). Three other specimens were most recently found in samples from Piedmont (NW) and Sardinia.

***Protentomon perpusillum* (Berlese, 1909)**
http://species-id.net/wiki/Protentomon_perpusillum
Fig. 2

Type area. Tuscany, S. Vincenzo (Livorno).

Distribution. Italy, Germany. Data from Denmark and Australia should be confirmed (Szeptycki 2007).

Remarks. Bibliographic data from Berlese (1909), Nosek (1973).

***Proturentomon condei* Nosek, 1967**
http://species-id.net/wiki/Proturentomon_condei
Fig. 3

Material examined. 6 ♀♀, 1 MJ.

Distribution. Austria, Slovakia.

Remarks. This species is not included in the World Catalogue (Szeptycki 2007) because it was recorded in Italy only more recently (Capurro et al. 2008b).

***Proturentomon minimum* (Berlese, 1908)**
http://species-id.net/wiki/Proturentomon_minimum
Fig. 3

Material examined. 11 ♀♀, 7 MJ, 1 undet.

Type area. Tuscany, Giardino di Boboli in Florence.

Figure 2. *Protentomon* spp.: collecting sites in Italy (dots *P. berlesei*; squares: *P. perpusillum*; blue: data from literature; red: samples personally analyzed by the authors; LT = type area).

Distribution. Recorded from nearly whole Europe (with exception of Scandinavia), but all of the older data should be confirmed (Szeptycki 2007).

Remarks. Bibliographic data from Berlese (1908), Dematteis (1971, 1972), Nosek (1973).

***Proturentomon noseki* Rusek, 1975**
http://species-id.net/wiki/Proturentomon_noseki
Fig. 3

Material examined. 2 ♀♀ (Vignale Monferrato, Alessandria, Piedmont).

Distribution. Central Europe.

Remarks. New record for the Italian fauna.

***Proturentomon pilosum* Rusek, 1975**
http://species-id.net/wiki/Proturentomon_pilosum
Fig. 3

Material examined. 1 ♀ (Concordia, Venice, Veneto).

Distribution. Central Europe.

Remarks. New record for the Italian fauna.

Familia: Acerentomidae Silvestri, 1907

***Acerentulus alpinus* Gisin, 1945**
http://species-id.net/wiki/Acerentulus_alpinus
Fig. 4

Distribution. South Europe.

Remarks. Bibliographic data from Dematteis (1972).

***Acerentulus apuliacus* Rusek & Stumpp, 1988**
http://species-id.net/wiki/Acerentulus_apuliacus
Fig. 4

Material examined. 3 ♂♂, 20 ♀♀, 3 PI, 1 MJ.

Type area. Apulia, 10 km South of Vico del Gargano, Bosco Sfilzi.

Distribution. Type area only.

Remarks. Bibliographic data from Rusek and Stumpp (1988).

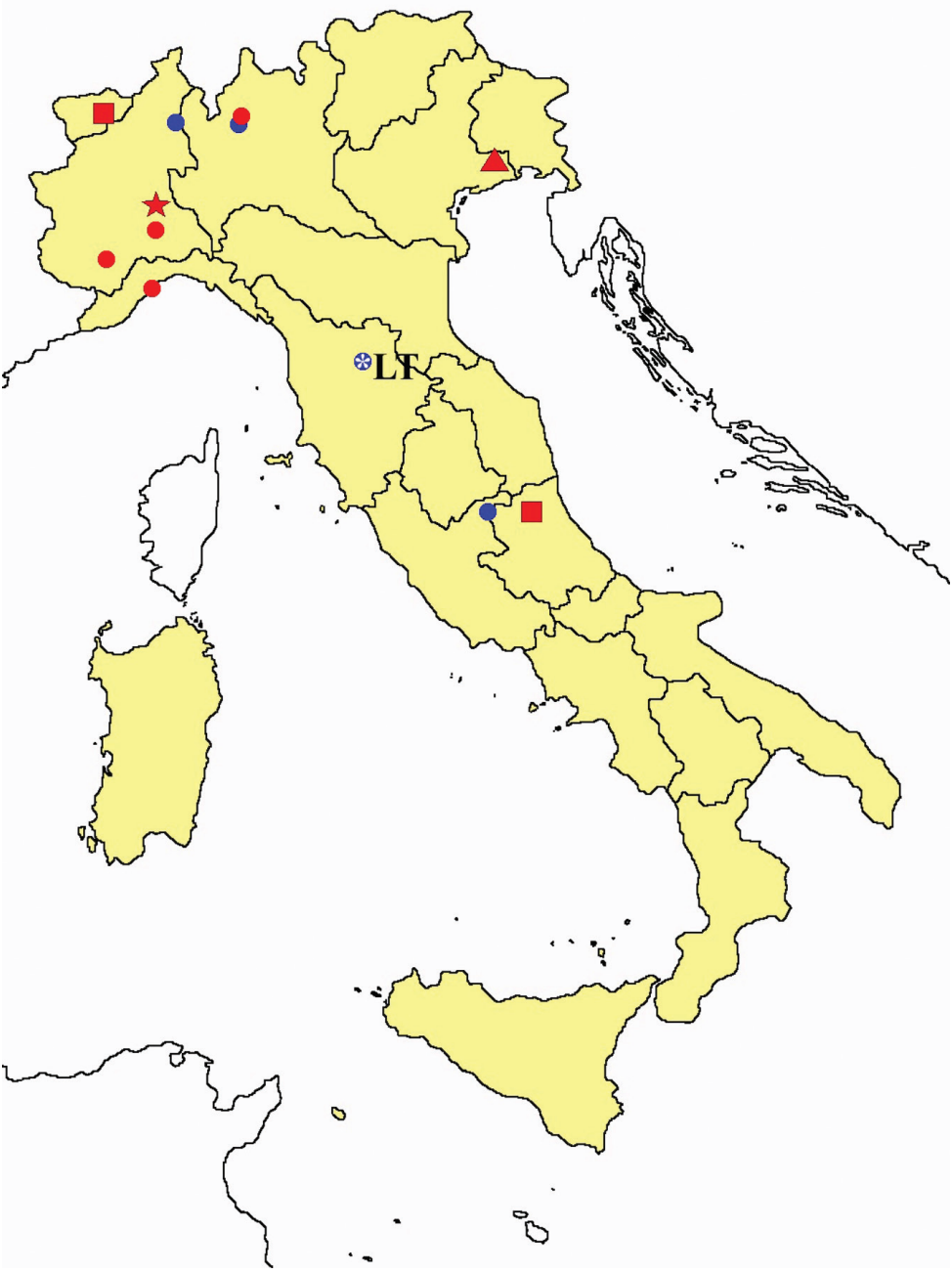

Figure 3. *Proturentomon* spp.: collecting sites in Italy (squares *P. condei*; dots *P. minimum*; star: *P. noseki*; triangle *P. pilosum*; blue: data from literature; red: samples personally analyzed by the authors; LT = type area).

***Acerentulus condei* Nosek, 1983**
http://species-id.net/wiki/Acerentulus_condei
Fig. 4

Type area. Sardinia, Strada Orientale Sarda km 158.

Distribution. Mediterranean Europe (Sardinia, Corsica, Slovenia).

Remarks. Bibliographic data from Nosek (1983).

***Acerentulus confinis* (Berlese, 1908)**
http://species-id.net/wiki/Acerentulus_confinis
Fig. 5

Material examined. 104 ♂♂, 187 ♀♀, 5 PI, 24 MJ.

Type area. Tuscany, Florence.

Distribution. Recorded from nearly all Europe (with exception of Scandinavia), North Africa, North America and Australia. Most of the older data are dubious and should be confirmed (Szeptycki 2007).

Remarks. Bibliographic data from Berlese (1908), Nosek (1973), Fratello and Gioia (1975).

***Acerentulus cunhai* Condé, 1950**
http://species-id.net/wiki/Acerentulus_cunhai
Fig. 6

Material examined. 1 ♀.

Distribution. Central and West Europe, Macaronesia.

Remarks. Bibliographic data from Dematteis (1971).

***Acerentulus exiguus* Condé, 1944**
http://species-id.net/wiki/Acerentulus_exiguus
Fig. 6

Material examined. 1 ♂, 1 MJ.

Distribution. Central and South Europe.

Remarks. Bibliographic data from Dematteis Ravizza (1975).

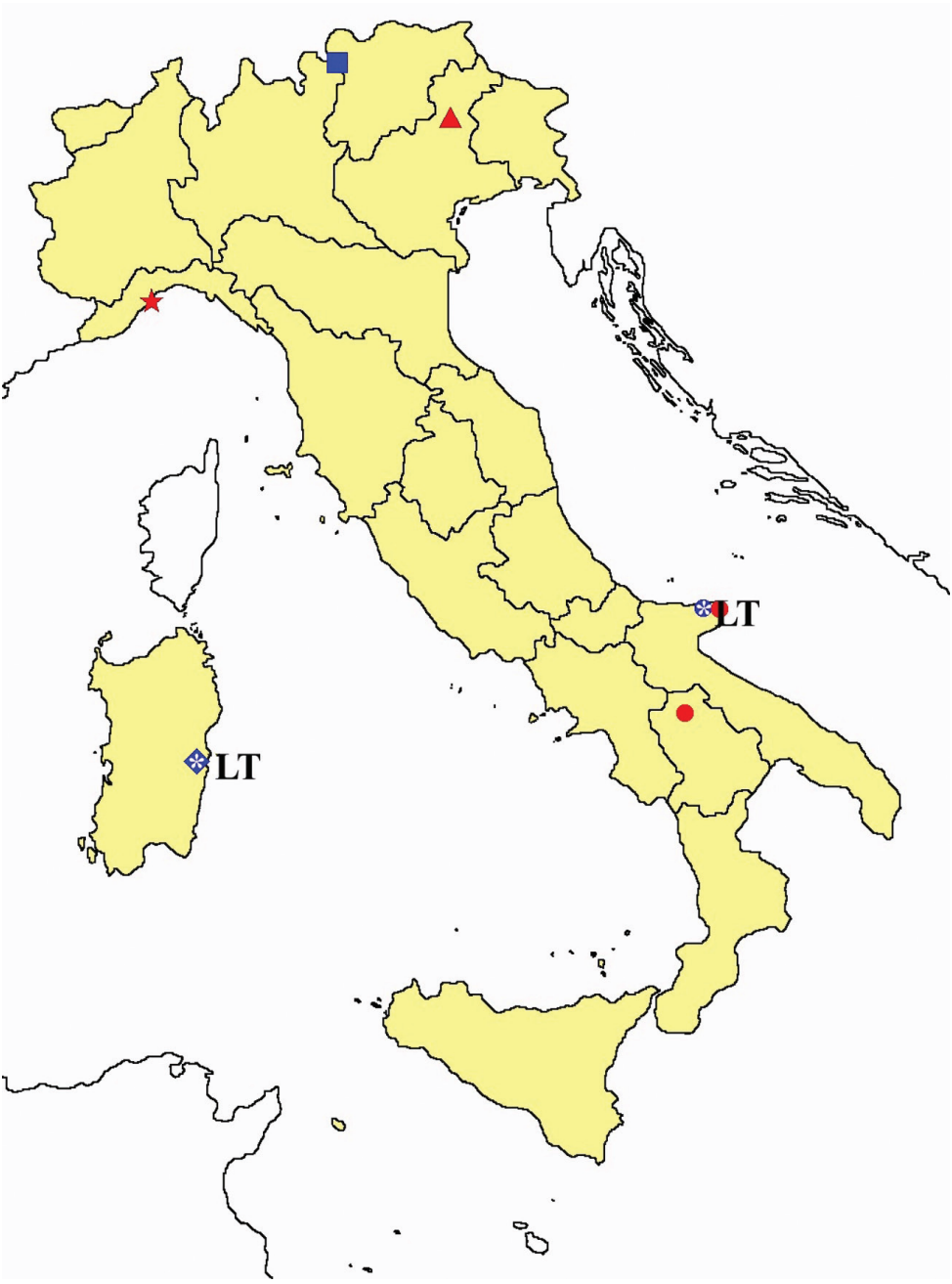

Figure 4. *Acerentulus* spp.: collecting sites in Italy (square: *A. alpinus*; dots: *A. apuliacus*; rhombus: *A. condei*; star: *A. terricola*; triangle: *A. tuxeni*; blue: data from literature; red: samples personally analyzed by the authors; LT = type area).

***Acerentulus gisini* Condé, 1952**
http://species-id.net/wiki/Acerentulus_gisini
Fig. 7

Material examined. 3 ♀♀.

Distribution. Central Europe, Italy; data from Bulgaria should be confirmed (Szeptycki 2007).

Remarks. Bibliographic data from Dematteis (1971, 1972).

***Acerentulus terricola* Rusek, 1965**
http://species-id.net/wiki/Acerentulus_terricola
Fig. 4

Material examined. 2 ♂♂ (Bergeggi, Savona, Liguria).

Distribution. Czech Republic (type area: Czech Rep., 'Tal Suchý _leb im Nordteil des Mährischen Karstes").

Remarks. New record for the Italian fauna.

***Acerentulus traegardhi* Ionesco, 1937**
http://species-id.net/wiki/Acerentulus_traegardhi
Fig. 8

Material examined. 15 ♂♂, 14 ♀♀, 5 PI, 16 MJ, 2 LII.

Distribution. Recorded from nearly whole Europe, but it was commonly mistaken with *A. insignis*. Many data (especially from the West Europe) should be confirmed (Szeptycki 2007).

Remarks. Bibliographic data from Nosek (1973), Fratello and Gioia (1975).

***Acerentulus tuxeni* Rusek, 1966**
http://species-id.net/wiki/Acerentulus_tuxeni
Fig. 4

Material examined. 3 ♂♂, 3 ♀♀ (Ponte delle Alpi, Belluno, Veneto).

Distribution. Central Europe.

Remarks. New record for the Italian fauna.

Figure 5. *Acerentulus confinis*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors; LT = type area).

***Gracilentulus gracilis* (Berlese, 1908)**
http://species-id.net/wiki/Gracilentulus_gracilis
Fig. 9

Material examined. 3 ♂♂, 5 ♀♀.

Type area. Tuscany, Toiana (Pisa).

Distribution. Recorded from many European countries, from North Africa, South Africa, Australia and New Zealand.

Remarks. Bibliographic data from Berlese (1908), Nosek (1973).

***Gracilentulus meridianus* (Condé, 1945)**
http://species-id.net/wiki/Gracilentulus_meridianus
Fig. 9

Material examined. 4 ♂♂, 4 ♀♀ (Elini, Ogliastra, Sardinia).

Distribution. France, Spain.

Remarks. New record for the Italian fauna.

***Gracilentulus sardinianus* Nosek, 1979**
http://species-id.net/wiki/Gracilentulus_sardinianus
Fig. 9

Material examined. 1 ♂, 3 ♀♀, 1 MJ.

Type area. Sardinia, between Luogosanto and Tempio Pausania.

Distribution. Type area only.

Remarks. Bibliographic data from Nosek (1979).

***Acerentomon affine* Bagnall, 1912**
http://species-id.net/wiki/Acerentomon_affine
Fig. 10

Material examined. 43 ♂♂, 63 ♀♀, 3 PI, 7 MJ, 1 undet.

Distribution. West Europe; data from Romania and "Czechoslovakia" should be confirmed (Szeptycki 2007).

Remarks. Species confirmed for Italy. Bibliographic data from Fratello and Gioia (1975).

Figure 6. *Acerentulus* spp.: collecting sites in Italy (rhombus: *A. cunhai*; dots: *A. exiguus*; blue: data from literature; red: samples personally analyzed by the authors).

***Acerentomon balcanicum* Ionesco, 1933**
http://species-id.net/wiki/Acerentomon_balcanicum
Fig. 11

Material examined. 17 ♂♂, 14 ♀♀, 1 PI, 1 MJ.

Distribution. Southeast Europe, Ukraine.

Remarks. Bibliographic data from Nosek (1973).

***Acerentomon baldense* Torti, 1986**
http://species-id.net/wiki/Acerentomon_baldense
Fig. 18

Material examined. 5 ♂♂, 7 ♀♀.

Type area: Veneto, Monte Balbo (Venetian PreAlps) surroundings of Prà Alpesina (Verona).

Distribution. Type area only.

Remarks. Bibliographic data from Torti (1986).

***Acerentomon condei* Nosek & Dallai, 1982**
http://species-id.net/wiki/Acerentomon_condei
Fig. 18

Material examined. 6 ♂♂, 2 ♀♀, 1 MJ.

Type area. Sardinia, Desulo (Gennargento).

Distribution. Type area only.

Remarks. Bibliographic data from Nosek and Dallai (1982).

***Acerentomon doderoi* Silvestri, 1907**
http://species-id.net/wiki/Acerentomon_doderoi
Fig. 12

Material examined. 64 ♂♂, 94 ♀♀, 5 PI, 2 MJ.

Type area. Liguria, Genoa.

Distribution. Known only from Italy and Slovenia. All data from Central and West Europe and from USA are highly doubtful (Szeptycki 2007).

Remarks. We have not yet been able to analyse the type material from Villetta Dinegro (Genoa Town). Four specimens originally labelled as "cotypus *doderoi*" in Genoa Museum collection have been recently identified by the authors as *A. italicum*.

Figure 7. *Acerentulus gisini*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors).

***Acerentomon fageticola* Rusek, 1966**
http://species-id.net/wiki/Acerentomon_fageticola

Distribution. Central Europe.

Remarks. Three specimens from Veneto (Cison, Treviso), and two from Liguria (Lavagna, Genoa) were identified by Prof. Nosek as *Acerentomon fageticola* and cited in a short note by Torti (1995a). These and some other similar specimens should be considered as individual variations of *A. italicum*: this hypothesis seems to be maintained by the coexistence in the same localities of individuals showing a continuum of diagnostic characters (foretarsal sensilla, chaetotaxy, pleural pectines) ranging from the *A. fageticola* to the *A. italicum* extremes, while we have not yet found sites where only "*fageticola*-type" specimens have been collected.

We hope that our current redescription of *Acerentomon italicum* could shed more light on the differences between this species and the related *A. fageticola*.

This species has been cited here and in the identification key only for exactness of information.

***Acerentomon gallicum* Ionesco, 1933**
http://species-id.net/wiki/Acerentomon_gallicum
Fig. 13

Material examined. 42 ♂♂, 90 ♀♀, 7 PI, 11 MJ, 6 LII, 1 LI, 1 undet.

Distribution. West and Central Europe, recorded also from Africa (Uganda – introduced?).

Remarks. Although in Szeptycki (2007) there is no information about the presence of this species in Italy, *A. gallicum* was cited in a short note by Torti (1995b).

***Acerentomon italicum* Nosek, 1969**
http://species-id.net/wiki/Acerentomon_italicum
Fig. 14

Material examined. 433 ♂♂, 573 ♀♀, 18 PI, 16 MJ, 14 LII, 6 undet.

Type area. Veneto, Colli Euganei near Padua, Italy.

Distribution. Italy.

Remarks. Species currently under redescription by the authors of this paper. Bibliographic data from Nosek (1969, 1973).

Figure 8. *Acerentulus traegardhi*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors).

***Acerentomon maius* Berlese, 1908**
http://species-id.net/wiki/Acerentomon_maius
Fig. 15

Material examined. 353 ♂♂, 455 ♀♀, 40 PI, 25 MJ, 3 LII, 2 LI, 3 undet.
Type area. Trentino Alto Adige, Tiarno.
Distribution. Italy, Central Europe.
Remarks. Bibliographic data from Berlese (1908), Dematteis (1972), Nosek (1973), Fratello and Gioia (1975).

***Acerentomon meridionale* Nosek, 1960**
http://species-id.net/wiki/Acerentomon_meridionale
Fig. 16

Material examined. 52 ♂♂, 93 ♀♀, 2 PI, 8 MJ, 1 undet.
Distribution. South and Central Europe, Near East (Israel).
Remarks. Bibliographic data from Nosek (1973).

***Acerentomon microrhinus* Berlese, 1909**
http://species-id.net/wiki/Acerentomon_microrhinus
Fig. 17

Material examined. 95 ♂♂, 161 ♀♀, 21 PI, 15 MJ, 1 LII, 2 undet.
Type area. Piedmont, Casale Monferrato.
Distribution. South and Central Europe.
Remarks. Bibliographic data from Berlese (1909), Dematteis (1972), Nosek (1973), Fratello and Gioia (1975).

***Acerentomon noseki* Torti, 1981**
http://species-id.net/wiki/Acerentomon_noseki
Fig. 18

Material examined. 2 ♀♀.
Type area. Piedmont, surroundings of Santuario di Oropa near Biella.
Distribution. Type area only.
Remarks. Bibliographic data from Torti (1981a).

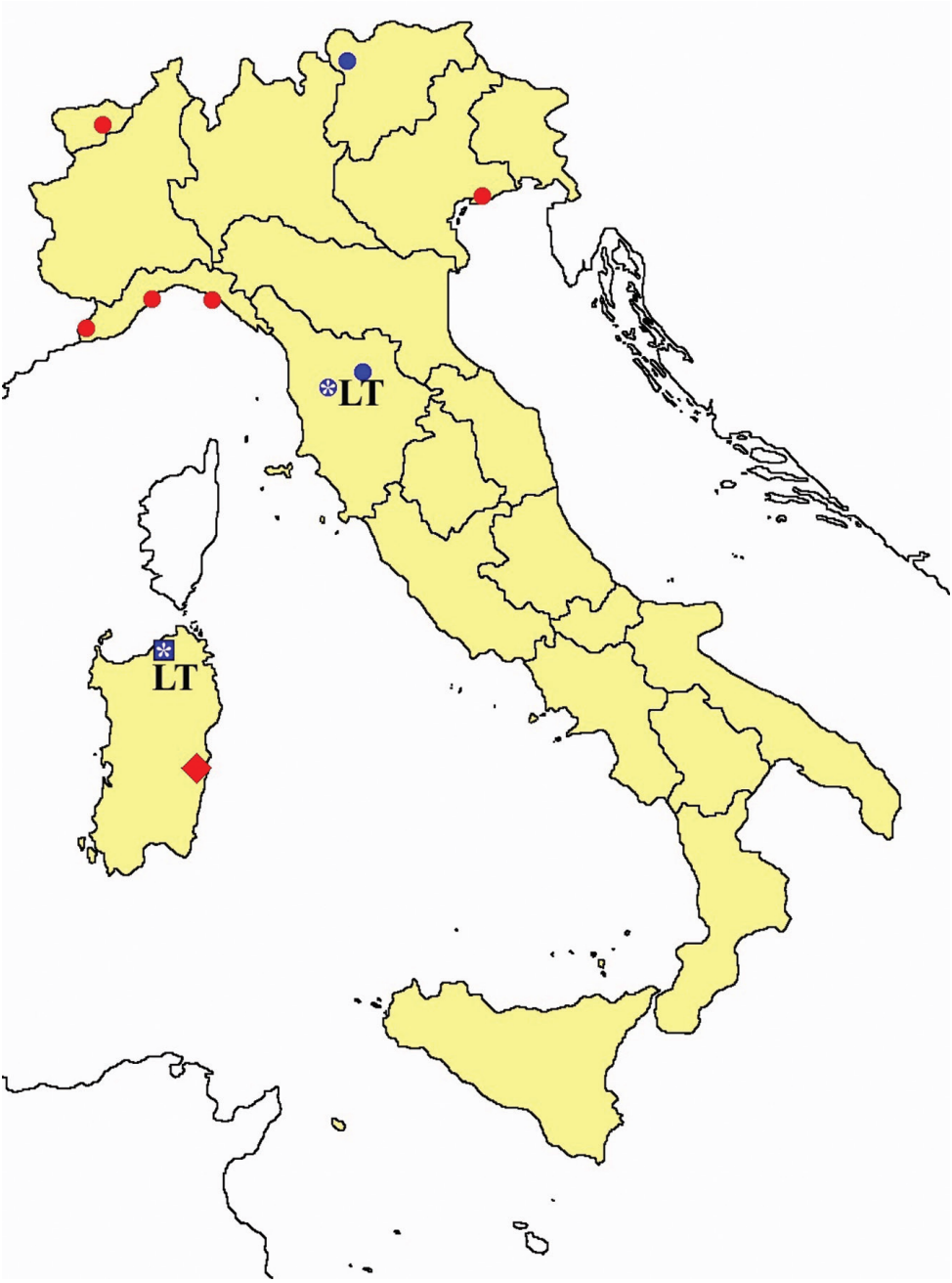

Figure 9. *Gracilentulus* spp.: collecting sites in Italy (dots: *G. gracilis*; square: *G. sardinianus*; rhombus: *G. gracilis* + *G. meridianus* + *G. sardinianus*; blue: data from literature; red: samples personally analyzed by the authors; LT = type area).

***Acerella muscorum* (Ionesco, 1930)**
http://species-id.net/wiki/Acerella_muscorum
Fig. 19

Material examined. 3 ♂♂, 6 ♀♀.

Distribution. Central and West Europe, Near East.

Remarks. Bibliographic data from Dematteis (1972), Nosek (1973), Fratello and Gioia (1975), Dallai et al. (2010).

***Acerella tiarnea* (Berlese, 1908)**
http://species-id.net/wiki/Acerella_tiarnea
Fig. 20

Material examined. 30 ♂♂, 95 ♀♀, 1 PI, 1 MJ, 1 LI.

Type area. Trentino Alto Adige, Tiarno.

Distribution. Mediterranean Europe; all data from the Central and North Europe should be checked (Szeptycki 2007).

Remarks. Bibliographic data from Berlese (1908), Dematteis (1972), Fratello and Gioia (1975).

ORDO: EOSENTOMATA
Familia: Eosentomidae Berlese, 1909

***Eosentomon armatum* Stach, 1926**
http://species-id.net/wiki/Eosentomon_armatum
Fig. 21

Material examined. 1 ♂ (Carlino, Udine, Friuli-Venezia Giulia) – 1 ♂, 6 ♀♀, 4 MJ (Floridia, Siracusa, Sicily).

Distribution. Probably widely distributed in Europe, but all data before 1986 should be checked – they most likely concern not only *E. armatum*, but also some other similar species (Szeptycki 2007).

Remarks. New record for the Italian fauna.

Figure 10. *Acerentomon affine*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors).

***Eosentomon delicatum* Gisin 1945**
http://species-id.net/wiki/Eosentomon_delicatum
Fig. 22

Material examined. 8 ♂♂, 9 ♀♀, 2 MJ, 1 LII, 1 undet.
Distribution. Europe, North Africa.
Remarks. Bibliographic data from Nosek (1973).

***Eosentomon foroiuliense* Torti & Nosek, 1984**
http://species-id.net/wiki/Eosentomon_foroiuliense
Fig. 21

Material examined. 1 ♀.
Type area. Friuli-Venezia Giulia, Aviano.
Distribution. Type area only.
Remarks. Bibliographic data from Torti and Nosek (1984).

***Eosentomon germanicum* Prell, 1912**
http://species-id.net/wiki/Eosentomon_germanicum
Fig. 21

Distribution. Central Europe, Scandinavia. The data from West Europe, Italy and Madeira (under *E. germanicum* and *E. forsslundi*) should be checked – *Eosentomon germanicum* was commonly mistaken with similar species (Szeptycki 2007).
Remarks. Bibliographic data from Nosek (1973). We didn't find specimens of this species in the collections we analyzed.

***Eosentomon noseki* Tuxen, 1982**
http://species-id.net/wiki/Eosentomon_noseki
Fig. 23

Material examined. 43 ♂♂, 43 ♀♀, 1 PI, 18 MJ, 2 LII.
Distribution. Macaronesia, Spain.
Remarks. This species is not included in the World Catalogue (Szeptycki 2007) because it was recorded in Italy only more recently (Capurro et al. 2008a).

Figure 11. *Acerentomon balcanicum*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors).

Figure 12. *Acerentomon doderoi*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors; LT = type area).

Figure 13. *Acerentomon gallicum*: collecting sites in Italy (red dots: samples personally analyzed by the authors).

Figure 14. *Acerentomon italicum*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors; LT = type area).

Figure 15. *Acerentomon maius*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors; LT = type area).

Figure 16. *Acerentomon meridionale*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors).

Figure 17. *Acerentomon microrhinus*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors; LT = type area).

Figure 18. *Acerentomon* spp.: collecting sites in Italy (square: *A. baldense*; dots: *A. condei*; rhombus: *A. noseki*; blue: data from literature; red: samples personally analyzed by the authors; LT = type area).

Figure 19. *Acerella muscorum*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors).

Figure 20. *Acerella tiarnea*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors; LT = type area).

Figure 21. *Eosentomon* spp.: collecting sites in Italy (stars: *E. armatum*; square: *E. foroiuliense*; dots: *E. germanicum*; blue: data from literature; red: samples personally analyzed by the authors; LT = type area).

Figure 22. *Eosentomon delicatum*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors).

Figure 23. *Eosentomon noseki*: collecting sites in Italy (red dots: samples personally analyzed by the authors).

Figure 24. *Eosentomon romanum*: collecting sites in Italy (blue dots: data from literature; LT = type area).

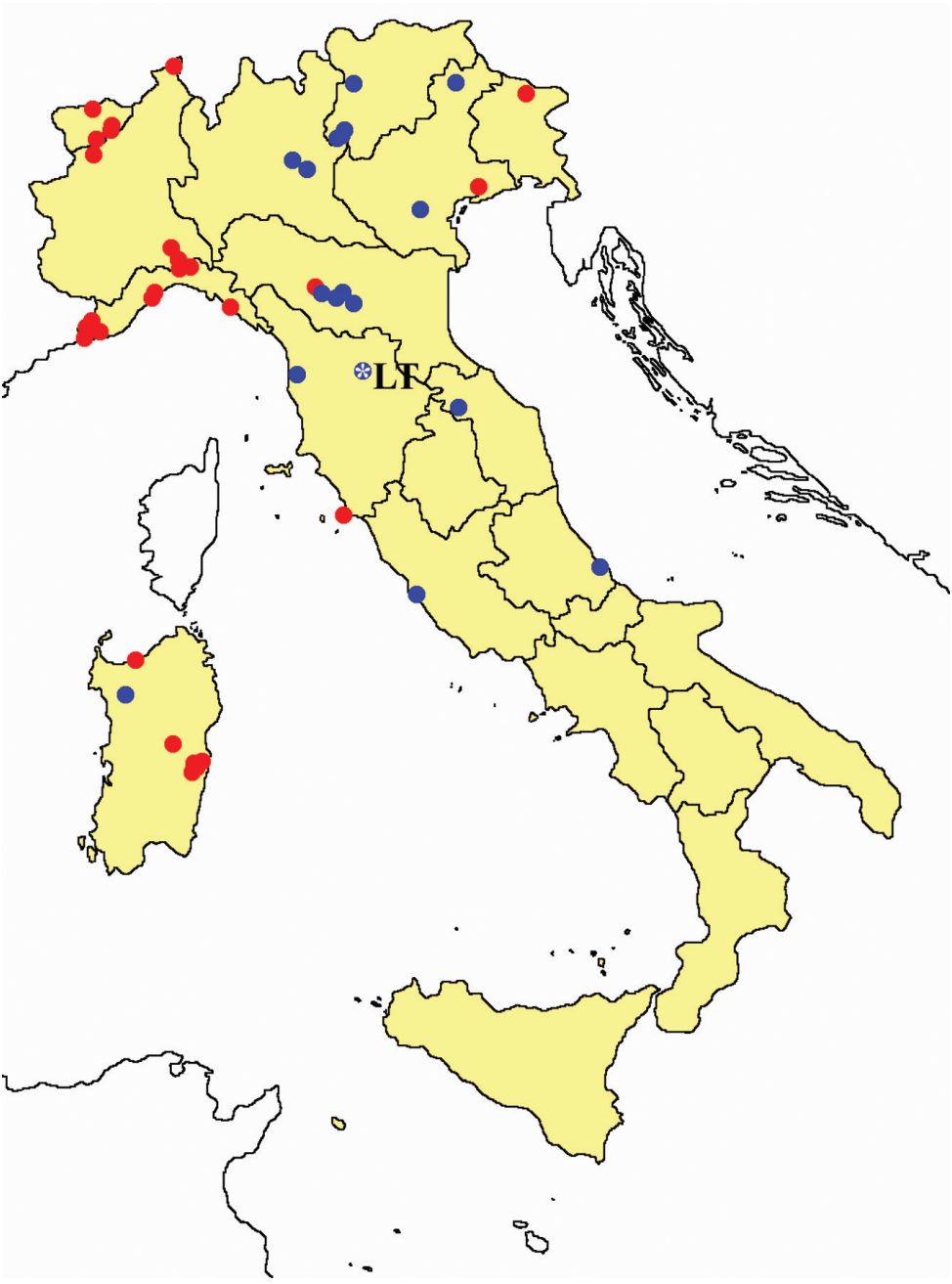

Figure 25. *Eosentomon transitorium*: collecting sites in Italy (blue dots: data from literature; red dots: samples personally analyzed by the authors; LT = type area).

***Eosentomon romanum* Nosek, 1969**
http://species-id.net/wiki/Eosentomon_romanum
Fig. 24

Type area. Lazio, Rome.

Distribution. Italy.

Remarks. Bibliographic data from Nosek (1969), Fratello and Gioia (1975).

***Eosentomon transitorium* Berlese, 1908**
http://species-id.net/wiki/Eosentomon_transitorium
Fig. 25

Material examined. 112 ♂♂, 107 ♀♀, 38 MJ, 11 LII, 6 LI, 13 undet.

Type area. Tuscany, Florence.

Distribution. Probably whole Europe and North Africa, but most of the data should be confirmed (Szeptycki 2007).

Remarks. Bibliographic data from Berlese (1908), Dematteis (1972), Nosek (1973), Dematteis Ravizza (1975), Fratello and Gioia (1975), Fratello and Sabatini (1989).

Conclusion

In Figures 26 and 27 the distribution of the sampling sites in Italy and the species richness in the Italian regions are shown, respectively. Unfortunately we regret for the lack of samples from Molise, Campania and Calabria (Southern part of the peninsula); but, apart from that, comparing maps on these Figures, it is clear that the species richness reflects the sampling effort in the different regions, with higher numbers of species known from regions such as Piedmont, Veneto and Liguria, where many more samples have been collected (for a detailed analysis of Protura of Liguria see Capurro et al. 2009).

According to the analysis made in this paper, we have been able to identify 40 Protura species in Italy, belonging to the families Hesperentomidae (1), Protentomidae (6), Acerentomidae (26) and Eosentomidae (7). At the species level, according to Vigna Taglianti et al. (1992), it is possible to outline the chorological categories shown in Table 2.

Based on the findings, the Italian fauna is mainly composed of species having a European or Mediterranean distribution. With regard to the 10 species known only in Italy, it cannot be said to be endemic due to the poor level of knowledge of this taxon. For the same reason, that given in Table 2 should be considered only a preliminary attempt at classification, which, most likely, is susceptible to changes in the future.

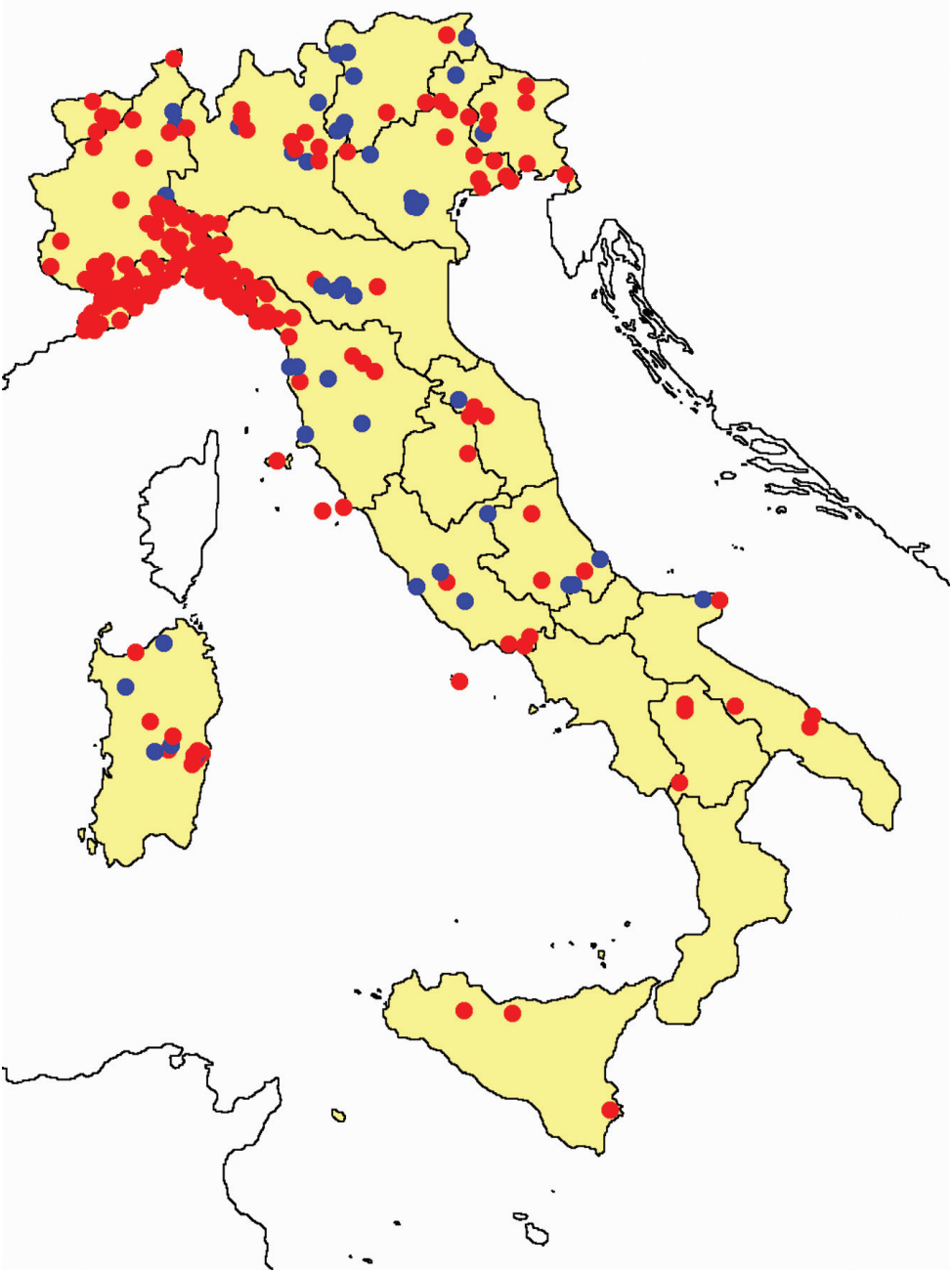

Figure 26. Distribution of the Protura sampling sites in Italy (blue dots: data known only from literature; red dots: data about specimens examined by the authors of this paper).

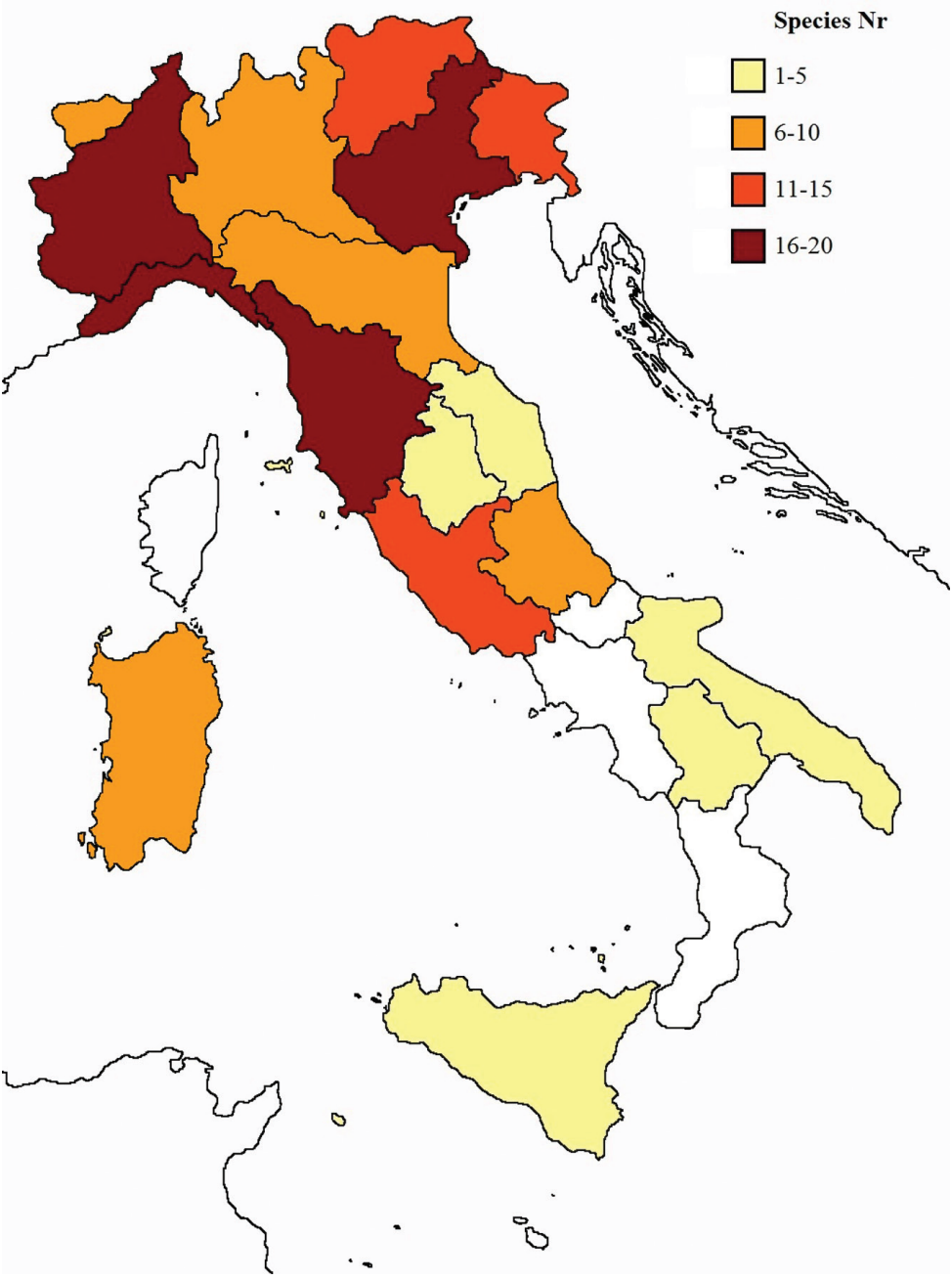

Figure 27. Species richness in the 20 Italian regions.

Table 2. Chorotypes of the Italian Protura.

Chorotypes	Species nr
Sub-Cosmopolitan	2
W-Palearctic	2
Turanic-European-Mediterranean	4
European-Mediterranean	5
European	3
Central-European	8
S-European	2
Mediterranean	4
Known only in Italy	10

Table 3. Number of Protura species and genera in the European Countries.

Country	Species nr	Genera nr
Austria	58	10
Balearic islands	7	5
Belgium	4	3
Bosnia and Herzegovina	16	7
Bulgaria	4	2
Corsica	15	7
Croatia	4	2
Czech Republic	33	7
Denmark	7	5
Finland	3	2
France	38	10
Germany	44	10
Greece	13	9
Hungary	10	5
Iceland	2	1
Ireland	5	3
Italy	40	8
Lithuania	2	1
Luxemburg	30	10
Macedonia	2	2
The Netherlands	1	1
Norway	4	1
Poland	68	11
Portugal	15	5
Romania	10	5
Russia	7	4
Serbia	3	2
Slovakia	38	8
Slovenia	7	3
Spain	23	7
Sweden	12	5
Switzerland	11	6
Ukraine	58	12
United Kingdom	14	6

The number of species and genera known in the European Countries (according to Szeptycki 2007; updated data for Austria and Ukraine are taken respectively from Christian 2011 and Shrubovych 2010) is shown in Table 3.

It seems rather unlikely that generally poorer (in terms of biodiversity) Countries such as Poland, Ukraine, Austria and Germany have more Protura species than Italy. It's more likely that this gap is due to a lack of knowledge of the Italian fauna. In support of this hypothesis, a year spent on sampling project in a small cork oak wood in Liguria (NW Italy) led us to identify (Capurro et al. 2011) 11 species. We therefore assume that is extremely possible that other species distributed in neighbouring Countries – or Palearctic ones as well (see as is the case of *Acerentulus terricola*) – could be found in Italy.

We therefore hope that in the future we will be able to deepen and broaden our research to obtain a more accurate picture of Protura's ecology and distribution.

Acknowledgements

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RESEARCH ARTICLE

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A new species of *Chucallis* Tao (Hemiptera, Aphididae, Calaphidinae) from China

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Abstract

A new species in the aphid genus *Chucallis* Tao, *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n. feeding on a species of bamboo, *Indocalamus tessellatus* (Munro) Keng f., is described. It differs from the only other known species in the genus by having remarkably large marginal processes on abdominal tergite IV. A key to species, morphological descriptions, distributional data and host plant information are provided. The type specimens studied are deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

Keywords

Chucallis, Aphididae, Calaphidinae, new species, China

Introduction

The aphid genus *Chucallis* was erected by Tao (1964), based on *Myzocallis bambusicola* Takahashi, 1921 as the type species. The genus can be easily separated from related genera by having long, finger-like dorsal processes on the abdomen, especially marginal ones. Until now, only one species is known (Remaudière and Remaudière 1997). After

identifying the specimens and checking the specimens of the type species, we found a new species, *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n., which is described in this paper. It is different from the only other known species in the genus in having remarkably large marginal processes on abdominal tergite IV. It feeds on one species of bamboo, *Indocalamus tessellatus* (Munro) Keng f., and occurs in Zhejiang and Fujian, China.

Materials and methods

Aphid terminology generally follows Quednau (2003) and Qiao et al. (2005). The unit of measurements is millimeters (mm). Metrical data were listed in Table 1.

Table 1. Metrical data of *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n.

Parts*		**Alate viviparae (n=13)**		
		Mean	**Range**	**Standard Deviation**
Length (mm)	Body length	2.112	1.670–2.266	0.122
	Body width	0.855	0.691–0.96	0.048
	Whole Antennae	1.805	1.670–1.901	0.056
	Ant.I	0.076	0.067–0.086	0.003
	Ant.II	0.058	0.058	0
	Ant.III	0.575	0.461–0.614	0.035
	Ant.IV	0.333	0.288–0.365	0.021
	Ant.V	0.335	0.317–0.374	0.014
	Ant.VIb	0.178	0.173–0.182	0.005
	PT	0.224	0.211–0.259	0.010
	URS	0.08	0.077–0.096	0.004
	Hind femur	0.588	0.48–0.643	0.029
	Hind tibia	1.113	0.974–1.210	0.045
	2HT	0.095	0.086–0.106	0.005
	SIPH	0.160	0.134–0.202	0.017
	SIPH BW	0.193	0.134–0.230	0.021
	SIPH DW	0.073	0.067–0.077	0.004
	Cauda	0.135	0.115–0.144	0.005
	BW Cauda	0.162	0.154–0.192	0.010
	Ant.IIIBW	0.019	0.019	0
	MW Hind tibia	0.032	0.024–0.038	0.004
	MT on Tergum IV	0.68	0.547–0.749	0.041
	BW of MT on Tergum IV	0.166	0.144–0.192	0.016
	SW of MT on Tergum IV	0.126	0.096–0.154	0.017
	DW of MT on Tergum IV	0.050	0.038–0.077	0.013
	Cephalic setae	0.042	0.038–0.058	0.007
	Setae on Tergum I	0.041	0.029–0.058	0.007
	Setae on Tergum VIII	0.039	0.029–0.058	0.007
	Setae on ANT.III	0.014	0.014	0
	Setae on SIPH	0.092	0.067–0.115	0.010
	Setae on MT of Tergum IV	0.030	0.019–0.029	0.005
	Setae on Hind tibia	0.046	0.038–0.058	0.005

Parts*		Alate viviparae (n=13)		
		Mean	Range	Standard Deviation
Ratio (times)	Whole Antennae / Body	0.83	0.79–0.88	0.025
	Hind femur / Ant.III	1.03	0.98–1.09	0.029
	Hind tibia / Body	0.54	0.50–0.59	0.020
	PT / Ant.VIb	1.26	1.16–1.33	0.051
	URS / BW URS	1.04	0.89–1.14	0.069
	URS / 2HT	0.86	0.72–1.11	0.075
	Cauda / BW Cauda	0.83	0.70–0.94	0.070
	Cephalic setae / Ant.IIIBW	2.13	1.50–3.00	0.324
	Setae on Tergum I / Ant.IIIBW	2.13	1.50–3.00	0.378
	Setae on Tergum VIII / Ant.IIIBW	2.08	1.50–3.00	0.352
	Setae on ANT.III / ANT.IIIBW	0.75	0.75	0
	Setae on hind tibia / MW Hind tibia	1.46	1.25–1.67	0.146
	SIPH / Cauda	1.20	1.00–1.43	0.139
	SIPH / SIPH BW	0.83	0.68–1.11	0.091
	SIPH / SIPH DW	2.09	1.67–2.86	0.274
	MT on Tergum IV / Ant.V	2.06	1.69–2.19	0.130
	Setae on SIPH / SIPH DW	1.26	0.88–1.50	0.112
	Setae on MT of Tergum IV / Ant.IIIBW	1.54	1.00–2.00	0.261

* Abbreviations. Ant. I, II, III, IV, V, VIb, antennal segments I, II, III, IV, V and the base of antennal segment VI, respectively; PT, processus terminalis; Ant.IIIBW, the basal width of antennal segment III; URS, ultimate rostral segment; BW URS, basal width of ultimate rostral segment; 2HT, second hind tarsal segment; MW hind tibia, mid-width of hind tibia; SIPH, siphunculi; SIPH BW, basal width of siphunculi; SIPH DW, distal width of siphunculi; MT on Tergum IV, marginal tubercle on abdominal tergite IV; BW of MT on Tergum IV, basal width of marginal tubercle on abdominal tergite IV; SW of MT on Tergum IV, width of marginal tubercle on abdominal tergite IV where seta distributing; DW of MT on Tergum IV, distal width of marginal tubercle on abdominal tergite IV; BW Cauda, basal width of cauda.

Taxonomy

Chucallis Tao

http://species-id.net/wiki/Chucallis

Chucallis Tao, 1964: 221. Type species: *Myzocallis bambusicola* Takahashi, 1921; by monotypy.
Chucallis Tao: Tao 1990: 139; Zhang 1999: 227–228; Qiao et al. 2005: 184.

Generic diagnosis. In alate viviparae, frontal tubercle not developed. Head without epicranial suture, clypeus without any processes. Antennae 6-segmented, processus terminalis slightly longer than base of the segment. Head and thorax without any dorsal processes. Abdominal tergites with dorsal spinal processes and developed marginal processes. Dorsal setae of body long and pointed, thick or fine. Rostrum short and stout.

Wing veins without black borders. Fore coxae distinctly expanded, mid- and hind coxae normal. First tarsal chaetotaxy: 5, 5, 5. Siphunculi truncated, slightly longer than their basal diameters. Cauda knob-shaped. Anal plate bilobed. Gonapophyses fused.

In embryos, dorsal setae of body thick and long, pointed or stout. Dorsum of head with 2 pairs of anterior and 2 pairs of posterior setae. Thoracic tergites each with 1 pair of spinal and 1 pair of marginal setae, respectively. Abdominal tergites I–VII each with 1 pair of spinal and 1 pair of marginal setae, respectively, and spinal setae on tergites III, V and VII slightly displaced pleurally; tergite VIII with 2 dorsal setae. Siphunculi visible.

Distribution. Only found in China (Zhejiang, Fujian, Sichuan, Gansu, Taiwan and Hong Kong).

Host plants. Plants of Gramineae/Poaceae, feeding on bamboos, such as *Bambusa stenostachya* Hack., *Dendrocalamus latiflorus* Munro, *Phyllostachys heteroclada* Oliv., *Thamnocalamus spathaceus* (Franch.) Soderstr. and *Indocalamus tessellatus*.

Biology. The species colonize the undersides of the leaves of their host plants.

Comments. The genus is similar to *Subtakecallis* Raychaudhuri & Pal and *Takecallis* Matsumura (Quednau 2003), but the alatae differ from those genera in having the clypeus without a nose-like processus (*Subtakecallis* and *Takecallis*: the clypeus with a nose-like processus), and some abdominal tergites with long, finger-like, seta-bearing spinal and marginal processes, the marginal ones on tergite IV being especially large (*Subtakecallis* and *Takecallis*: some abdominal tergites with small processes, not longer than their basal width).

Key to species of *Chucallis*

(Alate viviparous females)

1 Body dark purple to black in life; marginal processes on abdominal tergite IV about 0.60 times as long as antennal segment V; abdominal tergite VIII with 4 setae; siphunculi shorter, about 0.7 times as long as cauda .... ***C. bambusicola* (Takahashi)**

– Head and thorax pale brown, abdomen dark green in life; marginal processes on abdominal tergite IV 1.69–2.19 times as long as antennal segment V; abdominal tergite VIII with 5 or 6 setae, occasionally 7 or 8 ones; siphunculi longer, 1.00–1.43 times as long as cauda..... ..... ***C. latusigladius* Qiao, Jiang & Chen, sp. n.**

***Chucallis bambusicola* (Takahashi)**

http://species-id.net/wiki/Chucallis_bambusicola

Myzocallis bambusicola Takahashi 1921: 70

Agrioaphis bambusicola Takahashi 1931: 85; Tseng and Tao 1938: 209.

Chucallis bambusicola (Takahashi): Tao 1964: 62; Tao 1990: 139; Zhang 1999: 228; Qiao et al. 2005: 184–186.

Specimens examined. 2 alate viviparous females, 4 May 1975, Zhejiang (Hangzhou City), No. 5567, on *Phyllostachys heteroclada*, coll. T.S. Zhong; 1 alate viviparous female, 7 August 1987, Gansu (Chongxin County), No. 8858, on a kind of bamboo, coll. T.S. Zhong; 2 alate viviparpus females and 2 nymphs, 25 July 1986, Gansu (Longxi County), No. 8507, on a kind of bamboo, coll. G.X. Zhang, T.S. Zhong & J.H. Li; 4 alate viviparpus females and 6 nymphs, 22 July 1985, Gansu (Tianshui City, Maijishan Mountain), No. 8092, on a kind of bamboo, coll. G.X. Zhang & T.S. Zhong; 8 alate viviparpus females and 3 nymphs, 1 August 1987, Gansu (Gangu County), No. 8819, on *Thamnocalamus spathaceus*a, coll. T.S. Zhong.

Distribute. CHINA: Zhejiang (Hangzhou), Gansu (Chongxin, Longxi, Tianshui, Gangu), Sichuan (Chengdu), Taiwan and Hong Kong (Tao 1990).

Biology. On shoots and undersides of leaves of bamboos (*Bambusa stenostachya*, *Dendrocalamus latiflorus*, *Phyllostachys heteroclada*, *Thamnocalamus spathaceus*). The species is very active, jumping when disturbed. Anholocyclic in Taiwan (Takahashi 1921), and sexual morphs are unrecorded (Blackman and Eastop 1994).

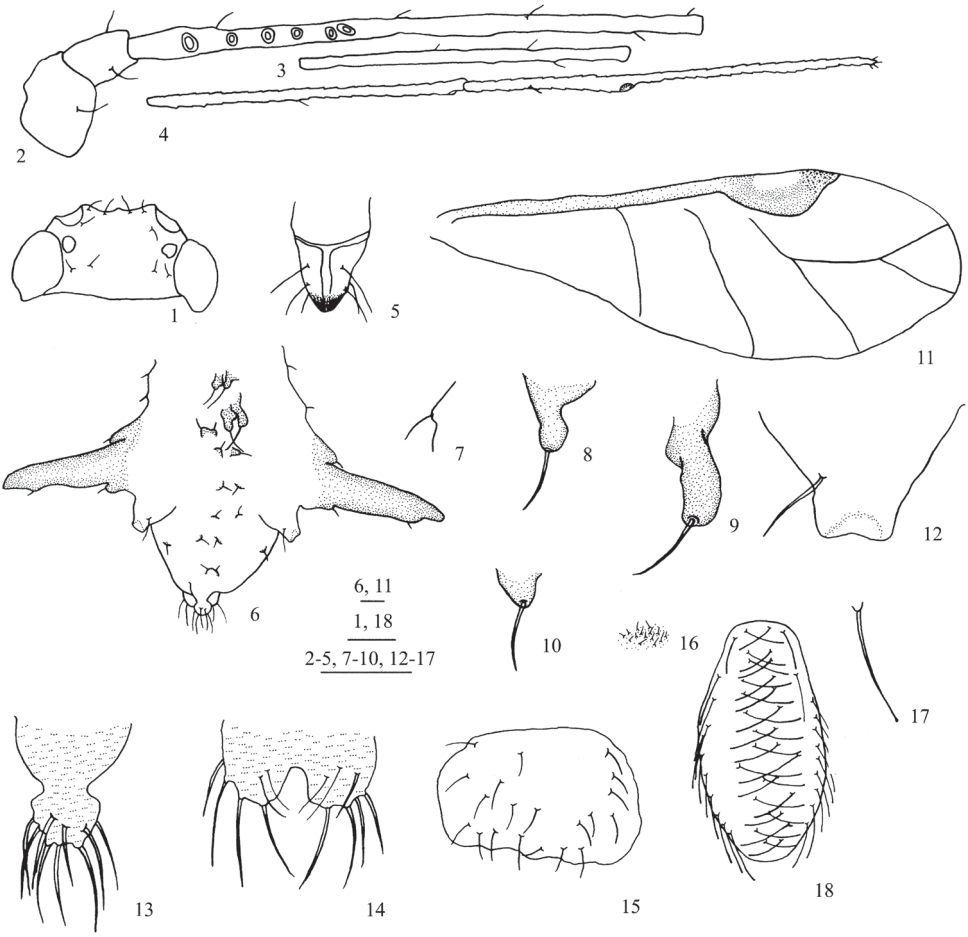
***Chucallis latusigladius* Qiao, Jiang & Chen, sp. n.**
urn:lsid:zoobank.org:act:2A359DA9-53F8-4D15-8348-41588AC1AF9D
http://species-id.net/wiki/Chucallis_latusigladius
Figures 1–42

Locus typicus. China (Zhejiang, 28.39533°N, 118.84490°E, altitude 450m).

Etymology. The species is named for the very large, broadsword-shaped marginal processes on abdominal tergite IV. The specific name combines "*latus* (Latin, =broad, wide)" and "*gladius* (Latin, =sword)".

Descriptions. *Alate viviparous female*: Body oval (Fig. 19), head and thorax pale brown, abdomen dark green in life (Figs. 36–38).

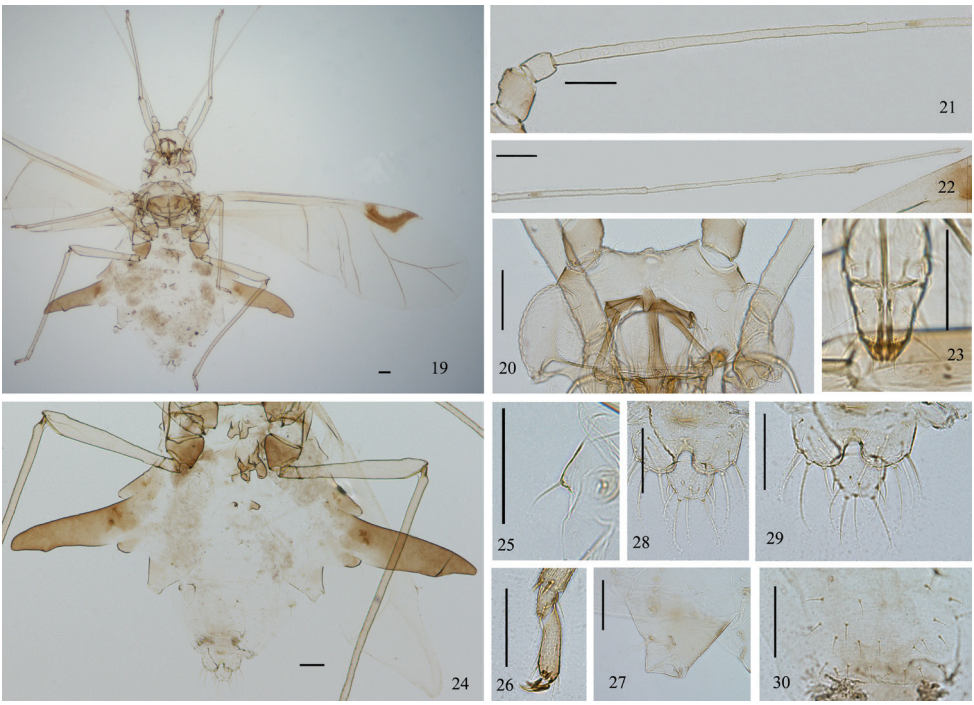
Mounted specimens. Head and thorax pale brown, dorsal spinal processes, marginal processes and seta-bearing processes brown; antennal segment I pale brown, antennal segments II-VI unpigmented; apex of rostrum brown; femora, tibiae and tarsi pale brown; siphunculi, cauda, anal plate and genital plate pale brown; wing veins pale and unbordered, basal and inner margins of pterostigma with dark fuscous forming a conspicuous crescent-shaped mark (Fig. 19); the other parts of specimens pale. Posterior margin of pronotum with short wrinkles; distal 1/3 of antennal segment III and segments IV–VI with sparse imbrications, middle of inner margin of segment I slightly swollen (Figs. 2, 21); distal 1/4 of tibiae with spinules, tarsi with spinulose short imbrications; dorsal spinal and marginal processes with sparse spinules or spinulose short stripes; cauda, anal plate and genital plate with sparse spinulose short stripes. Dorsal setae of body thick and pointed, long or short. Head with 1 pair of cephalic setae, 2 pairs of antennal tubercular setae and 2 pairs of posterior dorsal setae between eyes (Fig. 1); pronotum with 2 pairs of spinal and 1 pair of posterior marginal setae; abdominal tergite I with 1 pair of spinal and 1



Figures 1–18. *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n. Alate viviparous female: **1** dorsal view of head **2** antennal segments I–III **3** antennal segment IV **4** antennal segments V–VI **5** ultimate rostral segment **6** dorsal view of abdomen, showing processes **7** marginal tubercle on abdominal tergite I **8** spinal tubercle on abdominal tergite I **9** spinal tubercle on abdominal tergite II **10** spinal tubercle on abdominal tergite III **11** fore wing **12** siphunculus **13** cauda, **14** anal plate, **15** genital plate **16** gonapophyses. Embryo: **17** dorsal seta of body **18** setal pattern. Scale bars = 0.10 mm.

pair of marginal setae, each on dorsal processes; tergite VIII with 5 or 6 setae, occasionally 7 or 8, 1 pair of them on dorsal spinal processes. Length of cephalic setae, marginal setae on abdominal tergite I and dorsal setae on tergite VIII 0.038–0.058, 0.029–0.058 and 0.029–0.058, respectively, all 1.50–3.00 times as long as basal width of antennal segment III.

Head. Median front and antennal tubercles un-developed, frontal profile shallow "W"-shaped (Figs. 1, 20). Dorsum of head without any processes. Antennae fine and long (Figs. 2–4, 21, 22), 6-segmented, 0.79–0.88 times as long as body; length in pro-



Figures 19–30. *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n. Alate viviparous female: **19** dorsal view of body **20** dorsal view of head **21** antennal segments I–III **22** antennal segments IV–VI **23** ultimate rostral segment **24** dorsal view of abdomen **25** marginal tubercle and seta on abdominal tergite I **26** hind tarsal segments **27** siphunculus **28** cauda **29** anal plate **30** genital plate. Scale bars = 0.10 mm.

portion of segments I–VI: 12 : 9 : 100 : 60 : 60 : 36+47, respectively; processus terminalis 1.16–1.33 times as long as base of the segment. Secondary rhinaria round, with sparse and short ciliated, 4–7 ones distributing on basal 1/3–2/5 of antennal segment III. Antennal setae short and pointed, segments I–VI each with 2 or 3, 2 (occasionally 1), 5–7 (occasionally 3 or 4), 1–3, 1 (occasionally 2), 1+0 setae, respectively; apex of processus terminalis with 4 or 5 short pointed setae; setae of segment V distributing on basal 1/3 of the segment; length of setae on antennal segment III 0.75 times as long as basal width of the segment. Rostrum thick and short, apex reaching anterior margin of mesosternum; ultimate rostral segment stout, wedge-shaped (Figs. 5, 23), 0.89–1.14 times as long as its basal width, 0.72–1.11 times as long as second hind tarsal segment, with 3 pairs of primary and 3 pairs of accessory setae.

Thorax. Dorsum of thorax without any processes. Legs slender. Fore coxae distinctly expanded, mid- and hind coxae normal. Hind femur 0.98–1.09 times as long as antennal segment III, hind tibia 0.50–0.59 times as long as body. Setae on legs short, stiff and pointed, apex of tibiae with 3 peg-shaped setae (Fig. 26), distinct differ from other setae. Length of setae on hind tibia 1.25–1.67 times as long as mid-width of the segment. First tarsal chaetotaxy: 5, 5, 5. Wing veins pale without bordered; forewing with radial sector absent or with basal half indistinct; basal and

Figures 31–34. *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n. Dorsal view of body: **31** 1st instar nymph **32** 2nd instar nymph **33** 3rd instar nymph **34** 4th instar nymph. Scale bars = 0.10 mm.

inner margins of pterostigma thickly marked with brown fuscous (Figs. 11, 19); hind wings with two oblique veins.

Abdomen. Abdominal tergites with developed spinal and marginal processes (Figs. 6, 24). Tergite I: 1 pair of conical spinal processes (Fig. 8), 0.03–0.08 long, 0.57–1.38 times as long as its basal width, 0.75–2.75 times as long as its distal width; apex of each tubercle with 1 thick, long and pointed seta, 0.06–0.14 long, 1.17–2.14 times as long as length of spinal processes; marginal processes not well developed (Figs. 7, 25), 0.019–0.029 long, 0.50 times as long as their basal widths. Tergite II: 1 pair of long conical spinal processes (Fig. 9), 0.096–0.173 long, 0.73–1.64 times as long as their basal widths, 2.50–4.50 times as long as their distal widths; a spinal seta on apex of each spinal tubercle, 0.067–0.086 long, 0.60–0.67 times as long as length of spinal processes; marginal processes conical, 0.029–0.048 long, 0.25–0.50 times as long as their basal widths; marginal setae as long as marginal processes. Tergite III: 1 pair of spinal processes (Fig. 10), which are close to each other at base, 0.019–0.048 long, 0.75–0.80 times as long as their basal widths;

a spinal seta on apex of each spinal processus, 0.038–0.086 long, 1.60–3.00 times as long as length of spinal processes; 1 pair of pleural setae not on processes; marginal processes 0.106–0.182 long, 0.59–1.19 times as long as their basal widths; marginal setae 0.029–0.048 long, 0.16–0.30 times as long as marginal processes. Tergite IV: 1 pair of spinal processes, 0.048–0.086 long, 0.71–1.50 times as long as its basal width; spinal setae short and pointed, 0.028–0.048 long, about 0.50 times as long as spinal processes; marginal processes distinctly developed, broadsword-shaped, almost vertical with body in life (Figs. 36–38); 1.69–2.19 times as long as antennal segment V, 3.75–4.73 times as long as their basal widths; each with 1 seta on distal 1/3 of inner margin, 0.019–0.029 long, 1.00–2.00 times as long as basal width of the antennal segment III. Tergite V: 1 pair of spinal processes, 0.010–0.048 long, 0.25–1.67 times as long as their basal widths; spinal setae 0.048 long, 0.20–1.00 times as long as spinal processes; marginal processes 0.048–0.067 long, 0.45–0.78 times as long as their basal widths, marginal setae 0.058–0.077 long, 0.86–1.60 times as long as marginal processes, sometimes with 1 pair of short and pointed pleural setae on small processes. Tergite VI: 1 pair of spinal processes, 0.019–0.029 long, 0.43–0.67 times as long as their basal widths; each with 1 seta at apex, 0.029–0.038 long, 1.00–2.00 times as long as spinal processes. Tergite VII: 1 pair of spinal processes, 0.01–0.019 long, 0.33–0.50 times as long as their basal widths; 1 pair of spinal setae on spinal processes, 0.048–0.058 long, 2.50–3.00 times as long as spinal processes; 1 pair of marginal processes, 0.029–0.048 long, 0.50–0.72 times as long as their basal widths, marginal setae on marginal processes 0.048–0.077 long, 2.50–4.00 times as long as basal width of antennal segment III; 1 pair of pleural setae not on processes. Tergite VIII: 1 pair of spinal processes, 0.010–0.038 long, 0.33–1.00 times as long as their basal widths; pleural and marginal setae not on processes. Siphunculi truncated (Figs. 12, 27), smooth, without flange, 0.68–1.11 times as long as their basal widths, 1.67–2.86 times as long as their distal widths, 1.00–1.43 times as long as cauda; each with 1 long seta at base of siphunculi, length of seta 0.88–1.50 times as long as distal width of siphunculi**.** Cauda knob-shaped (Figs. 13, 28), 0.70–0.94 times as long as its basal width; with 9–12 long or short setae. Anal plate bilobed (Figs. 14, 29), with 18–23 long or short setae. Genital plate transversely oval (Figs. 15, 30), with 20–32 fine setae. Gonapophyses fused, with 11–15 short pointed setae (Fig. 16).

Embryo (in alate viviparous female). Dorsal setae of body thick, long and capitate at apex, with distinct basal processes (Fig. 17). Setal pattern (Fig. 18): dorsum of head with 2 pairs of anterior and 2 pairs of posterior setae; pro-, meso- and metanotum each with 1 pair of spinal and 1 pair of marginal setae, respectively; abdominal tergites I–VII each with 1 pair of spinal and 1 pair of marginal setae, respectively; spinal setae on tergites III, V and VII slightly displaced pleurally; tergite VIII with 2 spinal setae. Siphunculi visible.

First instar nymph. Body oval, head and thorax yellow green, and abdomen dark green in life (Fig. 39). Mounted specimens pale, with brown dorsal processes (Fig. 31). Body 0.80–1.06 long and 0.50–0.62 wide. Antennae 4-segmented, segment III

Figures 35–38. *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n. **35** A population on the underside of leaf of host plant **36–38** Dorsal view of alate viviparous female in life.

0.208–0.213 long, basal diameter of the segment 0.0144–0.0192. Abdominal tergites I–VII each with 1 pair of spinal and 1 pair of marginal processes, respectively; spinal processes on tergites III, V and VII slightly displaced pleurally; tergite VIII with 2 spinal processes. Each processus with one seta, thick, long and capitate at apex, same as setae of embryos. Spinal processes on tergite II 0.017–0.022 long, with setae 0.095–0.110 long; marginal processes on tergite IV 0.05–0.06 long. Siphunculi truncated. Cauda triangle, with blunt round apex. Anal plate semicircle.

Second instar nymph. Body 1.02–1.27 long and 0.75–0.94 wide (Figs. 32, 40). Antennae 5-segmented, segment III 0.20–0.30 long, basal diameter of the segment 0.0144–0.0192. Spinal processes on tergite II 0.018–0.038 long, with setae 0.087–0.136 long; marginal processes on tergite IV 0.12–0.16 long. The other characteristics similar to first instar nymph.

Figures 39–42. *Chucallis latusigladius* Qiao, Jiang & Chen, sp. n. Dorsal view of nymph in life: **39** 1st instar nymph **40** 2nd instar nymph **41** 3rd instar nymph **42** 4th instar nymph.

Third instar nymph. Body 1.31–1.66 long and 1.11–1.43 wide (Figs. 33, 41). Antennae 6-segmented, segment III 0.21–0.25 long, basal diameter of the segment 0.0192–0.024. Spinal processes on tergite II 0.04–0.05 long, with setae 0.137–0.143 long; marginal processes on tergite IV 0.24–0.31 long. The other characteristics similar to first instar nymph.

Fourth instar nymph. Body 1.72–2.06 long and 1.57–1.86 wide (Figs. 34, 42). Antennae 6-segmented, segment III 0.37–0.40 long, basal diameter of the segment 0.0192–0.024. Spinal processes on tergite II 0.05–0.08 long, with setae 0.14–0.18 long; marginal processes on tergite IV 0.36–0.42 long. The other characteristics similar to first instar nymph.

Specimens examined. Holotype: alate viviparous female, **CHINA:** Zhejiang (Suichang County, Jiulongshan Mountain, 28.39533°N, 118.84490°E, altitude 450m), 4 June 2011, No. 26816–1–1–1, on *Indocalamus tessellatus*, coll. J. Chen, Q.H. Liu & X.T. Li. Paratypes: 8 alate viviparous females, 2 first instar, 6 second instar, 4 third

instar and 6 fourth instar nymphs, with the same collection data as holotype; 4 alate viviparous females, **CHINA:** Fujian (Jiangle County, Bailian District, Yujiaping Village, Longqishan Mountain, 26.52045°N, 117.30568°E, altitude 890m), 17 July 2011, on *Indocalamus tessellatus*, coll. J. Chen, Q.H. Liu & X.T. Li.

Specimen depositories. All the type specimens of the new species and the other specimens examined are deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

Taxonomic notes. The new species is similar to the type species *C. bambusicola* (Takahashi), but differs in colour in life and morphology by the characters given in the key.

Host plant. *Indocalamus tessellatus*.

Biology. It **c**olonizes the underside of the leaves of the host plant (Fig. 35).

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