

## ARTIGO / ARTÍCULO / ARTICLE

# A new species of *Heteraphorura* Bagnall, 1948 (Collembola, Poduromorpha, Onychiuridae) from Apennine Mountains (Tuscany, Italy).

Javier I. Arbea

c/ Ría de Solía 3, ch. 39. E-39610 El Astillero (Cantabria, España). e-mail: jarbeapo@gmail.com

**Abstract:** A new springtail species of the genus *Heteraphorura* Bagnall, 1948 from Apennine Mountains (Tuscany, Italy) is described. *Heteraphorura steineri* sp. nov. is characterized by its chaetotaxy, without chaeta m1 on abdominal terga I-III, and the distribution of dorsal (30/011/11023) pseudocelli that allow to distinguish it from the other congeneric species. A key of the Euro-asiatic species of *Heteraphorura* is provided.

**Key words:** Collembola, chaetotaxy, identification key, *Heteraphorura*, new species, Italy.

**Resumen:** Una nueva especie de *Heteraphorura* Bagnall, 1948 (Collembola, Poduromorpha, Onychiuridae) de los Montes Apeninos (Toscana, Italia). Se describe una nueva especie de colémbolo del género *Heteraphorura* Bagnall, 1948 encontrado en los Montes Apeninos (Toscana, Italia). *Heteraphorura steineri* sp. nov. se caracteriza por su chaetotaxia, con la seda m1 ausente en los terguitos abdominales I-III, y la distribución de los pseudocelos dorsales (30/011/11023), que permiten diferenciarla de otras especies del género. Se incluye una clave de identificación de las especies euro-asiáticas de *Heteraphorura*.

**Palabras clave:** Collembola, chaetotaxia, clave de identificación, *Heteraphorura*, nueva especie, Italia.

**Recibido:** 13 de junio de 2014  
**Aceptado:** 16 de junio de 2014

**Publicado on-line:** 2 de julio de 2014  
urn:lsid:zoobank.org:pub:10D75480-FA97-4614-A492-C26110C29B27

## Introduction

The genus *Heteraphorura* was erected by Bagnall (1948) with type species *Onychiurus variotuberculatus* Stach, 1934. Later, Weiner (1996) and Pomorski (1998, 2002) redefined the genus *Heteraphorura* and now it appears as a monophyletic clade within Hymenaphorurini, with three diagnostic apomorphies: reduction of furca to a small area of fine granulation with 4 microchaetae arranged in one row, lack of dorsal pseudocelli on abdominal tergum III and presence of 7 modified chaetae on unpaired anal valve (Pomorski, 2002).

According to the database of Collembola of the World (Bellinger *et al.*, 1996-2014), the genus *Heteraphorura* includes 15 species, to which must be added *Paronychiurus imadatei* Yosii, 1956, that fully fit the above definition of the genus, and the new species here described. One of the species currently placed in the genus *Heteraphorura* is insufficiently described and exhibits characters that are not those of the genus. In the checklist given below, an asterisk (\*) indicates that the assignment of such species requires confirmation.

On the basis of the shape of PAO vesicles can be distinguished three groups of species within the genus *Heteraphorura*:

- Nearctic group (7a—N., 7b—S. and 8—Pacific North American biogeographic provinces after Christiansen & Bellinger, 1995). Vesicles in PAO simple or multilobed, located parallelly to the long axis of the organ.

- *Heteraphorura bima* (Christiansen & Bellinger, 1980)
  - *H. casa* (Christiansen & Bellinger, 1980) (syn. *Heteraphorura cassa* (sic) Pomorski, 2002)
  - *H. intricata* Pomorski, 2002
  - *H. justynae* Pomorski, 2002
  - *H. subtenuis* (Folsom, 1917)
  - *H. tala* (Christiansen & Bellinger, 1980)
- Euro-asiatic group (2a—European and 2b—N. Eurasian biogeographic provinces after Christiansen & Bellinger, 1995). Vesicles in PAO simple or multilobed, located perpendicularly or oblique to the long axis of the organ.
    - *H. carpatica* (Stach, 1954)
    - (\*) *H. edentata* (Kos, 1939). For the presence of 2+2 pseudocelli on abdominal tergum III, this species departs from *Heteraphorura*.
    - *H. orientalis* (Martynova, 1976)
    - *H. steineri* sp. nov.
    - *H. variotuberculata* (Stach, 1934) (syn. *Onychiurus variotuberculatus* var. *terricola* Kos, 1940, syn. *Onychiurus setiventris* Butschek, 1948)
  - Oriental group (3a—Sino-Japanese and 4—W. and Central Asian biogeographic provinces after Christiansen & Bellinger, 1995). Vesicles in PAO compound.
    - *H. conjungens* (Börner, 1909)
    - *H. japonica* (Yosii, 1967) and *H. japonica* ssp. *kyotensis* Yoshii, 1996
    - *H. longisetosus* (Lee & Park, 1986)
    - *H. pseudoseolagensis* (Martynova, 1981)
    - *H. seolagensis* (Lee, 1974)
    - *H. imadatei* (Yosii, 1956) **comb. nov.** Originally described within the genus *Onychiurus* (*Paronychiurus*) by Yosii (1956), later placed in *Onychiurus* (*Japonychiurus*) by Yoshii (1996).

## Material and methods

Specimens were mounted in Hoyer medium, after clearing in Nesbitt solution. Material is deposited in the Museo Nacional de Ciencias Naturales, Madrid, Spain (MNCN).

In the description it was used the nomenclature of morphological features as proposed by Jordana *et al.* (1997), Pomorski (1998, 2002) and Weiner (1996). Labial papillae type is named after Fjellberg (1999). Labium areas and chaetal nomenclature follow Massoud (1967) and D'Haese (2003). Chaetae on anal valves are recognised after Yoshii (1996). Pseudocellar formulae are the number of pseudocelli by half-tergite (dorsally) or half-sternite (ventrally) as follows: head anterior, head posterior/ Th. I, Th. II, Th. III/Abd. I, Abd. II, Abd. III, Abd. IV, Abd. V. Tibiotarsus chaetotaxy formula follows Deharveng (1983), and is expressed as: total number of chaetae (number of chaetae in row C, number of chaetae in row B, number of basal chaetae in rows A+T).

**Abbreviations used:** AIIIIO—sensorial organ of Ant. III, Th.—thoracic segments, Abd.—abdominal segments, Ant.—antennal subsegments, PAO—postantennal sense organ, pso—pseudocellus/pseudocelli, psx—parapseudocellus/parapseudocelli.

## Taxonomic section

### *Heteraphorura steineri* sp. nov. (Figs. 1-15, Table I)

*Onychiurus apuanus* Steiner in Franz, 1975 (*nomen nudum*)

**Type locality.** Stazzena, Tuscany, Apennine Mountains (Italy), 1000 m.

#### Type material.

**Holotype:** Female (mounted on slide labelled Sp305): Italy, Apennine Mountains, Tuscany, Stazzena, 1000 m, beech forest, leaf litter, 10.IX.1953, H. Franz leg. **Paratypes:** Four males, three females and one juvenile specimen (mounted on slides labelled Sp305) collected together with holotype. Holotype and paratypes deposited in MNCN.

#### Description.

Colour white. Size, without antennae, males 1.4-1.7 mm, females 1.7-1.9 mm (Holotype - 1.8 mm). Shape of body cylindrical, robust, with conically narrowing end of abdomen (Abd. V and VI) (Fig. 1). Granulation of dorsal side of the body distinct, regular, stronger around pso. Usually 10-11 grains around each pso (Figs. 9-11).

Head. Antennae distinctly shorter than head. AIIIO consists of: 5 conical papillae; 2 sensory rods; 2 finely granulated, spherical sensory clubs; 5 guard chaetae. On Ant. III the microsensillum is located laterally, slightly below AIIIO. Ant. IV with subapical organite and ms located distinctly above row of posterior chaetae (Fig. 3). Ant. II with 16 chaetae. Ant. I with 8 chaetae. Antennal base well marked. PAO in a long cuticular groove with 2 border chaetae, consisting of 20-25 simple and multilobed vesicles located perpendicularly or oblique to the long axis of the organ (Fig. 2). Dorsal cephalic chaeta d0 absent (Fig. 1). Mandible with strong molar plate and 4 apical teeth. Maxilla bearing 3 teeth and 6 short lamellae. Maxillary palp simple with 1 basal chaeta (bc), two sublobal hairs (Fig. 12). Labium with 7 proximal, 4 basomedian (E, F, G, f) and 6 basolateral chaetae (Fig. 4); labial type AC, papillae A-E respectively with 1, 4, 0, 3 and 3 guard chaetae. Head ventrally with 4+4 postlabial chaetae along ventral groove (Fig. 4).

Pso formula 30/011/11023. Subcoxae and ventral part of body without pso, psx invisible. Localization of pso is presented in Fig. 1.

Body chaetotaxy. Dorsal chaetotaxy usually symmetrical, ordinary chaetae well differentiated into meso and macrochaetae, as in Fig. 1. Th. I tergum with 7+7 dorsal chaetae. Th. II-III tergum with lateral microsensilla and 3+3 chaetae along axis. Abd. I-III terga with 2+2 chaetae along axis (chaeta m1 absent) (Fig. 1). Abd. IV tergum with median m0 chaeta, sometimes with p0 chaeta. Abd. V tergum with two submedian chaetae (a0 and m0) asymmetrical. Abd. VI tergum with three median chaetae. Sterna of Th. I, II, and III without chaetae. Abd. ventral chaetotaxy as in Figs. 5-6.

Appendages. Subcoxa 1 of legs I-III with 4, 5 and 6 chaetae respectively. Tibiotarsi of legs I, II and III with 21 (3, 7, 11), 21 (3, 7, 11) and 20 (2, 7, 11) chaetae each (Figs. 13-14). Claw always with strong denticle. Empodial appendage with basal lamella, appendage length equals 2/3 of the inner edge of the claw (Figs. 13-14). Tubus ventralis usually with 7-8+7-8 chaetae (Figs. 5-6). Trace of reduced furca in shape of two symmetrical small patches of fine granulation with 4 small chaetae in one row posteriorly (Figs. 7-8); only one manubrial row of chaetae posterior to dental chaetae (Figs. 7-8).

Genital plate with about 10 chaetae in females, 28-30 chaetae in male. Male ventral organ situated on abdominal sternum III, above trace of reduced furca, consists of 22-32 thick, weakly curved chaetae, located closely together in elliptical integumentary pocket (Fig. 7). Anal valves with numerous acuminate chaetae; each lateral valve with a0, 2a1; unpaired anal valve with chaetae a0, 2a1,

2a2, b0, 2b1, 2b2, c0, 2c1, 2c2, 5-7 of which are thickened chaetae, curved upwards: 2a1, b0, 2b1, 2b2 (b1 sometimes as normal or slightly thickened chaetae) (Figs. 15). Anal spines set closely together, rather strong, weakly curved, pointed, with distinct basal papillae, as long as the claw.

**Variability.** It is observed asymmetrical chaetotaxy and pseudocellar aberrations, manifested as reduction of pseudocelli on abdominal tergum V (2+3 pso in two adult specimens).

**Etymology.** Dedicated to Walter Steiner, an excellent Collembola specialist in MNCN, who nominated this species as *Onychiurus apuanus* n. sp., although its description remained unpublished. Franz (1975) published this species without description (*nomen nudum*).

**Discussion.** The new species belongs to the Euro-asiatic group of species with vesicles in PAO simple or multilobed, located perpendicularly or oblique to the long axis of the organ. Main differences between *H. steineri* sp. nov. and these species are summarized in Table I. The new species is more similar to *H. variotuberculata*. They differ in the chaetotaxy without chaeta m1 on abdominal terga I-III in the new species (chaeta m1 present in *H. variotuberculata*).

#### Key to the Euro-asiatic species of *Heteraphorura*.

- |   |                             |
|---|-----------------------------|
| 1. Abdominal terga I-III with submedian chaeta m1 present .....   | 2                           |
| - Abdominal terga I-III without submedian chaeta m1 .....   | 3                           |
| 2. Empodial appendage length equals 2/3 inner edge of the claw; basis of antenna usually with 3 pso .....                     | <i>H. variotuberculata</i>  |
| - Empodial appendage very short, rudimental, do not extend to the denticle on claw; basis of antenna usually with 2 pso ..... | <i>H. carpatica</i>         |
| 3. Basis of antenna with 2 pso .....  | <i>H. orientalis</i>        |
| - Basis of antenna with 3 pso .....   | <i>H. steineri</i> sp. nov. |

#### Acknowledgements

I am most grateful to Mercedes París, from the Museo Nacional de Ciencias Naturales in Madrid, for the loan of the specimens of the new species.

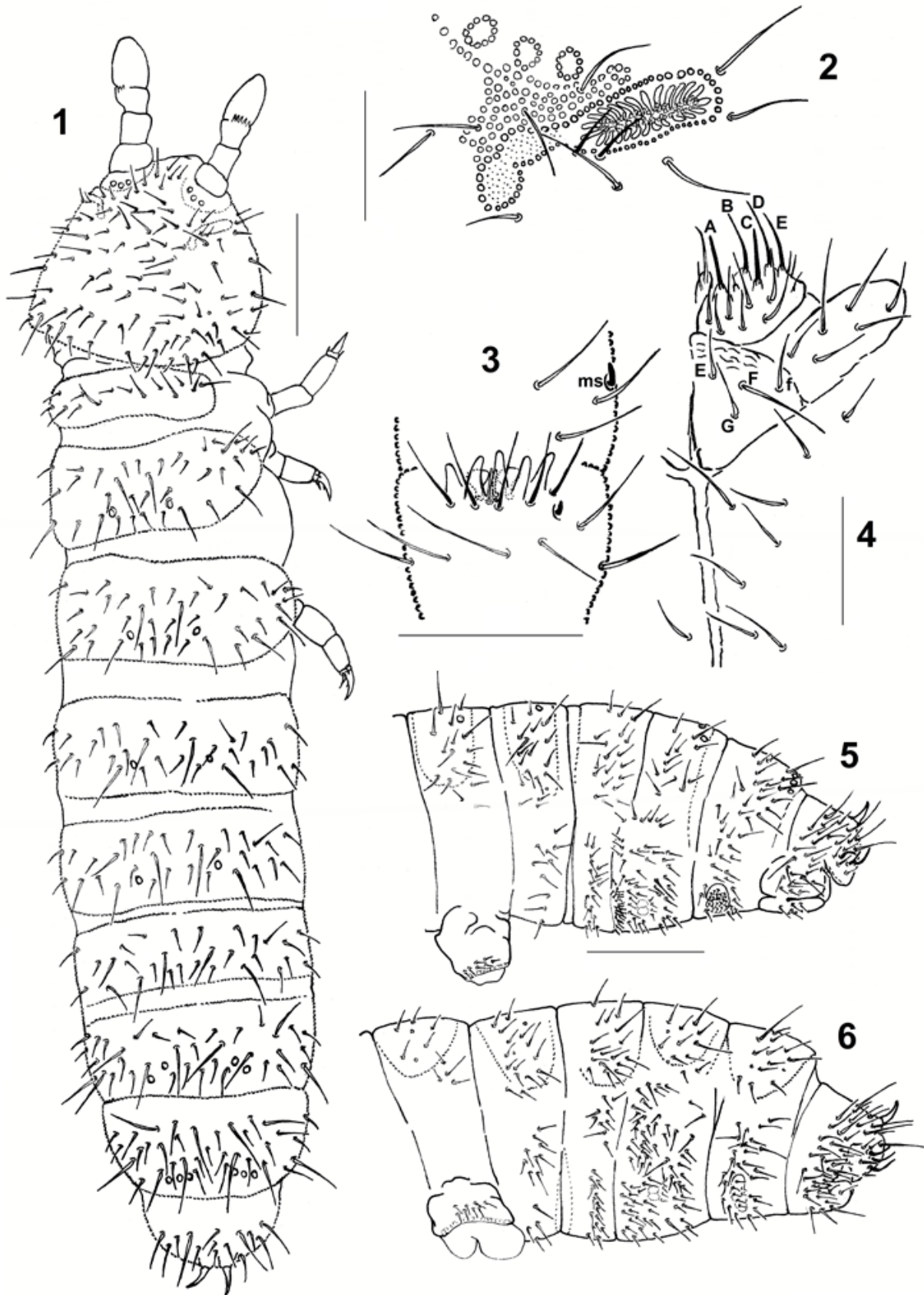
#### References

- Bagnall, R.S. 1948. Contribution towards a knowledge of the Onychiuridae (Collembola, Onychiuroidea). I-IV. Annals and magazine of Natural History, **11**(14): 631-642.
- Bellinger, P.F.; Christiansen, K.A. & Janssens, F. 1996–2014. *Checklist of the Collembola of the World*. Available online from <http://www.collembola.org> (accessed 30 May 2014).
- Christiansen, K.A. & Bellinger, P.F. 1995. The biogeography of Collembola. *Polskie Pismo Entomologiczne*, **64**: 279-294.
- Deharveng, L. 1983. Morphologie évolutive des Collemboles Neanurinae en particulier de la lignée Neanurienne. *Travaux du Laboratoire d'Ecobiologie des Arthropodes Edaphiques*, Toulouse, **4**(2): 1-63.

- D'Haese, C. 2003. Homology and morphology in Poduromorpha (Hexapoda, Collembola). *European Journal of Entomology*, **101**: 385-407.
- Fjellberg, A. 1999. The labial palp in Collembola. *Zoologischer Anzeiger*, **237**: 309-330.
- Franz, H. 1975. *Die Bodenfauna der Erde in Biozonotischer Betrachtung II*. Erdwiss. Forschung X. Verlag EF Steiner, Wiesbaden, 485 pp.
- Jordana, R.; Arbea, J.I.; Simón, C. & Luciáñez, M.J. 1997. *Collembola, Poduromorpha*. In: *Fauna Ibérica*, vol. 8. Ramos, M.A. et al. (Eds.). Museo Nacional de Ciencias Naturales, CSIC, Madrid, 807 pp.
- Massoud, Z. 1967. *Monographie des Neanuridae, Collemboles Poduromorphes à pièces buccales modifiées*. In: Delamare Deboutteville, C. & Rapoport, E.H. (Eds.). *Biologie de l'Amérique Australe*. Paris, CNRS, III, 7-399.
- Pomorski, R.J. 1998. Onychiurinae of Poland (Collembola: Onychiuridae). *Genus, International Journal of Invertebrate Taxonomy (Supplement)*: 1-201.
- Pomorski, R.J. 2002. Review of the North American *Heteraphorura* Bagnall, 1948 (Collembola: Onychiuridae) with description of two new species. *Insect Systematics & Evolution (Group 8)*, **33**(4): 457-470.
- Weiner, W.M. 1996. Generic revision of Onychiurinae (Collembola: Onychiuridae) with cladistic analysis. *Annales de la Société Entomologique de France (N.S.)*, **32**: 163-200.
- Yosii, R. 1956. Monographie zur Höhlencollembolen Japans. *Contributions from the Biological Laboratory, Kyoto University*, 3: 1-109.
- Yoshii, R. 1996. Identity of some Japanese Collembola IV. *Deuteraphorura* group of *Onychiurus* - continued. *Annales of the Speleological Institute of Japan (Iwaizumi)*, **14**: 1-15.

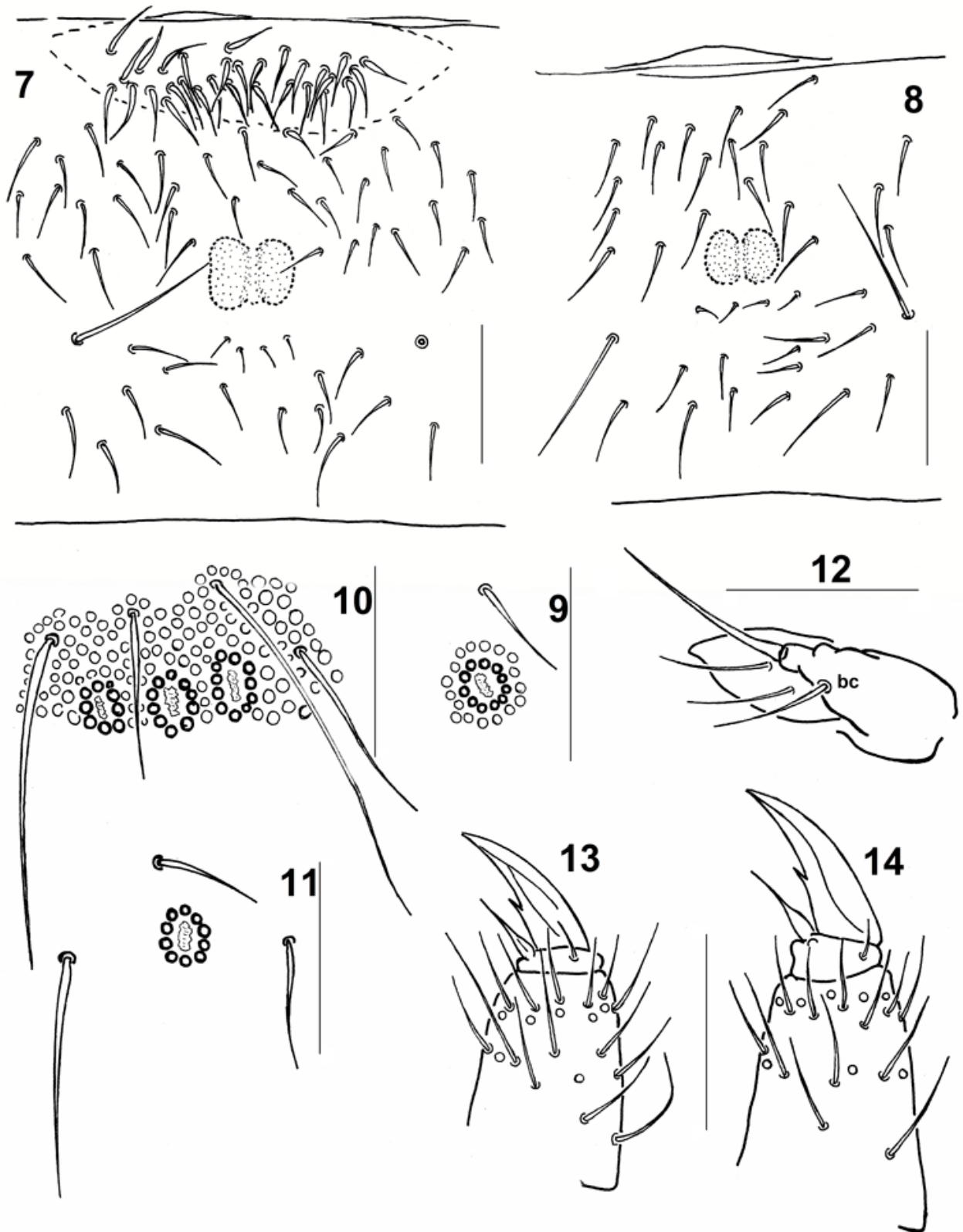
**TABLE I.** - Comparison of *H. steineri* sp. nov. with the other Euro-asiatic *Heteraphorura* with vesicles in PAO simple or multilobed, located perpendicularly or oblique to the long axis of the organ. Differences in **bold**. Emp = empodial appendage; claw = inner edge of the claw; - = absent; + = present; VT = ventral tube.

	<i>variotuberculata</i>	<i>carpatica</i>	<i>orientalis</i>	<i>steineri</i> sp. nov.
Pso dorsal	3(2)0/011/11022(3)	20/011/11023(2,4)	20/011/11022	30/011/11023
chaeta ml on Abd. I-III	+	+	-	-
Emp/claw	2/3	<b>1/4</b>	2/3	2/3
PAO vesicles	17-25	17-22	<b>25-28</b>	20-25
VT chaetae	8+8	8+8	<b>13-19+13-19</b>	7-8+7-8



Figs. 1-6.- *Heteraphorura steineri* sp. nov.

1.- Chaetotaxy and localization of pseudocelli on dorsal side of body. 2.- Postantennal organ. 3.- Antennal III sensory organ. 4.- Labium and postlabial chaetae. 5.- Ventral chaetotaxy of abdomen, male. 6.- Ventral chaetotaxy of abdomen, female. Scales: 0.2 mm (1, 5, 6), 0.05 mm (2, 3, 4).



Figs. 7-14.- *Heterophorura steineri* sp. nov.

7.- Chaetotaxy of central part of Abd. sternum IV, male ventral organ, remnant of furca. 8.- Chaetotaxy of central part of Abd. sternum IV, female, remnant of furca. 9.- Dorsal pso on Th. II. 10.- Dorsal pso on Abd. V. 11.- Dorsal pso on Abd. II. 12.- Maxillary palp. 13.- Distal part of leg I. 14.- Distal part of leg III. Scales: 0.05 mm.

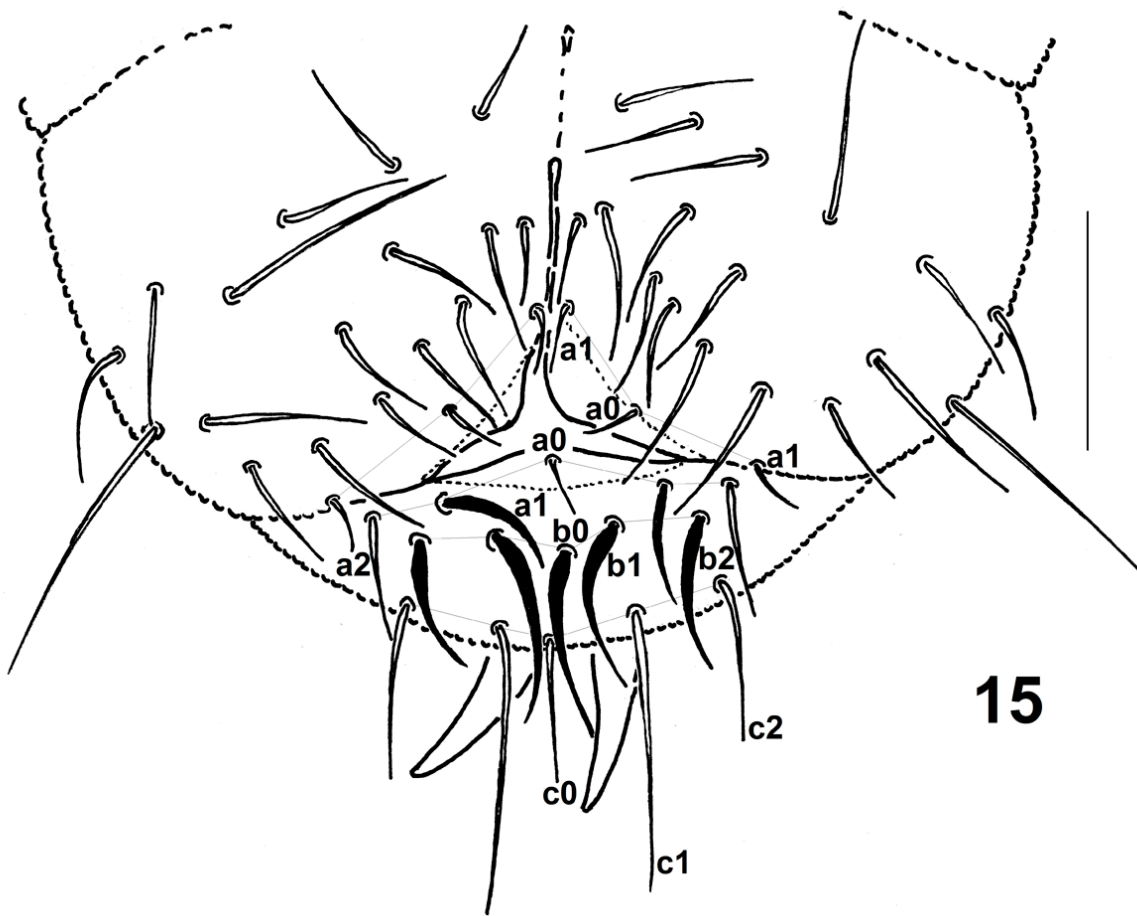


Fig. 15. - *Heteraphorura steineri* sp. nov. Anal valves. Scale: 0.05 mm.