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Two new species and descriptive notes for five *Pseudosinella* species (Hexapoda: Collembola: Entomobryidae) from West Virginian (USA) Caves

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Abstract

The present contribution gives a taxonomic account of the members of the springtail genus *Pseudosinella* Schäffer, collected during the 2004–2006 expeditions organized by Daniel Fong and David Culver to caves of eastern and southern West Virginia. These expeditions are part of an ongoing long-term effort to develop a complete inventory of the cave fauna of the state. The samples examined include seven species of *Pseudosinella*, two of which, *P. josemarii* **sp. nov.** and *P. meganporteri* **sp. nov.** are new to science. For five previously named species descriptive notes are given emphasizing new or incompletely described characters such as the dorsal and ventral head chaetotaxy, number of teeth in the ungulum of the maxilla, presence or absence of setae **a6** on the first abdominal segment, and lateral chaetotaxy of the fourth abdominal segment. Detailed analysis of the dorsal chaetotaxy of the head shows that Gisin's RST system of nomenclature confounds the identity of some macrosetae, hence, a new nomenclature system, denominated AMS, is proposed to more consistently identify macrosetae across all Lepidocyrtini. In addition, a system is proposed to describe variation in number of postlabial setae, their shape and ornamentation.

Key words: Lepidocyrtini, taxonomy, chaetotaxy, *P. josemarii* **sp. nov.**, *P. meganporteri* **sp. nov.**, *P. argentea*, *P. collina*, *P. gisini*, *P. orba*, *P. violenta*

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Introduction

As part of a continued survey of the biodiversity of caves in West Virginia (Fong *et al.* 2007), I received abundant material referable to the genus *Pseudosinella* Schäffer. Detailed study of this material revealed the presence of seven species, two of which are new to science and are herein described. I also took the opportunity to expand on the description of some previously described species, to explore the species level diagnostic utility of some new and little used characters. The characters discussed below are either used here for the first time to distinguish *Pseudosinella* species (e. g., presence or absence of seta **a6** on the first abdominal segment), or are already used to separate species in the allied genus *Lepidocyrtus* Bourlet (e.g., number of setae on the posterior margin of the fourth abdominal segment) but have never (or rarely) been applied to *Pseudosinella*. I also discuss some characters (e.g., dorsal head and postlabial chaetotaxies) routinely described for the group, but that from my perspective, need clarification in terms of their organization.

Types and all other specimens are deposited in the collection of the Illinois Natural History Survey, at the University of Illinois, Urbana-Champaign, Illinois, USA.

Abbreviations: In the descriptions of labial chaetotaxy, macrosetae (relative to other labial setae) are represented by upper case letters, microsetae by lower case, ciliate by underlining (Fig. 6), whereas the symbol for smooth setae is not modified (Fig. 78). Ant. (1–4), Th. (1–3), and Abd. (1–6) stand for antennal segment, thorax and abdomen, respectively.

Comments on character systems

Dorsal chaetotaxy of the head. In Lepidocyrtini, the dorsal chaetotaxy in the central region of the head is reduced (as compared to many Entomobryini and Seirini), relatively well organize and easy to understand. Traditionally the macrochaetotaxy of this region has been described using the RST system introduced by Gisin (1967). In Gisin's system, the two pairs of anterior macrosetae, which form a **R**ectangle, are part of the R series, the two pairs posterior to the R setae are denominated S and T (Fig. 24). However, it is clear that in North American species with four paired macrosetae, Gisin's S and T do not correspond to the same setae as in species with five paired macrosetae (cf. Figs. 24, 93). Thus, a more detailed identification system is necessary to resolve problems of primary homology determination. Here I extend to *Pseudosinella* (and Lepidocyrtini in general) a nomenclature system originally proposed by Szeptycki (1973) for macrosetae in Korean *Homidia*. This system was developed in more detail by Mari Mutt (1979) for *Dicranocentrus* Schött and later applied, with modifications, to *Entomobrya* Rondani (Jordana & Baquero 2005) and *Seira* Lubbock (Soto-Adames 2008).This system assigns the chaetotaxy of the central section of the head to three rows A(nterior), M(edial), and S(utural) (henceforth the AMS system). The most important characters in these rows thus far observed in Lepidocyrtini are the presence or absence of macrosetae, presence or absence of microseta **M0**, and position of setae **M1**/**S1** (I have not been able to determine the actual homology of these setae when only one of them is present, when both are present determination of the identity of each seta is trivial) and **S0**. In light of the AMS system, Gisin's **S** and **T** correspond to **M2** and **S3** in species with four paired macrosetae (e.g., *P. meganporteri* **sp. nov.**; Fig. 24), whereas in species with five paired setae (e.g., *P. orba* Christiansen, 1961; Fig. 93), **M2** is a microseta, and **R3**, **S** and **T** correspond to **M1**, **S3** and **S2**. The AMS system also accounts for additional setae, including a seta anterior to **A2** (here labeled **A2a** and identified as **R1s** by Wang *et al.* 2003 in the context of Gisin's system) and all posterior setae (Fig. 4). Most posterior setae are not considered here because they are often difficult to see, especially if they are short. Of the posterior setae, **Pa5** (**P_0** of authors, Mari Mutt 1986) is most frequently present as a macroseta. Some other species (e.g., *P. espana* Christiansen, 1961) have additional macrosetae on the latero-posterior region of the head, probably corresponding to **Pa3** and **Pm3**, but the illustrations currently available do not allow an unambiguous determination. The equivalency of the most common macrosetae present in New World Lepidocyrtini in the AMS and the extended Gisin (1967) systems is shown in Table 1.

TABLE 1. Nomenclature of the dorsal chaetotaxy of the head, comparison between Gisin (1967)/Wang. *et al. (2003)* and AMS systems.

Gisin (1967)/Wang *et al.* (2003)	AMS
R0	A0
–	A1
R1s	A2a
R1	A2
R2	A3
R3	M1
S	M2 or S3
T	S2 or S3
P_0	Pa5

Pleural fold and peristomal setae. Hüther (1986) showed that some lateral seta inserted near the mouth cone vary between species and may provide information to distinguish species. These setae are best seen on lateral mounts of the head and are often difficult to make out in dorso-ventral mounts, unless the head is slightly tilted. In the present descriptions I have emphasized five setae: the two pleural setae and the peristomal setae 0–2 (**pss0–2** in Hüther's notation). In all species discussed here the distal seta in the pleural fold is shorter than the basal seta. In most species these two setae have similar ornamentation. However, in *P. gisini* Christiansen, 1961 all but the largest individuals have the distal seta ciliate and the basal seta smooth; in the largest individuals both setae are smooth. Seta **pss0** is never differentiated and has the same ornamentation as most other surrounding setae, whereas **pss1–2** are often differentiated into needle-like smooth setae, bothriotricha-like ciliate setae, or simply have ornamentation that contrasts with the surrounding setae.

Ungulum of maxilla. The sclerotized portion of the head of the maxilla (ungulum) may have three (Fig. 112) or four (Fig. 80) teeth depending on the species. In the two species with four teeth discussed here (*P. argentea* and *P. gisini*) the fourth tooth appears as a subdivision of shortest tooth.

Proximal setae of labial palp. All species of Entomobryidae so far examined have five proximal setae at the base of the labial palps (Fjellberg 1999). In most species included here the outer setae (**Z**) is subequal to slightly smaller than the median seta (**Y**), but in *P. orba* and *P. meganporteri* **nov. sp.**, **Z** is distinctly shorter than **Y**.

Postlabial setae. The postlabial chaetotaxy has been used to separate species in *Sinella* Brook (Chen & Christiansen 1993, 1997), but in Lepidocyrtini only the number of setae along the ventral groove and those just posterior to the labial triangle suture are usually reported (e. g., Arbea & Ariza 2007, Mendoça & Fernandes 2007, Traser & Dány 2008, Mateos 2008a). The organization of postlabial setae in Lepidocyrtini is similar to that in *Sinella*, and although Chen & Christiansen (1993) use a nomenclature system based on rows, (G, H, I, etc.) I find the organization of setae easier to understand by naming columns instead. Here I consider only the five columns in the field delimited by the ventral groove, the lateral column continuous with labial seta **L2** and the most posterior seta along the ventral groove (Fig. 6). The five columns are labeled I(nner), C(entral), E(xternal), L(ateral) and O(uter). Characters varying in the species described below include the number of setae per column, ornamentation of the setae, and presence or absence of differentiated setae in columns L and O. Seta **O1** in the columnar system corresponds to **X** in *Sinella*, but seta **L2** apparently does not have a corresponding setae in *Sinella* (unless one considers it a laterally displaced **X3**). As in *Sinella*, additional differentiated setae occur external to column O, but they tend to be more variable within species than setae associated with columns L and O. In all drawings of the postlabial region presented here ciliate setae are represented by circles and smooth setae by dots.

Body chaetotaxy. All descriptions of the chaetotaxy follow Szeptycki's (1979) system. In Lepidocyrtini, mesothoracic rows m and p usually include 3 and 6 setae respectively. In the adults of some *Lepidocyrtus* (e.g., *L. curvicollis* Bourlet, *L. paradoxus* Uzel) these rows are polychaetotic and the proliferation of microsetae does not allow the unambiguous identification of the primary setae (Hüther 1986). All *Pseudosinella* reported here have a normal number of mesothoracic setae.

Seta **a6** on Abd.1 is apparently (?) present in all *Lepidocyrtus*, but it is absent in *P. josemarii* **sp. nov.**, *P. meganporteri* **sp. nov.** and *P. orba*.

The relative position of macroseta **B5** on Abd. 4 varies between species. Here I describe this variation as the relative position of **B5** with respect to a line drawn between **A5** and **C2**. In some instances, **B5** is displaced so far anteriorly as to be closer or even paired to **C2** and **A4** rather than to **A5** (e.g., *P. meganporteri* **sp. nov.**, *P. orba* and *P. violenta* (Folsom), 1924). In these cases, it would seem that seta **B5** is absent and two interpretations of the pattern of hairs are possible: 1) following the matching setae on column A, the seta missing in column B is **B5**, thus the macrosetae present would be **B4** and **B6**; 2) ignoring column A, and counting setae on column B from posterior to anterior, both **B5** and **B4** are present and the macrosetae are **B5** and **B6**. Given that macroseta **B5** appears to be primary (Szeptycki 1979), it seems appropriate for the time being to always consider the enlarged penultimate seta on the column as **B5**, irrespective of its position along the axis of the column. Following this convention, the only way to determine if **B5** is actually absent is to study the postembryonic development of the chaetotaxy in individual species. In any event, the correct identification of the anterior macroseta will require all setae between column C and the pseudopore to be accounted for.

Hüther (1971) Fjellberg (2007), Mateos (2008a, b), and Traser & Dányi (2008) have used the presence and position of lateral macrosetae to differentiate between species of *Lepidocyrtus*, but in general, the lateral chaetotaxy of Abd. 4 has not been use extensively in species diagnosis. Macrosetae in this region show two general morphologies (see Barra 2004 for an example of these differences in *Seira*, these are the same differences observed in Lepidocyrtini): short, thick and blunt or truncate; and long, thin and acuminate. These differences are usually reflected in the diameter of the socket, with blunt and truncate macrosetae having clearly larger sockets than the acuminate setae, although in small species (or individuals) sometimes it is difficult to decide to which category a seta belongs by just observing the socket. Although here I use the term stout for the larger truncate or blunt macroseta, and the acuminate hairs are referred to as slender macrosetae, the distinction is often blurred when only the socket are observed, and this ambiguity is reflected in the drawing renditions of the sockets. In the descriptions, all enlarged setae are referred to as macroseta. Setae **E2**, **E3** and **F1** are stout macrosetae in all species discussed here; **D3** maybe stout or slender, whereas **F2** is a stout in *P. gisini* and *P. violenta* and a microseta in all other species. Setae **T6**, **T7**, **D2**, **E1** and **F3** are variable, but appear mostly as slender macrosetae or microsetae. The identity of setae **E4** and **De1** is unclear. Seta **E4** appears to be a slender macroseta in all species considered here and seta **De1** seems absent in *P. argentea* and *P. violenta* and present in the other five species (cf. Figs 12, 47). However, across species, these two setae differ in insertion placement in relation to setae in other columns. Instead of trying to identify them in absolute terms the description only refer to the presence or absence of the microseta posterior **E3**.

The number of setae on the posterior margin of Abd. 4 is commonly included by Christiansen and Bellinger (1998) in the description of *Lepidocyrtus* species, but it has been ignored in *Pseudosinella*. However, this character also is informative to discriminate *Pseudosinella* species: *P. josemarii* **sp. nov.** and *meganporteri* **sp. nov.** lack posterior setae, *P. argentea* Folsom, 1902 has 2+2–4+4 setae, *P. orba* 3+3, *P. violenta* 4+4, and *P. collina* Wray, 1952 and *P. gisini* 5+5.

Characters in the *Pseudosinella* database (Christiansen *et al.* 2009). To facilitate comparisons with previously described species, Table 2 shows the character states of the new species for characters included in the *Pseudosienlla* database and identification key (Christiansen *et al.* 2009).

TABLE 2. Character states of the new species described here, corresponding to characters in the Christiansen *et al.* (2009) and Jordana & Baquero (2007) data matrices. In the character list column, Gisin's seta notation is followed (in parenthesis) by notation used in descriptions in the present work. Number in parenthesis under each species column refers to character code in the original database; character states m= macroseta, μ= microseta, fs= fan-shaped.

Character	*P. josemarii* **sp. nov.**	*P. meganporteri* **sp. nov.**
1. Head macroseta S (M2 or S3)	(1) absent	(2) present (M3)
2. Head macroseta T (S2 or S3)	(1) absent	(2) present (S3)
3. Labial seta m1	(4) ciliate m	(4) ciliate m
4. Labial seta m2	(4) ciliate m	(4) ciliate m
5. Labial seta r	(5) absent	(2) ciliate μ
6. Labial seta e	(4) ciliate m	(4) ciliate m
7. Labial seta L1	(4) ciliate m	(4) ciliate m
8. Labial seta L2	(4) ciliate m	(4) ciliate m
9. Abd. 2 seta a (a2)	(2) ciliate fs	(2) ciliate fs
10. Abd. 2 seta b (m3)	(4) ciliate m	(4) ciliate m
11. Abd. 2 seta p (a2p)	(1) absent	(1) absent
12. Abd. 2 seta q1 (m3e)	(1) smooth μ	(1) smooth μ
13. Abd. 2 seta q2 (p4)	(1) smooth μ	(1) smooth μ
14. Th. 2 shape posterior macrosetae	Not seen	Not seen
15. Th. 2 number posterior macrosetae	1 (p3)	2 (p3, p5)
16. Th. 3 shape posterior macrosetae	Not seen	Not seen
17. Th. 3 number posterior macrosetae	1 (p3)	2 (p2, p3)
18. Abd. 4 macroseta P (C1)	(1) absent	(1) absent
19. Abd. 4 number macrosetae M (B4-6)	2 (B5, B6)	2 (B5, B6)
20. Abd. 4 seta s	(2) ciliate fs	(2) ciliate fs
21. Tenent hair shape	(1) acuminate	(1) acuminate
22. Inner ungula teeth	(2) 3 teeth	(2) 3 teeth
23. Unguis wing tooth	(2) present	(1) absent
24. Unguiculus wing tooth	(3) weak	(1) absent
25. Unguiculus shape	(1) acuminate	(3) swollen
26. Eye number	0	0
27. Number inner setae on manubrial plate	2	5–6
28. Number outer setae on manurbial plate	2	2–5
29. Habitat	(1) caves	(1) caves
30. Biogeographic region	(2) North America	(2) North America
31. Ant. 4 apical bulb	(1) absent	(1) absent
32. Ant. 3 sense organ	Not seen	(3) paddles
33. Maximum length	1,4 mm	2,2 mm
34. Position distal unpaired ungual tooth	50–53%	36–43%
35. Antennal length/cephalic diagonal	1.4–1.8	1.8–2.3
36. Differentiated metatibiotarsal macrosetae	(3) blunt	(2) acuminate
37. Dorsal head seta RO (A0)	(2) present	(2) present

continued next page

TABLE 2. (continued)

Character	*P. josemarii* **sp. nov.**	*P. meganporteri* **sp. nov.**
38. Dorsal head seta R1 (A2)	(2) present	(2) present
39. Dorsal head seta R2 (A3)	(2) present	(2) present
40. Dorsal head seta R3 (M1)	(1) absent	(1) absent
41. Dorsal head seta P (Pa5)	present	present
42. Posterior edge of unguiculus	smooth	smooth
43. Apical/subapical mucronal tooth	>1	>1

Taxonomy

Entomobryidae, Schäffer, 1896

Lepidocyrtini Wahlgren, 1906 *sensu* Soto-Adames *et al.*, 2008

Pseudosinella Schäffer, 1897

Eyes fewer than 8, scales finely denticulate and apically rounded covering head, body and ventral face of furcula, distal vesicles of ventral tube smooth, mucro bidentate.

In addition to the characters mentioned in the previous section, the species described below share the absence of apical papilla on Ant. 4, absence of scales on antennae, ventral tube, legs and dorsal face of manubrium, outer maxillary lobe with apical and subapical setae smooth and subequal, three medial and one anterior seta-like processes on the sublobular plate (Fig. 40), labial papilla E with four seta-like processes in addition to the lateral process (Fig. 92), and the presence of a smooth mucronal spine reaching the basal mucronal tooth (Fig. 18). The sublobular plate of the outer maxillary lobe of all species has four processes, but the shortest process arises from the dorsal margin of the plate and in most cases it is folded under or covered by the edge of the labrum (Fig. 40).

Pseudosinella josemarii sp. nov.

Figs 1–20, Table 3

Material Examined. Holotype: **HARDY Co**., Dyer's Cave, 24 May 2006, D. Culver, D. Cowan, H. Hobbs & B. Hutchins, col.; female, slide mounted. Paratypes: **BERKELEY Co**., Whitings Necks Cave, 29 May 2006, D. Fong, M. Porter & C. Tudge, col., 1 on slide; **GRANT** Co., Kline Gap Cave, 20 May 2006, D. Culver, D. Fong, col., 1 on slide. Additional material: **GREENBRIER Co.,** Trillium Cave, 28 May 2004, 2 individuals on slides, 5 others in alcohol.

Etymology. This species is dedicated to my mentor, colleague and friend José A. Mari Mutt, for all his important contributions to our understanding of the taxonomy of Entomobryidae.

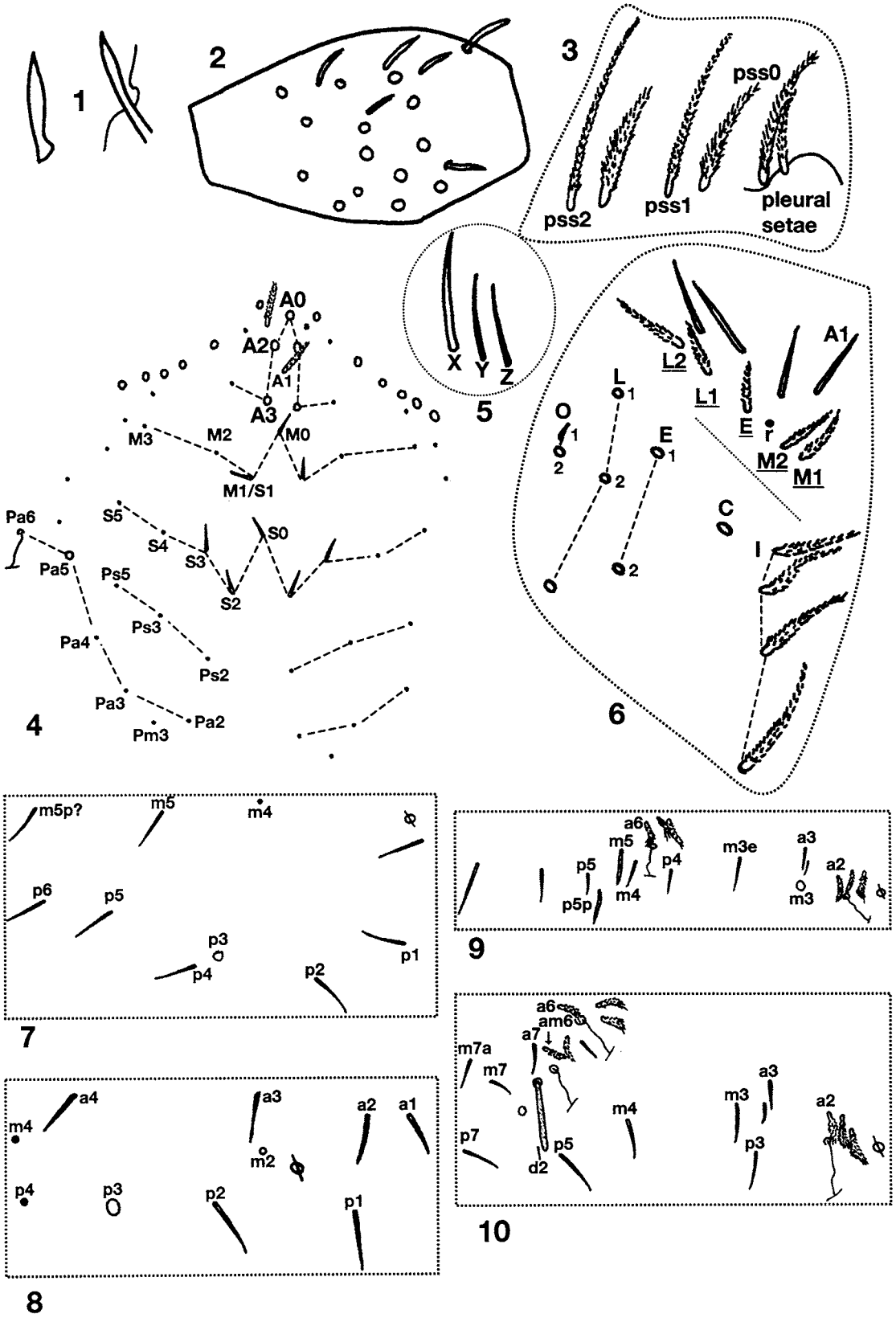
Description. Length up to 1.4 mm; color in alcohol white, without trace of pigment. Subapical sense organ of Ant. 4 clavate (Fig. 1). Typical Ant. 3 sense organ absent, two subapical thin walled sensilla present (Fig. 2). Dorsal head chaetotaxy (Fig. 4) includes five antennal macrosetae, and macrosetae **A0**, **A2**, **A3** and **Pa5**; microsetae **A1** and **M0** ciliate, all other dorsal microsetae smooth; seta **S0** closer to **S3** than **S2**; **M1**/**S1** closer to **M2** than **S0**. Eyes absent. Prelabral setae ciliate, all labral setae smooth. Labral papillae obscured in all specimens examined. Pleural setae ciliate, all **pss** setae ciliate, **pss0** normal, **pss1–2** bothriotricha-like (Fig. 3). Ungulum of maxilla with 3 teeth. Lateral process of labial papilla E slightly curved dorsally and not nearly

reaching tip of papilla. Basal proximal seta of labial palp with setae **Y** and **Z** subequal (Fig. 5). Labial and post-labial chaetotaxy as in Fig. 6: labial formula **M1M2oEL1L2A1–5**, socket of **r** present but without hair; postlabium with 4+4 ciliate setae along ventral groove (column I); columns C, E, and L with 1, 2 and 3 setae respectively; **L2** not modified, **O1** reduced and smooth; one or two setae modified as **O1** found beyond column O (not shown). Body formula for inner macrochaetotaxy as 11/0100+2. Mesothorax macroseta **p3** present (Fig. 7). Metathorax (Fig. 8) with macroseta **p3**. Setae on Abd. 1 arranged into a single row, **a6** absent. Chaetotaxy of Abd. 2 as in Fig. 9; **a2**, **a6** and all supplementary setae fan-shaped or strongly ciliate; **a2p** absent; **a3** external to **as**, and nearly reaching tip of **as**; **m3e** not reaching socket of **m3**; socket of **m5** modified as a normal macroseta, but seta itself not much larger than seta **p5p**; **p5p** as long as **m5**, but socket not enlarged. Abd. 3 (Fig. 10) with **a2**, **a6**, **am6** and most supplementary setae fan-shaped, supplementary seta **im** weakly ciliate; **a3** reaching **as**; **as** about half the length of **m3** and not reaching **m3**; **d2** present; **a7**, **m7**, **m7a** and **p7** normal microsetae, **a7** inserted very close to **am6**. Chaetotaxy of Abd. 4 bothriotrichal complex as in Fig. 11: all supplementary setae anterior to **T2**, including seta **s**, fan-shaped; **C1p**, **T3** and **D1p** weakly denticulate and appearing smooth at low magnification, **T3** anterior to **D1p**, but tip of **T3** surpasses base of **D1p**; **D1p** almost reaching tip of **Pe**; **Pe** and **Pi** fan-shaped. General chaetotaxy of Abd. 4 (Fig. 12) with macrosetae **B5**, **B6**, **D3**, **E2**, **E3**, **F1, F3 T6** and **T7**; **D2**, **E1**, and **F2** microsetae; **B5** a blunt macroseta inserted posterior to a line drawn between **A5** and **C2**; **B6** a slender macrosetae; **F2** closer to **E3** than **E2**. Microseta posterior to **E3** present. Posterior setae on Abd. 4 absent. All femora with two blunt macrosetae near middle section (Fig. 13), but lateral macrosetae often fallen off, not detectable. Trochanteral organ with 11 setae. Tenet hair acuminate (Fig. 17), shorter than unguiculus; unguiculus lanceolate with small, but clear posterior tooth, all other lamellae smooth. Unguis with 3 inner teeth (Figs 15–17): basal pair clearly unequal in size, shortest member of pair often difficult to see in lateral views; unpaired tooth prominent, displaced basally (easily confused as member of basal pair); outer teeth (Figs 14, 17) short, not reaching base of inner teeth. Ventral tube with 7+7 disto-lateral setae; anterior face with variable number of setae, holotype as in Fig. 19; posterior face (Fig. 20) with 3+3 setae on medial columns and 3+3 setae along distal margin. All manubrial setae ciliate; manubrial plate with 2 outer and 2 inner setae separated by 2 pseudopores. Apical mucronal tooth longer than subapical tooth (Fig. 18).

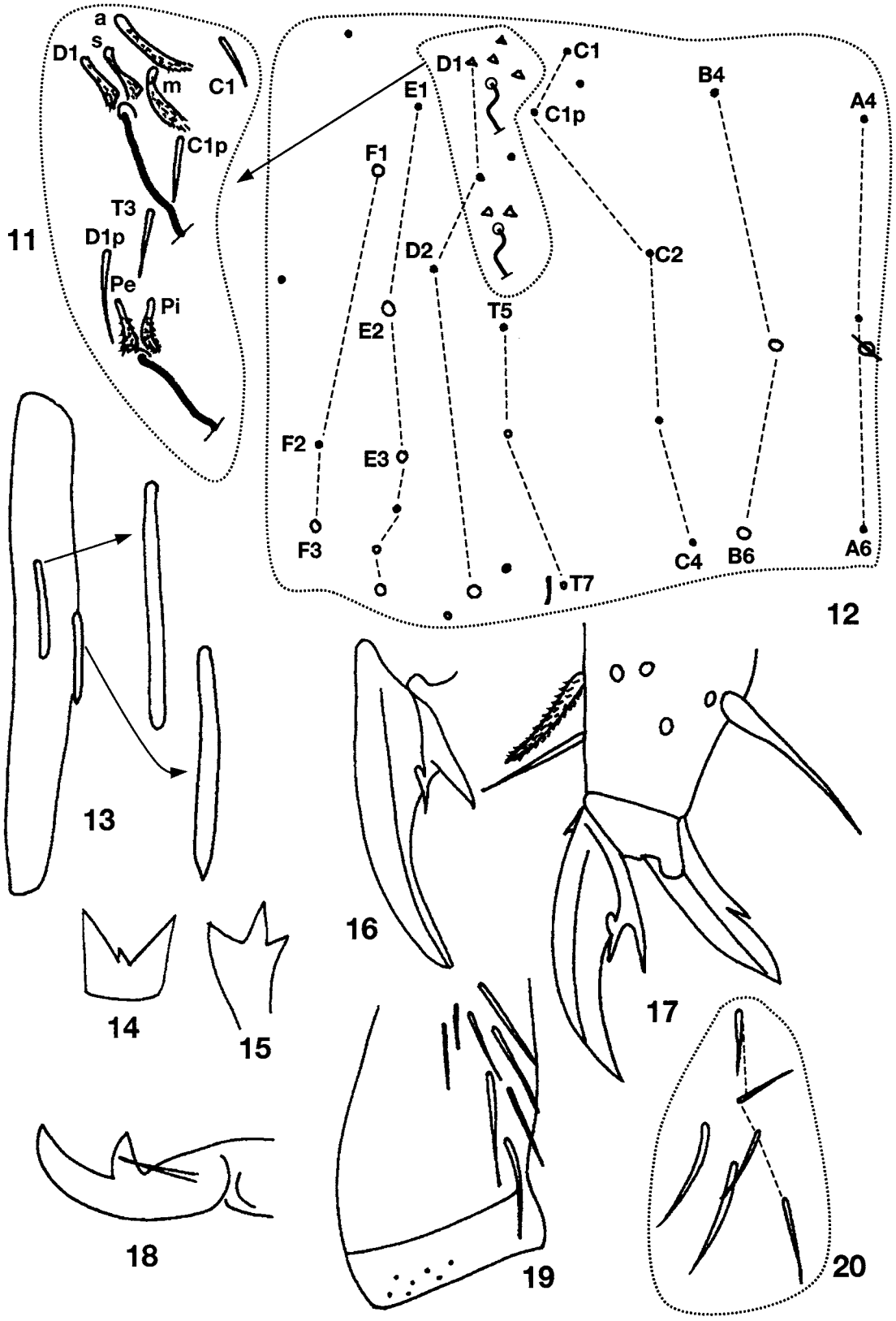
Variation. The individual from Whiting's Neck cave (i.e., the smallest adult) differs from the other adults by having labial setae E smooth and two setae in postlabial column C. The largest individual (from Dyer's cave) has Abd. 2 seta **a3** fan-shaped (smooth in other specimens) and Abd. 4 seta **F3** absent. The individuals from Trillium Cave are very small juveniles differing from adults in six unambiguous characters and at first were identified as *P. argentea* (macroseta **p3** on Th. 2 is difficult to see in my preparations). The characters differing in juveniles are the absence of macroseta **p3** on Th. 3, postlabial seta **O1** conic instead of acuminate, presence of three supplementary setae around lateral bothriotricha on Abd. 2–3, Abd. 4 setae **C1p** and **T3** smooth, and the absence of outer unguicular tooth. Most of these characters are probably related to postembryonic development, but adults from Trillium cave will be needed to confirm the present determination.

TABLE 3. Diagnostic characters of *Pseudosinella josemarii* **sp. nov.** in relation to *P. sera*, *P. certa* and *P. argentea*.

Species	Th. 2 Macrosetae	Th. 3 Macrosetae	Tenet Hair	Outer Ungual Tooth	Inner Ungual Teeth	Abd. 2 Seta a2	Abd. 2 Seta a2p	Manubrial Plate Outer Setae
josemarii **sp. nov.**	1	1	acuminate	present, small	3	fan-shaped	absent	2
sera	0	0	clavate	absent	3	smooth	absent	4–5
certa	1	0	acuminate	?	2	smooth	present	?
argentea	0	0	clavate/acuminate	present/ absent	3 or 4	smooth	present	4–6



FIGURES 1–10. *Pseudosinella josemarii*, **sp. nov.**: 1, Subapical sensilla of fourth antennal segment; 2, Distribution of sensilla on regenerated third antennal segment; 3, Pleural and peristomal setae; 4, Dorsal head chaetotaxy (dots are microsetae, circles macrosetae); 5, Proximal setae of labial palp, X is innermost seta; 6, Labium and postlabium, circles in postlabium represent ciliate setae; 7, Mesothoracic chaetotaxy; 8, Metathoracic chaetotaxy; 9, Second abdominal segment chaetotaxy; 10, Third abdominal segment chaetotaxy.



FIGURES 11–20. *Pseudosinella josemarii* **sp. nov.**: 11, Bothriotrichal complex of fourth abdominal segment; 12, Complete chaetotaxy of fourth abdominal segment (dots are acuminate microsetae, circles macrosetae, triangles fan-shaped microsetae); 13, Metatibiotarsus and macrosetae; 14, Dorsal view of outer teeth of metathoracic claw; 15, Posterior view of inner teeth of metathoracic claw; 16–17, Metathoracic claw in two individuals; 18, Mucro; 19, Anterior face of ventral tube, left side; 20, Posterior chaetotaxy of ventral tube, left side.

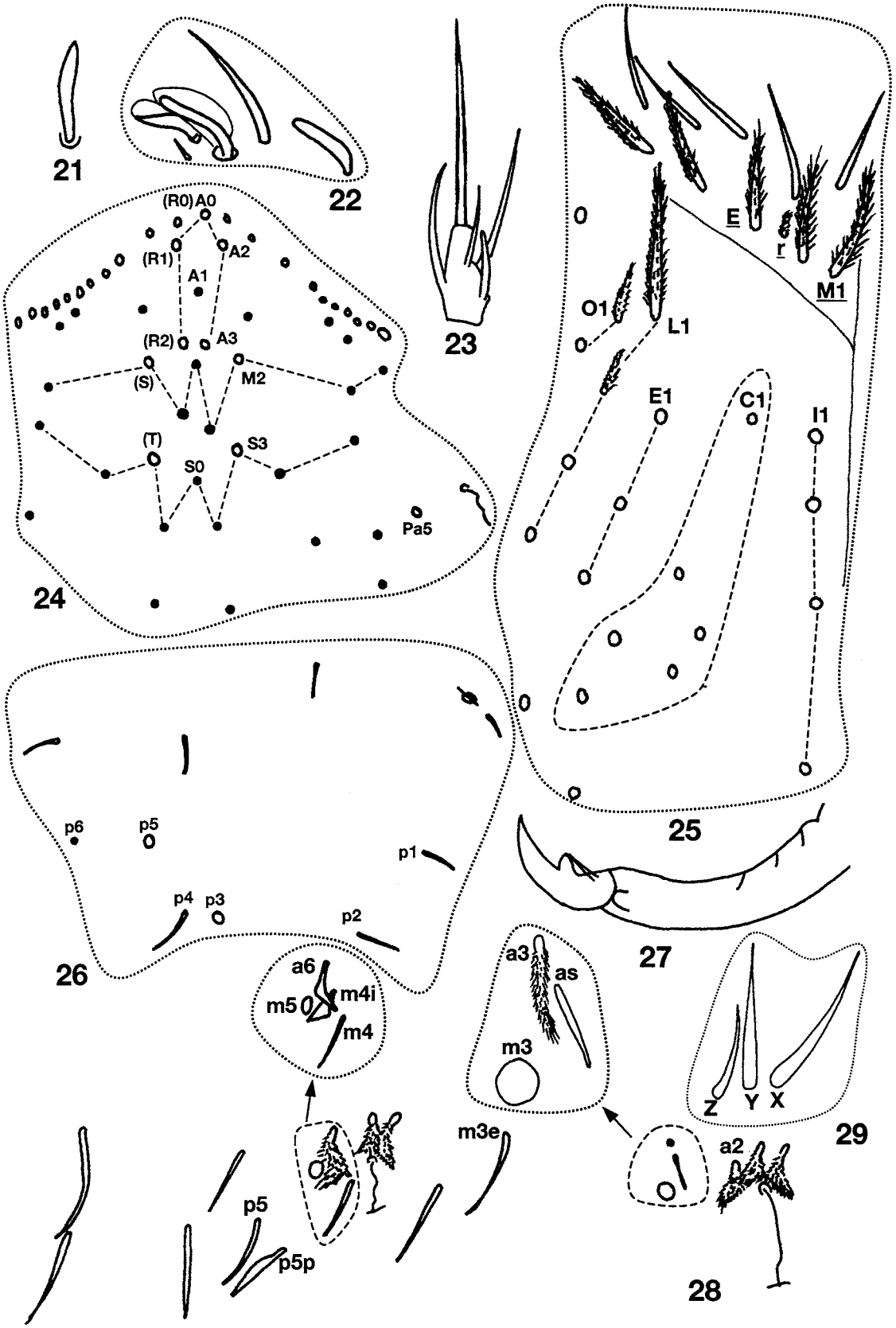
Remarks. Among North American *Pseudosinella*, the new species is most similar to *P. sera* Christiansen & Bellinger, 1980, *P. certa* Christiansen & Bellinger, 1980 and *P. argentea*. Adults of *P. josemarii* **sp. nov.** can be easily distinguished by having one meso- and one metathoracic macroseta, an acuminate tenet hair and distal manubrial plate with two setae external to the pseudopores, whereas *P. sera* does not have thoracic macrosetae, the tenet hair is clavate and the manubrial plate has 4–5 setae external to the pseudopores. *Pseudosinella josemarii* **sp. nov.**differs from *P. certa* in having one metathoracic macroseta (absent in *P. certa*), three inner ungual teeth (two in *P. certa*) and in the absence of Abd. seta **a2p** (present in *P. certa*). The presence of thoracic macrosetae and absence of seta **a2p** on Abd. 2 will also distinguish the new species from *P. argentea*. The differences between these four species are summarized in Table 3.

***Pseudosinella meganporteri* sp. nov.**
Figs 21–33, Table 4

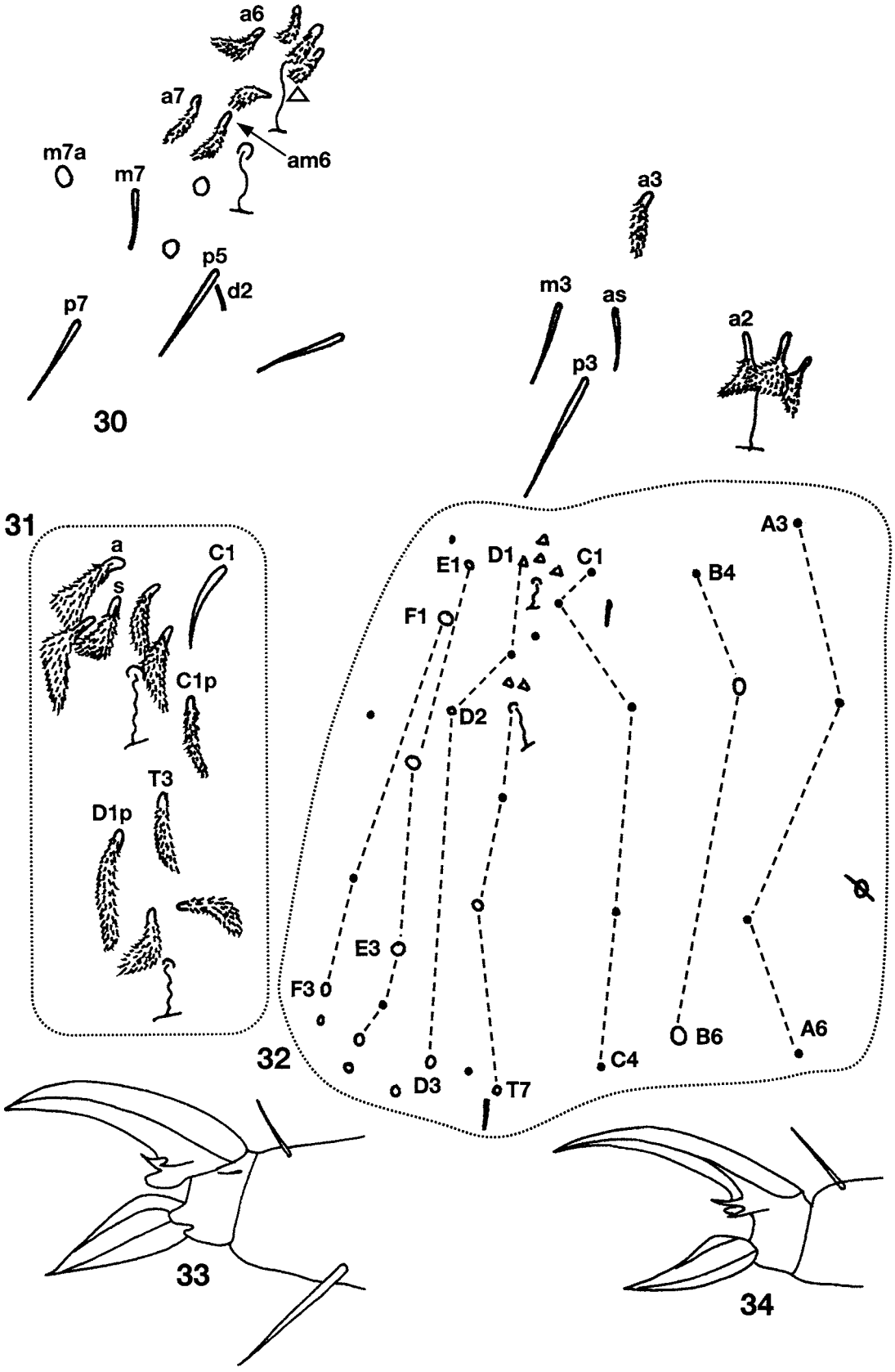
Material Examined. Holotype: **RANDOLPH Co**., Simmon's-Mingo Cave, 6–25 July 2005, D. Culver, D. Fong & H. Hobbs, col., 1 on slide. Paratypes: same collection information as the holotype, 2 individuals in alcohol. **POCAHONTAS Co**., Tub Cave, 2 June 2004, D. Culver, D. Cowan & H. Hobbs, col., 1 on slide; Dreen Cave, 6–25 July 2005, D. Culver, D. Fong & H. Hobbs, col., 1 on slide, 45 in alcohol, mostly in poor condition; High Hopes Cave, 6–25 July 2005, D. Culver, D. Fong & H. Hobbs, col., 1 on slide.

Etymology. This species is dedicated to Dr. Megan Porter a speleobiologist currently at University of Maryland-Baltimore County and one of the primary collectors for the West Virginia cave fauna survey.

Description. Length to 2.2mm; color in alcohol white, without trace of pigment. Ant. 4 subapical sensilla weakly clubbed (Fig. 21). Ant. 3 sense organ (Fig. 22) inserted in individual shallow pits and formed by two paddle-shaped sensilla, with dense raquis and thin, translucent lateral extensions; additional basally-swollen, thin walled setae present near usual sense organ. Eyes absent. Dorsal head chaetotaxy (Fig. 24) includes 10–11 macrosetae along antennal base and macrosetae **A0**, **A2**, **A3**, **M2**, **S3** and **Pa5**; macrosetae **M2** displaced forward, almost forming a row with **A3**; microseta **A1** ciliate; **M0**, **S0**, **S1** and **S2** smooth microsetae; **S0** inserted closer to **S3** than **S2**, **M1/S1** closer to **S3** than **M2**. Prelabral setae ciliate, all labral setae smooth. Outer labral papillae larger than inner pair, both sets of papillae smooth. Pleural fold setae ciliate. Peristomal seta **pss0** ciliate normal, slightly shorter than **pss1**; **pss1–2** slender, ciliate, bothriotricha-like. Maxillary ungulum with 3 teeth. Lateral process of labial papilla E blunt (Fig. 23), slightly curved forward, barely reaching papillar tip. Labial palp proximal seta **Z** clearly shorter than seta **Y** (Fig. 29). Labial chaetotaxy **M1M2rEL1L2A1–5**. All post-labial setae strongly ciliate (Fig. 25); 4+4 setae along ventral groove; column C with 3–6 setae posterior to **C1**; column E with 2–5 setae; L with 3–5 setae, **L2** reduced, similar to labial **r**; O with 2 setae, **O1** modified as **L2**. Body formula for inner macrochaetotaxy as 22/0100+2. Mesothorax macrosetae **p3** and **p5** present (Fig. 26). Metathorax with macrosetae **p2** and **p3**. Chaetotaxy of Abd. 1 linear, seta **a6** absent. Chaetotaxy of Abd. 2 as in Fig. 28; **m3** and **m5** normal macrosetae; **a2**, **a6** and all supplementary setae fan-shaped; **a2p** absent; **a3** ciliate, external to, and reaching **as**; **as** reaching socket of macroseta **m3**; **m3e** smooth or weakly ciliate, not reaching socket of **m3**; **p5p** short and ciliate. Abd. 3 (Fig. 30) with **a2**, **a6**, **am6** and all supplementary setae fan-shaped; **a3** ciliate, anterior to and far from **as**; **as** about half the length and reaching **m3**; **m3** reaching **as** socket; **d2** reaching **p5**; **im** fan-shaped (triangle in Fig. 30) and subequal to **em**; **a7**, **m7** and **p7** normal microsetae, **a7** ciliate, inserted close to, and reaching base of **am6**, **m7a** a macroseta. Chaetotaxy of Abd. 4 bothriotrichal complex as in Fig. 31: setae **a**, **m**, **s**, and **D1** fan-shaped; **s** posterior to **a**; **C1p**, **T3** and **D1p** ciliate; **T3** anterior to, and surpassing base of **D1p**; **D1p** reaching base of **Pe**; **Pe** and **Pi** fan-shaped. General chaetotaxy of Abd. 4 (Fig. 32) with macrosetae **B5**, **B6**, **T6, T7**, **D2, D3**, **E1, E2**, **E3**, **F1** and **F3**; macroseta **B5** anterior to line drawn between **A5** and **C2**; **A5** displaced externally with respect to other setae in row **A** and inserted near the position usually occupied by **B5**; microseta **F2** closer to **E3** than **E2**. Microseta posterior to **E3** present. Abd. 4 without posterior setae.



FIGURES 21–29. *Pseudosinella meganporteri* **sp. nov.**: 21, Subapical sensilla of fourth antennal segment; 22, Sense organ of third antennal segment; 23, Papillae E of labial palp; 24, Dorsal chaetotaxy of head, left side labeled using the RST system, right side labeled using the AMS system; 25, Labial and postlabial chaetotaxy; 26, Mesothoracic chaetotaxy; 27, Mucro; 28, Chaetotaxy of second abdominal segment; 29, Proximal setae of labial palp, left side.



FIGURES 30–34. *Pseudosinella meganporteri* **sp. nov.**: 30, Chaetotaxy of third abdominal segment; 31, Fourth abdominal segment bothriotrichal complex; 32, Complete chaetotaxy of fourth abdominal segment; 33, Metathoracic claw complex; 34, Prothoracic claw complex.

Male genital plate multisetaceous. Trochanteral organ with 21–27 setae. Metathoracic femora with three acuminate macrosetae on basal half. Foot complex as in Figures 33–34. Tenet hair acuminate, shorter than unguiculus and metathoracic posterior smooth setae. Unguiculus lanceolate with basal swelling; inner lamella weakly truncate on prothoracic legs; posterior lamella of all legs smooth. Unguis with 3 small, but distinct teeth near base: basal pair unequal in size, smaller member of pair shorter than unpaired tooth; outer teeth short and inconspicuous, not attaining base of inner teeth, visible only on anterior views. Collophore not seen clearly: anterior face apparently with at least 9+9 setae, lateral setae 9–10 (3–5 ciliate, others smooth), posterior face with 4 paired and 1 unpaired setae along distal margin, and 4+4 setae forming two columns. Manubrial plate with 5–6 outer and 2–5 inner setae separated by 2 pseudopores. Apical mucronal tooth longer and narrower than basal tooth (Fig. 27).

Variation. Second abdominal segment seta **m4i** is present only in the holotype. Second abdominal segment seta **Li** is present only in one individual, although detached from bothriotricha **a5**.

Remarks. Among North American *Pseudosinella* only *P. vita* Christiansen & Bellinger, 1980 and *P. espanita* Christiansen & Bellinger, 1996 are blind and have four paired dorsal head macrosetae. *Pseudosinella meganporteri* **sp. nov.** is most similar to *P. espanita*, but it keys out to *P. vita* in Christiansen and Bellinger (1998) due to the absence of an outer tooth on the unguiculus. The three forms can be easily separated by the number of body macrosetae and foot complex characters as indicated in Table 4. The single individual from Tube Cave was found together with 26 individuals of *P. gisini*.

TABLE 4. Characters distinguishing *P. meganporteri* **sp. nov.** from *P. vita* and *P. espanita*. o= labial seta r absent; seta **a2p** + = present or – = absent.

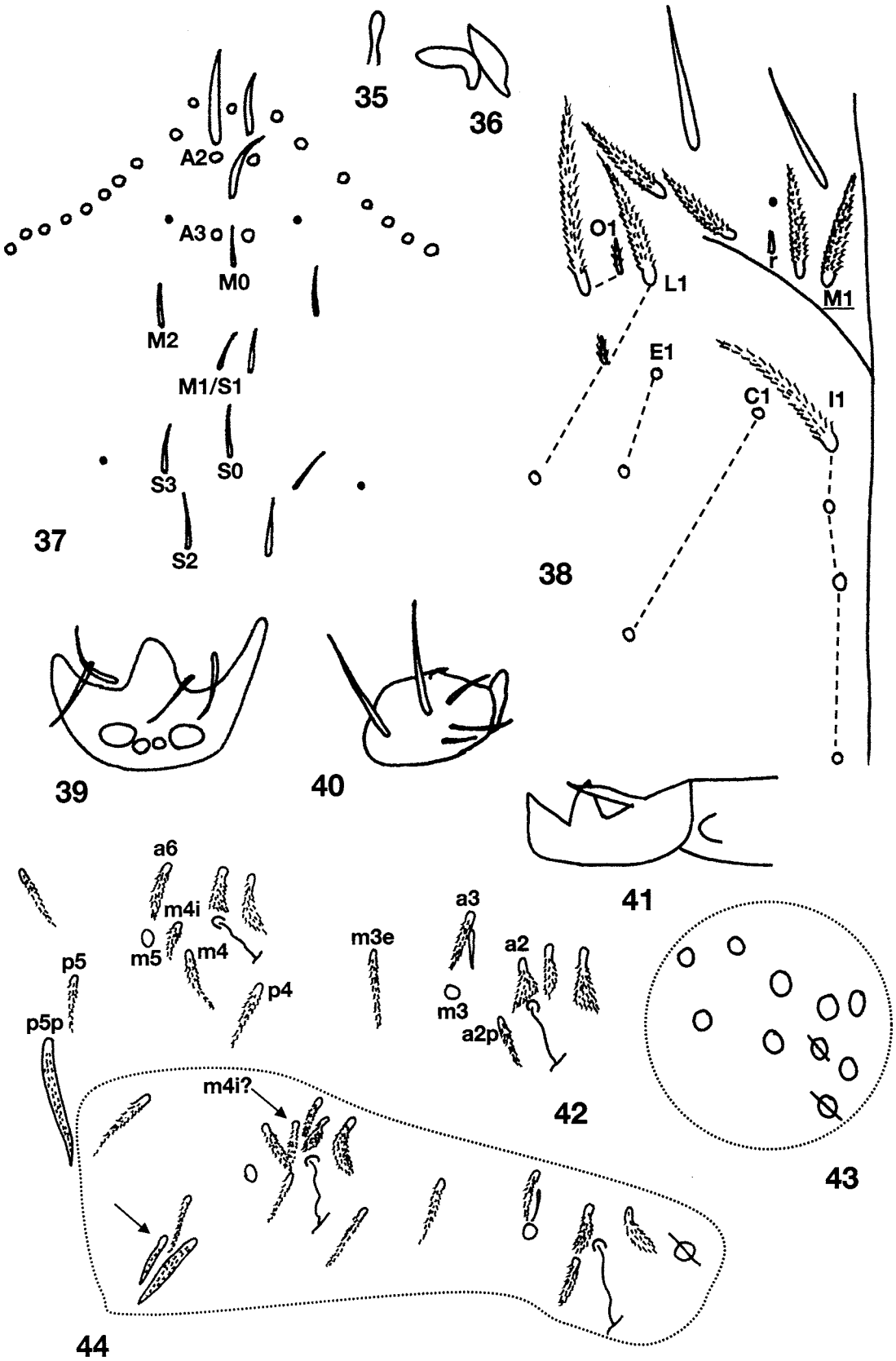
Species	Labial chaetotaxy	Th. 2 macrosetae	Th. 3 macrosetae	Abd. 2 seta a2	Abd. 2 seta a2p	Abd. 2 seta m3e	Abd. 4 seta C1	Unguiculus posterior lamella	Tenet hair	Inner Ungual Teeth
meganporteri **sp. nov.**	M1M2rEL1	2	2	fan-shaped	–	microseta	microseta	smooth	>0.5 unguiculus	small
vita	M1M2rEL1	4	3	macroseta	+	macroseta	macroseta	smooth	<0.5 unguiculus	large
espanita	M1M2oEL 1	3	2	fan-shaped	+	microseta	macroseta	large tooth	<0.5 unguiculus	large

Pseudosinella argentea Folsom, 1902

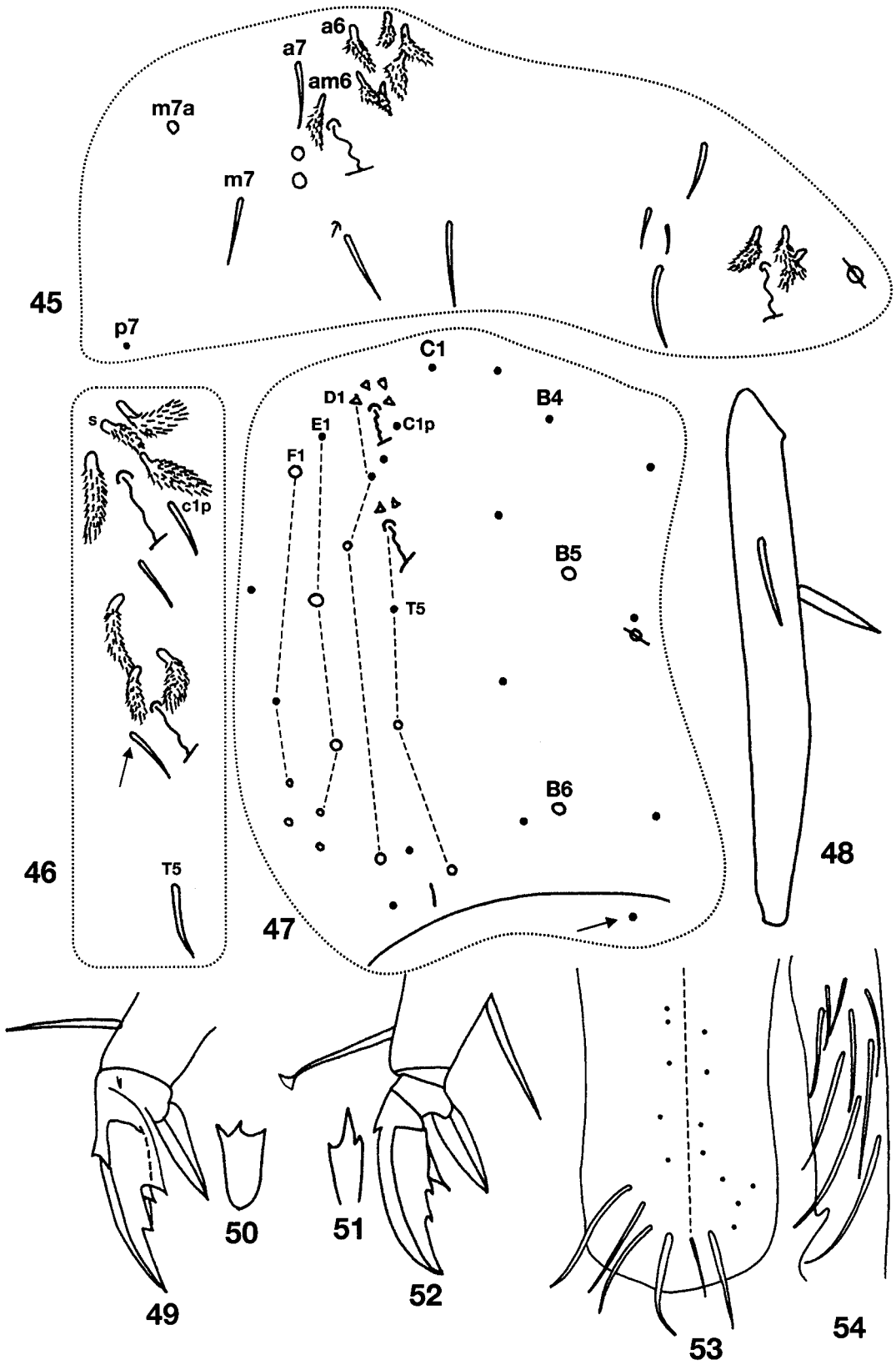
Figs 35–54, Table 5

Material Examined. **PENDLETON Co.**, Quarry Cave, 20 May 2006, 2 on one slide and 3 in alcohol; Cedar Cave, 15 May 2006, 1 on slide; Hoffman Pit, 20 May 2006, 1 on slide, 3 in alcohol; **MONOGALIA Co.**, Maiden Run #1 Cave, 12 June 2006, 1 on slide.

Descriptive notes. Length to 2.5mm; color in alcohol white, without trace of pigment, or just a wash of light blue pigment near base of antennae. Ant. 4 subapical sense organ clavate, or appearing capitate in some angles (Fig. 35). Ant. 3 sense organ formed by two enlarged sensilla (Fig. 36). Dorsal head chaetotaxy (Fig. 37) with 7–9 macrosetae along base of antennae; **A0**, **A2**, and **A3** macrosetae; **Pa5** a microseta; **A1** and **M0** ciliate microsetae, all other dorsal microsetae smooth; seta **S0** anterior to **S3**; **M1/S1** near **M2**. Eyes absent. Prelabral setae ciliate, all labral setae smooth. Labral intrusion and papillae as in Fig. 39. Pleural fold setae ciliate; peristomal setae **pss0** normal ciliate, **pss1–2** ciliate and bothriotricha-like. Ungulum of maxilla with 4 teeth. Lateral process of labial papilla E slightly curved dorsally and barely reaching papillar tip. Proximal seta of labial palp with seta **Y** subequal to somewhat longer than seta **Z**. Ventral head chaetotaxy as Fig. 38: labial chaetotaxy **M1M2rEL1L2A1–5**, microseta **r** smooth and thin walled; post-labial chaetotaxy includes 4+4 ciliate setae along ventral groove, and columns C, E, L and O with 2, 2, 3 and 2 setae respectively; **L2** and **O1** modified into short, ciliate and sharply acuminate microsetae. Inner macrochaetotaxy of the body 00/0100+2.



FIGURES 35–44. *Pseudosinella argentea*: 35, Subapical sensilla of forth antennal segment; 36, Sense organ of third antennal segment; 37, Dorsal head chaetotaxy; 38, Labial and postlabial chaetotaxy; 39, Anterior margin of labrum; 40, Sublobular plate of outer maxillary lobe; 41, Mucro; 42, Chaetotaxy of second abdominal segment; 43, Distribution of setae on distal manubrial plate, left side; 44, Atypical chaetotaxy of second abdominal segment in another individual.



FIGURES 45–54. *Pseudosinella argentea*: 45, Chaetotaxy of third abdominal segment; 46, Bothriotrichal complex of fourth abdominal segment; 47, Complete chaetotaxy of fourth abdominal segment; 48, Metatibiotarsus showing enlarged setae; 49, Prothoracic claw complex; 50, Anterior view of outer ungual teeth on metathoracic leg; 51, Posterior view of inner ungual teeth of prothoracic leg; 52, Metathoracic claw complex; 53, Posterior chaetotaxy of collophore; 54, Anterior chaetotaxy of collophore, left side.

TABLE 5. Comparison between *Pseudosinella* from West Virginia here identified as *argentea*, and *flatua*, *granda* and *argentea sensu* Christiansen & Bellinger (1998).

Species	Head macroseta A0	Prelabral setae	Sense organ Ant. 3	Labial setae m1 & m2	Labial seta r	Head ventral groove setae	Abd. 2 seta a3	Abd. 2 seta a2p	Ventral Tube anterior chaetotaxy	Ventral Tube posterior chaetotaxy (total/distal margin)	Ventral Tube vesicle base chaetotaxy
West Virginia '*argentea*'	1	ciliate	swollen	M1≈M2	smooth, thin walled blunt microseta	4 ciliate	ciliate	ciliate & ≈ a2	9	19/9	7–8; 4 ciliate
argentea	1	?	swollen	M1≈M2 or M1≈M2	smooth or truncate microseta or absent	4 ciliate	?	smooth	?	?	?
granda	2	ciliate	swollen	M1≈M2	Absent or conic reduced	4 ciliate	smooth	ciliate & > a2	9[1]	13/7	8–9; 4–5 ciliate
flatua	1	smooth	slightly swollen	m1<M2	smooth acuminate microseta	3 smooth 1 ciliate	smooth	ciliate & > a2	11–13	14/?	11–13

[1] Original description (Christiansen & Bellinger 1986) mentions 6–7 setae but Figure 46 shows 9.

Abd. 1 with setae in linear arrangement, **a6** present. Chaetotaxy of Abd. 2 as in Fig. 42; **a2**, **a6** and all supplementary setae of bothriotrichal complexes fan-shaped; **a2p** and **a3** more strongly ciliate than others; **a3** external and reaching tip of **as**; **as** reaches the socket of **m3** in some individuals, but not in others; **m3e** not reaching socket of **m3**; supplementary seta **m4i** ciliate, to weakly fan-shaped (the presence of microsetae **m4i** is often difficult to ascertain because the surrounding fan-shape setae tend to obscure **m4i**'s socket); **m5** a normal macroseta; **p5p** a short, ciliate mesoseta. The male from Quarry Cave has supernumerary setae associated with seta **p5p** on Abd. 2 and **m4i** appears to be displaced anteriorly towards **a5**, but only on one side of the body (arrows on Fig. 44). Abd. 3 (Fig. 45) with **a2**, **a6**, **am6** and all supplementary setae associated with bothriotrichal complexes fan-shaped, all other setae weakly ciliate, but appearing smooth at low magnification; **a3** not reaching **as**; **as** about 0.5x the length of **m3** and reaching base of **m3**; **d2** present; **a7**, **m7** and **p7** normal microsetae, **m7a** a long and slender acuminate macroseta, **a7** inserted anterior and close to **am6, m7** posterior to **p6**. Abd. 4 bothriotrichal complex as in Fig. 46: all supplementary setae anterior to **T2**, including seta **s**, fan-shaped; **C1p** and **T3** weakly ciliate (appearing smooth at low magnifications); tip of **T3** reaching base of **D1p**; **D1p** posterior to **T3** and reaching the base of **Pe**; **Pe** and **Pi** fan-shaped; the male from Quarry Cave carries an asymmetric supplementary seta between **Pe** and **T5** (arrow in Fig. 46). General chaetotaxy of Abd. 4 (Fig. 47) with macrosetae **B5**, **B6**, **T6**, **T7**, **D2 D3**, **E2**, **E3**, **F1**, **F3**; **E1** and **F2**, microsetae; macroseta **B5** on line drawn between **A5** and **C2**; **F2** closer to **E3** than **E2**; microseta posterior to **E3** absent. Abd. 4 usually with 1+1 posterior setae, but varying among some caves: specimens from Quarry Cave, Hoffman's Pit and Cedar Cave, and Maiden Cave have 2+2, 3+3 and 4+4 posterior setae, respectively. Trochanteral organ with 14–15 setae. Metathoracic femora with two outstanding acuminate macrosetae inserted near basal third of the segment (Fig. 48). Tenet hair as long as unguiculus, acuminate or truncate, varying according to locality. The two individuals from Quarry Cave, and the individual from Hoffman's Pit have acuminate tenet hairs on the pro- and mesothoracic legs (Fig. 49), but truncate on metathoracic legs (Fig. 52); the individual from Cedar Cave has all tenent hairs truncate, and the individual from Maiden Run Cave has all tenent hairs acuminate. Unguiculus lanceolate with indistinct serrations on posterior lamella, all other lamellae smooth. Unguis with three inner teeth (Figs. 49, 52): basal pair unequal in size (Fig. 51), the difference in size between teeth being more prominent on metathoracic legs; unpaired tooth prominent and closer to ungual tip than base. Outer ungual teeth (Fig. 50) short, closer to ungual base on third pair than on first two pairs of legs (cf. Figs. 49, 52). Collophore with 8+8 disto-lateral setae, four ciliate and four smooth; anterior face with variable number of setae, but generally arranged as in Fig. 54; posterior face (Fig. 53) with

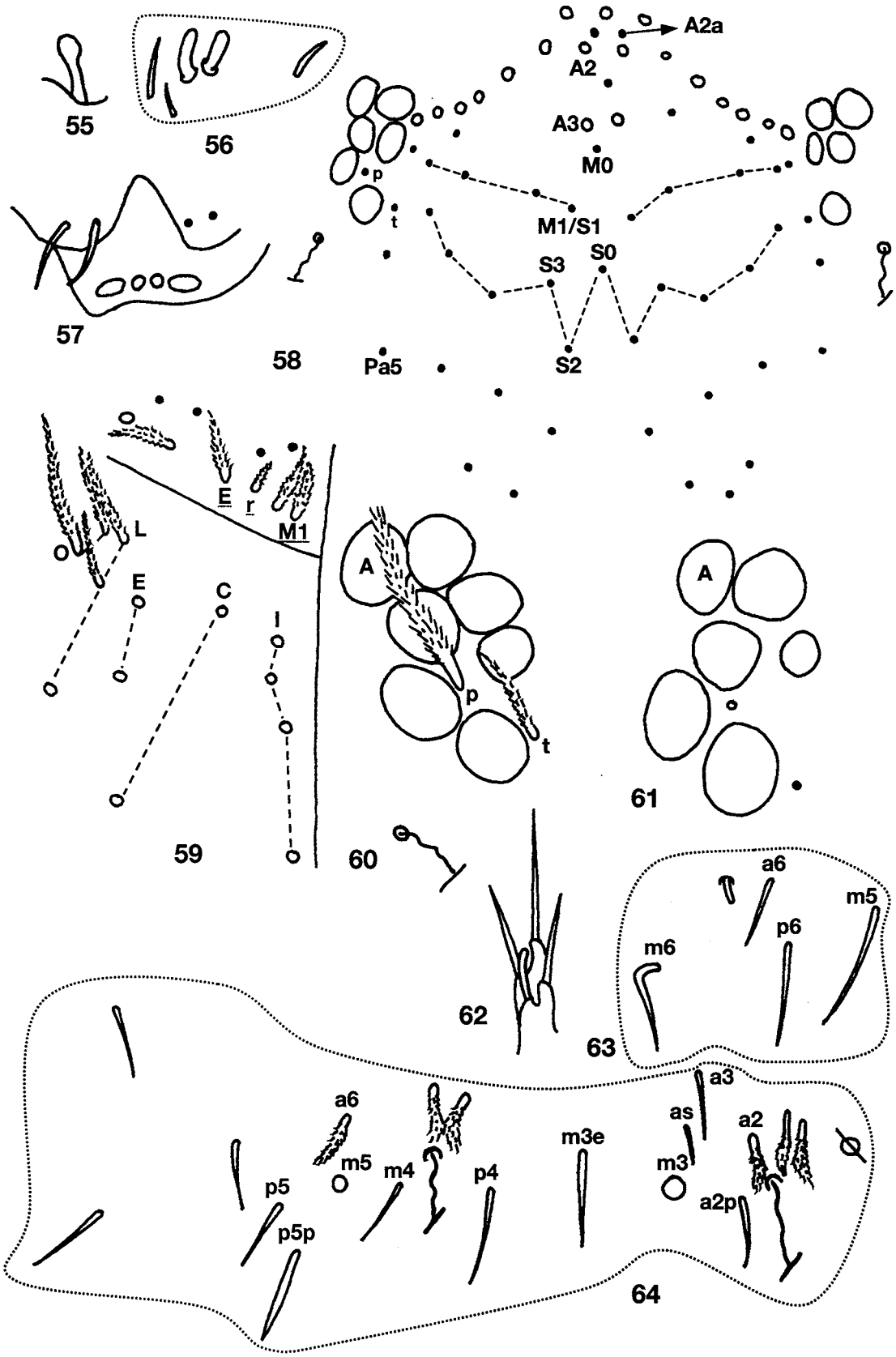
5+5 proximal and nine distal setae. Manubrial plate (Fig. 43) with six outer and two inner setae separated by two pseudopores. Mucro (Fig. 41) normal, with teeth subequal; mucronal spine with basal swelling.

Remarks. These specimens belong to the *P. argentea* complex, although specific determination remains ambiguous and is based on the preponderance of similarity with that apparently very variable species. The material from West Virginia keys out to *P. flatua* Christiansen & Bellinger, 1996 in Christiansen & Bellinger (1998) by the presence of a ciliate seta **a2p** on Abd. 2, but differs from that species in many chaetotacic characters of the labrum, labium, postlabium and ventral tube (Table 5). The variation in tenent hair shape and number of posterior setae on Abd. 4 suggest that these samples may include more than one species, but as with other cave forms, the limited material available makes a final determination difficult.

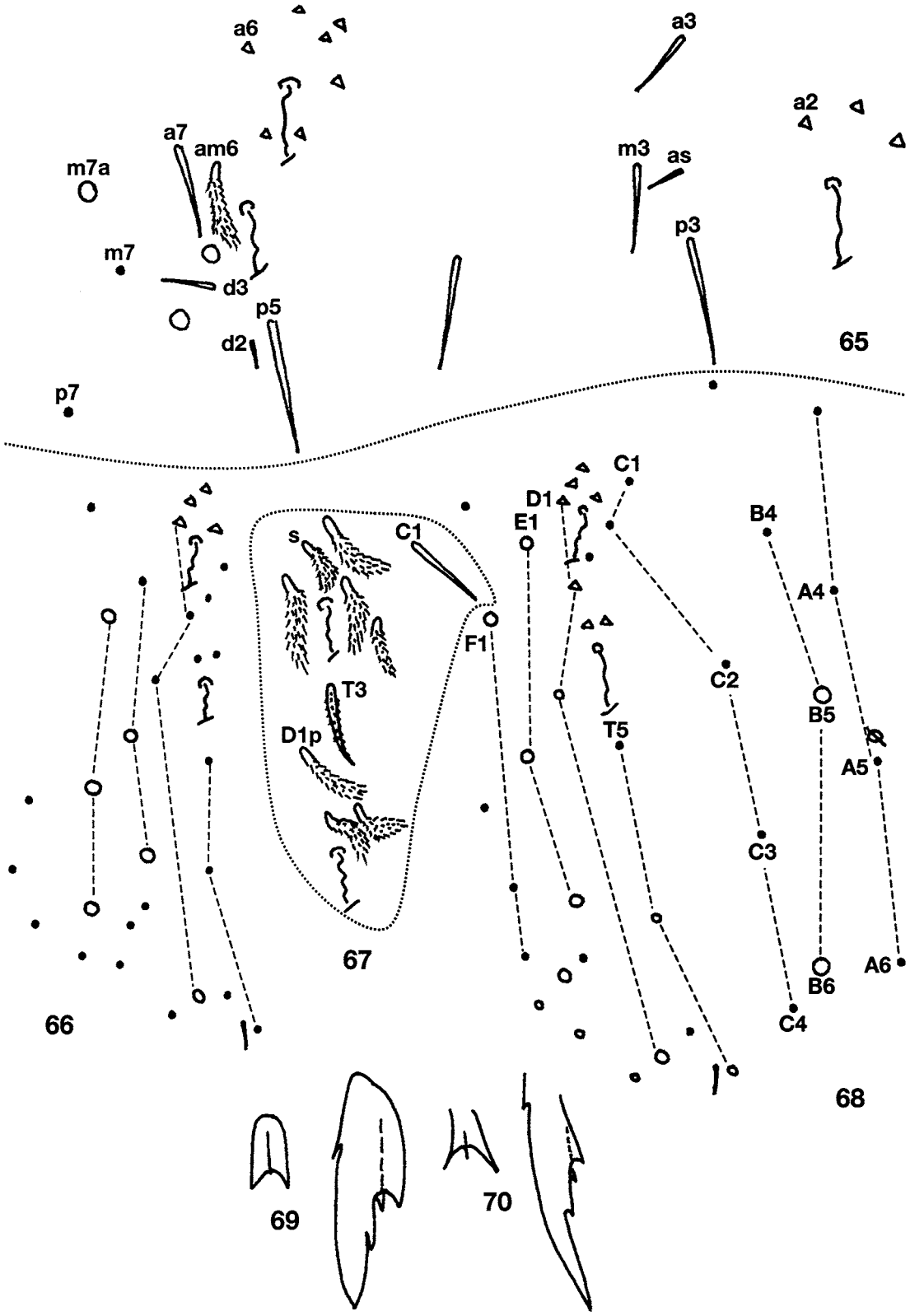
***Pseudosinella collina* Wray, 1952**
Figs 55–70

Material Examined. **GREENBRIER** Co., Trillium Cave, 28 May 2004, 1 on slide; Spencer Trap**,** 2 on one slide; Dyer's Cave, 24 May 2004, 2 on slides, 3 in alcohol; Klevi's Gap Cave, 20 May 2006, 1 mounted, 1 in alcohol; Stream Cave, Cassel-Windy System, 1 mounted.

Descriptive notes. Length up to 1.7mm. Color in alcohol variable among caves: individual from Trillium Cave, white with purple antennae, coxae and margin of Th. 2–Abd. 1; from Spencer Trap Cave white with a uniform blue wash over head and body; from Dyer's and Stream caves deep blue or purple over antennae, head, body and all leg segments; specimens from Klevi's Gap Cave were in very poor condition and the actual pigment distribution was not evident. Ant. 4 with subapical sense organ capitate (Fig. 55). Ant. 3 sense organ two thin walled rods (Fig. 56). Dorsal head chaetotaxy (Fig. 58) includes 6–7 macrosetae along antennal base, and macrosetae **A0**, **A2**, and **A3**, setae **A2a** enlarged but not typical macrosetae, **Pa5** a microseta; setae **A1** and **M0** ciliate, all other dorsal microsetae smooth; seta **S0** anterior to **S3**; **M1/S1** near, but posterior to **M2**. Eyes 6+6, subequal; one individual from Dyer's Cave has a distinct, although small, eye H only on one side (Fig. 60) whereas one individual from Stream Cave has eye C clearly smaller than the others (Fig. 61). Eye patch with setae **p** and **t** (Figs. 58, 60). Prelabral setae ciliate, all labral setae smooth. Inner labral papillae smaller than outer papillae, all papillae smooth (Fig. 57). Peristomal setae **pss 0–2** normal, ciliate; setae on pleural fold ciliate. Ungulum of maxilla with 3 teeth. Labial papilla E with lateral process slightly curved dorsally and not reaching tip of papilla (Fig. 62). Proximal labial palp seta **Y** and **Z** subequal. Labial chaetotaxy **M1M2rEL1L2A1–5,** in one individual from Dyer's cave setae **E** is smooth; the individual measuring less than 1 mm has only one seta **m.** All postlabial setae ciliate (Fig. 59), with 4+4 setae along ventral groove; columns C, E, L and O with 2, 2, 3 and 2 setae respectively, **L1–2** and **O1** shorter than other postlabial setae. Body formula for inner macrochaetotaxy as 00/0100+2. Abd. 1 setae organization linear; seta **a6** present (Fig. 63). Chaetotaxy of Abd. 2 as in Fig. 64: **a2**, **a6** and all supplementary setae fan-shaped (two individuals measuring ≤ 1mm with most supplementary setae ciliate instead of fan-shaped); **a2p** present, and from slightly to clearly longer than **a2**; **a3** inserted between **as** and **a2**, and reaching **as**; **as** not reaching socket of **m3**; **m3e** reaching socket of **m3**; **m5** a normal macroseta; **p5** smooth, **p5p** ciliate. Abd. 3 (Fig. 65) with **a2**, **a6**, **am6** and all supplementary setae fan-shaped; **a3** not reaching **as**; **as** shorter than, but reaching **m3**; **d2** and **d3**present; **a7**, **m7**, and **p7** normal microsetae, **m7a** a macroseta; **a7** weakly ciliate and inserted very close to **am6, m7** anterior to **p6**. Chaetotaxy of Abd. 4 bothriotrichal complex (Fig. 67) with all supplementary setae anterior to **T2** fan-shaped; **s** smaller than surrounding supplementary setae and posterior to **a**; **c1p** and **T3** ciliate; tip of **T3** reaching base of **D1p**; **D1p** fan-shaped, posterior to **T3** and reaching **Pe**; **Pe** and **Pi** fan-shaped. General chaetotaxy of Abd. 4 (Fig. 68) with, macrosetae **B5**, **B6**, **D2**, **T6**, **T7, D3, E1, E2**, **E3**, **F1; D3** and **E1** are slender and acuminate but have unusually large sockets, and in the absence of the hair would be interpreted as stout macrosetae; in the two individuals measuring ≤ 1mm, **D2** and **E1** are microsetae whereas **F2** and **F3** are macrosetae (Fig. 66); macroseta **B5** crossed by, or just anterior to a line drawn between **A5** and



FIGURES 55–64. *Pseudosinella collina*: 55, Fourth antennal segment subapical sensilla; 56, Third antennal segment sense organ; 57, Distal margin labrum; 58, Dorsal head chaetotaxy; 59, Labial and postlabial chaetotaxy (dots and circles are smooth and ciliate setae, respectively); 60, Eye patch with eye H; 61, Eye patch with reduced eye C; 62, Labial papilla E; 63, Setae surrounding anterolateral sensilla on first abdominal segment; 64, Chaetotaxy of second abdominal segment.



FIGURES 65–70. *Pseudosinella collina*: Circles, dots and triangles represent macro-, micro- and fan-shaped setae, respectively. 65,Chaetotaxy of third abdominal segment; 66, Lateral chaetotaxy of fourth abdominal segment in small juvenile; 67, Fourth abdominal segment bothriotrichal complex; 68, Complete chaetotaxy of fourth abdominal segment, adult; 69–70 Metathoracic claw complex and dorsal view of outer teeth in specimen from Dryer's Cave and Stream Cave, respectively.

C2; **F2** closer to **E3** than **E2**; microseta posterior to **E3** present. Abd. 4 with 5+5 posterior setae. Metathoracic femora with posterior blunt macrosetae, but not well differentiated; lateral and anterior macrosetae acuminate. Trochanteral organ with up to 20 setae. Tenet hair clavate, as long or longer than unguiculus; unguiculus lanceolate with posterior lamella appearing serrate in some individuals. Unguis with 3 inner and 3 outer teeth (Figs. 69–70): basal inner pair unequal in size, but difference not well marked, unpaired tooth distinct; outer teeth varying in size from short, not reaching base of inner teeth in specimens from Stream Cave (Fig. 70), to long and reaching base of basal inner pair in individuals from Dryer's Cave (Fig. 69). Ventral tube with 7+7 anterior setae, posterior and disto-lateral setae obscured in all specimens studied. Chaetotaxy of manubrial plate with 5–6 outer and 1–2 inner setae separated by 2 pseudopores (one individual has 3 pseudopores). Apical mucronal tooth longer than basal tooth; mucronal spine smooth and reaching basal tooth.

Remarks. The identification of these specimens as *P. collina* is based on the description provided by Christiansen and Bellinger (1998) and the characters available in the online *Pseudosinella* database (www.unav.es/unzyec/collembola). The specimens from West Virginia differ from the material described by Christiansen & Bellinger in having outer ungual teeth, and from the information in the *Pseudosinella* database online in having 5–6 outer setae on the manubrial plate (2 setae in the database). *Pseudosinella collina* appears most similar to *P. georgia* Christiansen & Bellinger, 1998, but the two species are easily distinguished by the sculpturing of prelabral and some labial setae, number of setae on anterior face of ventral tube, and general structure of tenent hair and claw complex.

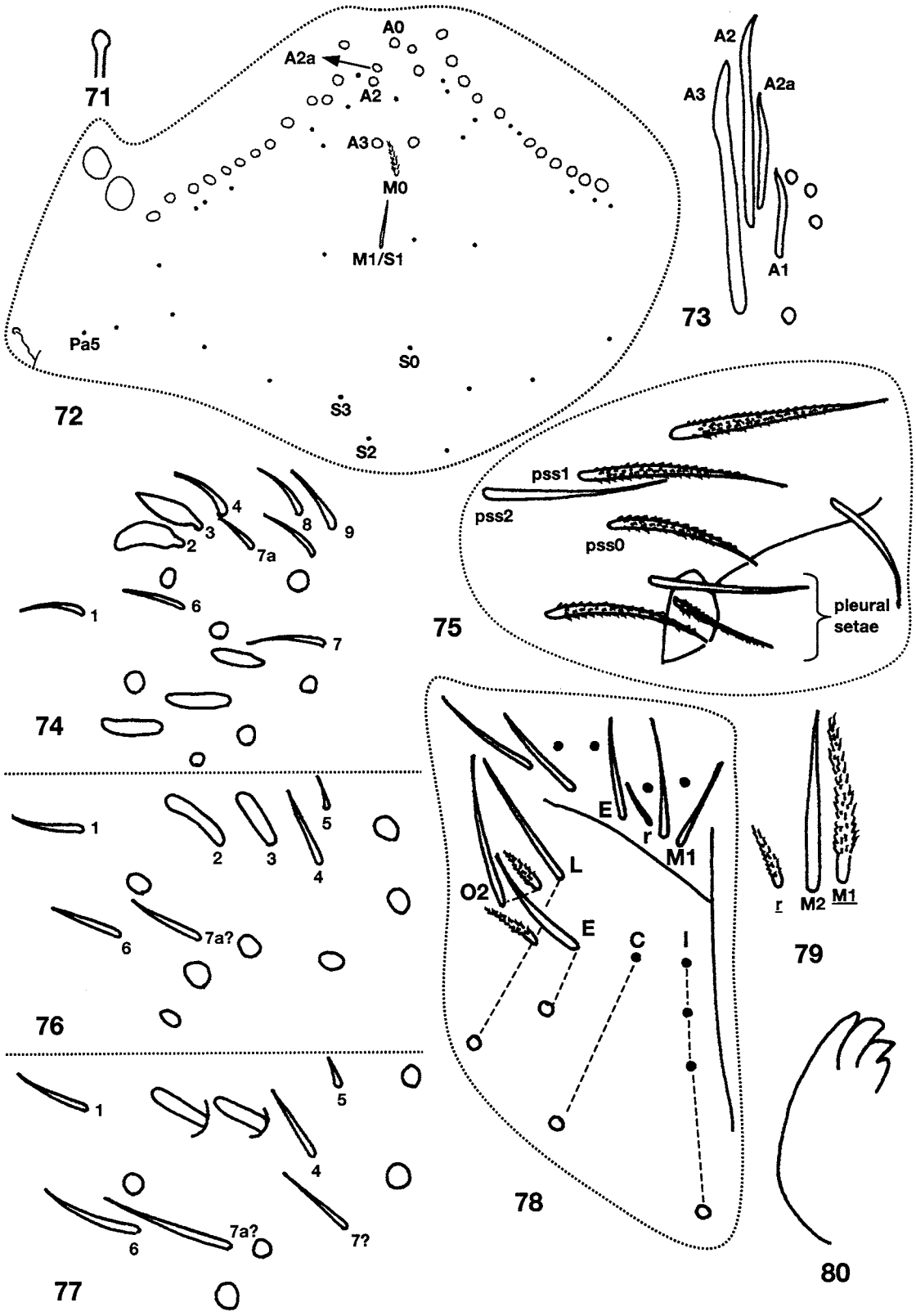
***Pseudosinella gisini* Christiansen, 1961**
Figs 71–86

Material Examined. **GREENBRIER CO.:** Al's Insurgence, 28 May 2004, 1 alcohol; Allison's Cave, 29 May 2004, 1 slide, 1 alcohol; Benedicts Cave System Persinger's Entrance, 1.June.2004, 36 in alcohol; Bill Jones, DATE, 2 alcohol; Boar Hole, 18 June 2004, 7 alcohol; Boothe Cave, 12 June 2004, 1 alcohol; Bubble Cave, 5 May 2004, 18 alcohol; Upper Buckeye Creek Cave, 18 June 2004, 30 alcohol; Callison's Pond, 22 May 2004, 5 alcohol; Clutetown Cave, 22–25 June 2004, 16 alcohol; Court Street Cave, 28 May 2004, 2 alcohol; Culverson Creek System, Hinkle-Unus Entrance, 1 in alcohol; Destitude Cave, 4 in alcohol; Field Station Pit, 6 June 2004, 3 alcohol; Fox Cave, 30 May 2004, 6 alcohol; Fuells Fruit Cave, 2 on slides, 17 in alcohol; General Davis Cave, 6 in alcohol; Grape Vine/Lost World Caverns, 28 May 2004, 1 slide, 19 alcohol; Goat Cave, 11 June 2004, 1 alcohol; Hell of a Pit 2, 28 May 2004, 1 on slide, 16 in alcohol; Hillside Pit, 9 June 2004, 12 in alcohol; Hit N Head Cave, 25 June 2004, 1 alcohol; The Hole System Gibbs Entrance, 6 alcohol; Inspired Pit, 5–8 June 2004, 1 alcohol; Ludington's Cave, 15 June 2004, 4 alcohol; MC Cave, 1 June 2004, 1 slide, 3 alcohol; MC Pit, 2 June 2004, 6 alcohol; McFerrin Water (Spur), 1 alcohol; McFerrin Breakdown Cave, 22 August 2004, 7 alcohol; Nellie's Cave, 20–23 May 2004, 4 alcohol; Osborne Pit, 2 June 2004, 3 on slides, 40 in alcohol; Organ Cave System, Lipp Entrance, 21 May 2004, 1 slide, 4 alcohol; Oak Sang Cave, 14 June 2004, 3 alcohol; Pilgrims Rest Church,19 alcohol; Pollock Cave, 1 on slide, 1 head and 1 leg of a second specimen in alcohol; Raceway Pit, 31 May 2004, 8 alcohol; Rapps Cave, 28 May 2008, 2 alcohol; Salamander Suicide Pit, 2 June 2004, 18 alcohol; Seep Cave, 12 June 2004, 4 alcohol; Spencer Cave, 17 June 2004, 1 alcohol; Upper Spout Cave, 3 alcohol; Teetering Rock Cave, 16 June 2004, 6 alcohol; Tin Cave, 9 June 2004, 1 alcohol; Trillium Cave, 28 May 2004, 1 alcohol; Turner Pit 2, 1 on slide; US219 Cave, 27 May 2004, 10 alcohol; Zimmerman's Pit, 11 June 2004, 7 alcohol; **MONROE Co:** Greenville Saltpeter Cave, Mill Pond Entrance, 10 June 2004, 2 alcohol; Hurricane Ridge Cave, 6 June 2004; Steele's Cave, 11 June 2004, 1 on slide; Union Cave, 1 June 2004, 2 alcohol; **POCAHONTAS Co:** Blue Spring Cave, 10 June 2004, 2 slides, 74 alcohol; Lobellia Saltpeter Cave, 6 June 2004, 29 alcohol; Stella's Cave, 14 June 2004, 11 alcohol; Martha's Cave, 20 August 2004, 2 slides, 7 alcohol.

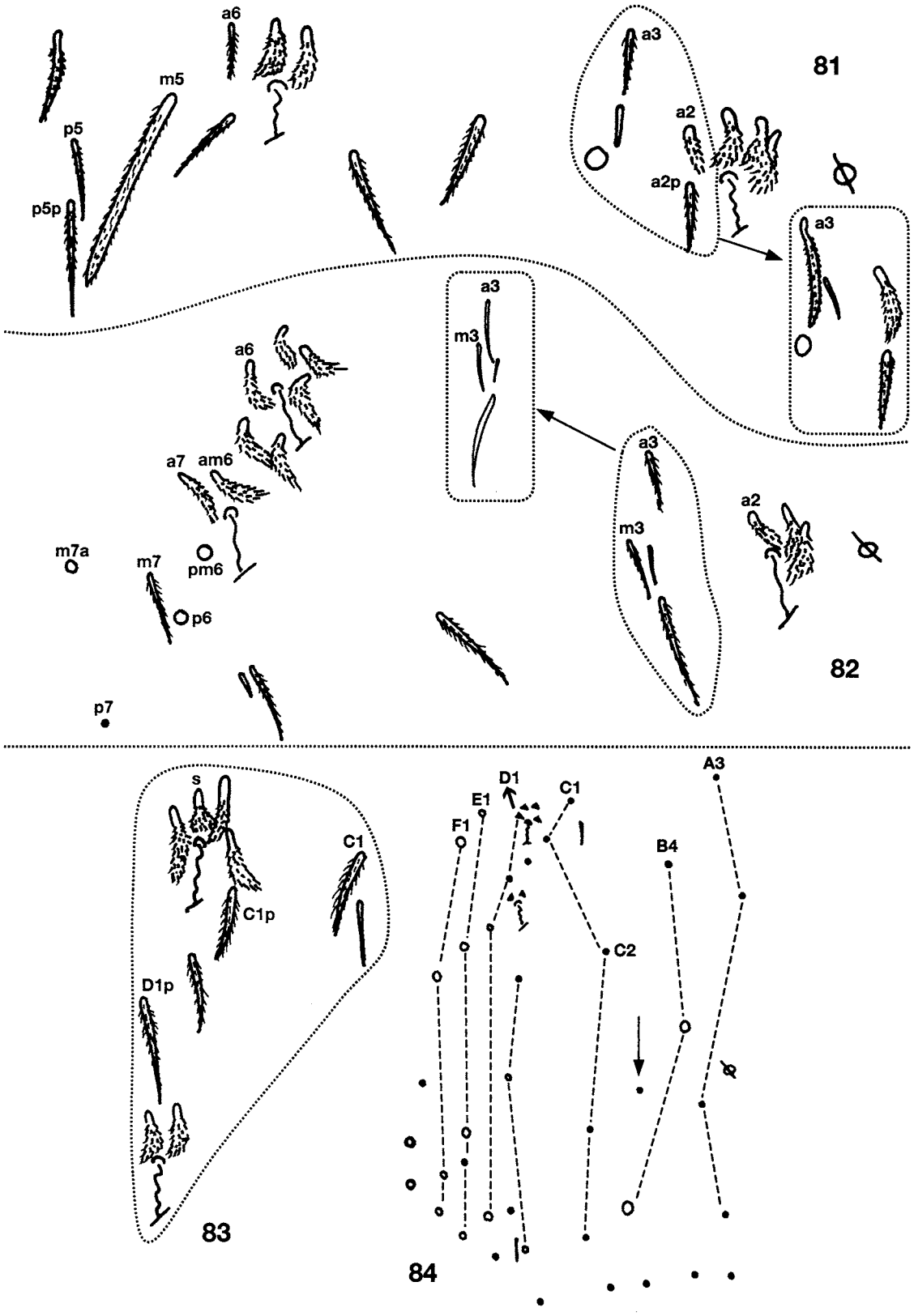
Descriptive notes. Color in alcohol variable among different caves and instars, from white, completely unpigmented, to light blue pigment only on eye patch or light blue in the form of small dots uniformly

distributed through out body. Manubrial length of the individuals examined ranging from 0.26–0.80mm. Individuals with manubrium measuring 0.71mm or less show a range of variable conditions probably attributable to instability of characters during postembryonic development (Szeptycki 1979, Soto-Adames 2008).

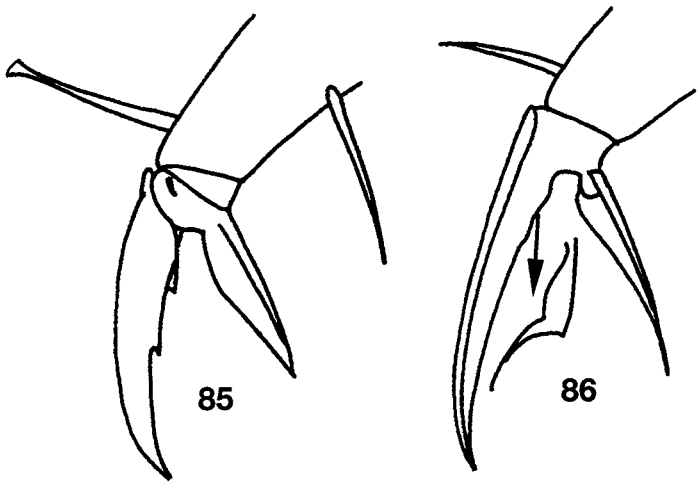
Ant. 4 subapical sense organ capitate (Fig. 71). Ant. 3 sense organ formed by 2 thin walled sensilla varying from somewhat expanded laterally to paddle-shaped; accessory sensilla as in Fig. 74, sensilla **7a** present in the largest individual with Ant. 3 (manubrium=0.70 mm long). Macrosetae at base of antennae variyng from 5–11, larger individuals usually with more macrosetae but correlation between manubrial size and setae number not perfect. Dorsal head chaetotaxy (Fig. 72) with macrosetae **A0**, **A2**, and **A3**; setae **A2a** enlarged, shorter than, but with socket not different in size from macroseta **A2** (Fig. 73); **Pa5** a microseta. All dorsal microsetae ciliate: **M0** present; **M1/S1** closer to **M2** than **S0**; row S with 5+1 setae, **S0** anterior to **S3**. Eyes 2+2, subequal. Prelabral and labral setae smooth. Inner labral papillae smaller than outer papillae, all papillae smooth. Pleural fold setae smooth. Peristomal seta **pss 0** smooth or ciliate, **pss 1–2** smooth and sharply acuminate. Maxilla with 4 ungular teeth (Fig. 80). Labial papilla E with lateral process curved dorsally and just reaching tip of papilla. Basal proximal seta of labial palpi with seta **Y** subequal or slightly longer than **Z**. Chaetotaxy of labial triangle with **M2** always smooth, but otherwise variable, with five combinations of characters involving variation in sculpturing of **M1**, **r, E** and **L1** depending on size of individual (Figs 78–79). All individuals with manubrium ≥ 0.71 mm have all posterior labial setae smooth (i.e., **M1M2rEL1L2**). At smaller manubrial sizes variation pattern not clear: all individuals with manubrial length ≥ 0.60mm have seta **M1** smooth and all individuals with manubrium ≤ 0.29mm have **M1** ciliate, but **M1** condition not predictable in individuals between these size ranges. Likewise, **r** is smooth at manubrial sizes ≥ 0.71mm, ciliate at sizes ≤ 0.29mm and unpredictable at intermediate sizes. Labial setae **L1** and **E** ciliate only in one small individual (manubrium = 0.47mm) in which **M1** and **r** are also ciliate. Postlabium (Fig. 78) with 4+4 setae along ventral groove, seta 1–3 smooth, seta 4 ciliate; columns M, E, L and O with 2, 2, 3 and 2 setae respectively, all setae on anterior row (except **O1**) and **O2** smooth, setae **C2** and **L3** ciliate, **E2** smooth or ciliate, setae **L2** and **O1** ciliate and shorter than other postlabial setae. Formula for inner macrochaetotaxy of body as 00/0100+2. Mesothorax moderately enlarged. Abd. 1 setae organization linear; seta **a6** present. Chaetotaxy of Abd. 2 (Fig. 81) with all supplementary setae fan-shaped; all other setae (except **as**) ciliate, **a2** and **a3** sometimes distally expanded but not quite fan-shaped (inset Fig. 81); 2–3 setae in series **m** around inner bothriotricha, **a2p** present; **a3** inserted anterior to **as**, usually not reaching **as**, but long and surpassing **as** in some individuals (Fig. 81 inset); **as** may or may not reach socket of **m3**; **m3e** not reaching socket of **m3**; series L anterior to lateral bothriotricha with 2 setae; **m5** a normal macroseta; **p5p** present and longer than **p5**. Abd. 3 (Fig. 82) with **a2**, **a6**, **am6** and all supplementary setae fan-shaped, all other setae (except **as** and **d2**) ciliate; in most individuals **a3** inserted between **as** and **a2** and not reaching **as**, in others, **a3** inserted between **m3** and **as** and reaching base of **as** (Fig. 82 inset); **as** shorter than, but reaching **m3**; **d2** present; **a7** ciliate and lanceolate and inserted very close to **am6**; **m7** and **p7** normal microsetae, **m7** inserted between **pm6** and **p6**, **m7a** an acuminate macroseta. Abd. 4 bothriotrichal complex (Fig. 83) with **m**, **a**, **s**, and **D1** fan-shaped; **s** smaller than surrounding supplementary setae; **C1p, T3** and **D1p** ciliate; tip of **T3** reaching base of **D1p**; **D1p** posterior to **T3** and almost reaching **Pe**; **Pe** and **Pi** fan-shaped. General chaetotaxy of Abd. 4 (Fig. 84) with macrosetae **B5**, **B6**, **T6**, **T7, D2**, **D3, E1, E2**, **E3**, **F1, F2** and **F3**; macroseta **B5** crossed by, or just anterior to a line drawn between **A5** and **C2**; a supplementary microseta present between **B5** and **B6** seen in 14 of 21 individuals examined (arrow in Fig. 84), presence of seta not correlated with manubrial size; **F2** closer to **E2** than **E3;** microseta posterior to **E3** present. Abd. 4 with 5+5 posterior setae. Macrosetae of metathoracic femora not seen although sockets clearly enlarged. Claw complex showing two distinct morphologies. Most individuals with tenet hair spatulate (Fig. 85), subequal to slightly shorter than unguiculus; unguiculus weakly truncate to lanceolate, with basal swelling varying in development; posterior lamella serrate in some individuals; unguis with 3 inner and 3 outer teeth, inner basal pair unequal in size, outer tooth very short on prothoracic legs, but distinct on metathoracic legs; lateral teeth short on prothoracic legs but apparently absent from metathoracic legs. One individual from Fuell's Fruit Cave and one



FIGURES 71–80. *Pseudosinella gisini:* 71, Subapical sensilla of fourth antennal segment; 72, Dorsal head chaetotaxy; 73, Detail of dorsal head macrosetae on series A showing development of seta A2a and relative size of socket; 74, Normal sense organ of third antennomere and associated sensilla, view of sensillum 5 obstructed by sensillum 3; 75, Peristomal and pleural setae in small juvenile; 76, Sense organ of third antennomere and associated sensilla in small juvenile; 77, Atypical sense organ of third antennomere and associated sensilla; 78, Labial and postlabial chaetotaxy; 79, Alternative morphology of labial setae **m** and **r**; 80, Ungulum of maxilla.



FIGURES 81–84. *Pseudosinella gisini*: Abdominal chaetotaxy, circles, dots and triangles are macro-, micro and fan-shaped setae, respectively. 81, Second segment; 82, Third segment; 83, Bothriotrichal complex of fourth segment; 84, Complete chaetotaxy of fourth segment.



FIGURES 85–86. *Pseudosinella gisini*: Metathoracic claw complex. 85, Common claw; 86, Claw of small individuals from Fuell's Fruit Cave and Scott's Hollow Cave.

from Scott's Hollow Cave have an elongate unguis (Fig. 86) with only the basal pair of inner teeth present, the outer tooth is very close to the base of the unguis and the lateral teeth appear to be absent, the tenent hair is acuminate and shorter than the unguiculus, and the unguiculus is sharply acuminate. These two individuals are relatively small (manubrial length≈ 0.47mm for individual from Fuell's Fruit Cave), either have one or no eyes (Fuell's Fruit Cave), and have all peristomal and setae (except **pss2**) ciliate (Fig. 75), but otherwise are similar to other individuals in the samples in which they were included. Ventral tube of most individuals with 2–3+2–3 macrosetae on distal anterior margin and 16 disto-lateral setae, three small individuals (manubrium ≤ 0.29mm) with only one distal macroseta on anterior face; setae on posterior face obscured in all specimens studied, but apparently more than ten in number. Chaetotaxy of manubrial plate with 6 outer and 2 inner setae separated by 2 pseudopores. Apical mucronal tooth not much longer than basal tooth.

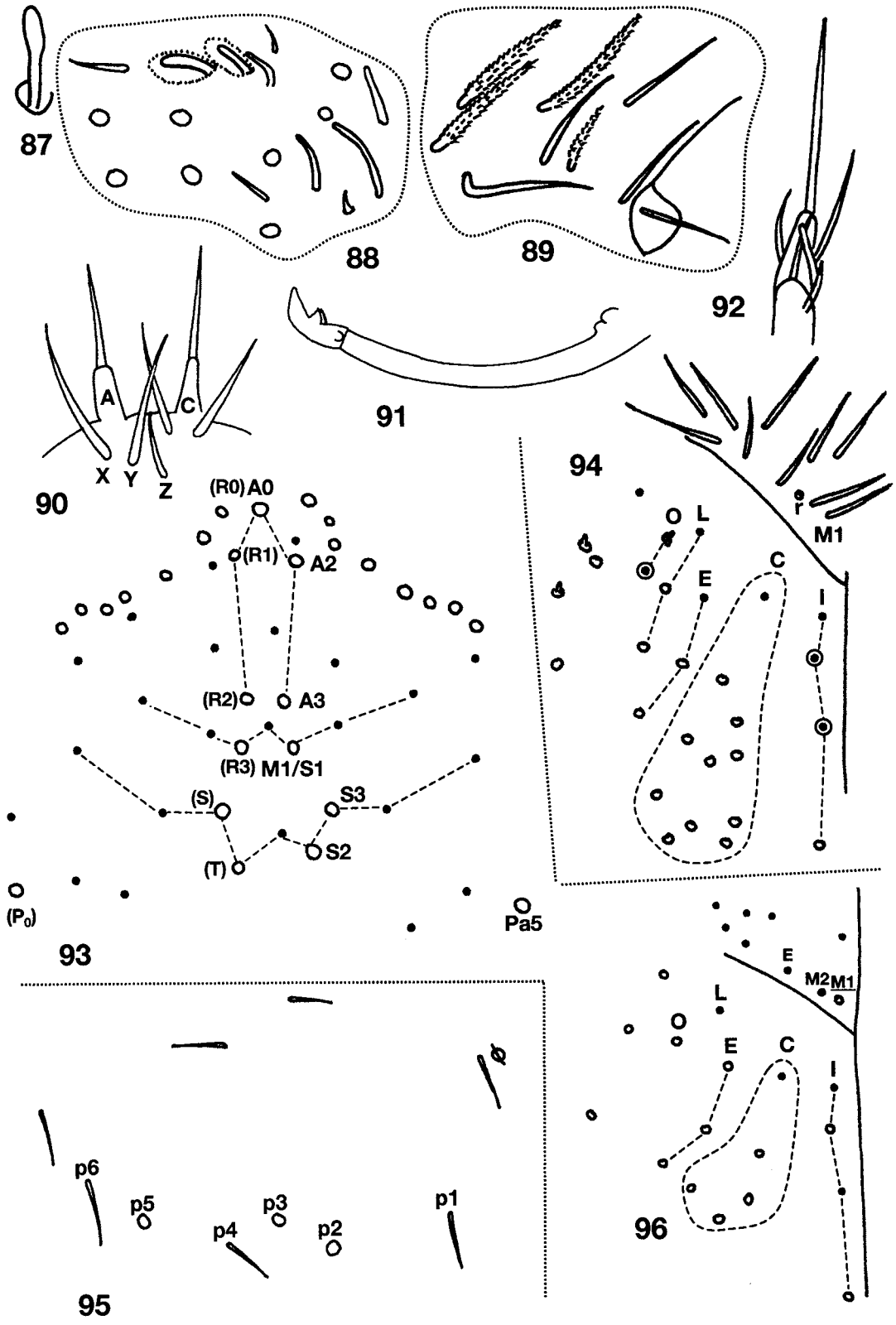
Remarks. Christiansen and Bellinger (1996) divided *P. gisini* into three subspecies based on the presence or absence of microsensilla **7a** on the sense organ of Ant. 3, eye number, sculpturing of setae along the ventral groove on the head (postlabial setae I), and to a lesser extent the labial and ventral tube chaetotaxy. Thus, the presence of sensilla **7a** on the sense organ of Ant. 3 identifies *P. g. gisini*, absence of sensilla **7a** and reduction of labial seta r identifies *P. g. virginia* Christiansen & Bellinger, 1996 and the combination of an absent sensilla **7a** and ciliate labial seta **r** characterizes *P. g. carolina* Christiansen & Bellinger, 1996. Other characters show uneven degrees of overlap among the three forms and can be used to differentiate among them only in combination with the characters mentioned above. Unfortunately, in 10 of the 21 individuals examined Ant. 3 had broke off or was obstructed by other appendages, but the individuals in which the presence or absence of sensilla **7a** could be determined form an heterogeneous group and do not fit the range of variation proposed by Christiansen and Bellinger (1998) for each subspecies. Of the 11 individuals in which Ant. 3 is intact, 5 have sensilla **7a** and would be identified as *P. g. gisini*, whereas 6 individuals have a small acuminate labial seta **r** which is either ciliate or smooth and would be identified as *P. g. carolina*. However, all putative *P. g. carolina* have 2 eyes (except the individual from Fuell's Fruit Cave mentioned above in reference to claw structure, which is blind) instead of the 0–1 typical of the subspecies, and all have the anterior seta in postlabial column I smooth (ciliate in typical *P. g. carolina*). Following the geographical distribution of the subspecies reported by Christiansen & Bellinger (1998), all individuals examined here should belong into *P. g. gisni* and all should have sensilla **7a**. Most individuals in which only one 7-series sensilla is visible are small and it is possible that either **7** or **7a** is secondary and absent in early instars (cf. Figs. 74, 76–77). The absence of sensilla **7a** in medium size individuals may result from broken antennae that did not re-grow a normal complement of sensilla.

***Pseudosinella orba* Christiansen, 1961**
Figs 88–104, Table 6

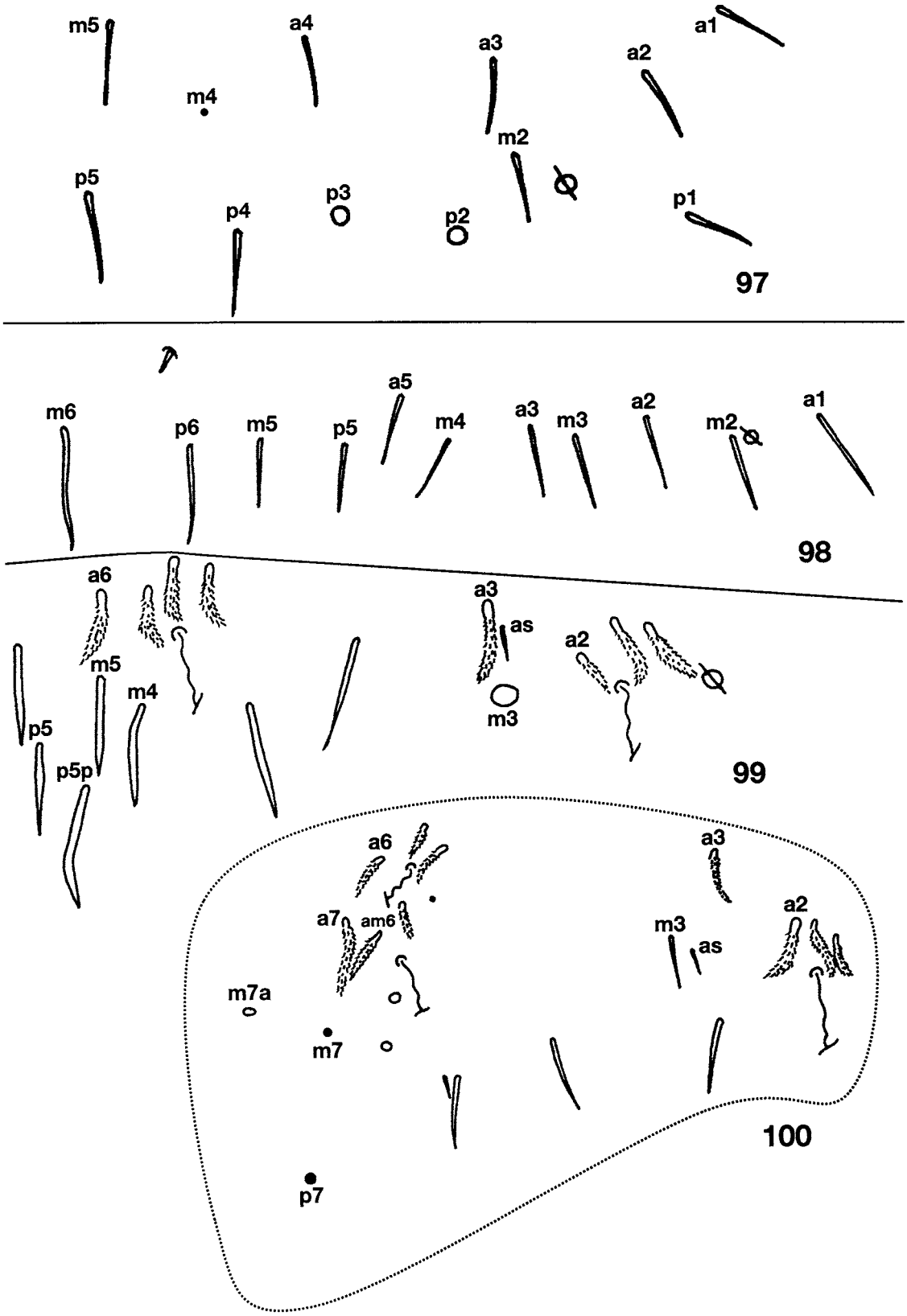
Material Examined. **West Virginia, MERCER** Co., Honacker Cave, 2 individual on one slide and 2 others in alcohol; Chris's Last Look, 2 individual on one slide and 2 others in alcohol. **Virginia**, **SMYTHE** Co., Dead Air Cave, water pool, 16 March 2000, 3 individuals on one slide.

Descriptive notes. Length to 2.4mm; color in alcohol white, without trace of pigment. Subapical sense organ weakly clavate (Fig. 87). Ant. 3 sense organ formed by two thin walled rods in shallow pits (Fig. 88); the segment has additional basally-swollen, thin walled setae and conic sensilla near the usual sense organ. Dorsal head chaetotaxy (Fig. 93) includes 6–7 macrosetae along antennal base, and macrosetae **A0**, **A2**, **A3**, **M1/S1**, **S2**, **S3** and **Pa5**; **A1** ciliate, all other dorsal microsetae smooth; seta **S0** closer to **S2** than **S3**; **M1/S1** just posterior to **M2**. Eyes absent. Prelabral and all labral setae smooth. Labral papillae obscured. Peristomal setae (Fig. 89) **pss0** ciliate, **pss1–2** smooth, pleural fold setae smooth. Ungulum of maxilla with 3 teeth. Labial papilla E (Fig. 92) with lateral process curved inwards and not reaching tip of papilla. Labial palp with proximal seta **Z** distinctly shorter than seta **Y** (Fig. 90). Labial chaetotaxy **M1M2oEL1L2A1–5**; in some individuals **r** visible as a translucent conic sensilla barely protruding beyond socket. Postlabial chaetotaxy (Fig. 90) with 4+4 setae along ventral groove, seta **I1** always smooth, **I4** always ciliate, **I2–3** variable, either ciliate or smooth; **C1** smooth, and 5–8 posterior ciliate setae not organized into a column; **E1** smooth, **E2** ciliate; **L1** smooth, **L2** ciliate but not modified; **O1** modified into a conic microsetae similar to but longer than labial **r**, **O2** smooth or ciliate. Inner macrochaetotaxy of body as 32/0100+3. Mesothoracic macrosetae **p2**, **p3** and **p5** present (Fig. 95). Metathorax (Fig. 97) with macroseta **p2** and **p3**. Abd. 1 seta **a6** absent, **a3** and/or **a5**, displaced anteriorly out of the row (Fig. 98). Chaetotaxy of Abd. 2 (Fig. 99) with **a6** and all supplementary setae fan-shaped; **a2** ciliate, **a2p** absent; **a3** fan-shaped, external to **as**, and surpassing tip of **as**; **as** not reaching socket of macroseta **m3**; **m3e** not reaching socket of **as**; socket of **m5** modified as a normal macroseta, but seta itself subequal or shorter than seta **p5p**; **p5p** a short, ciliate mesoseta. Abd. 3 (Fig. 100) with **a2**, **a6**, **am6**, **a7** and all supplementary setae fan-shaped or ciliate; **mi** shorter than **ml**; **a3** ciliate, anterior to and far from **as**; **as** reaching **m3**, nearly half the length of **m3**; **d2** reaching **p5**; **a7** inserted close to, longer than, and reaching **am6**; **m7** a normal microseta inserted anterior to **p6**; **p7** a long microseta; **m7a** macroseta; 1–2 additional acuminate macrosetae present posterior to **p7**. Abd. 4 bothriotrichal complex as in Fig. 101: **s** absent; **a**, **m, D1**, **Pi** and **Pe** fan-shaped; **C1p**, **T3** and **D1p** ciliate; **T3** and **D1p** almost forming a row, **T3** and **D1p** reaching **Pi** and **Pe** respectively. General chaetotaxy of Abd. 4 (Fig. 102) with macrosetae **B4, B5, B6, T6**, **T7, D2**, **E1, D3, E2, E3**, **F1** and **F3**; microseta posterior to **E3** present; macroseta **B5** anterior to a line drawn between **A5** and **C2**. Posterior setae on Abd. 4 usually 3+3. Trochanteral organ with 17–18 setae. Metathoracic femora with three blunt macrosetae inserted near the middle of the segment. Tenet hair (Fig. 103) acuminate, slightly shorter than unguiculus; unguiculus lanceolate with a small basal swelling and weakly truncate on third pair of legs; posterior lamella of all legs with small, clear tooth in the two largest individuals, but smooth on smaller specimens, all other lamellae smooth (Fig. 104). Unguis with three teeth (Fig.103): basal pair clearly unequal in size, shortest member of the pair smaller than distal unpaired tooth; unpaired tooth prominent; outer teeth short, not nearly attaining basal inner teeth, clearly seen only on pro- and mesothoracic legs, metathoracic claws apparently lacking outer teeth. Collophore with up to 11 distolateral setae; anterior face with 7–8 setae; posterior face with 3+3 distal setae. Dens with distal uncrenulate section at least 4x length of mucro (Fig. 91). Manubrial plate with 2 outer and 2 inner setae separated by 2 pseudopores. Apical mucronal tooth longer and narrower than basal tooth (Fig. 91).

Remarks. I have examined three individuals from Dead Air Cave in Smythe Co. Virginia kindly sent to me by Kenneth Christiansen and they differ from the material from West Virginia (Table 6) in the structure of labial seta **m1**, number and structure of setae in postlabial row O (Fig. 96) and in that Abd. 4 **B4** is a micro-, instead of a macroseta (Fig. 102, arrow). Some of this variation (e. g., number of setae on postlabium, Th. 2 and Abd. 4) may be attributed to differences in body size between locations given that the smallest specimen from Mercer Co. is 1.8mm long whereas the largest specimen seen from Smythe Co. is just 1.3mm long.

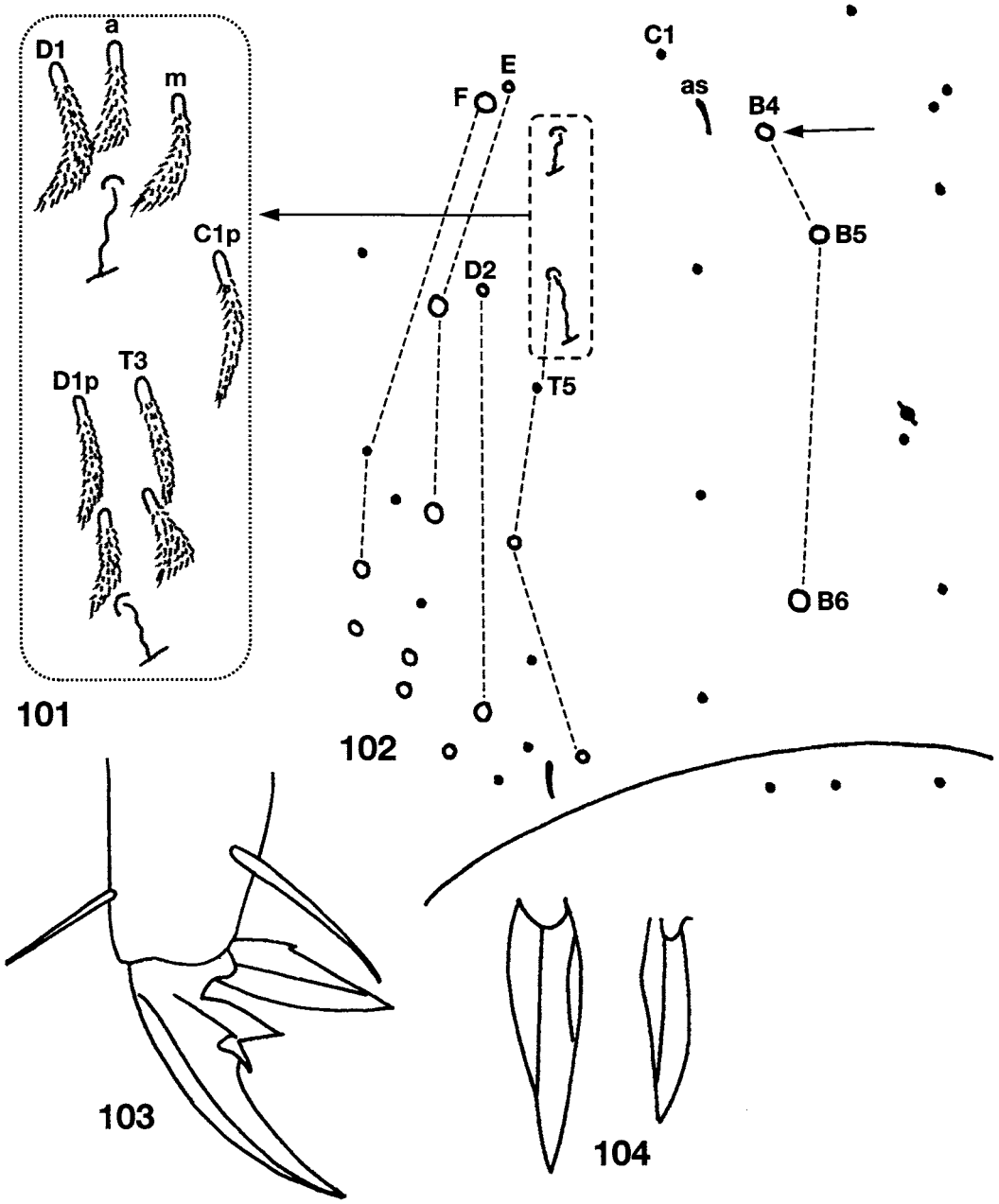


FIGURES 87–96. *Pseudosinella orba*: 87, Subapical sensilla of fourth antennal segment; 88, Sense organ of third antennomere and associated sensilla; 89, Peristomal and pleural fold setae; 90, Position of proximal setae of labial palp relative to papilla A and C; 91, Mucro and distal uncrenulate section of dens; 92, Labial palp papilla E; 93, Dorsal head chaetotaxy, left side labeled using the RST system, right side labeled using the AMS system; 94, Labial and postlabial chaetotaxy, dots and circles are smooth and ciliate setae, respectively, setae represented by circles with dots can be ciliate or smooth; 95, Mesothoracic chaetotaxy; 96, Labium and postlabium, individuals from Smythe Co. Virginia.



FIGURES 97–100. *Pseudosinella orba*: 97, Metathorax, inner chaetotaxy; 98, First abdominal segment; 99, Second abdominal segment, seta **m3e** is smooth, all other acuminate setae are finely ciliate; 100, Third abdominal segment.

However, populations considered by Christiansen and Bellinger (1998) as con-specific with *P. orba* also vary in details of the chaetotaxy of the head (dorsal), labium, postlabium, Th. 2, Th. 3 and Abd. 4 as shown in Table 6. These different 'populations' may in fact represent isolated species in a species complex, but a detailed analysis of the geographic distribution of the variation must be completed before reaching a conclusion. In addition, the chaetotaxy of the types from Tennessee needs description.



FIGURES 101–104. *Pseudosinella orba*: 101, Bothriotrichal complex of fourth abdominal segment; 102, Complete chaetotaxy of fourth abdominal segment, in specimens from Smythe Co., Virginia, B4 (arrow) as microseta; 103, Metathoracic claw complex; 104, Pro- and mesothoracic unguiculus.

TABLE 6. Differences between populations identified as *Pseudosinella orba* in Christiansen and Bellinger (1998) (C&B) and individuals described here from new collections from Mercer Co., WV and Smythe Co, VA. macroseta C1 + = present or – =absent.

'Population'	Head Macroseta S2	Labium m1	Postlabium Column O	Th. 2 Macrosetae	Th. 3 Macrosetae	Abd. 4 Macroseta C1	Abd. 4 Medial Macrosetae
WV, Mercer Co. (New)	present	smooth	2–3 setae; O1 modified	3	2	–	3
WV, Mercer Co (C&B, 1998)	present	smooth	?	3	3	+	2
VA, Smythe Co. (New)	present	ciliate	1 seta; O1 normal	2	2	–	2
VA, not Smythe Co. (C&B, 1998)	present	ciliate	?	3	3	–	2
NC, Macdowell Co. (C&B, 1998)	absent	smooth	?	2	2	+	2

***Pseudosinella violenta* (Folsom), 1924**
Figs 105–116, Table 7

Material Examined. GREENBRIER Co., Water Trough Cave, 3 on slides, 7 in alcohol; Tin Cave, 9 June 2004, 1 on slide.

Descriptive notes. The dorsal chaetotaxy of the head includes 5–6 macrosetae along the base of the antenna and posterior to needle-shaped smooth setae (Fig. 105); **A0** and **Pa5** are the only macrosetae present, all other setae in series A (except **A1**, which is ciliate), M, S and Ps are short and smooth; anterior to **A0** there is a conic sensilla (not shown in Fig. 105); **M0** absent. Macroseta **Pa5** and postocular bothriotricha (**Pa6)** distinctly displaced medially and inserted closer to seta **Ps3** than **Ps5** (cf. Figs. 105 and 4). Pleural and peristomal setae smooth and undifferentiated. Lateral appendage of labial palp papilla E curved internally and surpassing tip of papilla. Three of the four individuals examined have labial chaetotaxy as **M1M2rEL1L2** (Fig. 106), one individual with **m1** shorter than **M2**. All postlabial setae smooth in three of the four individuals examined, in one individual from Water Through Cave most setae are very weakly, but noticeably ciliate: columns I, C, E, L and O with 4, 2, 2, 3, 2 setae; **L2** and **O1** are conic to weakly blunt sensilla (Fig. 106). Ungulum of maxilla with three teeth (Fig. 112). Formula for inner macrochaetotaxy of body as 00/0300+2. Seta **a6** on Abd. 1 present. Abd. 2 (Fig. 110) with **a6**, **a3** and all supplementary setae around bothriotricha fan-shaped; **a2p** ciliate or smooth; macrosetae **a2**, **m3**, **m3e**, **m5** and **p5p** present. Abd. 3 (Fig. 111) with **a2**, **a6** and all supplementary setae around bothriotricha fan-shaped; **a3** ciliate, displaced posteriorly as to almost form a row with **m3** and **as**; **a7** ciliate, anterior to and reaching **am6**; **d2** absent; **p6** posterior to **p5** and **m7**; **m7a** a macroseta. Bothriotrichal complex of Abd. 4 (Fig. 113) with **T3** ciliate, all other setae fan-shaped; **s** absent; **T3** and **D1p** almost aligned into a row; **D1p** reaching **Pe**; a supplementary fan-shaped seta present between **Pe** and **T5** (arrow, Fig. 113). General chaetotaxy of Abd. 4 (Fig. 114) with macrosetae **B5**, **B6**, **T7, F2, D2**, **D3**, **E2**, **E3**, **F1**, **F3**, and two others probably belonging to series **Fe** present, **B5** anterior to a line drawn between **A5** and **C2**; **C1** a ciliate microseta; a supplementary microseta present between **E1** and **E2**. Abd. 4 Posterior setae 4+4. All individuals have claws with three inner teeth, with one of the basal teeth clearly larger than the other, unguiculus with a large posterior tooth. In the individuals from Water Trough Cave the difference in size between the basal paired teeth is less marked than in the specimen from Tin cave (cf . Figs 115, 116). In addition, the posterior unguicular tooth is longer in the individual from Tin cave than in those from Water Trough Cave. Anterior face of ventral tube with 1+1 distal macrosetae and seven other basal setae (Fig. 108); posterior face with 1+1 distal and 5 basal setae (Fig. 109); lateral vesicles view obstructed in

all specimens examined. The three individuals from Water Trough Cave have one smooth seta on the dorsodistal row of the manubrium (Fig. 107), 1 internal and 1 external setae on the manubrial plate and short spatulate tenet hairs on all feet (fig. 115), whereas in the individual from Tin Cave all manubrial setae are ciliate, the manubrial plate has two external setae and all tenent hairs are acuminate (fig. 116).

Remarks. Christiansen and Culver (1969) dealt with the extensive variation seen in this species across North America. The descriptive notes presented above are provided to place the West Virginian collections in the context of the geographic variation of the species and to add some characters not considered by previous authors.

Pseudosinella violenta is distinguished from other blind North American *Pseudosinella* by a combination of characters which include having the postocular bothriotricha and macroseta **Pa5** displaced dorsomedially on the head, having a large posterior unguicular tooth, all posterior setae on labial triangle, and the anterior row of postlabial setae smooth, Abd. 2 with five macrosetae, Abd. 3 with setae **a3**, **as** and **m3** forming an irregular row and macroseta **p6** displaced posteriorly as to be inserted between **p5** and **p7**, Abd. 4 with macroseta **B5** displaced interiorly, closer to **C1** than **B6**, and supplementary setae between **Pe**–**T5** and **E1**–**E2**.

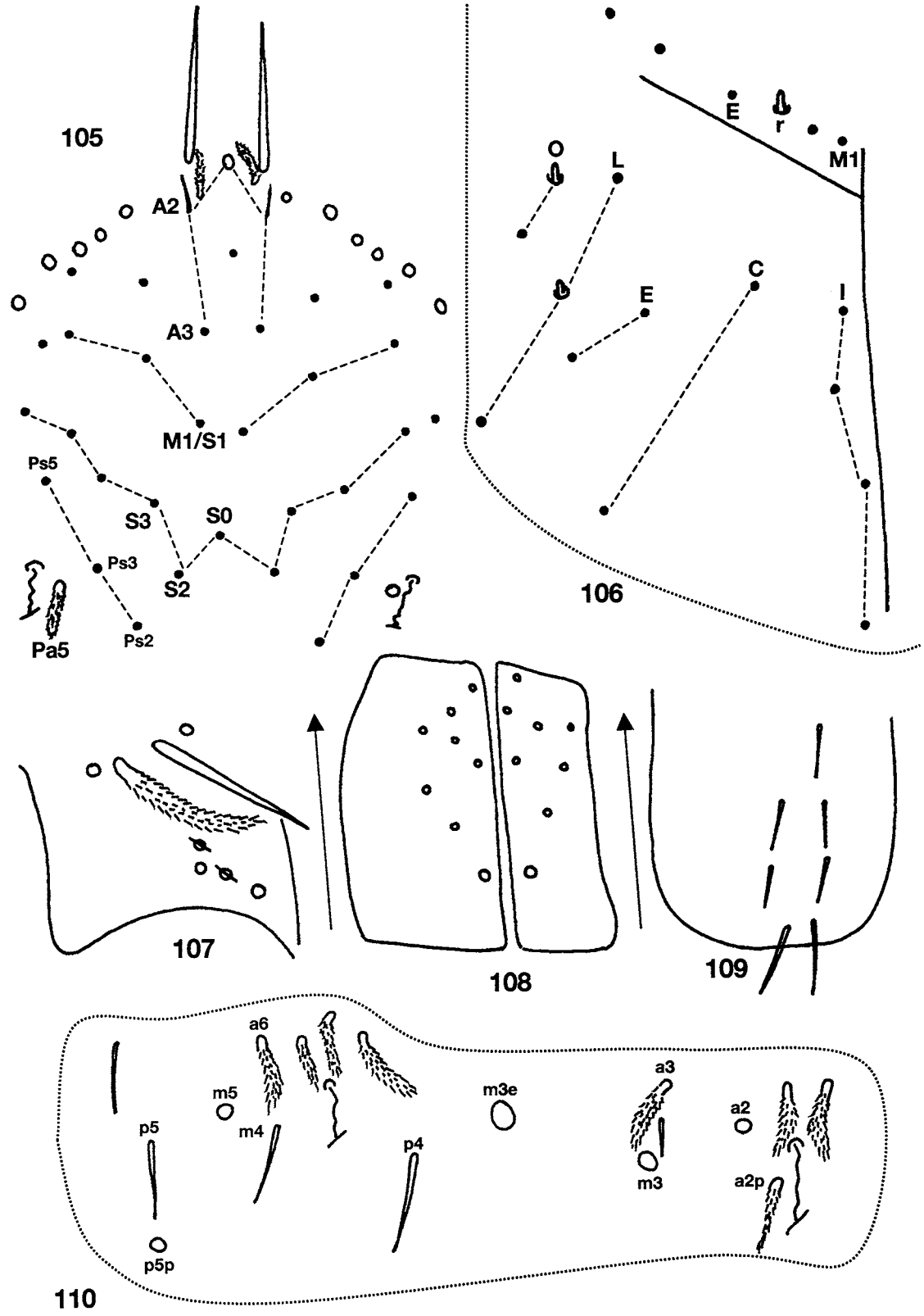
TABLE 7. Characteristics of members of the *P. violenta* species group. M= macroseta; µ= microseta; += present; –= absent

Species	Postocular bothriotricha medially displaced	Abd. 4 s	Abd. 2 a2p	Abd. 2 a2	Abd. 2 m3	Abd. 2 m3e	Inner Claw Teeth	Tenet Hair	Abd. 4 C1	Posterior Unguicular Tooth
violenta	+	+ –	+	M	M	M	2–3	clavate acuminate	µ[1]	+
halophila	+	–	+	M	M	M	2	acuminate	µ	+
ashmoleorum	+	–	+	M	M	M	2	acuminate	µ	+
gama	+	+	+	M	M	M	3	clavate	µ	+
bellingeri	?	–	–	M	M	µ	4	clavate	M	+
folsomi	+	+	+	M	M	M	3	clavate	M	–
rolfsi	+	–	+	µ	µ	M	3	clavate	µ[1]	+

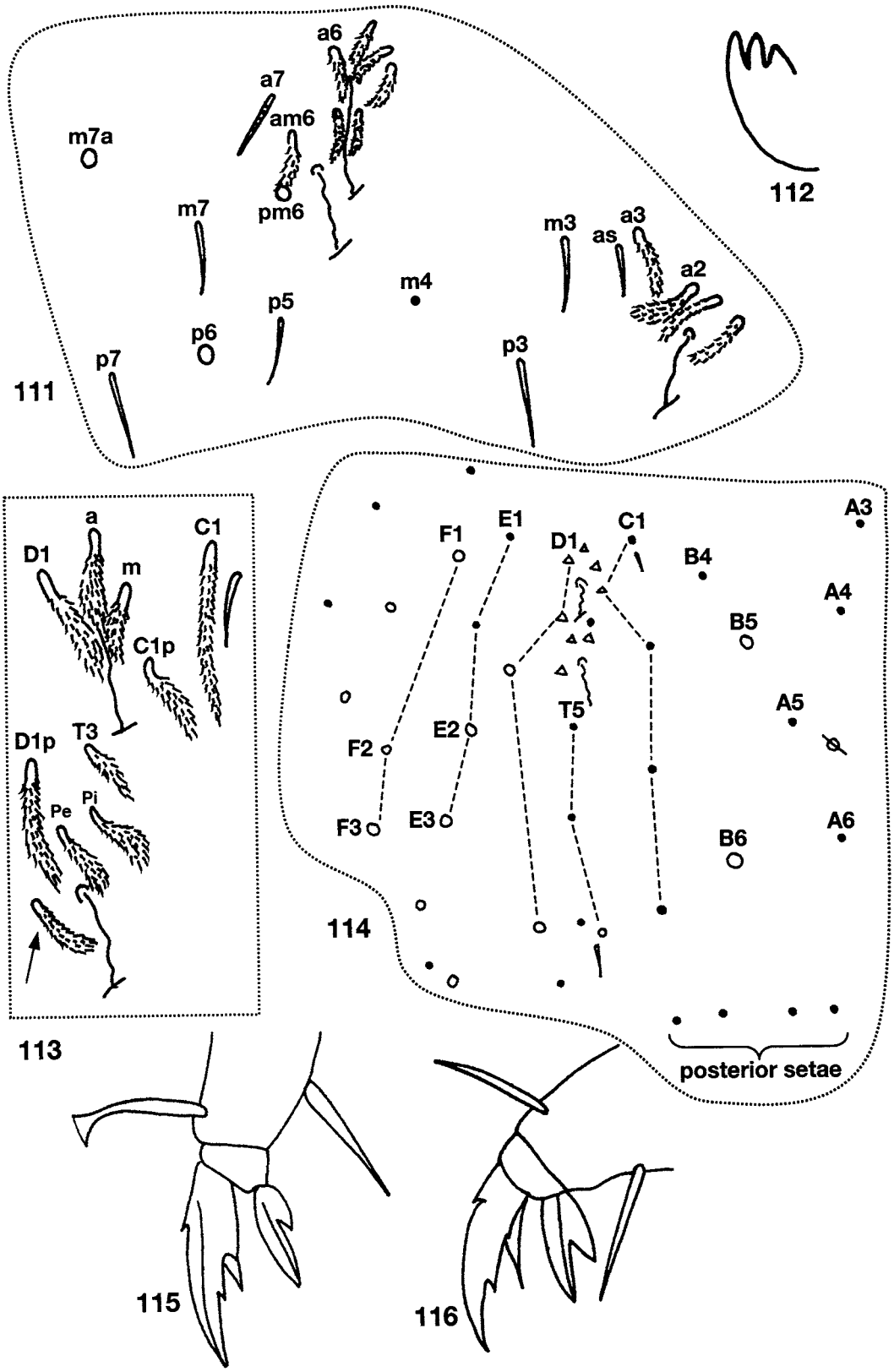
[1]Enlarged and roughly ciliate, but not a macroseta in the sense used here for Abd. 4 setae in series B.

The characteristic displacement of the cephalic bothriotricha and macrosetae **Pa5** is rare among *Pseudosinella* species, were it has been reported (to my knowledge) only in *P. rolfsi* Mills, 1932, *P. folsomi* (Mills, 1931), *P. ashmoleorum* Gama, 1988, *P. gamae* Gisin, 1967, and *P. halophila* Bagnall, 1939 (*sensu* Fjellberg 2008). These six species, plus *P. bellingeri* Wang, Chen & Christiansen, 2002 (relative position of the postocular bothriotricha unknown) have been considered as part of an informally defined species group (e.g., Wang *et al.* 2004). Of the seven species, *P. bellingeri* and to some extent *P. folsomi* and *P. rolfsi* can be unambiguously distinguished, but the separation between the European forms (*ashmoleorum*, *gamae* and *halophila*) from *P. violenta* as circumscribed by Christiansen & Bellinger (1998) is not clear. Table 7 presents a list of characters used to separate species in this group. According to Christiansen and Culver (1969) *P. violenta* from Central Texas and south through Mexico and South America have Abd. 4 seta **s**, whereas in North American populations north of Texas, seta **s** is absent. Christiansen and Culver (1969) also report great variation in claw complex structure, with some individuals having three inner teeth while others only having two teeth. This circumscription of *P. violenta*, leads me to concluded that *P. gamae* is a junior synonym of *P. violenta* (Central and South American populations), *P. ashmoleorum* is a junior synonym of *P. halophila* (*sensu* Fjellberg 2007), which in turn differs from some North American populations of *P. violenta* only in the absence of one inner ungual tooth. I refrain from proposing a formal synonymization of these names until I have the opportunity to study types or topotypical material of each species. In any case, it is possible that the great interpopulation variation reported for *P. violenta* in the Americas masks a species complex, and that

some of the names applied to European populations may be available to identify particular lineages within the complex.



FIGURES 105–110. *Pseudosinella violenta*: 105, Dorsal head chaetotaxy; 106, Labial and postlabial chaetotaxy; 107, Distal manubrial plate; 108, Anterior face of collophore, arrows point basally; 109, Posterior face of collophore, arrows point basally; 110, Second abdominal segment.



FIGURES 111–116. *Pseudosinella violenta*: 111, Third abdominal segment; 112, Ungulum of maxilla; 113, Bothriotrichal complex of fourth abdominal segment, arrow identifies supplementary seta; 114, Complete chaetotaxy of fourth abdominal segment; 115–116, Metathoracic claw complex, specimens from Water Trough Cave and Tin cave, respectively.

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