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Distinctive Collembola Communities in the Mesovoid Shallow Substratum: Entomobryomorpha of the Sierra de Guadarrama National Park (Central Spain)

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ABSTRACT
The material for this study was obtained after intensive sampling in the colluvial mesovoid shallow substratum, or MSS, of the Sierra de Guadarrama National Park using 33 subterranean sampling devices (SSD). The data were obtained from the first extraction of the traps between May and October of 2015. This paper presents the results for the Entomobryomorpha Börner, 1913, which was part of the Collembola captured. Four families and 12 genera have been studied: Isotomidae Schäffer, 1896 (*Folsomia* Willem, 1902, *Tetracanthella* Schött, 1891, *Uzelia* Absolon, 1901, *Folsomides* Stach, 1922, *Isotomurus* Börner, 1903, *Parisotoma* Bagnall, 1940, *Pseudisotoma* Handschin, 1924 and *Pachyotoma* Bagnall, 1949), Orchesellidae Börner, 1906 (*Orchesella* Templeton, 1835 and *Heteromurus* Wankel, 1860), Entomobryidae Schäffer, 1896 (*Entomobrya* Rondani, 1861) and Lepidocyrtidae Wahlgren, 1906 (*Lepidocyrtus* Bourlet, 1839 and *Pseudosinella* Schäffer, 1897). The species of *Orchesella* were studied in a previous paper (Baquero *et al.* 2017). The richness of the habitat sampled is defined by twenty-one species, eight of which are new: *Pachyotoma penalarensis* Baquero & Jordana n. sp., *Entomobrya guadarramensis* Jordana & Baquero n. sp., *Entomobrya ledesmai* Jordana & Baquero n. sp., *Lepidocyrtus labyrinthi* Baquero & Jordana n. sp., *Lepidocyrtus paralignorum* Baquero & Jordana n. sp., *Lepidocyrtus purgatori* Baquero & Jordana n. sp., *Pseudosinella valverdei* Baquero & Jordana n. sp. and *Pseudosinella gonzaloi* Baquero & Jordana n. sp. *Entomobrya intermedia* Brook, 1884 (England) is discussed and a new name *Entomobrya katzi* Jordana & Baquero n. sp. is proposed for *E. intermedia sensu* Katz *et al.* (2015) based on the American specimens.

KEY WORDS
Mesovoid shallow substratum (MSS), subterranean sampling devices (SSD), ecology, new species.

RÉSUMÉ

Communautés distinctes de collemboles dans le milieu souterrain superficiel : Entomobryomorpha du parc national de la Sierra de Guadarrama (centre de l'Espagne).

Le matériel de cette étude a été obtenu après un échantillonnage intensif dans le milieu souterrain superficiel colluvial (ou substrat mésovoïde peu profond) du parc national de la Sierra de Guadarrama, à l'aide de 33 pièges d'échantillonnage souterrain (SSD). Les données ont été obtenues à partir de la première extraction des pièges entre mai et octobre 2015. Cet article présente les résultats pour les Entomobryomorpha Börner, 1913, qui font partie des collemboles capturés. 21 espèces ont été identifiées, dont huit nouvelles. Quatre familles et 12 genres ont été étudiés, i.e., Isotomidae Schäffer, 1896 (*Folsomia* Willem, 1902, *Tetracanthella* Schött, 1891, *Uzelia* Absolon, 1901, *Folsomides* Stach, 1922, *Isotomurus* Börner, 1903, *Parisotoma* Bagnall, 1940, *Pseudisotoma* Handschin, 1924 et *Pachyotoma* Bagnall, 1949), Orchesellidae Börner, 1906 (*Orchesella* Templeton, 1835 et *Heteromurus* Wankel, 1860), Entomobryidae Schäffer, 1896 (*Entomobrya* Rondani, 1861) et Lepidocyrtidae Wahlgren, 1906 (*Lepidocyrtus* Bourlet, 1839 et *Pseudosinella* Schäffer, 1897). Les espèces d'*Orchesella* ont été étudiées dans un article précédent (Baquero *et al.* 2017). La richesse de l'habitat échantillonné est définie par 21 espèces, dont huit sont nouvelles : *Pachyotoma penalarensis* Baquero & Jordana n. sp., *Entomobrya guadarramensis* Jordana & Baquero n. sp., *Entomobrya ledesmai* Jordana & Baquero n. sp., *Lepidocyrtus labyrinthi* Baquero & Jordana n. sp., *Lepidocyrtus paralignorum* Baquero & Jordana n. sp., *Lepidocyrtus purgatori* Baquero & Jordana n. sp., *Pseudosinella valverdei* Baquero & Jordana n. sp. and *Pseudosinella gonzaloi* Baquero & Jordana n. sp. *Entomobrya intermedia* Brook, 1884 (Angleterre) est discuté et un nouveau nom *Entomobrya katzi* Jordana & Baquero n. sp. est proposé pour *E. intermedia sensu* Katz *et al.* (2015) sur la base des spécimens américains.

MOTS CLÉS
Milieu souterrain superficiel (MSS), trappes d'échantillonnage souterrain, écologie, espèces nouvelles.

INTRODUCTION

Entomobryomorpha Börner, 1913 are Collembola Lubbock, 1870 with an elongated body and conspicuous segmentation, three thoracic and six abdominal segments (some Isotomidae have four or five abdominal segments), prothorax not developed and without tergal chaetae. There are some habitual dwelling inhabitants of the ground and litter, but less specialized than Poduromorpha Börner, 1913. While more than 265 species have been found in the entire Iberian Peninsula since the publication of the catalogue by Jordana *et al.* (1990), five families with 21 genera and 59 species – seven of which were originally described in the Sierra de Guadarrama – have been found in the study area. This information is shown in 12 publications published between 1929 and 1995 (Cassagnau 1954; Steiner 1955; Selga 1961, 1962a, b, 1963, 1966a, 1966b, 1971; Simón 1971; Simón & Selga 1977 [Somosierra]; Acón 1980). All those researchers worked intensely in the area because of the proximity of the National Museum of Natural Sciences and major university centers in Madrid.

The *milieu souterrain superficiel* or mesovoid shallow substratum (MSS), consists of a network of interstices and fissures in the subsoil, and harbors diverse epigean species of a stenoic nature, and strictly hypogean species that permanently inhabit this environment (Gers 1992; Ortuño *et al.* 2013). Previous studies focused on ecology (Juberthie *et al.* 1980; Ledesma *et al.* 2020), while others explored some faunal aspects (Růžička *et al.* 1995; Nitzu *et al.* 2010; Jiménez-Valverde *et al.* 2015). This paper is a continuation of two previously published papers that study the biodiversity of the MSS collembolan fauna of the Sierra de Guadarrama (Baquero *et al.* 2017; Jordana *et al.* 2020). All these studies document the importance of the MSS biocenosis, demonstrating the enormous potential of this subterranean habitat as a refuge for fauna, and constitute a good tool for the management of natural spaces.

MATERIAL AND METHODS

Site

The sampling was conducted in the Sierra de Guadarrama National Park, which is in the eastern half of the Central System (i.e., the Iberian Peninsula) and consists of an area of 33 960 hectares, surrounded by a peripheral buffer zone of 62 687.26 hectares (MAPAMA 2017). The mountain range on which the Sierra de Guadarrama National Park is located, is formed by three mountainous axes (Siete Picos, La Mujer Muerta, Montes Carpetanos, and Cuerda Larga and associated mountainous complex) that converge at two mountain passes, those of Navacerrada and Los Cotos (Fig. 1A). The lithology is dominated by the presence of orthogneiss (Vialette *et al.* 1987; PNSG a), a metamorphic rock. In the Sierra de Guadarrama, the fragmentation and accumulation of these rocks originated from glacial (Pedraza & Carrasco 2005) and periglacial events (Sanz 1986). Almost the entire study area has numerous scree slopes that allow the development of the MSS. The climate is Mediterranean, with marked continentality. As a general rule, summers are cool and dry, and winters are cold. However, the diverse topography of the mountains belts favors a considerable variety of microclimates (PNSG b; Salazar Rincón & Vía García 2003; JCL & CAM 2010; Palomo Segovia 2012). The study area is divided into three bioclimatic zones: supra-Mediterranean, oro-Mediterranean and cryo-Mediterranean (Rivas-Martínez 1984; Rivas-Martínez *et al.* 1987). The most outstanding char-

ISOTOMIDAE	SSD
Folsomia trisetata	6
Folsomides portucalensis	14
Pachyotoma penalarensis Baquero & Jordana n. sp.	8
Isotomurus sp.	9, 29, 32
Tetracanthella orbaicetensis	30
Tetracanthella proxima	1, 2, 6, 10, 11, 25
Uzelia kuhenelti	3, 4
Pseudisotoma monochaeta	1, 2, 6, 7, 11, 12, 17, 18, 20, 22, 27, 29, 30, 31
Parisotoma notabilis	6

ENTOMOBRYIDAE	SSD
Entomobrya albocincta	14, 15, 25
Entomobrya guadarramensis Jordana & Baquero n. sp.	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 29, 31, 32, 33
Entomobrya ledesmai Jordana & Baquero n. sp.	2, 29, 30
Entomobrya nicoleti	22
Heteromurus major	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 24, 27, 28, 29
Lepidocyrtus lusitanicus nigrus	7, 29
Lepidocyrtus labyrinthi Baquero & Jordana n. sp.	1, 2, 3, 6, 7, 8, 9, 12, 13, 15, 16, 22, 23, 24, 28, 30, 33
Lepidocyrtus paralignorum Baquero & Jordana n. sp.	1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 17, 18, 20, 22, 25, 26, 27, 28, 29, 30, 31
Lepidocyrtus purgatori Baquero & Jordana n. sp.	14
Lepidocyrtus tellecheae	3, 14, 15, 19, 26
Pseudosinella valverdei Baquero & Jordana n. sp.	1, 2, 6, 10, 11, 16, 18, 21, 25
Pseudosinella gonzaloi Baquero & Jordana n. sp.	2, 3, 11, 16, 25, 26
Pseudosinella simoni	9, 11, 24

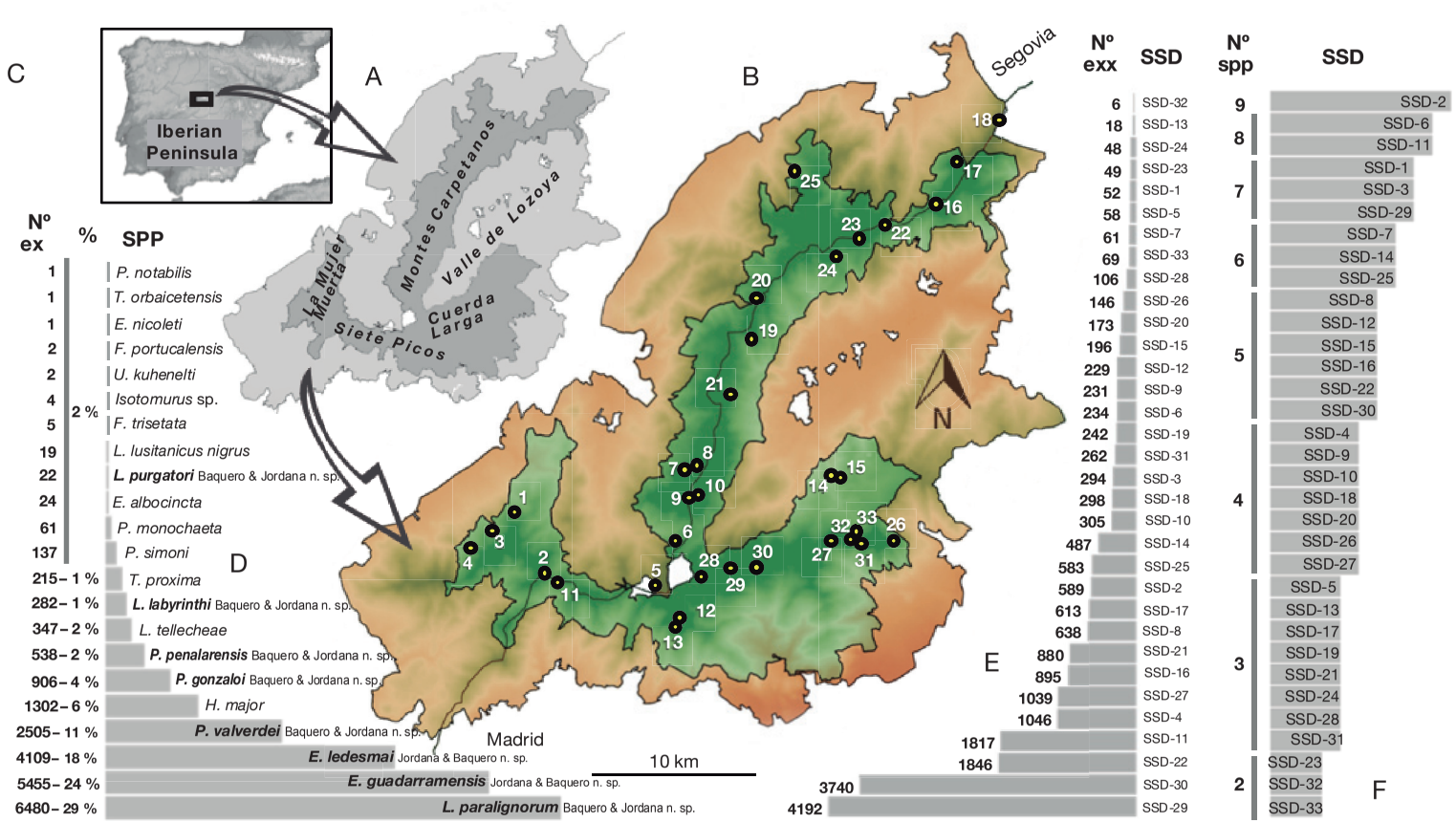

FIG. 1. — **A**, basic orography of the Sierra de Guadarrama National Park; **B**, location of the subterranean sampling devices (SSD) in the Sierra de Guadarrama National Park; **C**, collection sites of the species collected with the SSDs; **D**, relative abundance of Entomobryomorpha Börner, 1913 species (excluding *Orchesella* Templeton, 1835); **E**, relative abundance by SSDs; **F**, species richness by SSD. Abbreviations: **exx**, specimens; **spp**, species. Species authorships: see Index of species.

TABLE 1. — Location of the traps in the mountain areas of the Sierra de Guadarrama. Values: depth: meter; UTM coordinates: 100 × 100 m; altitude: m a.s.l. Abbreviations: **SSD**, subterranean sampling devices; **TSP**, traps in a slope, pitfall.

						Date of trap		
Mountain areas	**Code**	**Depth**	**UTM Coordinates**	**Altitude**	**Toponymy/Province**	**installation**	**recovery**	**Orientation**
Siete Picos-La Mujer Muerta	SSD–1	1	30 T 4081 45204	1606	Cancho del Río Peces/Segovia	20.V.2015	17.IX.2015	North
	SSD–1 (0.5)	0.5						
	SSD–2	1	30 T 4100 45166	1818	Corrales de la Majada Minguete/Segovia	20.V.2015	17.IX.2015	Northeast
	SSD–2 (0.5)	0.5						
	SSD–3	1	30 T 4068 45192	1622	Umbría de la Mujer Muerta/ Segovia	21.V.2015	17.IX.2015	North
	SSD–3 (0.5)	0.5						
	SSD–4	1	30 T 4056 45181	1685	Majada Conejo/Segovia	21.V.2015	17.IX.2015	Northwest
	SSD–4 (0.5)	0.5						
	SSD–11	1	30 T 4108 45161	1876	Cerro Ventoso/Madrid	09.VI.2015	17.IX.2015	East
Puerto de los Cotos-Puerto de Navacerrada	SSD–5	1	30 T 4166 45159	1923	Arroyo Seco/Segovia	27.V.2015	22.IX.2015	Northwest
	SSD–6	1	30 T 4179 45185	1787	La Pedriza/Segovia	27.V.2015	22.IX.2015	Northwest
Montes Carpetanos	SSD–7	1	30 T 4185 45229	1994	Majada Hambrienta/Segovia	02.VI.2015	17.IX.2015	Northwest
	SSD–8	1	30 T 4190 45231	2071	Majada Aranguez/Segovia	02.VI.2015	17.IX.2015	Northwest
	SSD–9	1	30 T 4187 45211	2208	Dos Hermanas/Madrid	03.VI.2015	05.X.2015	East
	SSD–10	1	30 T 4191 45213	2049	Hoya de la Laguna Grande/ Madrid	03.VI.2015	05.X.2015	East
	SSD–16	1	30 T 4334 45389	1956	Las Revueltas-Los Horcos/ Segovia	23.VI.2015	07.X.2015	West
	SSD–17	1	30 T 4347 45414	1976	Peña del Buitre/Segovia	23.VI.2015	07.X.2015	Northwest
	SSD–18	1	30 T 4373 45438	1885	Los Loberos/Segovia	23.VI.2015	07.X.2015	Northwest
	SSD–19	1	30 T 4224 45307	1866	La Gelecha-La Flecha/Madrid	24.VI.2015	06.X.2015	Southeast
	SSD–20	1	30 T 4226 45332	1937	Cerro de Navahonda/Segovia	24.VI.2015	06.X.2015	Northeast
	SSD–21	1	30 T 4211 45274	1891	El Paredón/Madrid	24.VI.2015	06.X.2015	Northeast
	SSD–22	1	30 T 4304 45376	1995	Alto del Puerto/Segovia	24.VI.2015	22.IX.2015	North
	SSD–23	1	30 T 4288 45367	2144	Circo del Pico Nevero/Madrid	25.VI.2015	06.X.2015	Southeast
	SSD–24	1	30 T 4274 45357	2042	Peñacabra/Madrid	25.VI.2015	22.X.2015	East
	SSD–25	1	30 T 4249 45407	1731	Arroyo del Charco (La Cepa)/ Segovia	02.VII.2015	22.X.2015	Northwest
	TSP-1	0.8	30 T 4314 45376	1780	Puerto de Navafría/Segovia	24.VI.2015	22.IX.2015	North
	TSP-2	0.8	30 T 4314 45376	1780	Puerto de Navafría/Segovia	24.VI.2015	22.IX.2015	North
Cuerda Larga and associated mountainous complex	SSD–12	1	30 T 4180 45138	2102	Collado del Piornal/Madrid	09.VI.2015	22.IX.2015	North
	SSD–13	1	30 T 4179 45135	2113	Los Almorchones-Las Buitreras/ Madrid	10.VI.2015	22.IX.2015	Southwest
	SSD–14	1	30 T 4274 45224	1406	El Purgatorio/Madrid	18.VI.2015	05.X.2015	West
	SSD–15	1	30 T 4273 45224	1375	Hueco de los Ángeles/Madrid	18.VI.2015	05.X.2015	Northeast
	SSD–26	1	30 T 4309 45186	1890	La Najarra-Cuatro Calles/Madrid	02.VII.2015	30.X.2015	East
	SSD–27	1	30 T 4270 45185	2101	Bailaderos/Madrid	02.VII.2015	30.X.2015	North
	SSD–28	1	30 T 4193 45164	2156	Collado de Valdemartín/Madrid	03.VII.2015	06.XI.2015	North
	SSD–29	1	30 T 4211 45168	2301	Cabeza de Hierro Mayor Menor/ Madrid	03.VII.2015	06.XI.2015	Crest
	SSD–30	1	30 T 4227 45170	2233	Collado de Peña Vaqueros (Loma de Pandasco)/Madrid	03.VII.2015	06.XI.2015	Crest
	SSD–31	1	30 T 4288 45184	1946	Collado de la Najarra/Madrid	09.VII.2015	22.X.2015	North
	SSD–32	1	30 T 4285 45187	1948	Arroyo de La Najarra/Madrid	09.VII.2015	22.X.2015	Northeast
	SSD–33	1	30 T 4286 45188	1819	Arroyo de La Najarra/Madrid	09.VII.2015	22.X.2015	North

acteristics of these bioclimatic zones in the Sierra de Guadarrama and their most conspicuous vegetation are summarized in Ortuño *et al.* (2019). On the scree slopes, the rupicolous plant and lichen species communities acquire special relevance (JCL & CAM 2010). Also of importance is precipitation in the form of snow, which is more intense in the cryo-Mediterranean and oro-Mediterranean scrub supra-forest zones, especially in areas that conserve snowfields for many months.

METHODOLOGY

Thirty three sampling points were established (Fig. 1B). The details describing the placement of the traps and the rest of the methodology for sampling the animals have already been described in Baquero *et al.* (2017). The UTM coordinates (datum WGS84) are given in Table 1, and in the typical localities of the new species described. The authors who performed the sampling included a team that consisted of V. M. Ortuño, E. Ledesma, J. D. Gilgado, A. Jiménez-Valverde, G. Pérez-Suárez and E. Baquero. Permits to collect samples were obtained from the appropriate authorities (General Directorate of Environment of the Community of Madrid and Territorial Service of the Environment of the Junta de Castilla y León). The traps (Table 1) were placed between 20 May 2015 and 9 July 2015, and the first series of samples was obtained between 17 September 2015 and 6 November 2015. The term "activity" is sometimes used in

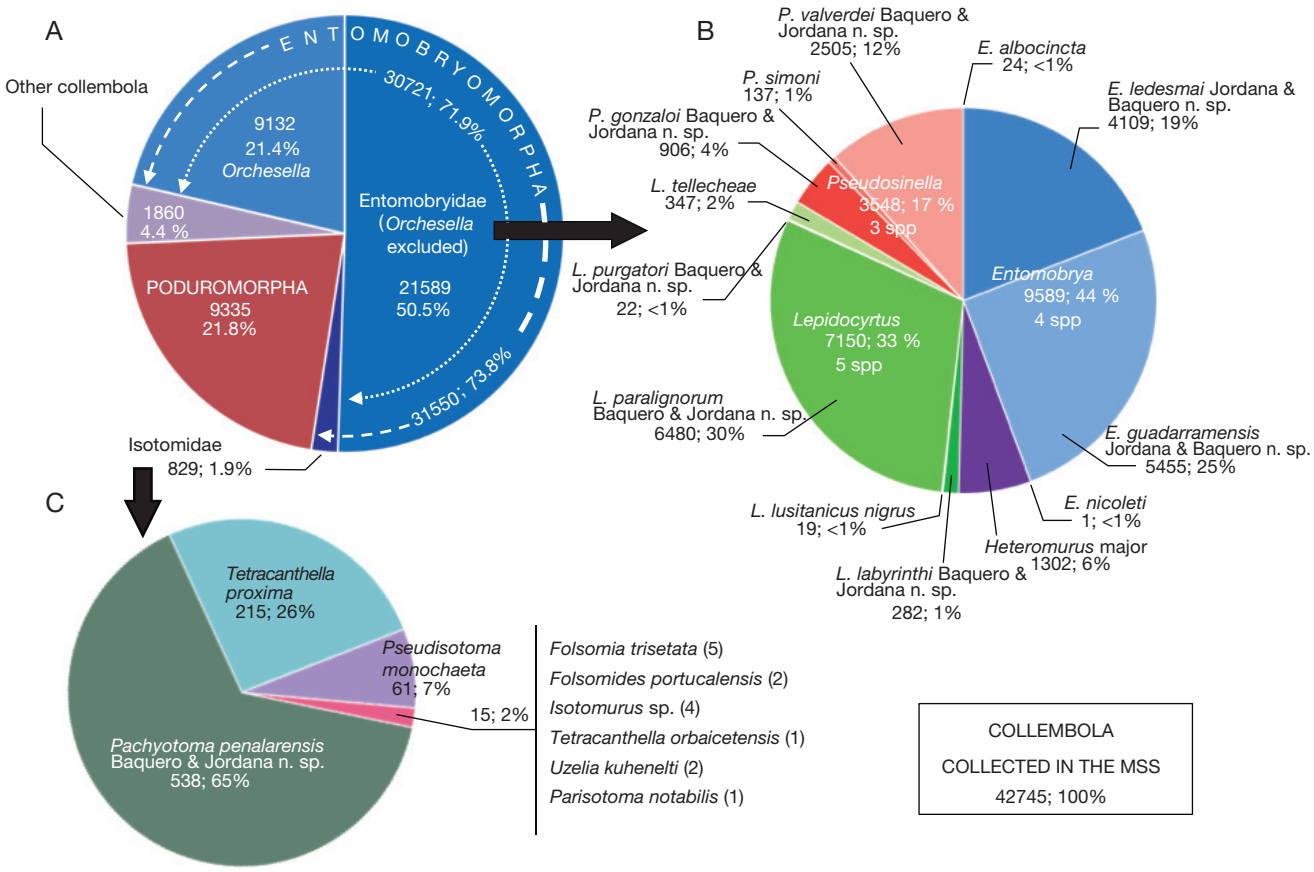

FIG. 2. — Diversity, abundance and percentage of Collembola (42 745 specimens) collected in the MSS of the Sierra de Guadarrama National Park: **A**, values by orders and families; **B**, Entomobryidae Schäffer, 1896 species values (excluding *Orchesella* Templeton, 1835); **C**, Isotomidae Schäffer, 1896 species values. Species authorships: see Index of species.

the study instead of "abundance", as it better characterizes a quantitative community parameter obtained by the capture method, pitfall trapping. It means that more active forms of Collembola tend to be caught in traps, thus covering only a part of the species pool that occupies the MSS.

After the preliminary triage to separate the Collembola Entomobryomorpha from the sampling fauna within the SSDs, some specimens were selected and mounted in Hoyer's medium for observation under a compound microscope in a phase contrast and DIC. Some specimens were cleared in Nesbitt's fluid. The remaining samples were stored in 70% ethyl alcohol.

In addition to the simplified formula of Jordana & Baquero (2005) as simplification of the dorsal macrochaetotaxy defined originally by Szeptycki (1979), the general color pattern (Katz *et al.* 2015) and some selected morphological characters (labral papilla shape, claw and empodium form, and mucro shape (Christiansen 1958; Christiansen & Bellinger 1980; Soto-Adames *et al.* 2008; Jordana 2012) have been used for the identification of the *Entomobrya* species. The macrochaetotaxy for *Pseudosinella* follows Gisin & Da Gama (1969), Szeptycki (1979), Mateos (2008) and Soto-Adames (2010). The characters defined by Christiansen et al. (1990) for *Pseudosinella*, and those used in a Delta key by Christiansen in Jordana *et al.* (2018), were used for identification and descriptions.

ABBREVIATIONS

a.s.l.	above sea level;
abd	abdomen or abdominal segment I-VI;
accp	accessory posterior row sensillum;
al	anterolateral s-chaeta;
am	anteromedial s-chaeta;
ant	antantennal or antenna/ae;
Mc	macrochaeta/ae;
ms	microsensillum;
mes	mesochaeta;
mic	microchaeta;
PAO	postantennal organ;
psp	pseudopore;
s	sensillum;
SSD	subterranean sampling devices;
Th	thorax, or thoracic segments II-III;
UTM	Universal Transverse Mercator coordinate system.

Institutions

CAM	Comunidad de Madrid;
JCL	Junta de Castilla y León;
MNHN	Muséum national d'Histoire naturelle, Paris;
MZNA	Museum of Zoology at the University of Navarra, Pamplona.

GRAPHICS

The spatial distribution, and relative activity of the species were assessed based on samples obtained from the 33 sampling points (Table 1; Figs 1; 2) from the use of 33 SSDs of

FIG. 3. — Places where new species have been collected more abundantly: **A**, **C**, **E**, **G**, photos of the sampled biotopes; **B**, **D**, **F**, **H**, exact installation point and brief card of the SSDs (location and collecting species of Entomobryomorpha Börner, 1913, excluding *Orchesella* Templeton, 1835). Species authorships: see Index of species.

1 m depth, and four SSDs of 0.5 m that accompanied SSD-1, SSD-2, SSD-3 and SSD-4 (Table 1). The relative activity has been calculated, and expressed in two different ways in order to be able to compare, in percentage terms, the prominence of each of the species under the taxonomic perspective of order (excluding the *Orchesella* Templeton, 1835 genus, subject of another study: Baquero *et al.* 2017) (Fig. 1D) and family (Fig. 2).

FIG. 4. — Places where new species have been collected more abundantly: **A**, **C**, **E**, **G**, photos of the sampled biotopes; **B**, **D**, **F**, **H**, exact installation point and brief card of the SSDs (location and collecting species of Entomobryomorpha Börner, 1913, excluding *Orchesella* Templeton, 1835). Species authorships: see Index of species.

Each of the 33 sampling points has been analyzed in terms of activity and specific diversity (Fig. 1E, F), and for this purpose, the following correspondence was established: sampling point = SSD (1 m). Data on the presence of a species registered in an SSD (0.5 m) were incorporated in only one case because in the corresponding SSD (1 m) the species did not occur, and given the evidence of presence at the site, it could not be excluded from the calculations of specific diversity.

INDEX OF SPECIES

RESULTS

In the total number of samples analyzed, the Entomobryomorpha taxon (*Orchesella* excluded) accounted for 52.4% of the Collembola captured in the traps. Specimens of 22 species belonging to two families were captured: Isotomidae and Entomobryidae.

SYSTEMATICS

Class COLLEMBOLA Lubbock, 1870
Order ENTOMOBRYOMORPHA Börner, 1913, *sensu* Soto-Adames *et al.* 2008
Family ISOTOMIDAE Schäffer, 1896
Subfamily ANUROPHORINAE Börner, 1901
Genus *Folsomia* Willem, 1902

Folsomia trisetata Jordana & Ardanaz, 1981 (Fig. 5)

Folsomia sexoculata trisetata Jordana & Ardanaz, 1981: 41.

MATERIAL EXAMINED. — **Spain** • 4 ♀, 1 ♂, on slide; SSD-14, slides 07, 08 and 13; Ortuño *et al.* leg; MZNA.

REMARKS

Until now, the distribution of this species was limited to the Pyrenean and pre-Pyrenean area (Potapov 2001), although it has been found in the Cantabrian Mountains (Santamaría *et al.* 2012). This new record adds a new biotope for the species, also in the mountains, but in the center of the Iberian Peninsula. The diagnostic characteristics are totally coincident with the original: antenna (Fig. 5A), head (Fig. 5B) and general chaetotaxy (Fig. 5C-E). Confirmation of the identity of the specimens found in the Sierra de Guadarrama was performed by comparing them with the type series specimens, and based on the presence of the three special long sensilla of the Abd V, which, in this case, are blunt (Fig. 5C, F), and the sensory chaetotaxy given by Potapov (2001), which is identical (Fig. 5F).

Since Potapov (2001) pointed out that this could be a synonym of *F. trisetata* due to the coincidence of the manubrial chaetotaxy (13 chaetae on *F. sexoculata* var. *iberica* Steiner, 1958 and 11-12 *F. trisetata*), it would be necessary to study Steiner's material (because at least seven *Folsomia* species have 13 chaetae in the manubrium ventral side).

Genus *Tetracanthella* Schött, 1891

Tetracanthella orbaicetensis Cassagnau, 1959

Tetracantella tuberculata ssp. *orbaicetensis* Cassagnau, 1959: 230.

MATERIAL EXAMINED. — **Spain** • 1 ♀ on slide; SSD-30, slide 03; Ortuño *et al.* leg.; MZNA.

REMARK

Species cited so far only in the Atlantic Pyrenees (France and Spain, between 600 and 2350 m), and also in the pre-Pyrenean area of Navarra, usually in beech forests at a certain altitude (400 m) (Deharveng 1987). In this study, it has been found in the Sierra de Guadarrama at an altitude of around 2000 m.

Tetracanthella proxima Steiner, 1955

Tetracanthella proxima Steiner, 1955: 337.

MATERIAL EXAMINED. — **Spain** • 2 specimens; SSD-1, slide 04; Ortuño *et al.* leg.; MZNA • 18 specimens on slide and 158 in ethyl alcohol; SSD-2, slides 01, 02, 05, 07 and 12-14; same data; MZNA • 7 specimens; SSD-6, slides 04, 06 and 09; same data; MZNA • 1 specimen on slide and 27 in ethyl alcohol; SSD-25, slide 07; same data; MZNA • 1 juvenile; SSD-10, slide 05; same data; MZNA • 1 specimen; SSD-11, slide 16; same data; MZNA.

REMARKS

Originally described from the Sierra de Guadarrama (Steiner 1955), according to Deharveng (1987), its distribution extends from the south of the Ebro River (Iberian Peninsula) to the Atlas Mountains in Morocco. Throughout Europe (de Jong et al. 2014), it is present from Bulgaria, North Africa, Portugal (mainland), Spain (mainland) and Ukraine. The citations of Cassagnau (1959) and Selga (1966a, 1971) probably refer to the nearby species *T. similis* Deharveng, 1987.

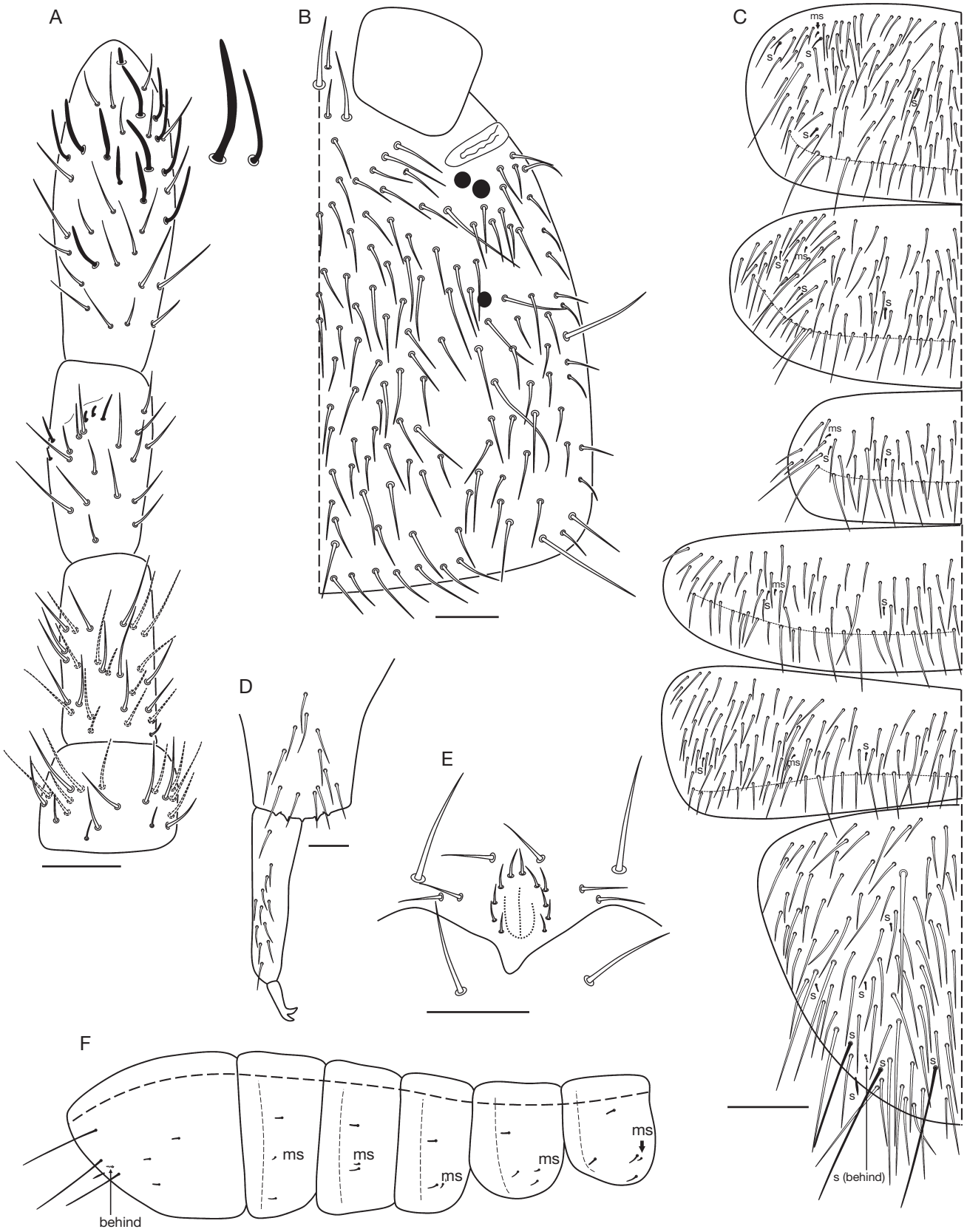

FIG. 5. — *Folsomia trisetata* Jordana & Ardanaz, 1981: **A**, antenna with detail of two sensilla; **B**, head chaetotaxy; **C**, body chaetotaxy (the arrow on segment IV-VI points to a sensillum on posterior side); **D**, furcula: manubrium and dens, anterior view; **E**, ♂ genital plate; **F**, body sensillar pattern. Abbreviations: see Material and methods. Scale bars: A, B, D, E, 0.02 mm; C, 0.05 mm.

Genus *Uzelia* Absolon, 1901

Uzelia kuehnelti Cassagnau, 1954

Uzelia kuehnelti Cassagnau, 1954: 613.

MATERIAL EXAMINED. — **Spain** • 1 juvenile; SSD-3, slide 07; Ortuño *et al.* leg.; MZNA • 1 ♀; SSD-4, slide 03; same data; MZNA.

REMARK
Originally described in Cádiz (South of the Iberian Peninsula) (Cassagnau 1954), it had already been cited in the Sierra de Guadarrama by Simón (1971).

Subfamily Proisotominae Stach, 1947
Genus *Folsomides* Stach, 1922

Folsomides portucalensis da Gama, 1961
sensu Fjellberg 1993

Folsomides variabilis ssp. *portucalensis* da Gama, 1961: 24.

Subisotoma variabilis psammophila Loksa & Vogojević, 1970: 128.

MATERIAL EXAMINED. — **Spain** • 2 ♀; SSD-7, slides 07 and 10; Ortuño *et al.* leg.; MZNA.

REMARK
Only two specimens have appeared and in a single trap. The species seems to have a European distribution (de Jong *et al.* 2014).

Subfamily ISOTOMINAE Schäffer, 1896
Genus *Isotomurus* Börner, 1903

Isotomurus sp.

MATERIAL EXAMINED. — **Spain** • 2 juveniles; SSD-9, slide 09; Ortuño *et al.* leg.; MZNA • 1 juvenile; SSD-29, slide 08 • 1 juvenile; SSD-32, slide 03; same data; MZNA.

REMARKS
By having only juvenile specimens, which appear to belong to the genus *Isotomurus* (fallen bothriotricha have been seen in two of the specimens), a reliable identification has not been possible.

Genus *Parisotoma* Bagnall, 1940

Parisotoma notabilis (Schäffer, 1896)

Isotoma notabilis Schäffer, 1896: 187.

Isotoma menotabilis – Börner 1903: 142.

Isotoma delicatula Brown, 1929: 425.

Isotoma eunotabilis Folsom, 1937: 92.

Parisotoma notabilis – Bagnall 1940: 171.

Desoria monticola Hao & Huang, 1995: 77.

MATERIAL EXAMINED. — **Spain** • 1 specimen; SSD-6, slide 09; Ortuño *et al.* leg.; MZNA.

REMARKS
Already cited in the Sierra de Guadarrama by Acón (1980). Originally described in Germany (Schäffer 1896), it is considered a Holarctic species (Potapov 2001). In this study, only one specimen has been collected and it therefore appears to be occasional in the MSS.

Genus *Pseudisotoma* Handschin, 1924

Pseudisotoma monochaeta (Kos, 1942)

Isotoma sensibilis var. *monochaeta* Kos, 1942: 125.

Pseudoisotoma unipila Stach, 1947: 321.

Pseudisotoma monochaeta – Stach 1947: 316.

MATERIAL EXAMINED. — **Spain** • 10 specimens; SSD-1, slides 05, 07, 09 and 10; Ortuño *et al.* leg.; MZNA • 2 specimens on slide and 6 in ethyl alcohol; SSD-2, slides 04 and 09; same data; MZNA • 1 specimen; SSD-6, slide 08; same data; MZNA • 1 specimen; SSD-7, slide 08; same data; MZNA • 3 specimens; SSD-17, slide 04; same data; MZNA • 10 specimens; SSD-18, slides 03 and 04; same data; MZNA • 4 specimens; SSD-20, slide 05; same data; MZNA • 2 specimens on slide and 9 in ethyl alcohol; SSD-22, slide 03; same data; MZNA • 2 specimens; SSD-11, slide 13; same data ; MZNA • 1 specimen; SSD-12, slide 09; same data; MZNA • 1 specimen; SSD-27, slide 04; same data; MZNA • 5 specimens; SSD-29, slide 08; same data; MZNA • 1 specimen; SSD-30, slide 05; same data; MZNA • 3 specimens; SSD-31, slides 11 and 14; same data; MZNA.

REMARKS
It had already been cited in the Sierra de Guadarrama by Cassagnau (1954). Originally described in Slovenia (East of Julian Alps, 2350 m) (Kos 1942), it has been cited in mountainous areas throughout Europe, excluding Great Britain, Norway, Sweden and Finland. Cited in Ireland, Russia (Urals, Caucasus) and Japan (Potapov 2001).

Subfamily PACHYOTOMINAE Potapov, 2001
Genus *Pachyotoma* Bagnall, 1949, *sensu* Deharveng 1977

Pachyotoma penalarensis Baquero & Jordana n. sp.
(Figs 6A; 7; Table 2)

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TYPE MATERIAL. — **Holotype**. **Spain** • ♀; Segovia, Sierra de Guadarrama, Majada Aranguez (Northwest); 30T 4190 45231; 2071 m a.s.l.; 17.XI.2015; Ortuño *et al.* leg.; pitfall SSD (since 20.V.2015); MZNA SSD-8 (slide 16).
Paratypes. Spain • 2 ♀ and 1 ♂; slide 16; same data as for holotype; MZNA • 1 ♂ (subadult) and 1 ♀; slide 02; same data as for holotype; MZNA • 11 juveniles on slide and approximately 500 in ethyl

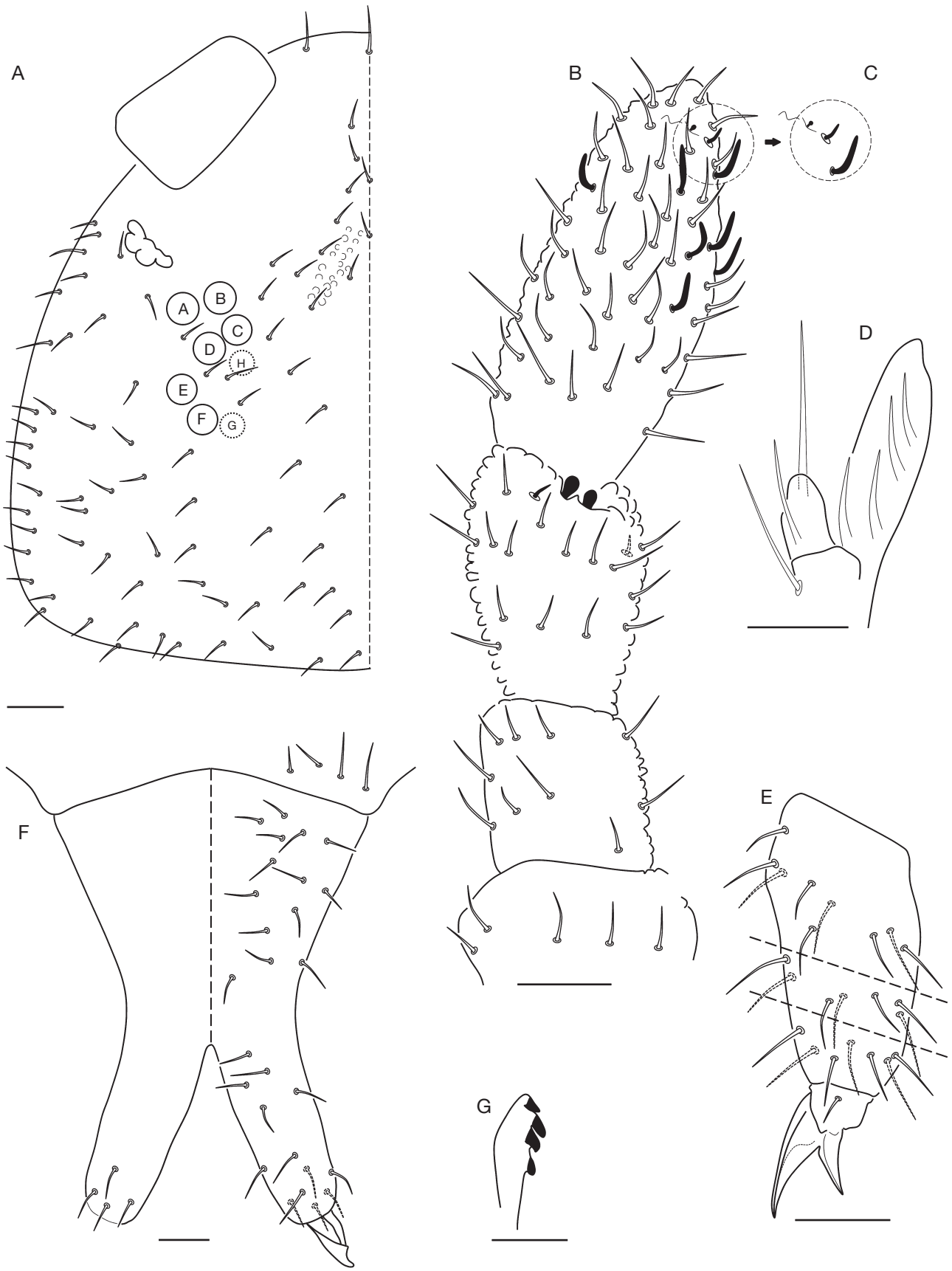

FIG. 6. — *Pachyotoma penalarensis* Baquero & Jordana n. sp.: **A**, head chaetotaxy; **B**, antenna, with detail of organite (**C**); **D**, maxillary palp; **E**, tibiotarsus, claw and empodium of leg 3; **F**, furcula, left – anterior side, right – posterior side; **G**, tenaculum. Scale bars: A, B, E, F, 0.02 mm; D, G, 0.01 mm.

TABLE 2.— Group of characters traditionally used for the identification of the species of the Proisotominae Stach, 1947 *s.l.*, and to establish some of the proposed subfamilies, for the species that share with *Pachyotoma penalarensis* Baquero & Jordana n. sp. (in combination) the number of eyes, the absence of tenent hair and a similar shape for the PAO, that are: *Ballistura excavata* Folsom, 1937 (N America; Africa), *Clavisotoma africana* (Womersley, 1934) (South Africa), *Clavisotoma fatonei* (Rapoport, 1959) (Neotropical), *Clavisotoma filifera* (Denis, 1931) (Europe, Neotropical), *Ballistura laticauda* Folsom, 1937 (as *Clavisotoma* in Bellinger *et al.* 1996-2019) (USA, Azores), *Coloburella cassagnaui* Rusek, 1972 (Europe), *Coloburella linnaniemii* (Denis, 1926) (Europe), *Folsomides centralis* (Denis, 1931) (Costa Rica), *Folsomides deflexus* (Schött, 1927) (Cameroon), *Folsomides delamarei* Thibaud, Najt & Jaquemart, 1994 (Galápagos), *Folsomides denisi* (Womersley, 1935) (Australia), *Folsomides deserticolus* Wood, 1970 (Australia), *Folsomides nepalicus* Yosii, 1971 (Nepal), *Pachyotoma pseudorecta* (Haybach, 1972) (Europe), *Proisotoma andina* Rapoport & Rubio, 1968 (Neotropical), *Proisotoma beta* Christiansen & Bellinger, 1980 (Neotropical), *Proisotoma muscicola* Stach, 1965 (South East Asia), *Proisotoma santosorum* PalaciosVargas & Arbea, 2009 (Caribe) and *Weberacantha beckeri* Stebaeva, 1966 (Russia). Legend for the headers of the columns: **Head**: **EYE**, eye number; **PAO**, form: b, broad; e, elliptical; l, long lobulated; i, long with central indentation; o, oval (almost circular), q, four lobes; **PE**, PAO/eye ratio. **Legs: CL**, claw tooth: 0, absent; 1, present. **Furca: ETF**, empodial terminal filament: 0, absent; 1, short; 2, long (as claw); **MA**, anterior manubrium chaetae number; **MP**, posterior manubrium chaetae number; **DA**, anterior dens chaetae number; **DP**, posterior dens chaetae number; **TT**, tenaculum teeth number; **TC**, tenaculum chaetae number; **MT**, mucro teeth number and shape: 9, absent; 8, fused to dens; 0, no dentate; 1, unidentate or falcate; 2, bidentate; 3, tridentate; 4, quadridentate. General abbreviations: **n**, numerous, **U**, unknown.

Subfamily	species	EYE	PAO	PE	CL	ETF	MA	MP	DA	DP	TT	TC	MT
Proisotominae	*B. excavata*	6+6	e	1.2-1.5	0	1	0	U	1-5	12	4+4	1	2
Proisotominae	*Cl. africana*	6+6	o	1.2	1	1	U	U	1	12	3+3	U	2
Proisotominae	*Cl. fatonei*	6+6	e	1.5-2	1	0	0	n	1	13-15	4+4	1	2
Proisotominae	*Cl. filifera*	6+6	e	1.5	1	2	0	U	2-3	16-17	4+4	1	2
Proisotominae	*Cl. laticauda*	6+6	o	2.5-3	1	2	0	U	2-3	9-15	3+3-4+4	1	2
Pachyotominae	*C. cassagnaui*	5+5-6+6	e	2.0	0	0	0	11+11	1	4	4+4	1	8
Pachyotominae	*C. linnaniemii*	6+6	e	2.0	0	0	0	26-30	4	6	4+4	1	8
Proisotominae	*F. centralis*	6+6	e	U	0	1	0	22	2-3	6-7	4+4	1	2
Proisotominae	*F. deflexus*	6+6	o	3	0	1	U	U	U	U	4+4	1	2
Proisotominae	*F. delamarei*	6+6	e	2	0	2	0	12	1	3	3+3	1	2
Proisotominae	*F. denisi*	6+6	o	2-3	0	0	0	6+6	0	3	3+3	1	9
Proisotominae	*F. deserticolus*	6+6	e	4	0	1	0	16	1	6	3+3	1	2
Proisotominae	*F. nepalicus*	6+6	b	2	0	1	0	12	0	2	3+3	1	2
Pachyotominae	*P. pseudorecta*	6+6	e	1.7	0	0	4	U	40	30	4+4	1	0
Pachyotominae	*P. penalarensis* Baquero & Jordana n. sp.	6+6	q	2.0	0	0	0	30	4	9	4+4	0	2
Proisotominae	*Pr. andina*	6+6	e	1.1	0	U	2	64	10	5	4+4	5	4
Proisotominae	*Pr. beta*	6+6	b	1	1	0	3	U	23-26	8-9	4+4	2-3	3
Proisotominae	*Pr. muscicola*	6+6	e	4	0	0	0	12	1	5	4+4	1	2
Proisotominae	*Pr. santosorum*	6+6	o	2.5-3.0	0	U	2	24-26	6	5	3+3	1	3
Proisotominae	*W. beckeri*	6+6	i	U	1	U	4	18	2	5	4+4	1	2

alcohol; slide 13; same data as for holotype; MZNA • 10 specimens in ethyl alcohol; Segovia, Sierra de Guadarrama, Majada Aranguez (Northwest); 30T 4190 45231; 2071 m a.s.l.; 17.XI.2015; Ortuño *et al.* leg.; pitfall SSD (since 20.V.2015); MNHN.

TYPE LOCALITY. — Spain, Segovia, Sierra de Guadarrama, Majada Aranguez (Northwest); 30T 4190 45231; 2071 m a.s.l.

ETYMOLOGY. — The specific epithet 'penalarensis' refers to the presence of this species in the Peñalara massif, which boasts the highest peak of the Sierra de Guadarrama.

DIAGNOSIS. — Cylindrical dens, mucro present and bidentate, PAO with four lobes, Ant III sensory organ with the two central sensilla more or less spherical and number of sensilla on tergites at about 10,10/6,6,6,9,7.

DESCRIPTION

Body

Size 0.72-0.80. Color dark blue. Integument granulated without reticulation. 6+6 to 8+8 eyes (sometimes eyes G and H disappear, but it is possible to see the refringent structures below). PAO with four lobes, two times eye A (Fig. 6A). Antenna as in Figure 6B, C; Ant III sensory organ with the central sensilla more or less spherical; Ant IV with seven sensilla, six dorsoexternal and one dorsointernal. Maxillary outer lobe bifurcated and four sublobal hairs (Fig. 6D). Labral formula 4/5,5,4 (labral chaetae papillated). Labium with four basomedial, three proximal and five basolateral chaetae and, as common for the family, with 16 guard chaetae.

Legs

Tibiotarsus tenent hairs all pointed. Claw without tooth; empodium short with lamella but without terminal filament (Fig. 6E).

Abdomen

Collophore with 5+5 (or 6+6) laterodistal, and five posterior chaetae. Furca: manubrium with 28-30 posterior and without anterior chaetae; dens with nine posterior (three groups: three basal, two medial and four distal) and four distal anterior chaetae; mucro with two poorly developed teeth, and two lamellae (Fig. 6F). Tenaculum with four teeth and without chaeta on *corpus* (Fig. 6G).

Chaetotaxy

Body chaetae short and without macrochaetae (see Figure 7 for number of rows and axial chaetae). Thoracic medial s-chaetae in front of p-row; abdominal medial s-chaetae in p-row (Abd IV-V with three and four respectively additional ones before p-row); s-chaetae formula (*c.* 10,10/6,6,6,9,7 for half tergite). Ms-chaetae formula 1,0/0,0,0 (Fig. 7).

ECOLOGY

So far, this species has only been located in the MSS of the northern slope of the Peñalara massif, in SSD-8, installed in the Canchal de la Majada Aranguez (Figs 1A, C; 3A, B). This site is located at altitudes that exceed 2000 m a.s.l., and is part of the

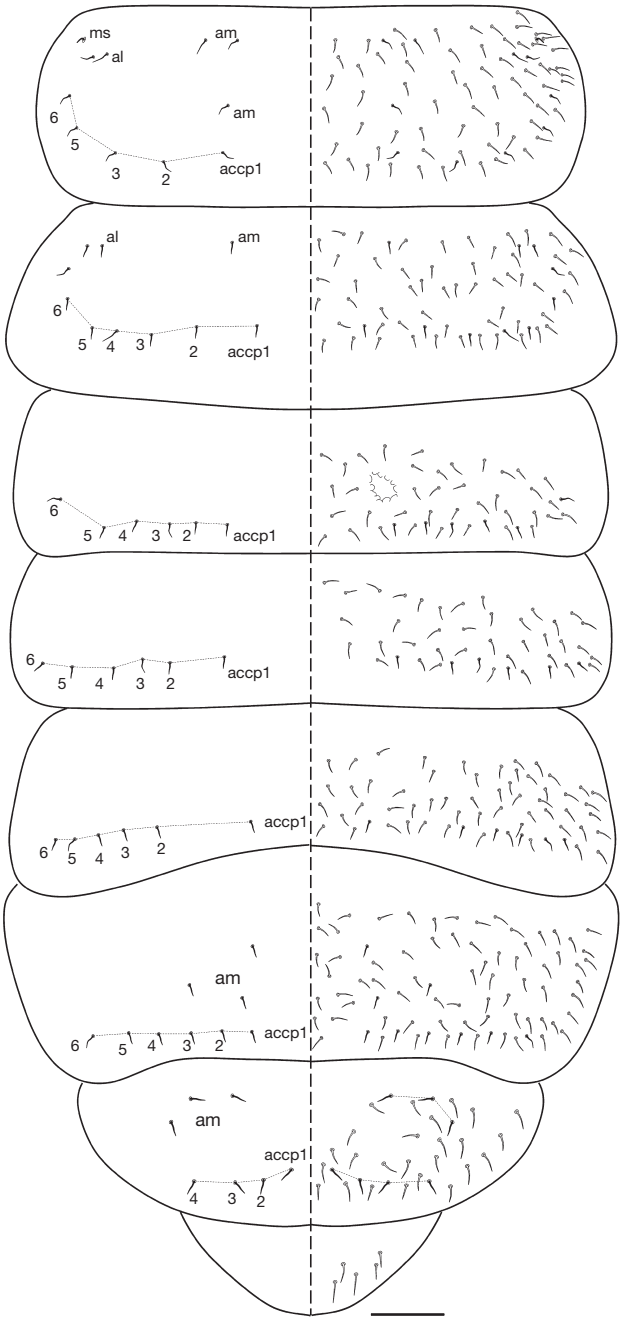

Fig. 7. — *Pachyotoma penalarensis* Baquero & Jordana n. sp., body chaetotaxy, left – only sensillar chaetotaxy. Abbreviations: see Material and methods. Scale bar: 0.05 mm.

supraforestal strip of the oro-Mediterranean bioclimatic zone. Extensive slopes dominate the landscape with a moderate slope, where there is very little vegetation, highlighting small stands of *Juniperus communis alpina* (Suter) Celak. (Fig. 3A). *Pachyotoma penalarensis* Baquero & Jordana n. sp. share their habitat with at least four other Collembola species, of which three are also new (Figs 1F; 3B). As a whole, the syntopy of the five species at this site has provided an average relative activity that does not reach a thousand specimens (Fig. 1E). This species only represents 2% of the total Entomobryomorpha studied in this paper (Fig. 1D), but accounts for 65% of the total *Isotomidae* collected (Fig. 2A, C).

Remarks

Considering the group of characters for the family, the 6 + 6 ocelli and a very specific PAO are enough to establish the specimens found as a new species, assigned to the Pachyotominae subfamily due to the absence of anal spines, the presence of furca, fewer than four chaetae in the anterior part of the manubrium, granulation of the body, abundant sensory chaetotaxy, dens with teeth and absence of Mc. The new species really has an extraordinary shape of PAO compared with congeners and Isotomidae as a whole. The characters that are used for the separation of the different genera of the Proisotominae s.l. seem to have a low diagnostic value. It is probable that all this taxonomy is artificial and it will take further work to update definitions of the genera and probably also the subfamilies of all Isotomidae. The separation of the specimens of this sampling into a new species according to the number of eyes, PAO and presence or not of the tenent hair on the tibiotarsus can be seen in Table 2, which includes the eye number, PAO shape, PAO/eye ratio, empodial terminal filament presence and shape, anterior manubrium chaetae number, posterior manubrium chaetae number, anterior dens chaetae number, posterior dens chaetae number, tenaculum teeth number, tenaculum chaetae number and mucro teeth number and shape. This table is an example of the absence of differential generic characters for the subfamily Proisotominae *s.l.*

Family Orchesellidae Börner, 1906
Subfamily Heteromurinae Absolon & Kseneman, 1942
sensu Zhang & Deharveng 2015
Genus *Heteromurus* Wankel, 1860

Heteromurus major (Moniez, 1889)

Templetonia major Moniez, 1889: 26.

Podura teres Linnæus, 1746: 342.

Podura plumbea Linnæus, 1761: 473.

Podura (*Longæ*) *plumbea* Geoffroy, 1762: 610.

Podura (*Longæ*) *violacea* Geoffroy, 1762: 611.

Heteromurus major – Börner 1901: 78.

Heteromurus caerulescens Börner, 1903: 156.

Heteromurus melitensis Stach, 1924: 115.

Heteromurus mexicanus Handschin, 1928: 545.

Lepidocyrtus lundbladi Agrell, 1939: 5.

Heteromurus caucasicus Tshelnokov, 1974 *in* Martynova *et al.* 1974: 70.

Material examined. — **Spain** • 6 specimens; SSD-1 (0.5 m depth), slides 05-07; Ortuño *et al.* leg.; MZNA • 13 specimens; SSD-1 (1 m depth), slides 06, 09 and 10; same data; MZNA • 8 specimens on slide and 13 in ethyl alcohol; SSD-2 (0.5 m depth), slides 04 and 09; same data; MZNA • 1 specimen on slide and 70 in ethyl alcohol; SSD-2 (1 m depth), slide 17; same data; MZNA • 2 specimens on slide and 28 in ethyl alcohol; SSD-3 (1 m depth), slides 02 and 11; same data; MZNA • 2 specimens on slide and

TABLE 3. — Group of species of *Entomobrya* Rondani, 1861 that share with *E. guadarramensis* Jordana & Baquero n. sp. the dorsal macrochaetae formula for tergites Abd II-III, 2-5/1-2-1(2): *E. airamii* Baquero & Jordana, 2018 (Canary Islands, La Gomera, La Palma, Tenerife), *E. dorsalis* Uzel, 1891 (Central and Eastern Europe, Czech Republic), *E. dorsolineata* Jordana, Schulz & Baquero, 2009 (Germany), *E. icoae* Baquero & Jordana, 2018 (Canary Islands, Fuerteventura, Gran Canaria, Lanzarote), *E. longisticta* Baijal, 1958 (India, Himalaya). Legend for the headers of the columns: **Head**: **H1**, Mc on series sd'$_4$-sd'$_{4'}$ (An_2-An_3), total number; **H2**, Mc on series sd$_4$-sd'$_{3a}$ (A_5-A_7), total number; **H3**, Mc on series d'$_0$ (S'$_0$), total number; **H4**, Mc on series d$_1$-sd$_1$-sd'$_1$ (S_1-S_3-S_4), total number; **H5**, Mc on series v$_1$-v$_3$-v$_4$ (Ps_2-Ps_3-Ps_5), total number; **L1**, labral papilla presence and shape: 1, without; 2, simple, smooth papilla; 3, multispinose; 4, a chaetalike projection. **Th II**: **T1**, Mc on series m$_1$-m$_{2i2}$; total number, 5 if > 4; **T2**, Mc on series a_5-m_5; total number, 9 if > 8; **E1**, empodium, shape of external lamella (pe) of leg 3: 1, smooth; 2, serrate; 3, with tooth. **Abd II**: **A1**, Mc on series a_2-a_3, total number; **A2**, Mc on series m_3 series, total number; **A3**, Mc on series a_1, total number; **A4**, Mc on series above m_2, total number; **A5**, Mc on series m_3-m_4 series, total number; **Abd IV**: **A6**, Mc on series a_1-a_5 (A_1E_{1a}), total number; 9 if >8; **A7'**, unpaired Mc on series ma_0 (A_{03}), total number; **A7**, Mc on series ma_1-ma_4 (A_2-E_1), total number; 10 if > 9; **A8'**, unpaired Mc on series m_0 (A_{04}), total number; **A8**, Mc on series m_1-m_3 (A_{4p}-C_4), total number; 6 if > 5; **A9'**, unpaired Mc on series mp_0 (A_{05}), total number; **A9**, Mc on series mp_1-mp_3 (A_5-B_5), total number; 6 if > 5; **A10**, Mc on series p_{1a}-p_3 (A_{6i}-B_6), total number; 6 if > 5; **M1**, mucro, sub-apical tooth: 1, without; 2, normal; 3, bigger than apical/ 4, smaller than apical. Abbreviations and symbols: *, difference for the character with the new species; **D**, total number of differences between the species and the new species; occasional number in brackets; **U**, unknown.

species	H1	H2	H3	H4	H5	L1	T1	T2	E1	A1	A2	A3	A4	A5	A6	A7'	A7	A8'	A8	A9'	A9	A10	M1	D
E. airamii	3	3	0	3*	2	3	2	4	1	2	45	1	2	1	3*	0	2*	0*	3*	0*	2	2	2	6
E. dorsalis	2*	1*	0	3*	1b*	4*	4*	8*	1	2	5	1	2	1	4*	1*	5*	0*	3*	0*	4*	4*	2	15
E. dorsolineata	4*	2*	0	3*	1*	4*	2	4	2*	2	5	1	2	1	0*	1*	7*	0*	0*	0*	3*	3*	3*	15
E. icoae	3	1*	0	3*	2	2*	2	4	2*	2	46	1	2	2	0*	0	4	0*	4	0*	2	2	2	7
E. longisticta	4*	1*	1*	2*	2	3	U	U	1	2	5	1	2	1	0*	0	0*	0*	3*	0*	2	2	2	9
E. guadarramensis Jordana & Baquero n. sp.	3	3	0	4	2	3	2	4	1	2(3)	5	1	2	1(2)	7	0	4	2	4	1	2	2	2	

10 in ethyl alcohol; SSD-4, slide 07; same data; MZNA • 1 specimen on slide and 50 in ethyl alcohol; SSD-5, slide 08; same data; MZNA • 1 specimen on slide and 11 in ethyl alcohol SSD-07, slide 11; same data; MZNA • 3 specimens; SSD-8, slide 08; same data; MZNA • 1 specimen on slide and 200 (approximately) in ethyl alcohol; SSD-16, slide 09; same data; MZNA • 4 specimens; SSD-20, slide 07; same data; MZNA • 1 specimen on slide and 74 in ethyl alcohol; SSD-9, slide 05; same data; MZNA • 1 specimen on slide and 18 in ethyl alcohol; SSD-10, slide 04; same data; MZNA • 8 specimens on slide and 213 in ethyl alcohol; SSD-11, slides 08, 11 and 17; same data; MZNA • 1 specimen on slide and 200 (approximately) in ethyl alcohol; SSD-12, slide 06; same data; MZNA • 2 specimens; SSD-13, slide 05; same data; MZNA • 4 specimens on slide and 89 in ethyl alcohol; SSD-14, slide 09; same data; MZNA • 11 specimens in ethyl alcohol; SSD-15; same data; MZNA • 1 specimen on slide and 20 in ethyl alcohol; SSD-19, slide 05; same data; MZNA • 90 specimens in ethyl alcohol; SSD-21; same data; MZNA • 2 specimens on slide and 33 in ethyl alcohol; SSD-24, slide 03; same data; MZNA • 1 specimen; SSD-27, slide 05; same data; MZNA • 3 specimens on slide and 55 in ethyl alcohol; SSD-28, slide 06; same data; MZNA • 1 specimen on slide and 16 in ethyl alcohol; SSD-29, slide 06.

REMARKS

Present in the south-west part of the palearctic region. In this study, it is present in almost all samples.

Family ENTOMOBRYIDAE Schäffer, 1896
Subfamily ENTOMOBRYINAE Schäffer, 1896
sensu Zhang & Deharveng 2015
Genus *Entomobrya* Rondani, 1861

Entomobrya albocincta (Templeton, 1835)

Podura albocincta Templeton, 1835: 95.

Degeeria albocincta – Nicolet 1847: 370.

Degeeria cincta – Lubbock 1862: 594.

Entomobrya albocincta – Brook 1884: 279.

MATERIAL EXAMINED. — **Spain** • 1 specimen on slide and 6 in ethyl alcohol; SSD-14, slide 02; Ortuño *et al.* leg.; MZNA • 13 specimens in ethyl alcohol; SSD-15; same data; MZNA • 4 specimens in ethyl alcohol; SSD-09; same data; MZNA.

REMARK

Already cited in the Sierra de Guadarrama by Selga (1971). It seems to have a wide distribution in the west of the palearctic region, with corticicolous species inhabiting forest canopy. It is found in the ground when it falls from the trees (Jordana 2012).

Entomobrya guadarramensis
Jordana & Baquero n. sp.
(Figs 8A; 9; Table 3)

urn:lsid:zoobank.org:act:35F1F485-6D6D-4333-8AB3-F52D73AE0D1F

TYPE MATERIAL. — **Holotype**. **Spain** • ♀; Segovia, Sierra de Guadarrama, Majada Hambrienta (Northeast); 30T 4185 45229; 1994 m a.s.l.; 17.XI.2015; Ortuño *et al.* leg.; pitfall SSD (since 2.VI.2015); MZNA SSD-7 (slide 06).
Paratypes. Spain • 19 specimens in ethyl alcohol; same data; MZNA as for holotype; Ortuño *et al.* leg.; MZNA • 4 specimens on slide and 78 in ethyl alcohol; SSD-6, slides 10 and 11; same data; MZNA • 5 specimens on slide and 24 in ethyl alcohol; SSD-8, slides 01 and 05; same data; MZNA • 4 specimens; SSD-10, slide 02; same data; MZNA • 2 specimens on slide and 10 in ethyl alcohol; SSD-8, slides 14 and 15; same data as for holotype; Ortuño *et al.* leg.; MNHN.

TYPE LOCALITY. — Spain, Segovia, Sierra de Guadarrama, Majada Hambrienta (Northeast); 30T 4185 45229; 1994 m a.s.l.

ETYMOLOGY. — The specific epithet refers to the presence of this species in the Sierra de Guadarrama.

ADDITIONAL MATERIAL. — **Spain** • 24 specimens on slide and 212 in ethyl alcohol; SSD-1 (0.5 m depth), slides 03-07; Sierra

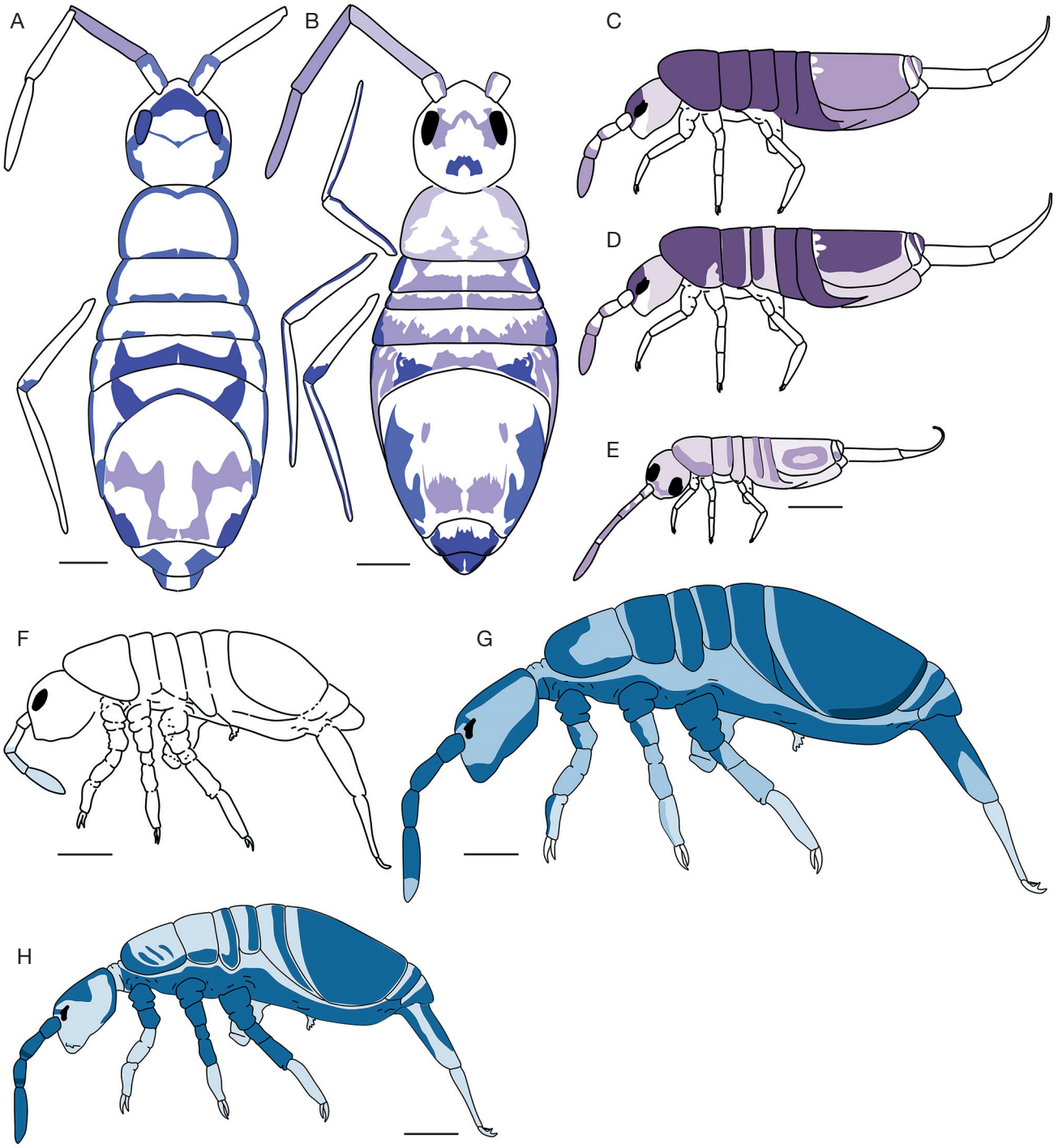

FIG. 8. — Habitus and color patterns of some species: **A**, *Entomobrya guadarramensis* Jordana & Baquero n. sp.; **B**, *Entomobrya ledesmai* Jordana & Baquero n. sp.; **C**, **D**, *Lepidocyrtus labyrinthi* Baquero & Jordana n. sp.; **E**, *Lepidocyrtus purgatori* Baquero & Jordana n. sp.; **F**, *Lepidocyrtus paralignorum* Baquero & Jordana n. sp.; **G**, *Pseudosinella valverdei* Baquero & Jordana n. sp.; **H**, *Pseudosinella gonzaloi* Baquero & Jordana n. sp. Scale bar: 0.25 mm.

de Guadarrama, Segovia; Ortuño *et al.* leg.; MZNA• 27 specimens; SSD-1 (1 m depth), slides 05, 06 and 08-09; same data; MZNA • 5 specimens; SSD-2 (0.5 m depth), slides 03, 05 and 09; same data; MZNA • 3 specimens on slide and 210 in ethyl alcohol; SSD-3 (0.5 m depth), slides 02, 03; same data; MZNA • 4 specimens; SSD-3 (1 m depth), slides 10, 11; same data; MZNA • 2 specimens on slide and 60 in ethyl alcohol; SSD-4 (0.5 m depth), slides 03, 04; same data; MZNA • 1 specimen on slide and approximately 1000 in ethyl alcohol; SSD-4 (1 m depth), slide 05; same data; MZNA • 5 specimens; SSD-5, slide 04; same data; MZNA • 1 specimen on slide and 30 in ethyl alcohol; SSD-16, slide 03; same data; MZNA • 12 specimens on slide and 562 in ethyl alcohol; SSD-17, slides 05 and 07; same data; MZNA • 2 specimens on slide and 158 in ethyl alcohol; SSD-18, slides

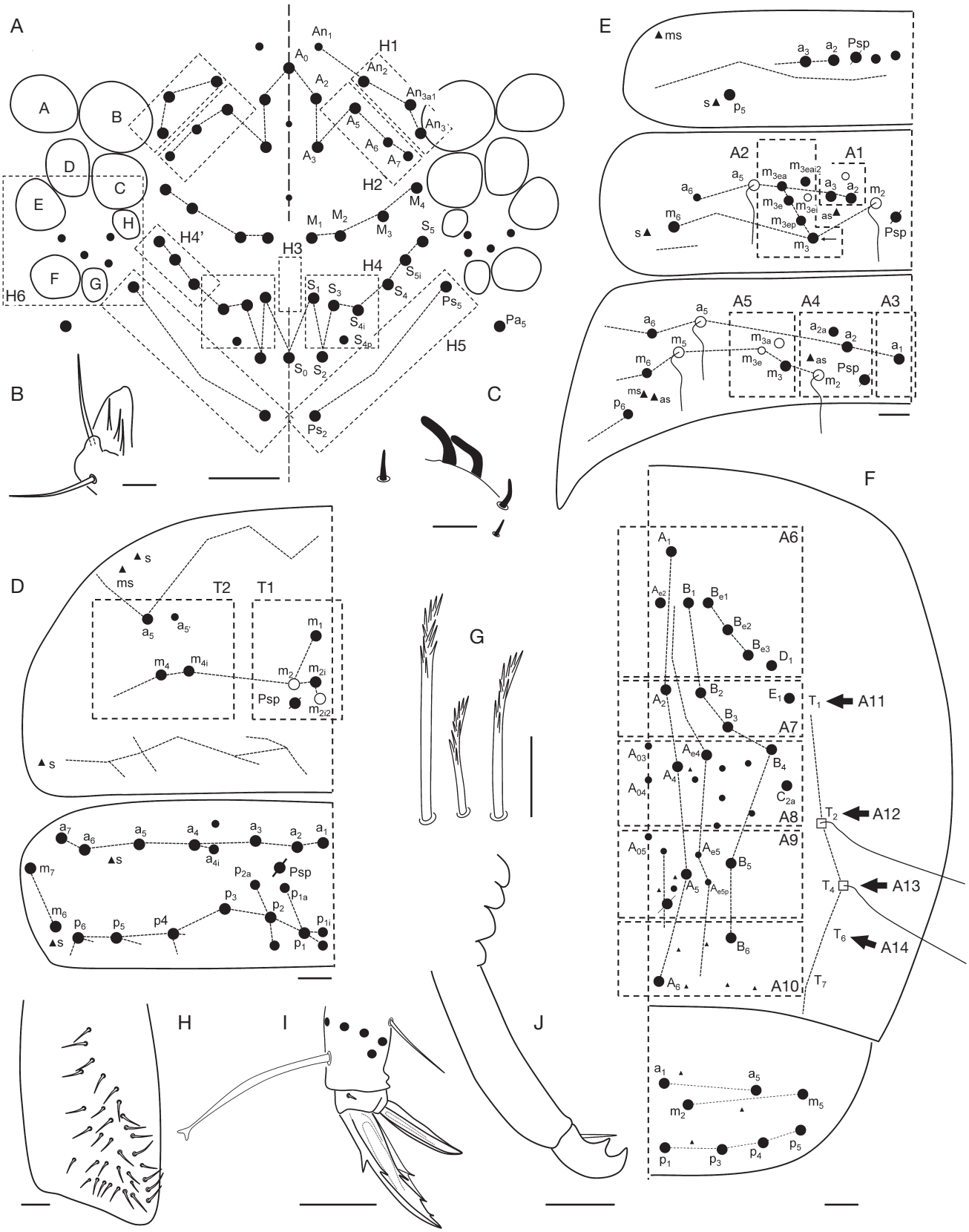

FIG. 9. — *Entomobrya guadarramensis* Jordana & Baquero n. sp.: **A**, head chaetotaxy; **B**, maxillary palp and outer maxillary lobe; **C**, sensory organ of antennal segment III; **D**, Th II dorsal macrochaetotaxy; **E**, Abd I-III dorsal macrochaetotaxy; **F**, Abd IV-V dorsal macrochaetotaxy; **G**, chaetae from central area of Abd II; **H**, trochanteral organ; **I**, claw and empodium; **J**, tip of furcula showing the nonringed area of dens, mucro and mucronal spine. Abbreviations: see Material and methods. Symbols: ●: Mc; ○, mes; ▲, sensilla. Scale bars: A, D-F, 0.05 mm; B, H-I, 0.02 mm; C, G, J, 0.01 mm.

04 and 06; same data; MZNA • 3 specimens on slide and 124 in ethyl alcohol; SSD-20, slide 04; Madrid; same data; MZNA • 2 specimens on slide and 19 in ethyl alcohol; SSD-22, slide 05; same data; MZNA • 1 specimen on slide and 371 in ethyl alcohol; SSD-25, slide 04. Madrid; same data; MZNA • 136 specimens in ethyl alcohol; SSD-11; same data; MZNA • 12 specimens in ethyl alcohol; SSD-12; same data; MZNA • 13 specimens; SSD-13, slides 03 and 05; same data; MZNA • 180 specimens in ethyl alcohol; SSD-14; same data; MZNA • 106 specimens in ethyl alcohol; SSD-15; same data; MZNA • 4 specimens on slide and 152 in ethyl alcohol; SSD-19, slides 05 and 06; same data; MZNA • 194 specimens in ethyl alcohol; SSD-21; same data; MZNA • 7 specimens; SSD-23, slide 03; same data; MZNA • 2 specimens on slide and 81 in ethyl alcohol; SSD-26, slide 02; same data; MZNA • 7 specimens on slide and 1027 in ethyl alcohol; SSD-27, slide 05; same data; MZNA • 1 specimen; SSD-29, slide 11; same data; MZNA • 4 specimens on slide and 180 in ethyl alcohol; SSD-31, slides 09 and 12; same data; MZNA • 5 specimens; SSD-32, slide 03; same data; MZNA • 3 specimens on slide and 64 in ethyl alcohol; SSD-33, slide 08; same data; MZNA.

DIAGNOSIS. — White species, with lateral pigmentation, 2-4 Mc on areas T1-T2 on Th II, 2-5/1-2-1(2) Mc on areas A1-A5 on Abd II-III, and abundant Mc on Abd IV. The unequivocal identification of the species can only be done using the abbreviated formula that, for this species, is: 3-1-0-3-2/2-4/2-5/1-2-1(2)/7-4-$2_0$4-$1_0$2-2 (following Jordana & Baquero 2005).

DESCRIPTION

Size and color

Body length (excluding antennae): 2.60 mm (n = 10), up to 2.84 mm (holotype 2.66 mm). Ground color white or very pale yellow, with pigment on lateral body, dorsolateral head and vertex, transversal stripes on some posterior tergites, and two patches with more or less development and intensity on Abd II-IV (Fig. 8A).

Head

Eight eyes, GH smaller than EF. Antennae length 1.36 mm, 2.08-2.92 times the length of the head (n = 4; the antennae have suffered the sampling method by the time the specimens have been in the polyethylene glycol); Ant IV with simple apical vesicle and pin chaeta present; sensory organ of Ant III with the special rod-like sensilla, and three additional guard sensilla (Fig. 9C); relative length of Ant I/II/III/IV = 1/2.08/1.95/1.89 (n = 3). Prelabral chaetae ciliated. Labral papillae multispinose. Lateral process of labial papilla E 1/3 shorter than the papilla, not reaching their apex. Maxillary palp bifurcated, with three sublobal chaetae (Fig. 9B).

Body and legs

Length ratio of Abd IV/III = 5.30 (between 3.85-6.43; n = 10). Trochanteral organ with approximately 35 chaetae (Fig. 9H). Tibiotarsus not sub-segmented, without smooth chaetae, except for smooth terminal chaeta on legs III. Claw with four teeth: paired at 50% and first unpaired at 75% from base; dorsal teeth not basal (Fig. 9I). Empodium lanceolate, with smooth external lamella (pe) in leg III. Tenent hair clavate. Length of manubrium and dens 0.53 and 0.66 mm, respectively (average for n = 9). Manubrial plate with four or five chaetae and two pseudopores. Mucro with teeth similar in size, mucronal spine reaching the tip of the subapical tooth (Fig. 9J); non-crenulated area of dens two times the length of mucro. Body chaetae as in Figure 9G.

Macrochaetotaxy (Fig. 9A, D-F)

Simplified Mc formula: 3-1-0-3-2/2-4/2-5/1-2-1(2)/7-4-2 $_0$4-$1_0$2-2. Head: H1 area with Mc An_2, An_{3a1} and An_3; H2 area with one Mc (A_5), and A6-A7 more or less developed to Mc in some specimens; H4 area with three Mc (S_1, S_3 and S_{4i}; S_{4p} always present); H4' area with three Mc (S_5, S_{5i} and S_4); H5 area with Ps_2 and Ps_5 Mc. Mesothorax: area T1 habitually with two Mc (m_1 and m_{2i}), sometimes m_2 or m_{2i2} instead m_{2i}; T2 with four Mc (m_4, m_{4i}, a_5 and $a^{5'}$). Abdomen: Abd II area A1 with two Mc (a_2 and a_3; sometimes and additional mes or Mc above them), area A2 with five Mc, between three and seven (m_3, m_{3ep}, m_{3e}, m_{3ea} m_{3eai2}; sometimes m_{3ei} present; Abd III with one Mc on area A3 (a_1) and two Mc on A4 (a_2 and a_{2a}) and A5 (m_3 always present, m_{3a} sometimes present as Mc, and m_{3e} – if present – as mes); Abd IV with up to seven Mc on A6 area (A_1, A_{e2}, B_1, B_{e1}, B_{e2}, B_{e3} and D_1), four Mc on A7 area (A_2, B_2, B_3 and E_1), four Mc on A8 (A_4, A_{e4}, B_4 and C_{2a}) in addition of two unpaired mes (A_{03} and A_{04}), two Mc on A9 (A_5 and B_5) in addition to one unpaired mes (A_{05}) and two on A10 (A_6 and B_6).

ECOLOGY

Species widely distributed in the three mountain ranges (Fig. 1B, C). It is present in the MSS of the three bioclimatic zones and its overwhelming implantation in the subsoil, and the fact that it has never been registered as epigeous, suggests that it is a regular inhabitant of this habitat. It was extraordinarily abundant in SSD-27 of the Canchal de Bailanderos (Figs 1B, C; 3C, D), located in the cryo-Mediterranean zone. At this site 1034 specimens of *E. guadarramensis* Jordana & Baquero n. sp. were collected; thus, almost all of the Entomobryomorpha (1039 not including *Orchesella*) found from SSD-27 (Fig. 1E) evidence the dominance of this species over the other three species of syntopic Entomobryomorpha (Figs 1F; 3D).

REMARKS

If we consider the dorsal macrochaetotaxy of the abdominal tergites Abd II-III using the simplified formula, 2-5/1-2-1(2), it differs from all the *Entomobrya* species described except for *E. airamii* Baquero & Jordana, 2018, *E. dorsalis* Uzel, 1891, *E. dorsolineata* Jordana, Schulz & Baquero, 2009, *E. icoae* Baquero & Jordana, 2018 and *E. longisticta* Baijal, 1958 (*sensu* Baquero *et al.* 2013). The differences among these species and the new species can be seen in Table 3, showing 6, 15, 15, 7 and 9 different chaetotactic characters.

Highly abundant species in the MSS of the Sierra de Guadarrama, accounting for 24% of the total Entomobryomorpha studied in this work (Fig. 1D), and 25% of the Entomobryidae (not including *Orchesella*) (Fig. 2A, B).

TABLE 4. — Group of species of *Entomobrya* Rondani, 1861 that share with *E ledesmai* Jordana & Baquero n. sp. the dorsal macrochaetae formula for tergites Abd II-III, 2-2/1-0-1: *E. katzi* Jordana & Baquero n. sp. (USA), *E. lawrencei* Baquero & Jordana, 2008 (British Isles), *E. luquei* Jordana & Baquero, 2006 (Spain), *E. nicoleti* (Lubbock, 1868) (British Isles, Spain, Switzerland, France, Sweden, Germany, Russia, Egypt), *E. rubella* Latzel, 1918 (Austria) and *E. siciliana* Jordana, Giuga & Baquero, 2011 (Sicilia, Italia). Legend for the headers of the columns: **Head**: **H1**, Mc on series sd'$_4$-sd'$_{4'}$ (An$_2$-An$_3$), total number; **H2**, Mc on series sd$_4$-sd'$_{3a}$ (A$_5$-A$_7$), total number; **H3**, Mc on series d'$_0$ (S'$_0$), total number; **H4**, Mc on series d$_1$-sd$_1$-sd'$_1$ (S$_1$-S$_3$-S$_4$), tota-l number; **H5**, Mc on series v$_1$-v$_3$-v$_4$ (Ps$_2$-Ps$_3$-Ps$_5$), total number; **L1**, labral papilla presence and shape: 1, without; 2, simple, smooth papilla; 3, multispinose; 4, a chaetalike projection. **Th II**: **T1**, Mc on series m$_1$-m$_{2i2}$; total number, 5 if > 4; **T2**, Mc on series a$_5$-m$_5$; total number, 9 if > 8. **E1**, empodium, shape of external lamella (pe) of leg 3: 1, smooth; 2, serrated; 3, with tooth. **Abd II**: **A1**, Mc on series a$_2$-a$_3$, total number; **A2**, Mc on series m$_3$ series, total number; **A3**, Mc on series a$_1$, total number; **A4**, Mc on series above m$_2$, total number; **A5**, Mc on series m$_3$-m$_4$ series, total number. **Abd IV**: **A6**, Mc on series a$_1$-a$_5$ (A$_1$-E$_{1a}$), total number; 9 if > 8; **A7'**, unpaired Mc on series ma$_0$ (A$_{03}$), total number; **A7**, Mc on series ma$_1$-ma$_4$ (A$_2$-E$_1$), total number; 10 if > 9; **A8'**, unpaired Mc on series m$_0$ (A$_{04}$), total number; **A8**, Mc on series m$_1$-m$_3$ (A$_{4p}$-C$_4$), total number; 6 if > 5; **A9'**, unpaired Mc on series mp$_0$ (A$_{05}$), total number; **A9**, Mc on series mp$_1$-mp$_3$ (A$_5$-B$_5$), total number; 6 if > 5; **A10**, Mc on series p$_{1a}$-p$_3$ (A$_{6i}$-B$_6$), total number; 6 if > 5; **M1**, mucro, sub-apical tooth: 1, without; 2, normal; 3, bigger than apical; 4, smaller than apical. Abbreviations and symbols: *, difference for the character with the new species; **D**, total number of differences between the species and the new species; **U**, unknown.

Species	H1	H2	H3	H4	H5	L1	T1	T2	E1	A1	A2	A3	A4	A5	A6	A7'	A7	A8'	A8	A9'	A9	A10	M1	D
E. katzi Jordana & Baquero n. sp.	3	2*	0	1*	2	3	3*	5*	U	2	2	1	0	1	0	0	4*	0	0	0*	2	2	2	6
E. lawrencei	3	1	0	2	2	2*	2	3*	U	2	2	1	0	1	0	0	2*	0	2*	0*	2	2	U	5
E. luquei	3	1	0	3*	2	3	2	3*	1*	2	2	1	0	1	0	0	0*	0	3*	0*	2	2	2	6
E. nicoleti	3	1	0	3*	3*	2*	2	3*	1*	2	2	1	0	1	0	0	0*	0	3*	0*	2	2	2	8
E. rubella	3	1	0	2	1*	3	1*	3*	1*	2	2	1	0	1	0	0	0*	0	3*	0*	2	1*	3*	9
E. siciliana	3	1	0	2	2	3	2	3*	2	2	2	1	0	1	0	0	0*	0	3*	0*	2	2	2	4
E. ledesmai Jordana & Baquero n. sp.	3	1	0	2	2	3	2	4	2	2	2	1	0	1	0	0	3	0	0	1	2	2	2	

Entomobrya ledesmai Jordana & Baquero n. sp. (Figs 8B; 10; Table 4)

urn:lsid:zoobank.org:act:689294BD-51C9-4D4D-9E44-948B53C2F0C2

TYPE MATERIAL. — **Holotype. Spain** • ♀; Madrid, Sierra de Guadarrama, Cuerda Larga and associated mountainous complex, Cabeza de Hierro Mayor Menor (crest); 30T 4211 45168; 2301 m a.s.l.; 6.XI.2015; Ortuño *et al.* leg.; pitfall SSD (since 3.VII.2015); MZNA SSD-29 (slide 13).

Paratypes. Spain • 4 specimens; same data as for holotype, slide 09; Ortuño *et al.* leg.; MZNA • 1 juvenile and approximately 4000 in ethyl alcohol; same data, slide 12 • 2 specimens; SSD-2 (1 m depth) on slide 02; same data; MZNA • 1 specimen; SSD-30 on slide 04; same data; MZNA • 10 specimens in ethyl alcohol; SSD-29; same data; MNHN.

TYPE LOCALITY. — Spain, Madrid, Sierra de Guadarrama, Cuerda Larga and associated mountainous complex, Cabeza de Hierro Mayor Menor (crest); 30T 4211 45168; 2301 m a.s.l.

ETYMOLOGY. — This species is dedicated to the biologist Enrique Ledesma, a very active participant in the sampling of the mesovoid shallow substratum.

DIAGNOSIS. — White species, with patches of pigmentation not only transversal, 2-4 Mc on areas T1-T2 on Th II, 2-2/1-0-1 Mc on areas A1-A5 on Abd II-III, and without Mc on A8 on Abd IV. The unequivocal identification of the species can only be done using the abbreviated formula that, for this species, is: 3-1-0-2-2/2-4/2-2/1-0-1/0-3-0-1$_0$2-2.

DESCRIPTION

Size and color

Body length: 2.12 mm, up to 2.33 mm (n = 7), excluding antennae. Ground color white or very pale yellow, with pigment as small patches as in Figure 8B; head with pigment between eyes and vertex, and on antennae on internal Ant I and from Ant II to IV.

Head

Eight eyes, GH smaller than EF. Antennae length 1.10-1.43 mm, 3.20 times the length of the head; relative length of Ant I/II/III/IV = 1/2.64/2.40/2.37 (n = 7); sensory organ of Ant III with the special rod-like sensilla, and three additional guard sensilla (Fig. 10B); Ant IV with apical vesicle bilobed. Prelabral chaetae ciliated. Labral papillae multispinose (Fig. 10C). Lateral process of labial papilla E not reaching the apex of the papilla. Labial chaetae ciliated: only one M, and R half of a M.

Body and legs

Length ratio of Abd IV/III = 4.27 (n = 7). Microchaetae on body relatively broadened (Fig. 10G). Tibiotarsus sub-segmented, without smooth chaetae, except for smooth terminal chaeta on legs III. Claw with four teeth: paired at 50% and first unpaired at 70% from base; dorsal teeth not basal, in an intermediate position between base and paired internal teeth (Fig. 10H). Empodium lanceolate, with serrate external lamella (pe) in leg III. Tenent hair clavate. Trochanteral organ with approximately 22 chaetae (Fig. 10I). Length of manubrium and dens 0.44 and 0.55 mm, respectively. Manubrial plate with four chaetae and two pseudopores. Non-ringed part of dens two times the length of mucro; mucro with teeth similar in size, mucronal spine reaching the tip of the subapical tooth.

Macrochaetotaxy (Fig. 10A, D-F)

Simplified Mc formula: 3-1-0-2-2/2-4/2-2/1-0-1/0-3-0-1$_0$ 2-2. Head: H1 area with Mc An$_2$, An$_{3a1}$ and An$_3$; H2 area with one Mc (A$_5$); H4 area with two Mc (S$_1$ and S$_3$); H4' area with three Mc (S$_5$, S$_{5i}$ and S$_4$); H5 area with Ps$_2$ and Ps$_5$. Mesothorax: area T1 with two Mc (m$_1$ and m$_{2i}$); T2 with four Mc (m$_4$, m$_{4i}$, a$_5$ and m$_5$). Abdomen: Abd II area A1 with two Mc (a$_2$ and a$_3$), area A2 with two Mc (m$_3$ and m$_{3e}$); Abd III with one Mc each on areas A3 (a$_1$) and A5 (m$_3$); Abd IV with three Mc on A7 area (A3, B3 and C1), three Mc on A9: one unpaired (A$_{05}$). A$_5$ and B$_5$, and two on A10 (A$_6$ and B$_6$).

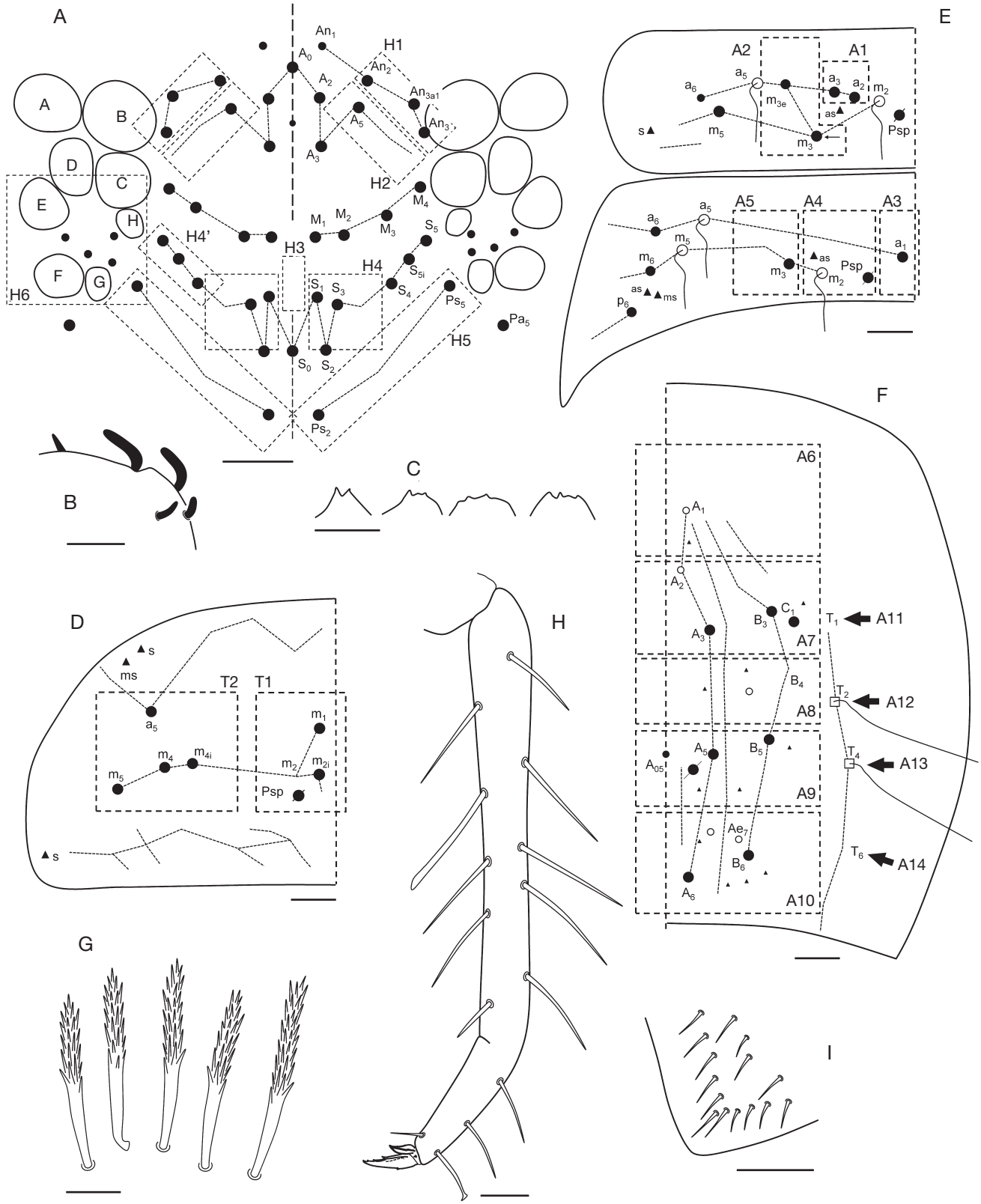

FIG. 10. — *Entomobrya ledesmai* Jordana & Baquero n. sp.: **A**, head chaetotaxy; **B**, sensory organ of antennal segment III; **C**, labral papillae; **D**, Th II dorsal macrochaetotaxy; **E**, Abd I-III dorsal macrochaetotaxy; **F**, Abd IV dorsal macrochaetotaxy; **G**, chaetae from central area of Abd II; **H**, tibiotarsus of leg 3; **I**, trochanteral organ. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes; ▲, sensilla. Scale bars: A, D-F, 0.05 mm; H-I, 0.02 mm; B, C, G, 0.01 mm.

TABLE 5. — Group of species of *Lepidocyrtus* Bourlet, 1839 that share the Gisin's reduced formula (1965, 1967a, b): *L. barbulus* Mateos, 2011 (Greece), *L. instratus* Handschin, 1924 (Europe), *L. juliae* Mateos, 2011 (Greece), *L. lignorum* (Fabricius, 1775) (Europe), *L. peisonis* Traser & Christian, 1992 (Slovakia and Ukraine), *L. traseri* Winkler, 2016 (Hungary), *L. tellecheae* Arbea & Jordana, 1990 (Iberian Peninsula), *L. uzeli* Rusek, 1985 (Czech Republic), *L. violaceus* ([Geoffroy, 1762] Fourcroy, 1785) (Europe), *L. paralignorum* Baquero & Jordana n. sp. and *L. labyrinthi* Baquero & Jordana n. sp. Legend for the headers of the columns: **Head: AS**, antennae and scales: 0, without scales; 1, scales on Ant I; 2, scales on Ant I-II; 3, scales on Ant I-III; 4, scales on Ant I-IV; **LP**, labral papilla shape: 0, absent; 1, smooth; 2, only the central one with a seta-like projection; 3, all with a seta-like projection; 4, multispinose; **La**, labral chaetae row "a" shape: 1, pointed; 2, bifurcated; 3, ciliated; 4, apically ciliated (the difference between type '2' (bifurcate) and '4' (apically ciliated) may be difficult to interpret); **M1**, ventral labial chaeta: 0, absent; 1, smooth microchaeta; 2, smooth macrochaeta; 3, ciliated microchaeta or mesochaeta; 4, ciliated macrochaeta; 5, smooth macrochaeta with supplementary seta; 6, ciliated macrochaeta with supplementary chaeta; **M2**, ventral labial chaeta: same as for M1; **R**, ventral labial chaeta: 0, absent; 1, smooth microchaeta; 2, smooth macrochaeta; 3, ciliated microchaeta or mesochaeta; 4, ciliated macrochaeta; **E**, ventral labial chaeta: same as for R; **L1**, ventral labial chaeta: same as for R; **L2**, ventral labial chaeta: same as for R. **Abdomen**: **SC**, supplementary seta '**s**' on Abd IV: 1, absent; 2, present. **Legs**: **CL**, claw teeth number and shape: 1, 0/ 2, only paired/ 3, 2 paired + 1 unpaired/ 4, 2 paired + 2 unpaired/ 5, 2 pairs (2 + 2) + 1 unpaired; **E1**, empodium external lamella (pe): 1, smooth; 2, minute; 3, weak; 4, fully developed; 5, serrate; **E2**, empodium shape: 1, acuminate; 2, truncate; 3, basally swollen; **CP**, color pattern. Abbreviations and symbols: *****, difference for the character with *L. paralignorum* Baquero & Jordana n. sp.; °, difference for the character with *L. paralignorum* Baquero & Jordana n. sp.; **D1**, total number of differences between the species and *L. labyrinthi* Baquero & Jordana n. sp.; **D2**, total number of differences between the species and *L. paralignorum* Baquero & Jordana n. sp.; **U**, unknown.

species	AS	LP	La	M1	M2	R	E	L1	L2	SC	CL	E1	E2	CP	D1	D2
L. barbulus	3*°	4*	1*°	6*°	6*°	3	4	4	4	1	4	5	1	Yellowish or diffuse blue pigment	5	4
L. instratus	2	U	U	4	4	3	4	4	4	1	3*°	1*°	3*°	Blue violet from Th III-Abd III	3	3
L. juliae	2	4*	2*	4	4	3	4	4	4	1	4	5	1	Blue or black Abd III, and lateral black spots on Abd IV	2	0
L. lignorum	2	4*	2*	4	4	3	4	4	4	1	3-4	1*°	1	Pale, blue pigment present on antennae, ventral head, Abd II-III and coxae	3	1
L. peisonis	U	1*	1*°	4	4	3	4	4	4	1	2*°	1*°	2*°	Pale	5	4
L. ruber	U	1*°	1*°	4	4	3	4	4	4	1	3*°	1*°	2*°	Variable	5	5
L. traseri	2	3°	2*	4	4	3	4	4	4	1	4	1*°	1	Dark violet, more intense backward	2	2
L. tellecheae	3*°	3°	1*°	4	4	3	4	4	4	1	3*°	5	1	Only blue on anterior coxae	3	4
L. uzeli	2	3°	1*°	4	4	3	4	4	4	1	2*°	1*°	2*°	Dark blue	4	5
L. violaceus	2	4*	2*	4	4	3	4	4	4	1	3*°	2*°	1	Violet, manubrium and legs included	4	2
L. paralignorum Baquero & Jordana n. sp.	2	4*	2*	4	4	3	4	4	4	1-2	4	5	1	White, pigment only on vertex, Ant II tip, Ant III-IV	2	
L. labyrinthi Baquero & Jordana n. sp.	2	3°	4	4	4	3	4	4	4	1	4	5	1	Violet, especially from Th II to Abd III; Abd IV-VI pale violet		2

ECOLOGY

Unlike what was observed with *E. guadarramensis* Jordana & Baquero n. sp., the high activity values shown by *E. ledesmai* Jordana & Baquero n. sp., do not correspond to wide distribution. It has been found in the MSS of only three sites, located in two mountain ranges (Fig. 1B, C), in the forest strip of the oro-Mediterranean zone and in the cryo-Mediterranean. Using reasonable interpolation, it is most likely also found in the supraforestal area of the Mediterranean. Almost all of the specimens (4106 of 4109) come from SSD-29, installed in the Canchal between Cabeza de Hierro Mayor and Menor (Fig. 3E, F), an extreme climate site that shows very little vegetation cover (*J. communis alpina*) and an eminently mineral substrate. *Entomobrya ledesmai* Jordana & Baquero n. sp. is the most abundant species at this site compared to other seven syntopic species (Figs 1C, F; 3F) with a total of 4192 specimens (Fig. 1E), with a dominance of 98%.

REMARKS

If we consider the dorsal macrochaetotaxy of the abdominal tergites Abd II-III using the simplified formula, 2-2/1-0-1, it is close to *E. intermedia sensu* Katz *et al.* (2015), *E. lawrencei* Baquero & Jordana, 2008, *E. luquei* Jordana & Baquero, 2006, *E. nicoleti* (Lubbock, 1868), *E. rubella* Latzel, 1918 and *E. siciliana* Jordana, Giuga & Baquero, 2011.

Katz *et al.* (2015) found an *Entomobrya* captured in Chester (USA) and ascribed the specimen to *E. intermedia*. Some specimens of *E. intermedia* from England were studied for the review of the palearctic Entomobryinae (specimens from different parts of the United Kingdom sent to Rafael Jordana by Peter Shaw) (Jordana 2012). The coloration of both populations is similar but the macrochaetotaxy is different: H4 (Jordana & Baquero 2005) has three chaetae in the specimens from England, one (sometimes an additional mes) in the American specimen; A2 has four Mc in the English form (m_3, m_{3ep}, m_{3e} and m_{3ei}), two in the American form (m_3 and m_{3e}); A7 has more Mc in the English form than in the American form; in addition, the labral papillae are smooth in the English specimens and multispinate in the American specimen. Given these differences and the geographical origin of the specimens, we consider *E. intermedia sensu* Katz *et al.* (2015) to be a new species of *Entomobrya* from the USA, denominated *Entomobrya katzi* Jordana & Baquero n. sp., with an abbreviated formula 3-2-0-1-2/3-5/2-2/1-0-1/0-4-0-2-2.

Table 4 shows that the new species differs by multiple characters from the species with which it shares the simplified formula of Abd II-III.

Entomobrya ledesmai Jordana & Baquero n. sp. represented 18% of the total Entomobryomorpha studied in this work, (Fig. 1D), and 19% of Entomobryidae (not including *Orchesella*) (Fig. 2A, B), i.e., it is the third species in the dominance rank.

Entomobrya nicoleti (Lubbock, 1868)

Degeeria nicoleti Lubbock, 1868: 299.

Entomobrya multifasciata var. *nicoleti* Brook, 1884: 278.

Entomobrya nicoleti – Börner 1901: 68.

Entomobrya aurantiaca Stach, 1922. — Jordana 2012: 149.

Entomobrya bimaculata Stach, 1963. — Jordana 2012: 149.

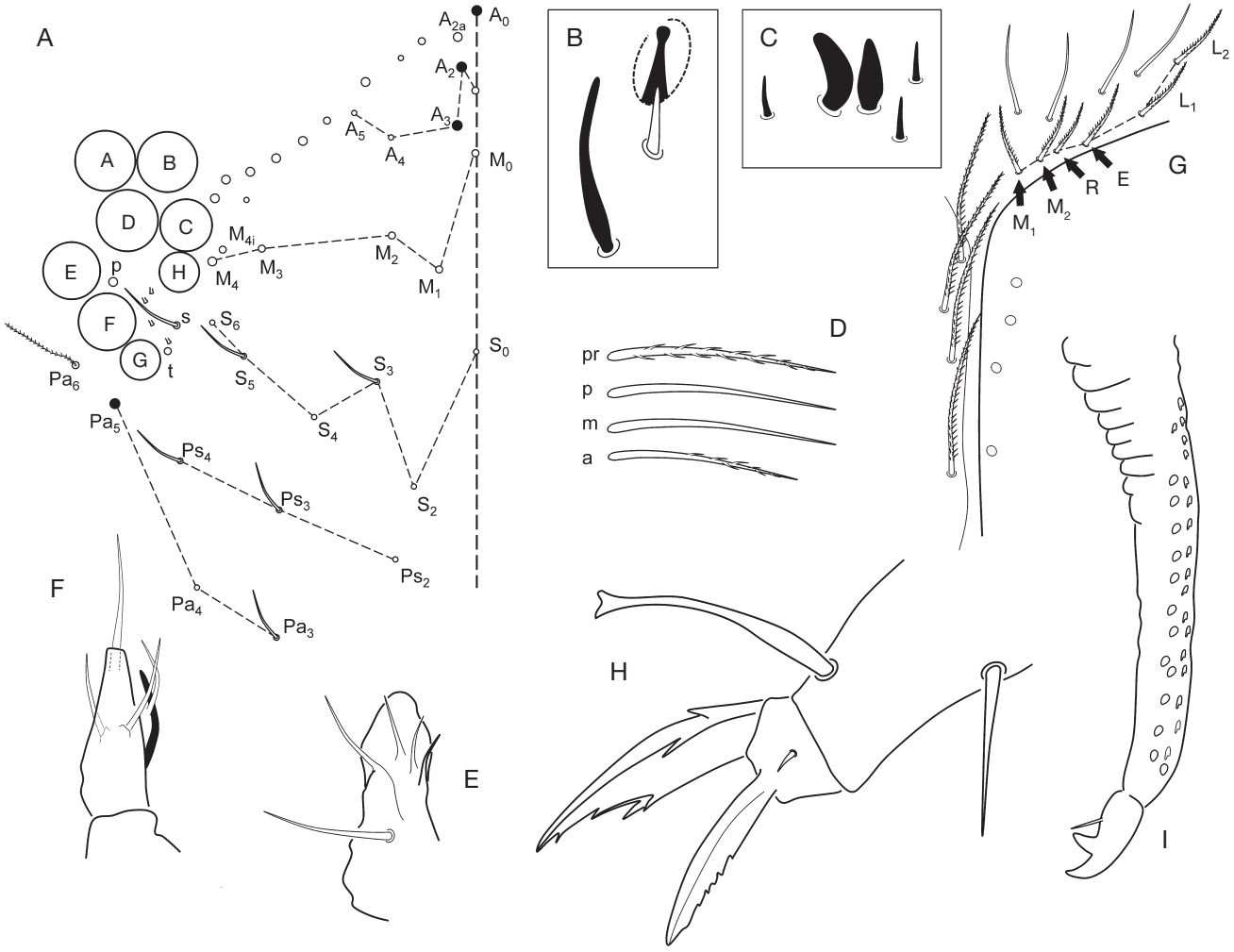

FIG. 11. — *Lepidocyrtus labyrinthi* Baquero & Jordana n. sp.: **A**, head chaetotaxy; **B**, organite and accessory sensillum on Ant IV; **C**, sensory organ of antennal segment III; **D**, prelabral chaetae (**PR**) and labral chaetae (rows 'p', 'm' and 'a'); **E**, maxillary palp and outer maxillary lobe; **F**, labial papilla '**E**'; **G**, area postlabial; **H**, apical part of tibiotarsus, claw and empodium of leg 3; **I**, tip of furcula, mucro and mucronal spine. Abbreviations: see Material and methods. Symbols: ●, ciliated Mc; ○, mes or small/doubtful Mc, size proportional to reality. Scale bars: A, 0.05 mm; D, 0.005 mm; E-I, 0.02 mm.

MATERIAL EXAMINED. — **Spain** • 1 specimen; SSD-22, slide 04; Ortuño *et al.* leg.; deposited at MZNA.

REMARKS
This is the first record for Guadarrama.

Family LEPIDOCYRTIDAE Wahlgren, 1906
sensu Zang *et al.* 2015
Subfamily LEPIDOCYRTINAE Wahlgren E, 1906
Genus *Lepidocyrtus* Bourlet, 1839

Lepidocyrtus lusitanicus nigrus
Simón-Benito, 2007

Lepidocyrtus lusitanicus nigrus Simón Benito, 2007: 322.

MATERIAL EXAMINED. — **Spain** • 6 specimens on slide and 12 in ethyl alcohol; SSD-7, slides 07 and 12; Ortuño *et al.* leg.; MZNA • 1 specimen; SSD-29, slide 08; same data; MZNA.

REMARKS
L. lusitanicus is present in Portugal, Spain and France. Different types of coloration that have been elevated to the rank of subspecies by different authors (Simón-Benito 2007; Mateos 2008). The specimens found in this study, based on their coloration, would belong to the subspecies *L. lusitanicus nigrus*, which is cited in Navarra, Zaragoza, Madrid and Pontevedra (Spain).

Lepidocyrtus labyrinthi Baquero & Jordana n. sp.
(Figs 8C, D; 11; 12; 13; Table 5)

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TYPE MATERIAL. — **Holotype. Spain** • ♀; Segovia, Sierra de Guadarrama, Montes Carpetanos, Majada Aranjuez (Northwest); 30T 419045231; 2071 m a.s.l.; 17.XI.2015; Ortuño *et al.* leg.; pitfall SSD (since 2.VI.2015); MZNA SSD-8 (slide 04).
Paratypes. Spain • 5 specimens on slide and 70 in ethyl alcohol; SSD-6, slides 05 and 11; Ortuño *et al.* leg.; MZNA • 6 specimens;

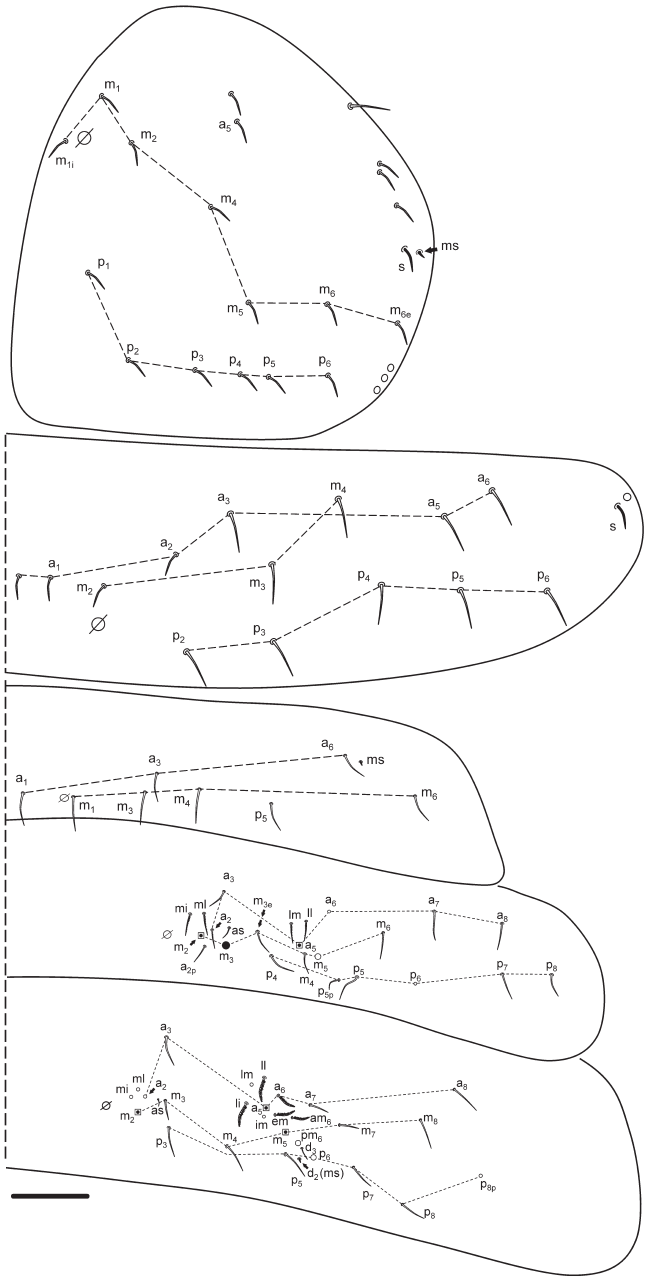

FIG. 12. — *Lepidocyrtus labyrinthi* Baquero & Jordana n. sp., Th II to Abd III dorsal chaetotaxy. Abbreviations: see Material and methods. Symbols: ●, ciliated Mc; ○, mes; ⦸, pseudopores; ▣, bothriotricha. Scale bar: 0.05 mm.

SSD-7, slide 09; same data; MZNA • 11 specimens on slide and 20 in ethyl alcohol; SSD-9, slide 06; same data; MZNA • 1 specimen; SSD-29, slide 08; same data; MZNA • 10 specimens in ethyl alcohol; SSD-6; same data; MNHN.

TYPE LOCALITY. — Spain, Segovia, Sierra de Guadarrama, Montes Carpetanos, Majada Aranjuez (Northwest); 30T 4190 45231; 2071 m a.s.l.

ETYMOLOGY. — The specific epithet "*labyrinthus*" (of the labyrinth), refers to the presence of this species in the underground crack network of the mesovoid shallow substratum.

ADDITIONAL MATERIAL. — Sierra de Guadarrama, Segovia; Ortuño *et al.* leg.; MZNA • 13 specimens; SSD-1 (0.5 m depth), slides 06, 07; same data; MZNA • 9 specimens; SSD-1 (1 m depth), slides 06, 09 and 10; same data; MZNA • 6 specimens; SSD-2 (0.5 m depth), slides 08, 09; same data; MZNA • 2 specimens on slide and 23 in ethyl alcohol; SSD-2 (1 m depth), slide 16; same data; MZNA • 3 specimens; SSD-3 (1 m depth), slide 01; same data; MZNA • 1 specimen; SSD-16, slide 12; same data; MZNA • 1 specimen; SSD-22, slide 06; Madrid; same data; MZNA • 1 specimen; SSD-12, slide 11; same data; MZNA • 3 specimens; SSD-13, slide 05; same data; MZNA • 1 specimen; SSD-15, slide 07; same data; MZNA • 12 specimens on slide and 30 in ethyl alcohol; SSD-23, slide 04; same data; MZNA • 1 specimen; SSD-24, slide 02; same data; MZNA • 1 specimen; SSD-28, slide 04; same data; MZNA • 3 specimens on slide and 26 in ethyl alcohol; SSD-30, slide 04; same data; MZNA.

DIAGNOSIS. — Body violet more or less pigmented, ocular spot black, and antennae and body violetblue, with darker pigment dorsally, especially on tergites Th II-Abd III and distal part of the head; antennae with distal area pigmented and Ant IV totally pigmented; some specimens with posterior Th III and Abd I paler (Fig. 8C, D). Head Mc Pa_5 present; A_0, A_2 and A_3 as Mc, and A_{2a} as mes; posterior labial row with M_1, M_2, R*, E, L_1 and L_2 ciliated Mc (R half to two thirds of M; sometimes M_1 absent and usually asymmetric); Th II a little projected overhead, i.e., not pointed completely downward; Th II-III without Mc; Abd II with chaeta a_{2p} present, a_3 forward from 'as' sensilla and only m_3 as ciliated Mc; Abd IV with four median ciliated Mc (C_1, $B_{4\text{-}6}$), three non-fan-shaped ciliated mic behind anterior bothriotrichum and bothriothrichal complex mic D_{1p} present; claw with four internal teeth: two basal and two unpaired; empodium acuminate; manubrial plate with three internal and 5-8 external chaetae.

DESCRIPTION

Size and color

Body length up to 2.00 mm, including head (mean 1.64 mm, n = 17 adults), excluding antennae (holotype: 1.80 mm). Color variable, from pale to dark violet almost whole body except last two abdominal segments and furcula; all specimens maintain transversal bands on Th II-Abd III; blue pigment on vertex of head and ocular patches Ant IV and tip of Ant II-III pigmented. Scales present on Ant I-II, ventral and dorsal head, thorax and abdomen dorsally, coxae I-III and femora-tibiotarsus I-III, dorsally and ventrally on manubrium and only dorsally on dens; manubrium and dens similar in length (0.37 mm, n = 15); non-annulated part of dens three times the length of mucro.

Head

Antennal head ratio 1.58 (n = 6). Ant IV without apical bulb, apical organite and accessory sensilla as in Figure 11B. Ant III sense organ with two curved and expanded sensilla, one of them bigger than the other (Fig. 11C) three spiny guard sensilla, one of them blunt; on Ant II one distal similar but straight to Ant III expanded sensilla; Head Mc P_{a5} present, A_0, A_2 and A_3 as ciliated Mc, A_{2a} as mes; t, s and p chaetae present on ocular well (p as mes, bigger than the other), three scales in the area; head dorsal chaetotaxy (Fig. 11A) with 5-8 antennal (An) ciliated Mc basomedian labial fields chaetae smooth. Four prelabral ciliated chaetae; labrum with three rows, 'a' row with four apically ciliated chaetae, 'm' and 'p' with five smooth chaetae (Fig. 11D). Four labral papillae, conical or with a spinelike chaeta. Maxillary palp bifurcated with three smooth appendages (Fig. 11E). Labial papilla (l.p.) E with finger-shaped process not reaching at base of apical appendage (Fig. 11F). Labial row with M_1, M_2, R*, E, L_1 and L_2 ciliated

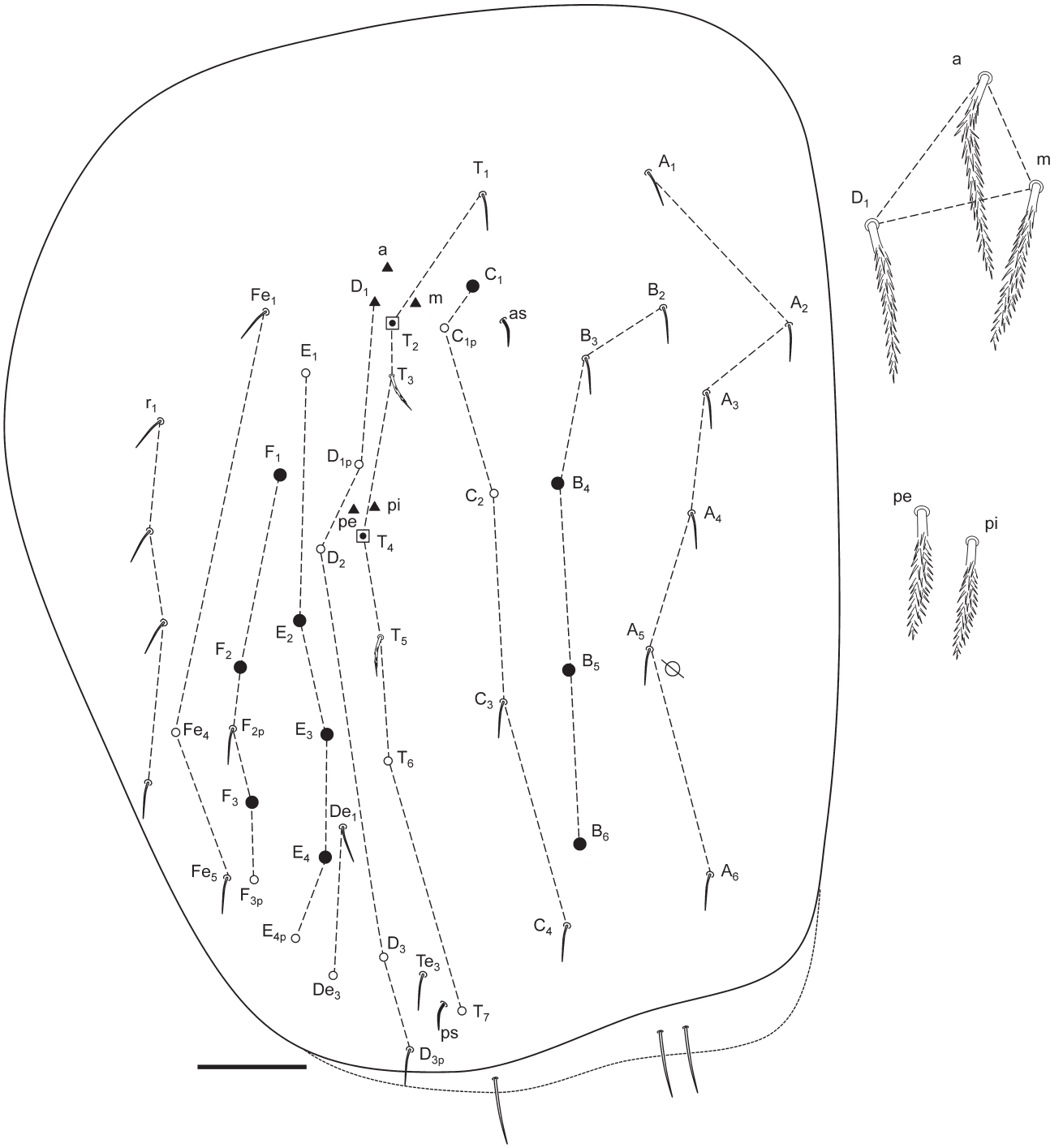

FIG. 13. — *Lepidocyrtus labyrinthi* Baquero & Jordana n. sp., Abd IV dorsal macrochaetotaxy, and detail of the shape of the accessory chaetae to bothriotricha. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes; ⦸, pseudopores; ▣, bothriotricha; ▲, special chaetae. Scale bar: 0.05 mm.

Mc (R half to two-thirds of M; M_1 sometimes absent and usually asymmetric) (Fig. 11G). Postlabial chaetotaxy with 3 + 1 ciliated central Mc along the groove. 12 + 12 spinelike chaetae on posterior dorsal head.

Thorax chaetotaxy (Fig. 12)

Th II and Th III without Mc; Th II with 's' and 'ms' in posterolateral position at level of m row; Th III with two 'a' mic before psp, a_2, a_3, a_5, a_6, m_2 (above psp), m_3, m_4, p_2-p_6, and on lateral tergite a mes with the lateral sensilla (sl) interiorly.

Abdomen chaetotaxy (Figs 12; 13)

Abd I with a_1 before psp; m_1 beside psp; a_3, a_6, m_3, m_4, m_6 and p_5 (with the 'ms' near a_3). Abd II, mi and ml chaetae present over bothriotrichum (m_2); a_{2p} (p) present as smooth

mic; a_2 (a) as smooth mic; m_3 (B) present as ciliated Mc; 'as' over m_3 and a_3 upside over a_2 (two times its length); m_{3e} and p_4 (q_1 and q_2) present as smooth mic; lm and ll present as pointed ciliated mic over bothriotrichum (a_5); a_6, m_4, m_6 and p_5 as smooth mic; m_5 as Mc. Abd III, mi, ml and a_2 as pointed ciliated mic over bothriotrichum (m_2); 'as' between a_2 and m_3; m_3 as smooth mic; a_3 very up; p_3 below m_3, and m_4 as smooth mic; lm, li, ll and a_6 as ciliated pointed mic surrounding bothriotrichum (a_5); im, em and am_6 as small ciliated mic over m_5 bothriotrichum; pm_6 and p_6 as ciliated Mc with d_3 between them; 'ms' near p_5 as smooth mic; p_{8p} as ciliated mes; a_7, a_8, m_7, m_8, p_7 and p_8 as smooth mic. Abd IV with four median mac (C_1, $B_{4\text{-}6}$; ratio between C_1-B_4/B_4-B_6 0.60-0.74, n = 3), and 6 lateral Mc ($E_{2\text{-}4}$, $F_{1\text{-}3}$); T_5 as mic, D_3, T_6 and T_7 as mes (D_3 as Mc in some specimens); before T_2 bothriotrichum, usually, three pointed ciliated mic (a, m and D_1), with a supplementary 's' chaeta present in only one specimen (♂) and asymmetric (Fig. 13).

Legs

Scales on legs (including all coxae). Trochanteral organ V-shaped with about 14-19 spine-like chaetae (n=3). Claw with four teeth on inner edge: basal pair at 50%, an unpaired median at 65%, and one minute unpaired subapical; two lateral teeth intermediate to base and paired, and one more basal dorsal tooth. Empodium acuminate, all with pe lamella serrated, other lamellae smooth (ae, ai, pi); claw:empodium ratio = 1 : 0.8. Tibiotarsus III distally with one inner smooth chaeta similar in size to empodium; tenent hairs spatulated, smooth, similar in size to claw (Fig. 11H).

Furcula

Manubrium with scales dorsally and ventrally. Dens with scales only dorsally; manubrium and dens similar in length; manubrial plate (dorsally) with three internal ciliate Mc, between 5 and 8 (n = 3) external chaetae, and 2 psp. Non-ringed area of dens three times the length of mucro (0,002 mm) (Fig. 11I).

Macrochaetotaxy

Reduced formula (from Gisin 1965, 1967a, b): $R_0R_1R_2$001/00/0101+3/0, $paBq_1q_2$, M1M2R*EL1L2 (* ½ to 2/3 of M).

Ecology

Species widely distributed in the three mountain ranges, found in the MSS of more than half of the sampling points (Fig. 1A-C). Although it is present in the three bioclimatic zones, given the average catch and its frequent occurrence, it is more common with increasing altitude. Nevertheless, its greatest activity was recorded in SSD-6 of Canchal La Pedriza (Fig. 3G, H), located in the oro Mediterranean forest zone, and accounts for 32% of the 234 Entomobryomorpha (not including *Orchesella*) collected there (Fig. 1E). At this site, *L. labyrinthi* Baquero & Jordana n. sp. is syntopic with seven other species (Figs 1F; 3H) of the group analyzed in this study.

Remarks

Winkler (2016) and Mateos (2011) defined the *L. lignorum* group as the species with the formula $R_0R_1R_2$001/00/0101+3 (with or without cephalic Mc S_0, also called Pa_5) and scales on antennae and legs, which currently includes the species: *L. barbulus* Mateos 2011, *L. instratus* Handschin, 1924, *L. juliae* Mateos, 2011, *L. lignorum* (Fabricius, 1775), *L. peisonis* Traser & Christian, 1992, *L. ruber* Schött, 1902, *L tellecheae* Arbea & Jordana, 1990, *L. traseri* Winkler, 2016, *L. uzeli* Rusek, 1985, *L. violaceus* ([Geoffroy, 1762] Fourcroy, 1785). According to this definition, this new species belongs to this group. The species that share the traditional dorsal body macrochaetotaxy formula of Gisin (1965, 1967a, b) with this species include *L. barbulus*, *L. instratus*, *L. juliae*, *L. lignorum*, *L. peisonis*, *L. traseri*, *L. tellecheae*, *L. uzeli* and *L. violaceus*.

Lepidocyrtus barbulus is differentiated by the labial formula; it also has a pale color. *Lepidocyrtus tellecheae* has scales in the antennal segments I-III, claw with three teeth and row 'a' of the labral series with pointed chaetae. *Lepidocyrtus juliae*, *L. lignorum* and *L. violaceus* have labial papillae multispinate; *L. juliae* also has a characteristic coloration, with only four spots and *L. lignorum* has no pigment. *Lepidocyrtus peisonis* has smooth labial papillae and row 'a' of labral chaetae pointed. *Lepidocyrtus instratus* has three teeth on the claw and outer lamella of the empodium smooth. *Lepidocyrtus traseri* also has the outer lamella of the empodium smooth, in addition labral chaetae of row 'a' are bifurcated. *Lepidocyrtus uzeli* has the claw with only two teeth. *Lepidocyrtus juliae*, *L. lignorum*, *L. traseri* and *L. violaceus* have the row 'a' of labral chaetae bifurcated (Table 5).

The wide distribution of *L. labyrinthi* Baquero & Jordana n. sp. does not correspond to the activity records, since it represents only 1% of the Entomobryomorpha and Entomobryidae, studied in this work, (Figs 1D; 2A, B).

Lepidocyrtus paralignorum

Baquero & Jordana n. sp.

(Figs 8F; 14A-F; 15A-E; 16; Table 5)

urn:lsid:zoobank.org:act:C3480E16-3903-4E20-83C6-807916103607

Type material. — **Holotype. Spain** • ♀; Madrid, Sierra de Guadarrama, Cuerda Larga and associated mountainous complex, Collado de Peña Vaqueros (Loma de Pandasco); 30T 4227 45170; 2233 m a.s.l.; 6.XI.2015; Ortuño *et al.* leg.; pitfall SSD (since 3.VI.2015); MZNA SSD-30 (slide 06).

Paratypes. Spain • 4 specimens on slide and 10 in ethyl alcohol; SSD-12, slide 10; Ortuño *et al.* leg.; MZNA • 1 ♂ and 2 juveniles on slide and 44 in ethyl alcohol; SSD-28, slide 05; same data; MZNA • 1 ♀ on slide and 50 in ethyl alcohol; SSD-29, slide 07; same data; MZNA • 10 specimens in ethyl alcohol; SSD-29; same data; MNHN.

Type locality. — Spain, Madrid, Sierra de Guadarrama, Cuerda Larga and associated mountainous complex, Collado de Peña Vaqueros (Loma de Pandasco); 30T 4227 45170; 2233 m a.s.l.

Etymology. — The specific epithet contains the prefix "para" (outside of…) of Greek origin. This indirectly conveys the idea that it is a species close to *L. lignorum*.

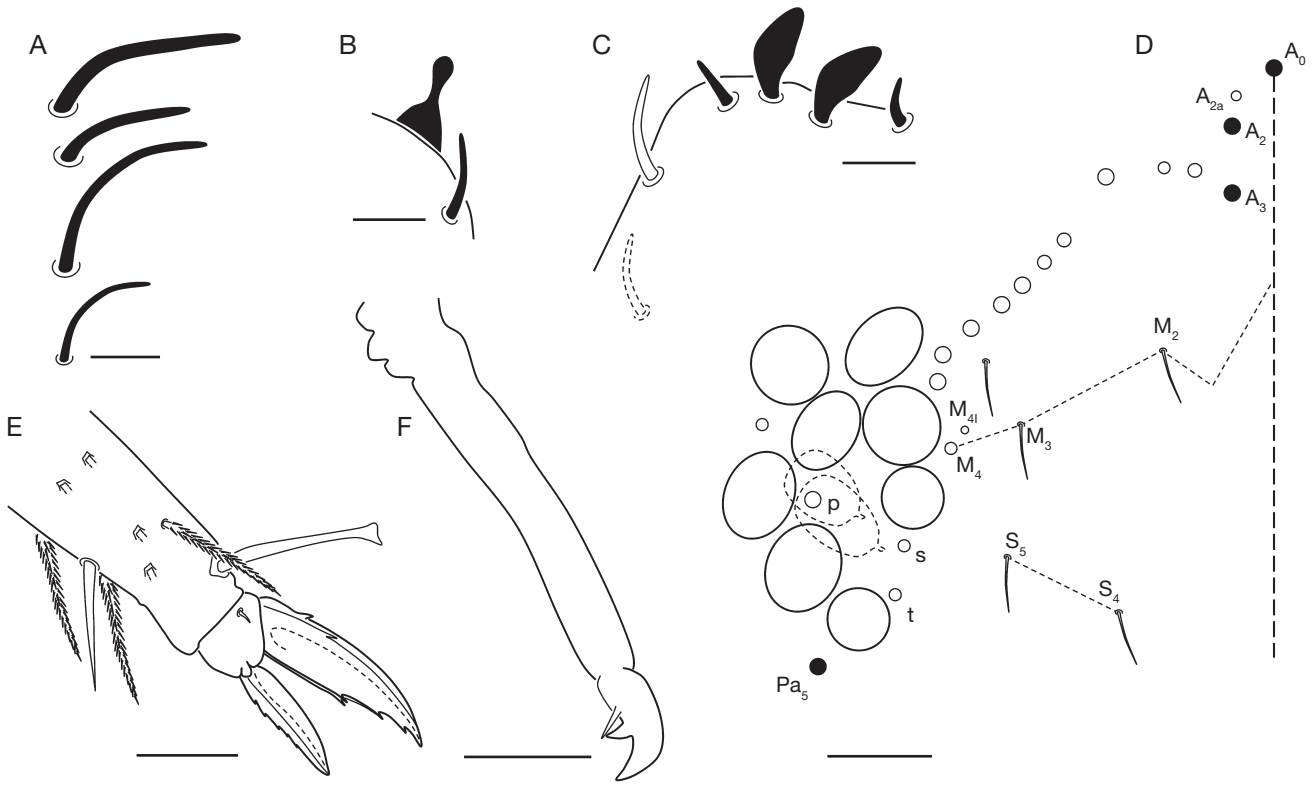

FIG. 14. — *Lepidocyrtus paralignorum* Baquero & Jordana n. sp.: **A**, four types of sensilla on Ant IV; **B**, organite and accessory sensillum on Ant IV; **C**, sensory organ of antennal segment III; **D**, head chaetotaxy; **E**, apical part of tibiotarsus, claw and empodium of leg 3; **F**, tip of furcula, mucro and mucronal spine. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes. Scale bar: A-C, 0.005 mm; D-F, 0.02 mm.

ADDITIONAL MATERIAL. — **Spain** • 3 specimens; SSD-1 (0.5 m depth), slide 05; Sierra de Guadarrama, Segovia; Ortuño *et al.* leg.; MZNA • 3 specimens on slide and 210 in ethyl alcohol; SSD-2 (0.5 m depth), slides 09 and 10; same data; MZNA • 8 ♀, 5 ♂ and 6 juveniles on slide and 22 in ethyl alcohol; SSD-2 (1 m depth), slides 04, 13 and 22; same data; MZNA • 2 ♀, 1 ♂ and 5 juveniles; SSD-3 (1 m depth), slides 11 and 13; same data; MZNA • 3 specimens on slide and 29 in ethyl alcohol; SSD-4; 1 m depth; slide 06; same data; MZNA • 1 ♂ subadult and 1 juvenile on slide; SSD-5, slide 07; same data; MZNA • 13 specimens; SSD-6, slides 11 and 12; same data; MZNA • 4 specimens; SSD-7, slide 09; same data; MZNA • 1 ♀ and 3 juveniles on slide and 16 in ethyl alcohol; SSD-8, slide 09; same data; MZNA • 1 ♀ and 5 juveniles on slide and 68 in ethyl alcohol; SSD-11, slide 07; same data; MZNA • 1 ♀ and 3 juveniles on slide and 32 in ethyl alcohol; SSD-17, slide 06; same data; MZNA • 5 ♀ and 2 juveniles on slide and 60 in ethyl alcohol; SSD-18, slides 09 and 10; same data; MZNA • 4 juveniles; SSD-20, slide 06; same data; MZNA • 1 ♀ and 11 juveniles on slide and approximately 1800 in ethyl alcohol; SSD-22, slides 05 and 07; same data; MZNA • 4 specimens on slide and 150 in ethyl alcohol; SSD-25, slide 12; same data; MZNA • 1 ♀ and 3 juveniles on slide and 26 in ethyl alcohol; SSD-26, slide 05; Madrid; same data; MZNA • 3 specimens; SSD-27, slide 05; same data; MZNA • 2 ♀ and 1 ♂ on slide and 71 in ethyl alcohol; SSD-31, slide 10; same data; MZNA.

DIAGNOSIS. — Body without pigment, except for head vertex, ocular spot and antennae (final part of Ant II, whole Ant II-IV); Ant I-II and legs I-III scaled (except coxa I). Head Mc Pa_5 present; A_0, A_2 and A_3 as Mc, A_{2a} as ciliated mes; posterior labial row with M_1, M_2, R*, E, L_1 and L_2 ciliated Mc. Th II projecting over head, i.e., pointed downward; Th II-III without Mc; Abd II with chaeta a_{2p} present, a_3 very forward from 'as' sensilla and only m_3 as ciliated Mc; Abd IV with four median mac (C_1, $B_{4\text{-}6}$), three or four non-fan-shaped ciliated mic behind anterior bothriotrichum and bothriothrichal complex mic D_{1p} present; claw with four internal teeth: two basal and two unpaired; empodium acuminate; manubrial plate with 3 internal and 5-8 external chaetae.

DESCRIPTION

Size and color

Body length up to 2.40 mm including head (mean 1.57 mm, n = 27 adults), excluding antennae (holotype: 2.10 mm). Color white with blue pigment on Ant III-IV and tip of Ant II; blue pigment on vertex of head and ocular patch (Fig. 8F). Scales present on Ant I-II, ventral and dorsal head, thorax and abdomen dorsally, coxae II-III and femora-tibiotarsus I-III, and furcula dorsally and ventrally.

Head

Antennal head ratio 1.5 (n = 4). Ant IV without apical bulb, four types of sensilla (Fig. 14A), and apical organite and accessory sensilla as in Figure 14B; Ant III sense organ with two expanded sensilla, three spiny guard sensilla, s-blunt sens, ciliated and weakly ciliated chaetae (Fig. 14C); on Ant II two distal similar to Ant III expanded sensilla. Head Mc Pa_5 present; A_0, A_2 and A_3 as Mc, A_{2a} as ciliated mes; 5-8 antennal (An) ciliated Mc; s, t and p chaetae present on ocular well (p as mes) (Fig. 14D); basomedian labial fields chaetae smooth. Four prelabral ciliated chaetae (only one

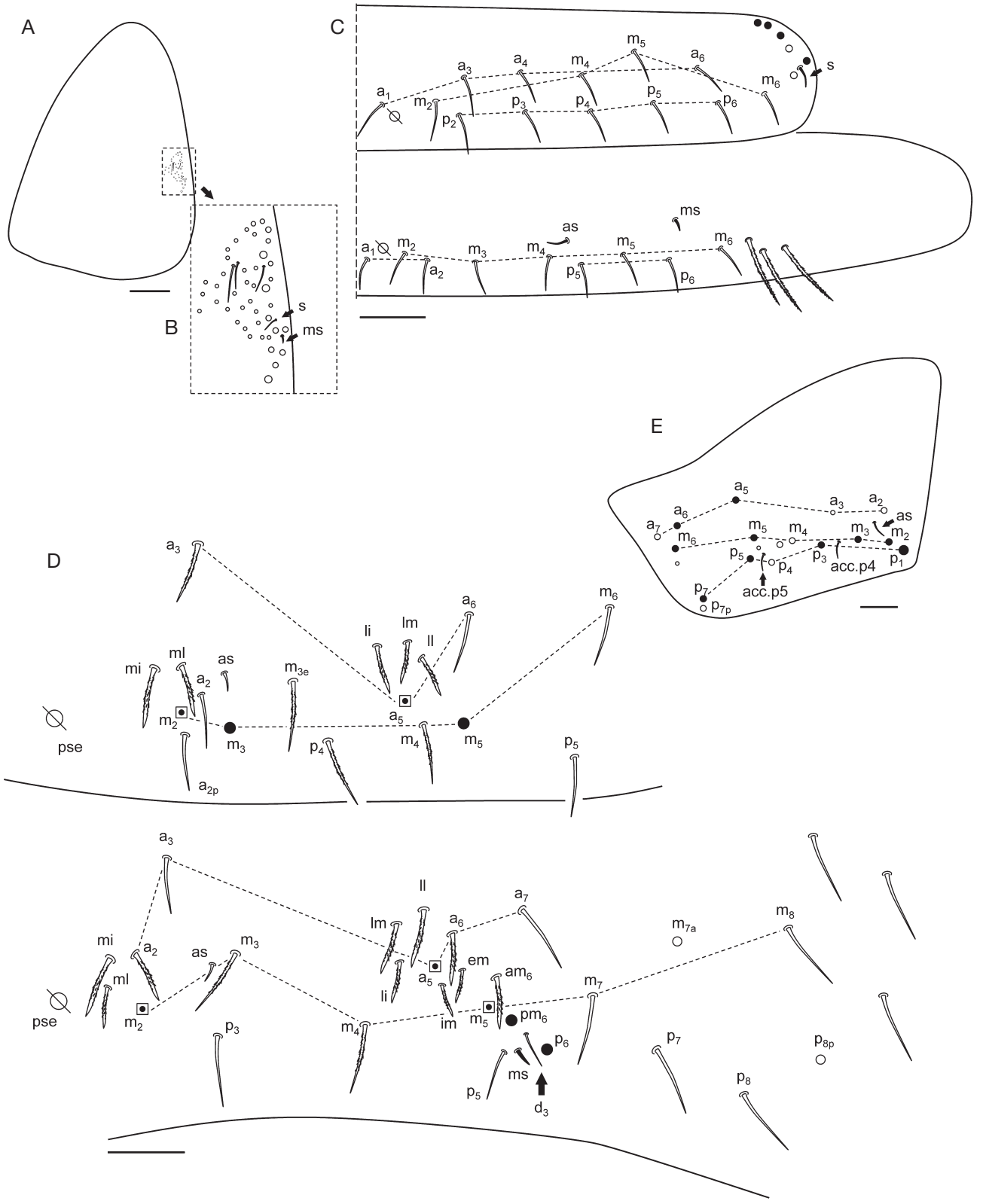

FIG. 15. — *Lepidocyrtus paralignorum* Baquero & Jordana n. sp.: **A**, ThII dorsal chaetotaxy with detail of the area with the lateral sensilla and microsensilla (**B**); **C**, ThIII-AbdI dorsal chaetotaxy; **D**, AbdII-AbdIII dorsal chaetotaxy; **E**, AbdV dorsal chaetotaxy. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes; ⦸, pseudopores; ▣, bothriotricha. Scale bar: 0.02 mm.

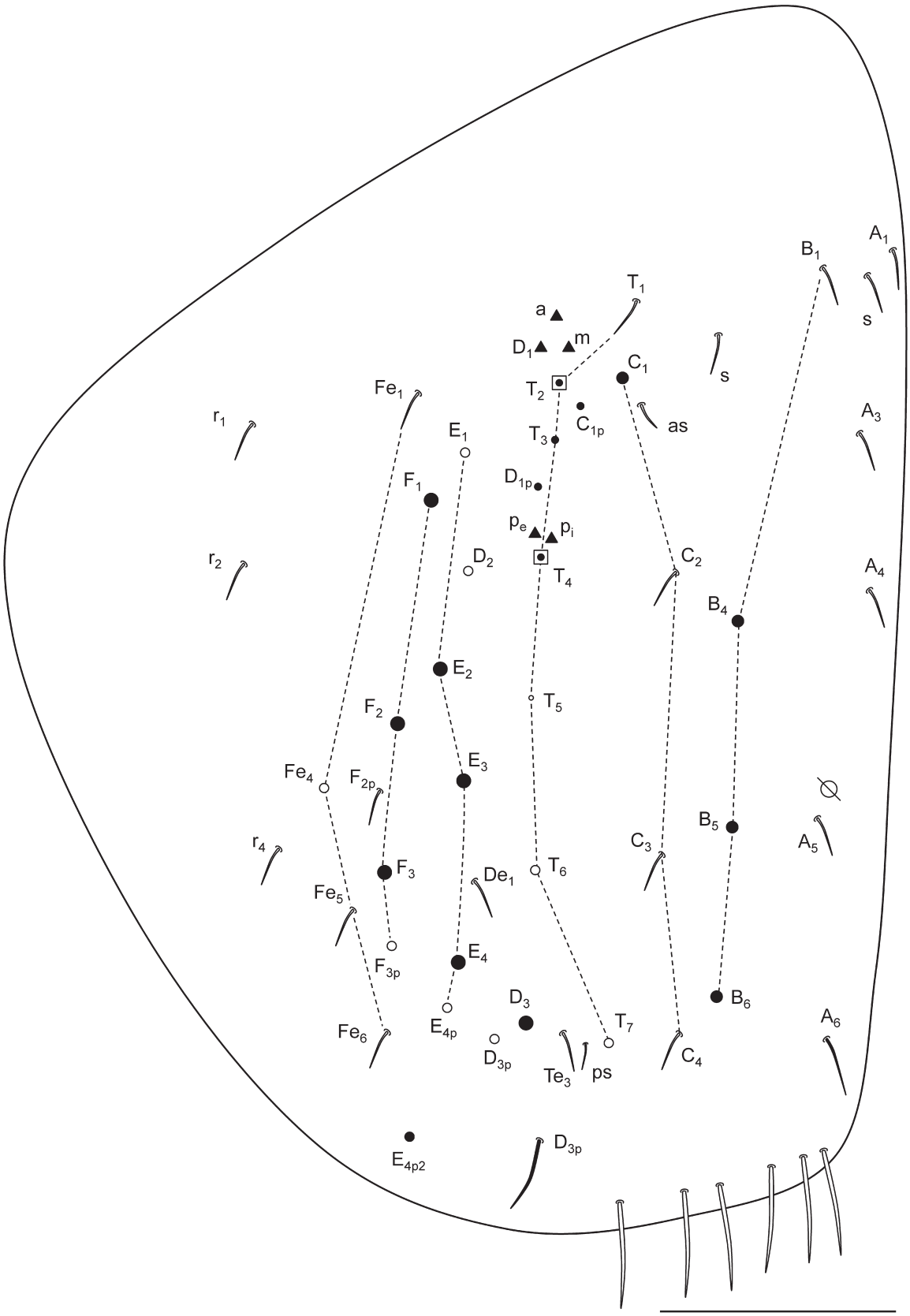

FIG. 16. — *Lepidocyrtus paralignorum* Baquero & Jordana n. sp., Abd IV dorsal chaetotaxy. Symbols: ●, ciliated Mc, size proportional to reality; ○, mes; ⦸, pseudopores; ▣, bothriotricha; ▲, accessory chaetae. Abbreviations: see Material and methods. Scale bar: 0.05 mm.

specimen among 42 observed has smooth prelabral chaetae); labrum with three rows, 'a' row with four bifurcate chaetae, 'm' and 'p' with five smooth chaetae. Four labral papillae, mono to three spinulated (small projection, not a relatively large chaetalike projection). Maxillary palp bifurcated with three smooth appendages. Labial papilla (l.p.) E with finger-shaped process not reaching base of apical appendage. Labial row with M_1, M_2, R*, E, L_1 and L_2 ciliated Mc (R half to two thirds of M; sometimes M_{1a} or M_{1p} present and usually asymmetric). Postlabial chaetotaxy with 3 + 1 ciliated central Mc along the groove.

Thorax chaetotaxy (Fig. 15A, B)
Th II and Th III without Mc; Th II with s and ms in postero-lateral position at level of m row; Th III with a1 before psp, a_3, a_4, a_6, m_2, m_4, m_5 and m_6, p_2, p_3, p_4, p_5 and p_6, two lateral mes with the lateral sensilla (s) between them, and four Mc in front of the sensilla.

Abdomen chaetotaxy (Figs 15C-E; 16)
Abd I with a_1 before psp, and a_2; a_5 as; m_2, m_3, m_4, m_5 and m_6; p_5 and p_6, a sensilla in front of p_6 and m_6, and three lateral mes. Abd II, mi and ml chaetae present over bothriotrichum (m_2); a_{2p} (p) present as smooth mic; a_2 (a) as smooth mic; m_3 (B) present as Mc; 'as' over m_3 and a_3 very up; m_{3e} and p_4 (q_1 and q_2) present as slightly ciliated mic; li, lm and ll present as pointed ciliated mic over bothriotrichum (a_5); a_6, m_6 and p_5 as smooth mic; m_4 as slightly ciliated mic; m_5 as Mc. Abd III, mi, ml and a_2 as pointed ciliated mic over bothriotrichum (m_2); m_3 and m_4 as slightly ciliated pointed mic; 'as' before m_3; a_3 very up; p_3 below m_3 as smooth mic; lm, li, ll and a_6 as ciliated pointed mic surrounded bothriotrichum (a_5); im and em as small ciliated mic under a_5 bothriotrichum; am_6 as ciliated pointed mic over bothriotrichum (m_5); pm_6 and p_6 as ciliated Mc with d_3 between them; 'ms' near p_5 smooth mic; m_{7a} and p_{8p} as ciliated mes; m_7, m_8, p_7 and p_8 as smooth mic. Abd IV with four median mac (C_1, $B_{4\text{-}6}$; ratio between C_1-B_4/B_4-B_6 0.79, n = 32), and 7 lateral mac (D_3, $E_{2\text{-}4}$, $F_{1\text{-}3}$); T_5 as mic, T_6 and T_7 as ciliated mes; before T_2 bothriotrichum, there are usually three pointed ciliated mic (a, m and D_1); in a 20% is present the supplementary 's' chaeta. Abd V as in Figure 15E.

Legs
Scales on legs except coxa I. Trochanteral organ V-shaped with about 13 spinelike chaetae (n = 37, between 10-17; 30 in a specimen with 2.4 mm in length). Claw with four teeth on inner edge: basal pair at 50%, an unpaired median at 65%, and one minute unpaired subapical; two lateral teeth intermedial to base and paired, and one more basal dorsal tooth. Empodium acuminate, all with pe lamella serrated, other lamellae smooth (ae, ai, pi); claw: empodium ratio = 1 : 0.70. Tibiotarsus III distally with one inner smooth chaeta 1.10 longer than empodium; tenent hairs spatulated, smooth, and 0.88 shorter than claw (Fig. 14E).

Macrochaetotaxy
Reduced formula (from Gisin 1965, 1967a, b): $R_0R_1R_2001/00/0101+3/0s$, $paBq_1q_2$, $M_1{*}M_2R{*}EL_1L_2$ (* in a 28% M_1 is duplicate with a smaller chaeta; ** 1/2 to 2/3 of M). No significant relationship between the duplication of the M_1 and the presence of the supplementary chaeta 's' over the Abd IV bothriotrichum. Furcula: manubrium and dens with scales dorsally and ventrally; manubrial plate (dorsally) with seven external (between 5 and 12, n = 36), three (exceptionally two) internal ciliate Mc, and 2 psp. Non-ringed part of dens two times the length of mucro, with subapical tooth a little smaller than the apical tooth. (Fig. 14F).

Ecology

Species widely distributed in the three mountain ranges (Fig. 1A-C), and present in the three bioclimatic zones. Only surpassed in distribution by *E. guadarramensis* Jordana & Baquero n. sp., and almost at the same time as *H. major*. From an altitudinal perspective, the average of collections per bioclimatic zone shows that the activity of *L. paralignorum* Baquero & Jordana n. sp. increases with altitude. However, this is due to the bias provided by two sampling points: 1812 specimens (SSD-22) and 3708 specimens (SSD-30), respectively, for this new species. La Loma de Pandasco (SSD-30), in the cryo-Mediterranean zone, is one of the places with the most extreme environmental conditions (Fig. 4A, B). At this site *L. paralignorum* Baquero & Jordana n. sp. represents 99% of the total collected specimens (Fig. 1E), being syntopic with other four Entomobryomorpha species (excluding *Orchesella*) (Fig. 1F; 4B) that were poorly represented.

Remarks

Lepidocyrtus paralignorum belongs to the *L. lignorum* group as the previous species. With regard to the shape of the labral papillae, it is separated from *L. peisonis* and *L. ruber* by smooth papillae, and from *L. traseri*, *L. tellecheae* and *L. uzeli* because they have a chaeta-like projection. *Lepidocyrtus barbulus* is separated from the remaining species by having the labral chaetae of row 'a' pointed instead of bifurcated, and, in addition to the chaetae, M_1, M_2 and R are duplicated or triplicated, something not found in any other species of the group. *Lepidocyrtus instratus* and *L. violaceus* have only three teeth on the inner border of the claw (the last unpaired tooth missing). *Lepidocyrtus juliae* has a particular color pattern, with four dorsal spots on Abd II and Abd IV; it also has intraocular 'q' chaeta, and four scales in the area; *Lepidocyrtus juliae* does not have the chaeta d_3 in Abd III, and does not have ml in Abd II. *Lepidocyrtus lignorum* has all chaetae over bothriotricha fan-shaped and external lamella of empodium smooth. See Table 5.

It is the most abundant species, with capture records that account for 29% of the Entomobryomorpha studied here (Fig. 1D), and 30% of the Entomobryidae (not including *Orchesella*) (Fig. 2A, B).

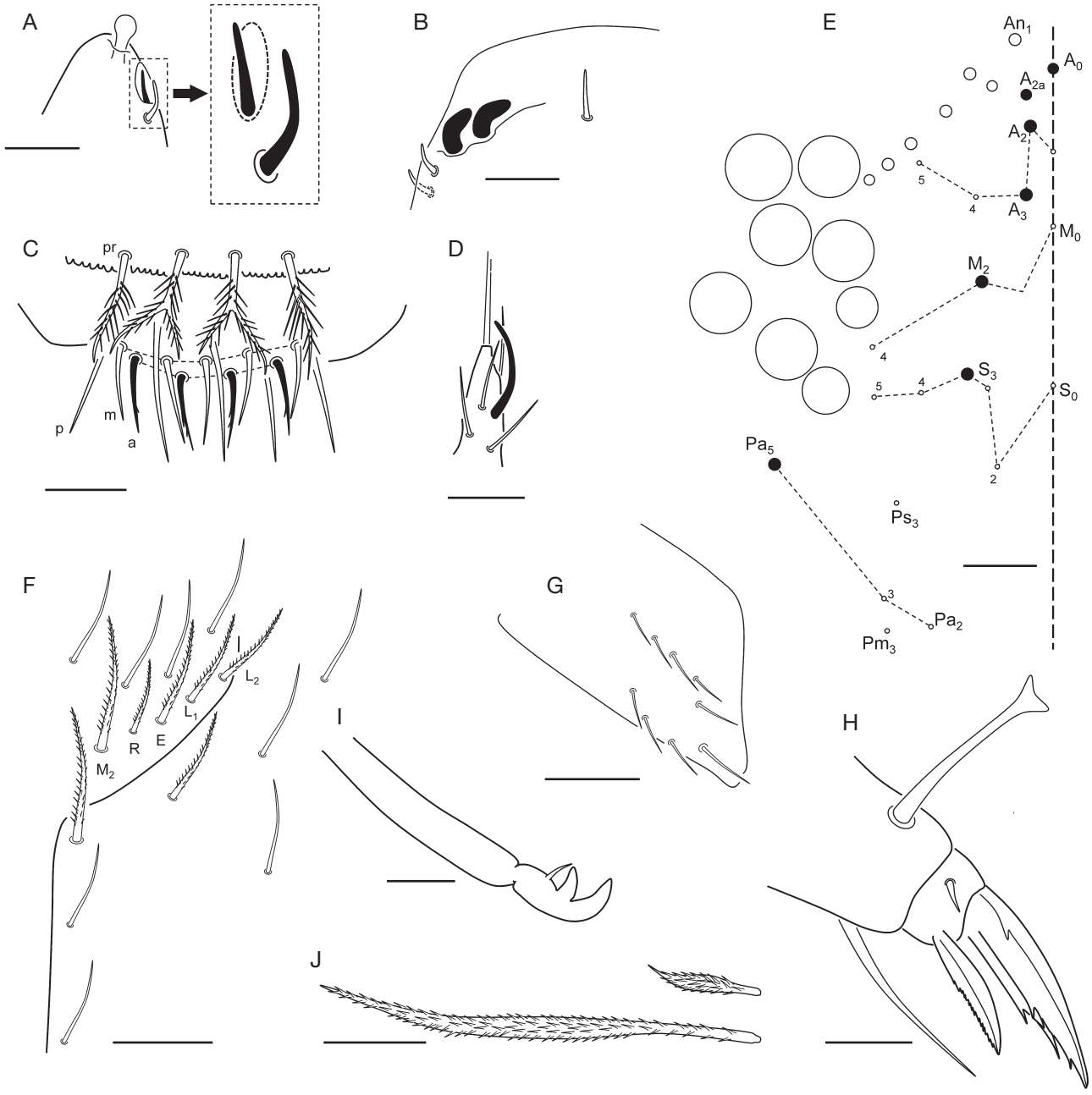

FIG. 17. — *Lepidocyrtus purgatori* Baquero & Jordana n. sp.: **A**, organite and accessory sensillum on Ant IV; **B**, sensory organ of antennal segment III; **C**, prelabral chaetae (**PR**) and labral chaetae (rows 'p', 'm' and 'a'); **D**, labial papilla 'E'; **E**, head chaetotaxy; **F**, area postlabial ; **G**, trochanteral organ; **H**, claw and empodium of leg 3; **I**, tip of dens, mucro and mucronal spine; **J**, mic of some parts of the body. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes. Scale bars: A-D, H and I, 0.01 mm; E-G and J, 0.02 mm.

Lepidocyrtus purgatori Baquero & Jordana n. sp. (Figs 8E; 17; 18; 19)

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TYPE MATERIAL. — **Holotype**. **Spain** • ♀; Madrid, Sierra de Guadarrama, Cuerda Larga and associated mountainous complex, El Purgatorio; 30T 4274 45224; 1406 m a.s.l.; 5.X.2015; Ortuño *et al.* leg.; pitfall SSD (since 18.VI.2015); MZNA SSD-14 (slide 04). **Paratypes. Spain** • 5 specimens on slide and 11 in ethyl alcohol; same data as for holotype, slide 08; Ortuño *et al.* leg.; MZNA • 5 specimens in ethyl alcohol; SSD-29; same data as for holotype; MNHN.

TYPE LOCALITY. — Spain, Madrid, Sierra de Guadarrama, Cuerda Larga and associated mountainous complex, El Purgatorio; 30T 4274 45224; 1406 m a.s.l.

ETYMOLOGY. — The specific epithet "purgatorium" (purgatory), refers to the presence of this species in a beautiful place from the Sierra de Guadarrama, known as 'Cascada de El Purgatorio'.

DIAGNOSIS. — Body pale violet-blue, ocular spot black, antennae partially bluish from distal part of Ant I to tip, dorsal head slightly pigmented, Th II-Abd III with bluish bands (darker on Abd II-III), and an oval spot with a pale interior area on lateral Abd IV. Head: A_0, A_2, A_3, M_1, S_3 and Pa_5 as Mc; A_{2a} as mes; basomedian labial

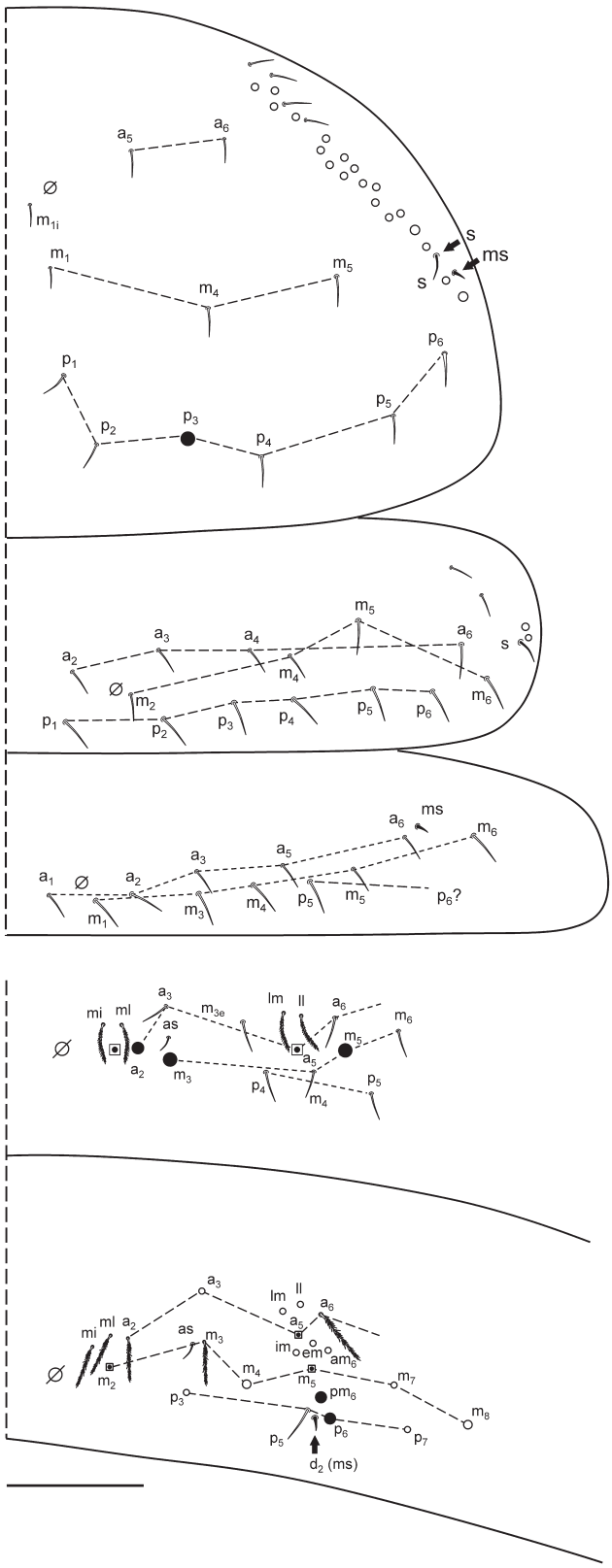

FIG. 18. — *Lepidocyrtus purgatori* Baquero & Jordana n. sp., Th II to Abd III dorsal chaetotaxy. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes; ⦸, pseudopores; ▣, bothriotricha. Scale bar: 0.05 mm.

fields chaetae smooth; posterior labial row with M_2, R*, E, L_1 and L_2 ciliated Mc (*R half to two thirds of M); one ciliated and two smooth postlabial Mc. Th II a little projected over head, i.e., not pointed completely downward, and with one Mc; Th III without Mc; Abd II without chaeta a_{2p}, a_2 and m_3 as ciliated Mc; Abd IV with four median Mc (C_1, $B_{4\text{-}6}$), three non-fan-shaped ciliated mic behind anterior bothriotrichum and bothriothrichal complex mic D_{1p} present; claw with four internal teeth: two basal and two unpaired; empodium acuminate; manubrial plate with 2 internal and 0-3 external chaetae.

DESCRIPTION

Body

Body length up to 1.25 mm (holotype), head included (mean 1.05 mm, n = 6 adults), excluding antennae. Body pale violet blue, ocular spot black, antennae partially bluish from distal part of Ant I to tip, dorsal head slightly pigmented, Th II-Abd III with bluish bands (darker on Abd II-III), and an oval spot with a pale interior area on lateral Abd V (Fig. 8E). Scales absent on antennae, present on coxa, ventral and lateral manubrium, ventral dens, thorax, and abdomen; manubrium and dens similar in length (0.27 mm, n = 5); not annulated part of dens 4-5 times the length of mucro. Microchaetae on body with a particular aspect (Fig. 17J).

Head

Antennal head ratio 2.40 (n = 5). Ant IV with simple apical bulb, apical organite not capitate and accessory sensilla as in Figure 17A; Ant III sense organ with two curved and expanded sensilla (Fig. 17B) three spiny guard sensilla, one of them blunt. Four prelabral chaetae, lateral ciliated and central bifurcated and ciliated; labrum with three rows, 'a' row with four apically bifurcated chaetae, 'm' and 'p' with five smooth chaetae (Fig. 17C). Four labral papillae not visible or absent. Maxillary palp bifurcate with three smooth appendages. Labial papilla (l.p.) E as in Figure 17D with finger-shaped process reaching toward base of apical appendage. Labial row with M_2, R*, E, L_1 and L_2 ciliated Mc (R half to two thirds of M). Postlabial chaetotaxy with one ciliated and two smooth central Mc along the groove (Fig. 17F). Head dorsal chaetotaxy with four antennal (An) ciliated Mc. A_0, A_2, A_3, M_2, S_3 and Pa_5 as Mc; R_{1s} (A_{2a}) as mes; 4-5 Mc on series An (Fig. 17E); interocular chaetotaxy not seen.

Thorax chaetotaxy (Fig. 18)

Th II with one Mc (p_3), with 's' and 'ms' in posterolateral position at level of m row; a_5, a_6, m_1, m_4-m_5, p_1-p_3 (Mc), p_4-p_6 (p_6 more spiniform); Th III without Mc, with two mic before psp (a_2 and p_1), and a_3-a_4, m_2 (near psp), m_4-m_6, p_2-p_6, an 'al' sensilla near a mes up to m_6 (Fig. 18).

Abdomen chaetotaxy (Figs 18, 19)

Abd I with a_1 before psp; a_2-a_3, a_5-a_6 ('ms' near and external to a_6); m_2 (next to psp), m_3-m_6; p_5-p_6. Abd II, mi and ml chaetae present over bothriotrichum (m_2); a_{2p} (p) absent; a_2 (a) and m_3 (B) present as ciliated Mc; 'as' over m_3 and a_3 upside over a_2 (1.5 times the length of as); m_{3e} and p_4 (q_1 and q_2) present as smooth mic; lm and ll present as pointed ciliated

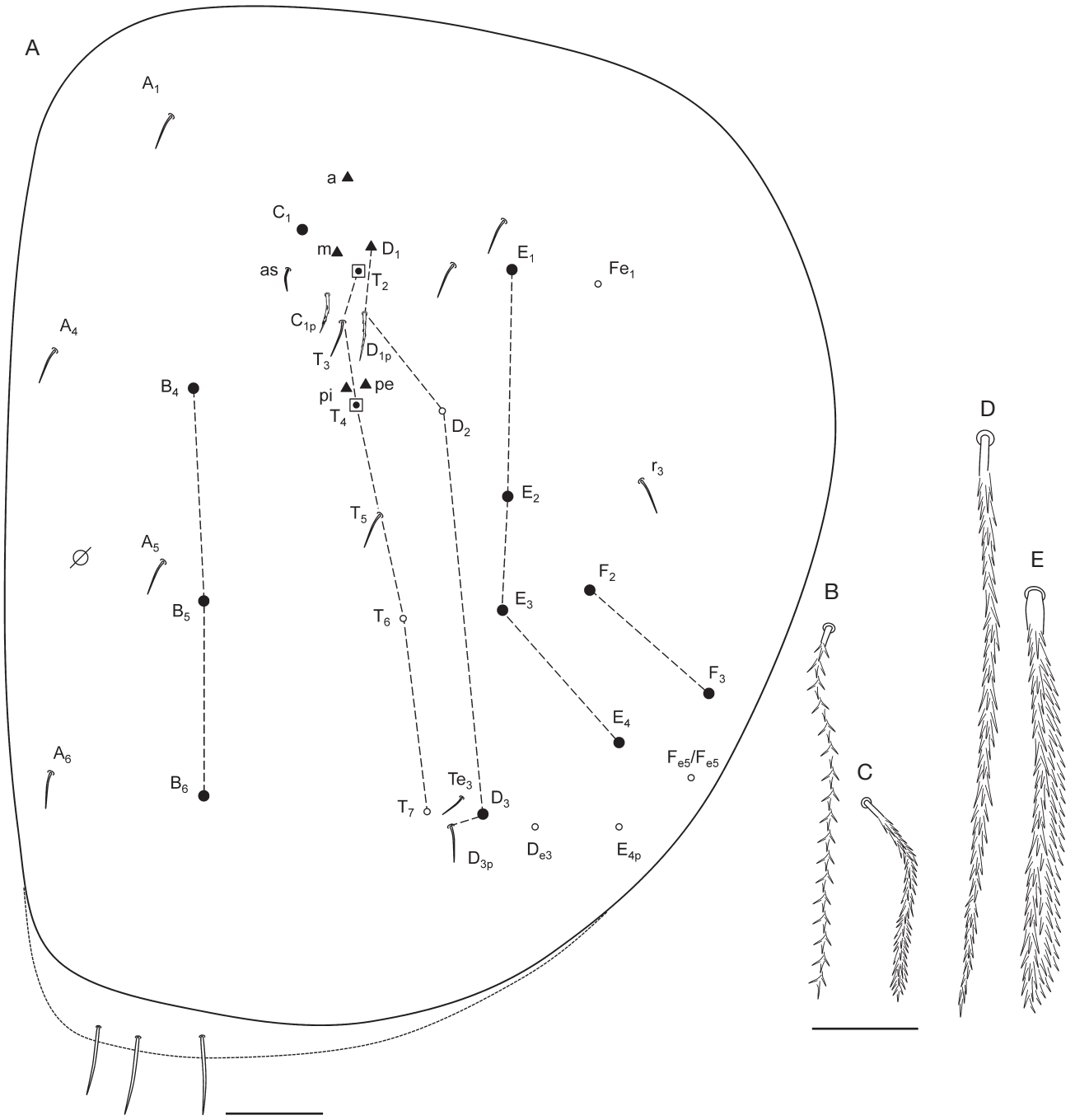

FIG. 19. — *Lepidocyrtus purgatori* Baquero & Jordana n. sp., **A**, Abd IV dorsal chaetotaxy; **B**-**E**, detail of some chaetae of Abd III and IV: **B**, bothriotrichum lateral of Abd III; **C**, T6 chaeta of Abd IV; **D**, M3 chaeta, lateral, of Abd III; **E**, B4 chaeta of Abd IV. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes; ⦸, pseudopores; ▣, bothriotricha; ▲, special chaetae. Scale bars: 0.05 mm for tergite, 0.02 mm for chaetae.

mic over bothriotrichum (a_5); a_6, m_4, m_6 and p_5 as smooth mic; m_5 as a very big ciliated Mc. Abd III, mi, ml and a_2 as pointed ciliated mic over bothriotrichum (m_2); 'as' between a_2 and m_3, next to m_3; m_3 as ciliated mic; a_3, m_3 and p_3 equidistant; p_3 below m_3, and m_4 as mes; lm, ll and a_6 apparently as ciliated mic surrounding bothriotrichum (a_5); im, em and am_6 as small ciliated mic over m_5 bothriotrichum; pm_6 and p_6 as very long and pointed ciliated Mc; d_3 absent; 'ms' near p_5 as smooth mic; m_8 as ciliated mes; m_7 and p_7 as smooth mic. Abd IV with four median mac (C_1, $B_{4\text{-}6}$; ratio between C_1-B_4/B_4-B_6 0.46, n = 5), and 7 lateral mac (D_3, $E_{1\text{-}4}$, $F_{2\text{-}3}$; E_2 missing in a ♂); T_5 as mic, T_6 and T_7 as mes; before T_2 bothriotrichum, usually, there are three pointed ciliated mic (a, m and D_1) (Fig. 19).

TABLE 6. — Group of species of *Pseudosinella* Schäffer, 1897 that share the Gisin's reduced formula (1965, 1967a, b): *P. styriaca* Neuherz & Nosek, 1975 (Austria, cave), *P. subcentralis* da Gama, 1985 (Majorca, cave), *P. valverdei* Baquero & Jordana n. sp. and *P. gonzaloi* Baquero & Jordana n. sp. Legend for the headers of the columns: **Head: EN**, eyes number; **S**, dorsal cephalic macrochaetae M1 or M2: 1, absent; 2, present; **T**, dorsal cephalic macrochaetae S_2, S_3 or S_4: 1, absent; 2, present; **P**, dorsal cephalic macrochaetae Pa_5: 1, absent; 2, present; **M1**, ventral labial chaeta: 0, absent; 1, smooth microchaeta; 2, smooth macrochaeta; 3, ciliated microchaeta or mesochaeta; 4, ciliated macrochaeta; 5, smooth macrochaeta with supplementary seta; 6, ciliated macrochaeta with supplementary chaeta; **M2**, ventral labial chaeta: same as for M1; **R**, ventral labial chaeta: 0, absent; 1, smooth microchaeta; 2, smooth macrochaeta; 3, ciliated microchaeta or mesochaeta; 4, ciliated macrochaeta; **E**, ventral labial chaeta: same as for R; **L1**, ventral labial chaeta: same as for R; **L2**, ventral labial chaeta: same as for R. **Thorax**: **T2**, posterior Th II macrochaeta number; **T3**, posterior Th III macrochaeta number. **Abdomen**: **p**, a_{2p} chaeta (Abd II): 1, absent; 2, present; **a**, a_2 chaeta shape (Abd II): 0, absent; 1, smooth microchaeta; 2, ciliated microchaeta; 3, smooth macrochaeta; 4, ciliated macrochaeta; **b**, m_3 chaeta shape (Abd II): same as for the anterior character; **q1**, m_{3e} chaeta shape (Abd II): same as for the anterior character; **q2**, p_4 chaeta shape (Abd II): same as for the anterior character; **C1**, C_1 chaeta (Abd IV): 1, absent; 2, present; **B**, medial (M or B) Abd IV dorsal macrochaetae number; **SC**, supplementary seta 's' on Abd IV: 1, absent; 2, present; **TH**, tenent hair shape: 1, acuminate; 2, clavate; 3, truncate; **CL**, claw teeth number and shape: 1, 0/ 2, only paired/ 3, 2 paired + 1 unpaired/ 4, 2 paired + 2 unpaired/ 5, 2 pairs (2 + 2) + 1 unpaired; **CP**, color pattern. Abbreviations and symbols: *****, difference for the character with *P. valverdei* Baquero & Jordana n. sp. ; **°**, difference for the character with *P. gonzaloi* Baquero & Jordana n. sp.; **D1**, total number of differences between the species and *P. valverdei* Baquero & Jordana n. sp.; **D2**, total number of differences between the species and *P. gonzaloi* Baquero & Jordana n. sp.; **U**, unknown.

species	EN	S	T	P	M1	M2	R	E	L1	L2	T2	T3	p	a	b	q1	q2	C1	B	s	TH	CL	CP	D1	D2
P. styriaca	0*°	1	1	U	U	U	U	U	U	U	3*°	2*°	U	U	U	U	U	2	2	U	1*°	3*°	white*°	6	6
P. subcentralis	0*°	1	1	U	2/4	2°	1*°	2°	2°	4*	3*°	1*°	2	4	4	1	1	2	2	2	1*°	2	white*°	7	9
P. valverdei Baquero & Jordana n. sp.	5°	1	1	1	4	2°	3	2°	2°	2°	0	0	2	4	4	1	1	2	2	2	2	4	uniform blue	–	5
P. gonzaloi Baquero & Jordana n. sp.	6*	1	1	1	4	4*	3	4*	4*	4*	0	0	2	4	4	1	1	2	2	2	2	4	uniform blue	5	–

Legs

Scales only on coxae, not on rest of appendage. Trochanteral organ V-shaped with about 7 spine-like chaetae (n = 5) (Fig. 17G). Claw with four teeth on inner edge: basal pair at 50%, a unpaired median at 65% (highly developed), and one minute unpaired subapical; two big lateral teeth intermedial to base and paired, and dorsal at level of lateral. Empodium acuminate, 0.66 times the length of claw, with pe lamella serrated and other lamellae smooth (ae, ai, pi). Tibiotarsus III distally with one inner smooth chaeta reaching the tip of empodium and same size than claw; tenent hair spatulated, smooth, similar in size than claw (Fig. 17H).

Furcula

Manubrium with scales dorsally and laterally; dens with scales only dorsally; manubrium and dens similar in length; manubrial plate (dorsally) with between 1-2 (n = 3) internal chaetae, 0-3 external ciliate Mc, and 2 psp. Non-ringed area of dens 4-5 times the length of mucro (0.015 mm) (Fig. 17I).

Macrochaetotaxy

Reduced formula (from Gisin 1965, 1967a, b): $R_0R_1R_2111/10/0201+3/0$, ABq_1q_2, $M_2R^*EL_1L_2$ (* ½ to 2/3 of M).

ECOLOGY

Species only found in the MSS of the site of El Purgatorio (Fig. 1A, C). The sampling point (SSD-14) is at the lower limit of the supra-Mediterranean bioclimatic zone and is located in the 'Garganta del Arroyo Aguilón' near large rocky walls (Fig. 4C, D). In these escarpments, the pine forest (*Pinus sylvestris*) loses distribution and gives way to *Quercus pyrenaica*, *Acer monspessulanus*, *Sorbus aucuparia* and *Rhamnus frangula*. *Lepidocyrtus purgatori* Baquero & Jordana n. sp. is syntopic with five other species (Figs 1F; 4D), three of which outnumber its activity (*E. guadarramensis* Jordana & Baquero n. sp., 180 specimens; *H. major*, 93 specimens; and *L. tellecheae*, 183 specimens).

REMARKS

This species does not share the reduced formula of Gisin (1965, 1967a, b) with any other species (R111/10/0201 + 3/0, ABq_1q_2). The closest species belong to the *L. lusitanicus* group with a characteristic three Mc on Abd II, but are different in many other characters: prelabral chaetae, absence of labral papillae, length of the antennae and, in the case of *L lusitanicus*, the color pattern.

Lepidocyrtus purgatori Baquero & Jordana n. sp. is, of all the newly described species of Entomobryomorpha, the one with the lowest abundance, with only 22 specimens collected (Figs 1D; 2F).

Lepidocyrtus tellecheae Arbea & Jordana, 1990

Lepidocyrtus tellecheae Arbea & Jordana, 1990: 28.

MATERIAL EXAMINED. — **Spain** • 3 specimens; SSD-3, slide 11; Ortuño *et al.* leg.; MZNA • 3 specimens on slide and 180 in ethyl alcohol SSD-14, slide 06; same data; MZNA • 2 specimens on slide and 63 in ethyl alcohol; SSD-15, slide 08; same data; MZNA • 2 specimens on slide and 63 in ethyl alcohol; SSD-19, slide 04; same data; MZNA• 4 specimens on slide and 27 in ethyl alcohol; SSD-26, slide 08; same data; MZNA.

REMARKS

Present in several localities in the north of Navarra (Spain), where it was originally described (Arbea & Jordana 1990). It has been subsequently cited in Barcelona (Mateos *et al.* 2018).

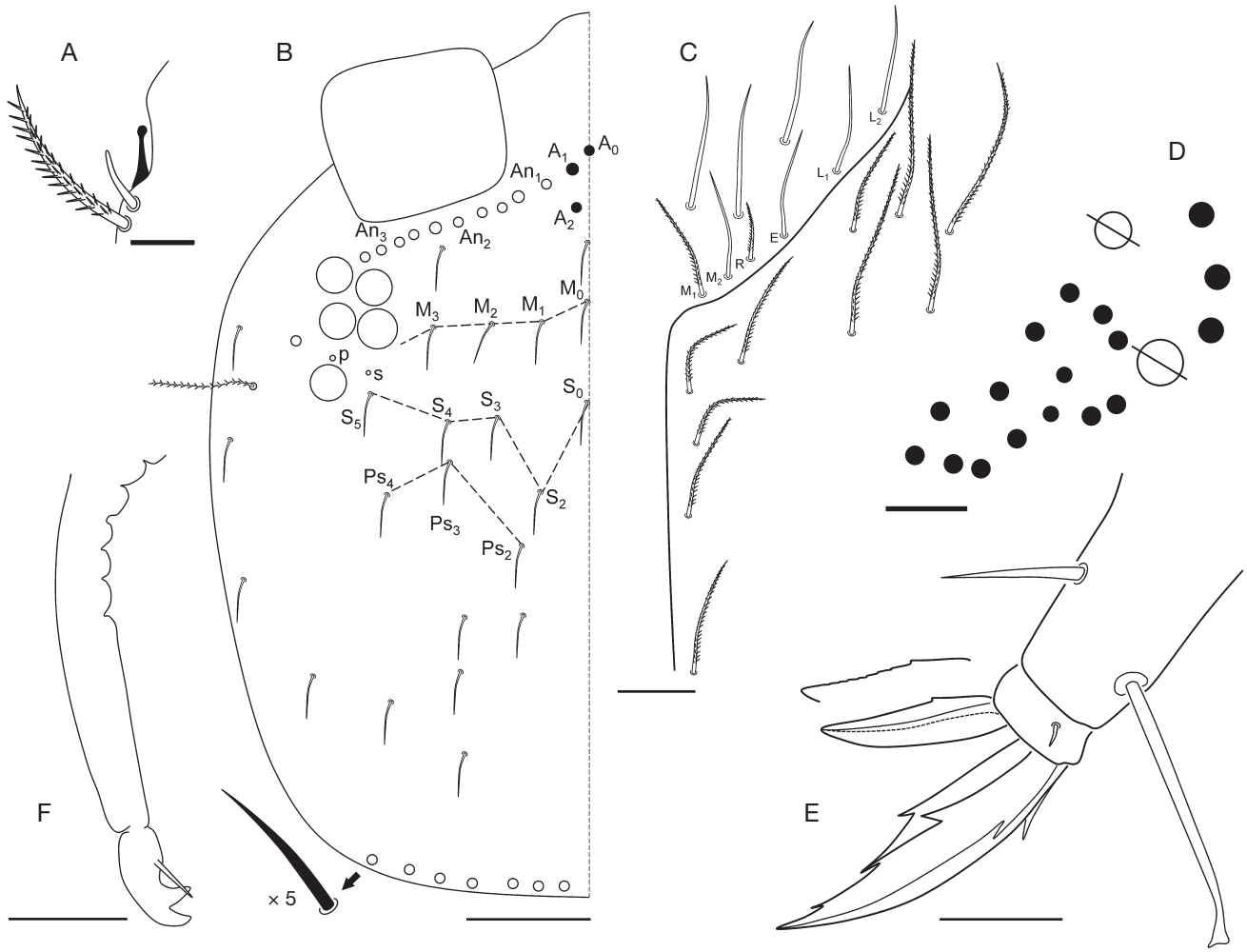

FIG. 20. — *Pseudosinella valverdei* Baquero & Jordana n. sp.: **A**, organite and accessory sensillum on Ant IV; **B**, head chaetotaxy; **C**, hind part of labium and post-labial area ; **D**, manubrial plate chaetae and pseudopores; **E**, claw and empodium of leg 3; **F**, tip of dens, mucro and mucronal spine. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes or small/doubtful Mc; ⦸, pseudopores. Scale bars: A, D, 0.01 mm; C, E, F, 0.02 mm; B, 0.05 mm.

Genus *Pseudosinella* Schäffer, 1897

Pseudosinella valverdei Baquero & Jordana n. sp.
(Figs 8G; 20; 21; 22; Table 6)

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TYPE MATERIAL. — **Holotype. Spain** • ♀; Madrid, Sierra de Guadarrama, Montes Carpetanos, Hoya de la Laguna Grande (east); 30T 4191 45213; 2049 m a.s.l.; 5.X.2015; Ortuño *et al.* leg.; pitfall SSD (since 3.VI.2015); MZNA SSD-10 (slide 06).
Paratypes. Spain • 10 specimens on slide and 15 in ethyl alcohol; same data as for holotype, slides 06 and 07; Ortuño *et al.* leg.; MZNA • 5 specimens on slide and 40 in ethyl alcohol; SSD-6, slides 03 and 11; same data; MZNA • 5 specimens in ethyl alcohol; SSD-6; same data; MNHN.

TYPE LOCALITY. — Spain, Madrid, Sierra de Guadarrama, Montes Carpetanos, Hoya de la Laguna Grande (east); 30T 4191 45213; 2049 m a.s.l.

ETYMOLOGY. — This species is dedicated to the biologist Alberto Jiménez-Valverde, member of the research team of this project and active participant in the sampling of the mesovoid shallow substratum.

ADDITIONAL MATERIAL. — **Spain** • 2 juveniles; SSD-1 (0.5 m depth), slides 05 and 06; Sierra de Guadarrama, Segovia; Ortuño *et al.* leg.; MZNA • 2 specimens; SSD-2 (0.5 m depth), slide 09; same data; MZNA • 8 specimens on slide and 393 in ethyl alcohol; SSD-2 (1 m depth), slides 05, 06 and 08; same data; MZNA • 2 juveniles on slide and 56 in ethyl alcohol; SSD-16, slide 07; same data; MZNA • 1 juvenile; SSD-18, slide 07; same data; MZNA • 1 juvenile; SSD-25, slide 06; Madrid; same data; MZNA • 10 specimens on slide and 1103 in ethyl alcohol; SSD-11, slides 05-07; same data; MZNA • 7 juveniles on slide and 589 in ethyl alcohol; SSD-21, slides 03 and 05; same data; MZNA.

DIAGNOSIS. — Body with blue pigment, including antennae and first leg segments. Head with 5 + 5 eyes (A-E); A_0, A_2 and A_3 as Mc, A_{2a} absent; basomedian labial fields chaetae smooth; posterior labial row with M_1, m_2, R*, e, l_1 and l_2 Mc (R half to two-thirds of M; sometimes M_2 and L_2 ciliated, and usually asymmetric); three plus one anterior postlabial chaetae as ciliate Mc. Th II-III without Mc; Abd II with chaeta a_{2p} present, a_3 forward from 'as' sensilla; a_2 as mes

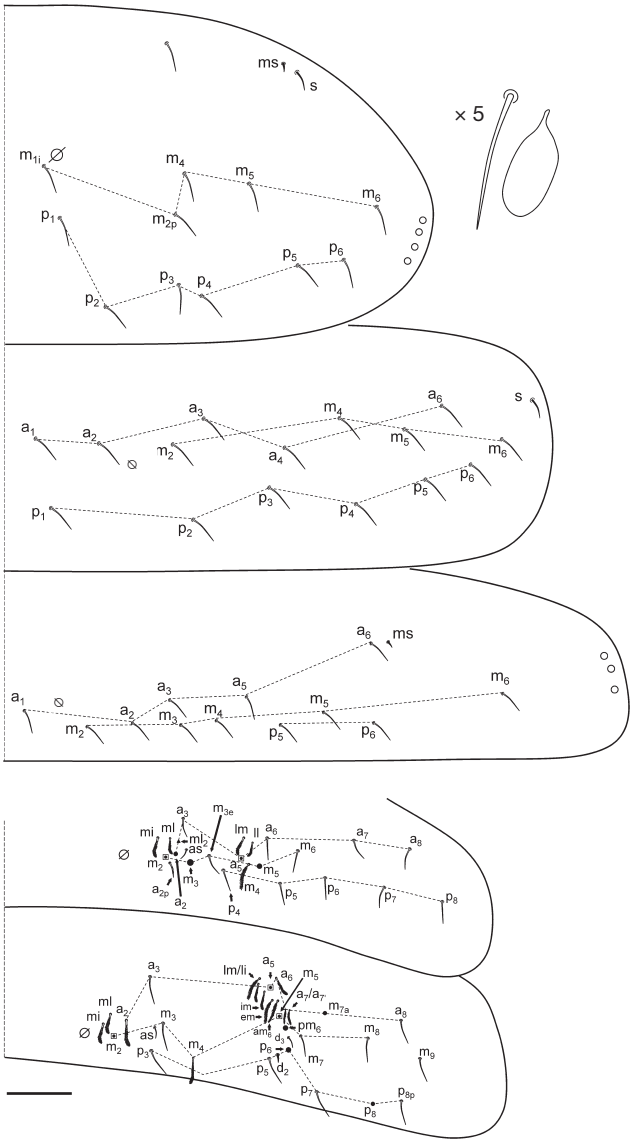

FIG. 21. — *Pseudosinella valverdei* Baquero & Jordana n. sp., Th II to Abd III dorsal macrochaetotaxy. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes or mic; ⦸, pseudopores; ▣, bothriotricha. Scale bar: 0.05 mm.

or short Mc, and m_3 as ciliated Mc; Abd IV with three median mac (C_1, B_{5-6}), four ciliated mic behind anterior bothriotrichum and bothriothrichal complex mic D_{1p} present; claw with four internal teeth: two basal and two unpaired (the last one sometimes almost imperceptible); empodium acuminate; manubrial plate with three internal and 10-13 external chaetae.

DESCRIPTION

Body

Body length up to 2.40 mm, head included (mean 2.05 mm, n = 11 adults), excluding antennae (holotype: 2.05 mm). Color blue dark, especially on Ant I-IV (except tip of IV), anterior part of the head, and posterior area of the tergites Th II-Abd VI), coxae, and basal manubrium; Th II darker in front area (Fig. 8G). Scales absent on antennae and legs, present on ventral and dorsal head, thorax and abdomen dorsally, and furcula only ventrally.

Head

Antennal head ratio 1.65 (n = 6). Ant III sense organ with two rod-shaped sensilla (individually encased in a pit), three spiny guard sensilla, s-blunt sens, ciliated and weakly ciliated chaetae; on Ant II 2-3 distal similar to Ant III sensilla; Ant IV without apical bulb, apical organite and accessory sensilla as in Figure 20A. 5 + 5 eyes (A-E). Head dorsal chaetotaxy with 8-12 antennal (An) ciliated Mc; s or t and p chaetae present (p as Mc); 4/554 smooth prelabral and labral chaetae (Fig. 20B). Labral papillae absent. Maxillary palp bifurcate with three smooth sublobal chaetae. Labial papilla (l.p.) E with finger-shaped process reaching the base of apical appendage. Labial row with M_1, m_2, R*, e, l_1 and l_2 Mc (R half to two-thirds of M; sometimes M_2 and L_2 ciliated, and usually asymmetric). Postlabial chaetotaxy with 3 + 1 ciliated central Mc along the groove (Fig. 20C).

Thorax chaetotaxy (Fig. 21)

Th II and Th III without Mc; Th II with s and ms in anterolateral position; Th III with a1 before psp, a_3, a_4, a_6, m_2, m_4, m_5 and m_6, p_2, p_3, p_4, p_5 and p_6, two lateral mes with the lateral sensilla (s) between them, and four Mc in front of the sensilla.

Abdomen chaetotaxy (Figs 21; 22)

Abd I with a_1, a_2 and p_1 before psp; a_3, a_4, a_6, m_2, m_4-m_6; p_1-p_6, a sensilla in front of m_6, and some lateral mes. Abd II, mi and ml chaetae present over bothriotrichum (m_2) (sometimes an additional mic between ml and a_2); a_{2p} (p) present as slightly ciliated mic; a_2 (A) as small Mc or mes, but not mic; m_3 (B) present as Mc; 'as' over m_3 and a_2, and a_3 a little above 'as'; m_{3e} and p_4 (q_1 and q_2) present as slightly ciliated mic; lm and ll present as slightly broadened at tip ciliated mic over bothriotrichum (a_5); m_4 as slightly ciliated chaeta; m_5 as mes. a_6 (smooth), a_{7-8}, m_6, p_5-p_8 (slightly ciliated) as mic; Abd III, mi, ml and a_2 as slightly broadened ciliated mic over bothriotrichum (m_2); 'as' before m_3 that is apparently smooth; a_3, m_4 and p_3 as slightly ciliated pointed mic; a_3 very up; im, li, lm and a_6 as ciliated pointed mic surrounding bothriotrichum (a_5); em, am_6 and a_7 as small ciliated mic under a_5 bothriotrichum (sometimes an additional mic near a_7); pm_6 and p_6 as Mc with d_3 between them (d_3 not always present, and duplicated in one specimen); 'ms' (d_2) near p_5 as smooth mic; m_{7a} and p_8 as mes; m_7-m_9, p_7 and p_9 as smooth mic. Abd IV with three median mac (C_1, B_{5-6}; ratio between C_1-B_5/B_{5-6} 1.00, n = 9), and 7 lateral mac (D_3, E_{2-4}, F_{1-3}); T_5 as mic, D_2, De_3, E_{4p}, F_{3p}, T_6 and T_7 as mes; before T_2 bothriotrichum four ciliated mic (a, m, s and D_1) as in Figure 22; pi and pe as ciliated fan-shape mic.

Legs

Legs without scales. Trochanteral organ with near 40 spine-like chaetae. Claw with four teeth on inner edge: basal pair at 40% and 50% with respect to the internal claw edge length, respectively, first unpaired median at 70%, and one minute (sometimes imperceptible) unpaired subapical at 90%; two lateral teeth at 20%, and one more basal dorsal tooth. Empodium acuminate, all with non-serrated pe lamella (but with a small tooth on first third of all legs, and a minute serration

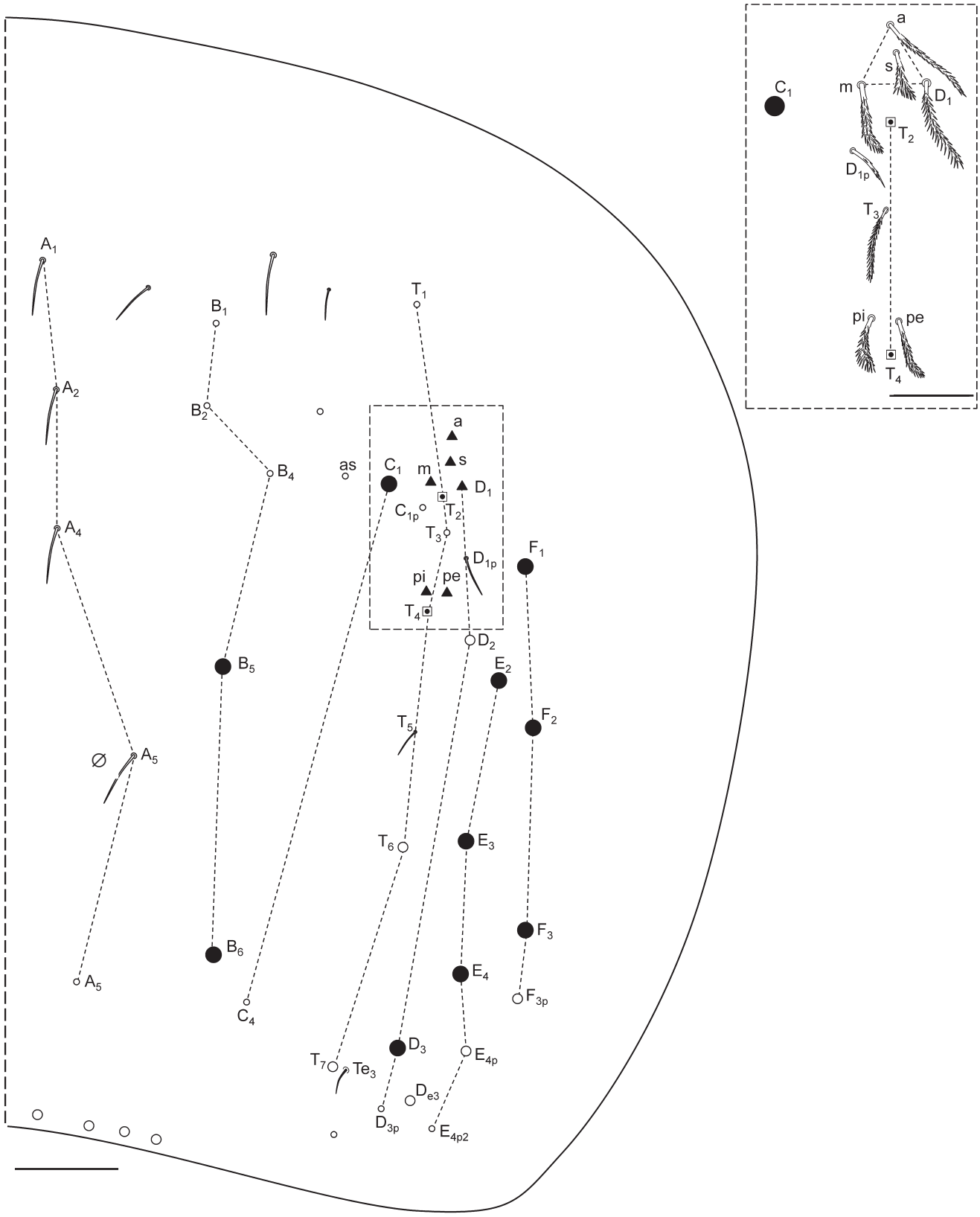

FIG. 22. — *Pseudosinella valverdei* Baquero & Jordana n. sp., Abd IV dorsal macrochaetotaxy and detail of chaetotaxy lateral to anterior mac C1. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes; ⦸, pseudopores; ▣, bothriotricha; ▲, special chaetae. Scale bars: 0.05 mm for whole tergite, 0.025 mm for detail.

on legs 1 and 2), other lamellae smooth (ae, ai, pi); claw : empodium ratio = 1 : 0.65. Tibiotarsus III distally with one inner smooth chaeta 0.50 longer than claw; tenent hairs capitate, smooth, and 0.90 shorter than claw (Fig. 20E).

Furcula

Manubrium and dens with scales only ventrally, and with the same length; manubrial plate (dorsally) with three internal, approximately thirteen external ciliated Mc, and 2 psp (Fig. 20D). Non-ringed area of dens 2-3.5 times the length of mucro, with subapical tooth a little smaller than apical tooth (Fig. 20F).

Macrochaetotaxy

Reduced formula (from Gisin 1965, 1967a, b): $R_0R_1R_2000/00/0201+2/s$, $pABq_1q_2$, $M_1m_2R^*el_1l_2$ (* ½ to ⅔ of M; sometimes M_2 and L_2 ciliated, and usually asymmetric).

ECOLOGY

Species widely distributed in MSS of Montes Carpetanos and Siete Picos-La Mujer Muerta, not detected in Cuerda Larga (Fig. 1A-C). According to the available data (presence and activity), it appears to show a preference for the subsoil of the oro-Mediterranean zone, with dominance in the forest strip. Its presence in the cryo-Mediterranean zone has not been verified and the upper level of this species is 2049 m a.s.l., which corresponds to SSD-10 installed in the Canchal Hoya de la Laguna Grande (supraforestal strip of the oro-Mediterranean zone). Its greatest activity was recorded in SSD-11 in the Canchal Cerro Ventoso (Fig. 4E, F), exceeding a thousand specimens (more than half of the Entomobryomorpha, excluding *Orchesella*, collected there (Fig. 1E). The MSS of this site, under the narrow influence of the pine forest (*Pinus sylvestris*), has revealed itself as one of the most diverse in Collembola, as it contains eight species of Entomobryomorpha (excluding *Orchesella*), with *P. valverdei* Baquero & Jordana n. sp. as the dominant species (Figs 1F; 4F).

REMARKS

The species that share the traditional formula of Gisin (1965, 1967a, b) are, in addition to *P. gonzaloi* Baquero & Jordana n. sp., *P. styriaca* Neuherz & Nosek, 1975, *P. subcentralis* Gama, 1985 and *P. valverdei* Baquero & Jordana n. sp. Table 6 shows the differences between these four species.

In terms of activity, *P. valverdei* Baquero & Jordana n. sp. is the fourth best represented species of Entomobryomorpha (excluding *Orchesella*) in the MSS, with 11% (Fig. 1D), and Entomobryidae with 12% (Fig. 2A, B).

Pseudosinella gonzaloi Baquero & Jordana n. sp.
(Figs 8H; 23; 24; 25; Table 6)

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TYPE MATERIAL. — **Holotype. Spain** • ♂; Segovia, Sierra de Guadarrama, Siete Picos-La Mujer Muerta, Umbría de la Mujer Muerta (North); 30T 4068 45192; 1622 m a.s.l.; 17.XI.2015; Ortuño *et al.* leg.; pitfall SSD (since 21.V.2015); MZNA SSD-3 (slide 01).
Paratypes. Spain • 1 ♀; same data as for holotype, slide 01; Ortuño *et al.* leg.; MZNA • 6 juveniles; SSD-2, slide 04; same data; MZNA • 1 ♀ on slide and 257 in ethyl alcohol; SSD-11, slide 05; same data; MZNA • 10 specimens in ethyl alcohol; SSD-11; same data; MNHN.

TYPE LOCALITY. — Spain, Segovia, Sierra de Guadarrama, Siete Picos-La Mujer Muerta, Umbría de la Mujer Muerta (North); 30T 4068 45192; 1622 m a.s.l.

ETYMOLOGY. — This species is dedicated to the biologist Gonzalo Pérez-Suárez, member of the research team for this project and active participant in the sampling of the mesovoid shallow substratum.

ADDITIONAL MATERIAL. — **Spain** • 4 juveniles and 600 (approximately) in ethyl alcohol; SSD-16, slide 08; Sierra de Guadarrama, Segovia; Ortuño *et al.* leg.; MZNA • 4 ♀, 1 ♂ and 19 in ethyl alcohol; SSD-25, slides 05, 06; same data; MZNA • 2 juveniles; SSD-26, slide 09; same data; MZNA.

DIAGNOSIS. — Body with blue pigment, including antennae and first leg segments, as in Figure 8H. Head with 6 + 6 eyes (A-F); Mc A_0, A_1 and A_2 present, A_{1a} present; t and p chaetae present (p as Mc); basomedian labial fields chaetae smooth; posterior labial row with M_1, M_2, R*, E, L_1 and L_2 Mc (R half to two thirds of M); two or three anterior postlabial chaetae as ciliated Mc. Th II-III without Mc; Abd II with chaeta a_{2p} present, a_3 forward from 'as' sensilla; a_2 as mes or short Mc, and m_3 as ciliated Mc; Abd IV with three median mac (C_1, $B_{5\text{-}6}$), four ciliated (some fan-shaped) mic behind anterior bothriotrichum and bothriothrichal complex mic D_{1p} present; claw with four internal teeth: two basal and two unpaired; empodium acuminate; manubrial plate with 3 internal and 6-9 external chaetae.

DESCRIPTION

Body

Body length up to 1.80 mm, head included (mean 1.55 mm, n = 8 adults), excluding antennae (holotype: 1.40 mm). Color blue dark, especially on Ant I-IV, head vertex, and posterior area of the tergites Abd I-Abd VI), coxae, dorsal and basal manubrium; Th II darker at front area. Scales absent on antennae and legs, present on ventral and dorsal head, thorax and abdomen dorsally, and furcula only ventrally.

Head

Antennal head ratio 1.60 (n = 2). Ant IV without apical bulb, apical organite and accessory sensilla present (Fig. 23A); three types of sensilla on Ant IV-II (Fig. 23B). Ant III sense organ with two rod-shaped sensilla, three spiny guard sensilla, s-blunt sens, ciliated and weakly ciliated chaetae; 6 + 6 eyes (A-F). Head dorsal chaetotaxy with 10-12 antennal (An) ciliated Mc (Fig. 23D). 4/554 prelabral and labral chaetae: prelabral ciliated, labral row 'a' ciliated only on the final part, and rows 'm' and 'p' smooth. Labral papillae absent. Maxillary palp bifurcated with three smooth sublobal chaetae. Labial papilla (l.p.) E with finger-shaped process not reaching the base of apical appendage. Labial row with M_1, M_2, R*, E, L_1 and L_2 Mc (R half to two thirds of M). Postlabial chaetotaxy with 2-3 ciliated central Mc along the groove (Fig. 23C).

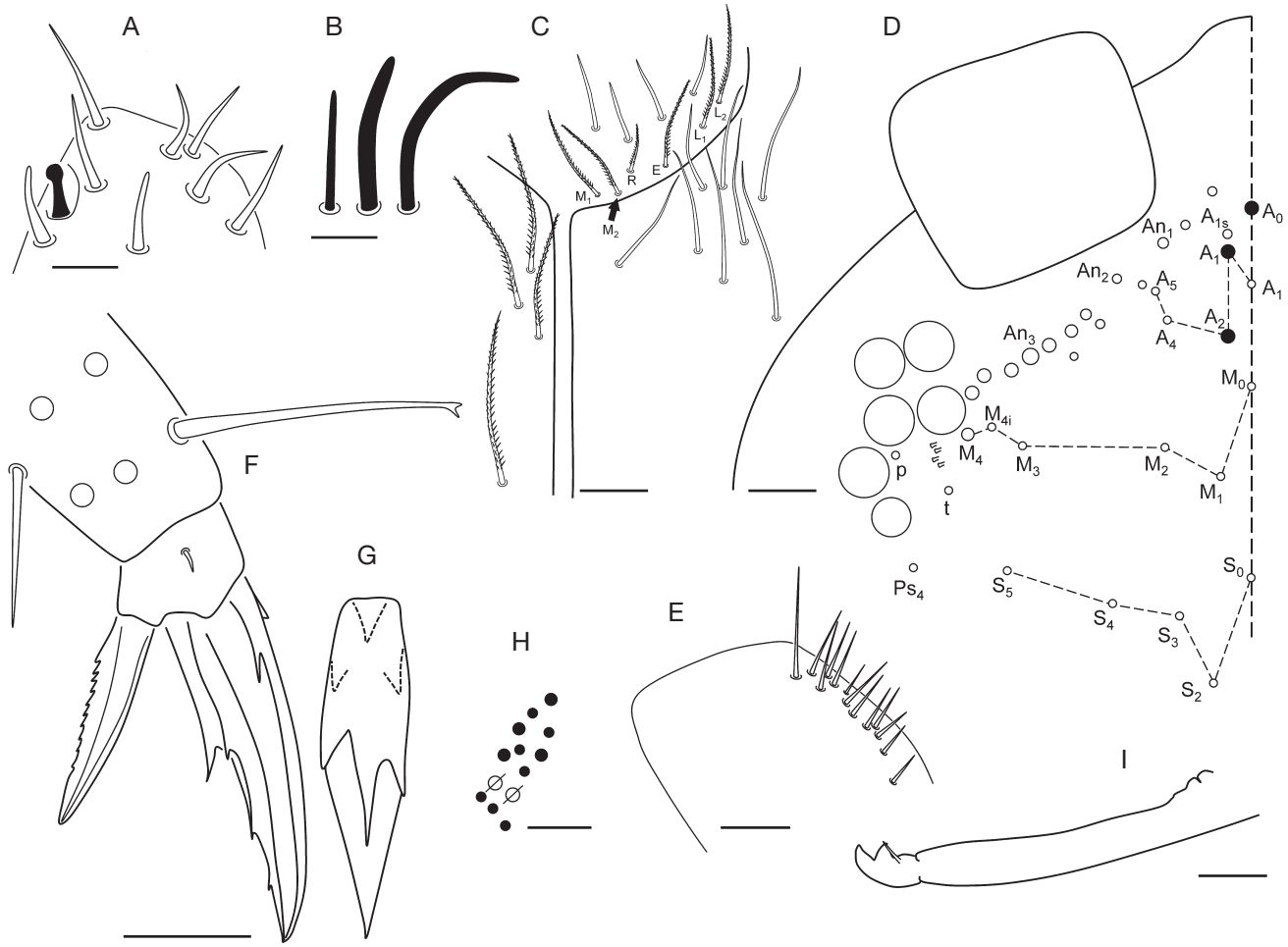

FIG. 23. — *Pseudosinella gonzaloi* Baquero & Jordana n. sp.: **A**, organite on tip of Ant IV; **B**, three types of sensilla on Ant IV; **C**, area postlabial ; **D**, head chaetotaxy; **E**, trochanteral organ; **F**, claw and empodium of leg 3; **G**, detail of the claw, ventral view; **H**, manubrial plate chaetae; **I**, tip of dens, mucro and mucronal spine. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes or small/doubtful Mc; ⦸, pseudopores. Scale bars: A, B, 0.005 mm; C, G, H, 0.02 mm; G, 0.01 mm.

Thorax chaetotaxy
Th II and Th III without Mc.

Abdomen chaetotaxy (Figs 24; 25)
Abd II, mi and ml chaetae present over bothriotrichum (m_2) (sometimes an additional mic externally to mi); a_{2p} (p) present as slightly ciliated mic; a_2 (a) as small Mc or mes, but not mic; m_3 (B) present as Mc; 'as' over m_3, and a_3 above a_2 and m_2; m_{2e} and p_4 (q_1 and q_2) present as slightly ciliated mic; lm and ll present as slightly broadened at tip ciliated mic over bothriotrichum (a_5) (additional mic interior to a_5 bothriotrichum; m_4 as slightly ciliated chaeta; m_5 as mes; a_6 (smooth), a_7-a_8, m_6, p_5-p_8 (slightly ciliated) as mic; Abd III, mi, ml and a_2 as slightly broadened ciliated mic over bothriotrichum (m_2); a_3, m_3, m_4 and p_3 as smooth mic; li, lm and a_6 as ciliated mic above bothriotrichum (a_5); im and am_6 as small ciliated mic under a_5 bothriotrichum; pm_6 and p_6 as Mc with d_3 as slightly ciliated mic between them; 'ms' (d_2) near p_5 as smooth mic; m_{7a} and p_{8p} as mes; p_8 as small ciliated mic; a_8, m_7-m_9 and p_9 as smooth mic. Abd IV with three median mac (C_1, $B_{5\text{-}6}$; ratio between C_1-B_5/$B_{5\text{-}6}$ 109/99 = 1.10), and 7 lateral mac (D_3, $E_{2\text{-}4}$, $F_{1\text{-}3}$); T_5 and D_2 as mic; De_3, E_{4p2}, F_{3p}, Fe_5, T_6 and T_7 as mes; before T_2 bothriotrichum four ciliated mic (a, m, s and D_1), some fan-shaped; pi and pe as ciliated fanshape mic.

Legs
Legs without scales. Trochanteral organ with about 15-20 spine-like chaetae (Fig. 23E). Claw with four teeth on inner edge: basal pair at 60% with respect to the internal claw edge length, respectively, first unpaired median at 75%, and one minute unpaired subapical at 85%; two lateral teeth at 20%, and one more basal dorsal tooth. Empodium acuminate, all with pe lamella serrated, other lamellae smooth (ae, ai, pi); claw : empodium ratio = 1 : 0.65. Tibiotarsus III distally with one inner smooth chaeta 0.50 longer than claw; tenent hairs capitate, smooth, and 0.90 shorter than claw (Fig. 23F).

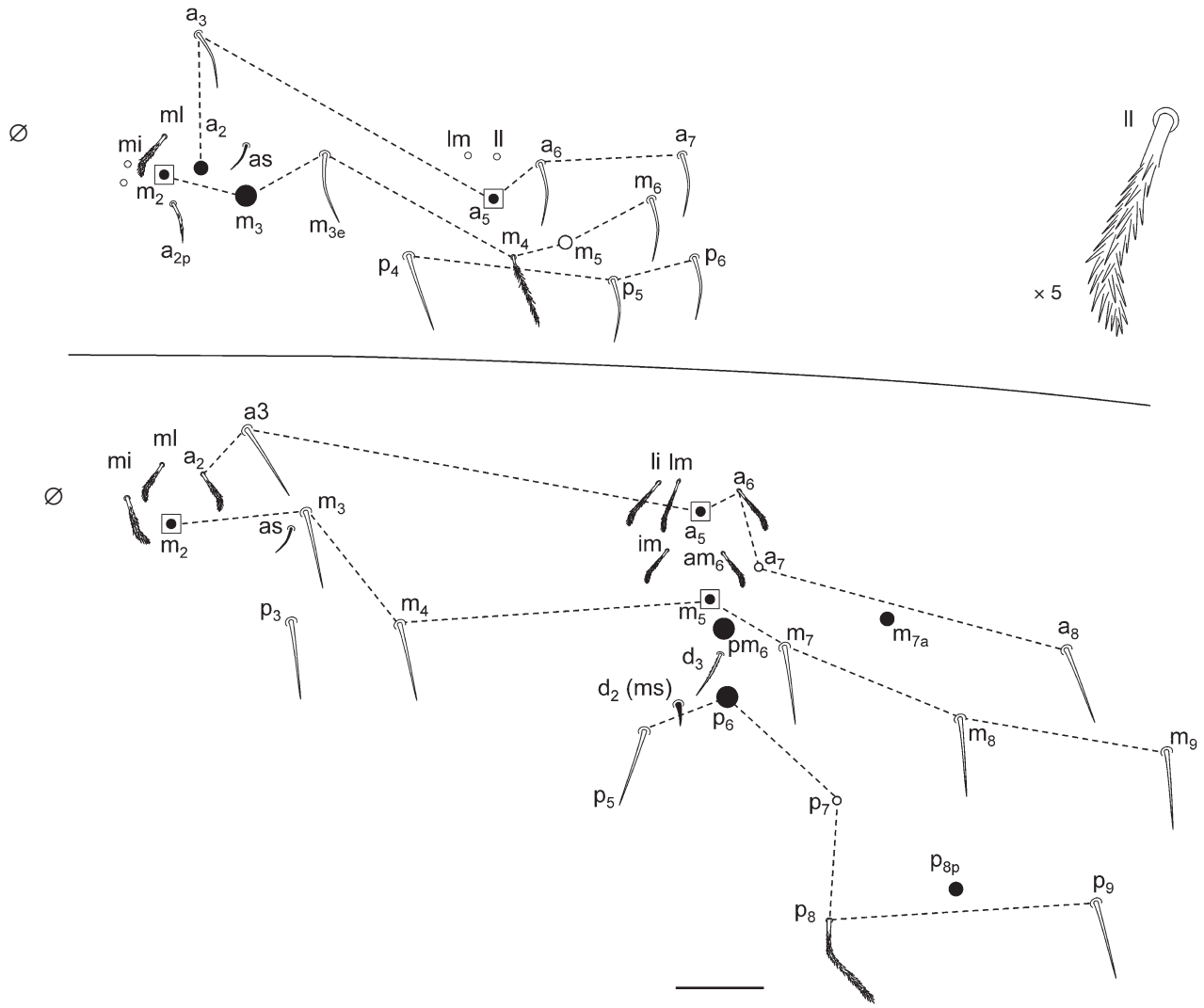

FIG. 24. — *Pseudosinella gonzaloi* Baquero & Jordana n. sp., Abd II-III dorsal macrochaetotaxy. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes or mic; ⦸, pseudopores; ▣, bothriotricha. Scale bar: 0.02 mm.

Furcula

Manubrium and dens with scales only ventrally, and with the same length; manubrial plate (dorsally) with three internal, approximately eight external ciliated Mc, and 2 psp (Fig. 23G). Non-ringed area of dens 3.4 times the length of mucro (2.5-5.33, n = 8), with subapical tooth a little smaller than apical tooth. (Fig. 23H).

Macrochaetotaxy

Reduced formula (from Gisin 1965, 1967a, b): $R_0R_1R_2000/00/0201+2/s$, $pABq_1q_2$, $M_1M_2R^*EL_1L_2$ (* ½ to ⅔ of M).

ECOLOGY

Species present in the MSS of the three mountainous ranges (Fig. 1A-C) but only verified from the supra-Mediterranean and oro-Mediterranean bioclimatic zones (in the forest strip), in the latter with records that suggest a more stable population. The largest number of specimens was collected with SSD-16, installed in the Canchal Las Revueltas-Los Horcos (Fig. 4G-H), site with strong influence of the pine forest (*Pinus sylvestris*), and where *P. gonzaloi* Baquero & Jordana n. sp. accounted for 67% of the 895 Entomobryomorpha (excluding *Orchesella*) collected there (Fig. 1E). At this site, where this species is dominant, it is syntopic with four other Entomobryomorpha species (Figs 1F; 4H).

REMARKS

The species that share the traditional formula of Gisin (1965, 1967a, b) with this species are, in addition to *P. valverdei* Baquero & Jordana n. sp., *P. styriaca* Neuherz & Nosek, 1975 and *P. subcentralis*. Table 6 shows the differences between these four species.

Of the 22 species of Entomobryomorpha (*Orchesella* excluded), *P. gonzaloi* Baquero & Jordana n. sp. is the sixth most abundant, accounting for 4% of the specimens collected (Fig. 1D).

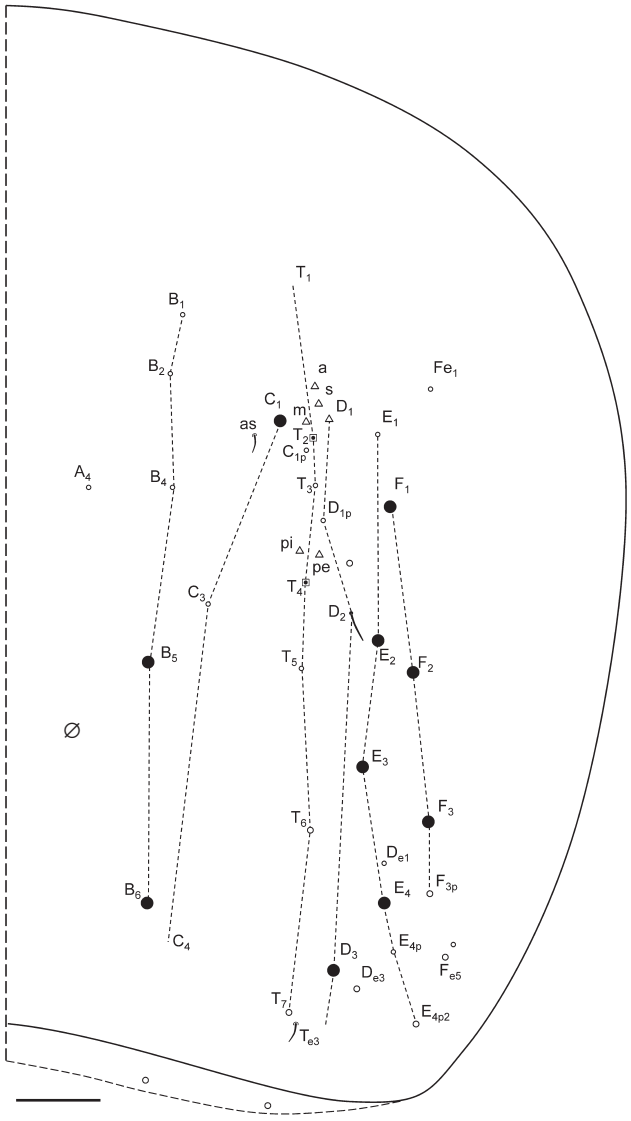

FIG. 25. — *Pseudosinella gonzaloi* Baquero & Jordana n. sp., Abd IV dorsal macrochaetotaxy. Abbreviations: see Material and methods. Symbols: ●, Mc; ○, mes or mic; ⦸, pseudopores; △, special chaetae. Scale bar: 0.05 mm.

Pseudosinella simoni Jordana & Baquero, 2007

Pseudosinella simoni Jordana & Baquero, 2007: 13.

MATERIAL EXAMINED. — **Spain** • 23 specimens on slide and 100 (approximately) in ethyl alcohol; SSD-9, slide 07; Sierra de Guadarrama, Segovia; Ortuño *et al.* leg.; MZNA • 2 specimens; SSD-11, slide 17; same data; MZNA • 1 specimen on slide and 11 in ethyl alcohol; SSD-24, slide 03; same data; MZNA.

REMARKS

Known only to date from the specimens of the type locality (Navacerrada, Sierra de Guadarrama, Spain) (Jordana & Baquero 2007). It therefore appears for the second time in the same area.

DISCUSSION

Of the eight new species described, seven are among the nine most abundant of a total of 22 species analyzed in this work (Figs 1D; 2). Four of them have been collected in thousands of specimens (*L. paralignorum* Baquero & Jordana n. sp., *E. guadarramensis* Jordana & Baquero n. sp., *E. ledesmai* Jordana & Baquero n. sp., *P. valverdei* Baquero & Jordana n. sp.), and another three collected in hundreds of specimens (*P. gonzaloi* Baquero & Jordana n. sp., *P. penalarensis* Baquero & Jordana n. sp., *L. labyrinthi* Baquero & Jordana n. sp.). The taxonomic analysis of the captures recorded in the different SSDs reveals that five new species are among the nine most widespread species (Fig. 1B, C). Therefore, if we combine activity and distribution, the result may be surprising, as new species are not rare in the prospected territory. This diversity pattern has already been observed with the new species of *Orchesella* collected in the MSS of the Sierra de Guadarrama (Baquero *et al.* 2017). Moreover, the Sierra de Guadarrama is a mountainous area that has long been studied by eminent collembologists (for example, F. Bonet, D. Selga, W. Steiner, J. C. Simon and M. J. Luciáñez) (Luciáñez & Simón 1989). Regarding *Orchesella,* Baquero *et al.* (2017) concluded "that this environment has its own assemblage of characteristic species". All the data indicate that the MSS in the Sierra de Guadarrama contains a wide range of species (of various genera) of Collembola, which are specific or nearly specific to these singular habitats.

Predatory species, particularly of Carabidae, have been found with Collembola regularly and abundantly. Four species stand out for their constancy, activity and distribution in the MSS of the Sierra de Guadarrama (Ortuño *et al.* 2019): *Leistus* (*Leistus*) *constrictus* Schaufuss, 1862, *Nebria* (*Nebria*) *vuillefroyi* Chaudoir, 1866, *Trechus* (*Trechus*) *schaufussi pandellei* Putzeys, 1870, and *Laemostenus* (*Eucryptotrichus*) *pinicola* (Graells, 1851). In particular, specialization in hunting both the imago and larva of Collembola has been recognized in *L.* (*L.*) *constrictus*, as well as in other species of the genus. The presence of this species in the MSS, where its larvae are particularly abundant (Ortuño *et al.* 2019), should be taken into account as a regulator of the Collembola populations in these underground spaces.

The results of this study indicate that the MSS is remarkably heterogeneous in terms of the activity, richness and composition of Entomobryomorpha species (Fig. 1C, E, F). The same is likely to be true of other MSS on the Iberian Peninsula. In the future, new studies to characterize this type of Collembola communities will require the development of extensive sampling protocols.

Acknowledgements

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stratum in enclaves of high Mountain (Sierra de Guadarrama National Park)], conceded by the Autonomous Organism of National Parks of Spain. Ref.(1143/2014). We would like to express our gratitude to the other members of the research team who were responsible for developing this project: Gonzalo Pérez-Suárez, Alberto Jiménez-Valverde, Alberto Sendra, Pablo Barranco, Alberto Tinaut, Luis Subías and Juan José Herrero-Borgoñón. Finally, the field work could not have been completed without the valuable collaboration of the authorities responsible for the national park as well as other workers (biologists, forestry agents and staff of the Oficina de Atención a la Población Local – Sector Lozoya – and the Centro de Visitantes – Peñalara). In particular, we extend our thanks to Patricia Riquelme, Pablo Sanjuanbenito, Juan A. Vielva, Javier Donés, Marisol Redondo, Ignacio Granados, Ángel Rubio, César Martín, José Carrillo, Miguel Ángel Palomar, Ángel Velasco, Germán Mato, Manuel Criado, Enrique Calvo, Federico Madejón, Aurora de la Rosa and Montserrat Sanz. We thank the reviewers (Ľubomír Kováč, Eduardo Mateos and an anonymous reviewer) for their careful reading of our manuscript and their many insightful comments and suggestions, which have allowed us to produce a more robust manuscript.

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