

# A new genus and species of larval mite (Acari: Prostigmata: Microtrombidiidae) parasitising Orthoptera (Tettigoniidae) from the Sierra Nevada, Spain

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**Abstract** *Nevada capileirarum* n. g., n. sp. (Acari: Microtrombidiidae: Microtrombidiinae) is described from ectoparasitic larvae parasitising two endemic species of Orthoptera (Tettigoniidae), *Baetica ustulata* (Rambur) and *Pycnogaster inermis* (Rambur) from the Sierra Nevada mountain range, Granada, Spain. A key to the larvae of microtrombidiine genera with three dorsal scuta and a coxal setal formula of 2-1-1 is presented.

## Introduction

Twenty-one larvae were collected parasitising two different species of Orthoptera (Tettigoniidae) during two different field trips separated in both time and location but within the same high mountain range in the south of Spain (Sierra Nevada). The two orthopteran hosts are endemic species; *Baetica ustulata* (Rambur) is endemic to the Sierra Nevada, and *Pycnogaster inermis* (Rambur) is endemic to the Sierra Nevada and the neighbouring mountains, the “Sierra de los Filabres” and “Sierra de Baza”.

All of the larvae collected belong to a single species of the family Microtrombidiidae Thor, 1935 (Acari: Prostigmata). This family is distributed worldwide and currently hosts 46 described larval genera (Sedghi et al., 2010). These parasites belong to a new genus within the subfamily Microtrombidiinae among a group of genera bearing three dorsal scuta and a coxal setal formula of 2-1-1. In the present work we describe, illustrate and discuss *Nevada capileirarum* n. g., n. sp. A key to the genera of this group worldwide is presented.

## Materials and methods

Orthopterans were caught by hand and, after removing their parasites using forceps, they were immediately released. Measurements and illustrations were made, after clearing the specimens in 50% lactic acid and mounting them on slides using PVA or Hoyer medium, under a Nikon Optiphot-2 compound microscope with a drawing attachment. The terminology and abbreviations follow Makol (2007) and Sedghi et al. (2010). All the measurements are given in micrometres.

## Abbreviations

IL – length of idiosoma

IW – width of idiosoma

AW – distance between the bases of AL setae

PW – distance between the bases of PL setae

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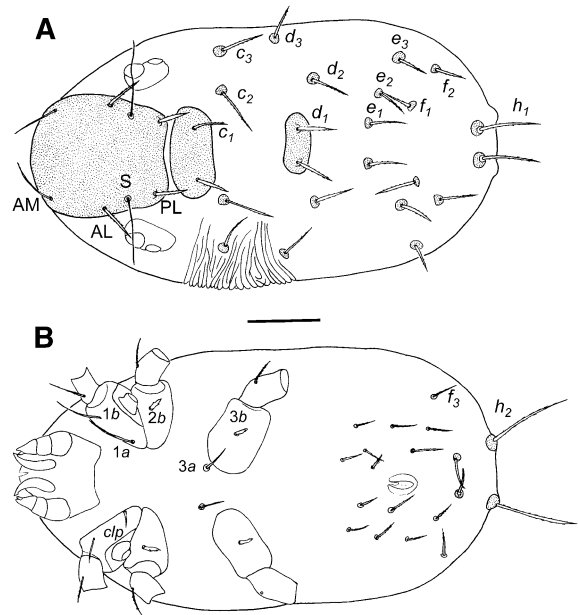
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AA – distance between the bases of AM setae  
 SB – distance between the bases of sensillary setae  
 ASB – distance between the anterior margin of scutum and the level of bases of sensillary setae  
 PSB – distance between the posterior margin of scutum and the level of bases of sensillary setae  
 SD – length of scutum  
 W – width of scutum  
 MA – distance between the bases of AM and AL setae  
 AL – anterolateral seta of scutum  
 PL – posterolateral seta of scutum  
 AM – anteromedian seta of scutum  
 S – sensillary seta  
 SL – setae on scutellum  
 SS – distance between bases of setae on scutellum  
 LSS – width of scutellum  
 HS – scutellum  
 DS – dorsal idiosomal setae (min–max)  
*h1* – medial pygosomal seta  
*h2* – lateral pygosomal seta  
*1a* – proximal seta on coxa I  
*1b* – distal seta on coxa I  
*2b–3b* – setae on coxa II & III, respectively  
*3a* – intercoxal seta  
*or* – adoral seta  
*bs* – hypostomal seta  
 I, II, III – legs I to III, respectively.  
 Ta – tarsus  
 Ti – tibia  
 Ge – genua  
 Fe – femur  
 Tr – trochanter  
 Cx – coxa  
 IP – total length of legs (leg I + leg II + leg III)

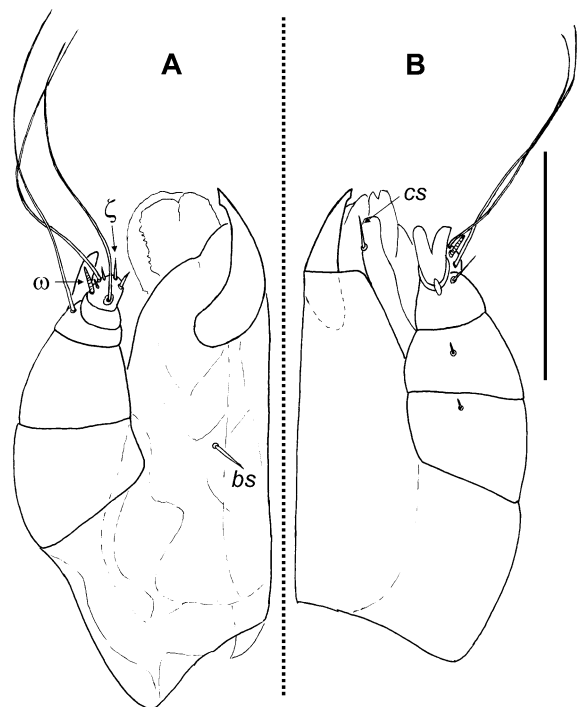
### *Nevada* n. g.

#### *Diagnosis (of the larva)* (Figs. 1–2)

Microtrombidiids with 3 dorsal scuta with punctations. Scutum with 2 pairs of scutalae (AL, PL) and 2 pairs of sensilla (AM, S) (Fig. 1A). Scutella I and II each with 2 setae. Palpal tibia with 3 nude setae. Hypostomalae normal, without projections, nude (*bs*, Fig. 2A). Coxa I with 2 normal setae, nude (*1a*, *1b*, Fig. 1B) (broken in holotype). Coxae II and III with single short, thickened, modified seta with several



**Fig. 1** *Nevada capileirarum* n. g., n. sp. (larvae), holotype. A, idiosoma, dorsal view; B, idiosoma, ventral view. Scale-bar: 100 µm



**Fig. 2** *Nevada capileirarum* n. g., n. sp. (larvae), paratype. Gnathosoma: A, dorsal view; B, ventral view. Scale-bar: 50 µm

barbs each (2*b*, 3*b*, Fig. 1*B*). All dorsal and ventral setae on small platelets with punctuations (Fig. 1).

*Type-species: Nevada capileirarum* n. sp.

## Remarks

Several characters, such as the presence of six setae on femur I, two normal setae on genua II and III, five branched setae on femur II, a microseta ( $\kappa$ ) on genu II, setulose coxalae I (1*b*), hypostomala (*bs*) not modified, and palpal genu with one seta, place these larvae in the family Microtrombidiidae and subfamily Microtrombidiinae.

Within the Microtrombidiinae, these new larvae belong to the group of microtrombidiids with three dorsal scuta. Two genera are similar to *Nevada* n. g. in having a coxal setal formula of 2-1-1 and the scutum with punctuations (not striated). These are *Cercothrombium* Methlagl, 1928, described free-living from Austria, and *Crinitrombium* Southcott, 1994, collected and described from free-living larvae in Malaysia (Methlagl, 1928; Southcott, 1994; Sedghi et al., 2010). However, *Cercothrombium* is distinctively different from *Nevada* and *Crinitrombium* by having four scutalae on the second scutum and a small ventral plate with four setae anterior to the anus (versus two scutalae on the second scutum and no ventral plate).

Sometimes microtrombidiine larvae have modified hypostomala, with projections terminally blunted and/or with digitations, and this is the case for *Crinitrombium*; on the other hand, specimens of *Nevada* have a pair of slender and nude hypostomala (*bs*) which are unmodified (Fig. 2*A*). Modifications on tarsus III are very different in these two genera; whereas in *Crinitrombium* the anterior claw is thick, long and completely retroflexed (Shiba, 1976), in *Nevada* it is thick, short and not retroflexed (Fig. 3*C*, *D*). Remarkably, in specimens of *Crinitrombium* a lophotrix is present as a broom-like seta with very long branches, as long as the tarsus segment, each with ciliations; it arises from the apical end of this segment (dumala according to Southcott, 1994), but this is not present in specimens of the new genus (Fig. 3*C*). Coxalae II and III (2*b*, 3*b*) are modified, thick and short in *Nevada* specimens (Fig. 1*B*) but thin, long and with a single ciliated seta in *Crinitrombium* specimens (Shiba, 1976; Southcott, 1994). This character is unique within the subfamily

Microtrombidiinae and it is found in the sister subfamily Eutrombidiinae (characterised by modified coxalae 1*b*, 2*b* and 3*b*). However, the absence of this character on coxalae I (1*b*) (a key character for the subfamily), together with nude hypostomala (versus modified and never setulose) and the presence of three dorsal scuta clearly place this new genus in the Microtrombidiinae.

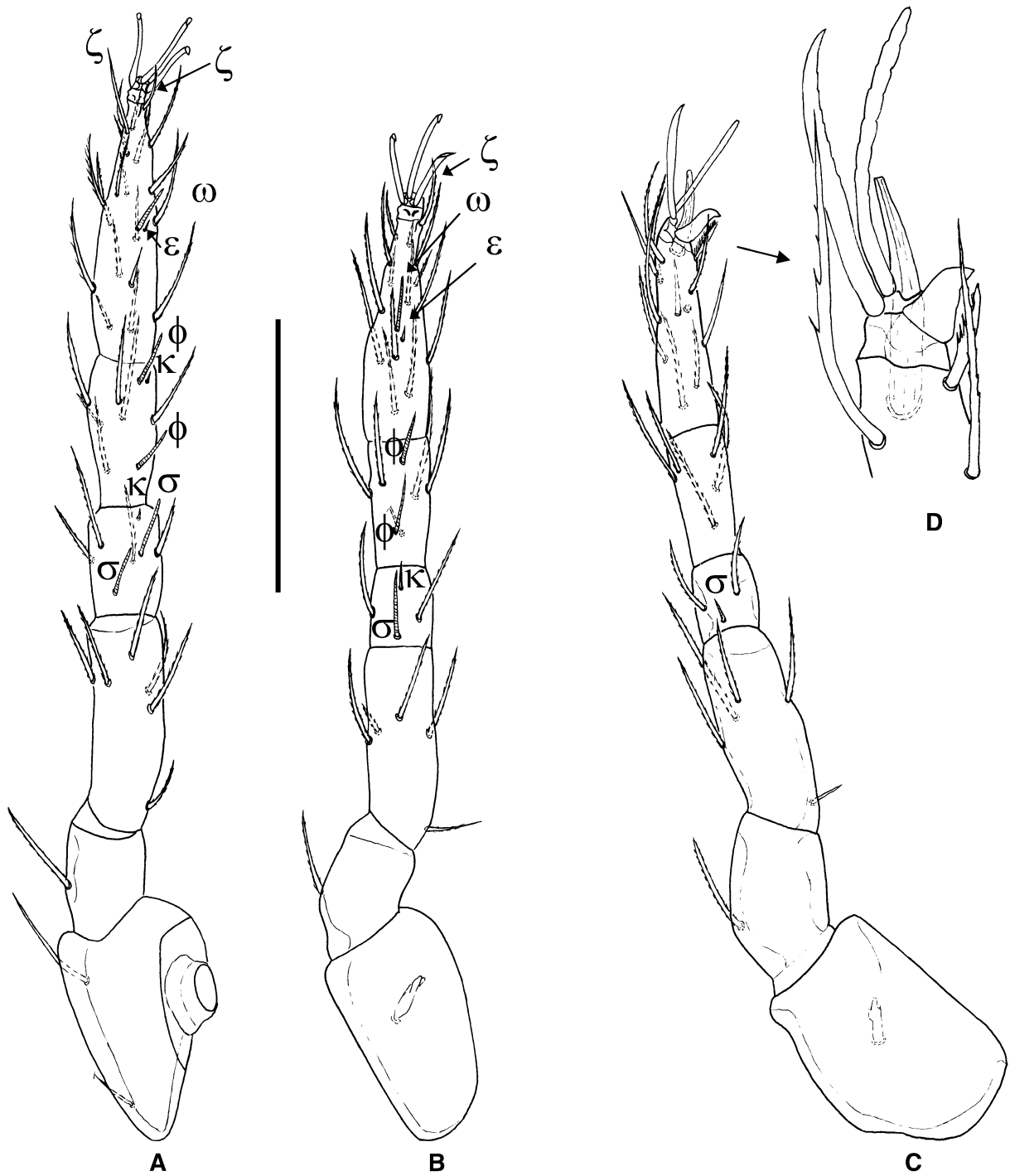
A key to the larvae of microtrombidiine genera of the world with three dorsal scuta and a coxal setal formula of 2-1-1 (modified after Southcott, 1994, and Sedghi et al., 2010)

- 1 Dorsal scutum longitudinally striated ..... 2
- Dorsal scutum porose, not longitudinally striated ..... 3
- 2 Dorsal scutum with many fine, contiguous, longitudinal striations. Tarsal claws 3,3,3 (dissimilar) ..... *Shibadania* Southcott, 1994
- Dorsal scutum with a few coarse, scattered longitudinal striations. Tarsal claws 2, 2, 2 (dissimilar) ..... *Workandella* Southcott, 1994
- 3 Scutellum I with four setae ..... *Cercothrombium* Methlagl, 1928
- Scutellum I with two setae ..... 4
- 4 Setae 2*b* and 3*b* slender, setulose ..... *Crinitrombium* Southcott, 1994
- Setae 2*b* and 3*b* modified, shortened and thickened..... *Nevada* n. g.

## *Nevada capileirarum* n. sp.

*Type-material:* Holotype, larva: Puerto de Trevélez, Sierra Nevada (Granada), Spain (type-locality). 12/ix/2004. Mayoral, J.G. leg. On *Baetica ustulata* (Rambur) (R147A) (type-host). Paratypes: 14 larvae, Puerto de Trevélez, Sierra Nevada (Granada), Spain. 12/ix/2004. Mayoral, J.G. leg. On *B. ustulata* (R147B-O); 4 larvae, Puerto de Trevélez, Sierra Nevada (Granada), Spain. 12/ix/2004. Mayoral, J.G. leg. On *B. ustulata* (R146A-D); 2 larvae, Chullo, Sierra Nevada (Almería), Spain. 20/vi/1993. Barranco, P. leg. On *Pycnogaster inermis* (Rambur) (R114A-B).

Holotype and 10 paratypes deposited in the Museo Nacional de Ciencias Naturales (MNCN), Madrid (Spain) with numbers MNCN 20.02/17170 and



**Fig. 3** *Nevada capileirarum* n. g., n. sp. (larvae), holotype. A, Leg I; B, Leg II; C, Leg III; D, detail of tarsus III. Scale-bar: A–C, 100  $\mu$ m

**Table 1** Morphometric data (in micrometres) for *Nevada capileirarum* n. g., n. sp. (larvae)

	H	P1	P2	P3	P4	P5	P6	P7	P8
<b>IL</b>	542	–	735	–	–	–	–	717	770
<b>IW</b>	297	–	–	595	–	–	–	499	499
<b>AW</b>	121	121	120	121	111	113	117	117	117
<b>PW</b>	85	85	79	81	74	77	83	83	77
<b>AA</b>	108	106	99	101	104	95	100	108	97
<b>SB</b>	97	101	95	97	90	95	95	97	95
<b>ASB</b>	121	113	104	112	108	106	113	120	119
<b>PSB</b>	45	51	–	48	50	38	45	47	50
<b>SD</b>	166	164	158	160	158	144	158	167	169
<b>W</b>	144	146	131	142	140	135	140	144	142
<b>MA</b>	63	61	59	59	59	54	–	61	63
<b>AL</b>	41	45	41	45	–	41	41	41	41
<b>PL</b>	38	36	34	36	34	36	–	43	36
<b>AM</b>	59	63	56	63	52	52	56	63	61
<b>S</b>	94	94	–	94	–	–	–	81	81
<b>SL</b>	45	50	50	45	47	–	45	50	47
<b>SS</b>	63	72	61	63	61	70	65	72	47
<b>LSS</b>	106	117	108	106	108	106	110	113	100
<b>HS</b>	47	50	41	43	41	45	41	45	43
<b>DS</b>	43–58	45–54	45–56	41–58	41–52	38–52	38–52	32–56	40–58
<b>h1</b>	68	–	68	74	–	61	63	72	79
<b>h2</b>	86	–	88	90	–	–	81	113	95
<b>or</b>	9	11	9	9	9	9	11	9	9
<b>bs</b>	12	14	–	9	–	–	16	14	14
<b>1a</b>	–	–	34	45	–	36	–	41	45
<b>1b</b>	45	54	–	–	–	–	45	–	–
<b>2b</b>	18	18	18	18	18	–	18	18	18
<b>3a</b>	32	40	–	–	–	–	–	43	36
<b>3b</b>	20	20	18	18	18	18	18	18	20
<b>CxI</b>	83	86	81	85	81	83	81	81	81
<b>TrI</b>	41	41	43	36	41	32	38	38	43
<b>FeI</b>	79	74	77	77	74	72	77	77	74
<b>GeI</b>	36	36	36	32	32	32	32	32	34
<b>TiI</b>	54	47	47	50	–	45	48	47	47
<b>TaI</b>	101	103	100	99	–	95	101	92	104
<b>CxII</b>	72	77	74	74	74	72	77	77	77
<b>TrII</b>	45	41	43	45	41	41	36	43	45
<b>FeII</b>	67	68	72	68	72	68	70	72	68
<b>GeII</b>	25	21	27	25	27	23	29	23	25
<b>TiII</b>	45	45	43	41	38	41	41	43	41
<b>TaII</b>	83	88	83	86	77	81	83	86	83
<b>Cx III</b>	90	81	90	86	81	81	83	86	86
<b>TrIII</b>	59	67	52	54	58	50	56	61	59
<b>FeIII</b>	70	72	72	72	68	63	68	74	72

Table 1 continued

	H	P1	P2	P3	P4	P5	P6	P7	P8
<b>GeIII</b>	23	29	27	23	23	23	25	23	23
<b>TiIII</b>	45	50	52	50	–	45	45	47	47
<b>TaIII</b>	72	74	68	68	–	63	68	65	68
<b>IP</b>	1090	1100	1087	1071	–	1010	1058	1067	1077
	P9	P10	P11	P12	P13	P14	P15	P16	Range
<b>IL</b>	–	–	–	1,015	1,102	1,242	805	735	542–1,242
<b>IW</b>	–	–	–	700	735	787	560	586	297–787
<b>AW</b>	117	117	110	110	119	117	117	108	108–121
<b>PW</b>	79	86	81	77	78	83	81	77	74–86
<b>AA</b>	97	108	95	92	105	102	103	95	92–108
<b>SB</b>	95	97	92	90	97	93	94	108	90–108
<b>ASB</b>	122	113	–	–	115	104	108	110	104–120
<b>PSB</b>	40	47	–	–	52	45	48	40	38–52
<b>SD</b>	162	160	–	–	167	149	156	150	144–167
<b>W</b>	135	142	137	137	144	135	137	130	130–144
<b>MA</b>	61	61	–	–	63	56	56	52	52–63
<b>AL</b>	–	45	–	–	41	–	40	–	40–45
<b>PL</b>	–	38	–	36	34	32	–	–	32–43
<b>AM</b>	–	65	–	–	63	–	61	63	52–63
<b>S</b>	87	90	–	–	85	85	94	94	72–94
<b>SL</b>	45	52	–	–	45	–	43	47	43–52
<b>SS</b>	56	65	63	59	63	65	61	59	47–72
<b>LSS</b>	106	113	104	100	113	108	104	108	100–113
<b>HS</b>	45	41	43	38	41	45	39	36	38–50
<b>DS</b>	45–52	48–59	45–54	40–54	43–54	42–50	41–56	40–54	32/48–50/59
<b>h1</b>	68	–	65	68	68	68	72	–	61–79
<b>h2</b>	100	–	79	81	79	–	87	–	79–113
<b>or</b>	–	9	–	–	7	9	7	–	7 + 11
<b>bs</b>	–	14	9	–	11	11	9	–	9 + 16
<b>1a</b>	34	45	36	32	36	38	41	–	32–45
<b>1b</b>	41	41	–	–	50	–	–	–	41–54
<b>2b</b>	18	20	18	18	18	18	14	18	18–20
<b>3a</b>	34	43	–	–	32	–	–	–	32–43
<b>3b</b>	20	20	18	18	20	18	–	18	18–20
<b>CxI</b>	79	79	83	79	86	81	79	81	79–86
<b>TrI</b>	38	43	36	36	40	38	40	36	36–43
<b>FeI</b>	74	77	68	70	77	72	77	72	68–79
<b>GeI</b>	34	34	–	–	32	32	34	32	32–36
<b>TiI</b>	47	45	45	45	45	47	50	45	45–50
<b>TaI</b>	97	95	88	88	95	90	97	92	90–104
<b>CxII</b>	72	72	81	72	77	72	74	74	72–81
<b>TrII</b>	43	43	43	36	45	45	40	36	36–45
<b>FeII</b>	74	70	65	65	70	68	65	63	63–74
<b>GeII</b>	21	20	21	23	23	23	27	23	20–27

**Table 1** continued

	P9	P10	P11	P12	P13	P14	P15	P16	Range
<b>TiII</b>	41	43	36	38	38	40	40	36	36–45
<b>TaII</b>	83	81	77	72	81	79	81	74	74–88
<b>Cx III</b>	81	86	83	86	86	87	86	86	81–90
<b>TrIII</b>	61	65	50	52	61	63	57	52	50–67
<b>FeIII</b>	70	70	65	68	70	68	68	65	65–74
<b>GeIII</b>	25	23	25	23	23	23	20	18	18–29
<b>TiIII</b>	43	45	41	45	50	47	45	43	41–52
<b>TaIII</b>	72	70	61	60	65	63	72	63	60–74
<b>IP</b>	1055	1061	968	958	1060	1038	1052	991	958–1100

–, Measurement not reliable or not possible

MNCN 20.02/171–MNCN 20.02/17180 for the holotype and paratypes, respectively. Four paratypes are deposited in the first author's collection.

**Etymology:** The generic name is after the mountain range where the hosts and parasites were collected, the Sierra Nevada, Spain. The specific name is after the village close to the type-locality, Capileira (Granada).

#### Description (Figs. 1–3)

[Based on holotype larva.] Colour in life red. Idiosoma slightly engorged, 542 long, 297 wide. Idiosoma with scutum and 2 scutella; all with punctations (Fig. 1A). Scutum rectangular with rounded corners; lateral borders slightly convex and posterior border concave. AM setae nude and located on anteriormost level of scutum. AL and PL with fine barbs. AL setae inserted at mid-level of scutum and PL at posteriormost level of scutum. S setae slender, filiform, smooth, between AL and PL. Scutella I and II wider than long. Scutellum I larger than scutellum II. Anterior border of scutellum I convex; posterior border slightly concave. Anterior border of scutellum II concave; posterior convex. Each scutellum bears 2 setae. Idiosoma bears 24 (+2) setae in 5 (c, d, e, f, h) transverse rows (6 (+2)+6+6+4+2) on small platelets with punctations. Two pair of eyes on each side of scutum on platelets; anterior eye larger than posterior one, 23 and 18 in diameter, respectively.

Venter idiosoma with pair of smooth intercoxalae (3a), without setules. Posterior to coxa III 15 nude setae (7 + 8) on small platelets, plus setal pairs  $f_3$  and  $h_2$  setae; pair  $h_2$  on small tubercle-like protrusions. Coxae I and II contiguous. Claparède's organ (*clp*) present laterally at posterior border of coxa I, between

coxa I and coxa II, oval. Coxa I with 2 slender setae, nude, 27 long (broken; up to 45 in paratypes). Coxae II and III each with single short, thickened modified seta with several barbs, 18 and 31 long, respectively (Fig. 1B).

Gnathosoma (Fig. 2A–B) without oral ring, with pair of ventral tritrostral setae (hypostomalae, *bs*), normal, without projections, 12 long, and pair of short, nude adoral setae (*cs*), 9 long. Cheliceral blades curved, with small subterminal tooth on outer edge of each blade. Palpal trochanter without seta. Palp femur and genu with short dorsal spine-like seta. Palpal tibia with 3 nude setae: spine-like seta posterior to odontus, dorsal seta 7 long, and longer (almost 10 times longer) ventral seta 69 long. Palpal claw bifid; one end thick and blunt; other also thick but with pointed edge. Palptarsus with solenidion, eupathidium and 3 short and 2 long nude setae. fPp: 0-N-N-NNN<sub>2</sub>-5Nζω.

Leg segmentation formula: 6-6-6. Tarsal claw 3-3-3 (dissimilar). Tarsi I and II with long empodium, longer than 2 lateral falciform claws. Tarsus II bears thickened seta dorsally and proximal to solenidion. Tarsus III with anterior claw shortened, thickened (smilum); median empodium long and thin, falciform, about same length as posterior claw. Scopae present, with 5 setules. Lophotrix absent. Enlarged sword-like seta inserted ventrally at distal border of tarsus III.

Leg setal formula: Leg I: Ta-1ω, 1ε, 2ζ, 18B; Ti: 2φ, 1κ, 6B; Ge-2σ 1κ, 4B; Fe-6B; Tr-1B; Cx-2 N (Fig. 3A). Leg II: Ta-1ω, 1ε, 1ζ, 14B; Ti: 2φ, 5B; Ge-1σ, 1κ, 2B; Fe-5B; Tr-1B; Cx-1B (Fig. 3B). Leg III: Ta-12B; Ti: 5B; Ge-1σ, 2B; Fe-5B; Tr-1B; Cx-1B (Fig. 3C).

IP = 394 + 337 + 359 = 1090.

Measurements of the holotype and paratypes are given in Table 1.

## Remarks

*Nevada* is monotypic. In terms of the variability of the species, we only observed that specimen R-146B has three nude and slender setae on the left coxa I; the other coxa in this specimen is normal with two setae, as in all of the other specimens.

This new genus is restricted to the high mountains of the Sierra Nevada, Spain.

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## References

- Makol, J. (2007). Generic level review and phylogeny of Trombidiidae and Podothrombiidae (Acari: Actinotrichida: Trombidoidea) of the world. *Annales Zoologici*, 57, 1–194.
- Methlagl, A. (1928). Über die Trombidiose in den österreichischen Alpenländern. *Denkschriften der Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Klasse*, 101(8), 213–250.
- Sedghi, A., Saboori, A., Akrami, M. A., & Hakimitabar, M. (2010). A new genus and species of larval mites (Acari: Prostigmata: Microtrombiidae) from Iran. *Zootaxa*, 2504, 61–68.
- Shiba, M. (1976). Taxonomic investigation on free-living Prostigmata from the Malay Peninsula. *Nature and Life in Southeast Asia*, 7, 83–229.
- Southcott, R. V. (1994). Revision of the larvae of the Microtrombidiinae (Acarina: Microtrombidiidae), with notes on life histories. *Zoologica*, 144, 1–155.