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Article

A new species of fossil oribatid mite (Acariformes, Oribatida, Trhypochthoniidae) from the Lower Cretaceous amber of San Just (Teruel Province, Spain)

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Abstract

A new fossil species, *Trhypochthonius lopezvallei* **sp. nov.** (Trhypochthoniidae), is described based on one specimen preserved in amber from the San Just outcrop (Teruel Province, Spain) believed to be Albian in age. A comparison with Recent and fossil Trhypochthoniidae is given. A new name, *Sachalinbates*, is proposed to replace *Sachalinella* (a fossil oribatid genus described from Sakhalin Paleocene amber) which is preoccupied.

Key words: Mites, Oribatida, Trhypochthoniidae, Lower Cretaceous, San Just amber, Spain

Introduction

Oribatid mites, with around 10,000 extant described species (Subías 2004) are common today in almost all terrestrial environments. However they are rare as fossils, especially in pre-Cenozoic strata, where they are usually overlooked due to their minute size. Oribatid mites have a long evolutionary history, with the oldest fossils coming from Paleozoic outcrops. Several genera are known from the Givetian (Middle Devonian) of Gilboa (Schoharie County, New York, USA) and from the Frasnian (Upper Devonian) of South Mountain (New York, USA) (Norton *et al*. 1988; Subías & Arillo 2002). Six Carboniferous genera have been described from the Brigantian of Fair Head, near Ballycastle, County Antrim, North Ireland, UK (Subías & Arillo 2002). Oribatid mites do not appear again in the fossil record until the Lower Jurassic: one species is known from the Sinemurian of Höganäs, Skåne, Sweden (Sivhed & Wallwork 1978), another species is known from the Callovian of South Cave, Yorkshire, UK (Selden *et al*. 2008) and five species are known from the Tithonian of Burea River Bank, Far East of Russia (Krivolutsky & Krassilov 1977). The earliest known fossil oribatid mites preserved in amber come from the Cretaceous: five species were described from Albian Spanish amber (Arillo & Subías 2000, 2002; Arillo *et al*. 2008, 2009, 2010) and two species are known from the Santonian amber of Taymir, Northern Russia (Bulanova-Zachvatkina 1974; Krivolutsky & Ryabinin 1976). All known pre-Cenozoic fossil oribatid mites are summarized in Table 1.

In this paper we describe a new species belonging to the family Trhypochthoniidae found in a Lower Cretaceous outcrop. The superfamily Crotonioidea has a cosmopolitan distribution, considering its seven currently recognized families (Norton & Behan-Pelletier 2009): Camisiidae, Nothridae, Crotoniidae, Nanhermanniidae, Trhypochthoniidae, Malaconothridae and Hermaniidae. Although poorly represented in the fossil record, it is one of the best known superfamilies from

Mesozoic strata; *Palaeochthonius krasilovi* Krivolutsky, 1977 and *Juracarus serratus* Krivolutsky, 1977 (Trhypochthoniidae) were described from the Jurassic and *Eocamisia sukatshevae* Bulanova-Zachvatkina, 1974 (Camisiidae) was described from the Upper Cretaceous. To date only the cohort Brachypylina was recorded in Lower Cretaceous ambers, but here we have increased our knowledge of the suborder Oribatida as the family Trhypochthoniidae belongs to the cohort Nothrina, previously only recorded from Jurassic and Upper Cretaceous outcrops.

TABLE 1. Fossil oribatid mites known from pre-Cenozoic deposits (stage in brackets).

PALAEOSOMATA (Supercohort Palaeosomatides)
Ctenacaronychus nortoni Subías & Arillo 2002 (Frasnian)
Palaeoctenacarus simmsoi Subías & Arillo 2002 (Brigantian)
Monoaphelacarus carboniferus Subías & Arillo 2002 (Brigantian)
PARHYPOSOMATA (Supercohort Parhyposomatides)
Gehypochthonimimus hibernicus Subías & Arillo 2002 (Brigantian)
ENARTHRONOTA (Supercohort Enarthronotides)
Prothochthonius gilboa Norton, 1988 (Givetian)
Devonacarus sellnicki Norton, 1988 (Givetian)
Palaeohypochthonius jerami Subías & Arillo 2002 (Brigantian)
Carbochthonius antrimensis Subías & Arillo 2002 (Brigantian)
MIXONOMATA (Supercohort Mixonomatides)
Archaeoplophora bella Subías & Arillo 2002 (Brigantian)
HOLOSOMATA (Supercohort Desmonomatides, Cohort Nothrina)
Palaeochthonius krasilovi Krivolutsky, 1977 (Tithonian)
Juracarus serratus Krivolutsky, 1977 (Tithonian)
Trhypochthonius lopezvallei Arillo *et al*., (present paper) (Albian)
Eocamisia sukatshevae Bulanova-Zachvatkina, 1974 (Santonian)
BRACHYPYLINA (Supercohort Desmonomatides, Cohort Brachypylina)
Cultroribula jurassica Krivolutsky, 1977 (Tithonian)
Hydrozetes sp. Sivhed & Wallwork, 1978 (Sinemurian)
Jureremus foveolatus Krivolutsky, 1977 (Tithonian)
Jureremus phippsi Selden *et al*., 2008 (Callovian)
Eupterotegaeus bitranslamellatus Arillo & Subías, 2002 (Albian)
Ommatocepheus nortoni Arillo *et al*., 2008 (Albian)
Strieremaeus minguezae (Arillo & Subías, 2000) (Albian)
Cretaceobodes martinezae Arillo *et al*., 2010 (Albian)
Ametroproctus valeriae Arillo *et al*., 2009 (Albian)
Rasnitsynella punctulata Krivolutsky, 1976 (Santonian)

Geological setting

The studied fossil comes from the San Just locality which is near the villages of Escucha and Utrillas (Maestrazgo Basin, Teruel Province, East Spain). This outcrop occurs in the Escucha Formation, which is conventionally dated to Albian (ca. 110 mya) and is associated with deltaic environments corresponding with the Lower Cretaceous coastline.

The stratigraphy, taphonomy, and diversity of the San Just organismal inclusions are given in Delclòs *et al.* (2007).

Material and methods

The specimen was embedded in epoxy resin to permit optimal study, as described by Corral *et al*. (1999). Camera lucida drawings were made using an Olympus U-DA drawing tube attached to an Olympus BX50 compound microscope. A digital camera OPTIKA Pro 5 attached to an Olympus BX50 microscope was used for photomicrography.

Systematic palaeontology

Family: Trhypochthoniidae Willmann, 1931
Genus: *Trhypochthonius* Berlese, 1904
Type species: *Hypochthonius tectorum* Berlese 1896

***Trhypochthonius lopezvallei* sp. nov. (Figs. 1–7)**

Derivation of name. After our colleague Mr. Rafael López del Valle, geologist and gemologist of the Álava Museum of Natural Sciences, who prepared the specimen.

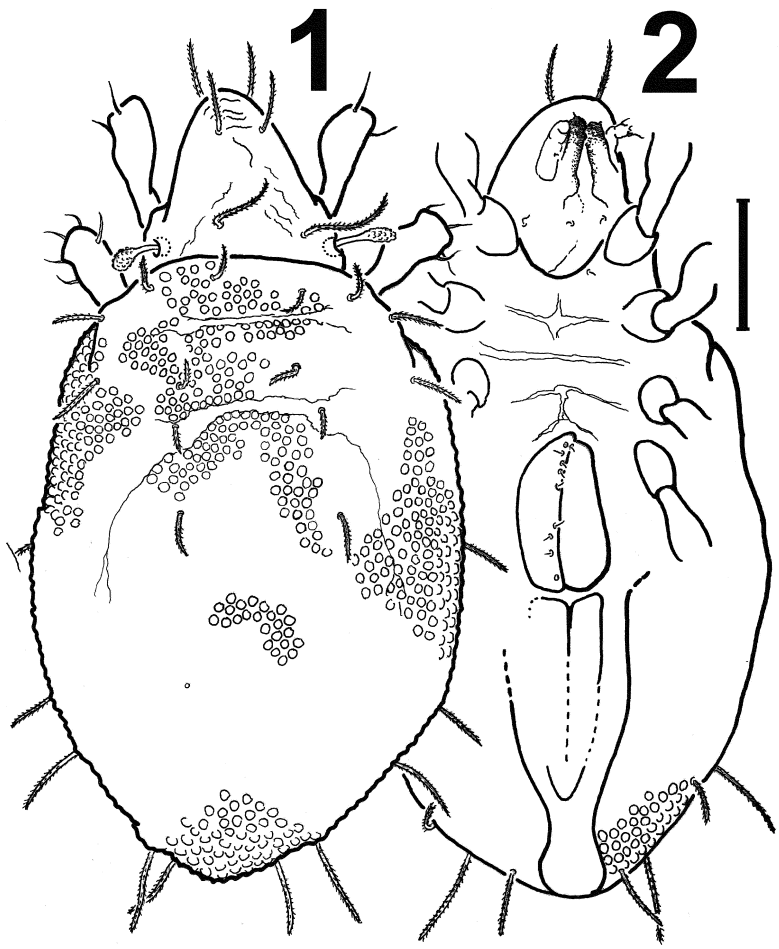

FIGURE 1–2. *Trhypochthonius lopezvallei* **sp. nov.** 1, dorsal view; 2, ventral view. Scale bar 100μm.

Holotype: CPT-4161 housed in the Fundación Conjunto Paleontológico de Teruel-Dinopolis (Teruel Province, Spain). Complete specimen present in a clear, but quite turbid piece of amber sized 7 x 5 mm embedded in an epoxy resin preparation sized 21 x 14 x 1 mm. An air bubble inside the body makes it very difficult to view chaetotaxy on the posterior part of the notogaster.

Type locality and stratigraphy: Specimen collected from the San Just outcrop, in the municipality of Utrillas, near the village of Escucha (Teruel Province, Spain). Escucha Fm. (La Orden Member), Lower Cretaceous (Lower-Middle Albian).

Description

Measurement: 600 μm long and 320 μm wide.

Integument: The body is well sclerotized, dark reddish brown.

Prodorsum (Figs. 1 & 5): Prodorsal surface without lamellae but with some irregular folds. Rostral, lamellar and interlamellar setae strong and barbed, the interlamellar pair being very long (Figs. 4 & 7). Sensillus with a short stalk, head clavate and barbed. Exobothridial setae absent.

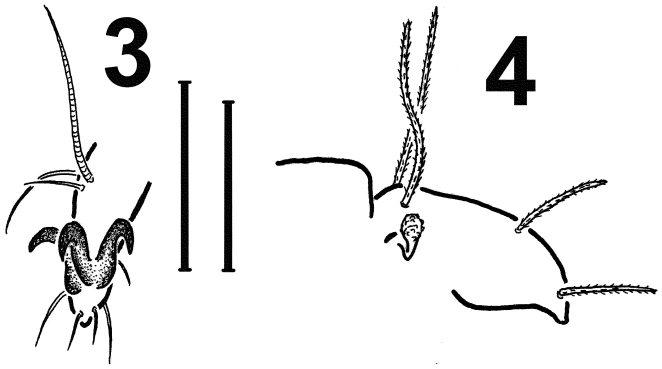

FIGURE 3–4. *Trhypochthonius lopezvallei* **sp. nov.** 3, detail of claws; 4, lateral view. Scale bar 3 50μm, 4 100μm.

Notogaster (Figs. 1 & 5): Dorsosejugal suture complete and slightly curved. All the integument is densely foveolated except two horizontal clear folds. Thirteen pairs of notogastral setae are visible; area of setae f_1 and h_1 is partially hidden by an air bubble, but one alveolus (f_1) seems to be present. Setae p_2 visible only in ventral view. Setae p_3 not visible. All the notogastral setae are strong and spinose.

Ventral side (Figs. 2 & 6): Lateral margins of notogaster extend ventrally forming a U-shaped end to the ventral plates. Only one genital plate preserved bearing 9 (or 10) setae. Epimeral region not visible.

Gnathosoma: The subcapitulum is badly distorted but a stenarthric situation is most likely.

Legs: Tridactylous tarsi (Fig. 3). Setation only partly visible.

Discussion

The new species is very closely related to *Trhypochthonius tectorum* (Berlese, 1896) and its species group due to its body size and the shape of the notogastral setae. This group was recently revised by Weigmann and Raspotnig (2009) who considered the size and shape of notogastral setae to be a good diagnostic feature to distinguish species. *Trhypochthonius lopezvallei* **sp. nov.** could

be differentiated from these Recent species by (1) setae d_1 length similar to c_2 and (2) setae p_2 larger than p_1.

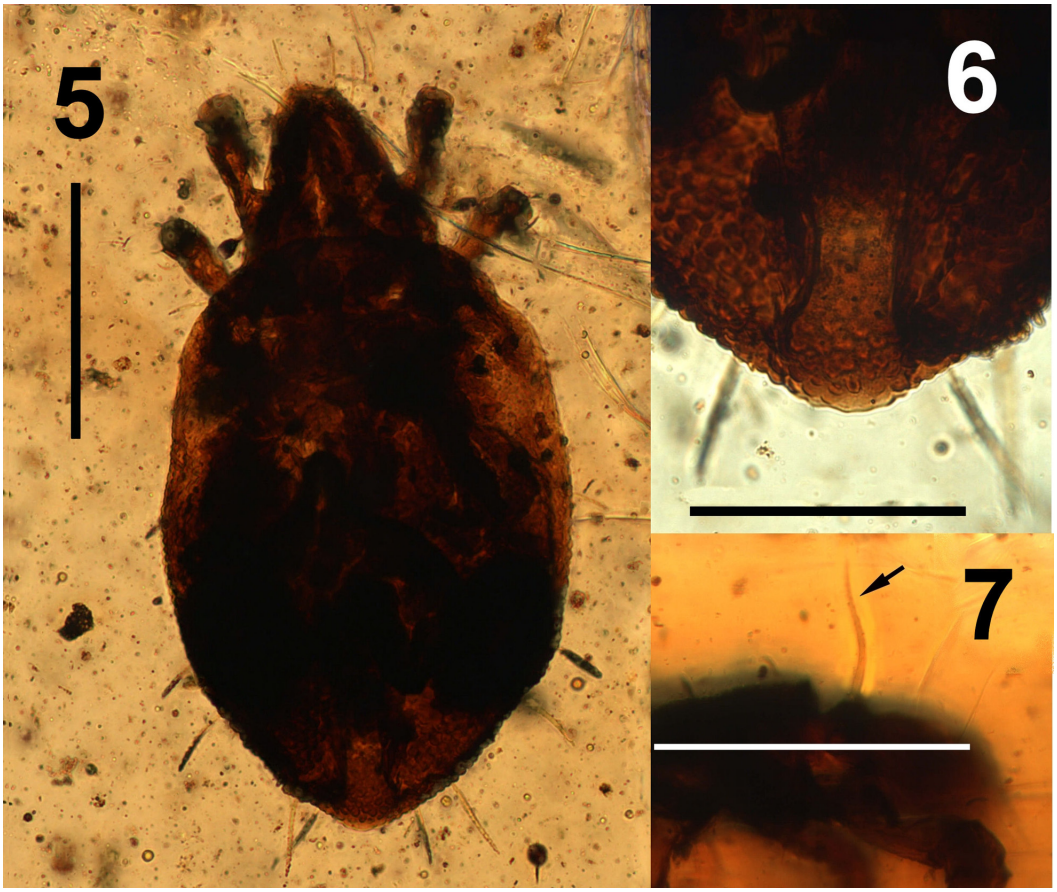

FIGURE 5–7. *Trhypochthonius lopezvallei* **sp. nov.** 5, dorsal view; 6, posterior margin of ventral plate; 7, lateral view with arrow showing interlamellar seta. Scale bar 5 & 7 200µm, 6 100µm.

Fossil Trhypochthoniidae are known from the Upper Jurassic (Tithonian) of Burea River Bank, Far East of Russia (Krivolutsky & Krasilov 1977). The Jurassic species, *Palaeochthonius krasilovi* Krivolutsky, 1977 and *Juracarus serratus* Krivolutsky, 1977 are preserved as compression fossils. They clearly belong to this family, but a comparison with younger genera is difficult. *Trhypochthonius* is more related to *J. serratus* as it has a similar body shape, long interlamellar setae and a sensillus with a clavate head. A comparison with the genital plates is not possible as they are not preserved in *Juracarus*. *Palaeochthonius krasilovi* seems to be very different as it has short interlamellar setae and a small number of genital setae.

The family appears again in the fossil record in Eocene Baltic amber, from where Sellnick (1931) described two species: *T. badiiformis* and *T. sulcatus*. Although Sellnick's collections were for a long time feared to be lost following the Second World War, it was discovered that both holotypes and type series remain in Kaliningrad, Russia (Ezhova & Kostyashova 1997). *Trhypochthonius badiiformis* was considered by Sellnick to be closely related to *T. badius* Berlese, 1905 but this Holarctic species was excluded from the genus *Trhypochthonius* and is now considered to belong to the genus *Mainothrus* Choi, 1996. On the other hand, *T. sulcatus* was considered by Sellnick to be very similar to *T. tectorum* but their sizes are very different as Sellnick gave a body length of 462

μm, much smaller than the range of *T. tectorum*, between 600–700 μm (Weigmann & Raspotnig 2009).

A further comparison with these Baltic amber species will be possible when they are redescribed in the near future. A closer relationship between Baltic specimens and our fossil could not be excluded as per the redescription of Sidorchuk and Norton (2011) of *Strieremaeus illibatus* Sellnick, 1931. This genus was found to be an older synonym of *Archaeorchestes* described from Álava amber (Arillo & Subías 2000). Another fossil Trhypochthoniidae is known from Miocene Dominican amber: *Allonothrus* sp. (Norton & Poinar 1993).

Nomenclatorial note

Sachalinella zherichini Ryabinin, 1976 is a fossil oribatid species found in Sakhalin Paleocene amber, belonging to the family Oribatulidae (Krivolutsky & Ryabinin 1976). As Dunlop *et al.* (2011) pointed out, *Sachalinella* Ryabinin, 1976 is preoccupied by a fossil Bivalvia *Sachalinella* Savitskii, 1969, a subgenus of *Yoldia* Moller, 1842. Thus we propose the name *Sachalinbates* **nom. nov.** as a substitute name for *Sachalinella* Ryabinin (with *Sachalinella zherichini* as its type species).

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