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BURNIA SPELAEA GEN. NOV., SP. NOV., THE FIRST EYELESS NEMASTOMATID FROM THE IBERIAN PENINSULA, WITH NEW RECORDS AND GENERIC REASSIGNMENT OF *NEMASTOMELLA SEXMUCRONATA* (SIMON, 1913) (OPILIONES: DYSPNOI: TROGULOIDEA)

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Abstract: The Basque region is home to the richest and most diverse troglobitic fauna of the order Opiliones in western Europe, so far represented by three *Peltonychia* spp. (Cladonychiidae), four *Ischyropsalis* spp. (Ischyropsalididae) and *Nemastomella sexmucronata* (Nemastomatidae). The new species *Burnia spelaea* **gen. nov.**, **sp. nov.** is a minute, depigmented, eyeless, long-legged nemastomatid which has been found in four caves, all of them in the Montes de Triano, a limestone massif strongly altered by the exploitation of currently depleted veins of iron. The oculate troglobitic *Nemastomella sexmucronata* (Simon, 1913) from the limestone massifs of Cantabria and western Biscay has a similar penis, other somatic similarities and a close genetic relationship that together justify its placement in the same genus, and thus is transferred to *Burnia*, as *Burnia sexmucronata* **comb. nov.**
Key words: Opiliones, Nemastomatidae, new species, cave fauna, Spain, Bizkaia, Montes de Galdames.

***Burnia spelaea* gen. nov., sp. nov., primer nemastomátido anoftalmo de la Península Ibérica, con nuevos registros y reasignación genérica de *Nemastomella sexmucronata* (Simon, 1913) (Opiliones: Dyspnoi: Troguloidea)**
Resumen: El País Vasco alberga la fauna troglobia más rica y diversa del orden Opiliones de Europa occidental, representados hasta la fecha por tres *Peltonychia* spp. (Cladonychiidae), cuatro *Ischyropsalis* spp. (Ischyropsalididae) y *Nemastomella sexmucronata* (Nemastomatidae). La especie nueva *Burnia spelaea* **gen. nov.**, **sp. nov.** es un nemastomátido diminuto, despigmentado, ciego y de patas largas que se ha encontrado en cuatro cuevas, todas ellas excavadas en los Montes de Triano, un macizo calizo fuertemente alterado por la explotación de vetas de mineral de hierro actualmente agotadas. La especie troglobia, aunque oculada, *Nemastomella sexmucronata* (Simon, 1913) de los macizos calcáreos de Cantabria y oeste de Bizkaia tiene un pene y otras características somáticas similares y una estrecha relación genética que justifican su emplazamiento en el mismo género y es por tanto transferida a *Burnia*, como *Burnia sexmucronata* **comb. nov.**
Palabras clave: Opiliones, Nematomastidae, especie nueva, fauna cavernícola, España, Bizkaia, Montes de Galdames.

Taxonomy / Taxonomía: *Burnia* **gen. nov**., *Burnia spelaea* **sp. nov.**; *Burnia sexmucronata* (Simon, 1913) **comb. nov.**

Introduction

Knowledge of the Iberian opiliofauna has been accelerated in recent times. Since the latest update of the Iberian checklist (Prieto, 2008), with 113 species after discarding spurious records, the number of Iberian species has grown to 134 taxa. Most of the growth is by description of new taxa (Schönhofer & Martens, 2008; Murienne & Giribet, 2009; Martín & Prieto, 2010; Martens, 2011; Sánchez-Cuenca & Prieto, 2014; Giribet, Merino-Sáinz & Benavides, 2017; Barrientos *et al*., 2017; Prieto & Wijnhoven, 2020; Prieto & Las Heras, 2020; Derkarabetian *et al*., 2021) or revalidation of old names (Prieto & Wijnhoven, 2017). This increase is however far from complete; Prieto (2008) recorded also a number of undescribed new taxa for the Iberian Peninsula and only a few of them have been named.

Concerning the troglobitic fauna, the Iberian Peninsula is divided into eight biospeleological districts (Bellés, 1987) and all but the Central one houses troglobitic harvestmen. Southern Iberian districts (Portuguese, Betic, Levantine and Balearic) are poor in harvestmen, with one species on each. The Basque district, after the refinement proposed by Galán (1993) to remove Bizkaia from the Cantabrian district, is the richest. It includes *Peltonychia navarica* (Simon, 1872), *P. piochardi* (Simon, 1872), *P. sarea* Roewer, 1935, *Ischyropsalis dispar* Simon, 1872, *I. magdalenae* Simon, 1881, *I. navarrensis* Roewer, 1950, *I. noltei* Dresco, 1972 and *Nemastomella sexmucronata* (Simon, 1913), the last one shared with the Cantabrian district (Prieto, 1990, 2004). Additionally, six troglobitic populations of *Ischyropsalis* from isolated massifs, showing genetic differences enough to be recognized as new taxa, await to be described (Prieto, in prep.). More than in other zoological fields, amateur enthusiastic speleologists, frequently produce discoveries in biospeleology during their hard exploratory journeys. Unfortunately, only a few teams and speleologists from the Basque country are sufficiently involved in collecting cave fauna. One of them is the Sociedad Espeleológica Burnia, which is mainly involved in the study of the karst from Montes de Triano; one of their members, Javier Moreno collected the first specimen of the nemastomatid here described, and another, Alfonso Calvo, collected the remaining specimens. This finding was communicated in the 17th International Congress of Arachnology (São Pedro, Brazil, 2007).

The nominate subfamily of the family Nemastomatidae is a Palaearctic group of small soil-dwelling harvestmen. It includes 18 genera and more than 170 species, with a core distribution in West, Central and Southeast Europe and the Caucasus, that harbours a very diverse fauna (Martens, 2007), although isolated species have been recorded eastward in Kyrgyzstan and Pamir (Schönhofer, 2013) and more recently in China (Martens, 2016; Zhang & Martens, 2018).

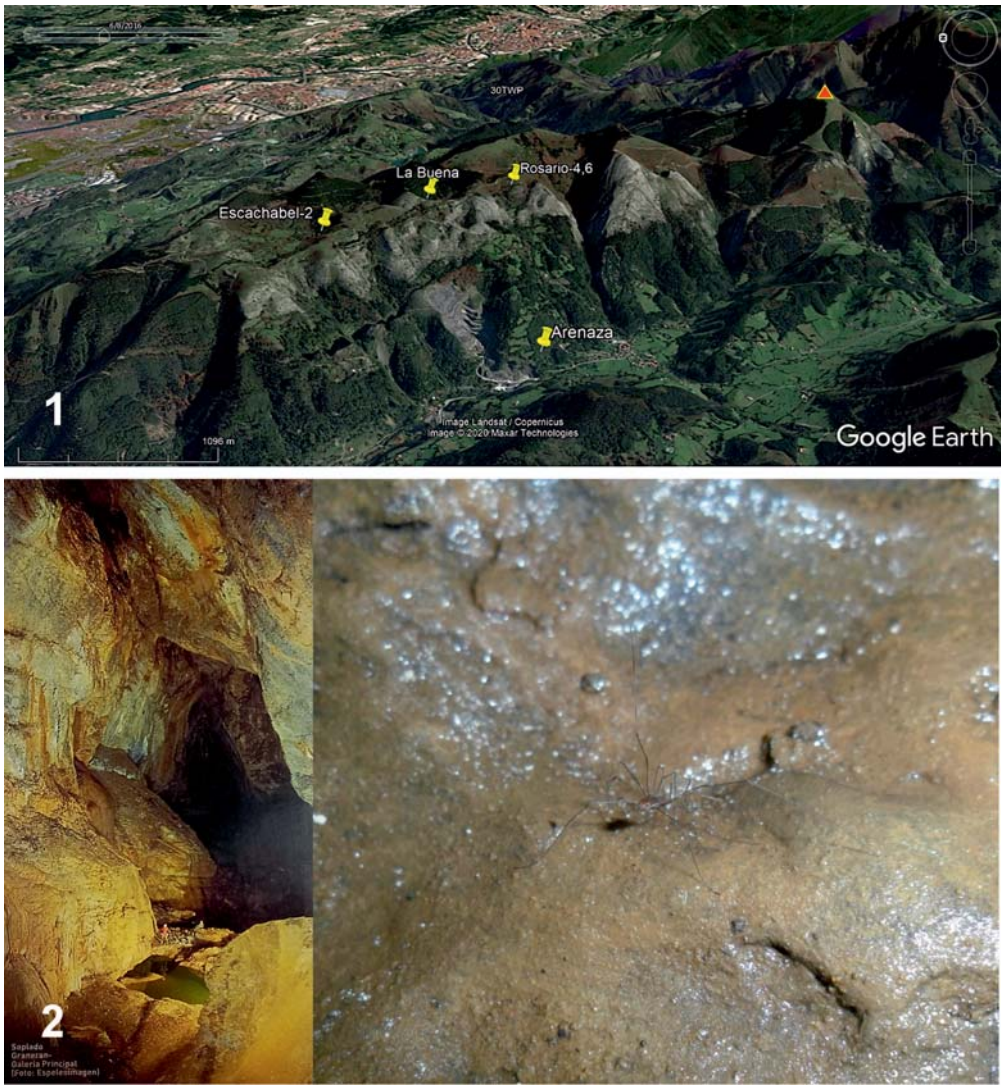


Fig. 1. Aerial (virtual) view from the West of the Montes de Galdames massif showing the main cave entrances of known localities of *Burnia spelaea* gen. nov., sp. nov. The three highest cavities were closed natural cavities but were opened by mine galleries. The red triangle indicates the highest peak, Mount Eretza (887m) and the city in the top background is Bilbao. **Fig. 2. A**, View of the gallery of the Soplado Granerán (Mina La Buena) where the first specimen of *Burnia spelaea* gen. nov., sp. nov. was found (Photo taken from Fernández 2004: p.27). **B**, The virtually invisible male was found in Escachabel-2 Cave [ZUPV·9003] on wet and slimy walls was only discovered by the shadow caused by the light from the helmet. / **Fig. 1.** Vista aérea (virtual) desde el Oeste del macizo Montes de Galdames que muestra los principales accesos a las cuevas de las localidades conocidas de *Burnia spelaea* gen. nov., sp. nov. Las tres cavidades más elevadas eran cavidades naturales cerradas pero que fueron abiertas por galerías de minas. El triángulo rojo indica el pico más alto, el monte Eretza (887m) y la ciudad en el fondo superior es Bilbao. **Fig. 2. A**, Vista de la galería del Soplado Granerán (Mina La Buena) donde se encontró el primer ejemplar de *Burnia spelaea* gen. nov., sp. nov. (Foto tomada de Fernández 2004: p.27). **B**, El macho virtualmente invisible que fue encontrado en Escachabel Cave-2 [ZUPV·9003] en las paredes húmedas y viscosas solo fue descubierto por la sombra causada por la luz del casco.

The Nemastomatinae harbour several eyeless taxa, e. g. the Macedonian *Hadzinia karamani* (Hadži, 1940) and the Bulgarian *Buresiolla bureschi* (Roewer, 1926), both in monotypic genera; *Nemaspela sokolovi* (Lyovushkin & Starobogatov, 1963) and all of five congeneric species from Crimea to the Caucasus, and *Mitostoma anophthalmum* (Fage, 1946) from the Bergamascan Alps (Hadži, 1940; Fage, 1946; Kratochvíl, 1958; Lyovushkin & Starobogatov, 1963; Martens, 1978, 2007). More recently, Mitov (2011) described the first eyeless species of the genus *Paranemastoma* Redikorzev, 1936.

The Montes de Galdames is a low altitude limestone massif (top at 887 m a.s.l. in Monte Eretza), 15 km west from Bilbao, in northern Spain (Fig. 1). An interesting peculiarity of this massif is that it was deeply and profusely veined by very rich iron veins, which were intensively exploited since the mid 19th century until exhaustion in the mid 20th century. As a consequence, there are many mine galleries, some of them connecting with naturally closed karstic cavities (termed "soplados" by miners). This limestone massif is part of the Galdames anticline, whose western slope was divided initially by hydrogeological reasons into five sectors, but the increasing knowledge of the underground conduit network led to the discovery of the hydrogeological connection of sectors 1 (including the former sector 0) and 2 in a single karst geosystem (Calvo & Jiménez, 2017). Sector 1 is drained mainly by the Complejo Atxuriaga, which constitutes one of largest cave systems of Spain (more than 54.6 km topographed, 546 m of deep and five entrances up to date; Calvo & Jiménez, 2017). The upper entrance to the Atxuriaga system is through La Buena mine which was open in a large sinkhole and connected with the Soplado Granerán, an astonishing cavity with a main gallery of 40m wide and 60m height where the first specimen of this new taxon was found (Fig. 2A).

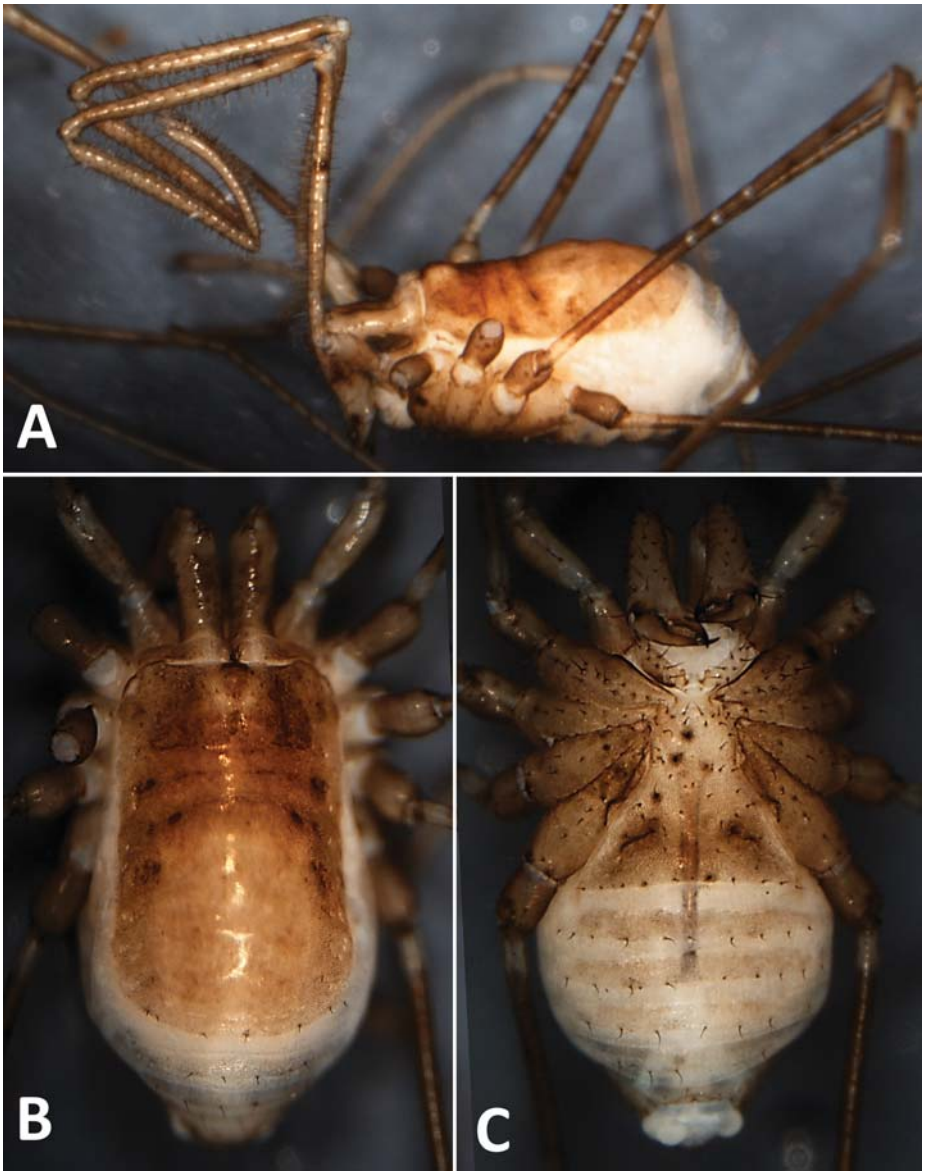


Fig. 3. Habitus of *Burnia spelaea* gen. nov., sp. nov. Holotype [MNCN20.02/19865], body length, 1.6 mm. **A**, Lateral view. **B**, Dorsal view. **C**, Ventral view (note the penis inside). / **Fig. 3.** Habitus de *Burnia spelaea* gen. nov., sp. nov. Holotipo [MNCN20.02/19865], longitud del cuerpo, 1.6 mm. **A**, Vista lateral. **B**, Vista dorsal. **C**, Vista ventral (obsérvese el pene en el interior).

Taxonomy

Suborder **DYSPNOI** Hansen & Sørensen, 1902

Superfamily **Troguloidea** Sundevall, 1833

Family **Nemastomatidae** Simon, 1872

Subfamily **Nemastomatinae** Simon, 1872

Genus *Burnia* gen. nov.

TYPE SPECIES: *Burnia spelaea* sp. nov.

DIAGNOSIS. Minute depigmented and eyeless Nemastomatinae, with scutum magnum nearly rectangular, very long legs (ratio leg II length/body length > 10) and palps. Supracheliceral lamellae fused but recognizable. Prosoma smooth with ozopores clearly visible and low ocularium without eyes but covered with microspines. Opisthosomal portion of scutum convex, smooth, with unclear pairs of paramedial knobs and a posterior row of sparse setae. Free tergites smooth. Coxae with a central row of long setose tubercles; coxosternal plate triangular with scaly microsculpture, rounded genital operculum and two coxosternal grooves, each with a double pit. Sternites with a row of setae in each. Basichelicerite long, with a dorsodistal small apophysis, without evident gland opening, provided with three long setae. Palp covered with clavate setae; femur and patella long and straight, tibia slightly curved and tarsus club-shaped and conspicuously curved. Legs ornamented with erect setae; femur and metatarsus with many pseudoarticulations.

ETYMOLOGY. The generic name (femenin) is based in the Sociedad Espeleológica Burnia to honour the discoverers of this taxon, Javier Moreno and Alfonso Calvo. The "Burnias" were ancient furnaces to obtain iron by reduction through intense heat, which gave origin to the word "burnia" (meaning iron in Basque langue). First mention of the word was in a proverb of the XVII century (Martínez de Isasti 1625: "*Balizco olaac burnia guchi"* = Saying 'if I had furnace' brings little iron).

***Burnia spelaea* sp. nov.** (Figs. 3-7)

Burnia spelaea (*nomen nudum*) – Prieto, 2007a: 108; 2007b: 38; 2010: 59; 2011: 9.

TYPE LOCALITY: Soplado Granerán de Mina La Buena (1mt93, Galdames, Bizkaia, Spain), at 185 m depth (see the cave passage in Fig. 2A), 30TVN9323990562, 607 m a.s.l.

TYPE MATERIAL: Holotype, male [MNCN20.02/19865, ex-ZUPV·3779]: 24/06/2006, Javier Moreno leg.

Paratypes: 1 female [ZUPV·4295]: Sima Escachabel-2 (0mt19, Galdames, Bizkaia, Spain), 30TVN9279491367, 570 m a.s.l., 28·03·2009, Alfonso Calvo leg. 1 male [ZUPV·4903],

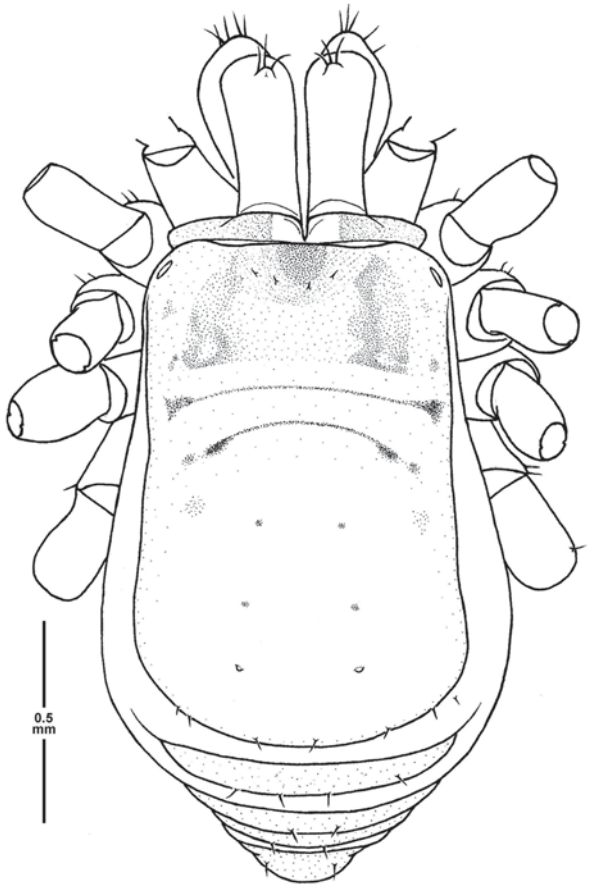


Fig. 4. Body of *Burnia spelaea* gen. nov., sp. nov. in dorsal view. Holotype [MNCN20.02/19865]. / **Fig. 4.** Cuerpo de *Burnia spelaea* gen. nov., sp. nov. en vista dorsal. Holotipo [MNCN20.02/19865.

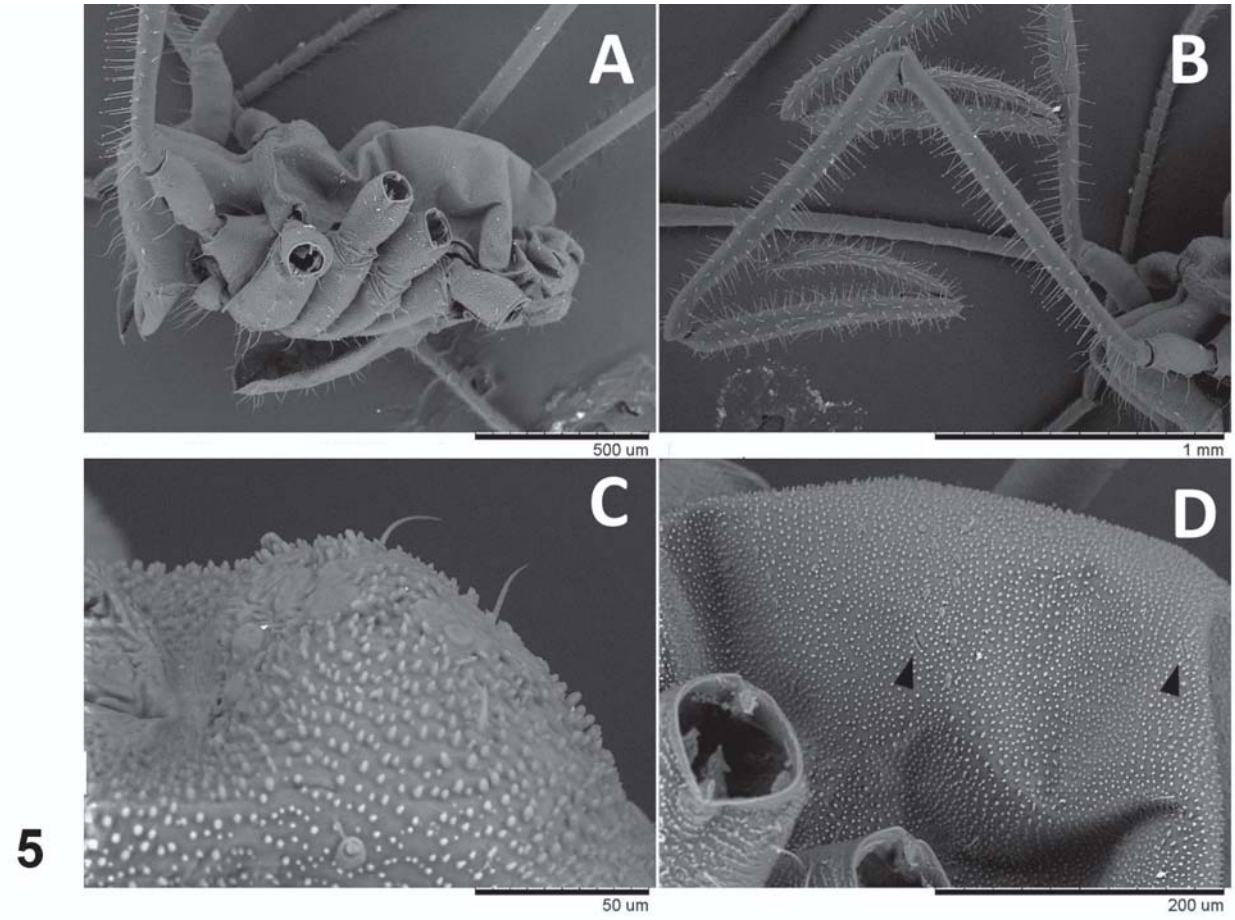
idem, 31·03·2013, Carlos Prieto & Alfonso Calvo leg (Fig. 2B; sequenced: COI, CytB, 28S rRNA). 1 male [ZUPV·5533]: Sistema Arenaza: Galería Septiembre Negro (1mt1, Galdames, Bizkaia, Spain), 30TVNVN9189789644, 195 m a.s.l., 11·11·2017, Alfonso Calvo leg. 1 juvenil [ZUPV·5263]: Sumidero Rosario-4,6 (1mt26-31, Galdames, Bizkaia, Spain), 30TVN9358089859, 659 m a.s.l., 02·08·2015, Alfonso Calvo leg. 1 juvenile [ZUPV·5395]: idem, 11·09·2016, Alfonso Calvo leg. (sequenced: COI, 28S rRNA). All coordinates, in MGRS system (ETRS89), are from the cave entrances.

ETYMOLOGY. The specific epithet is based on the evident troglomorphism (depigmentation, eyelessness, appendage lengthening) of the new species.

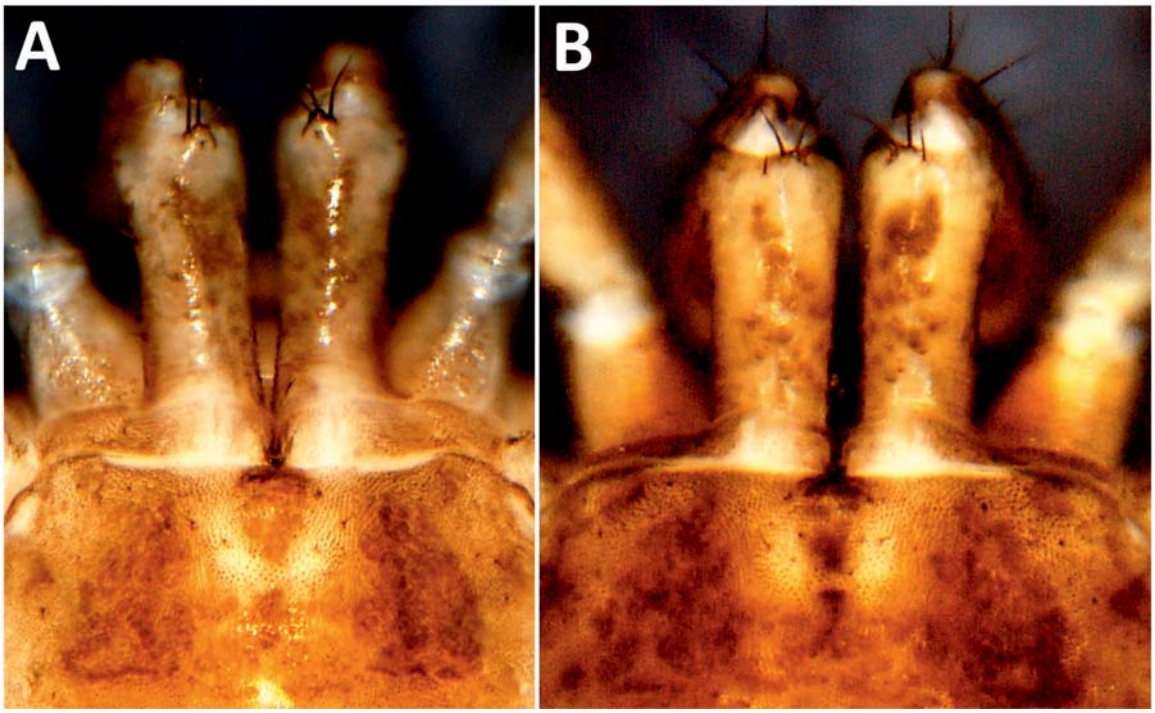
DESCRIPTION (male holotype).
Body small (1.60 x 1.00 mm) and depigmented with scutum magnum nearly rectangular and light brown.
Carapace with smooth frontal border and without cheliceral notches. Supracheliceral lamellae fused but recognizable by interlamellar grooves; the central is smooth and deeply grooved but laterals are fully covered by microspines. Ocularium low, convex and placed on the frontal border; eyeless, covered by microspines concentrically arranged and with two pairs of setae on the lateral and rear slopes. Repugnatory gland openings clearly visible in frontolateral corners. Propeltidium with lateral darker, irregular fields recognizable respect to the fused mesopeltidium. Metapeltidium broad and somewhat recurved.
Opisthosoma. Scutum convex and nearly smooth (apart of the microspinulation) with only 6 setae on the rear end. Scutum areas indistinct and only recognizable by obsolete, paramedian pairs of 'tubercles' on areas II–IV (although only the last pair forms a small knob), having slit sensilla (probably segmental; visible those areas II and III) on scutum sides. Free tergites smooth and only with few setae on the rear margin (two pairs in the anteriormost, one pair in second and third). Anal operculum with one pair of setae.
Venter. Coxapophysis of leg I with two rows of setae, anterior with six and rear with four. Coxae seemingly free, covered by a scaly microsculpture and weaker armature: coxae I–III with a central row of long setose tubercles along the coxa, a posterior short row of low smooth tubercles and a loose tubercle row on frontal margin of the coxa; coxa IV with the central row of setose tubercles and a striking triangular notch in the middle of the rear margin, just in front of coxosternal grooves. Coxosternal plate markedly triangular, with nearly round genital operculum (without articulation line), scaly microsculpture, disperse setae and a setose row along the rear margin; straight paramedian pair of coxosternal trenches, each with a double pit. Free sternites with rear rows of 8–10 setae. Posterior sternite with 3 setae.
Chelicerae. Basichelicerite (Fig. 6A) relatively long, with disperse short setae on ectal side and dorsal glandular apophysis small, without evident gland opening, provided with three long setae. Second segment longer and stronger than basichelicerite, with a dorsobasal tuft of long setae.
Palps (Fig. 5B). Coxa with one (apical) and trochanter with two setose knobs on ventral side. Femur to tarsus covered with clavate setae. Femur long and straight, patella shorter, tibia slightly curved and tarsus club-shaped and conspicuously curved.
Legs. Long and slender, ornamented with erect setae. Femur and metatarsus with many pseudo-joints, mainly in central part. Tarsus multisegmented.
Penis (Fig. 7). Muscular shafts fused into a unique block. Truncus robust, distally thickened and bicarinate and ending in a joint area. Glans dorsoventrally compressed, with many small setae, obscurely aligned in longitudinal rows. Stylus short and broad, slightly bent, with funnel opening.
Female. Body (1.65 x 1.13 mm) small and depigmented, as in male, although the prosoma is narrower (0.98 mm). Palps and legs somewhat longer. Basichelicerite (Fig. 6B) with small dorso-apical apophysis provided with three long setae.
Measurements. See table I.

Table I. Palp and legs measurements (in mm) of the holotype (male) and a paratype female (ZUPV·4295). Pj: pseudoarticulations; Tm: tarsomeres.

♂	Tr	Fe	Pa	Ti	Mt	Ta	Total	Pj(Fe)	Pj(Mt)	Tm(Ta)
PALP	0.35	1.36	1.26	0.97	-	0.68	4.62	-	-	-
LEG 1	0.22	2.03	0.44	1.14	2.33	1.89	8.05	5	3	15
LEG 2	0.22	3.63	0.52	2.57	5.45	3.76	16.15	13	12	23
LEG 3	0.22	2.13	0.42	1.06	2.39	1.88	8.1	3	3	11
LEG 4	0.23	3.13	0.46	1.42	2.51	2.34	10.09	4	6	13
♀	Tr	Fe	Pa	Ti	Mt	Ta	Total	Pj(Fe)	Pj(Mt)	Tm(Ta)
PALP	0.45	1.60	1.62	1.22	-	0.80	5.69	-	-	-
LEG 1	0.27	2.36	0.53	1.36	2.81	2.11	9.44	5	3	12
LEG 2	0.28	4.0	0.63	3.01	6.24	3.94	18.1	11	11	22
LEG 3	0.25	2.55	0.51	1.25	2.82	2.13	9.51	6	3	13
LEG 4	0.26	3.62	0.57	1.62	4.05	2.58	12.7	6	4	14



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Fig. 5. *Burnia spelaea* gen. nov., sp. nov. Holotype [MNCN20.02/19865]. **A**, Body (lateral view). **B**, Left palp (retrolateral view). **C**, Eyeless ocularium. **D**, dorsal scutum showing microgranulations and segmental slit sensilla. The holotype was accidentally damaged by a wrong drying previous to SEM study. **Fig. 6.** Chelicera of *Burnia spelaea* gen. nov., sp. nov. in dorsal view. **A**, Male holotype [MNCN20.02/19865]. **B**, Female [ZUPV·4295]. / **Fig. 5.** *Burnia spelaea* gen. nov., sp. nov. Holotipo [MNCN20.02/19865]. **A**, Cuerpo (vista lateral). **B**, Palpo izquierdo (vista retrolateral). **C**, Ocularium sin ojos. **D**, Escudo dorsal que muestra microgranulaciones y sensillas de hendidura segmentarias. El holotipo fue dañado accidentalmente por un secado incorrecto previo al estudio SEM. / **Fig. 6.** Quelíceros de *Burnia spelaea* gen. nov., sp. nov. en vista dorsal. **A**, Macho holotipo [MNCN20.02/19865]. **B**, Hembra [ZUPV·4295].

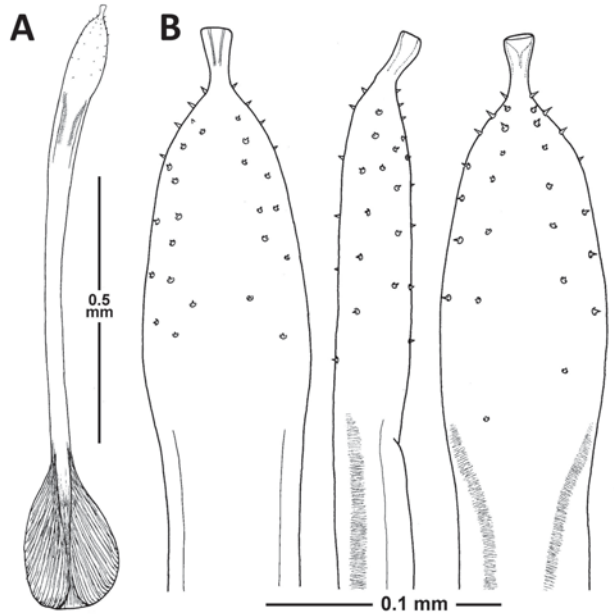


Fig. 7. Penis of *Burnia spelaea* gen. nov., sp. nov. Holotype (MNCN20.02/19865). **A**, Penis in ventral view. **B**, Glans penis in dorsal, lateral and ventral views. / **Fig. 7.** Pene de *Burnia spelaea* gen. nov., sp. nov. Holotipo (MNCN20.02/19865). **A**, Vista ventral del pene. **B**, Glande del pene en vistas dorsal, lateral y ventral.

GEOGRAPHICAL DISTRIBUTION (Fig. 1, 8)

Burnia spelaea gen. nov., sp. nov. seems to be restricted to caves from the Montes de Galdames massif (Fig. 1, 8). Findings have been sporadic but concentrated only on the karst limestone of the western slope of the Galdames anticline; the eastern slope facing Bilbao, called Montes de Triano present only small and separate limestone blocks, where iron veins came to replace in some places the limestone and most caves were deeply altered by the mining work (Calvo & Jiménez, 2017) but intensive sampling in recent years has not provided specimens of this species. On the western slope, it could be restricted to the speleological sector 1, since intensive sampling in nearest caves from the sector 2 has not provided specimens of this species although the deep Barranco de Arañaga that separates them does not seem to be a hard barrier because the thalweg is of limestone rock.

Although initially the three cavities belonging to sector 1 (La Buena, Arenaza and Rosario-4,6) were considered different cavities, intensive speleological exploration has recently connected them through cave passages, constituting the so-called Atxuriaga Complex.

The three upper cavities (Escachabel-2, La Buena and Rosario-4.6) are at a similar altitude (570–660 m asl). Escachabel-2 is the only cavity not connected by cave passages with the others, but it is connected hydrogeologically, suggesting (Calvo & Jiménez, 2017) that the erosive processes first eliminated the upper part of the calcareous mass (the one that would have been initially colonized by its ancestor) and later carved the relief isolating the Urallaga System (to which Escachabel-2 belongs) from the Atxuriaga Complex. As the water table descended and karstification also progressed down, new cavities at lower levels were filled with air and were prone to colonization, as is the case of Arenaza, located 400 m below the previous level.

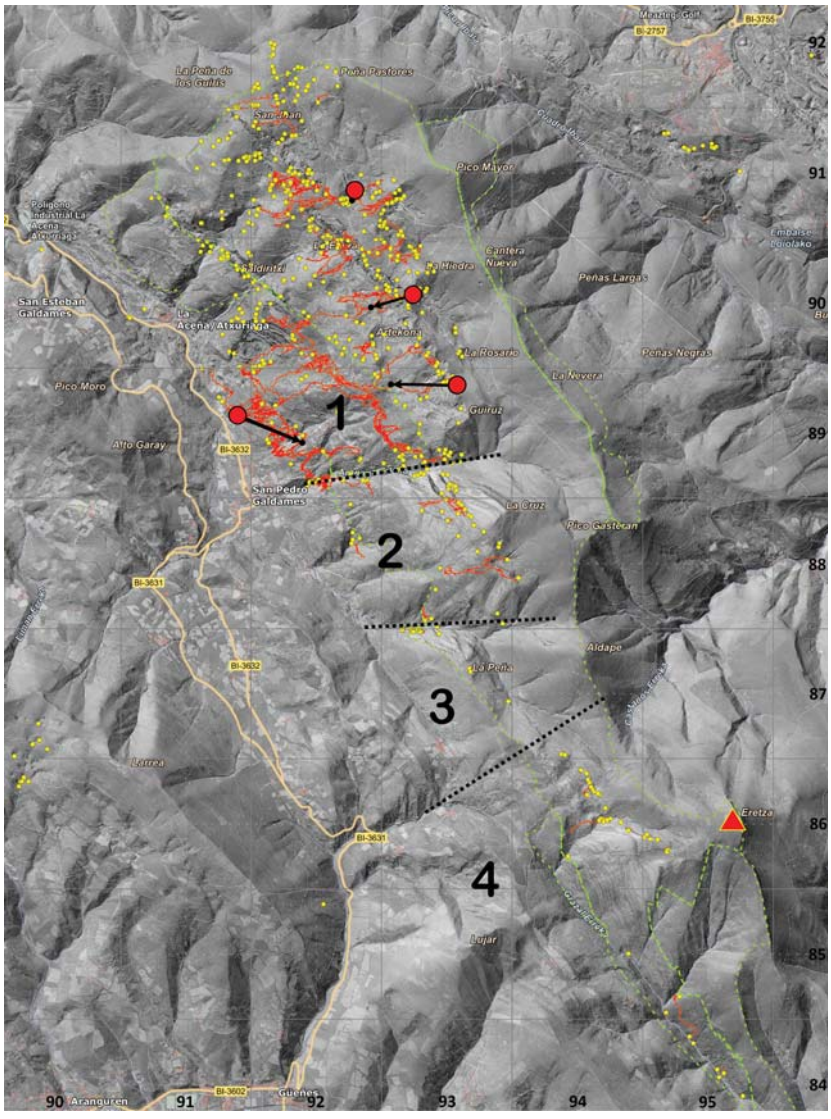


Fig. 8. Shaded relief map of the Montes de Galdames with known localities of *Burnia spelaea* gen. nov., sp. nov. (Dots at the arrowheads indicate the sites where the specimens were collected). Yellow small dots indicate the known cavities; red lines the extension of topographed cavities; the red triangle the Eretza mountain top and numbers 1-4 the diferent speleological sectors. The dashed green line indicates the limit of the Protected Biotope of "Meatzaldea - Bizkaia Mining Zone". Map provided by Pedro Jiménez (Sociedad Espeleológica Burnia). / **Fig. 8.** Mapa en relieve sombreado de los Montes de Galdames con las localidades conocidas de *Burnia spelaea* gen. nov., sp. nov. (Los puntos señalados por flechas indican los lugares donde se recogieron los especímenes). Los pequeños puntos amarillos indican las cavidades conocidas; las líneas rojas la extensión de las cavidades topografiadas; el triángulo rojo la cima de Monte Eretza y los números 1-4 los diferentes sectores espeleológicos. La línea verde discontinua indica el límite del Biotopo Protegido de Meatzaldea - Zona Minera de Bizkaia.Mapa facilitado por Pedro Jiménez (Sociedad Espeleológica Burnia).

ECOLOGICAL NOTES.

This species has been found solely on wet walls covered by percolation clay in the deepest galleries of caves, where individuals are hard to see due its small size and brown colour (Fig. 2B). Data are so scarce that we do not have information on its abundance, which must be very low because it has only been found sporadically (one individual on each occasion) nor about their diet, which can be inferred to be based on collembolans (Wolff et al. 2016) and perhaps small dipterans. The Montes de Galdames massif is inhabited by another troglobitic harvestman, *Ischyropsalis magdalenae* Simon, 1881, also endemic but with a broader distribution dwelling the four sectors. Both species have been found in the same caves (unpublished data) but probably they are not direct competitors due to the great difference in size between them.

ASSESSMENT PROPOSAL FOR THE IUCN RED LIST OF THREATENED SPECIES.

The evaluation of the criteria to determine the degree of threat suffered by a species (IUCN 2012) allows to determine that Burnia spelaea should be included in the ENDANGERED (EN) category. There are no data for an assessment by demographic criteria (A, C, D) since there is none population estimation, but as mentioned previously, the populational density must be very low since only one individual has been found on each successful occasion. According to the criterium of geographic range (B) by extension of presence, the estimator B1ab(iii) corresponds to it. The four known localities (Fig. 9) are located in contiguous 1x1 km squares, and three of them are less than one km away from an active quarry that is currently destroying part of the Atxuriaga system network of galleries and altering at least the climatic regime of the galleries next to the quarry front, if not that of the whole system. On the other hand, the three upper localities should be protected by the decree 26/2015, published in the BOPV 52 of March 17, 2015 declaring the "Biotopo Protegido de Meatzaldea - Zona Minera de Bizkaia" whose limit on the western slope is established at 450 m asl, leaving out the quarry.

IUCN (2012) IUCN Red List categories and criteria, version 3.1, second edition. Ed. IUCN Species Survival Commission (SSC). Gland (Swiss) and Cambridge (United Kingdom). iv + 32 pp.

SYSTEMATIC PLACEMENT

Being an eyeless and depigmented troglobiont species, *Burnia spelaea* gen. nov., sp. nov. cannot be confused with any other Iberian species since all other Iberian nemastomatids have eyes, including other troglobitic species. This morphological peculiarity does not guarantee *per se* that it is an independent genus of the other Iberian or European taxa because eyelessness has evolved in other cave-dwelling species of epigeal genera, including *Mitostoma anophthalmum* from the Bergamascan Alps (Fage 1946) or two *Paranemastoma* species from Bulgaria, *P. bureschi* (Roewer, 1926) and *P. beroni* Mitov, 2011 (Beron & Mitov, 1996, Mitov, 2011). Moreover, eyelessness can evolve quickly, in about 100,000 years in cavities from tropical regions (White & Culver, 2010), although this process could take much longer in temperate regions.

The first attempt of internal systematization of nemastomatids came from Roewer (1951), who divided the family into four genera, and the genera *Nemastoma* C.L. Koch, 1839 and *Mitostoma* into eight and four groups respectively. Kratochvíl (1958) erected many new genera and divided the European Nemastomatidae into three subfamilies (Giljarovviinae, Mitostomatinae and Nemastomatinae) but that division was questioned by Silhavý (1966) and undisputedly discarded by Gruber (1976). No more recent proposals for the internal classification of the subfamily Nemastomatinae have been made. The morphological analysis of Shear & Gruber (1983) for American taxa (Ortholasmatinae) and the combined phylogenetic analysis of Giribet *et al*. (2002) supporting the monophyly of Ortholasmatinae + Nemastomatinae are the only contributions to their intrafamiliar relationships. After Shear & Gruber (1983), plesiomorphic features of Nemastomatinae were anvil-shaped tubercles forming complex fences on dorsal surface, paramedian pairs of segmental protuberances on opisthosomal tergites, ocularium carrying a club-shaped dorsal/frontal median process forwardly projected and 1-2 pairs of lateral hood processes, short legs and palps, small, radially symmetric glans penis, with long, right stylus and monomorphic spines. According Shear & Gruber (1983), basal groups of the Nemastomatinae should present plesiomorphic features and Nemastomatidae genera with a penial troguloid facies as in Ortholasmatinae genera (e.g., radially symmetric glans with monomorphic small spines and right stylus) are better candidates. One such penis having a lanceolate glans with many small spines is found in *Nemastoma hankiewiczii* Kulczynski, 1909 from NW-Iberia (Rambla, 1980), the troglobite *Nemastoma sexmucronatum* Simon, 1913 from Cantabria and Biscay (Prieto, 2004) and *Burnia spelaea* gen. nov., sp. nov.

Nevertheless, the molecular analysis of Schönhofer & Martens (2010) for Trogulidae and some Nemastomatidae (no species of Ortholasmatinae was included), based on 28S rRNA and cytochrome *b* sequence data, shed some light on the matter. The strict consensus cladogram leaves *Mitostoma chrysomelas* and *Nemastoma (s.l.) hankiewiczii*, the only one Iberian nemastomatid included, as isolate basal lines. The remaining Nemastomatinae splits into two clades, *Nemastoma–Mediostoma–Pyza* (the Bayesian analysis of the combined 28S rRNA and cytb data unites *N. hankiewiczii* to this clade) and *Paranemastoma–Carinostoma–Histricostoma*. In the first clade, the closely related *Mediostoma* and *Pyza* present an alate penis, whereas *Nemastoma* presents strong spines along the glans sides; in the other clade, the three genera have an asymmetric bilobed glans where the tall right lobe (in ventral view) is the stylus. As Silhavý (1966) already recognized, the asymmetry of a penis with a bilobed glans is the clearest characters splitting the European Nemastomatidae and it constitutes an unquestionable odd synapomorphy. *Centetostoma* and *Acromitostoma*, with very different external appearance, have a similar alate penis (Rambla, 1980; Martens, 2011) and could be related to the *Mediostoma–Pyza* clade, but there is not a comfortable site to place *Nemastomella* and its spooned glans penis. It is interesting to note that the rejectedMitostomatinae subfamily, once proposed by Kratochvíl (1958), could be recovered due the isolate basal position of *Mitostoma*.

Schönhofer & Martens (2012) presented a version of that reconstruction for the marker 28S rRNA that includes the Iberian endemism *Nemastomella dubia* (Mello-Leitao, 1936) from GenBank sequences when they described the new genus *Saccarella* for *Saccarella schilleri* Schönhofer & Martens, 2012. It is somewhat different respect Schönhofer & Martens

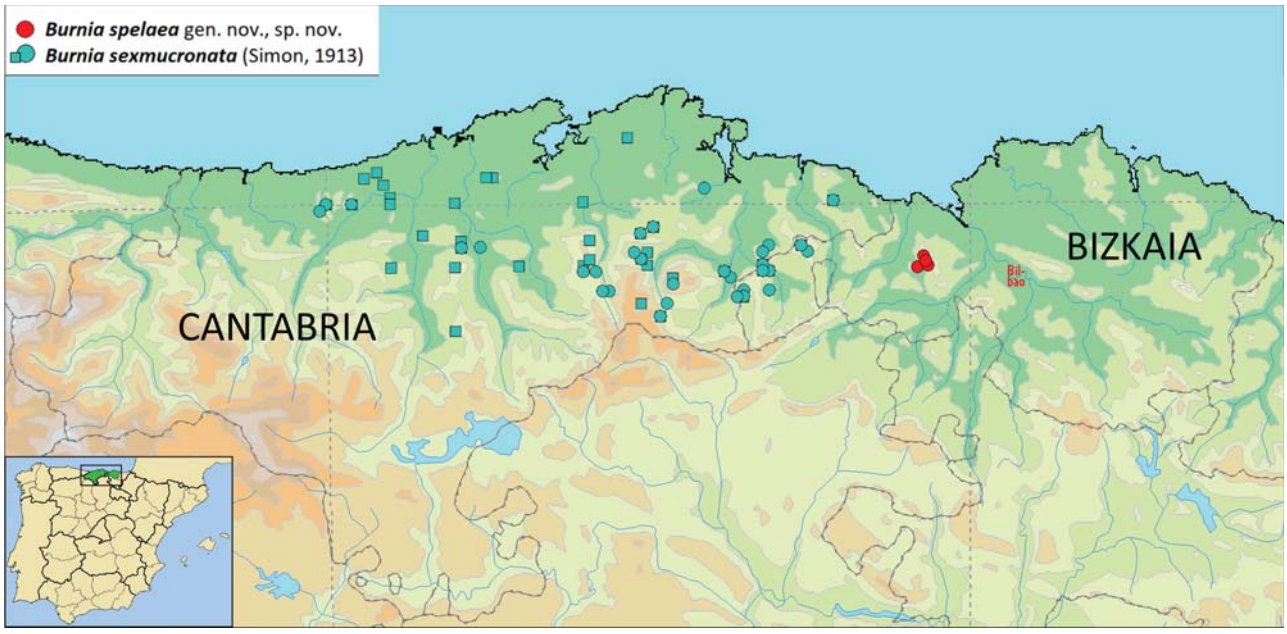


Fig. 9. Geographic distribution of *Burnia sexmucronata* Simon, 1913 (squares indicate bibliographic records) and *Burnia spelaea* gen.nov., sp.nov. The shown area includes the Spanish provinces of Bizkaia (belonging to the Basque Country) and Cantabria. Hypsographic lines/colours at 300, 600, 900… m asl. / **Fig. 9.** Distribución geográfica de *Burnia spelaea* gen. nov., sp. nov. y *Burnia sexmucronata* Simon, 1913 (los pequeños cuadrados indican registros bibliográficos). El área mostrada comprende los territorios de Cantabria y Bizkaia (perteneciente al País Vasco). Líneas / colores hipsográficos a 300, 600, 900… m snm.

(2010) because it is based on a Bayesian analysis, and not on the strict consensus of the most parsimonious trees, by grouping the species in their genera and by adding the non-sequenced genera to different clades in basis of their morphological characteristics, mainly penial and basicheliceral. In their phylogenetic scheme (Schönhofer & Martens, 2012: Fig. 1), the genus *Nemastomella* takes the place of *Nemastoma hankiewiczii* but incorporates the penial structure of *N. dubia*, so it is implicitly proposed that *N. dubia* would form a clade with *Nemastoma hankiewiczii*, the only other Iberian species sequenced. Now *Nemastomella* is grouped with *Acromitostoma*, *Centetostoma* and *Giljarovia*, all three with winged penises, although none of them have been sequenced.

Consequently with relationship between *N. hankiewiczii* and *N. dubia*, Schönhofer (2013) proposed tentatively the expansion of the genus *Nemastomella* to include, in addition to the eleven species that Staręga (1987) included when the revalidation of the genus, to species that had never been related to it, such as the Portuguese *Mitostoma armatissimum* Roewer, 1962 and *Nemastoma monchiquense* Kraus, 1961, or the Algerian *Nemastoma maarebense* Simon, 1913, thus ending with the endemicity of the genus *Nemastomella* for the Iberian Peninsula. The only extra-Iberian species considered by Staręga (1987), the alpine *Nemastomella centetes* (Simon, 1881) was restated as the type species of *Centetostoma* Kratochvíl, 1958, which includes also three Pyrenean species (Martens 2011). That 'tentative' proposal contrasts with that of Prieto (2004), when he restricted *Nemastomella* to Iberian species with pairs of long rods in the dorsal shield, a basicheliceral process forming a medially oriented cavity and a penis with 1–3 pairs of setae at the apical edge of a tapered or spooned glans and microspines along the stylus. This diagnosis excluded *Nemastoma cristinae* Rambla, 1968, for lacking a basicheliceral process and presenting peculiar supracheliceral laminae, and *Nemastoma sexmucronatum* Simon, 1911, for presenting only three pairs of protuberances on the dorsal shield, a basicheliceral process reduced to a protuberance without secretory cavity and a flattened glans with numerous microspines on both faces. Surprisingly, the preliminary results of a phylogenetic analysis of the Iberian Nemastomatidae based on the sequencing of the mitochondrial gene COI and the nuclear gene 28S rRNA (Ugarte *et al*., 2019) show that both hypotheses are respectively congruent since species included by Schönhofer (2013) in *Nemastomella* (but the unstudied *N. maarebense* and *N. armatissima*) are grouped into a set of four clades that could reach genus rank, separating the species that Prieto (2004) included in *Nemastomella* from *N. hankiewiczii*, *N. cristinae* and *N. sexmucronatum*, and the latter being closely related to *Burnia spelaea* gen. nov., sp. nov. Accordingly, it is here transfered to the new genus *Burnia*.

***Burnia sexmucronata* (Simon, 1913) comb. nov.**

NEW RECORDS (all records from ZUPV collections; OP Opiliones collection; FC cave fauna collection):

Bizkaia: [OP/5208] 1F: Lanestosa: Mina La Clara, 30TVN 641859, 300m, C. Prieto, A. Calvo, 08·02·2015. [FC/2708] 1M, 2F: idem. [OP/5176] 1F: Trucíos: Jorrios: T135, 30TVN 757929, 687m, Sh.Martín, 12·07·2014. [OP/5431] 1F: Valle de Carranza: Matienzo: Mina Angela, 30TVN695869, 237m, C. Prieto, J. Fernández, 05·01·2017. [OP/5197] 1M: Valle de Carranza: Mina Txomin, 30TVN6 50861, m, A. Calvo, 09·12 ·2014. [FC/2919] 1F: Valle de Carranza: Ranero: Cueva de Pozalagua, 30TVN686898, 493m, C. Prieto, J. Fernández, J. Moreno, 04·10·2015. [FC/3006] 1M,1F: idem, C. Prieto, J. Moreno, 10·10·2015. [FC/2396] 1M: Valle de Carranza: Ranero: Cueva de Santa Isabel de Ranero, 30TVN696895, 309m, J. Riezu, 04·07·1982.

Cantabria: [OP/5899] 1M, 1J: Arredondo: Bustablado: Cueva del Molino, 30TVN484921, 230m, C. Prieto, A. Sendra,

28·08·2019. [OP/5414] 1M: Arredondo: Porracolina: Torca de El Porrón, 30T VN461889, 920 m, M. Gutiérrez, 15·10·2016. [OP/5851] 2M, 1F, 2J: Astrana: Torca del Mortero, 30TVN 537841, 737m, C. Prieto, A. Calvo, 15·12·2018. [OP/5887] 1M, 2J: Bustablado: Torca de la Rabia, 30TVN499911, 555m, C. Prieto, A. Calvo, 11·05·2019. [OP/5269] 1M, 1F: Miera: Ajanedo: Cueva La Puntida, 30TVN422896, 500m, C. Prieto, A. Calvo, 12·10·2015. [FC/3035] 1ej.: idem. [OP/5246] 1M: Novales: La Busta: Cueva del Linar, 30TVP042003, 110m, J. Fernández, 03·05·2015. [OP/5330] 2F: idem, C. Prieto, J. Fernández, 18·06·2016. [OP/5344] 1M, 2F: Puente Viesgo: Cueva del Pis, 30TVN240931, 125m, C. Prieto, S. Quiñonero, 21·07·2016. [FC/4295 & 4581] 2M, 1F: idem, C. Prieto, J. Fernández, 27·11·2016. [OP/5041] 1M: Rada: Cueva de La Boscana, 30TVP597020, 74m, C. Prieto, D. Ávila, D. Perfecto, 19·10·2013. [OP/5044] 3M, 1F: Rada: Cueva Zorrilla, 30TVP596025, 120m, C. Prieto, D. Ávila, D. Perfecto, 19·10· 2013. [OP/5308] 2M: Ramales: Cueva Baranda, 30TVN 635887, 290m, C. Prieto, J. Fernández, 30·01·2016. [OP/5446] 1M: Rasines: Cueva Lo Nuevo, 30TVN694933, 220m, GAES, 05·03·2017. [OP/5362] 1F: Rasines: Sima RN-37 (-40m), 30TVN681922, 465m, GAES, 11·09·2016. [OP/5396] 1M: Rasines: Torca del Regato Calero-2 (RN-103), 30TVN680922, 425m, GAES, 17·09·2016. [OP/5486] 1M: idem, 25·03·2017. [OP/5333] 3M: San Roque de Riomiera: Cueva Covallarco, 30TVN403895, 402m, C. Prieto, J. Fernández, 18·06·2016. [FC/3965] 1M: idem. [OP/5421] 1M, 1F: San Roque de Riomiera: Sima PO-153, 30TVN439865, 585m, C. Prieto, M. Gutiérrez, 12·11·2016. [OP/3786] 1M, 2F: Soba: Cueva del Becerral, 30TVN524822, 670m, C. Prieto, 05·10·2006. [OP/3879] 1M, 2F: idem, C. Prieto, 11·03·2007. [OP/4748] 2F: idem, C. Prieto, J. Fernández, 22·04·2012. [OP/5099] 1J: idem, C. Prieto, J. Malumbres, 10·01·2014. [OP/5328] 1M: Soba: Sima de la Calaca, 30TVN543870, 1067m, A. Calvo, 17·06· 2016. [OP/5320] 1M: Soba: Valdició: Cueva de Las Montosas, 30TVN431863, 725m, M. Gutiérrez, 20·02·2016. [OP/5288] 1M: Udías: Cueva de Udías, 30TVP004003, 225m, M. Gutiérrez, w/o date. [OP/5297] 3M: idem, C. Prieto, J. Fernández, 16·01·2016. [FC/4109] 1F: Udías: La Gándara: Mina La Buenita, 30TUN999993, 155m, M. Gutiérrez, 28·08· 2016. [OP/6006] 3F, 1J: idem, C. Prieto, J. Fernández, 02·02· 2020.

COMMENTS: *Nemastoma sexmucronatum* Simon, 1913 was described from the world-famous Altamira Cave and other archaeological caves from Cantabria (Simon 1913) and Roewer (1935) recorded it from Biscay in Ventalaperra Cave, another cave with prehistoric paintings. Without knowledge of its penial morphology, Roewer (1951), Dresco (1967), Rambla (1968) and Staręga (1987) grouped *N. sexmucronatum* with the "*bacilliferum*-group" or at last in the genus *Nemastomella*. Prieto (2004) described the penial morphology but did not resolve the systematic position of *N. sexmucronatum* because he excluded it from *Nemastomella*, suggesting, previously to the discovery of the species herein described, that it would deserve its own genus.

The geographical distribution of *Burnia sexmucronata* (Fig. 9) extends over most of Cantabria, being absent only from the southwestern part, which is essentially siliceous, and the western part of Bizkaia, where it reaches the Jorrios massif. *Burnia sexmucronata* and *Burnia spelaea* gen. nov., sp. nov. have allopatric distributions.

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