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Cavernicolous Collembola from karst caves in the west of Navarra (Spain)

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1613 specimens of springtails belonging to 27 species and 16 genera were studied. The study has been realized on 41 caves in the Navarra karst (Spain). In 19 cavities collembola have been found. Two species new to the science are described: *Onychiurus akelaris* and *Pseudosinella unguilonginea*. *Mesachorutes spelaeus* is the first record of Spain and the second record of the World. Three new records to the Spanish fauna are cited. Also new data on the geographical distribution of the species are given.

A series of caves in the karst region west of Navarra (Spain) have been searched for spelean Collembola. The specific places where the specimens have been found were noted, in order to find some clues concerning the ecological niches of the species. Some species may be troglubiotes, i. e. true spelean organisms living only in caves, whereas others may be facultative cavernicolous, such as the guanobiotes living on the faeces of cave dwelling bats.

PLACES OF INVESTIGATION AND RECORDS

The cavities prospected

Presence or absence of Collembola is indicated by + or - respectively.

Mendaur mountains:

Arrutzipi (Aranaz) +.

Aralar ridge:

High zone: Cave in San Miguel road +, Sump-cave of Guardetxe +, Belén cave -.

Larraún Valley: Lezegalde cave +, Akelar cave +, Astiz cave +, Muguïro cave +.

Urbasa ridge:

Zumbelz fault: Tximoa deep-cave +, Sauco cave +, Arleze cave -, Roble deep-cave -, Elizarrate deep-cave -, Agadia deep-cave -, Cerro Viejo I cave +, Cerro Viejo II cave -, Santumutur cave -, Baibeltz cave -.

North zone: Laminatitur cave +, Laminatitur II cave -, Aibol deep-cave +, Otxaportillo deep-cave +, Cave at Km. 3 Otxaportillo I -, Cave at Km. 3 Otxaportillo II -.

Central zone: Cave of Ibis path -.

South zone: Origutxi cave +, Ostolaza cave +, Akuandi cave +, Cave of San Lorenzo shrine -, Noriturri cave +, Arantzaduya cave +, Arantzaduya deep-cave -, Eulate cave -, Cabras cave -.

Andía ridge:

Usede cave -, Artzunbide Aitzulo deep-cave -, Animas deep-cave -.

Lóquiz ridge:

Corral de Isidro I deep-cave -, Corral de Isidro II deep-cave -, Basaura cave +.

Estella Salt Plug:

Los Longinos cave -.

Description of cavities with Collembola

Mendaur mountains: It is formed by schists and limestones from the Carboniferous. Annual rain precipitation: 1800 mm.

Arrutzipi cave: It is excavated in a contact between limestones and schists. There is a river in it.

Aralar ridge, High zone: It is formed by limestones from reefs of the Cretaceous. Annual rain precipitation: 1400 mm.

Guardetxe sump-cave: This cave has been developed in a contact zone between marly limestones (impermeable) and limestones (permeable). It has a course of water in it.

Cave at San Miguel road: Excavated in limestones from Cretaceous reefs. It is very much connected with outside, and there is no course of water in it.

Aralar ridge, Larráun: The terrain is constituted by limestone from the Lower and Middle Jurassic. Annual rain precipitation: 1300 mm.

Lezegalde cave: The mouth of this cave is opened at the bottom of a dolina, 30 m in diameter and 10 m in depth. It has a lake which regulates the Larraun river. It works like a sump of the Ercilla river.

Akelar cave: It has a hall with a lake and a little course of water.

Astiz cave: Galleries system of great development and important litogenical and clastical phenomena.

Muguiro cave: It has laminar circulation of water.

Urbasa ridge, Fault of Zumbeltz: The terrain is constituted by Eocene limestone. Annual rain precipitation: from 1300 to 1100 mm.

Tximoa deep-cave: The access is by a vertical hole of 20 m depth and then descends as a ramp to a depth of 130 m.

Sauco cave: Horizontal cavity, containing semifossilized gours.

Cerro Viejo cave: Cavity of 50 m of development. It has a waterpool in it.

Urbasa ridge, North zone: The terrain is constituted by limestones and dolomitical limestones from Eocene. Annual rain precipitation: 1400 mm.

Laminatitur cave: With a lake in it, the cave is overflowed every year.

Aibol deep-cave: The access is by a vertical hole of 20 m depth. It has galleries with courses of water and litogenical processes.

Otxaportillo deep-cave: The access is by a vertical hole of 30 m depth. One of the halls has stalagmitical formations and little courses of water. There is an accumulation of detritus at the bottom of the vertical hole.

Urbasa ridge, South zone: The terrain is constituted by Eocene limestones. Annual rain precipitation: 1200 mm.

Origutxi cave: Cavity with two levels, the lower one with a water course.

Ostolaza cave: It has a water course and a great hall surrounded by calc-sinters, with a lake in the middle.

Akuandi cave: In the cave there are three lakes, two of them are residuals, and a little course of water. It presents a great amount of litogenical processes.

Noriturri cave: Cavity with two levels, the upper one is fossil and the lower level is active in the winter.

Arantzaduya cave: This cave has no water courses but is outward related with.

Lóquiz ridge: The terrain is constituted by Cretaceous limestones. Annual rain precipitation: 1000 mm.

Basaura cave: It has a development of about 5000 m and presents fossilized, semi-fossilized and active levels. In the entrance there are guano depositions from *Minopterus schreibersi* (KUHLE, 1819).

Biotopes prospected

Organic matter depositions. The extraction of microarthropoda has been made by the Berlese method. Search and manual capturing on the floors, walls, and water ponds.

The labeled specimens are deposited in the Zoology Museum of Navarra University.

RESULTS

List of Species (compare Table)

1. *Mesachorutes levantinus* (BONET, 1930)
2. *Mesachorutes spelaeus* (IONESCO, 1922)
3. *Protachorutes pyreneus* CASSAGNAU, 1955
4. *Schaefferia emucronata emucronata* ABSOLON, 1900
5. *Xenylla boernerii* AXELSON, 1905
6. *Onychiurus akelaris* n. sp.
7. *Onychiurus cancellatus* GISIN, 1956
8. *Onychiurus cantabricus* STEINER, 1958
9. *Onychiurus silvarius* GISIN, 1952
10. *Tullbergia krausbaueri* (BORNER, 1901)
11. *Folsomia candida* WILLEM, 1902
12. *Folsomia fimetaria* (LINNEAEUS, 1758)
13. *Isotoma notabilis* SCHAFFER, 1896
14. *Isotomiella minor* (SCHAFFER, 1896)
15. *Heteromurus nitidus* (TEMPLETON, 1835)
16. *Pseudosinella antennata* BONET, 1931
17. *Pseudosinella picta* (BORNER, 1903)
18. *Pseudosinella subinflata* GISIN GAMA, 1969
19. *Pseudosinella suboculata* BONET, 1931
20. *Pseudosinella subterranea* BONET, 1929
21. *Pseudosinella unguilonginea* n. sp.
22. *Tomocerus minor* (LUBBOCK, 1862)
23. *Arrhopalites boneti* STACH, 1945
24. *Arrhopalites sericus* GISIN, 1947
25. *Sminthurinus krausbaueri* BORNER, 1901
26. *Sphaeridia pumilis* (KRAUSBAUER, 1898)
27. *Neelus murinus* FOLSOM, 1896

Description of and comments upon the species

Mesachorutes levantinus (BONET, 1930)

Sin.: *Hypogastrura* (*Mesogastrura*) *levantina* (BONET, 1930)

Samples: Basaura (Lóquiz), SP1038AE, 24-I-1982, 3 specimens (sp).

Comment: Endemic species from Spanish Levante, with this new locality its spread area is enlarged.

Mesachorutes speleus (IONESCO, 1922)

Sin.: *Beckerella spelea* IONESCO, 1922; *Hypogastrura* (*Mesogastrura*) *spelea* (IONESCO) in BONET 1931; *Acherontides spelea* BONET, 1946; *Subbeckerella spelea* STACH, 1943.

Samples: Basaura (Lóquiz), SP1024AE, 19-VIII-1979, 18 sp.; SP1025AE, 6-X-1979, 64 sp.; SP1027AE, 2-XII-1979, 164 sp.; SP1030AE, 23-II-1980, 127 sp.; SP1035AE, 11-V-1980, 75 sp.; SP 1082AS, 1-XI-1980, 1 sp.; SP1038AE, 24-I-1982, 658 sp.

Description: Fig. 1. Size about 1 mm. Antennae cylindrical, 1.07 times the head length. The relative lengths of antennal segments: I/II/III/V = 0.034/0.040/0.048/0.060 (mm). Long antennal hairs. The hairs of antennal segment IV are smooth, in the antennal segments I-III the hairs are more or less serrated. Antennal segment IV is conical, with four sensorial setae like a flame. Apical vesicle retractil, and with a cylindrical, small rod among the three external sensorial setae. Sense organ on antennal segment III consists of two short, straight,

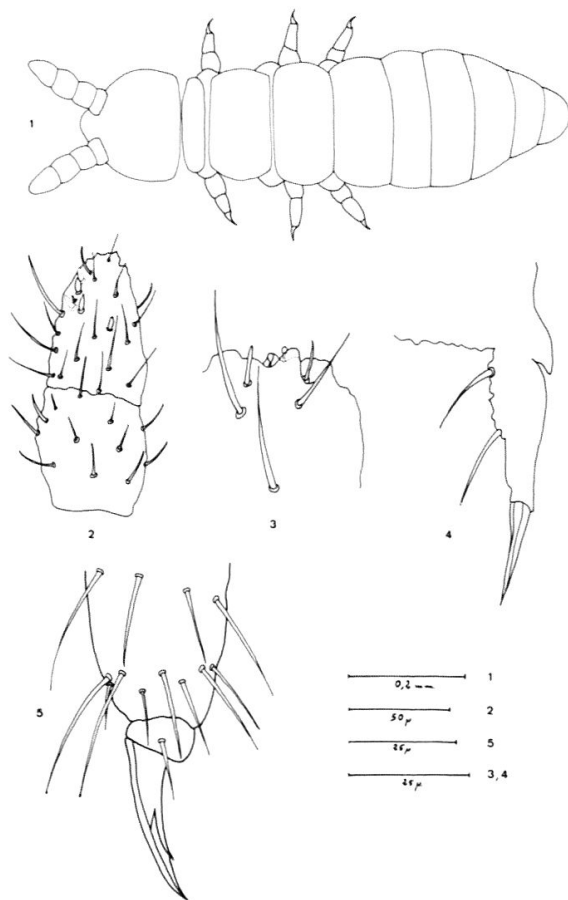


Fig. 1: *Mesachorutes speleus* 1: General shape, 2: Antennal segments III and IV, 3: Sense organ of the antennal segment III, 4: Furcula, 5: Claw and tibiotarsi of the leg III.

mace form rods, situated in a cuticular fold. Antennal segment II isodiametrical. Antennal segment I broader than long.

Eyes and postantennal organ absent. Tibiotarsi with two little spatulated hairs. Claw without empodial appendage and with an inner tooth near the apex.

Ventral tubule with 4 + 4 hairs. Tenaculum with 3 + 3 teeth. Dens with two setae in the posterior side. Mucro sharp.

Body white, skin granulated. Abdominal segment VI with two short, feathered hairs.

Comment: This species is the first record to the Spanish fauna and the second record to the world. It was described for the first time by IONESCO (1922), from the Isvernian caves in Rumania, which is the type locality. Like most of the *Mesachorutes* it is guanobiotic. The collection in Navarra from guano of the *Miniopterus schreibersi* (KUHL., 1819) suggests that it may have been introduced by the migration movements of these bats. This hypothesis might help to understand the species distribution in two different areas and could point out that it is a guanobiote rather than a troglobiote. Its distribution could be linked with this bat. Similar comments could be made on *M. levantinus*.

Protachorutes pyreneus CASSAGNAU, 1955

Samples: Lezegalde (Larraun), SP1028AS, 12-X-1979, 1 sp.

Schaefferia emucronata emucronata ABSOLON, 1900

Samples: Basaura (Lóquiz), SP1028AE, 2-XII-1979, 1 sp.

It is the first record to Spain.

Xenylla boernerii AXELSON, 1905

Samples: Basaura (Lóquiz), SP1027AE, 2-XII-1979, 2 sp.

Onychiurus akelaris n. sp.

Samples: Akelar (Larraun), Holotype, ♂, SP1029AE-A, 27-XII-1979, 1 sp.; Paratypes: ♂, SP1029AE-B, 27-XII-1979, 1 sp.; ♀, SP1039AS, 27-XII-1979, 1 sp. Muguiro (Larraun), SP1032AE, 8-V-1980, 1 sp.; SP1087AS, 25-XI-1980, 1 sp.

Description: Fig. 2. Size 1.2 mm, body unpigmented white-yellow, with thin granulation.

Antennae cylindrical, shorter than the head. The relative length between them: 0.22/0.30 (in mm). Antennal segment IV with small subapical vesicle and a sensorial, short hair folded in a depression. Sense organ of third antennal segment consists in five, broad, rough papillae, that protect two sensorial rods and two sensorial, granulated but not racemose maces. Surrounding the sense organ there are five normal hairs. Below them is present a sensorial, short hair, like those of segment IV, situated in a shallow depression. The relative length of segments I/II/III/IV = 0.035/0.050/0.055/0.080 (mm).

Postantennal organ constituted by an elongated depression with 12–14 compound grains.

Pseudocelli distributed on the body as formula: 33/133/45454 dorsal and 3/011/2211 ventral. In some specimens the pseudocelli situation and number is asymmetrical on each side.

Claw long and narrow, inner tooth absent. Empodium with basal lamella, shorter than the claw. The relative length between basal lamella/empodium = 0.015/0.032. Relation claw III/empodium III = 0.055/0.030.

Furcula and anal spines absent. Body relatively broad and covered with short sparse hairs.

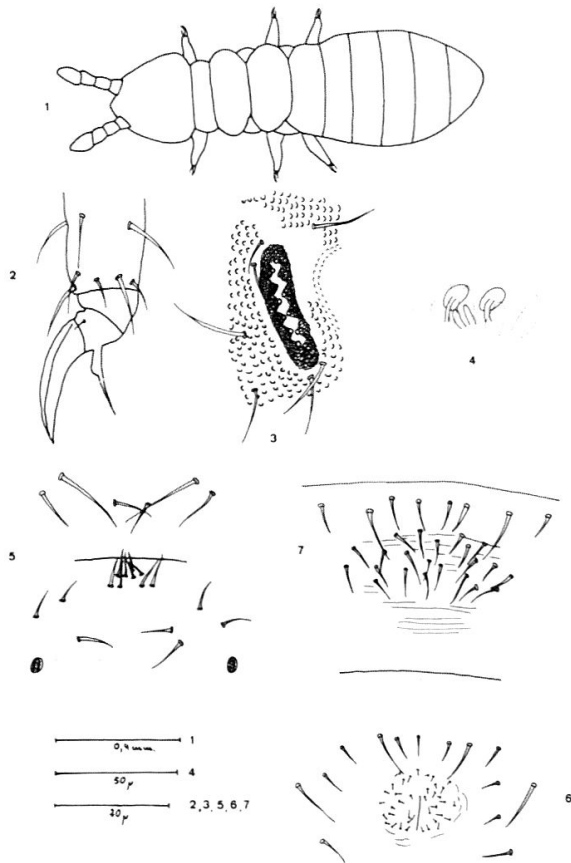


Fig. 2: *Onychiurus akelaris* 1: General shape, 2: Claw and tibiotarsi of the leg III, 3: Postantennal organ, 4: Sense organ of the antennal segment III, 5: Male ventral organ, 6: Male genital plate, 7: Female genital plate.

Onychiurus cancellatus GISIN, 1956

Samples: Akelar (Larraun), SP1029AE, 27-XII-1979, 1 sp. Cerro Viejo (Urbasa-Zunbeltz), SP1080AS, 26-X-1980, 1 sp.; Akuandi (Urbasa-South), SP1041AE, 7-III-1982, 2 sp.

Onychiurus cantabricus STEINER, 1958

Samples: Sauco (Urbasa-Zunbeltz), SP1085AS, 9-XI-1980, 1 sp.

Onychiurus silvarius GISIN, 1952

Samples: Cerro Viejo (Urbasa-Zunbeltz), SP1080AS, 26-X-1980, 1 sp.; Akuandi (Urbasa-South), SP1041AE, 7-III-1982, 1 sp.

Tullbergia krausbaueri (BORNER, 1901)

Samples: Astiz (Larraun), SP1026AE, 13-X-1979, 2 sp.; Muguiro (Larraun) SP1033AE, 8-V-1980, 2 sp., SP1034AE, 8-V-1980, 29 sp.; Basaura (Lóquiz),

SP1038AE, 24-I-1982, 19 sp.; Noriturri (Urbasa-South), SP1039AE, 14-II-1982, 2 sp., SP1040AE, 14-II-1982, 2 sp.

Onychiurus silvarius GISIN, 1952

Samples: Cerro Viejo (Urbasa-Zunbeltz), SP1080AS, 26-X-1980, 1 sp.; Akuandi (Urbasa-South), SP1041AE, 7-III-1982, 1 sp.

Tullbergia krausbaueri (BORNER, 1901)

Samples: Astiz (Larraún), SP1026AE, 13-X-1979, 2 sp.; Muguero (Larraún) SP1033AE, 8-V-1980, 2 sp., SP1034AE, 8-V-1980, 29 sp.; Basaura (Lóquiz), SP1038AE, 24-I-1982, 19 sp.; Noriturri (Urbasa-South), SP1039AE, 14-II-1982, 2 sp.; SP1040AE, 14-II-1982, 2 sp.

Folsomia candida WILLEM, 1902

Samples: Lezegalde (Larraún), SP1028AS, 12-X-1979, 2 sp.; Arrutzipi (Mendaur), SP1092AS, 16-XII-1981, 1 sp.; Aibol (Urbasa-North), SP1098AS, 10-I-1982, 1 sp.

Folsomia fimetaria (LINEAEUS, 1758)

Samples: Basaura (Lóquiz), SP1028AE, 2-XII-1979, 1 sp.

Isotoma notabilis SCHAFFER, 1896

Samples: C. de Astiz (Larraún), SP1026AE, 13-X-1979, 1 sp.; Ostolaza (Urbasa-South), SP1031AS, 4-XI-1979, 1 sp.; Basaura (Lóquiz), SP1038AS, 24-I-1982, 1 sp.; Noriturri (Urbasa-South), SP1040AE, 14-II-1982, 4 sp.

Isotomiella minor (SCHAFFER, 1896)

Samples: Muguero (Larraún), SP1033AE, 8-V-1980, 2 sp.; Basaura (Lóquiz), SP1095AS, 21-XI-1981, 11 sp.; Noriturri (Urbasa-South), SP1040AE, 14-II-1982, 1 sp.

Heteromurus nitidus (TEMPLETON, 1835)

Samples: Cerro Viejo (Urbasa-Zunbeltz), SP1080AS, 26-X-1980, 1 sp.; Basaura (Lóquiz), SP1083AS, 1-XI-1980, 4 sp.

Pseudosinella antennata BONET, 1931

Samples: Lezegalde (Larraún), SP1028AS, 12-X-1979, 1 sp.; Akelar (Larraún), SP1039AS, 27-XII-1979, 29 sp.; Muguero (Larraún), SP1060AS, 8-V-1980, 9 sp., SP1087AS, 25-XI-1980, 2 sp.; Guardetxe (Aralar), SP1073AS, 1-X-1980, 2 sp.; C. de San Miguel (Aralar), SP1104AS, 26-I-1982, 1 sp.

Pseudosinella picta (BORNER, 1903)

Samples: Basaura (Lóquiz), SP1025AE, 6-X-1979, 2 sp.; SP1027AE, 2-XII-1979, 3 sp.; SP1036AE, 17-VII-1980, 1 sp.; SP1082AS, 1-XI-1980, 5 sp.; SP1000TS, 1-XI-1980, 2 sp., SP1001TS, 1-XI-1980, 3 sp.; SP1038AE, 24-I-1982, 4 sp.

Pseudosinella subinflata GISIN & GAMA, 1969

Samples: Basaura (Lóquiz) SP1025AE, 6-X-1979, 3 sp.; SP1028AE, 2-XII-1979, 3 sp.; SP1082AS, 1-XI-1980, 1 sp.; SP1101AS, 24-I-1982, 2 sp.; Lezegalde (Larraun) SP1028AS, 12-X-1979, 4 sp.; Cerro Viejo (Urbasa-Zunbeltz) SP1080AS, 26-X-1980, 15 sp.; C. del Sauco (Urbasa-Zunbeltz), SP1085AS, 9-XI-1980, 3 sp.; Tximoa (Urbasa-Zunbeltz), SP1116AS, 9-IV-1982, 27 sp.

Pseudosinella suboculata BONET, 1931

Samples: Cerro Viejo (Urbasa-Zunbeltz), SP1080AS, 26-X-1980, 68 sp.

Pseudosinella subterranea BONET, 1929

Samples: Noriturri (Urbasa-South) SP1090AS, 18-IV-1981, 1 sp.; Aibol (Urbasa-North) SP1098AS, 10-I-1982, 34 sp.; Akuandi (Urbasa-South) SP1109AS, 7-II-1982, 1 sp.; Arantzaduya (Urbasa-South), SP1111AS, 14-II-1982, 1 sp.; Laminatitur (Urbasa-North), SP1112AS, 14-II-1982, 17 sp.

Pseudosinella unguilonginea n. sp.

Samples: Akuandi (Urbasa-South), Holotype, ♂, SP1109AS-A; Paratypes: SP1109AS, 7-II-1982, 7 sp. in slices and 19 sp. in flasks. Origitxi (Urbasa-South), SP1107AS, 7-II-1982, 1 sp.; Ostolaza (Urbasa-South), SP1108AS, 7-II-1982, 17 sp.; Akuandi (Urbasa-South), SP1113AS, 7-III-1982, 7 sp.

Description:

Fig. 3. Holotype size 1.7 mm female 1.9–2.2 mm.

Body white, unpigmented. Antennae longer than the head. Relative length antenna/head diagonal = 1.16/0.45 mm. Relative length of the antennal segments I/II/III/IV = 0.12/0.22/0.27/0.55 mm. Antennal segment IV without apical vesicle, covered with ciliated, smooth, long and short hairs and sparse sense rods in variable number.

Sense organ of antennal segment III consists of two short rods in a fold of the cuticle. Frequently there are two more sensilla. Between both groups of sensilla there is an especially, straight and small rod. Antennal segment II with a sense organ constituted by two plus a variable number of sensillae. Antennae without scales.

Eyes absent. Basal labium chaetotaxis: M1 M2r E L1 L2. All hairs are smooth. r is vestigial. Dorsal side of the head covered with round, hyaline scales.

Dorsal chaetotaxis of macrochaeta: R111/32/0201 + 3. Chaetotaxis of the abdominal segment II: p A B q1 q2. The \underline{s} setae on the abdominal segment IV is present.

Claw very narrow and long, with a minute external tooth. Dental basal plate is 1/5 shorter than the inner side of the claw. Distal tooth reduced, sometimes indistinct. Proximal tooth small. The hind tooth two times longer than the anterior one. Empodium like a lancet, sinuous. Tibiotarsi with every hair ciliated. Tibiotarsal hair not spatulated. There is one ventral, spiniform, smooth hair in the tibiotarsi.

Tenaculum with 4 + 4 teeth. Furcula well developed. Manubrium and dens with scales on the foreside (ventral) and ciliated hairs on the backside (dorsal). Dens uniformly ringed. Mucro with two teeth, the apical one larger than the antepical, with basal spine. Relation manubrium/dens/smooth part of dens/mucro = 0.350/0.430/0.048/0.020.

Habitat: This species has been collected on active calc-sinter stalactites and stalagmites. Its very long and thin claws are interpreted as an adaptation to climbing on walls covered by a water film.

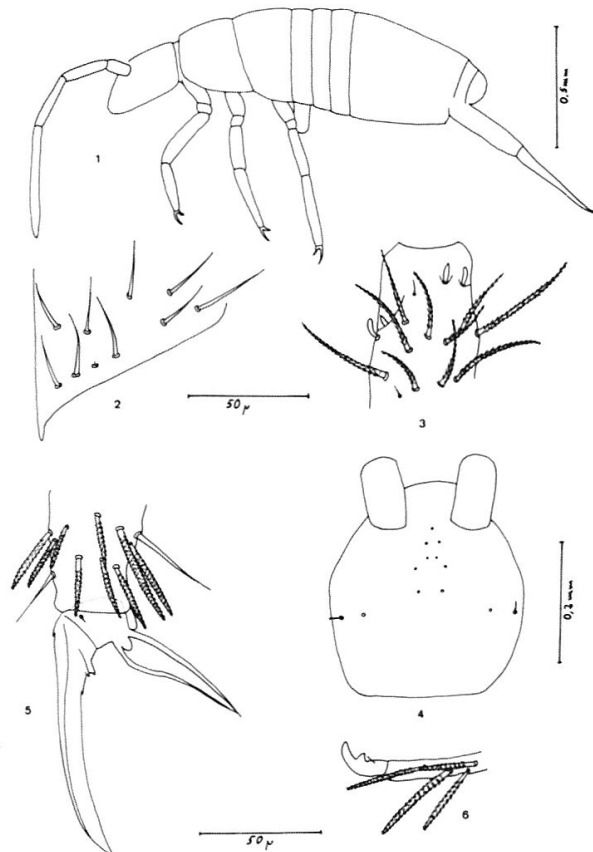


Fig. 3: *Pseudosinella unguilonginea* 1: General shape, 2: Labium chaetotaxis, 3: Sense organ of the antennal segment III, 4: Dorsal macrochaeta of the head, 5: Claw and tibiotarsi of the leg III, 6: Mucro.

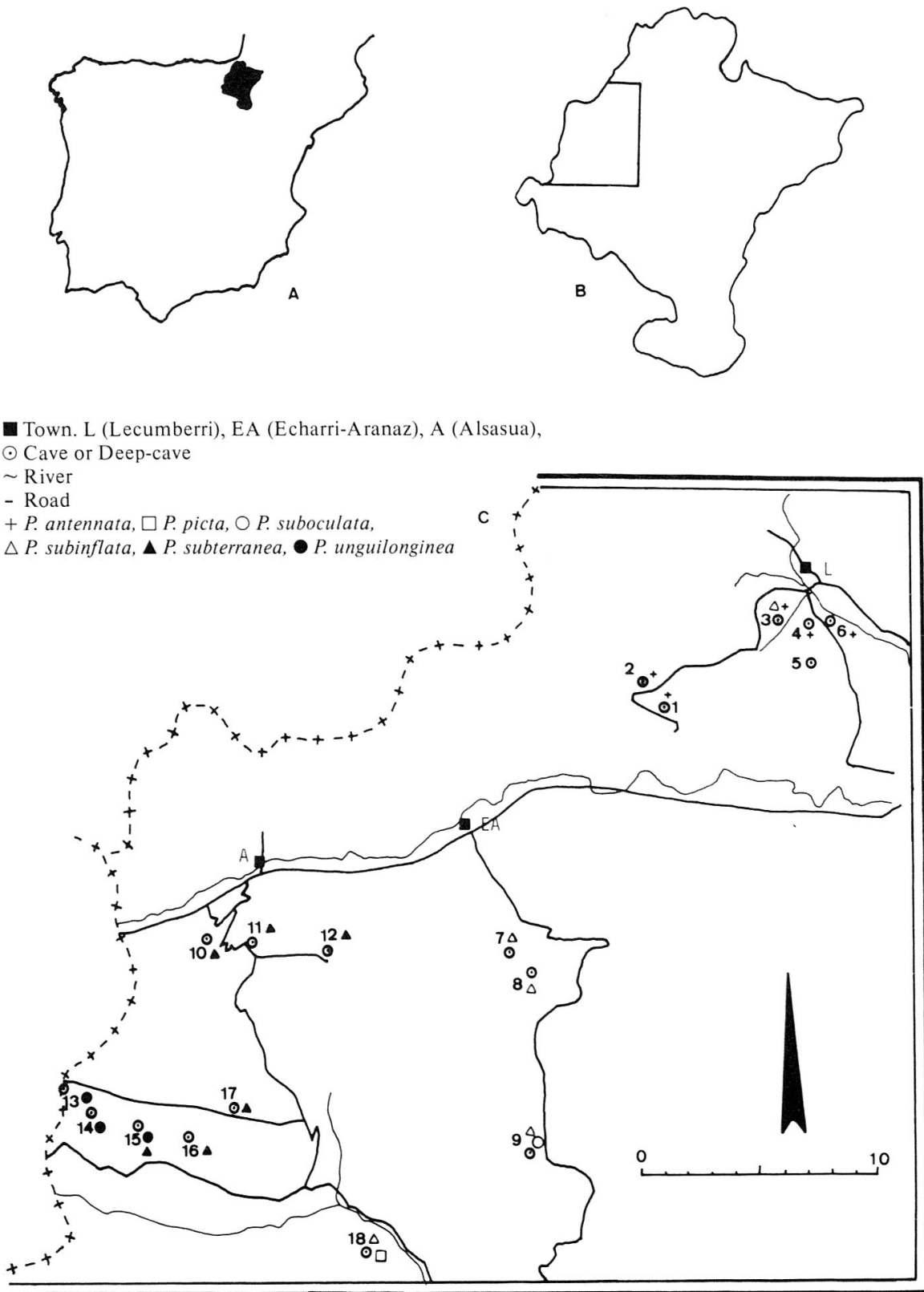
Tomocerus minor (LUBBOCK, 1862)

Samples: Lezegalde (Larraun), SP1028AS, 12-X-1979, 2 sp.; SP1115AS, 7-IV-1982, 25 sp.; Ostolaza (Urbasa-South), SP1031AS, 4-XI-1979, 13 sp.; Tximoa (Urbasa-Zunbeltz), SP1032AS, 25-XI-1979, 1 sp.; SP1116AS, 9-IV-1982, 1 sp.; Saucó (Urbasa-Zunbeltz), SP1085AS, 9-XI-1980, 15 sp.; Otxaportillo (Urbasa-North), SP1097AS, 3-I-1982, 6 sp.; Aibol (Urbasa-North), SP1098AS, 10-I-1982, 29 sp.; Noriturri (Urbasa-South), SP1040AE, 14-II-1982, 1 sp.; Laminatur (Urbasa-North) SP1112AS, 14-II-1982, 1 sp.

Arrhopalites boneti STACH, 1945

Samples: Basaura (Lóquiz), SP1035AS, 2-XII-1979, 1 sp.; Cerro Viejo (Urbasa-Zunbeltz), SP1080AS, 26-X-1980, 1 sp.

Fig. 4: Distribution of six species of *Pseudosinella*. A: Localization of Navarra province in Spain (black area). B: Same area magnified with inset in the west of province. C: The inset enlarged; the numbers are caves: 1. Cave at San Miguel Road, 2. Guardetxe Sump-cave, 3. Lezegalde cave, 4. Akelar cave, 5. Astiz cave, 6. Muguiro cave, 7. Tximoa deep-cave, 8. Sauco cave, 9. Cerro Viejo cave, 10. Laminatitur cave, 11. Aibol deep-cave, 12. Otxaportillo deep-cave, 13. Origitxi cave, 14. Ostolaza cave, 15. Akuandi cave, 16. Noriturri cave, 17. Arantzaduya cave, 18. Basaura cave.



Arrhopalites sericus GISIN, 1947

Samples: Cerro Viejo (Urbasa-Zunbeltz), SP1080AS, 26-X-1980, 2 sp.

Sminthurinus krausbaueri BORNER, 1901

Samples: Basaura (Lóquiz), SP1027AE, 2-XII-1979, 1 sp.

Sphaeridia pumilis (KRAUSBAUER, 1898)

Samples: Basaura (Lóquiz), SP1027AE, 2-XII-1979, 3 sp.

Neelus murinus FOLSOM, 1896

Samples: Astiz (Larraún), SP1026AE, 13-X-1979, 10 sp.; Basaura (Lóquiz), SP1038AE, 24-I-1982, 2 sp.

DISCUSSION

According to the results of species distribution and places where the species appear, we think that the following species are troglobiota:

Onychiurus akelaris

Pseudosinella antennata

P. subinflata

P. subterranea

P. unguilonginea

Arrhopalites boneti

In relation with the geographical distribution of *Pseudosinella* (Fig. 4) it could be remarked that *P. antennata* is endemic in Aralar ridge, *P. unguilonginea* is endemic in Urbasa-South; it lives in the same area with other *Pseudosinella* but does not share the same ecological niche. *P. subinflata* lives on organic matter in Lóquiz, Urbasa-Zunbeltz and Aralar ridge but is substituted in Urbasa-North by *P. subterranea* (compare also Table 1).

RESUMEN:

Se han estudiado 1613 Ejs. de colémbolos pertenecientes a 27 especies de 16 géneros. El estudio se ha realizado sobre 41 cuevas y simas de la zona kárstica de Navarra (España). En 19 de las cavidades estudiadas han aparecido colémbolos. Se describen dos nuevas especies para la ciencia: *Onychiurus akelaris* y *Pseudosinella unguilonginea*. Se cita por segunda vez para la ciencia *Mesachorutes spelaeus* (IONESCO, 1922). Se dan tres nuevas citas para España. Se dan datos sobre la distribución geográfica de las especies citadas en las zonas kársticas de Navarra.

ZUSAMMENFASSUNG

Höhlen-Collembola aus Karsthöhlen im Westen von Navarra (Spanien) - Es wurden 1613 Exemplare von Colembolen untersucht, die 27 Arten von 16 Gattungen zugehörten. Dabei wurden 41 Höhlen der Karstzone von Navarra (Spanien) durchforstet. In 19 dieser Höhlen wurden Colembolen gefunden. Es werden zwei neuentdeckte Arten wissenschaftlich beschrieben: *Onychiurus akelaris* und *Pseudosinella unguilonginea*. Zum 2. Mal wird *Mesachorutes spelaeus* (IONESCO, 1922) für die Wissenschaft zitiert. Neu für die spanische Fauna sind 3 Arten. Es werden Angaben über die geographische Verbreitung der oben genannten Arten aus der Karstzone von Navarra gemacht.

Table 1: Table of species distribution in karst zones of Navarra

	LOQUIZ		URBASA	URBASA	URBASA	ARA-
	GUANO	CAVITY	SOUTH	NORTH	ZUNBELTZ	LAR
1. <i>M. levantinus</i>	+	-	-	-	-	-
2. <i>M. spelaeus</i>	+	-	-	-	-	-
3. <i>P. pyreneus</i>	-	-	-	-	-	+
4. <i>S. emucronata</i>	+	-	-	-	-	-
5. <i>X. boerleri</i>	+	-	-	-	-	-
6. <i>O. akelaris</i>	-	-	-	-	-	+
7. <i>O. cancellatus</i>	-	-	+	-	+	+
8. <i>O. cantabricus</i>	-	-	-	-	+	-
9. <i>O. silvarius</i>	-	-	+	-	+	-
10. <i>T. krausbaueri</i>	+	-	+	-	-	+
11. <i>F. candida</i>	-	-	-	+	-	+
12. <i>F. fimetaria</i>	+	-	-	-	-	-
13. <i>I. notabilis</i>	+	-	+	-	-	+
14. <i>I. minor</i>	+	-	+	-	-	+
15. <i>H. nitidus</i>	+	-	-	-	+	-
16. <i>P. antennata</i>	-	-	-	-	-	+
17. <i>P. picta</i>	+	-	-	-	-	-
18. <i>P. subinflata</i>	+	+	-	-	+	+
19. <i>P. soboculata</i>	-	-	-	-	+	-
20. <i>P. subterranea</i>	-	-	+	+	-	-
21. <i>P. unguilonginea</i>	-	-	+	-	-	-
22. <i>T. minor</i>	-	-	+	+	+	+
23. <i>A. boneti</i>	-	+	-	-	+	-
24. <i>A. sericus</i>	-	-	-	-	+	-
25. <i>S. krausbaueri</i>	+	-	-	-	-	-
26. <i>S. pumilis</i>	+	-	-	-	-	-
27. <i>N. murinus</i>	+	-	-	-	-	+
Total	14	2	8	3	9	11

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