

# Collembola (Hexapoda) from caves of the Community of Valencia, Spain

## Collemboles (Hexapoda) provenant de grottes de la Communauté de Valencia, Espagne

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### ABSTRACT

The study of 44 samples of Collembola from 19 caves from the Spanish provinces of Valencia, Castellón and Alicante has revealed the existence of 18 species inhabiting these caves, among which one species, *Disparrhopalites patrizii*, is reported for the first time from continental Spain, being three species (*Acherontiella xenylliformis*, *Troglopedetes absoloni* and *Troglopedetes cf. vandeli*) probably troglobite.

### RÉSUMÉ

L'étude de 44 échantillons de Collemboles provenant de 19 grottes des provinces espagnoles de Valencia, Castellón et Alicante a révélé l'existence de 18 espèces habitant ces grottes, parmi lesquelles une espèce, *Disparrhopalites patrizii*, est citée pour la première fois de l'Espagne continentale, et trois espèces (*Acherontiella xenylliformis*, *Troglopedetes absoloni* et *Troglopedetes cf. vandeli*) étant probablement troglobies.

## INTRODUCTION

Collembola is a group commonly found in caves. Usually we use habitat and morphological features to establish a classification of cave Collembola: Species limited to caves are considered *troglobites*, those living in caves, soil and related environments are *troglophiles*, and those found occasionally and temporarily in caves are *trogloxenes*. However, although these categories are useful, they are often problematic and insufficient, since it is difficult to ensure whether a species is a strict cave dweller when its biogeographical knowledge is not complete (Thibaud, 1994). Concerning morphological features characterizing collembolan cave species, a longer and thinner unguis (which represents an adaptation to the movement over water and wet surfaces) appears only in some cavernicolous species (Christiansen, 1965). Other traits generally associated to cave inhabiting fauna, as ocular regression and depigmentation, do not characterize troglobite collembolans, since they also occur in collembolan species inhabiting soil environments (Thibaud, 1970, 1976). Therefore, to fully categorize cave forms, data on their biology, ecophysiology and biogeography are necessary (Thibaud & Vannier, 1987).

A number of studies have analysed the fauna of cave collembolans in the Iberian Peninsula (e.g., Bonet 1931; Gama, 1962, 1977, 1979, 1984, 1985; Gisin & Gama, 1969, 1970, 1972; Jordana & Beruete, 1983; Arbea & Baena 2002-2003; Martínez *et al.*, 2004). The first data available on the cavernicolous Collembola from the Community of Valencia have been given by Bonet (1931), who recorded seven species from this region: *Hypogastrura* (*Mesogastrura*) *levantina* Bonet, 1930 (= *Mesogastrura ojcoviensis* Stach, 1919), *Onychiurus fimetarius* (L., 1766) (= *species inquirenda* (Gisin, 1960)), *Isotoma maritima* Tullberg, 1871 (= ?*Halisotoma maritima* (Tullberg, 1871)), *Pseudosinella sexoculata* Schött, 1902, *Heteromurus nitidus* (Templeton, 1835), *Troglopedetes absoloni* Bonet, 1931, and *Arrhopalites pygmaeus* (Wankel, 1860). In the present study, further data on the collembolan fauna from 19 caves of the Spanish provinces of Valencia, Castellón and Alicante are provided.

## MATERIALS

The materials concerning this study have been sent to me by Dr. Sergio Montagud Alario and Dr. Alberto Sendra Mocholi from the Museu Valencià d'Història Natural – Fundació Entomològica Torres Sala.

These materials were collected in the following nineteen caves from the Spanish provinces of Valencia, Castellón and Alicante: Cave 1: Cova Negra, Ayora, Valencia, 30SXJ550262; Cave 2: Cueva Hermosa, Cortes de Pallás, Valencia, 30SXJ707483; Cave 3: Cova de les Graelles/Alto de Tous, Tous, Valencia, 30SYJ021320; Cave 4: Cova de la Moneda, Cotes, Valencia, 30SYJ067261; Cave 5: Cova de les Meravelles, Llombai, Valencia, 30SYJ083537; Cave 6: El Túnel de Canals, Canals, Valencia, 30SYJ102117; Cave 7: Sima de l'Aguila, Picassent, Valencia, 30SYJ135560; Cave 8: Cova de les Meravelles, Alzira, Valencia, 30SYJ226340; Cave 9: Cova de les Ratetes, Corbera, Valencia, 30SYJ284366; Cave 10: Cova de les Rates Penades, Rótova, Valencia, 30SYJ367127; Cave 11: Cova Xurra, Gandía, Valencia, 30SYJ412176; Cave 12: Cueva de la Carrasquilla, Enguera, Valencia; Cave 13: Cova de l'Ondera, Aín, Castellón, 30SYK272205; Cave 14: La Covatilla, Aín, Castellón, 30SYK277203; Cave 15: Cueva Oscura, Adzaneta del Maestrat, Castellón, 30SYK371538; Cave 16: Cova de l'Ereta, Aín, Castellón, 30TYK277204; Cave 17: Cova dels Encenalls, Sant Mateu, Castellón; Cave 18: Cova de les Rates del Cap de Moraira, Teulada, Alicante, 31SBC520856; Cave 19: Cova de la Punta de Benimàquia, Dènia, Alicante, 31SBD451011.

These caves will be cited by the number above assigned in the text concerning the results.

Most of these materials, preserved in alcohol, and some specimens of several species (*Mesogastrura ojcoviensis*, *Acherontiella xenylliformis*, *Folsomia candida*, *Parisotoma notabilis*, *Heteromurus nitidus*, *Lepidocyrtus fimetarius*, *Pseudosinella infrequens*, *Arrhopalites pygmaeus* and *Disparrhopalites patrizii*), mounted in permanent slides are deposited in the Museu Valencià d'Història Natural - Fundación Entomológica Torres Sala. Specimens of almost all the species studied in this paper, mounted in permanent slides, are deposited in the Departamento de Zoologia da Universidade de Coimbra.

## RESULTS

A total of eighteen species of Collembola have been identified from the nineteen caves studied. Below, a relation of the species found with comments on distribution is provided.

### *Mesogastrura ojcoviensis* (Stach, 1919)

*Occurrence*: Cave 4. – numerous specimens, leg. A. Sendra *et al.*, 8.XII.2002. Cave 5. – 40 juv., leg. A. Sendra *et al.*, 21.XI. 2002. Cave 7. – 30

specimens, leg. S. Montagud, 21.III.2003. Cave 8. – numerous specimens, leg. A. Sendra *et al.*, 13.X.2002 and 17.XI.2002. Cave 9. – 7 specimens, leg. A. Sendra *et al.*, 11.VIII.2002. Cave 10. – 19 specimens, leg. S. Montagud *et al.*, 1.XI.2002-19.I.2003. Cave 11. – 18 specimens, leg. A. Sendra *et al.*, 1.XI.2002. Cave 13. – 1 specimen, leg. J. Albesa *et al.*, 10.XI-14-XII.2002. Cave 14. – 1 specimen, leg. J. Albesa *et al.*, 9.XI-14.XII.2002. Cave 15. – 8 specimens, leg. J. Albesa *et al.*, 24.XI.2002. Cave 18. – 60 specimens, leg. J. A. Zaragoza, 28.IX.2002.

European species. It has been mentioned in many caves of different provinces in the Iberian Peninsula: Valencia (Bonet, 1931; Gama, 1985), Alicante (Bonet, 1931), Murcia (Gama, 1984), Almería (Martínez *et al.*, 2004), Barcelona (Gama, 1985), Navarra (Jordana & Beruete, 1983), Madrid (Bonet, 1931), Bragança, Coimbra and Setúbal-Arrábida (Gama, 1962, 1964). Troglophile.

#### *Acherontiella xenylliformis* Gisin, 1951

*Occurrence*: Cave 1. – numerous specimens, leg. A. Sendra *et al.*, 25.VIII.2002.

Mediterranean species. It was known from caves of Morocco (Gisin, 1951; Gama, 1962, 1964) and Portugal-Faro and Coimbra (Gama 1962, 1964). It was also found recently in two caves of Córdoba-Spain (Arbea & Baena, 2002-2003) and Almería (Martínez *et al.*, 2004). Troglobite.

#### *Friesea albida albida* Stach, 1949

*Occurrence*: Cave 9.–3 specimens, leg. A. Sendra *et al.*, 11.VIII.2002.

European species with a wide distribution in Spain, occurring accidentally in caves.

#### *Deuteraphorura ghidinii* (Denis, 1938)

*Occurrence*: Cave 1.–6 specimens, leg. A. Sendra *et al.*, 25.VIII.2002.

Atlantic – Mediterranean species occurring in South Europe, North Africa and in the Canary Islands (Gama, 1988a; Gama & Ferreira, 2000), sometimes in caves.

*Folsomia candida* (Willem, 1902)

*Occurrence:* Cave 8. – 4 specimens, leg. A. Sendra *et al.*, 13.X.-17.XI.2002. Cave 14. – 4 specimens, leg. J. Albesa *et al.*, 9.XI.-14.XII.2002.

Cosmopolite species. Troglophile.

*Parisotoma notabilis* (Schäffer, 1896)

*Occurrence:* Cave 3. – 10 specimens, leg. A. Sendra, 19.I.2003.

Cosmopolite species, occurring accidentally in caves.

*Sinella coeca* (Schött, 1896)

*Occurrence:* Cave 16. – 1 specimen, leg. J. Albesa *et al.*, 9.XI.2002.

Species with a wide distribution. Troglophile.

*Entomobrya multifasciata* (Tullberg, 1871)

*Occurrence:* Cave 18. – 1 specimen, leg. J. A. Zaragoza, 28.IX.2002.

Species with a wide distribution, occurring accidentally in caves.

*Seira domestica* (Nicolet, 1841)

*Occurrence:* Cave 4. – 1 specimen, leg. A. Sendra *et al.*, 8.XII.2002.

Cosmopolite species, occurring in human environments.

*Heteromurus nitidus* (Templeton, 1835)

*Occurrence:* Cave 1. – 19 specimens, leg. A. Sendra *et al.*, 25.VIII.2002 and 6.X.2002. Cave 6. – 2 specimens, leg. A. Sendra *et al.*, 10.XI.2002. Cave 7. – 1 specimen, leg. S. Montagud, 21.III.2003. Cave 8. – 2 specimens, leg.

A. Sendra *et al.*, 13.X.2002. Cave 9. – 21 specimens, leg. S. Montagud *et al.*, 29.IX.2002 and A. Sendra *et al.*, 11.VIII.2002. Cave 10. – 1 specimen, leg. S. Montagud *et al.*, 1.XI.2002-19.I.2003. Cave 12. – 12 specimens, leg. A. Sendra and S. Montagud *et al.*, 8.III.2003. Cave 14. – 1 specimen, leg. J. Albesa *et al.*, 9.XI.-14.XII.2002. Cave 15. – 27 specimens, leg. J. Albesa *et al.*, 24.XI.2002 and 11.I.2003. Cave 16. – 1 specimen, leg. J. Albesa *et al.*, 9.XI.-14.XII.2002. Cave 17. – 6 specimens, leg. S. Montagud, 21.III.2003. Cave 19. – 9 specimens, leg. J. A. Zaragoza, 5.X.2002.

Species with a wide distribution, occurring principally in caves. Troglophile.

*Lepidocyrtus montseniensis* Mateos, 1985

*Occurrence*: Cave 9. – 1 specimen, leg. J. A. Zaragoza, 11.VIII.2002.

It was previously known from Barcelona (Mateos, 1986, 1988; Mateos & Selga, 1991) and Madrid (Luciáñez & Simon, 1991) as an edaphic species.

*Lepidocyrtus fimetarius* Gisin, 1964

*Occurrence*: Cave 2. – 10 specimens, leg. A. Sendra *et al.*, 6.X.2002.

It was described from St. Gervais (Seine-et-Oise, France) as edaphic and found also, as edaphic, in Portugal (Estoril-Lisbon and Urgeiriça-Viseu; Gama, 1966), in Hamburg (Germany; Hüther, 1971), in Shanghai (China; Rusek, 1971) and in Baghdad (Iraq; Rusek, 1981). Gisin (1967) has cited this species from one warm cave near Alhama (Murcia-Spain). Troglophile.

*Pseudosinella infrequens* Gisin & Gama, 1969

*Occurrence*: Cave 5. – 1 specimen, leg. A. Moreno and S. Teruel, 3.X.2002. Cave 8.- 1 damaged specimen, leg. A. Sendra *et al.*, 13.X.2002. Cave 9. – 4 specimens, leg. A. Sendra *et al.*, 11.VIII.2002. Cave 13. – 7 specimens, leg. J. Albesa *et al.*, 10.XI.2002.

Atlantic – Mediterranean species previously known from one cave near Alhama-Murcia (Gisin & Gama, 1969) and, as edaphic, from several localities

of the center and south of Portugal (Gama *et al.*, 1989, 1991, 1994, 1995, 1997, 1998; Sousa et Gama, 1994; Pinto *et al.*, 1997) and from Tenerife (Canary Islands; Gama, 1974a, 1974b, 1988a).

*Troglopedetes absoloni* Bonet, 1931

*Occurrence:* Cave 5. – 2 specimens, leg. A. Moreno and S. Teruel, 3.X.2002. Cave 9. – 1 specimen, leg. S. Montagud *et al.*, 29.IX.2002.

It was previously known from Mina del Cepellat (Calpe) Alicante. Troglobite. Endemic from the Community of Valencia.

*Troglopedetes cf. vandeli* Cassagnau & Delamare, 1955

*Occurrence:* Cave 11. – 8 damaged specimens, leg. A. Sendra *et al.*, 1.XI.2002-19.I.2003.

It was described from one cave in Lebanon and found in Tenerife (Canary Islands) also in caves (Gama & Ferreira, 2000). Troglobite.

*Megalothorax minimus* Willem, 1900

*Occurrence:* Cave 9. – 3 specimens, leg. S. Montagud *et al.*, 29.IX.2002.

Species with a wide distribution occurring sometimes in caves.

*Arrhopalites pygmaeus* (Wankel, 1860)

*Occurrence:* Cave 8. – 2 specimens, leg. A. Sendra *et al.*, 13.X.2002. Cave 11. – 8 specimens, leg. A. Sendra *et al.*, 1.XI.2002-19.I.2003. Cave 16. – 1 specimen, leg. J. Albesa *et al.*, 9.XI-14.XII.2002.

Holarctic species occurring in caves in all the Iberian Peninsula. Troglophile.

*Disparrhopalites patrizii* (Cassagnau & Delamare, 1953)

*Occurrence*: Cave 13. – 47 specimens, leg. J. Albesa *et al.*, 10.XI.-14.XII.2002.

It has been collected from caves in France, Italy, Greece, Crete, Great Britain, Canary Islands (Tenerife), Madeira and Azores (S. Miguel, Terceira, Santa Maria, Graciosa, Pico and S. Jorge) (Delamare Debutteville & Bassot, 1957, Gama & Ferreira, 2000). In this archipelago this species has been found on lava flows near the coast and in semi-dark caves (lava tubes) (Gama, 1988b, 1992; Ashmole *et al.*, 1996). In Vienna (Austria) it has been collected in the catacombs of St. Stephan's Cathedral and, as edaphic, in Italy and Germany (Bretfeld, 1999). This species was found for the first time in continental Spain. Troglophile.

## CONCLUSIONS

Among the cited species is interesting to emphasize the occurrence of *Troglopedetes absoloni*, described by Bonet in 1931 from the Mina del Cepellat (Alicante) and found in this study in two caves of the province of Valencia. According to our current data this species must be considered endemic from the Community of Valencia. In addition, *Disparrhopalites patrizii* is cited for the first time to the Iberian Peninsula. This species was already known from the Canary Islands (Gama & Ferreira, 2000).

The majority of the species found are troglophile, but *Acherontiella xenylliformis*, *Troglopedetes absoloni* and *Troglopedetes cf. vandeli* are probably troglobite.

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