Zootaxa 4044 (3): 391–410
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.4044.3.4
http://zoobank.org/urn:lsid:zoobank.org:pub:DD54E580-B6E7-441E-943C-BDDA2EB193C3

Sierra Nevada (Granada, Spain): a high-altitude biogeographical crossroads for millipedes (Diplopoda), with first data on its MSS fauna and description of a new species of the genus *Ceratosphys* Ribaut, 1920 (Chordeumatida: Opisthocheiridae)

JOSÉ D. GILGADO[1,5], HENRIK ENGHOFF[2], ALBERTO TINAUT[3], JEAN-PAUL MAURIÈS[4] & VICENTE M. ORTUÑO[1]

[1]*Research Team on Soil Biology and Subterranean Ecosystems. Department of Life Sciencies. Faculty of Biology, Chemistry and Environmental Sciences. University of Alcalá (UAH). A.P. 20. Campus Universitario. E-28805, Alcalá de Henares, Madrid, Spain*
[2]*Natural History Museum of Denmark (Zoological Museum), University of Copenhagen, Universitetsparken 15, DK-2100, København Ø, Denmark*
[3]*Department of Zoology, Campus Fuentenueva, Faculty of Sciences, University of Granada, E-18071 Granada, Spain*
[4]*Muséum National d'Histoire Naturelle, Dpt. Systématique et Evolution, 61 rue Buffon, F-75231 Paris Cedex 05, France*
[5]*Corresponding author. E-mail: josedomingo.gilgado@uah.es*

Abstract

Millipedes (Diplopoda), with a few notable exceptions, are poor dispersers, showing a very high degree of endemicity, not the least in mountains. The first samplings of the Mesovoid Shallow Substratum (MSS) of the higher altitudes of the Sierra Nevada Mountains (Baetic System, Southern Spain) have led to the discovery of a high number of millipedes, each of the species present showing a different degree of establishment in this subterranean environment. An update of the knowledge on the millipedes of this region, the first data of the millipede communities in the MSS and the description of *Ceratosphys cryodeserti* Gilgado, Mauriès & Enghoff **n. sp.** are here provided, as well as the first data on the humidity and temperature fluctuations in the MSS of this high mountain. The new species is similar to other Baetico-Riffan species, while the only previously known congener from the region, *C. soutadei* Mauriès, 1969, has more similarities to certain Pyrenean species. Biogeographical relationships of all the captured species are also discussed.

Key words: hypogean millipedes, MSS, Orophilous fauna, superficial subterranean habitats

Introduction

The habitat known as the Mesovoid Shallow Substratum, or the Superficial Subterranean Environment (originally described as *Milieu Souterrain Superficiel* and henceforth abbreviated MSS), is a hypogean habitat consisting of a network of interstices under the soil that may be formed by different processes and have different lithological components (Juberthie *et al*. 1980, 1981; Oromí *et al*. 1986; Ortuño *et al*. 2013). In some respects, conditions in the MSS are similar to those in caves (absence of light, high humidity, low temperature fluctuations), but unlike caves, the MSS is characterised by strong interconnection with the surface and soil layers, abundance of organic matter, and denser arthropod populations, making the MSS equally suitable for hypogean and certain epigean species (see for example Gers 1992, 1998; Culver & Pipan 2008; Nitzu *et al*. 2010, 2014; Pipan *et al*. 2011; Rendoš 2012). In some cases, the MSS harbours relict species that found shelter in this environment as a response to climatic changes (Christian 1987; Hernando *et al*. 1999; Růžička 1999; Ortuño *et al*. 2014a,b).

Exploration of the MSS in the Iberian Peninsula has led to the discovery of new species (Barranco *et al*. 2013; Ortuño *et al*. 2014a) but also new records that notably increase the known distribution areas of several arthropod taxa (Ortuño *et al*. 2013; Ortuño *et al*. 2014b) or provide new data about their ecological requirements (Ortuño & Toribio 1994; Gilgado *et al*. 2014; Gilgado & Ortuño 2015). Regarding millipedes, several discoveries have been made in the MSS in different parts of the world (Juberthie *et al*. 1980, 1981; Vicente & Enghoff 1999; Decu *et al*.

Accepted by W. Shear: 14 Oct. 2015; published: 19 Nov. 2015