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)

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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-Riffian 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.