*Zootaxa* 1757: 1–30 (2008)
www.mapress.com/zootaxa/


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

# New records and within-species variability of Iberian tardigrades (Tardigrada), with comments on the species from the *Echiniscus blumi-canadensis* series

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## Abstract

The present report describes the results obtained from a survey on the tardigrade communities of five microhabitats (leaf litter, and mosses and lichens on rocks and tree trunks) in the Sierra de Guadarrama (Madrid, Spain). Sampling design was conducted according to a spatially mixed stratified-random procedure. A list with new records for Europe, the Iberian Peninsula and Madrid is provided. I have added two species to the European check list, increased number of known species in the Iberian Peninsula from 118 to 131, and duplicated the number of species known in the Madrid Province. Besides, some variations in morphological characters have been observed within-species, the majority related to structures of the buccal-pharyngeal apparatus and claws. More within-species variability studies are needed to determine their validity as diagnostic characters. A specific discussion is made about morphological variability within the *Echiniscus blumi-canadensis* series, as a result of observations among and within species from the series.

**Key words:** terrestrial, leaf litter, lichen, moss, Spain, Eutardigrada, Heterotardigrada, *Echiniscus blumi*, *Echiniscus canadensis*, *Echiniscus mediantus*, *Echiniscus bisetosus*, *Echiniscus trisetosus*

## Introduction

Tardigrades are micrometazoans that show bilateral symmetry and range in size from 50 μm to 1,200 μm (Nelson 2002). This phylum, with uncertain phylogenetic position (see for example, Giribet *et al.* 1996; Schmidt-Rhaesa *et al.* 1998; Giribet 2003; Dunn *et al.* 2008) currently comprises 959 species (Guidetti & Bertolani 2005), inhabiting both limnoterrestrial and marine habitats all around the world (Nelson 1995). All tardigrades require a film of water surrounding their body, regardless of their habitat, to be active. However, under unfavorable conditions, some tardigrades enter into a reversible latency state, called cryptobiosis (Crowe & Crowe 2000), which has attracted the attention of researchers due to its potential biomedical and biotechnological implications (Crowe & Crowe 2000; Eroglu *et al.* 2000; Guo *et al.* 2000).

Few studies have been focused on Iberian tardigrades. Only 37 articles have been published, mainly dealing with tardigrade taxonomy and faunistic analyses (reviewed by Guil 2002; Guil & Guidetti 2005). However, as many as 98 limnoterrestrial tardigrade species have been identified in the Iberian Peninsula (Guil 2002; Guil & Guidetti 2005). Only five out of 37 articles mentioned above include tardigrades observed in the Madrid Province (central Spain) (Madrid Moreno 1911; Rodríguez Roda 1951; Mihelčič 1954; Guil 2002; Guil & Guidetti 2005) and only 28 species have been recorded in this area (Guil 2002; Guil & Guidetti 2005).

I designed a spatially mixed stratified-random collection in the Sierra de Guadarrama (Madrid, Spain) to collect as much diversity of terrestrial tardigrades as possible. Accordingly to Guil's revision (Guil 2002), we performed this faunistic survey exploring five terrestrial microhabitats (namely, leaf litter, mosses and lichens growing on rocks, mosses and lichens on tree trunks) in a great diversity of landscapes. My main objective

*Accepted by C. Beasley: 27 March 2008; published: 28 Apr. 2008*