



A new hypogean species of Iberian *Microtyphlus* and review of the taxonomic position of *Speleotyphlus* and *Aphaenotyphlus* (Carabidae: Trechinae: Anillini)

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Abstract

A new species of cave-dwelling Anillini (Coleoptera: Carabidae) *Microtyphlus charon* n. sp. is described from the “Surgençia de l’Orao” Cave (Valencia, East Spain). *M. charon* n. sp. is close to two troglobiomorphic species, *M. infernalis* and *M. alegreï* (new comb.), sharing the same aedeagus morphology. These three species constitute a monophyletic group that is hypothesized as originating in the endogean environment of the southern end of the Iberian Mountain Range, around the Valencia trough. These three species live in caves that were possibly isolated by the Miocene basins. The analysis of key morphological characters in the *Microtyphlus* phyletic series showed that the slenderness of appendages, that defines taxa as *Speleotyphlus* and *Aphaenotyphlus*, are of little phylogenetic value, as this also happens with other troglobiomorphic features (e.g., depigmentation). However, other morphological characteristics (male aedeagus, chaetotaxy, labial tooth) suggest a close relationship between *Microtyphlus*, *Speleotyphlus* and *Aphaenotyphlus*, which leads us to propose the last two taxa as synonyms of *Microtyphlus*.

Key words: Arthropoda, Hexapoda, Coleoptera, Carabidae, Anillini, *Microtyphlus*, Taxonomy, Systematic, cave fauna, troglobiormorphism

Introduction

The subterranean ecosystem is a mix of different habitats that play important roles as refuges to several zoological groups, some of which are primitive in origin. It is common for such refuges to exist in the vast karstic regions of the Iberian Peninsula (Bellés 1987). Some of these regions belong to the Mediterranean arc (Domingo *et al.* 2006; Barranco *et al.* 2008). However, it is important to note that not all subterranean species have undergone important physiological and morphological changes. The subterranean ecosystem is also the refuge for epiedaphic fauna—hygrophile and sciophile—trying to escape from xeric conditions affecting large areas during particular geological periods, as exemplified by the carabid *Trechus barratxinai* Español 1971 (Ortuño 2004). Subterranean colonization causes isolation between populations and eventually notable rates of speciation, as exemplified by the high level of microendemism found in the ibero-balearic carabid fauna (Jiménez-Valverde & Ortuño 2007).

The subterranean ecosystem is divided into two well-defined separate environments, the endogean environment corresponding to the B-horizon of the soil and the hypogean environment closely related with the rock or C-horizon (Ortuño & Gilgado 2010). The rock has micro-, meso-, and macrovoids. This terminology differs from the more traditional which considers the hypogean milieu to be part of the subterranean milieu in the strictest sense (Giachino & Vailati 2010); this last is divided into deep cavities and the Mesovoid Shallow Substratum –*Milieu souterrain superficiel* or MSS of Juberthie (2000). The adaptive characters for each of these subterranean environments are different (Casale *et al.* 1998), although they may share homoplastic features because of convergence. Parallel evolution has probably occurred in repeated instances, thus inducing errors in the taxonomy of cave-dwelling species (Ortuño & Sendra 2010). Endogean species usually enter caves through hydrochoria, live in “epithelial