



Phylogenetic relationships among the *Epiperipatus* lineages (Onychophora: Peripatidae) from the Minas Gerais State, Brazil

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Abstract

The taxonomy and phylogeny of Onychophora (velvet worms), in particular of the neotropical Peripatidae, are understudied, due to a low number of useful morphological characters. In this paper, we use mitochondrial DNA markers to investigate the evolutionary relationships among the *Epiperipatus* lineages from the Minas Gerais State of Brazil. Our phylogenetic analyses of two fragments of the *cytochrome oxidase subunit I (COI)* and *small ribosomal subunit RNA* genes (*12S rRNA*) provide evidence of three major monophyletic clades and indicate cryptic speciation among specimens from different geographic localities. Our findings highlight the utility of molecular methods for studies of cryptic speciation, phylogeography, and evolutionary history of Onychophora.

Key words: Phylogeny, phylogeography, mtDNA, velvet worms, cryptic speciation

Introduction

Several studies have been carried out on cryptic speciation and diversity of the Peripatopsidae from South Africa, Australia and New Zealand whereas the second major onychophoran subgroup, the Peripatidae, has received little attention (Gleeson *et al.* 1998; Treweek 1998, 1999, 2000; Sunnucks & Wilson 1999; Rockman *et al.* 2001; Daniels *et al.* 2009; Daniels & Ruhberg 2010). Since morphological characters either vary intraspecifically or are uniform among the peripatid species, traditional morphological methods are of limited value for studies of their taxonomy and phylogenetic relationships. However, recent studies indicate high diversity and endemism among the Brazilian peripatids, which might be a common phenomenon of Onychophora (Sampaio-Costa *et al.* 2009; Oliveira *et al.* 2010).

In this study, we use mitochondrial DNA markers to clarify the phylogenetic relationships among the *Epiperipatus* lineages in the Minas Gerais State (Brazil). Our findings confirm previous morphological observations on species diversity and suggest a high number of potentially new species. In addition, we found at least two cryptic species, which had remained undetected by using morphological methods alone.

Material and methods

Specimens. We analyzed 30 *Epiperipatus* specimens, which originated from 14 different localities in the Minas Gerais State (localities “A–J and “L–O in Fig. 1), obtained from the scientific collection of the Department of Zoology, Universidade Federal de Minas Gerais (DZUFMG). Additional tissue samples were obtained from two specimens from Serra da Moeda (locality “K in Fig. 1) held in the collection of the Museu Nacional do Rio de Janeiro [National Museum of Rio de Janeiro]. Only the specimens from the localities “A–C were identified as representati-