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No millipede endemics north of the Alps? DNA-Barcoding reveals *Glomeris malmivaga* Verhoeff, 1912 as a synonym of *G. ornata* Koch, 1847 (Diplopoda, Glomerida, Glomeridae)

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Abstract

In order to evaluate the status of the only species of pill millipede (Glomerida) endemic to Germany, *Glomeris malmivaga* Verhoeff, 1912, a DNA barcoding study based on the COI mitochondrial gene was conducted. Sequences of *G. malmivaga* were compared to those of *G. ornata* Koch, 1847 from Slovenia, of which the former was previously described as a variety of the latter before being elevated to subspecies- and, recently, species-rank. Included in the analysis were specimens of *G. helvetica* Verhoeff, 1894, also originally described as a variety of *G. ornata*, which was supposed to be closely related to *G. malmivaga* based on its morphology, as well as geographical proximity of occurrence. Additionally, *G. valesiaca* Rothenbühler, 1899, which occurs in sympatry and looks quite similar to *G. helvetica* was also sequenced for the first time and included in the study. Sequences of four widespread *Glomeris* species, all occurring in close proximity to *G. malmivaga*, *G. marginata* Villers, 1789, *G. connexa* Koch, 1847, *G. klugii* Brandt, 1833 and *G. intermedia* Latzel, 1884 were downloaded from Genbank and incorporated in the analysis. While *G. helvetica* and *G. valesiaca* were found to be clearly separate from *G. ornata* (11.8–14.6% p-distance), *G. malmivaga* is almost identical to the latter (0.5% p-distance), despite the large geographical distance between both species. Because of their great morphological and genetical similarity, *G. malmivaga* **n. syn.** is synonymised under *G. ornata*.

Key words: soil arthropod, endemism, central Europe, Barcoding, COI

Introduction

The pill millipedes of the order Glomerida have their center of diversity in Europe. Aside from the mainly Asian *Hyleoglomeris* Verhoeff, 1910 (Golovatch *et al.* 2006), the most species-rich genus of the order is *Glomeris* Latreille, 1803, whose species are mainly distributed in Europe (Kime & Enghoff 2011), with a few species occurring in northern Africa (Golovatch *et al.* 2009).

The taxonomy of the genus *Glomeris* is difficult and outdated, with numerous recent changes and clarifications being undertaken (Hoess *et al.* 1997, Hoess & Scholl 1999b, 2001). The genus reaches its highest concentration in terms of the number of species just south of the Alps in Italy (Kime 2000). Only a single species, *G. marginata*, is present in the northern half of Germany, southern Scandinavia, and the British Isles. The genus has several species each of which is found in only a small area (hence referred to as microendemics), most of these microendemic species are located either in single caves or in northern Italy (Strasser & Minelli 1984, Foddai *et al.*1995, Kime & Enghoff 2011), have not been collected for more than 75 years, and warrant a redescription.

However, one of the microendemic species sticks out: *Glomeris malmivaga* Verhoeff, 1912. This species is only known from two small areas in southwestern Germany (Spelda 1999, Kime & Enghoff 2011), and is the only known endemic pill millipede north of the Alps. *G. malmivaga* was originally described as *G. ornata* var. *malmivaga*, a variety of *G. ornata* Koch, 1847, a species otherwise distributed in the southeast Alps and the northwest Balkans (Kime & Enghoff 2011). Because of the disjunct area of distribution of *G. malmivaga* in southwest Germany, the taxon was elevated to a subspecies, *G. ornata malmivaga*, 20 years later (Schubart 1934); a move which was followed by a number of recent authors (e.g. Spelda 1991, 1998, Hoess 2000). However, just a

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