



New species of *Anillinus* Casey (Carabidae: Trechinae: Bembidiini) from Great Smoky Mountains National Park, U.S.A. and phylogeography of the *A. langdoni* species group

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Abstract

The *Anillinus langdoni*-species group is characterized and two new species are described, *Anillinus cieglerae* Sokolov and Carlton **sp. nov.** and *A. pusillus* Sokolov and Carlton **sp. nov.**, both from Great Smoky Mountains National Park. The *langdoni*-group includes four species at present, three apparently endemic to the Great Smoky Mountains and adjacent mountains of western North Carolina/Tennessee, and a fourth from South Mountains of middle North Carolina. They are distinguished mainly using characters of the male genitalia and to a lesser extent, differences in shapes of female spermathecae. Phylogenetic analyses based on aedeagal morphology and COI gene sequences yielded conflicting results, with the later providing a phylogeny that was more parsimonious with expectations based on geographic distributions. Speciation within the group may derive from ecological constraints and altitudinal fluctuations of habitat corridors during past climate changes combined with the impact of local watersheds as fine scale isolating mechanisms.

Key words: Coleoptera, Adephaga, Carabidae, *Anillinus*, South Appalachians, new species, taxonomy, identification key, COI gene sequences, phylogeography

Introduction

The genus *Anillinus* Casey is one of the most diverse genera of carabid beetles in the Southern Appalachian region of eastern United States. Species representing several distinct forms adapted to certain types of habitats inhabit different altitude zones. Localities within each zone may harbor up to three morphologically distinct lineages that presumably reflect a long and complicated history of speciation in the region. In the last review of the genus (Sokolov *et al.* 2004) morphological characters of these lineages were summarized. That paper provided a basis for character analysis within complexes of *Anillinus* species across the region. The Great Smoky Mountains of eastern Tennessee and western North Carolina, and Great Smoky Mountains National Park (GSMNP) in particular, is exceptionally important as an area of *Anillinus* species radiation. Five species of the genus have been described from GSMNP to date (*l.c.*), and each of these species represents a morphologically distinct lineage with putative relatives in other localities of the Southern Appalachian region.

During the past three years of sampling of the litter fauna at the GSMNP, we have discovered two new species that are similar to *Anillinus langdoni* Sokolov and Carlton externally, including microsculpture patterns. In this paper we describe these species, provide a determination key for all extensively microsculptured species of *Anillinus* from the Southern Appalachians, and discuss the evolutionary history of the *langdoni*-species group as inferred from distributional data, morphology, and analysis of cytochrome oxidase I (COI) gene sequences.