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New species of *Anillinus* Casey (Carabidae: Trechinae: Bembidiini) from the Southern Appalachians and phylogeography of the *A. loweae* species group

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Abstract

The *Anillinus loweae*–species group comprises five species occurring in the southern Appalachian Mountains and adjacent upland terrains in southeastern United States. Three new species are described herein. Two are members of the *loweae*-group, *Anillinus merritti* **sp. nov.** from Great Smoky Mountains National Park (GSMNP) (southeastern Tennessee and western North Carolina) and *A. juliae* **sp. nov.**, from McMinn County, Tennessee. The third, *A gimmeli* **sp. nov.** from GSMNP, is closely allied to them morphologically. *Loweae*-group species may be distinguished from those of other species groups by the presence of paramedian areas without microsculpture on the head. They occur in forest litter habitats and the group's distribution extends from Mississippi and Alabama in the south to the French Broad River of North Carolina and Tennessee in the north. Species within the group are distinguished mainly using characters of the male genitalia and to a lesser extent, differences in shapes of female spermathecae, body size, and relative proportions of body parts. A phylogeny of *loweae*-group species based on analyses of COI gene sequences, in combination with geographic distributions and correlations to likely physiographic isolating mechanisms, allow a hypothetical reconstruction of the biogeographic history of the group. The following major factors affected speciation within the *loweae*-group: (1) division of former ancestral ranges, due to changes in major drainage systems beginning prior to the onset of Pleistocene glaciation; (2) Pliocene-Pleistocene climate cooling and subsequent dispersal constrained by physical barriers; (3) Early Pleistocene glacial cycles influencing altitudinal stratification among species.

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

Introduction

This paper is our fifth contribution to the knowledge of tiny, blind carabids of the subtribe Anillina from the southern Appalachian Mountains and adjacent highlands (Sokolov *et al.* 2004; Sokolov *et al.* 2007; Sokolov & Carlton 2008; Sokolov & Watrous 2008). In this paper we describe three new species, discuss phylogenetic divergence and local biogeography within the *loweae*-group (group 2 in part, Sokolov *et al.* 2004). Data presented here and in previous papers contribute to hypotheses about the evolutionary history of the subtribe in North America, specifically the eastern lineage of anillines having umbilicate series of setae of type A (*sensu* Jeannel 1963). Significant obstacles to these investigations historically have included a lack of specimens from large areas within the species' ranges, especially along zones of sympatry and parapatry. This lack of data limits assessments of the possible impacts of natural barriers (e.g., rivers) in isolation and dispersal of *Anillinus* populations. Recent intensive sampling within and around Great Smoky Mountains National Park (GSMNP) has allowed a reasonably comprehensive distributional dataset for two diverse species groups, the *langdoni*-group (reviewed by Sokolov *et al.* 2007) and the *loweae*-group, reviewed here. Members of the two groups are morphologically distinct. *Langdoni*-group species are in general smaller (1.42–1.75mm) and characterized having the dorsal surface of the head (frons and vertex) totally covered by microsculpture. *Loweae*-group species are larger in general (1.61–2.12mm) and characterized by having two

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