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Derek A. Woller
Texas A&M University

Sandor L. Kelly
University of Central Florida

Daniel K. Young
University of Wisconsin, dkyoung@wisc.edu

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Comments on a Major Range Extension of the Little-Known *Acrocera bakeri* (Diptera: Acroceridae)

Derek A. Woller¹, Sandor L. Kelly², and Daniel K. Young^{3*}

Abstract

The spider fly *Acrocera bakeri* Coquillett, 1904 (Diptera: Acroceridae) is reported as a new state record for Wisconsin. This is a major range extension, because this rarely-encountered species was previously known only from the western U.S., specifically Arizona, California, and Nevada. The taxonomic history of the species is briefly discussed and hypotheses are offered for its unexpected presence in Wisconsin.

Acroceridae, commonly referred to as spider flies, is a fascinating and understudied family within the insect order Diptera. Based on personal observations and correspondence, and as indicated by recent descriptions of species and genera (Winterton 2012, Schlinger et al. 2013), the family is also not well-represented in collections. The life histories of its species are intriguing as well in that the larvae are spider parasitoids that exhibit hypermetamorphic development (distinctly different larval stages: Schlinger 1987). Based on the examination of numerous specimen data labels, trapping (especially with Malaise traps) appears to be one of the most effective methods of capturing these cryptic flies.

While examining and identifying acrocerids on loan from the University of Wisconsin Insect Research Collection (WIRC) in Madison, WI, two male specimens quickly stood out from the remainder. These specimens were determined to be *Acrocera bakeri* Coquillett, 1904 (Diptera: Acroceridae) (Fig. 1A–D). Not only does this discovery constitute a new state record for Wisconsin, it also suggests the range of *A. bakeri* is considerably wider and much farther east than previously known. Prior to this, *A. bakeri* had been considered a western U.S. species, having been recorded only from the western U.S. states of Arizona, California, and Nevada (Coquillett in Baker 1904, Sabrosky 1948). Herein, we report this new record, discuss potential reasons for the extension of its range, and include figures of the species.

Materials and Methods

Digital images of one specimen were taken in the Song Laboratory of Insect Systematics and Evolution at the University of Central Florida (UCF) (recently relocated to Texas A&M University) using a Visionary Digital BK Plus Imaging System in combination with a Canon EOS 7D camera and 65mm lens (often coupled with a 1.4x magnifier) to take multiple images at different focal lengths. The resulting files were converted from RAW to TIFF format using Adobe Lightroom 3.2

¹Song Laboratory of Insect Systematics and Evolution, Department of Entomology, Texas A&M University, College Station, TX, U.S.A. (e-mail: asilid@gmail.com).

²University of Central Florida Collection of Arthropods (UCFC), Department of Biology, University of Central Florida, Orlando, FL, U.S.A.

³Department of Entomology, University of Wisconsin, Madison, WI, U.S.A.

* Corresponding author: (e-mail: dkyoung@wisc.edu).

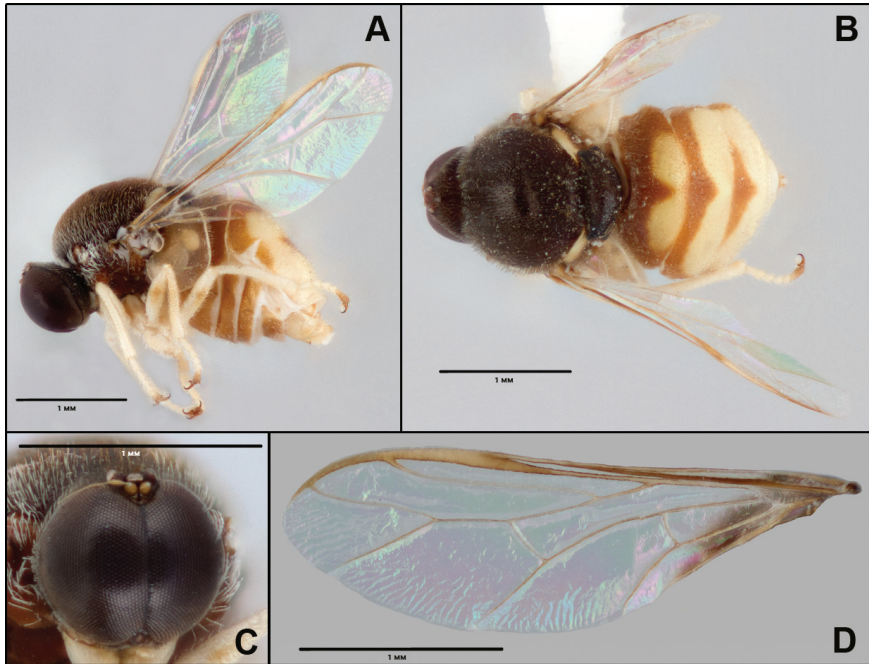


Figure 1. *Acrocerus bakeri* male. (A) Habitus, lateral view; (B) Habitus, dorsal view, displaying characteristic abdominal pattern; (C) Head, anterior view; (D) Left wing, dorsal view. Composite Digital Images: D.A. Woller.

and then stacked into a single composite image using Zerene Stacker (v.1.02). Next, Adobe Photoshop CS5 Extended was used to add a scale bar and adjust light levels, background coloration, and sharpness.

The habitat image (Fig. 2) was taken using a Canon EOS Rebel T2i digital camera and depicts the specific locality where the acrocerids were captured in a Malaise trap. This site is dominated by large-toothed aspen, *Populus grandidentata* Michaux, within the confines of Quincy Bluff in southcentral Wisconsin (TNC 2015). Originally purchased by The Nature Conservancy, Quincy Bluff and Wetlands has recently been turned over to the Wisconsin Department of Natural Resources for its management. The bluff area is largely managed as an oak-pine savanna with smaller prairie restorations, although numerous sites within the acreage have significant aspen stands. Malaise traps have been running for several years in aspen, mixed oak (*Quercus* spp.), and jack pine (*Pinus banksiana* Lambert) habitats, but the acrocerids discussed here were recovered solely in the aspen or oak-aspen habitat.

The specimens were field collected into 70–80% ethanol. However, since most Diptera are prone to excessive tissue distortion during the normal dehydration process associated with pinning, the HMDS technique (Nation 1983) was used in specimen preparation to minimize exoskeletal collapsing and shriveling.

Two male specimens were examined from the same locality: U.S.A.: WI: Adams Co., Quincy Bluff TNC, 43.86627, -089.88363 [WGS84], collected by Daniel K. Young, *ex*: Malaise in *Populus grandidentata* blow. One specimen was collected 13–21 July 2011 and the other 26 July–1 August 2011. Both specimens are deposited in the WIRC.



Figure 2. Aspen stand habitat where both male specimens of *Acrocera bakeri* were recovered from a Malaise trap (image taken 29 September 2014).

Digital Image: D. K. Young.

Results and Discussion

The taxonomic history of *A. bakeri* is convoluted. Prior to Sabrosky (1948), males of *A. bakeri* and *Acrocera melanderi* Cole, 1919 were comingled with a third species: *Acrocera bulla* auctorum multorum, non Westwood, 1848, which was named and described as *Acrocera steyskali* Sabrosky, 1944 due to his (and previous authors') disagreement with the original description in relation to specimens in their possession. Sabrosky (1948) did not indicate specifically how *A. melanderi* and *A. steyskali* differ, because he wanted to first examine the type of *A. melanderi*. However, he suspected that *A. steyskali* might be a junior synonym of *A. melanderi*, a suspicion confirmed by Schlinger's (1965) synonymization of the two species.

Regarding *A. bakeri* and *A. steyskali*, Sabrosky (1948) commented that males were superficially similar while females were quite different. His couplet that separates the two species, his comments regarding the males of *A. bakeri*, and his citing of figures from an earlier work (Sabrosky 1944) indicate that the general abdominal color pattern (Fig. 1B) is the primary character separating the males of the species. Although Sabrosky (1948) insisted this patterning was enough to consider *A. bakeri* a unique species, it should be noted that he possessed only nine specimens, seven of which were males. Furthermore, *A. bakeri* was originally described from a single female from Nevada (Coquillett *in* Baker 1904), while all other known specimens are from Arizona and California (Sabrosky 1948).

We know first-hand that acquiring acrocerid material is generally difficult, which, as outlined above, can cause taxonomic issues. Thus, at first, it does seem

remarkable that this hitherto western species has been found in a state so far to the northeast, so we offer the following hypotheses to explain this new locality.

First, it is feasible that the Wisconsin specimens represent a new species based largely on the geographic location. We are hesitant to follow this hypothesis, because over-splitting in Acroceridae is not unknown, especially in *Acrocera* and *Ogcodes* (Kehlmaier and Almeida 2014, C.J. Borkent personal communication), and we still have very few specimens. C.J. Borkent (personal communication) has suggested that a general lack of geographically-intermediate specimens has often led to over-splitting, as many species have been described from only a few specimens in a small geographic region. Probably, as more specimens are acquired, colors, and even patterns, may exhibit variation across the range. Recently, Kehlmaier and Almeida (2014) utilized molecular and morphological evidence to demonstrate this possibility. They investigated a potential species complex in the European acrocerid, *Acrocera orbiculus* (Fabricius, 1787), and, although some degree of differentiation was detected in both sets of evidence, they concluded that variation at the genetic level was not significant enough to warrant the recognition of multiple species. They posited that a high degree of phenotypic plasticity was responsible for the observed differences in specimen size and color throughout its range and within populations.

A second hypothesis (C.J. Borkent, personal communication) is that the spiders serving as hosts (currently unknown) for larvae of *A. bakeri* may have moved eastward, whether by human-mediated means or naturally. If it was the latter, then it might imply that these spiders move fairly quickly in terms of time (1948 until now). Alternatively, the flies, and their spiders, may actually have moved westward, and *A. bakeri* may have simply gone unrecorded in the non-western U.S. until now. Yet another possibility is that either the hosts or their corresponding flies (or both) are actually widespread across the U.S., but the flies are rarely collected. Finally, it is conceivable that these flies and their hosts are now becoming more common, in general, due to a suite of ecological and environmental reasons, like climatic alteration, human-mediated habitat fragmentation, or even host switching. Given the relatively low numbers of acrocerids in U.S. insect collections, none of these ideas are improbable and only further collecting efforts will provide support for one to prevail over the others.

Since we possessed only two males, we followed the more conservative approach of assigning the Wisconsin specimens to *A. bakeri* until additional material or other evidence indicates otherwise. The Wisconsin specimens strongly conform to the pattern concept of Sabrosky (1948), and we see no other obvious features to suggest that these males should be considered a new species.

We strongly encourage the continued pursuit of members of this fascinating fly family as increased knowledge will only come from the acquisition of more acrocerids; this is not exactly a new idea (Sabrosky 1944), but worth repeating. Quite likely, many collections possess undiscovered acrocerid treasures – perhaps contained in the vast unsorted residues of insect traps. Such “insect soup” often sits untouched for years in the average collection due to time and personnel constraints (ABN 2015). We conclude with this invitation: if you encounter unidentified acrocerids and would like them identified (to at least the genus level), we encourage you to contact the first author.

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Fellow in the third author's lab, whose photo of another *Acrocera* species online (Gruber and UW-Madison Dept. of Entomology 2015) caught the eye of the first and second authors and led indirectly to this work. You never quite know what tasty morsels will be found within insect soup, so, by all means, dig in! Finally, we gratefully acknowledge the constructive input from two reviewers of the manuscript.

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