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Morphology and life history of *Brachypeplus glaber* LeConte (Coleoptera: Nitidulidae), with a discussion of multiple life stage data for phylogenetic analyses

ANDREW R. CLINE¹, PAUL E. SKELLEY² & PAOLO AUDISIO³

¹Plant Pest Diagnostics Center, 3294 Meadowview Rd., Sacramento, CA 95832. E-mail: andrew.cline@cdfa.ca.gov

²Florida State Collection of Arthropods, Florida Department of Agriculture - DPI, 1911 SW 34th St., Gainesville, FL 32608.

E-mail: paul.skelley@freshfromflorida.com

³Department of Biology and Biotechnologies 'Charles Darwin', Sapienza Rome University, Rome, Italy.

E-mail: paolo.audisio@uniroma1.it

Abstract

A detailed description of the sap beetle *Brachypeplus glaber* LeConte (Nitidulidae) is provided, including egg, larval, pupal and adult stages. Rearing and DNA barcoding were used to confirm life stage identifications. This is the first New World *Brachypeplus* species for which larval and pupal descriptions are available. Characters and character states for larvae, pupae, and adults are discussed at the species and generic levels within the context of phylogenetic revisions at different hierarchical levels.

Key words: Sap beetle, morphology, larvae, pupae, DNA barcode, COI, natural history, systematics, phylogeny

Introduction

Brachypeplus Erichson is a large, globally distributed beetle genus in the subfamily Cillaeinae, family Nitidulidae. Species diversity is richest in tropical areas, with no *Brachypeplus* species shared between eastern and western hemispheres (Grouvelle 1913). Within the western hemisphere more than twenty described species are currently known. However, there are likely many times this number of undescribed species based on estimates from museum specimens from localities throughout Central and South America (Cline, pers. obs.). Little species overlap occurs between South, Central, and North America. Only *B. anceps* Murray and *B. mutilatus* Erichson are found ubiquitously throughout the Neotropics (Blackwelder 1945); however, many distribution and species records have not been checked and voucher material is not available for many historical records on which these distributions are based. There is a high likelihood that *B. anceps*, in particular, has been misidentified from several areas.

Members of *Brachypeplus* are often found in subcortical conditions (Hamilton 1894; Rozen 1963; Cline, pers. obs.; Audisio, pers. obs.) where they persist on fungal substrata. The exceedingly dorso-ventrally flattened bodies of these beetles enable them to navigate the confined subcortical spaces beneath bark and between the cracks and crevices in palm sheaves. In the Neotropics, the first author has collected other species of *Brachypeplus*, i.e., *B. anceps*, *B. mutilatus*, *B. staphylinoides* Sharp, and *B. vicinus* Sharp, within split palm sheaves. This was accomplished by splitting juvenile palm stalks length-wise and leaving the splayed stalks upright and otherwise intact. After 2–3 days of incubating air-borne fungal propagules, the stalks would be reexamined by slowly and methodically pulling the splayed stalks apart and examining the minute cracks and crevices where fungal growth was occurring. Adult beetles would then be aspirated from the palm. Split stalks could be “harvested” for *Brachypeplus* specimens daily as beetles would constantly reinvade the fungus-infested palm. Hyphae and other fungal matter were observed following dissection of the gut in specimens from both Costa Rica and Puerto Rico (Cline, unpub. data); however, no further analyses were completed on the fungi. In Florida, several large series of *B. glaber* LeConte specimens were obtained by Dale Habeck in the 1960s, 1970s and onward by splitting senescent

molecular methods for associating immatures of *B. glaber* with adults of the species should provide others with a means to establish a 100% connection between life stages of this species. This same method was recently used to confirm the specific identity of larval and adult stages and host-plant associations of a *Brassicogethes* species in northwestern Spain (Audisio *et al.* 2011). Molecular methods for associating life history stages have been performed in other arthropods with similar success (Caterino & Tishechkin 2006; Slowik & Blagoev 2012); however, this is the first time these methods have been extensively used for Nitidulidae.

The description of immature forms for *B. glaber* provided here are the first known complete immature descriptions for this genus. Böving & Rozen (1962) included *B. rubidus* (an African member of the genus) in their key to mature larvae of Nitidulidae (couplet 21) and provided drawings of the mesothorax, first abdominal segment and the spiracular tube of the first abdominal segment. However, a complete description is lacking and there are no habitus or other figures provided. In addition, *B. rubidus* pupae were partially figured, but not fully described, in a preliminary treatment of nitidulid pupae (Rozen 1963). Thus, we feel warranted in our statement that this is the first comprehensive larval or pupal description for the genus. The pupal stage of *Brachypeplus* is thus far known only from the African *B. rubidus* (Rozen 1963) and our observations herein for *B. glaber*. This is significant not only for understanding the immature stages of these beetles, assessing potentially phylogenetic characters, and providing a means to identify this species, but also for developing a more robust knowledge base for understanding the biology of these beetles in confined subcortical conditions and how this biology may reflect ecological interactions with congeners (of different life stages), commensals, and food sources.

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Dale Habeck, one of the academic mentors of author Skelley, worked on the life history of *Brachypeplus glaber* in the 1960s–1970s and produced rough drafts of a manuscript during that time. Dale died in 2009, leaving many specimens and a long-term project unpublished. The unfinished rough draft manuscript and some original line drawings were graciously supplied by Dr. J. Miller and Dr. D. Matthews, MGLC. We hope this manuscript provides a satisfactory end to that work.

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