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Discovery of a new species of *Caloptilia* (Lepidoptera: Gracillariidae) from east and central Africa with its suggested associated host (Gentianales: Rubiaceae) and natural enemies (Hymenoptera: Eulophidae)

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Abstract

A new species of the leaf-mining moth genus *Caloptilia* (Gracillariidae), *C. mwamba* **sp. nov**., suggested to be associated with *Cremaspora triflora* (Thonn.) K.Schum. (Rubiaceae) is described from east and central Africa. The taxonomic relationships of the new species with its congeners from the Oriental and the Palaearctic regions are discussed. Newly obtained taxonomic and biological data are linked with the DNA barcode workbench in BOLD, providing the molecular, machine-readable identification tag of the new species. New distribution and morphological data for two parasitoid species, *Afrotroppopsis risbeci* Gumovsky, 2007 and *Zaommomentedon newbyi* (Kerrich, 1969) (Eulophidae), which were found to be associated with *C. mwamba* **sp. nov**., are presented.

Key words: Afrotropical, DNA, Eulophidae, Gracillariidae, integrative taxonomy, new species, multitrophic interactions, Rubiaceae, vulnerable biotopes

Introduction

Some older and more recent studies suggest that direct resource competition among herbivorous insects, including leaf-miners, has much less impact on relevant populations than the interactions between herbivorous insects and their natural enemies (Masters & Brown 1992; Denno *et al*. 2000; Ohgushi 2005; Ohgushi *et al*. 2012; Tack *et al*. 2012). The interplay and effects of such interactions may also determine patchy distribution patterns by the herbivorous insects (Maron & Harrison 1997) or act as a major force structuring the insect communities (Morris *et al*. 2004, 2005; van Veen *et al*. 2006; Kaartinen & Roslin 2013). Within the system of herbivorous leaf-mining moths and their natural enemies, the parasitoids can switch from local hosts to new hosts (Murphy & LaSalle 1999; Girardoz *et al*. 2006, 2007), and even follow the range of expansion of their new hosts (Gebiola *et al*. 2013). Until now no studies have addressed the composition of the interacting insect system consisting of a herbivorous leaf-mining moth species, its host and its parasitoids in Africa, yet these studies are important to understand how members of different insect orders adapt to specific environmental conditions in vulnerable African biotopes. There is a big potential for an extensive array of surveys to study the herbivorous host-parasitoid communities in sub-Saharan Africa and to record the tritrophic interactions of the ecologically interacting units (Kaartinen & Roslin 2013).

In order to understand the evolutionary processes that generate and sustain the diversity in tropical faunas of leaf-mining moths, several trials were made to integrate the obtained molecular data with traditional approaches. The phylogenetic results obtained so far on the genera of Gracillariidae (Kawahara *et al*. 2011; De Prins & Kawahara 2012; Regier *et al*. 2013) suggest that the generic lineages in Gracillariidae radiated in different geological ages, as a result of different geological events and/or ecological adaptations, for example the genus *Phyllonorycter* originated 50.3–73.3 million years ago (Lopez-Vaamonde *et al*. 2006). According to Kawahara *et al*. (2011), the diverse genus *Caloptilia* speciated at about the same time.

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