



Discovery of the second European *Amalopsis* species: an integrative survey of the widespread *Pedicia (Amalopsis) occulta* (Meigen, 1830) (Insecta, Diptera, Pediciidae)

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Abstract

Integrative taxonomy enhances species discovery and facilitates species delimitation by combining DNA sequence data, morphology, and distributional and ecological information. In this paper we use complementary methods of morphology and DNA barcoding to delineate species boundaries in a widespread European spring-dwelling crane-fly, *Pedicia (Amalopsis) occulta* (Meigen). We describe a previously overlooked large cryptic dipteran as *Pedicia (Amalopsis) fusca* n. sp. We also designate the lectotype of *P. occulta* of the basis of a comprehensive study of relevant type specimens. Morphological differences between the two species are delicate but detectable, and comprise mostly male genital structures. However, the sequence divergence of 13.1% reflects an ancient divergence, which plausibly pre-dates the Pleistocene. The European *Amalopsis* species differ significantly from all the rest of *Amalopsis* species with Far East distributions, but share a number of similarities with a species identified from the Himalayas, India and described as *Pedicia (Tricyphona) ericarum* Alexander, 1966. We also discuss a possible close relationship between *P. ericarum* and the European *Amalopsis* species.

Key words: Crane flies, alpha taxonomy, lectotype designation, new species, genetic differentiation, DNA barcoding

Introduction

Alfa taxonomy is recognized as one of the most basic sources of information in biological research. However, species delimitation based on gross morphological features underestimates and simplifies biodiversity (Macías-Hernandez *et al.* 2010, Bálint *et al.* 2011). DNA sequence data can reveal cryptic complexes in a pluralistic evolutionary framework of discoveries, delineations and classifications of new species (Padial *et al.* 2010, Ebach 2011, Schlick-Steiner *et al.* 2010).

Pediciidae is a monophyletic taxonomic unit within Tipuloidea, proposed first by Starý (1992). He separated it from Limoniidae, raising it to the rank of family. A series of synapomorphies in adult morphology support Pediciidae as a clearly defined group within the “tipuloid line”, like the pubescent eye and strongly retracted Sc₂ in combination with some of the structural details of the mouthparts, thorax or genital structures. The idea was also supported by larval characters, such as the presence of protruding lateral corners of the praementum, the two distinct papillae in the larval antenna, the narrow or hardly developed posterior incisions of the genae and the presence of a silken cocoon in pupae (Oosterbroek & Theowald 1991). A recent comparative investigation of molecular and morphological evidences demonstrated a basal position of Pediciidae within Tipuloidea and placed them as the sister group of all remaining Tipuloidea (Petersen *et al.* 2010, Ribeiro 2008). At present Pediciidae comprises 518 recognized taxa distributed mostly in Holarctic and Oriental regions (Oosterbroek 2011). In the Neotropics there are only 13 species, and in the Australasian region only 5. The family is further divided into two subfamilies, or tribes. This division is based on deep divergences in larval morphology and biology. The subfamily of Uliinae has terrestrial fungivore larvae with 5 anal lobes. The subfamily of Pediciidae has aquatic and semi-aquatic predator larvae