



DOCTORAL DISSERTATION ABSTRACT

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Title of the doctoral dissertation: **The phylogenetic relationships within Muscidae (Diptera): a perspective illuminated by phylogenomic and immature stages morphology data**

Doctoral dissertation abstract:

Flies (Diptera), one of the most species-rich insect orders, have achieved extraordinary evolutionary success and evolved an unprecedented diversity of life strategies. However, phylogenetic relationships and evolutionary history of Diptera remain largely unresolved, and the results of analyses of morphological and molecular data often lead to conflicting phylogenetic hypotheses or statistically weakly supported relationships. In this study, in addition to phylogenetic analyses, particular emphasis was placed on utilising the morphology of the larval stage as a source of data useful in taxonomic and systematic studies of insects. The study was conducted on representatives of the Muscidae family, one of the most species-rich families of flies, characterised by extraordinary morphological and biological diversity of both adults and preimaginal stages. Although the current concept of the Muscidae as a family is relatively well-established, many phylogenetic relationships within it, particularly those concerning species relationships and the position of individual taxa within subfamilies, often exhibit variation depending on the data source used or the analytical method adopted.

The aim of this study was to better understand the phylogenetic relationships of selected representatives of the Muscidae and to document in detail the morphology of early larval instars. The analyses utilised both molecular data, using next-generation sequencing methods, and a morphological approach based on modern microscopic techniques. Particularly, confocal laser scanning microscopy (CLSM) enabled detailed visualisation of previously undescribed and undocumented structures of the cephaloskeleton of larvae, providing new characters crucial for phylogenetic reconstruction and systematic revision of selected taxa.



Particular attention was paid to three problematic taxa: the clade consisting of the genus *Alluaudinella* Giglio-Tos and its sister taxa *Aethiopomyia* Malloch and *Ochromusca* Malloch, the genus *Achanthiptera* Rondani and the genus *Lispe* Latreille. In the case of *Alluaudinella* and its sister taxa, analyses were carried out on morphological data from the larvae as well as on molecular data, allowing for the clarification of their previously ambiguous systematic position. For the genus *Achanthiptera*, detailed larval documentation was produced using CLSM and scanning electron microscopy (SEM), enabling a reassessment of its phylogenetic relationships within the Azeliinae. For the genus *Lispe*, restriction site-associated DNA sequencing (RAD-seq) combined with nanopore sequencing was used, yielding new data on intrageneric relationships and suggesting the need for revision of some species groups. A significant part of the work also involved documenting and interpreting the morphology of early immature stages (first and second instar larvae) of necrophagous muscid species. The data obtained allowed for the development of the first comprehensive identification key for species occurring in the western Palearctic region, filling a significant knowledge gap and providing a valuable tool for forensic entomology and future research on the diversity and evolution of Muscidae.

Keywords: *Achanthiptera*, *Alluaudinella*, cephaloskeleton, confocal laser scanning microscopy, light microscopy, *Lispe*, molecular phylogeny, parastomal bar, phylogenetic analysis

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