**PHD PROJECT DESCRIPTION**
**(4000 characters max., including the aims and work plan to de published online)**

**Project title: Morphological diversity of larval stages of flesh flies (Diptera: Sarcophagidae) in the context of their life strategies.**

## 1.1. Project goals

The aim of the project is to characterize morphological adaptations of Sarcophagidae larvae in the context of their life-history strategies. In recent years, significant progress has been made in our understanding of the preimaginal stages of this large group of flies (approximately 3,000 species). At the same time, the application of next-generation sequencing (NGS) methods has led to substantial advances in the reconstruction of their phylogeny (e.g. Johnston et al. 2024). The current state of knowledge provides an opportunity to trace the evolution of larval traits in Sarcophagidae while testing the strength of their phylogenetic signal. This is particularly important, as until recently, classical phylogenetic reconstructions were based mainly on adult morphological characters (Pape 1996). The project will therefore adopt a novel approach and will constitute an important contribution to our understanding of the evolution of Sarcophagidae.

## 1.2. Outline

Sarcophagidae is a large and diverse family of flies found all around the world (Pape, 1996). It is mainly known for its role in cadaver colonization and forensic use (Byrd & Tomberlin, 2020), but the large subset of parasitic species remained understudied. Even though the morphological traits of adult flies are relatively well-established, there is still a large gap concerning the preimaginal stages (e.g. Szpila et al. 2025). The proposed research aims to document the preimaginal morphology using advanced microscopy (SEM, Confocal Laser Scanning Microscopy and light microscopy) of following groups of species: 1) species of genus *Sarcophaga* representing various life histories (coprophagy, necrophagy, reptilian eggs predation); 2) parasitoid/predatory species of subfamily Paramacronychiinae; 3) kleptoparasitic and termite-related species of subfamily Miltogramminae; 4) South American Sarcophaginae (necrophagous, parasitic, predacious). The final aim of the project will be mapping of the larval characters on the phylogenetic tree and testing strength of their signal.

## 1.3. Work plan

The work plan is divided into four parts, each focusing on a different group of flesh flies, followed by final data analysis and publication of results (five publications in impacted journals in total). It is important to note that larval material has already been accumulated by the supervisor.
Year 1
Morphological examination of the preimaginal stages of the following species: *Sarcophaga albiceps* Meigen, 1826; *Sarcophaga protuberans* Pandellé, 1896; *Sarcophaga similis* Meade, 1876; *Angiometopa falleni* Pape, 1986; *Brachicoma devia* (Fallén, 1820); *Dexagria ushinskyi* Rohdendorf, 1978; *Oophagomyia plotnikovi* Rohdendorf, 1928.
Preparation and submission of two manuscripts.
Year 2
Morphological examination of the preimaginal stages of the following species: *Apodacra orthogona* Rohdendorf, 1925; *Awashiops* sp.; *Metopia pauciseta* Dodge, 1966; *Eremasiomyia*

*dissimilis* Rohdendorf & Verves, 1980; *Sarcotachina aegyptiaca* Villeneuve, 1910; *Tricharaea femoralis* (Schiner, 1868); *Lepidodexia* sp.; *Helicobia* sp.; *Argoravinia aurea* (Townsend, 1918).
Preparation and submission of two manuscripts.
Year 3
Preparation of the larval character matrix.
Mapping of larval characters onto a phylogenetic framework to trace evolutionary patterns.
Preparation and submission of final synthesis manuscript.
Year 4
Preparation of the doctoral thesis and its defense.

## 1.4. Literature (max. 7 listed as a suggestion for a PhD candidate preliminary study)

1. Byrd, J.H. & Tomberlin, J.K. (2020) Forensic entomology: the utility of arthropods in legal investigations. Boca Raton: CRC Press, Taylor & Francis Group.
2. Johnston, N.P., Pape, T., Piwczyński, M., Wallman, J.F., Wiegmann, B.M., Cassel, B.K., Akbarzadeh, K., Szpila, K. 2024. Anchored phylogenomics and revised classification of the Miltogramminae (Diptera: Sarcophagidae). Systematic Entomology. 49(1), 138–155
3. Pape, T. (1996). Catalogue of the Sarcophagidae of the world (Insecta: Diptera). Memoirs on Entomology, International, 8, 1-558.
4. Szpila, K., Maliszewski, S., Soszyńska, A., Villet, M., Richet, R., & Pape, T. (2025). Morphological identification of first-instar larvae of European flesh flies of forensic importance. Medical and Veterinary Entomology, 39(4), 802-816.

## 1.5. Required initial knowledge and skills of the PhD candidate

- Knowledge on entomology
- Knowledge on ecology and morphology of Diptera (confirmed by publications or conference presentations)
- Experience in lab and field work (microscopy, insect collection and preparation)
- Proficiency in verbal and written English

## 1.6. Expected development of the PhD candidate's knowledge and skills

Through the completion of the proposed project, the doctoral student will acquire highly specialized skills and knowledge in the descriptive morphology and taxonomy. The candidate is expected to develop critical thinking, proficiency in scientific writing and conference presentations, as well as communication skills enabling effective collaboration with international research institutions.