

Institute: Institute of Systematics and Evolution of Animals, Polish Academy of Sciences

Title: The evolutionary changes occurring in a selected group of Diptera Nematocera during the Eocene.

Name of potential supervisor: prof. dr hab. Wiesław Krzemiński ORCID 0000-0001-5685-891X

Financial conditions: Scholarship of PLN 3000 gross (approx. PLN 2600 net) per month for a period of one year and scholarship of PLN 4100 gross (approx. PLN 3600 net) per month for a period of next two years financed by the National Science Centre under the project entitled The influence of environmental and climate conditions in Eocene Europe on contemporary fauna of nematoceran Diptera.

Background information:

The Eocene is an extremely important period for the formation of the contemporary fauna of flies (Diptera). It is considered as a part of the Cenozoic period which lasted from 56 to 34 million years ago. Its onset was characterized by the highest temperatures recorded during the Cenozoic. Even though they decreased with time, the hot climate had a long-term effect on the development of the European fauna, so it is no coincidence that this period is informally referred to as "the dawn of a new age". Therefore, modern organisms evolved under tropical or subtropical climate conditions, and their direct descendants form the modern fauna of our continent.

The main aim of this project is to explain how environmental, climatic and biogeographical conditions have affected the further evolutionary stages of selected groups of flies up to the present day. Research will mainly focus on the oldest evolutionary lineages of flies (Diptera, Nematocera) which appear very frequently in the fossil record.

An additional, but no less important goal of the project is to conclude the age of the Baltic amber. The commonly accepted time of existence of amber forests in the territory of Europe is the middle Eocene. These forests covered nearly the entire continent over several million years. However, some theories assume an extension of the time of amber formation to the Lower as well as the Upper Eocene. These hypotheses can be verified in the present project by precise determination of species in amber and comparative analysis with recent species and with species preserved in amber and sedimentary rocks of a well-determined age: amber from the Oise, localities with fossils: the Isle of Wight off the coast of Great Britain, and the Mo-Clay outcrop off the coast of Denmark.

The main research hypotheses in the project:

1. The Diptera Nematocera fauna of the Eocene and the contemporary fauna of Europe are similar at the family and genus level.
2. The Diptera Nematocera fauna of the Baltic amber from Ukraine and Saxony is common at the species level.
3. The Diptera Nematocera fauna of the Baltic amber is different or similar to the fauna of amber from Oise Amber (France) at the species level?

Information on the methods/description of work:

1. In the first stage of the project the most important task will be to segregate materials into families of fossil flies, both amber inclusions and imprints in sedimentary rocks. Differentiation between groups is based on wing venation patterns. The work will be performed in the collections of Polish and Danish museums; trips to excavation sites in Denmark are also planned. Photographic documentation of the specimens will be prepared locally.
2. Subsequently, specimens of the selected family will be marked to the generic and species level; descriptions of new taxa to science will be prepared.
3. The most important part of the project will be the comparison on the species level of a selected family from the Baltic amber, the Paris amber (Oise) and fossils from the early Eocene of Denmark and the late Eocene of England
4. The further processing of the collected data is a phylogenetic and biogeographic analysis (i.e.: preparation of a family tree of the selected family over at least the Eocene to the present day, and the current distribution of selected fly groups whose older representatives occur in the studied fossils and amber inclusions). This will allow us to reconstruct the evolutionary pathways of selected flies and to deduce climatic conditions in the amber forest. These analyses will require the use of statistical and phylogenetic methods (knowledge of at least the TNT program).

Additional information (e.g., special requirements from the student):

1. Experience in working in fossil collections (amber and imprints in sedimentary);
2. Identification of Nematocera flies at least to families and genera level;
3. Proficiency in English language;
4. Experience in statistical and phylogenetic data analysis;
5. Driving license cat. B is welcome;
6. Availability to work non-standard hours (e.g. weekends).

References:

- Krzemińska, E., Krzemiński, W., Haenni, J.P., Dufour Ch. 1993. W bursztynowej pułapce. Muzeum Przyrodnicze Instytutu Systematyki i Ewolucji Zwierząt PAN w Krakowie.
- Krzemiński, W., Krzemińska, E. 2003. Triassic Diptera: descriptions, revisions and phylogenetic relations. *Acta Zoologica Cracoviensia* 46 (Suppl. 1 e Fossil Insects), 153-184.

McAlpine, J. F. 1981. *Manual of Nearctic Diptera*. Ottawa: Research Branch, Agriculture Canada.

Documents should be sent electronically to prof. dr hab. Wiesław Krzemiński (wieslawk4@gmail.com) by February 22, 2022. The interview with the candidates will take place on February 24, 2021 at the Institute of Systematics and Evolution of Animals of the Polish Academy of Sciences (Sławkowska 17, 31-016 Krakow).