Does the usage of Sakhalin amber inclusion bridge the information gap about the Eocene stage of the biological and morphological evolution of aphids?

Amber, the fossilized resin of trees, has unique properties that allow the preservation of organic matter. Amber retains unique morphological features of the soft tissues of organisms. Therefore, biological inclusions in ambers are a kind of record of ancient fauna and flora. They are a window into the past. The inclusion provides information not only about the taxonomic diversity and phylogenesis of individual groups, but also about palaeoecology, palaeogeography and animal behavior. However, this knowledge is related only to the time when amber was formed. Hence, there are many geological periods for which amber has not yet been found and thus, their inclusion records remain unknown to date. One of the most intriguing gaps in the amber record of inclusions is the Eocene Amber Bioinclusion Gap. It occurred between 50 and 42 million years ago. It corresponds to the period of time between the Early Eocene climatic optimum and the Middle Eocene climatic optimum. At that time, changing climatic conditions influenced the evolution of flora and fauna and induced formation of modern biocenoses.

The results of preliminary studies indicate that bioinclusions from the Far East Asian amber from Sakhalin Island may partially fill this gap (43-47 million years ago). Apart from the insects already described, aphid inclusions may provide a lot of information about this period of time. Aphids are the most frequently found in Sakhalin amber. The study of these aphid remains by the use of variety of microscopic techniques will allow not only to understand the taxonomic diversity of these insects in the Middle Eocene in the Southeast Asia region but also to understand how the complex relationships between phytophages and their host plants were formed. The study may additionally reveal the relationship between phytophages and the predators as well as parasites that feed on them. It will also help to answer the questions regarding symbiotic relationships between aphids and ants that we can observe today, and answer the following questions: whether the relationships already existed in the Middle Eocene and how complex they were.

The goal of the project is not only to study and describe the Eocene biocenosis of the Sakhalin forest but also to conduct a comprehensive biological comparative analysis of many other Eocene sites with the occurrence of fossil insects. The results should provide information on the evolution of terrestrial ecosystems during the Eocene Amber Bioinclusion Gap [EAGB, 50 – 42 Ma].

The results of the project will be disseminated in the form of scientific articles in international scientific journals and presentations at major international conferences in Poland and abroad.

Sakhalinian amber inclusions of aphids