

Does the little mean a lot? Bacterial endosymbiotic microbiome of aphids as a driver of mutualistic relationship with ants.

Mutualism is the relationship between two species that live together in symbiosis, i.e. they both benefit from mutual relationship. The mutualistic relationship between aphids and ants is widely known and often cited as a flagship example of symbiotic interaction known as trophobiosis. Phytophagous aphids in exchange for a sweet excrement - honeydew, receive from ants care and protection from predators. One can also observe some morphological changes in the group of myrmecophilous aphids (i.e. those that live with ants in symbiosis), called a trophobiotic organ, which seems to be adaptation to mutualism, among others: shortened cauda or arrangement of hairs in the anal zone into a characteristic basket. All this to facilitate the aphid sustaining the droplet of honeydew till the ant receives a sweet liquid. Aphids, besides, have other, small but very important allies with whom they share the same relationship - symbiotic bacteria. Possessing them is by no means a characteristic only for them. On the contrary, symbiotic bacteria are present in the life of most (if not of all) organisms. They accomplish various functions: some help to digest cellulose, others produce vitamins, and others protect the hosts against pathogens. In the case of aphids, so far we know, that they regulate internal metabolism and improve resistance to pathogens and predators.

The main target of the project is to determine the variety of bacteria in the aphids and their connection to the relationship between aphids and ants. We would like to answer the following questions:

- Is there a connection between the species composition of aphids endosymbionts and their relationship with ants?
- What is the significance of endosymbionts in individual aphid species in the context of their involvement into symbiosis with ants?
- Can symbionts present in a particular aphid species perform other, unknown functions, such as a alternating the life cycle or behavioral pattern of aphids?

The project concerns aphids of the genus *Dysaphis*, due to its ecological diversity: this genus contains monoecious and heteroecious species (i.e. aphids living on one or two different species of plants throughout the year) as well as myrmecophilous and non-myrmecophilous species. Some of them also live in galls or on underground parts of plants. Due to this diversity, we will be able to determine the tendencies to colonize specific species of aphids visited and not visited by ants by various endosymbionts. The main research method will be the molecular identification of endosymbiotic bacteria using 20 different molecular markers, specific for individual bacterial strains. It will be complemented with the analysis of morphological adaptations of the species of aphids from the genus *Dysaphis* to the trophobiosis. The next, and also the last stage of the research will be the analysis of data collected during the project in order to find the correlation in the occurrence of specific species of endosymbiotic bacteria in aphids and the correlation of their occurrence with the involvement in symbiotic relationship with ants by individual species of aphids.

The result of the project will certainly shed new light on the internal factors underlying the evolution of mutualism between organisms.