Plant secondary metabolites constitute an unusually large group of structurally diversified compounds that have long been suggested to contribute to the interactions of plants with other organisms. Numerous functions of plant secondary metabolites include their roles in plant response to abiotic stresses, defense against insects and plant immunity. Of note, the phylogenetic occurrence of particular plant secondary products is frequently restricted to particular lineages, such as a family or genus, suggesting rapid evolution of respective biosynthetic pathways . Among the most thoroughly studied groups of constitutive secondary metabolites with defensive function are thioglucosides, known as glucosinolates, which are produced mainly by plants belonging to the cabbage plant family that includes many economically important vegetables and oil plants. These compounds constitute a very interesting group of secondary metabolites with several important functions in plant fitness, which include defense against insect herbivores and plant immunity. In addition, glucosinolates are responsible for the pungent taste of vegetables and spices representing cabbage family, making them attractive for humans. Finally, numerous researches indicated that presence of these compounds in human diet can decrease of risk of certain cancer forms and have additional beneficial impacts on human health. Interestingly, beside significance for plant fitness and the ubiquity of glucosinolates in the cabbage family some published results indicate that particular species representing this family lost the ability to produce these phytochemicals. For instance, a common weed shepherd's purse (Capsella) and related species were reported to be deficient in glucosinolates.

The main objective of this study is to identify molecular mechanism underlying loss of the ability of glucosinolate production in small phylogenetic clade comprising genera Capsella. In addition, we will address the question if loss of glucosinolates had been preceded by evolution of novel secondary metabolites, which could fulfill glucosinolate function in interactions of glucosinolate-deficient species with other organisms. Finally, this project will focus on the regulation of the biosynthetic branch point between glucosinolates and plant hormone auxin.

Obtained results will expand our fundamental knowledge on the evolution of plant secondary metabolites with function in plant defense and on the control of biosynthesis of the key plant hormone auxin. Knowledge on the biosynthetic pathways leading to phytochemicals with function in plant immunity and to plant hormones is of significance for future crop cultivation and protection strategies. This may facilitate rational breeding of cabbage family varieties with secondary metabolite and auxin profiles optimal for plant immunity and yield. In addition, as glucosinolates appear to play important role in our diet generated results can also facilitate breading of cabbage vegetable lineages with the phytochemical composition that optimally affects human health.