

Plant specialized 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 these compounds include their roles in plant response to abiotic and biotic stresses. 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. It has been suggested that this chemical diversity is supported by low substrate specificity of enzymes involved in specialized metabolism, which enables rapid generation of novel metabolic branches.

Among the most thoroughly studied groups of plant specialized 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 specialized 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 risk of certain cancer forms and have additional beneficial impacts on human health. Similarly as many other enzymes involved in plant specialized metabolism, also majority of glucosinolate biosynthetic and metabolic enzymes seems to be promiscuous regarding their substrates. These include also glucosidase PEN2 and glutathione transferase GSTU13 that are indispensable for glucosinolate function in Brassicaceae plant resistance towards fungal pathogens. As indicated by detailed microscopic analysis PEN2 localizes to mitochondria which upon pathogen inoculation are delivered to, and immobilized at the sites of attempted pathogen entry. This unique localization is possibly important to control activity of this promiscuous β -glucosidase.

In this study we would like to identify subcellular location of GSTU13, compare it with the mitochondrial PEN2 localization and identify protein fragments, which deliver GSTU13 to the respective organelles. We also want to check, which of the other members of glucosidase and glutathione transferase protein families can replace PEN2 and GSTU13 in glucosinolate metabolism and plant immunity when targeted to the same organelles.

Results obtained in this project will expand our fundamental knowledge on the *in planta* specificity of glucosidases and glutathione transferases, which are enzymes ubiquitous in living organisms. In addition, knowledge on the activity of enzymes involved in the biosynthesis of phytochemicals with function in plant immunity is of significance for future crop cultivation and protection strategies. Obtained results may facilitate rational breeding of cabbage family varieties with specialized metabolite profiles optimal for plant immunity and yield. In addition, as glucosinolate derivatives appear to play important role in our diet generated results can also facilitate breeding of cabbage vegetable lineages with the phytochemical composition that optimally affects human health.