



CHEMICAL COMMUNICATION IN ECOLOGICAL SYSTEMS

Application Call 2025 - Project 8

Molecular mechanisms of adaptation and counter-adaptation between *Brassica* and beetles

Supervisors:

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Background:

Due to the development of pesticide resistance and a lack of resistant crop cultivars, insect pests pose a significant threat to crop production. The cabbage stem flea beetle (*Psylliodes chrysocephala*) is a key pest of winter oilseed rape (OSR; *Brassica napus*), the main oilseed crop in Europe used for vegetable oil and biofuel production. Both climate change and the ban on neonicotinoid seed dressings have contributed to increasing pest pressures on OSR in Europe. There appears to be little variation in the resistance of OSR varieties to this pest, and not much is known about specific plant traits that confer resistance and could therefore be considered as breeding targets. In addition, natural genetic variation within and between pest populations is an important factor influencing the interaction with crop plants. The latter aspect has been largely neglected in the development of sustainable pest control strategies.

Project description:

This project will identify molecular and metabolomic mechanisms of plant resistance against the cabbage stem flea beetle as well as consider natural variation in herbivore adaptation. We will screen different accessions of winter OSR and closely related natural *Brassica* species for susceptibility to adult and larval feeding using beetles from different populations. Phenotyping data will be correlated with the constitutive and induced plant transcriptome and metabolome to identify candidate pathways and metabolites that have the potential to improve plant resistance. Candidate genes and pathways will be verified using mutants. To better understand natural variation in adaptation of the beetle, we will compare the transcriptomic response of beetles from different populations when feeding on selected plant lines, and correlate these differences with metabolomic analyses and beetle performance. By uncovering plant resistance mechanisms and the adaptive potential of a pest, this project will contribute to basic knowledge on the evolution of plant-herbivore

interactions as well as to the development of sustainable pest management strategies.

Candidate profile:

We are looking for a candidate with a Master degree in biology, ideally with a strong background in plant sciences, molecular/chemical ecology or similar. Experience in working with insects and the analyses of transcriptomic and/or metabolomic data would be of advantage. You will work in an international team, therefore proficiency in written and spoken English, good communication skills and team spirit are essential.

Reading (optional):

Li, Z., Costamagna, A. C., Beran, F., You, M. (2024) Biology, Ecology, and Management of Flea Beetles in Brassica Crops. *Annual Review of Entomology* 69, 199-217

Beran, F., Sporer, T., Paetz, C., Ahn, S.-J., Betzin, F., Kunert, G., Shekhov, A., G. Vassão, D., Bartram, S., Lorenz, S., Reichelt, M. (2018). One pathway is not enough: The cabbage stem flea beetle *Psylliodes chrysocephala* uses multiple strategies to overcome the glucosinolate-myrosinase defense in its host plants. *Frontiers in Plant Science*, 9: 1754.