

# Learning and adaptation in agronomic pests

## OBJECTIFS

Insect pests of cultivated plants learn, evolve and adapt. They can colonize new crops, or bypass the control means that farmers engage to regulate them. Our project aims at predicting the impact of insect pests' learning on their future adaptations to new crops and agro-ecological management strategies. As a proof of concept, we will test whether learning can change the direction and speed of evolution of oviposition behavior in two species of phytophagous insects.

For this, we will (i) develop an ad hoc experimental methodology, based on individual learning measures, and (ii) estimate the effect of learning on the mean, the variance and the rank of the oviposition choices of individual females of each species.

This will help develop agronomic strategies sustainable to plastic behavioural changes and associated adaptations in pest species, and pave the way to new practices actively using insect learning to prevent adaptation to valuable crops.

We have two specific objectives to achieve our main goal. Our first objective is to establish a repeatable, high-throughput methodology to measure both innate and learned oviposition choices in individual females of *O. nubilalis* and *D. suzukii*. The new experimental protocols must be repeatable and standardized enough to ensure accurate and individual estimation of a trait that is notoriously prone to extreme variance (learning), both between individuals and within an individual's life. Additionally, the experimental procedures should enable high-throughput processing to test a sufficiently large number of individuals to estimate the evolutionary consequences of learning at the population level (i.e., several thousand phenotyped individuals), ideally in various environmental situations (e.g., to test phenotypic responses to various host transitions and control strategies). Our second objective is to test theoretical expectations on the population-level phenotypical consequences of individual learning that will help predict the effect of learning on the direction and speed of adaptation. In brief, studies on phenotypic effects of learning have highlighted that individual learning may modify the population mean, variance and the rank of individuals in a behavioral task. In turn, theoretical works on the evolutionary consequences of learning predict that such change may either accelerate, slow down or prevent genetic change. By reshaping phenotypic mean, variance and/or rank, learning will indeed modify which genotypes are subject to natural selection and to what extent natural selection will operate on genetic variation. We will be able to test various environmental conditions (e.g., host transitions and management strategies) and challenge the notion that learning is inherently adaptive.

**Responsable :**

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