Oak genotype and chemical defences as drivers of the performance of two insect herbivores

Thomas Damestoy*[1], Benjamin Brachi[1], Xoaquín Moreira[2], Hervé Jactel[1], Christophe Plomion[1], and Bastien Castagneyrol[1]

[1]Biodiversité, Gènes Communautés (BioGeCo) – Institut National de la Recherche Agronomique : UMR1202, Université de Bordeaux – France
[2]Misión Biológica de Galicia – Spain

Abstract

Ecological research on plant-herbivore interactions has long recognized that plant genotypic identity plays a key role in shaping insect abundance and herbivory, as well as in determining plant defensive levels. However, how plant genotype influences herbivore feeding behaviour, and which plant defensive traits are associated with such genetic effects on herbivore feeding behaviour, remain poorly understood.
We investigated how pedunculate oak genotype affects feeding behaviour of two insect leaf chewers, the generalist *Lymantria dispar* and the specialist *Thaumetopoea processionea*. We further tested whether leaf chemical defences were associated with genetic effects on insect feeding behaviour. We collected leaves from oak trees consisting in four replicates of 30 genotypes randomly distributed in a common garden. With these leaves we performed laboratory feeding trials to estimate performance of both herbivore and quantified the concentration of constitutive phenolic compounds.

Oak genotype significantly predicted leaf consumption by the specialist herbivore species only. In contrast, oak genotype did not significantly predict growth rate of both herbivore species or concentration of leaf phenolic compounds. We found positive significant genetic correlations between all phenolic compounds and growth rate of the generalist herbivore species only. Consumption by both herbivore species significantly increased in leaves with higher concentrations of condensed tannins. Such increased leaf consumption in highly-defended leaves could be due to a compensatory feeding response. We found significant positive genetic correlations between the both herbivores, for leaf consumption and growth rate. These results suggest the existence of oak genotypes with multiple resistance against insect herbivores.
Overall, our results indicate that oak genotype and chemical defences partly explain variability in leaf consumption and growth rate of insect herbivores. These results stress that further studies investigating genetic control of plant-herbivore interactions should focus simultaneously on both plant and insect herbivore points of view.

*Speaker