Press release

July 28th 2021

Making oak forests more resistant to pest attacks

Discovered biomarkers of resistant trees

Defoliated oak trees have been a recurring sight in recent years. The defoliation is often caused by the massive occurrence of the green oak leaf roller (*Tortrix viridana*) caterpillars, a tiny moth larvae pest favored by the warmer summers. But oak trees are not defenseless: they pursue various defense strategies that are objects of current studies. Scientists at the Thünen Institute of Forest Genetics in Großhansdorf and the Helmholtz Center Munich, Research Unit of Environmental Simulation, are elucidating the defense mechanisms of naturally occurring resistant trees of European oak (*Quercus robur*) found in defoliated forests. Their joint effort now resulted in the discovery of biomarkers in leaves of remarkably resistant trees. On the one hand, this finding facilitates predict how susceptible certain forest areas are to an infestation with the green oak leaf roller, and on the other hand, resistant young plants can be selectively grown and used for reforestation programs.

In the course of evolution, European oaks have developed mechanisms to keep their predators at bay. Thünen and Helmholtz researchers deciphered years ago important details of the complicated interplay between host plant and pest. So-called T-oaks (for "tolerant") form substances in their leaves that inhibit feeding by the young caterpillars - they virtually starve at the table. On the other hand, S-oaks (for "sensitive" to herbivory defoliation) respond to herbivory feeding by releasing certain scents, a mechanism of inducible resistance that offers the advantage of investing energy and carbon in defense only when needed, saving resources for growth. The inducible smell is intended to attract the pest's enemies, but this strategy fails during *T. viridana* outbreaks, and S-oaks pay their strategy with severe defoliation (see Thünen press release of August 31, 2012).

The scientists at the Thünen Institute and the Helmholtz Center have now searched for biomarkers in four oak stands in Germany that can distinguish T-types from S-types. They examined the leaf metabolome, a complete set of small-molecules found in leaf extract such as sugars, amino acids, phenols, and found what they were looking for: reliable metabolic markers

Thünen-Institut
Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei
Bundesallee 50
38116 Braunschweig
www.thuenen.de

Pressesprecher:
Dr. Michael Welling
Fon: 0531-596 1016
Fax: 0531-596 1099
pressestelle@thuenen.de

that are associated with the resistance and susceptibility of oaks. T- and S-oaks can currently be detected in laboratory tests. Based on mass spectrometry and machine learning, the developed tool allows now studying the possible infestation levels of European oak forests in different climatic zones in Germany and assessing the proportion of T- and S-oaks in each stand. Importantly, oak forests are usually created through targeted planting rather than through natural regeneration and the discovered biomarkers will now allow the selection of resistant young plants to oak moth infestation. Therefore, future plantings of resistant trees will make our forest more resistant to upcoming herbivory attacks - a way to preserve oak forests in Europe.

This project is financed by the Fachagentur Nachwachsende Rohstoffe e. V. (FNR) in the programme “Waldklimafond” (28W-B-4-113-01/2), funded by Federal Ministry of Food and Agriculture and Federal Ministry for Environment, Nature Conservation and Nuclear Safety, Germany.

Original publication:

Marko Bertić, Hilke Schroeder, Birgit Kersten, Matthias Fladung, Franziska Orgel, Franz Buegger, Jörg-Peter Schnitzler, Andrea Ghirardo (2021): European Oak Chemical Diversity – From Ecotypes to Herbivore Resistance. New Phytologist. DOI:10.1111/NPH.17608

Contact:

Dr. Hilke Schröder
Thünen-Institut für Forstgenetik, Großhansdorf
Tel.: 04102 696-148
Mail: hilke.schroeder@thuenen.de