

## Phytosanitary effects of aqueous extracts from essential oil production

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Essential oils (EOs) from medicinal and aromatic plants (MAPs) are characterized by a broad spectrum of biological activities, especially against plant pathogens and insect pests. Compared to many synthetic pesticides, their advantages lie in their volatility and the associated low persistence as well as the absence of problems due to resistance development. Therefore, there is little concern with field application, especially just prior to harvest, which is likely for many synthetic products due to critical residues.

The commercial use of EOs and their by-products is mainly limited to human applications and veterinary medicine, resulting in limited application in crop protection. During steam distillation, the distilled biomass (residual pomace) and an aqueous condensed phase, so-called hydrolate, are by-products in addition to the essential oil. They still contain residual amounts of essential oil components and could be used as sustainable and eco-friendly alternative in plant protection.

Our studies focus on hydrolates and pressurized hot water extracts (PHWE) of MAPs relevant for cultivation and distillation in Germany. In vitro tests with hydrolates showed antifungal effects against the phytopathogenic fungi *Botrytis cinerea*, *Fusarium culmorum* and *F. sambucinum*. Furthermore, selected hydrolates were sprayed on *Brassica napus* plants under field conditions. In a randomised block design, the bioactivity of hydrolates against the herbivorous pollen beetle *Brassicoglyphus aeneus* was assessed by flower bud damage. Laboratory studies of olfactory orientation of beetles to tested hydrolates and PHWE confirmed the repellent effect on beetles as observed in the semi-field trial (2020-2022). Gas chromatographic methods uncovered potentially active substances of bioactive hydrolates and PHWE. In addition, we observed only minimal effects of selected hydrolates on non-target organisms such as earth worms and nitrogen mineralization and nitrification in soils.

This will increase the value added for residual and waste streams from the extraction of essential oils in the field of biobased plant protection. With the utilization of these by-products and the development of new applications, MAPs cultivation is to be expanded not only in Germany.

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