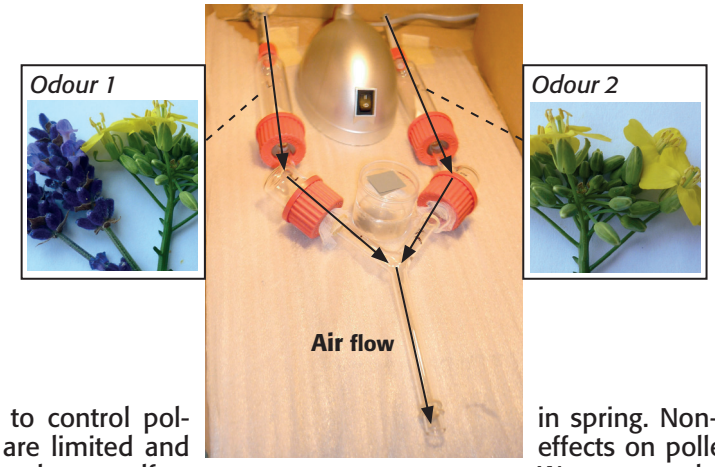
FiBL
Forschungsinstitut für biologischen Landbau
Institut de recherche de l'agriculture biologique
Research Institute of Organic Agriculture
Istituto di ricerche dell'agricoltura biologica
Instituto de investigaciones para la agricultura orgánica
EXCELLENCE FOR SUSTAINABILITY

C. Daniel
Research Institute of Organic Agriculture, Ackerstrasse 21, CH-5070 Frick, Switzerland, claudia.daniel@fibl.org

Olfactometer screening of repellent essential oils against the pollen beetle (*Meligethes spp.*).



Introduction

Organic agricultural methods to control pollen beetle (*Meligethes spp.*) are limited and alternatives are needed. The beetles use olfactory cues to locate oilseed rape fields during immigration in spring. Non-host odors can have repellent effects on pollen beetles (Maucheline 2005). We compared the repellent effects of 15 different essential oils using a Y-tube-olfactometer.

Material and methods

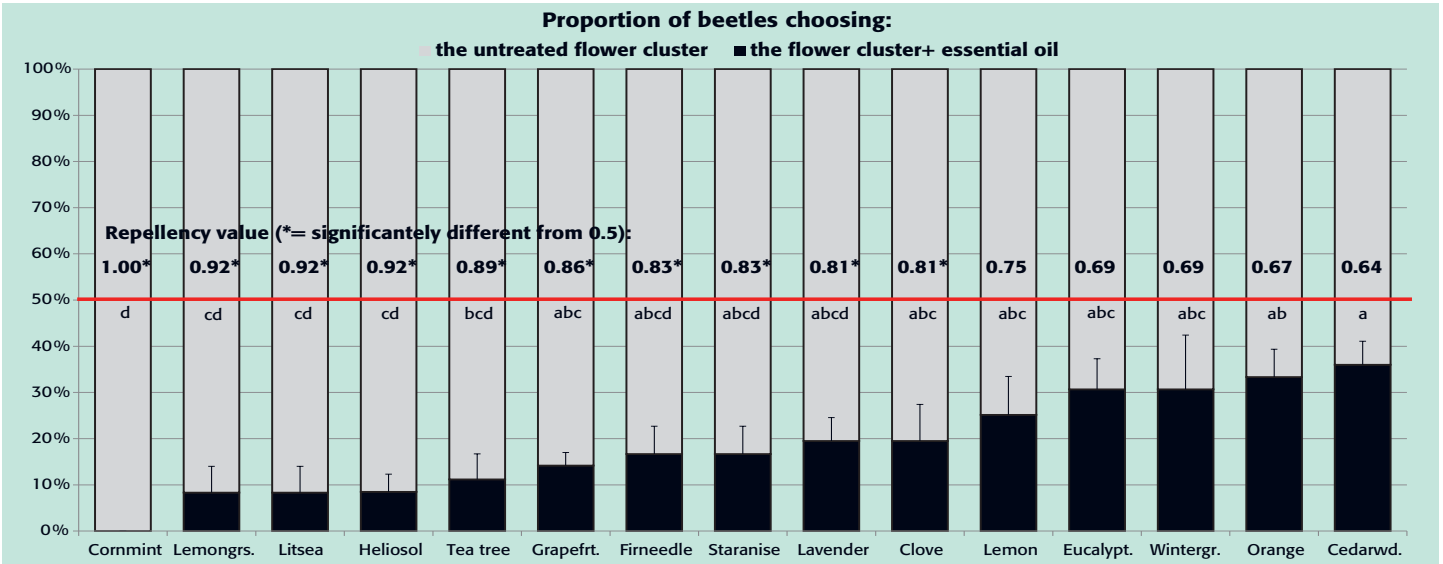
- Y-tube-olfactometer described by Belz et al. 2013.
- Essential oils diluted 1:10 in acetone; 40 µl applied on filter paper.
- Filter papers + a flower cluster of oilseed rape were placed in the odour containers of the olfactometer (control treatment: filter papers with acetone +flower).
- Beetles were released individually into the olfactometer.
- The beetles' choices were recorded.
- Six replicates with six beetles each were conducted.
- Repellency values (RV) = nb of beetles on the untreated flower / total nb of beetles.
- Wilcoxon signed rank test to test whether mean RV significantly different from 0.5.
- To compare different essential oils: RV [arcsin√(x)] transformed, ANOVA: $F_{14,72}=5.03$, $p<0.0001$; Tukey HSD tests ($\alpha=0.05$); different letters show significant differences.

Tested essential oils:

- Cornmint (*Mentha arvensis*),
- Orange (*Citrus sinensis*),
- Wintergreen (*Gaultheria procumbens*),
- Lemongrass (*Cymbopogon flexuosus*),
- Eucalyptus (*Eucalyptus globulus*),
- Fir needle (*Abies sibirica*),
- Lemon (*Citrus limon*),
- Tea-tree (*Melaleuca alternifolia*),
- Clove (*Syzygium aromaticum*),
- Star anise (*Illicium verrum*),
- Grapefruit white (*Citrus paradisi*),
- Texas cedarwood (*Juniperus mexicana*),
- *Litsea cubeba* (*Litsea cubeba*),
- Lavender oil (*Lavendula angustifolia*)
- Pine oil product Heliosol (Omya Agro, Switzerland)

Results

- On average, it took the beetles 39.8±0.6 s to make their choice.
- 87.8 % *Meligethes aeneus*, 12.2 % *M. viridescens*.
- Ten essential oils significantly repelled the beetles.
- Highest repellency values were obtained for cornmint, lemongrass, Litsea and Heliosol.



Conclusion

In addition to a high repellency value, the price of an essential oil is a major factor to choose candidates for field application strategies. The cheapest essential oil in our experiments was grapefruit oil (14.00 € / kg). Lemongrass and Litsea oil are also reasonably priced (17.50 and 18.00 € / kg). Cornmint oil is considerably more expensive (31.50 € / kg) and lavender oil was by far the most expensive oil in our experiments (104.00 € / kg). Based on the results of the experiments and on the prices of the essential oils, the development of a field application strategy will focus on cornmint oil, lemongrass oil and *Litsea cubeba* oil.

Acknowledgements:
A thousand thanks to Christian Urech who spent the splendid days of spring in the dark room patiently watching beetles speeding through the olfactometer. Many thanks to Brian Baker for language editing the manuscript Many thanks to qualiessentials gmbh for providing the essential oils. The project was funded by Migros Genossenschaftsbund and supported by Biofarm Genossenschaft

References:
Belz, E., Kölliker, M. & Balmer, O. (2013): Olfactory attractiveness of flowering plants to the parasitoid *Microplitis mediator*: potential implications for biological control. BioControl 58: 163–173
Mauchline, A.L., Osborne, J.L., Martin, A.P., Poppy, G.M. & Powell, W. 2005: The effects of non-host plant essential oil volatiles on the behaviour of the pollen beetle *Meligethes aeneus*. Entomol Exp Appl 114: 181-188.