Oilprotect – Use of essential oil as insecticides for grain storage

Henri Martin[1], Sébastien Demeter[2], Thierry Hance[2], Saskia Sergeant[1], Manon Genva[1], Marie-Laure Fauconnier[1]

[1] *Laboratory of Chemistry of Natural Molecules, Gembloux Agro-Bio Tech, University of Liège, Gembloux, Belgium*

[2] *Earth and Life Institute – UCLouvain, University of Louvain-la-Neuve, Belgium.*

Context


Sitophilus granarius


Rhyzopertha dominica


Oryzeaphilus surinamensis

Cereals are consumed in our alimentation through different forms. Between the harvesting in fields and the human/livestock consumption, cereals can be stored for long months in silos. During this period, these cereals are potential food resources for many insects (*S. granarius*, *O. surinamensis*, *R. dominica*, …) that can cause 10-30% losses in silos. On a global scale, it concerns millions of tons of cereal per year. Consequently, many insecticides have been developed on the market to overcome this issue. Even if current molecules are less toxic than before, the residues that are present are a major challenge for public and animal health, as well as for the environment.

Objectives

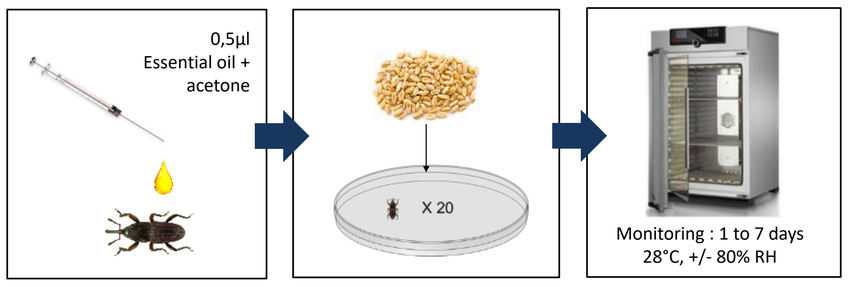
Find a less toxic alternative to current insecticides using essential oils blend.

Industrial objectives :

- Formulation of an efficient and natural insecticide with different essential oils
- Sprayable product
- Residue-free product on grain

Methods

Evaluation of essential oil toxicity on insects



n=6

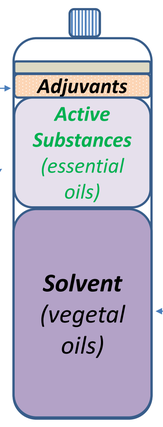
Toxicity of essential oils

The mortality depends on the essential oil and its main compounds.

Increase of the efficiency

1° Improve active compounds penetration
Terpenes, surfactants

2° Increase toxicity
Essential Oils

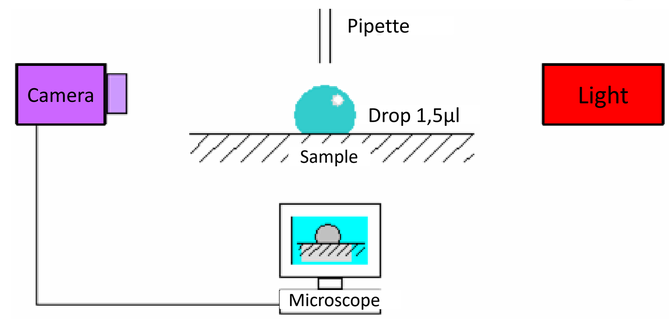


3° Maximise contact surface
Wetting agent

4° Optimise the pulverisation
Thickness

5° Slow down the evaporation
Solvents

Measurement of the contact angle



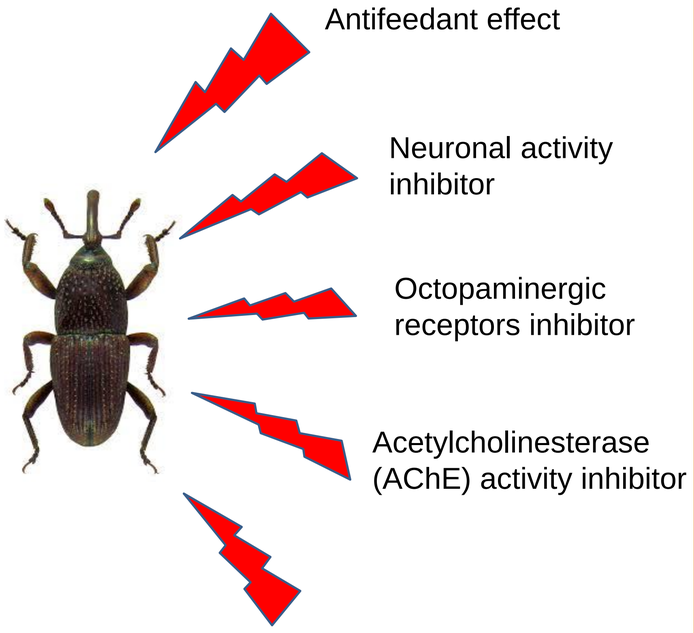
Deposit of the drop (left) and reading of the contact angle (right)

A small contact angle maximises the contact surface and penetration inside the insect.

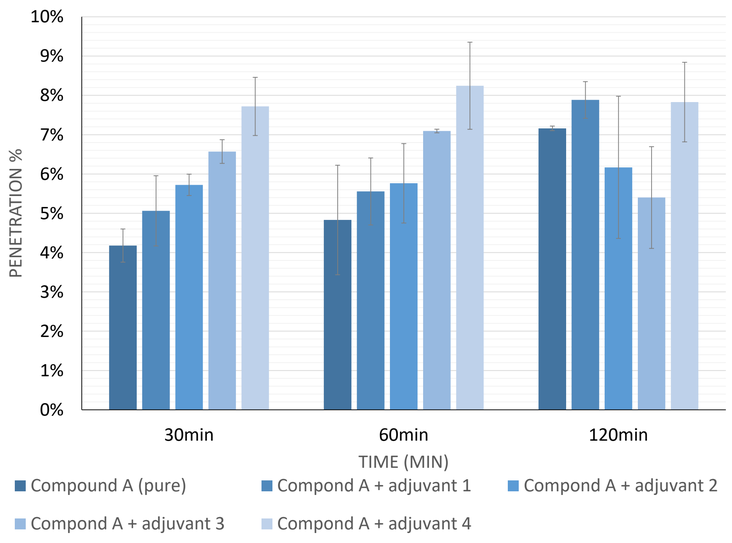
This angle has to be bigger on the seed to limit the penetration.

Results

Toxicity on insects

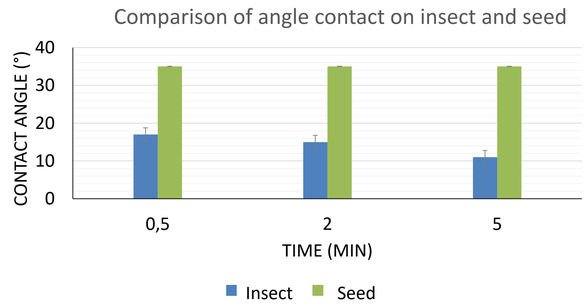


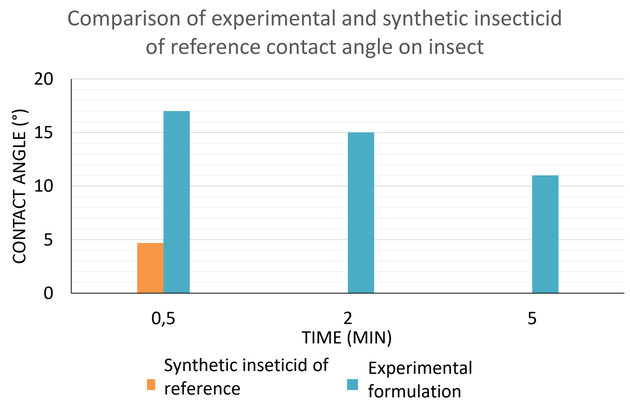
Cuticle penetration kinetics of compound A



Synergy between the active compound and adjuvants improves cuticle penetration.

Adsorption kinetics





The experimental formulation has a better affinity with the insect than with the seed, but the blend has still to be improved.

Conclusion

Essential oils of interest were characterized and their toxicities determined. Then, an in-depth study of cereal silos eco-systems was carried out in the lab to determine the potential protection of this kind of treatment with plant extracts. Current research is now focusing on the formulation to improve the treatment efficiency, studying evaporation kinetics of oils and maximising their penetration in the insects.

For more information

henri.martin@uliege.be

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