

Potential of destruxins from *Metarrhizium anisopliae* for the control of the honey bee parasitic mite *Varroa destructor*.



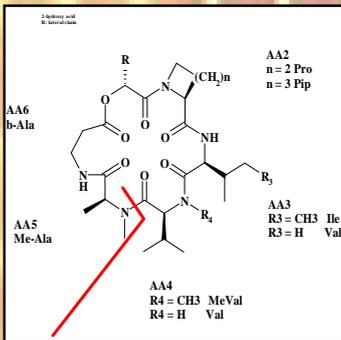
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Introduction

Varroa destructor is an ectoparasitic mite which causes severe damage to *Apis mellifera* populations worldwide. At present, chemical control is the most effective and widely used means of reducing the negative impact of *V. destructor* infestation. Recent studies showed that *V. destructor* is susceptible to entomopathogenic fungi such as *Metarrhizium anisopliae*. One important aspect of the mode of action of these pathogens is the production and release of mycotoxins. Among these, destruxins are of particular interest because they are the only mycotoxins detected in the insect body when advanced stages of infection cause death. Destruxins are typically composed of five amino acids and a α -hydroxy acid forming a cyclic hexadepsipeptide.



Entomopathogenic fungi could represent a promising alternative to chemical insecticides. However, a major hurdle concerning the registration of these fungi as veterinary biocontrol agents is the possible toxicity of secreted metabolites, especially secondary metabolites. Thereby the isolation and purification of the toxins causing insect death could bypass these uncertainties and provide a safer biocontrol product. Also, the temperature and humidity conditions in the hive do not correspond to the ideal growth conditions for the fungus, and efficacy of direct application of an entomopathogenic fungus is therefore limited by reduced proliferation.

Our project aims to investigate the possible application of purified destruxins instead of *M. anisopliae* as agents to control *Varroa* infestation in bee hives.

Materials and methods



Metarrhizium anisopliae
(ARSEF: 4556 [DAT 506])

Czapek culture broth + 0.5 %
peptone;
10 days at 26° C and 200 rpm in a
rotary shaker



Sprayer



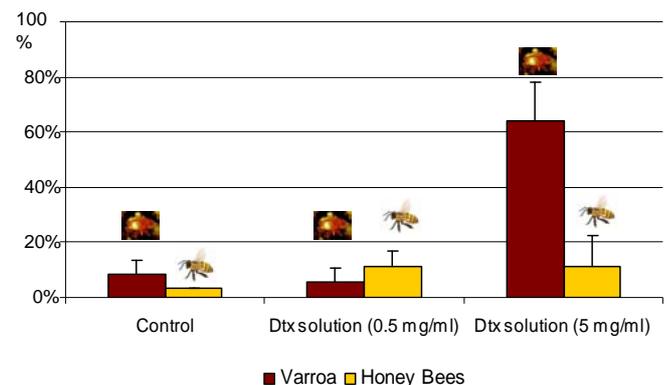
Varroa mites
(treated and control
dishes)



Honey bee adults
(treated and control cages)

Results

With a higher dtx concentration (5 mg/ml) dissolved in 20% ethanol solution a higher mite mortality (63.9 ± 14.2 %) compared to control (8.3 ± 5.3 %) was observed 48h post treatment ($p < 0.001$). In the same trial bees sprayed with the same concentration did not die sooner compared to control (water sprayed) ($p = 0.118$).



Death Rates of *V. destructor* and honey bees 48h after treatment with crude dtx extract solution

Conclusion

Our experiments show that destruxins may have a good potential for controlling *V. destructor* infestation levels, as mortality of the mites in laboratory tests is significant.

Further research will focus on improving standardization of the extracts obtained from the fungal cultures, in order to decrease variability of effectiveness and to ensure the best combination of varroa toxicity and harmlessness to bees.

Acknowledgements

This project has been awarded the 2009 Vita Research Award.