APIMONDIA SCANDINAVIA 2025
SWEDEN | DENMARK | NORWAY

PP-019 [Bee Health]

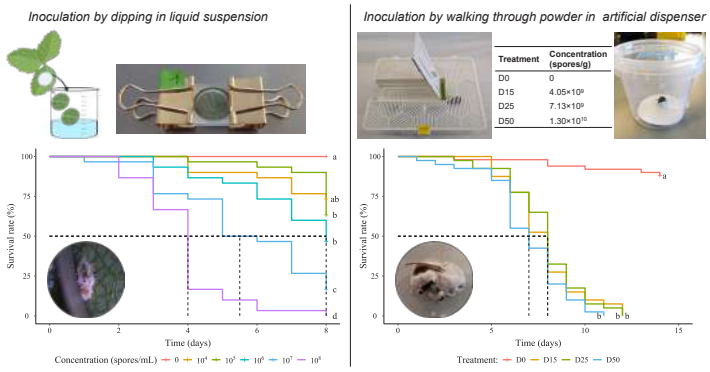
Api-vectoring potential of the entomopathogenic fungus *Beauveria bassiana* by *Bombus terrestris* for thrips control in strawberry production

Morgane Ourry, Marta Montoro, Søren S. Henriksen, Anastasia Karatza, Katja K. Nielsen, Paulo Stipanic, Zhicong Wu, Shuhan Zhang, Antoine Lecocq, Annette B. Jensen, Nicolai V. Meyling

Background and objective

Thrips are an increasing problem in early-season tunnel strawberry production, with limited control options available. The fungus *Beauveria bassiana* shows potential as a microbial control agent, though direct targeting of thrips is difficult. While api-vectoring using the 'Flying Doctors' hive (BioBest, Belgium) is used against grey mold (Iqbal *et al.*, 2022), its application for insect pest control remains largely unexplored (Temmermans & Smagghe, 2022). **Project BUMBLEBIO aimed to evaluate the possibility of api-vectoring BotaniGard by bumblebees for thrips (*Frankliniella occidentalis*) control in strawberry crops.**

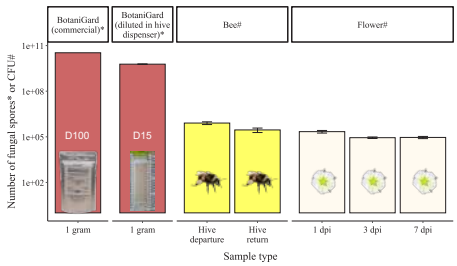
How lethal is BotaniGard to thrips and to bumblebees in lab conditions?

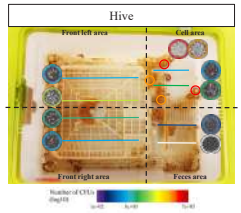


Treatment	Concentration (spores/g)
D0	0
D15	4.05×10^{9}
D25	7.13×10^{9}
D50	1.30×10^{10}

- *Beauveria bassiana* suspensions **(≥10^5 spores/mL)** applied to leaf discs significantly **reduced survival in adult thrips, but also in larvae**.
- The biopesticide BotaniGard (*B. bassiana*), diluted with corn flour, caused **0% survival in individually exposed bumblebees to the tested doses** (D15, D25, D50).
- **Observation of fungal growth** on cadavers confirmed that death was caused by *B. bassiana* in both thrips and bumblebees bioassays.

How much BotaniGard can be vectored by bees?





- Bumblebees **carried and deposited 10^5 CFUs** of fungus on flowers.
- The same fungal load remained **detectable for 7 days** in flowers.
- Fungal residues were also **traced back to the hive**, with:
  - 10^2–10^3 CFUs in hive areas
  - Up to 10^5 CFUs in cells

Is api-vectoring of BotaniGard efficient for thrips control in greenhouse conditions?

Scan here—this bee's got a video to show you!

Heterogenous hives and bee activity

Standardized flying hives	
Treatment	Average bee survival rate (SE)
Control	87.36% (3.27)
BotaniGard	92.71% (4.36) | ns

Treatment	Repetition	Average number of individuals per flower (SE) Larva	Adult
Control	R1-R2	9.69 (1.28)	0.92 (0.11)
BotaniGard		9.78 (0.92) | ns	0.70 (0.09) | ns
Control	R3	6.89 (1.49)	0.61 (0.15)
BotaniGard		6.64 (1.80) | ns	0.47 (0.10) | ns

- Api-vectored BotaniGard had **no effect on the number of thrips (adults or larvae)** and very few individuals were infected by *B. bassiana*.
- A **microclimate gradient** (Δ_{RH} = 7 to 18%, Δ_{temp} = 2 to 4°C) was observed in the greenhouse: the **number of larvae was correlated**, negatively to air relative **humidity** and positively to air **temperature**.
- Surprisingly, **no impact of BotaniGard on bee survival** was observed in standardized hives (*i.e.*, contained the same number of bees).

Conclusions

BotaniGard was successfully vectored to flowers by bumblebees, despite variability in hive activity, and persisted over time. However, its lethality against both thrips and bumblebees appeared reduced under greenhouse conditions—less harmful to the bees, but less effective for pest control. This reduced efficacy may result from variable climate in the greenhouse that favor thrips reproduction while hindering fungal pathogenicity.

References: Iqbal *et al.* (2022), doi: 10.1094/PHYTO-05-21-0205-R; Temmermans & Smagghe, 2022, doi: 10.20506/rst.41.1.3308

Affiliation
University of Copenhagen, Faculty of Science, Frederiksberg, Denmark
✉ mo@plen.ku.dk; m.montoro.caceres@gmail.com; antoine@plen.ku.dk; abj@plen.ku.dk; nvm@plen.ku.dk

Ministry of Environment and Gender Equality
Environmental Protection Agency

UNIVERSITY OF COPENHAGEN
DEPARTMENT OF PLANT AND ENVIRONMENTAL SCIENCES

PP-019 [Bee Health]

Api-vectoring potential of the entomopathogenic fungus Beauveria bassiana by Bombus terrestris for thrips control in strawberry production

Morgane Ourry, Marta Montoro, Søren S. Henriksen, Anastasia Karatza, Katja K. Nielsen, Zhicong Wu, Antoine Lecocq, Annette Bruun Jensen, Nicolai Vitt Meyling
Department of Plant and Environmental Sciences, University of Copenhagen, Thorvaldsensvej 40, 1871 Frederiksberg C, Denmark

Thrips infestations are increasingly problematic in tunnel production of strawberries, especially early in the season, and the growers have limited control options against these pests. The entomopathogenic fungus Beauveria bassiana shows promise as a microbial control agent, but targeting thrips directly remains challenging. Api-vectoring of microbial control agents is used against grey mold in strawberry production using the 'Flying Doctors' hive design (BioBest, Belgium), while few attempts for insect pest control with this method have been made. This study aimed to investigate the potential of vectoring B. bassiana (BotaniGard WP) to strawberry flowers by bumblebees (Bombus terrestris) to target Western flower thrips (Frankliniella occidentalis), and to evaluate the consequences of B. bassiana exposure for bumblebees, both individually and in groups, as well as potential hive contamination by B. bassiana. Through different sets of laboratory and greenhouse experiments, we assessed the bumblebee and thrips survival when exposed to different B. bassianaconcentrations, the bumblebee vectoring capacity, the efficacy of api-vectored B. bassiana on thrips survival and reproduction, bumblebee activities during exposure, and B. bassiana distribution inside hives. Laboratory results showed susceptibility of both thrips and bumblebees to B. bassiana. Approximately 50% thrips mortality was achieved with relatively low conidia concentrations in strawberry leaf bioassays. Complete mortality of bumblebee workers occurred by exposure to the BotaniGard WP product, while incubation of the exposed worker with 5 nestmates resulted in mortality of approx. of the individuals. In greenhouse experiments, bumblebees carried and deposited 10 colony forming units (CFU) per strawberry flower and vectored the fungus back to the hive, with 10^2-10^3 CFU detected in hive areas and up to 10 CFU in the cells built by the bumblebees. Despite high fungus levels in hives, bumblebee survival was unaffected in the greenhouse setup using the 'Flying Doctors' hive, though foraging activities decreased slightly over time. This project aims to promote the multi-functionality of commercial bumblebee hives and targeted biopesticide application, to establish foundations for more widespread use of api-vectoring of microbial control agents beyond control of plant pathogens and to qualify risk assessment on hives when using microbial control agents.