

# **The effect of kaolin and the microbial biopesticides Prestop-Mix and BotaniGard on respiratory physiology and longevity of bumblebees (*Bombus terrestris* L.)**

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# Entomovector technology

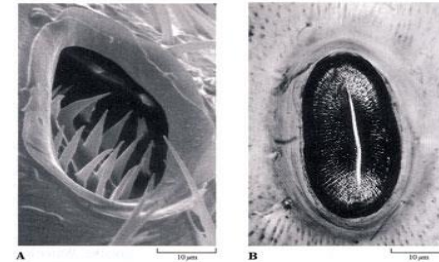
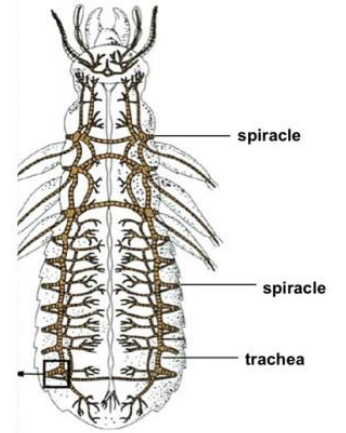
- New method
- Bees (foragers) as vectors to distribute plant protection agents to flowers
- Precise application, smaller amounts of preparations needed
- Uses powdery biopreparations
- Must be safe
  - Plant products (strawberries etc)
  - Honey
  - **Vectoring insect**



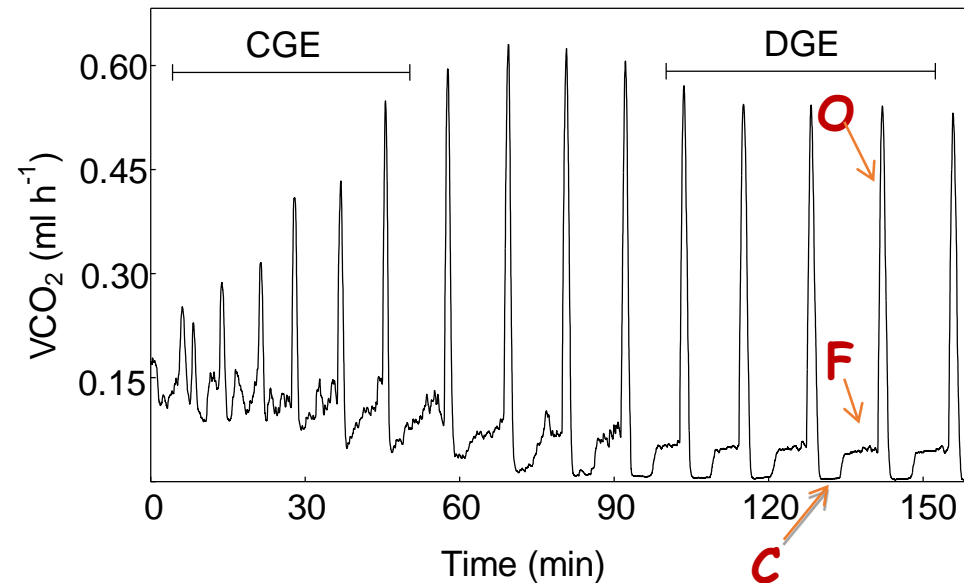
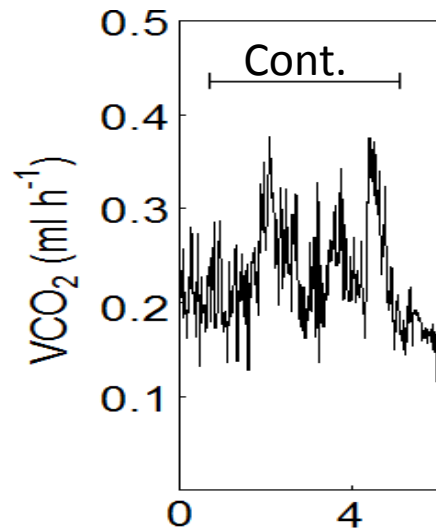
# Effect on respiratory physiology

- Insect respiration

- vulnerable system, easily affected by stressors
- reflects the metabolic rate of the organism
- different respiratory patterns:
  - Continuous (Cont.)
  - Cyclic (CGE)
  - Discontinuous (DGE)

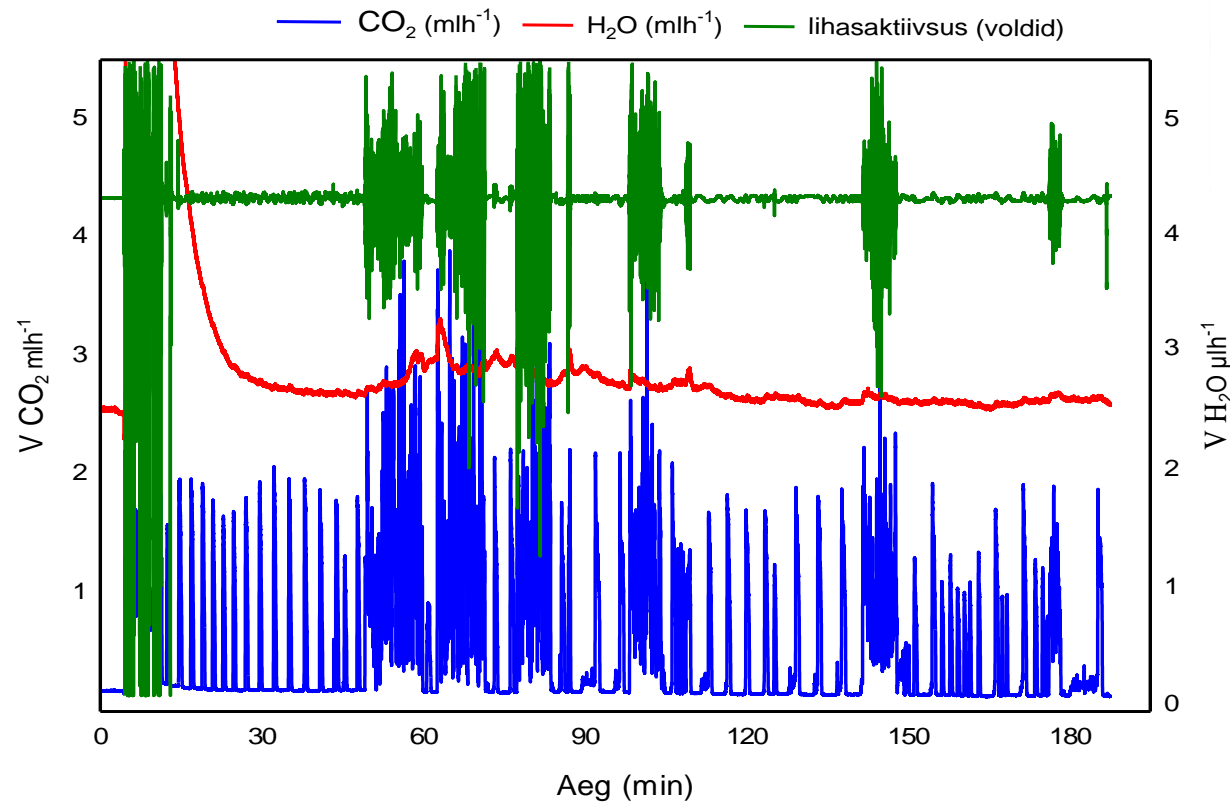


<http://www.biog1445.org/demo/05/tracheasystems.15.html>



- **Flow through respirometry: LI-7000 CO<sub>2</sub>/H<sub>2</sub>O analyzer combined with IR-actography**

- Metabolic rate, respiratory rhythms
- Water loss rate
- Muscle contractions



[http://www.licor.com/env/products/gas\\_analysis/li-7000/](http://www.licor.com/env/products/gas_analysis/li-7000/)

# Our experiment

- **Are powdery formulations affecting bumble bee physiology?**
  - Causing respiratory failure?
  - Changing cuticule properties?
- Bumble bees (*B. terrestris* L.): Koppert Biological Systems
- Treatments:
  - Prestop Mix - fungus *Gliocladium catenulatum*,
  - Kaolin powder - formulation additive (carrier /diluent)
  - BotaniGard - fungus *Beauveria bassiana*
  - Wheat flour
  - Blank control



# Single topical treatment:

- Immediate effect (N=6 each treatment; 18°C)
  - metabolic rate (MR)
  - water loss rate (WLR) – respiratory and cuticular WLR
  - measured 3 h before and 3 h after treatment
- Long term effect (N=20 each treatment; 18°C and 28°C)
  - longevity



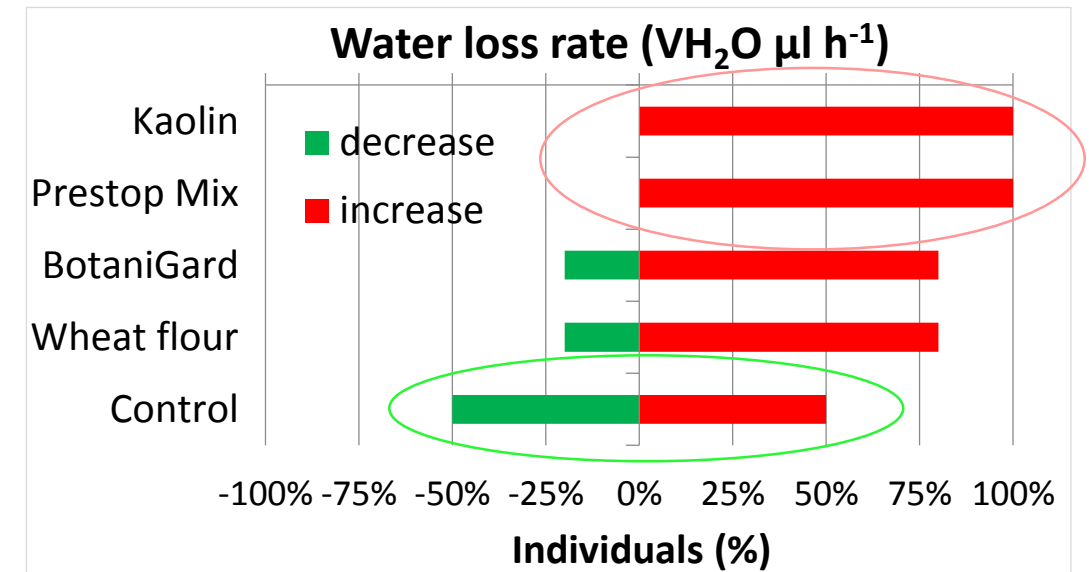
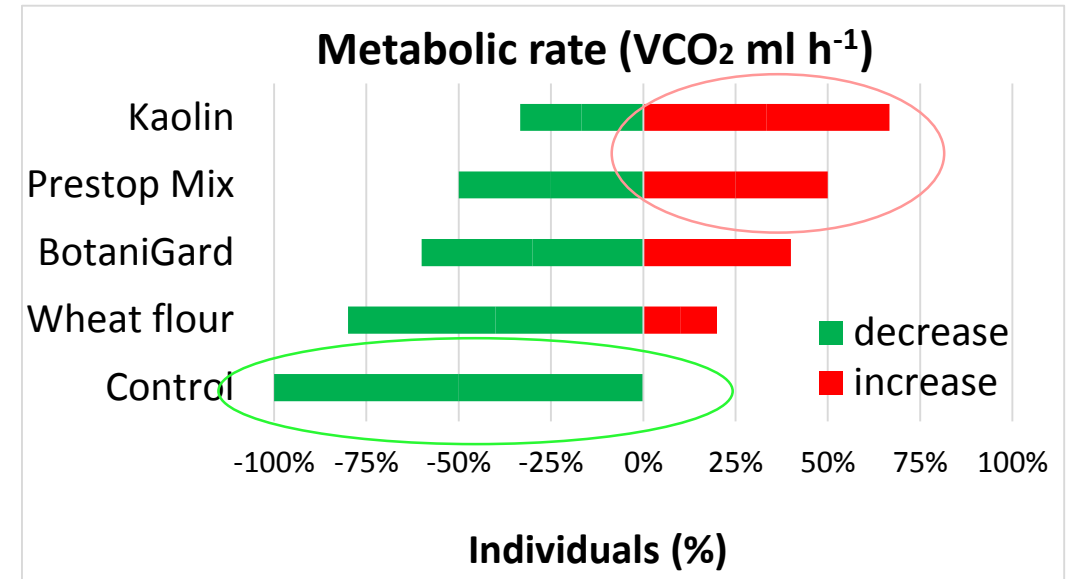
# Results

## Metabolic rate:

- No significant differences before and after treatment
- MR normally decreases during long observation
- Kaolin and Prestop Mix increase MR - irritation?

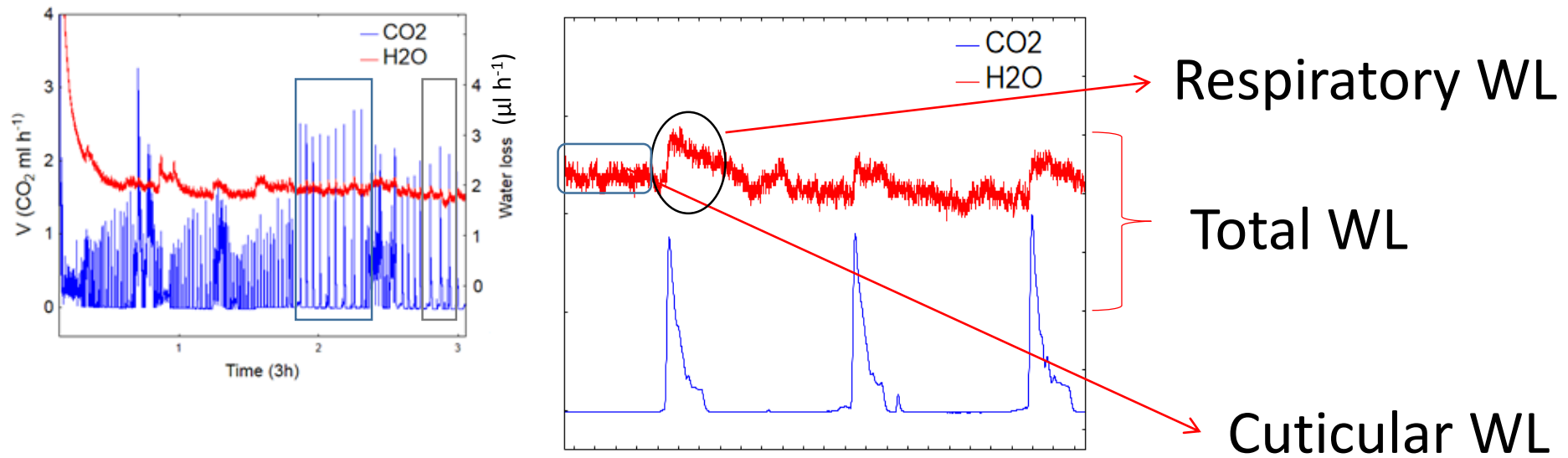
## Water loss rate:

- Kaolin and Prestop Mix caused significant increase in WLR



# Respiratory and Cuticular WL

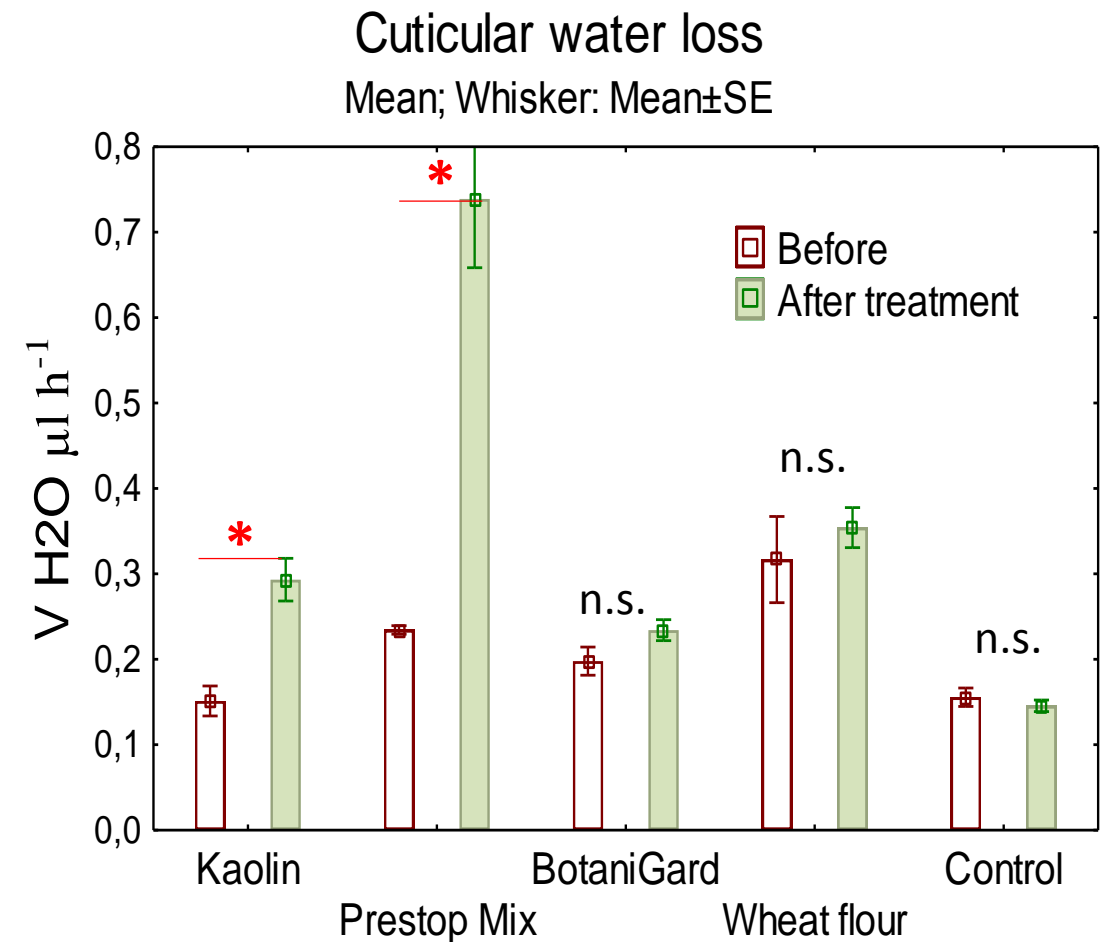
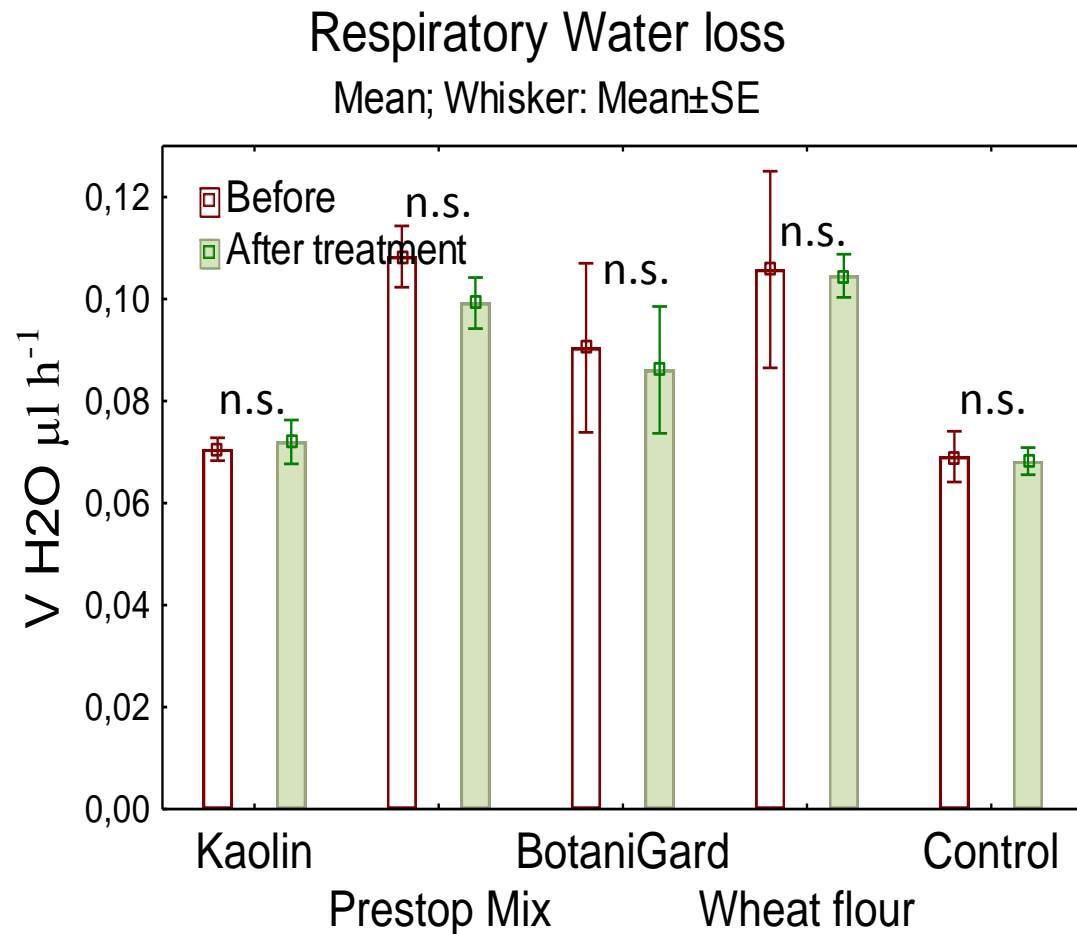
- Can be measured during the periods of DGE
- We calculated the mean respiratory and cuticular WLR of 3 consecutive cycles of DGE



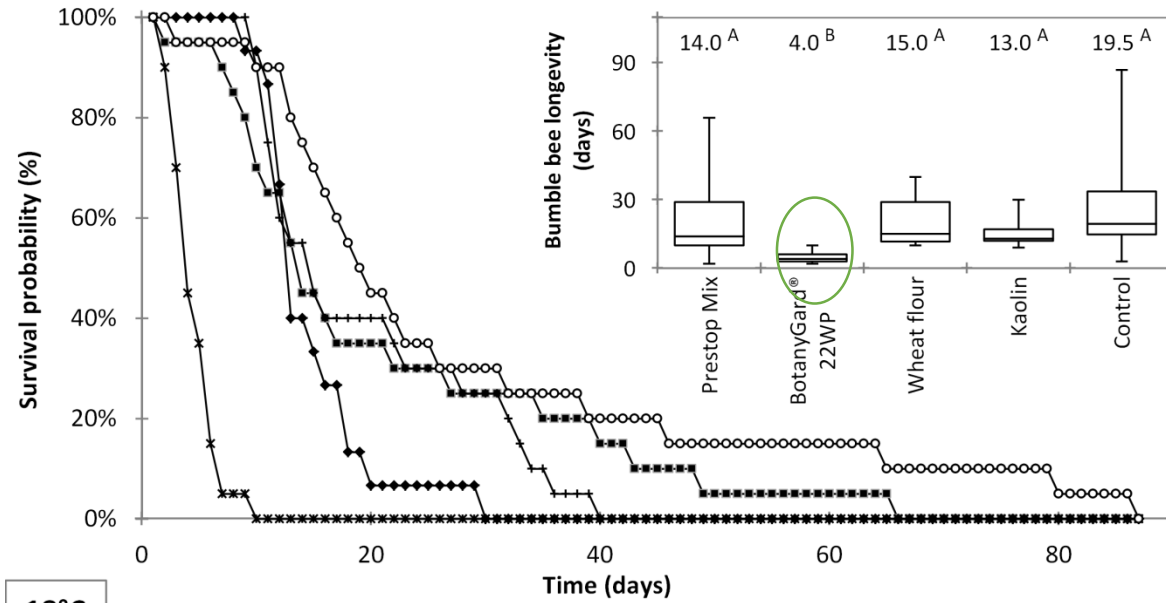
$$\text{Respiratory WL} = \text{Total WL} - \text{Cuticular WL}$$



- No difference in mean Respiratory WL
- **Significant differences in Cuticular WL: Kaolin and Prestop Mix**

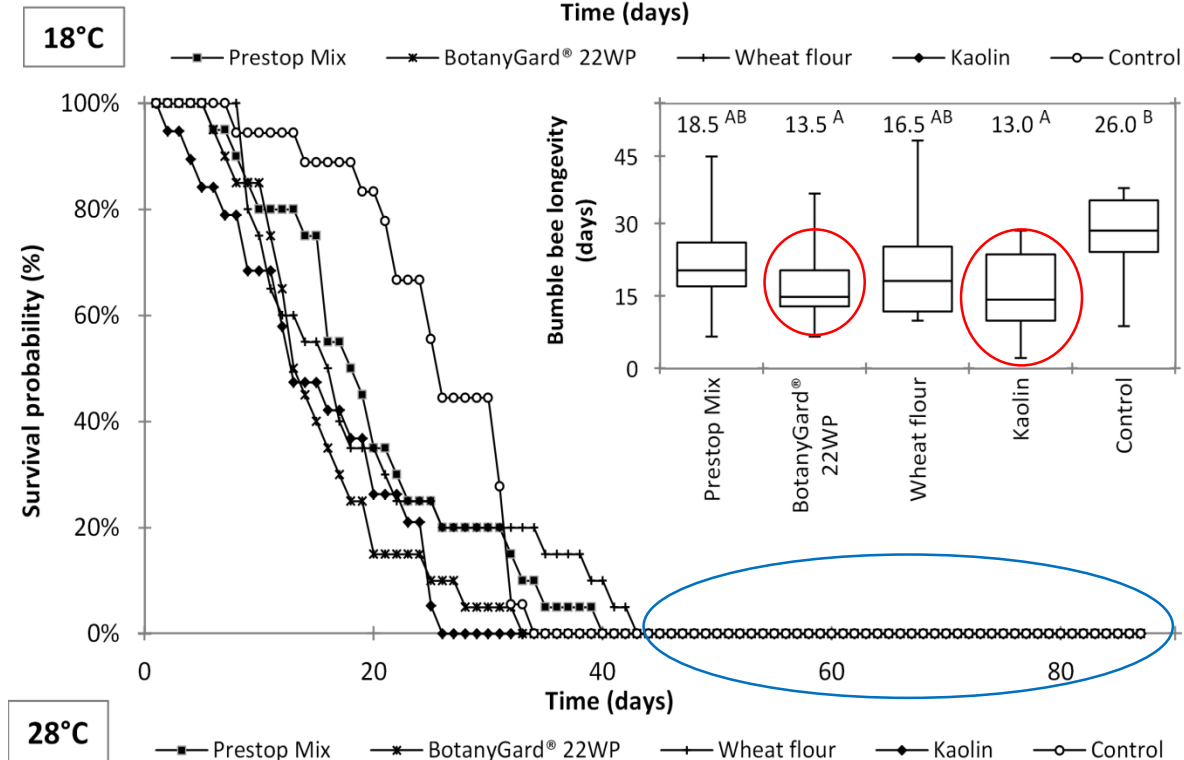


# Longevity



[Temperatuure võrreldes:]

- Median longevity shorter at 18 °C  
\*\*\* BotaniGard
- Maximum longevity shorter at 28 °C



[Temperatuure eraldi vaadates:]

- At 18 °C only **BotaniGard** differed significantly
- At 28 °C **BotaniGard** and **kaolin** differed significantly

# Conclusions

- Our results indicate that powdery formulations of microbial pest control agents may pose some risk to vectoring bees, still the risk is much lower than with synthetic pesticides.
- The standard risk assessment should include physiological methods, for instance respirometry, and include analyses of the effects of inert materials of microbial pesticides.

Thank you for your attention!

