ApisRAM

Agent based honey bee model for risk assessment
Background

- A part of EFSA's MUST-B project (EU efforts towards the development of a holistic approach for the risk assessment on MUltiple STressors in Bees)

- Honeybee colony weakening and losses have been reported due to multiple stressors, including:
  - Nutritional stress
  - Thermal stress
  - Pesticide exposure
  - Biological agents (diseases and parasites)

- Model evaluation by field data collected at six study sites
Introduction

ApisRAM: an agent-based model for honey bee which can
- Integrate multi-stressor impacts
- Simulate feedbacks and interactions between components
- Predict complex system-dynamics
Honey bee agent

- Behaviour occurs at the individual level
- Behaviour depends on the individual bee’s situation and its contexts
- Behaviour depends on individual motivation not a systems response

1. What is my age?
2. What is the time?
3. How about the weather?
4. Do I know any place to forage nectar?
   Fly out and forage nectar!
Honey bee agent

Three castes

- Worker
- Drone
- Queen

Four life stages

- Egg
- Larva
- Pupa
- Adult
Multi-stressors and mortality

- Thermal
- Pesticide
- Biological agents:
  - Varroa
  - Nosema
  - Acute Bee Paralysis Virus (ABP)
  - Deformed Wing Virus (DWV)

- Nutrition
- Vitality
- Development Age
- Mortality
- Increment by activity
- Vitality
Pesticide - landscape

- Spraying
  - Vegetation surface
  - Soil
  - Vegetation

- Seed coating

- Overspray
- Contact

- Pollen/Nectar
- Foraging

- Hive
Pesticide - hive

Pesticide is tracked in cell level.

- Thermoregulation
- HPGs
- Homing ability
- Reproductive performance of the queen

- Pollen/Nectar/Honey
- Cell Wax
- Eating
- Feeding
- Bees on honeycomb
Thanks for your attention!
If you have any questions, please feel free to contact
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