

Realistic exposure to boscalid induces shorter-lived honey bees and disturbs colony dynamics

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Thanks to : Stéphane Grateau², Carole Moreau-Vauzelle², Daniel Raboteau², Colombe Chevallereau², Maxime Pineaux², Manon Desaiivres²

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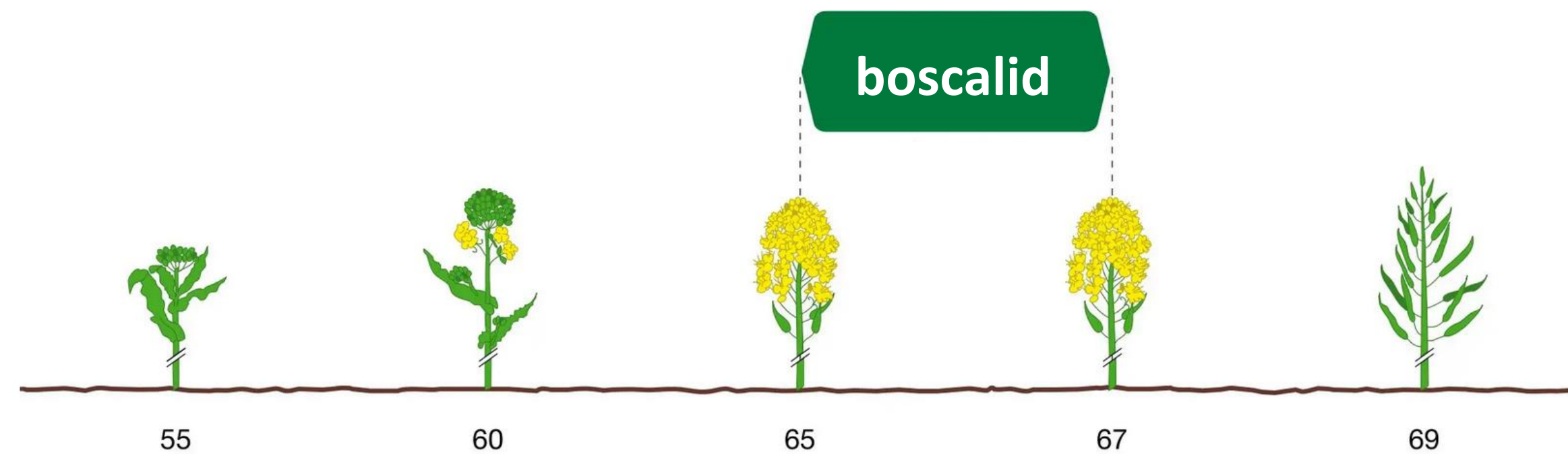
Context

Apis mellifera in danger

- Colony collapse disorder : Start in 1998 in Europe. It manifests by hives entirely empty of workers, generally at the end of winter, more rarely at the height of the foraging season.
- Significant winter losses of honeybee colonies : Winter 2021-22 : 29.4%; Winter 2022-23 : 25,6%.¹

➔ **Ecological and economical lost for biodiversity and agriculture.²**

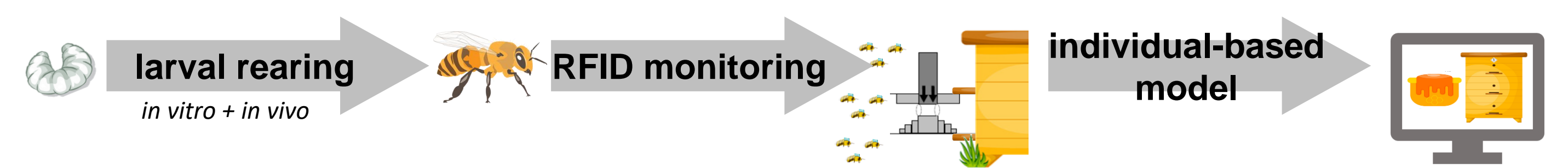
- Boscalid is used during crop flowering and is present in the pollen collected by the bees and transported to the colony.



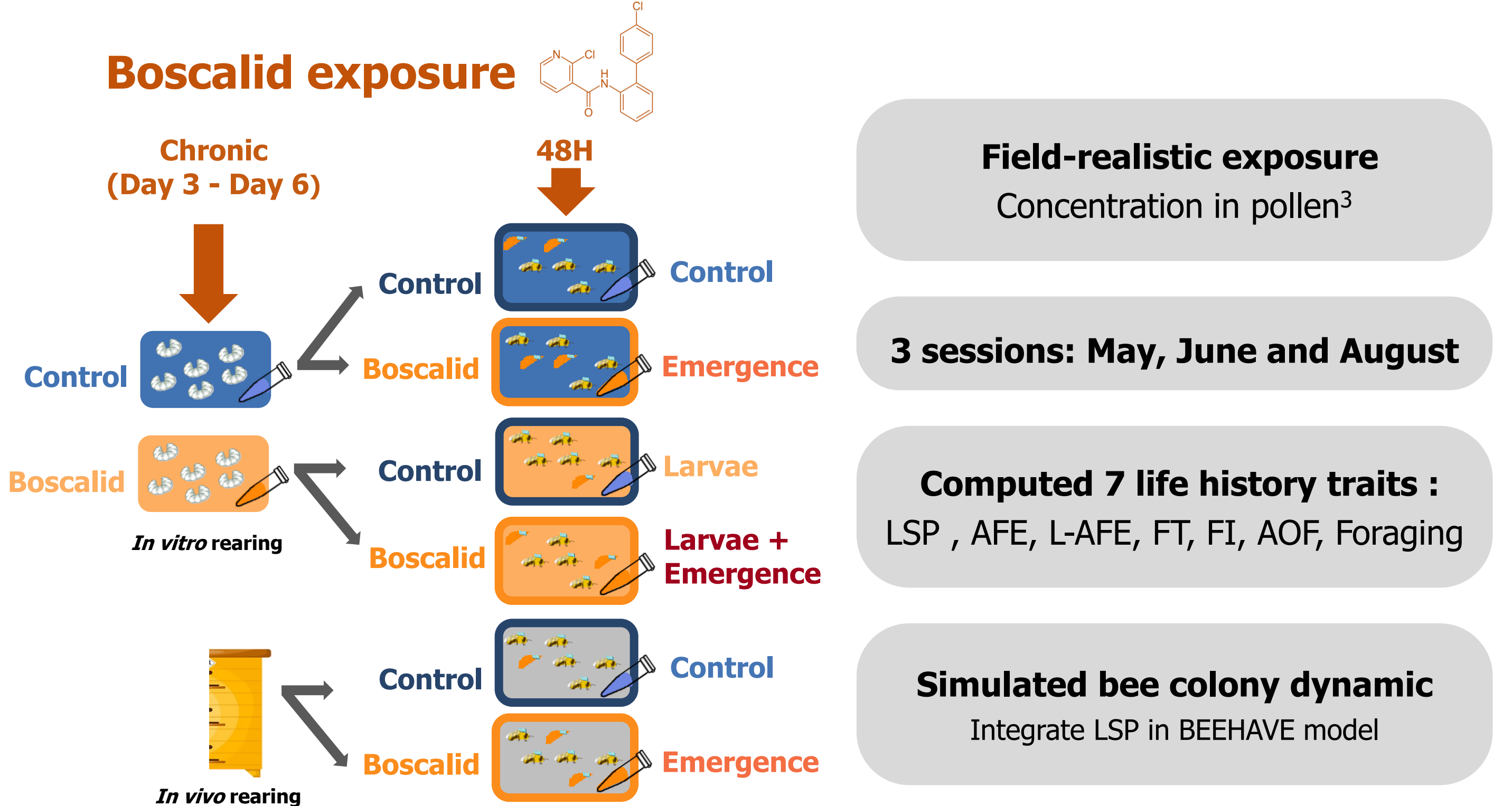
➔ **The most common scenarios are early and recurrent exposure of bees to boscalid through their diet.**

Protocol

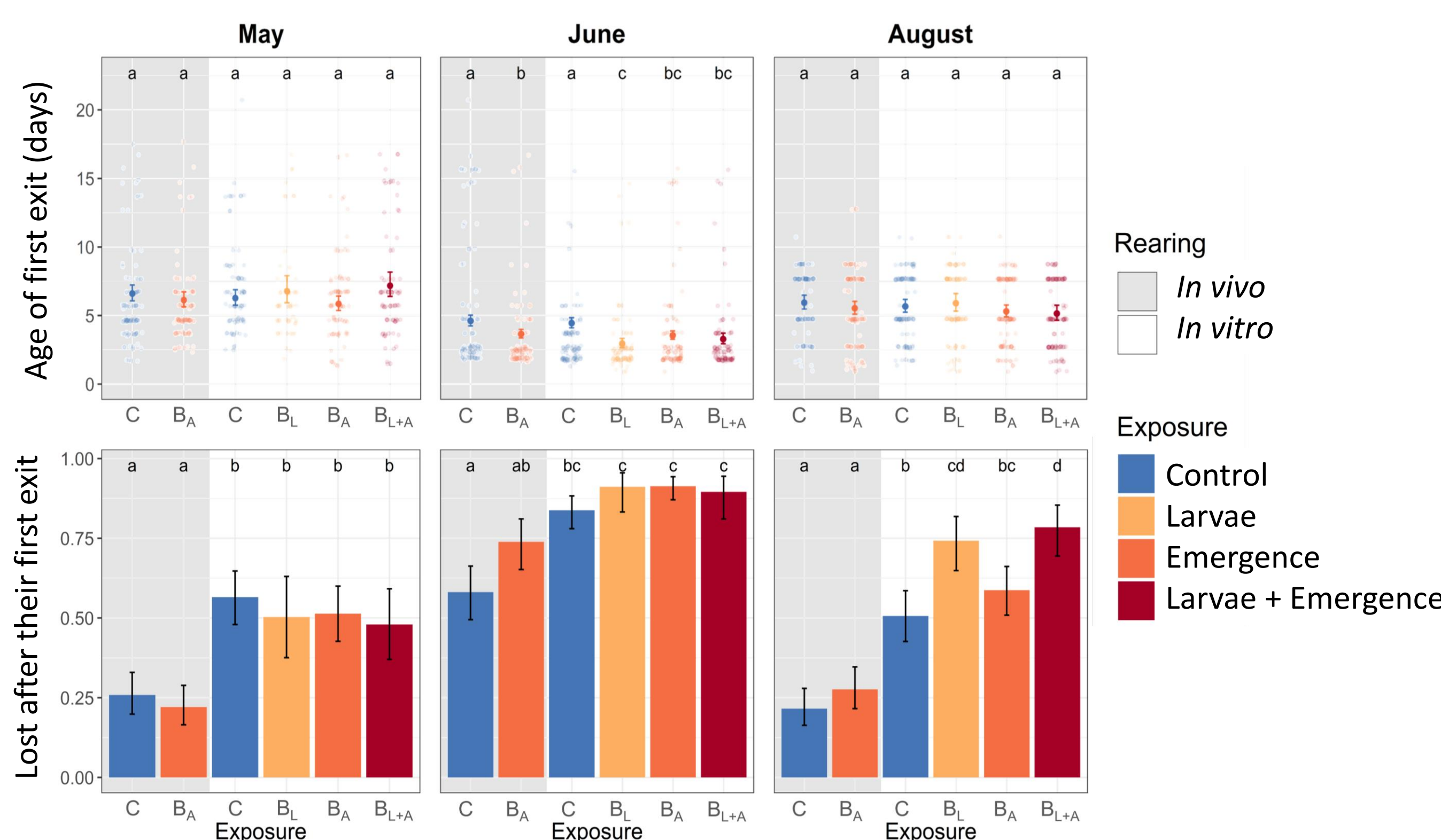
Monitoring individuals through their entire life cycle.



➔ **Effect of recurrent boscalid exposure on life history traits.**



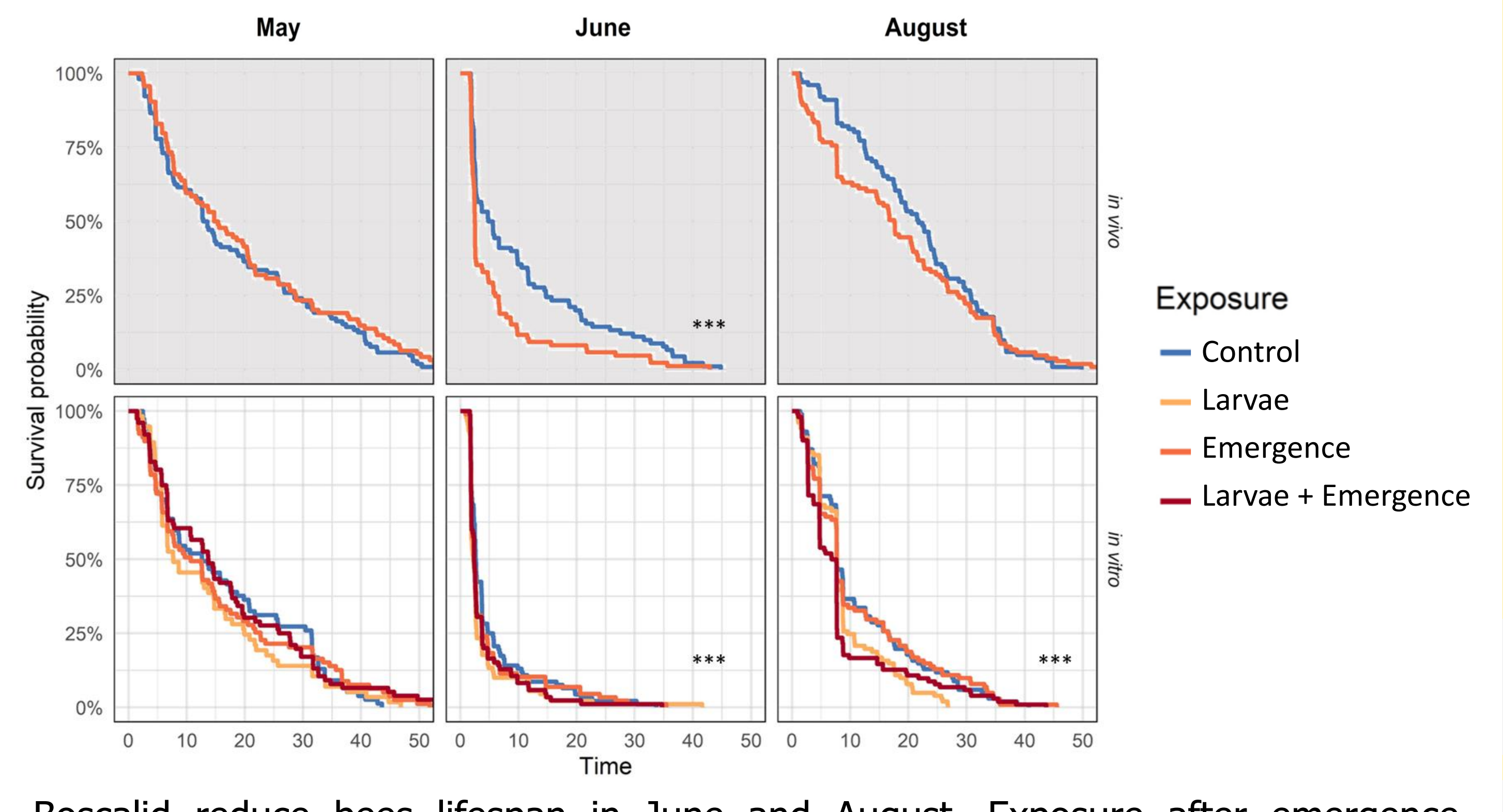
Impact at first exit



In June, first exit was accelerated for bees exposed to boscalid. The most affected bees were those exposed at larval stage : **first exit earlier : 1.49 days.**

In August, boscalid exposure at larval stage **increase (29.7%) the proportion of bees lost after the first exit.**

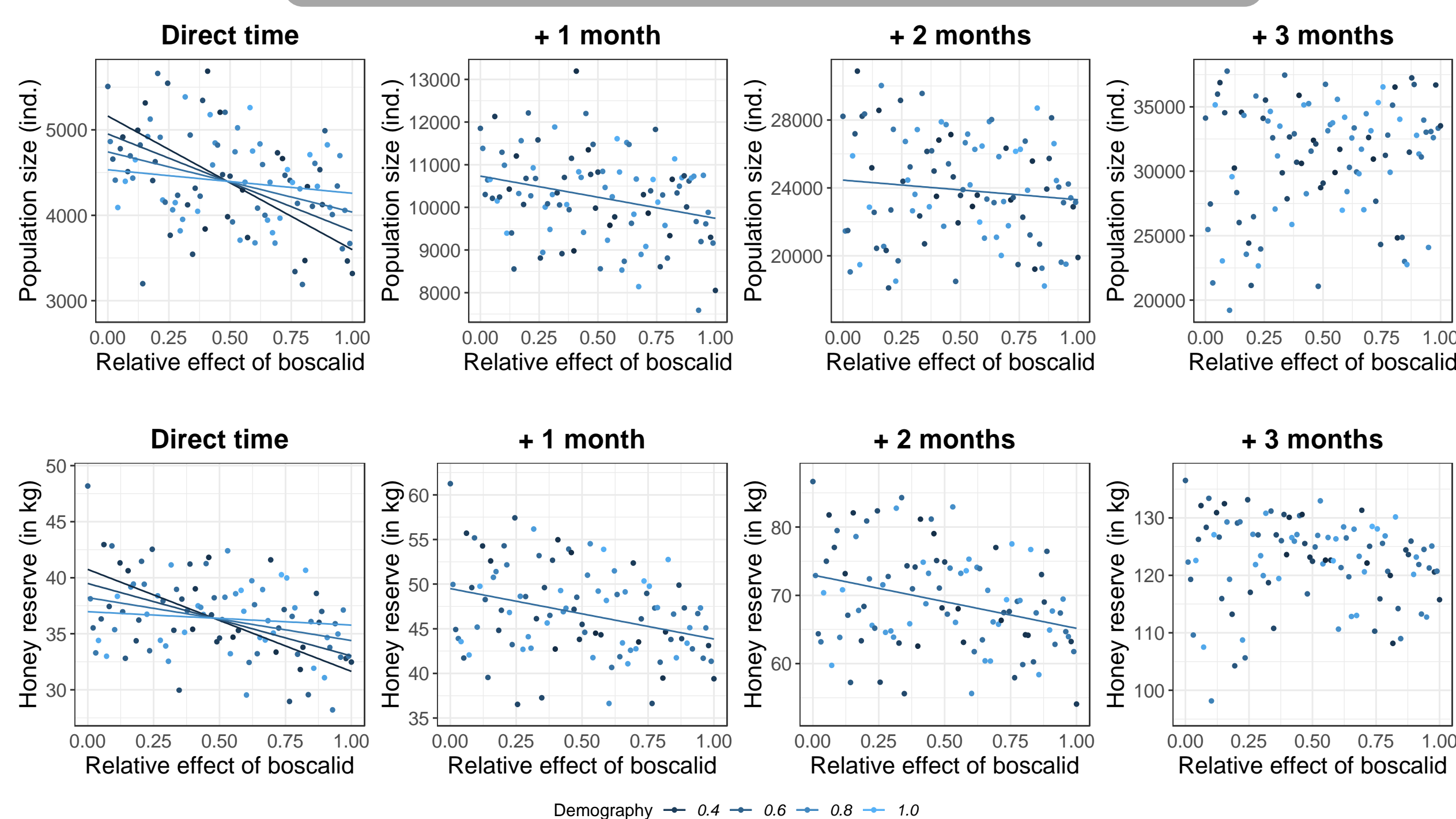
Decrease lifespan



Boscalid reduce bees lifespan in June and August. Exposure after emergence **reduced their lifespan by 29.9% in June.**

➔ **Bees lifespan depend on environmental and rearing conditions.⁴**

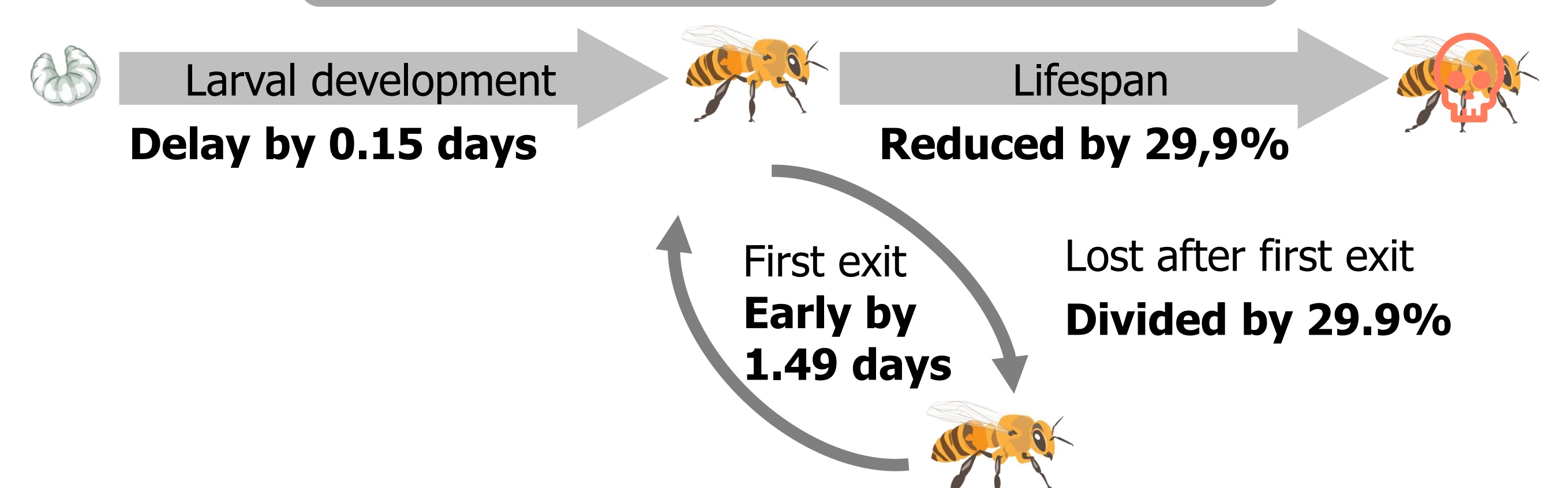
Reduces colony activity



In simulations, colonies with low demographic strength are more severely affected by the effects of stress induced by exposure to boscalid. This stress will **reduce population size by 18.5%** and **honey production by 13.0%**. The effects could be detected up to 2 months after the cessation of stress in the simulations.

➔ **Bee colonies dynamics simulation are more sensitive to periods of stress in spring.**

Summary of major results



Effect of boscalid on the colony simulation
most sensitive before the growth period in spring

Population size **Reduced by 18,5%** Honey production **Reduced by 13,0%**

Boscalid disrupts bees' first activities and reduces their lifespan. This stress can have an impact on colonies based in simulation, resulting in reduced bee populations and honey resources.

➔ **Boscalid reduce colony production and potentially weakness the ability to respond to other stresses.**