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Effect of a common fungicide on the honeybees activities after chronic exposure

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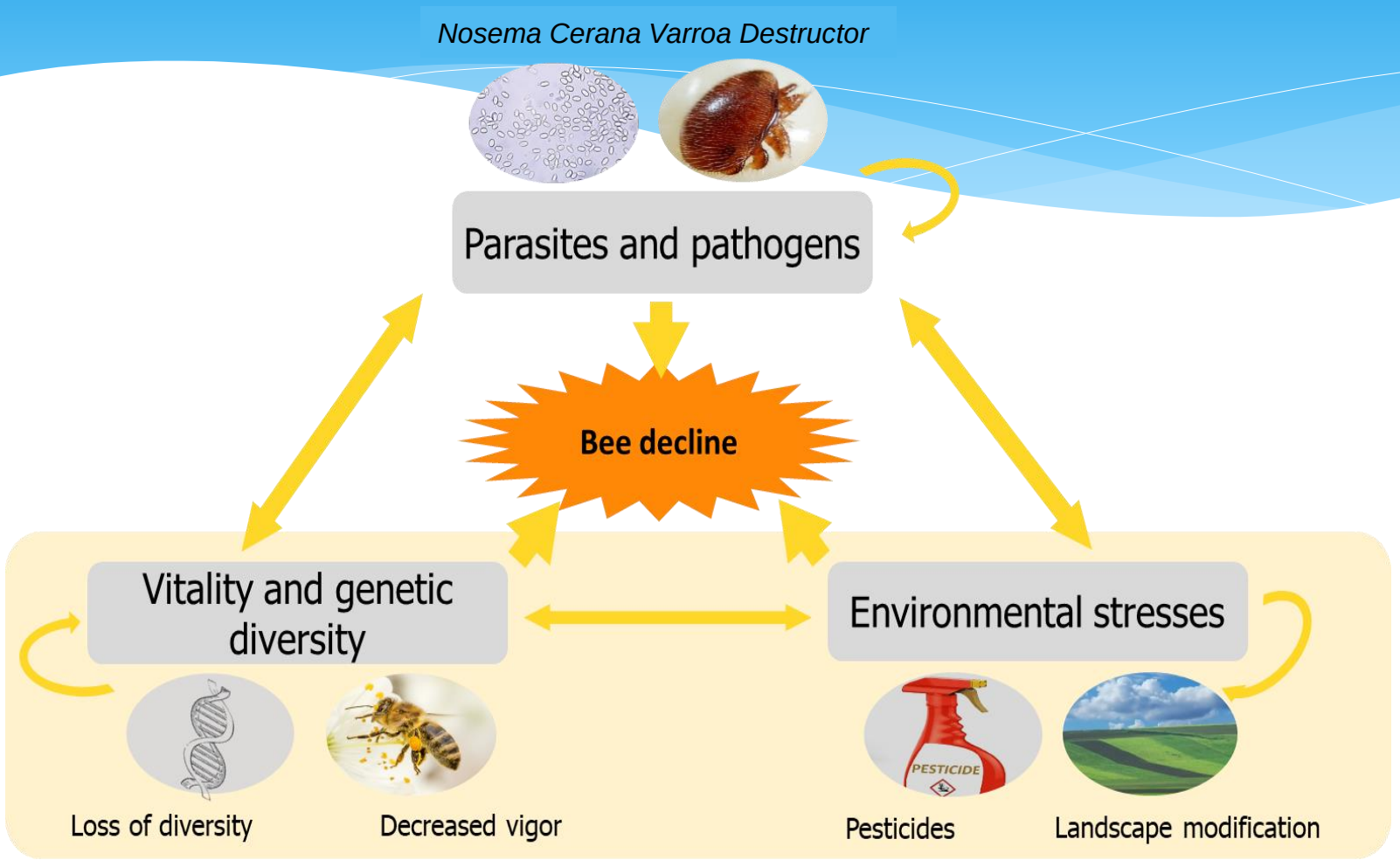
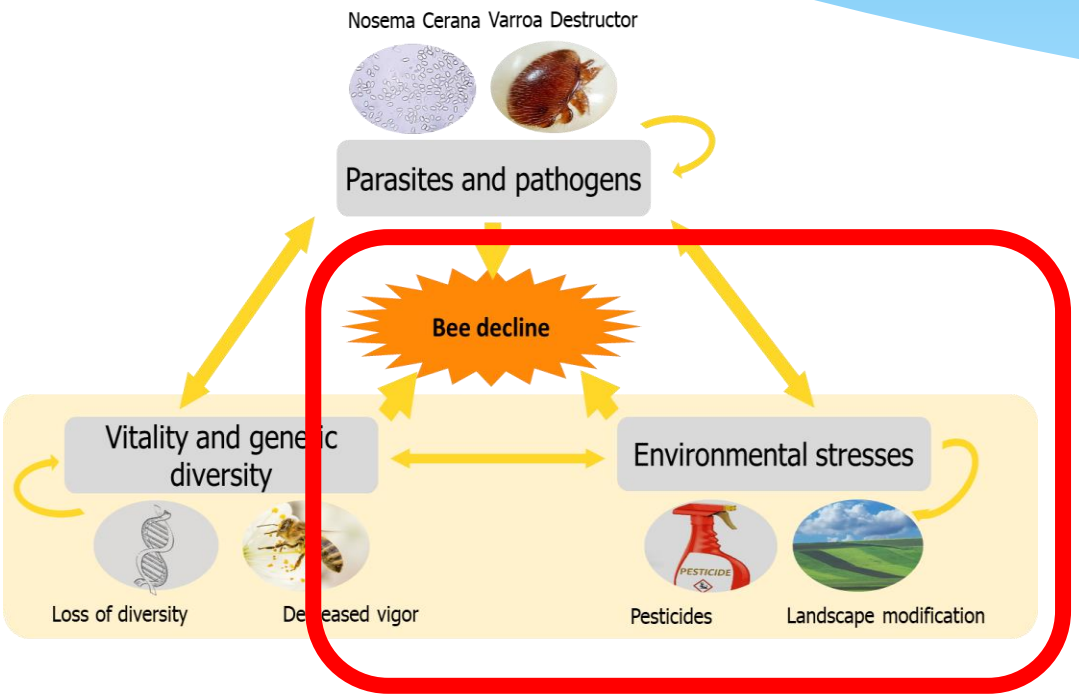
Bee decline: a multifactorial cause



Sánchez-Bayo *et al.*, *Biol Cons* (2019)
Müller *et al., Basic and Applied Ecology* (2018)
Goulson *et al., Science* (2015)
Potts *et al.*, *Trends in Ecology & Evolution* (2010)

Pesticides



- Fungicides not well documented
- Non-target species are complex to study and likely underestimated
- Sublethal and combined effects on bees

Sánchez-Bayo *et al.*, *Biol Cons* (2019)
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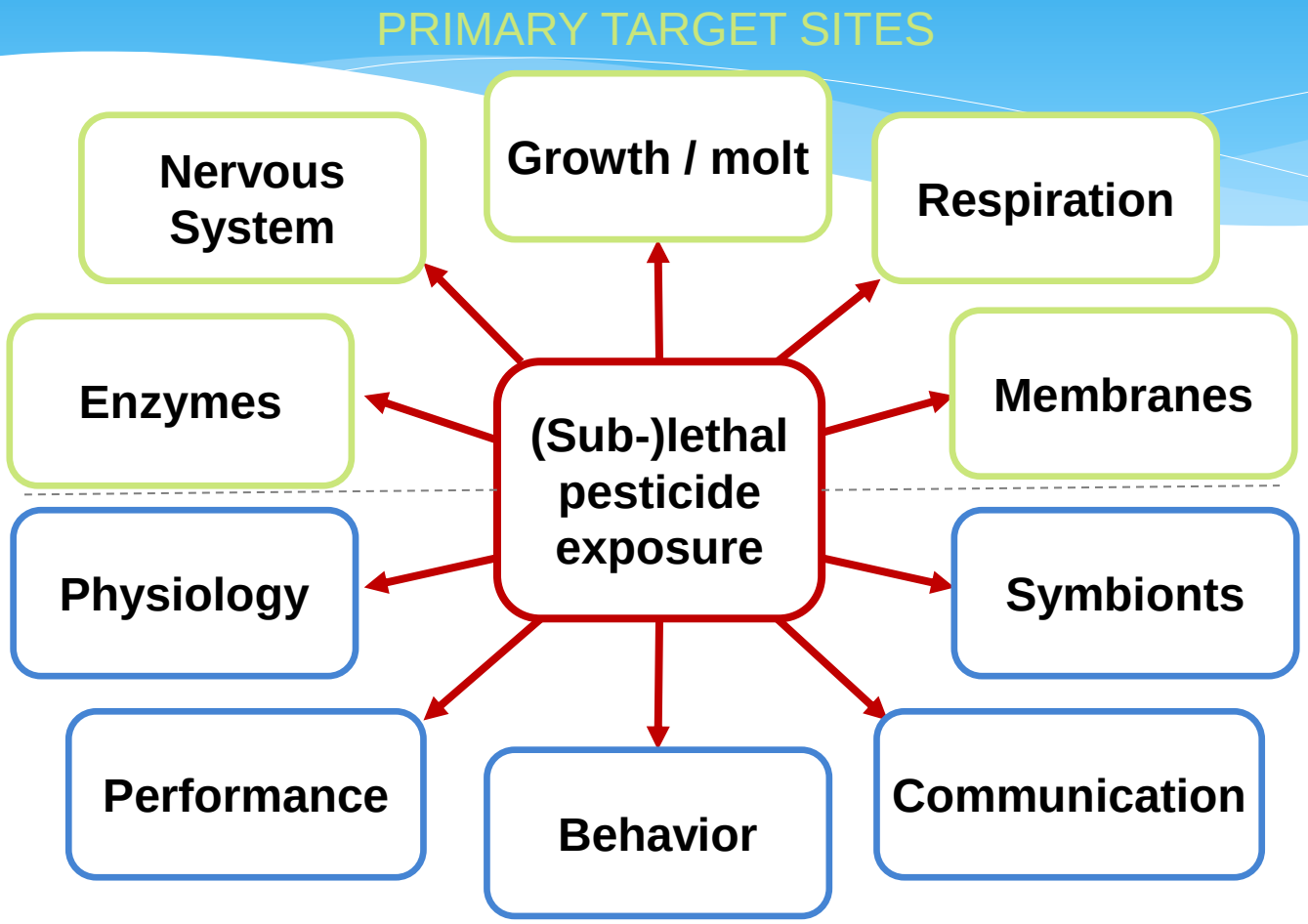
Sublethal effects of pesticides



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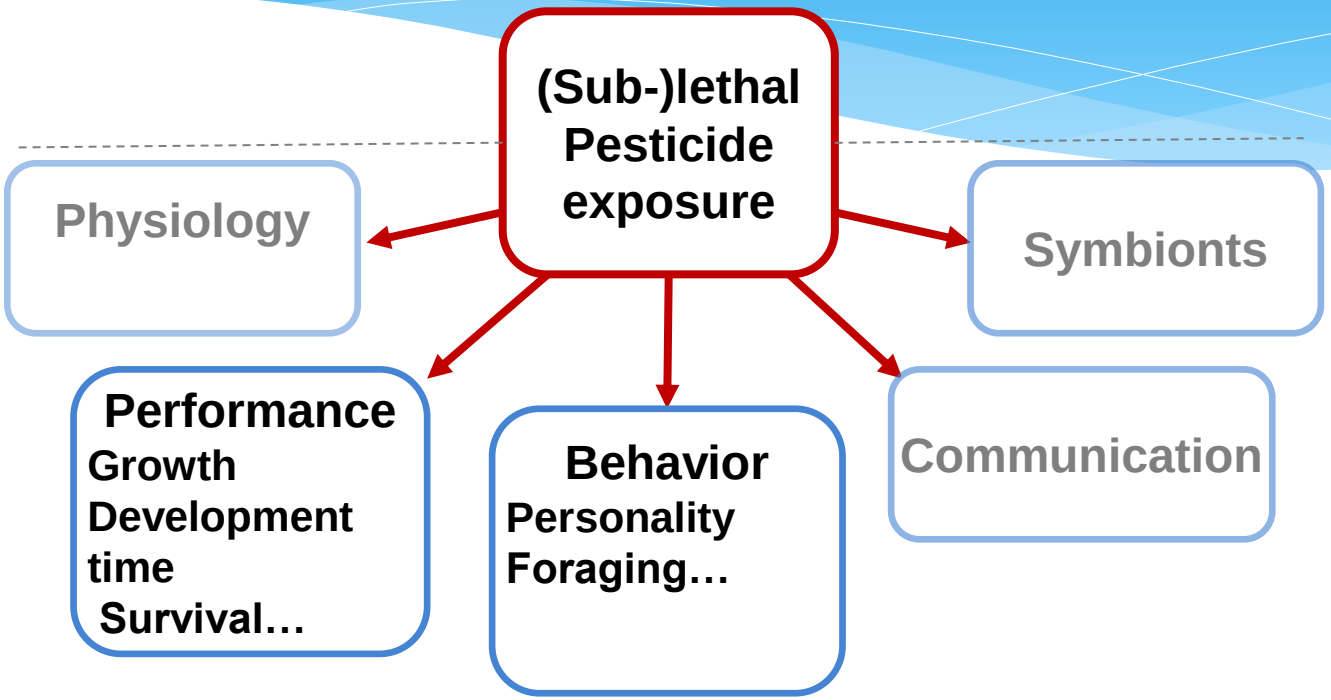
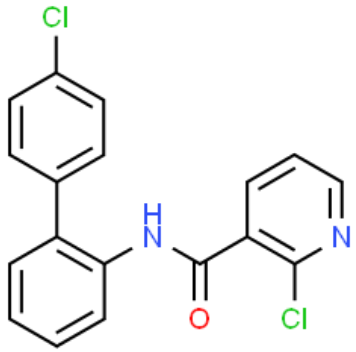
Sublethal effects of pesticides



SECONDARY TARGET SITES

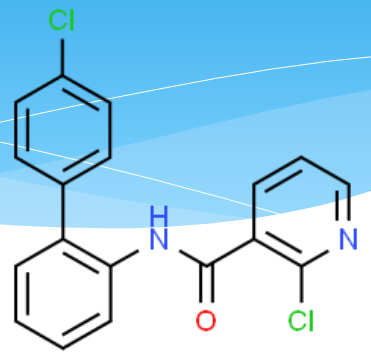
Sánchez-Bayo *et al.*, *Biol Cons* (2019)
Müller *et al., Basic and Applied Ecology* (2018)
Goulson *et al., Science* (2015)
Potts *et al.*, *Trends in Ecology & Evolution* (2010)

What are the effects of early and repeated exposure of Boscalid on *Apis mellifera*?



Boscalid

Impact of a fungicide



Boscalid

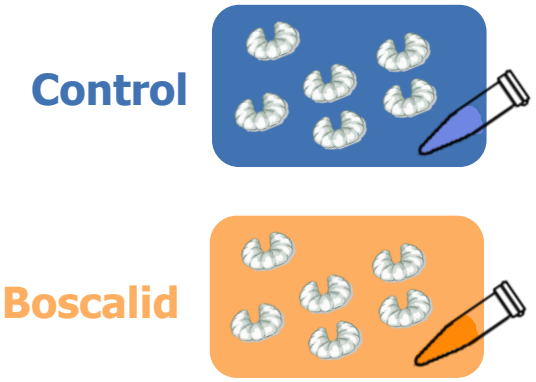
* Carboxamide family
* Inhibits ATP production

* Against brown rot, gray mold...
* In the orchards, on rapeseed...
* Use during flowering
* High dose (high LD50)
* In many commercial solutions (Pristine®, Pictor Pro ®, Cantus ® ...)

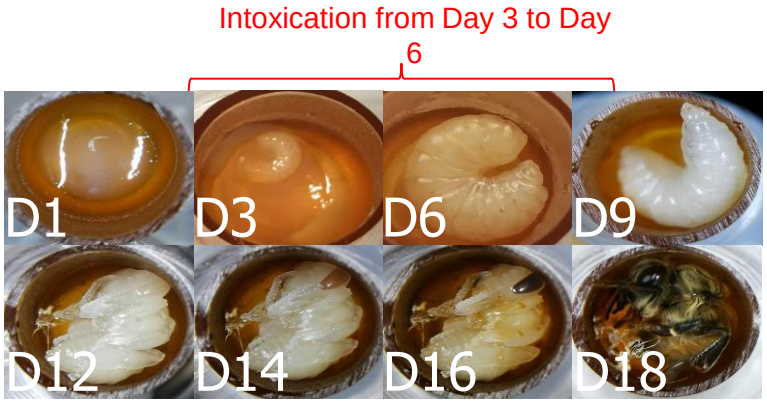
Experimental approach

* **Chronic exposure in the larval phase**

Protocol developed by INRAE and adopted at the OECD



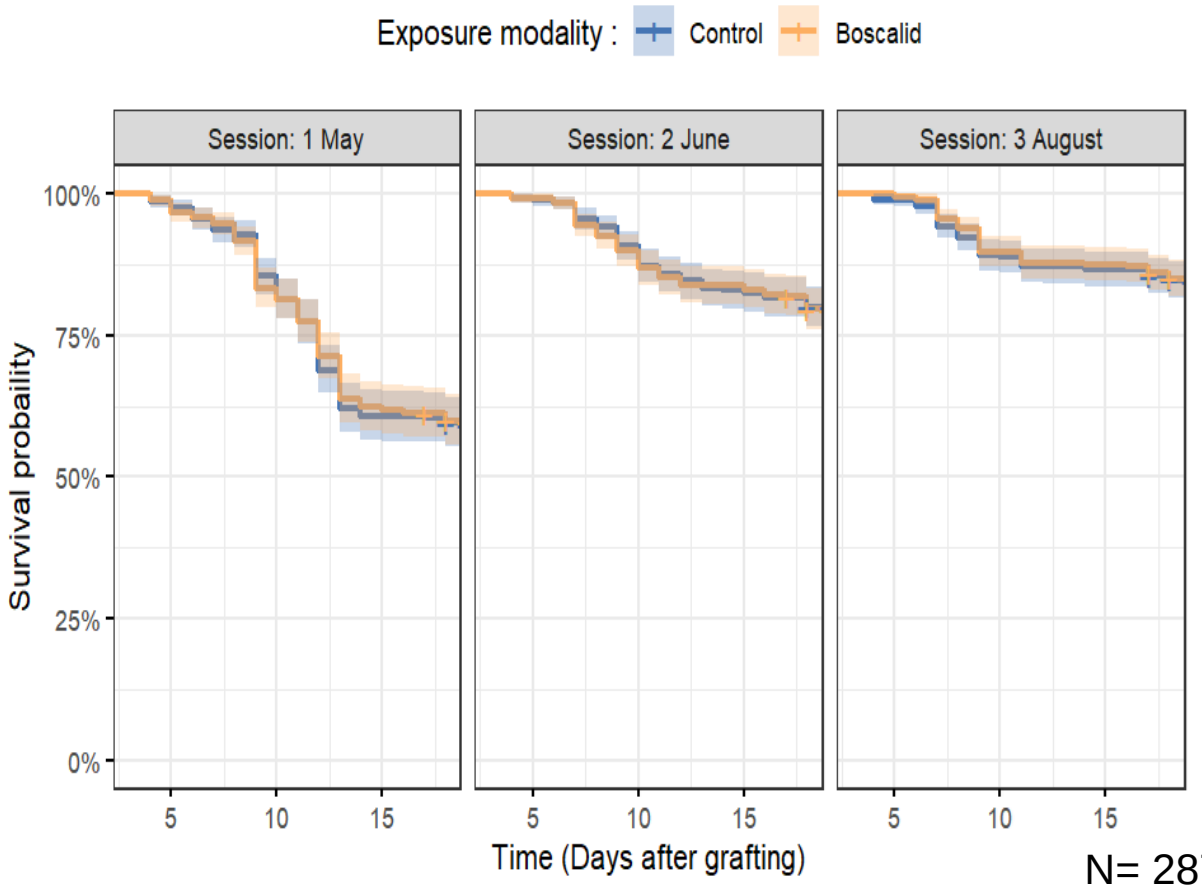
In vitro rearing



* Representative dose of the one found in the environment
* 3 sessions
* Dietary exposure

Chronic exposure in the larval phase

Larval mortality



May: High mortality allowed the protocol to be improved

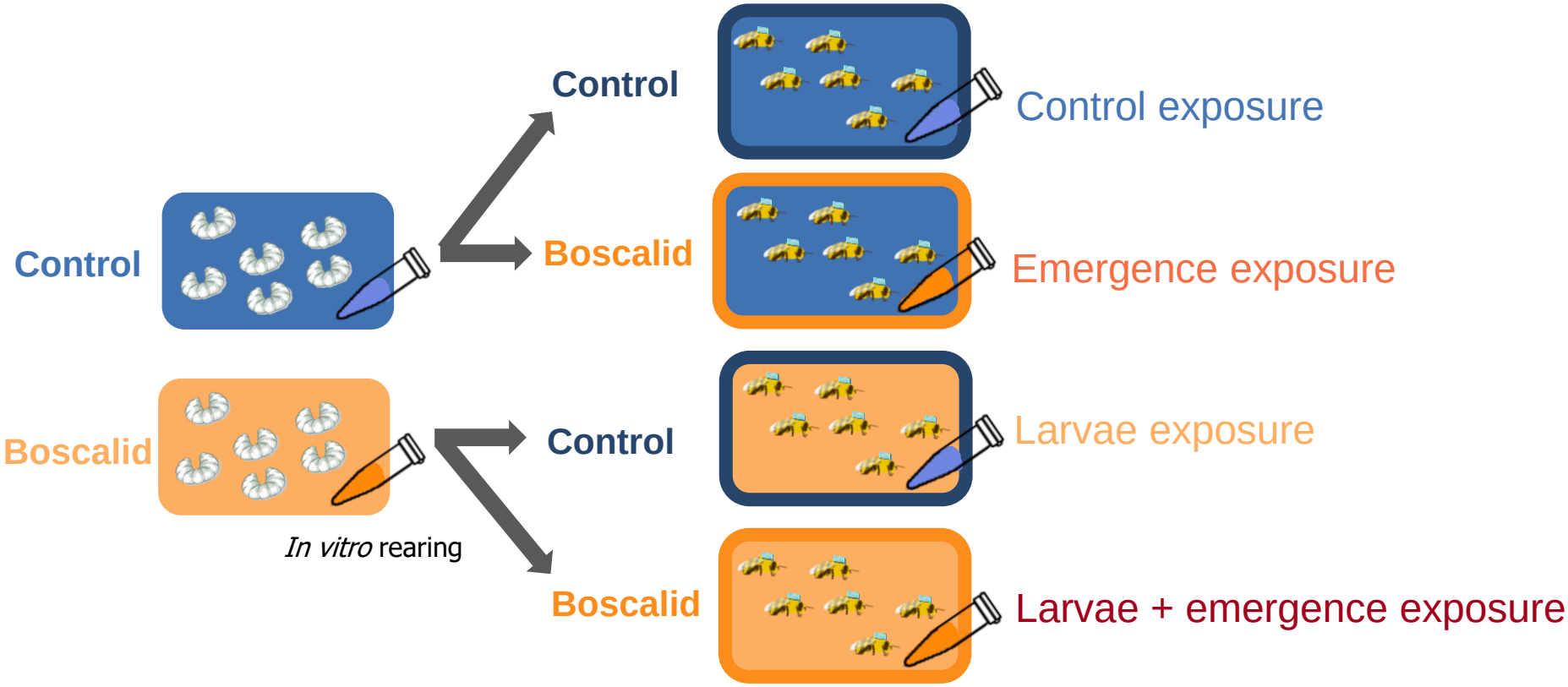
No impact of Boscalid on mortality

Slightly delayed emergence of larvae exposed to Boscalid

N= 2877 larvae

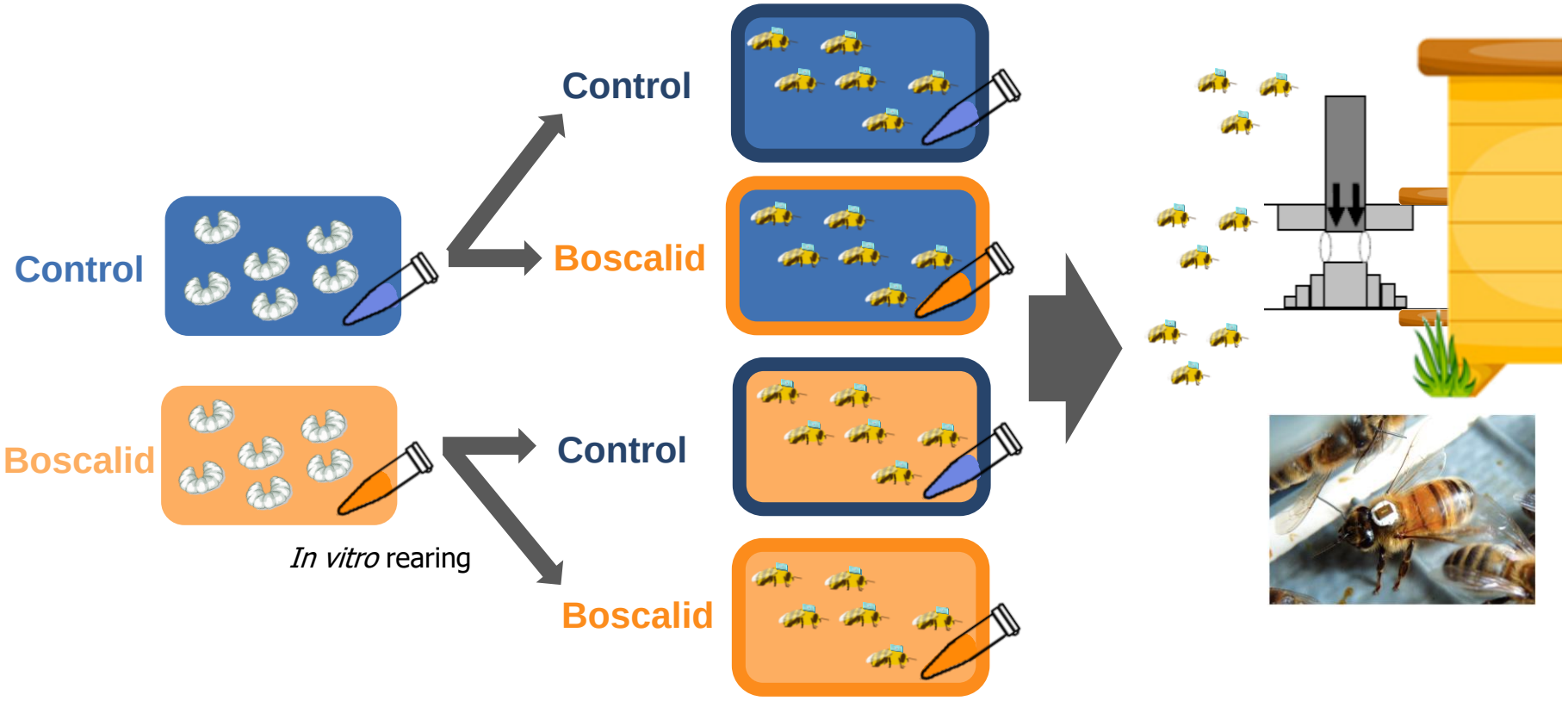
Experimental approach

* **Exposure 48h after emergence**
* Representative dose of the one found in the environment



Experimental approach

* **Released workers into the RFID hive**



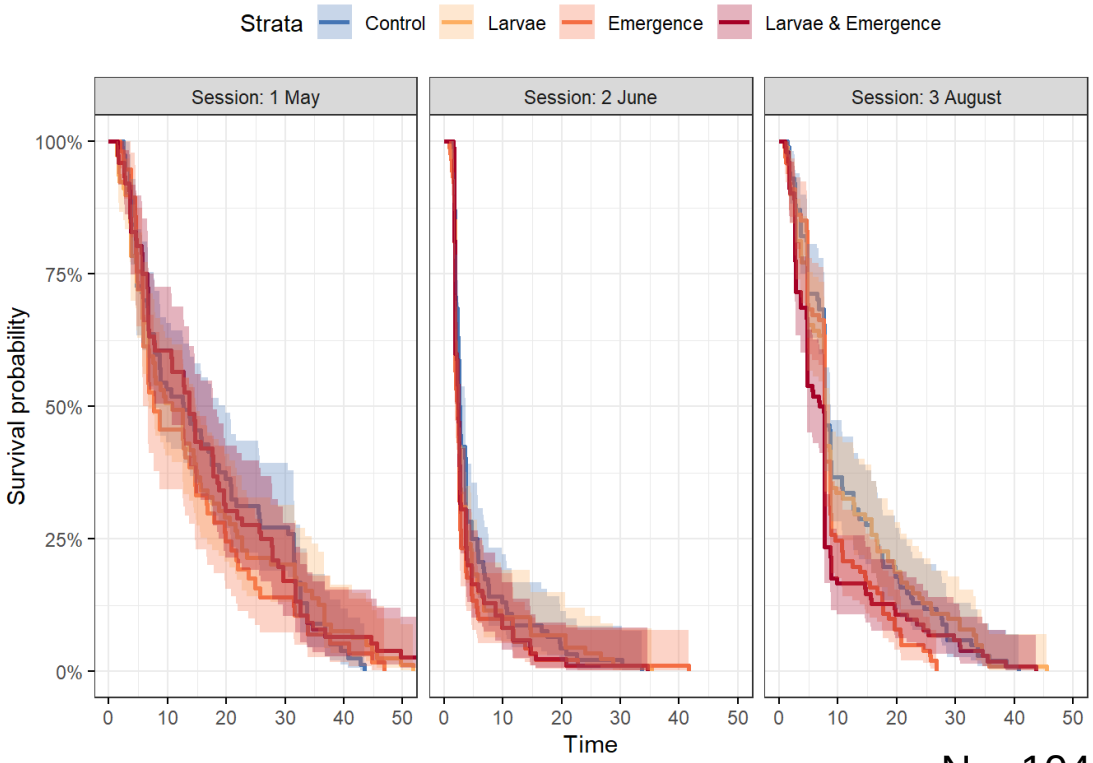
RFID system

Radio Frequency Identification

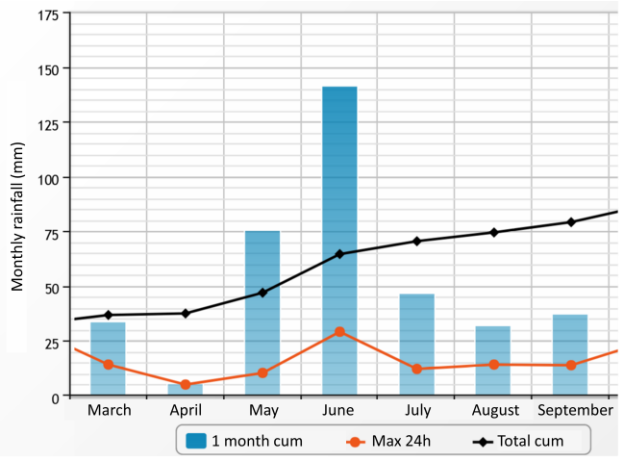
* 8 detectors (to detect exit and enter the hive)
* Tracking the bees all their lives
* Identify individual characteristics (age of first exit, number of flights, age of foraging...)

Repeated exposure of bees *in vitro*

Survival in the hive



* Lots of rain in June

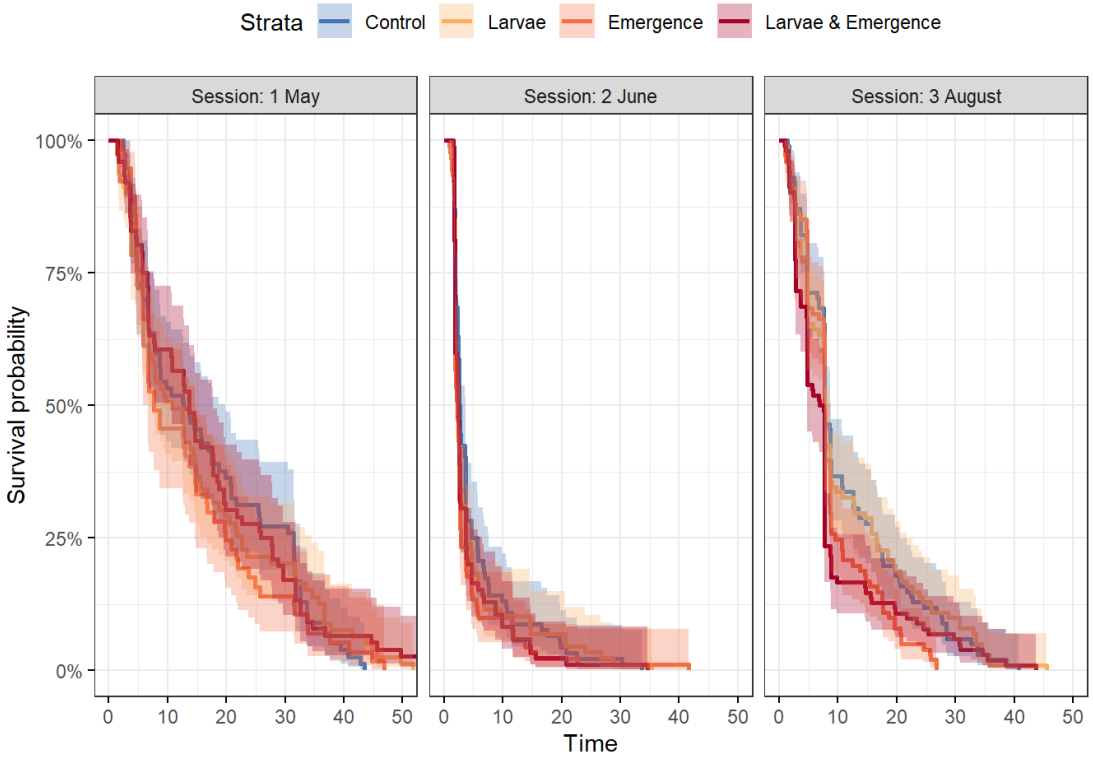


* **Lifespan is shorter in June**

N = 1048 bees

Repeated exposure of bees *in vitro*

Survival in the hive

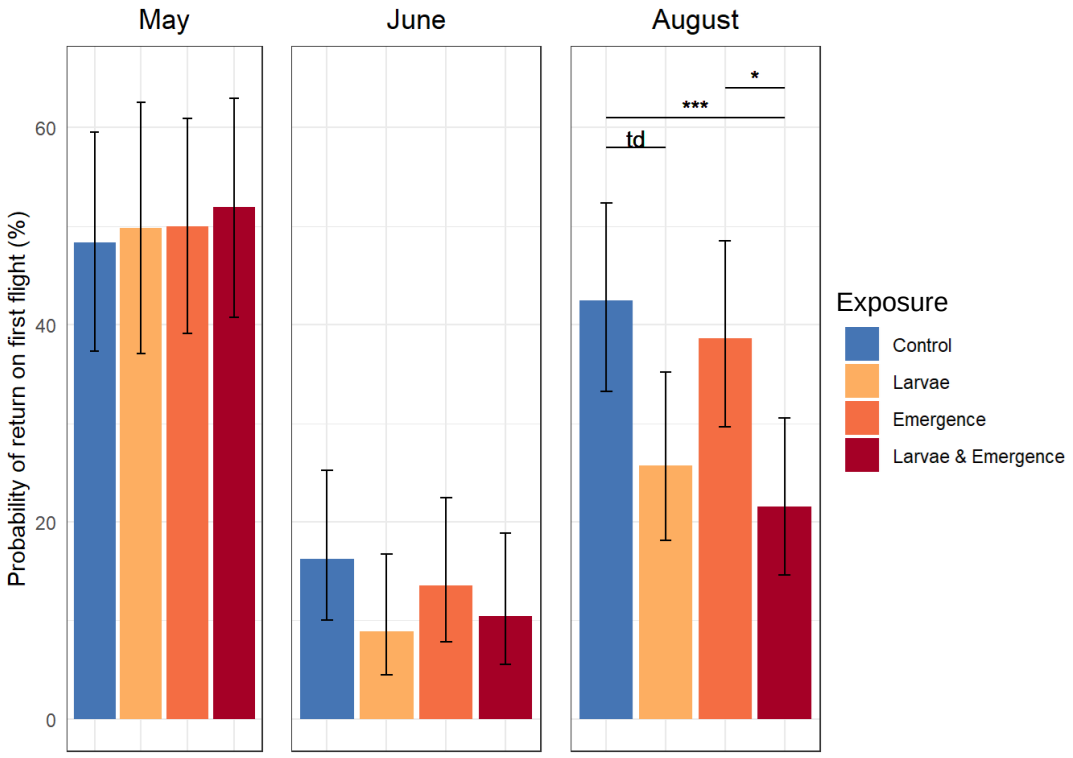


* No difference between May and June
* **Significant difference between exposure modalities for control and Boscalid larvae in August**

Repeated exposure of bees *in vitro*

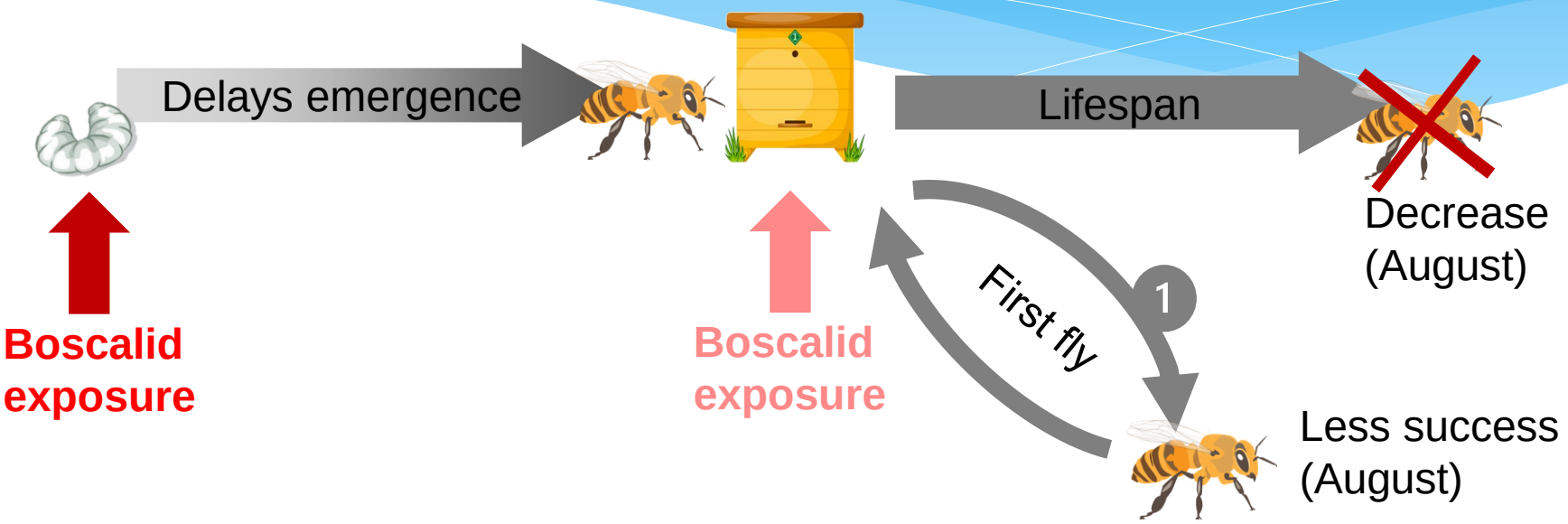
Successful of first flight

* Less success in June
* No difference between exposure in May and June
* **Significant difference between exposure modalities for control and Boscalid larvae in August**



N= 1048 bees

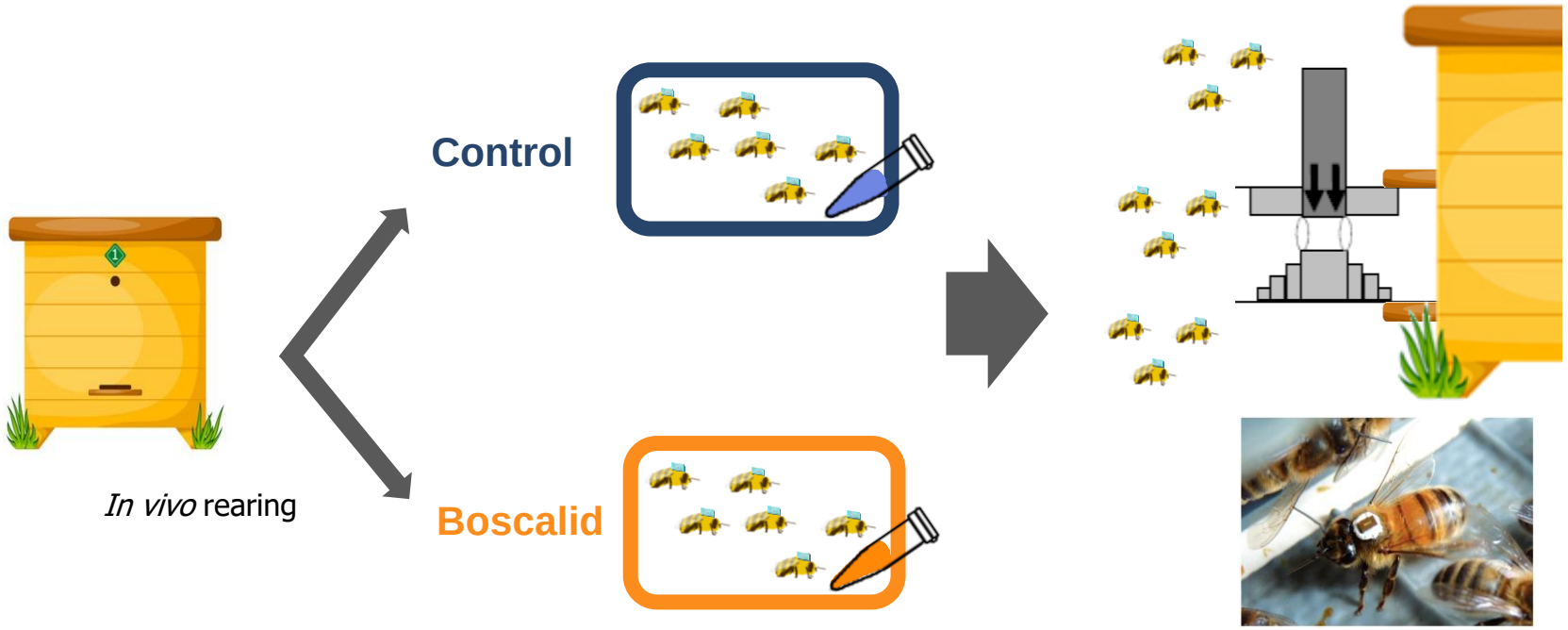
Effects of Boscalid on *in vitro* workers



- The effects of Boscalid are not constant throughout the season
- Boscalid impact life history of *in vitro* bee exposed in larval stage
- Double exposure to Boscalid impacts more significantly than single exposed bees

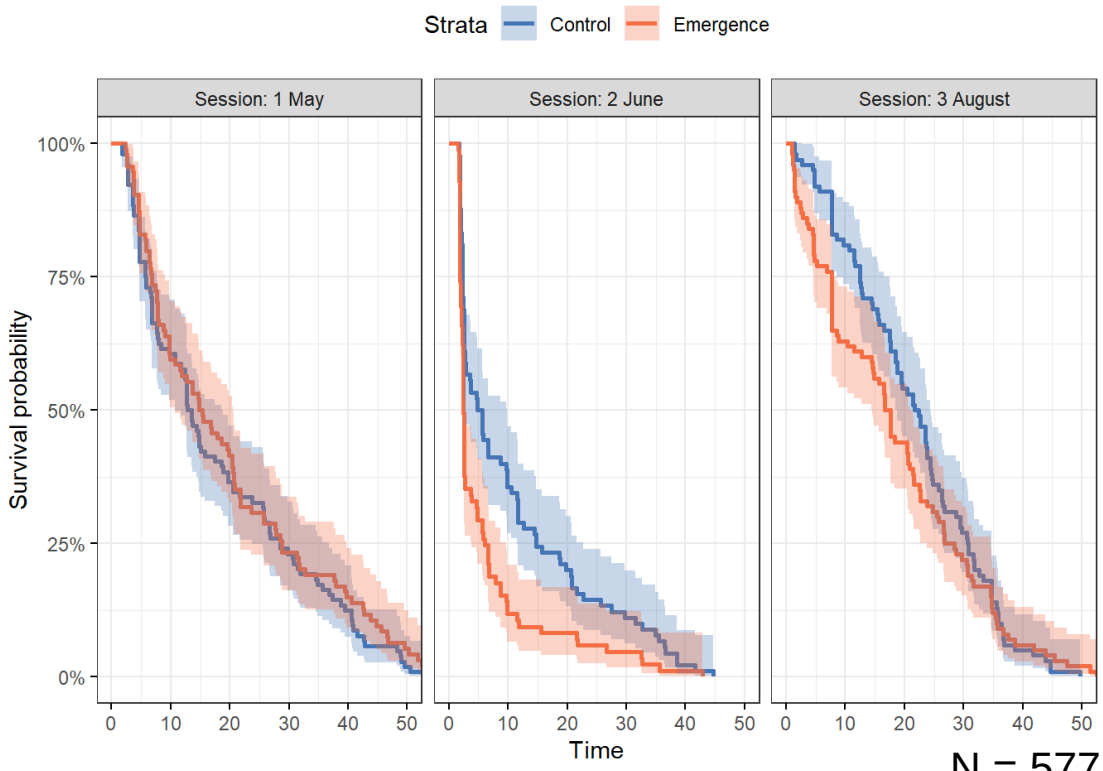
Experimental approach

* **Exposure 48h after emergence**
* **Released workers into the RFID hive**



Effects of Boscalid on *in vivo* workers

Survival in the hive



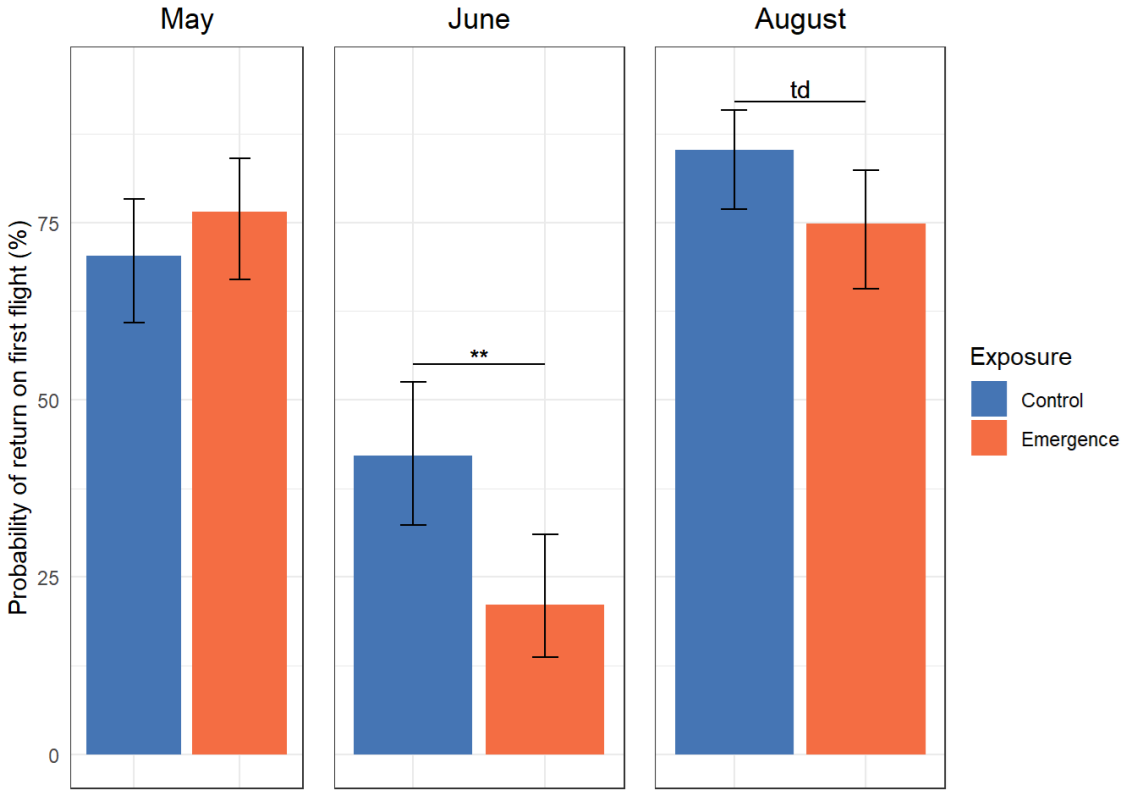
- Shorter bee lifespan in June
- **Significant difference between control and Boscalid in May**

N = 577 bees

Effects of Boscalid on *in vivo* workers

Successful of first flight

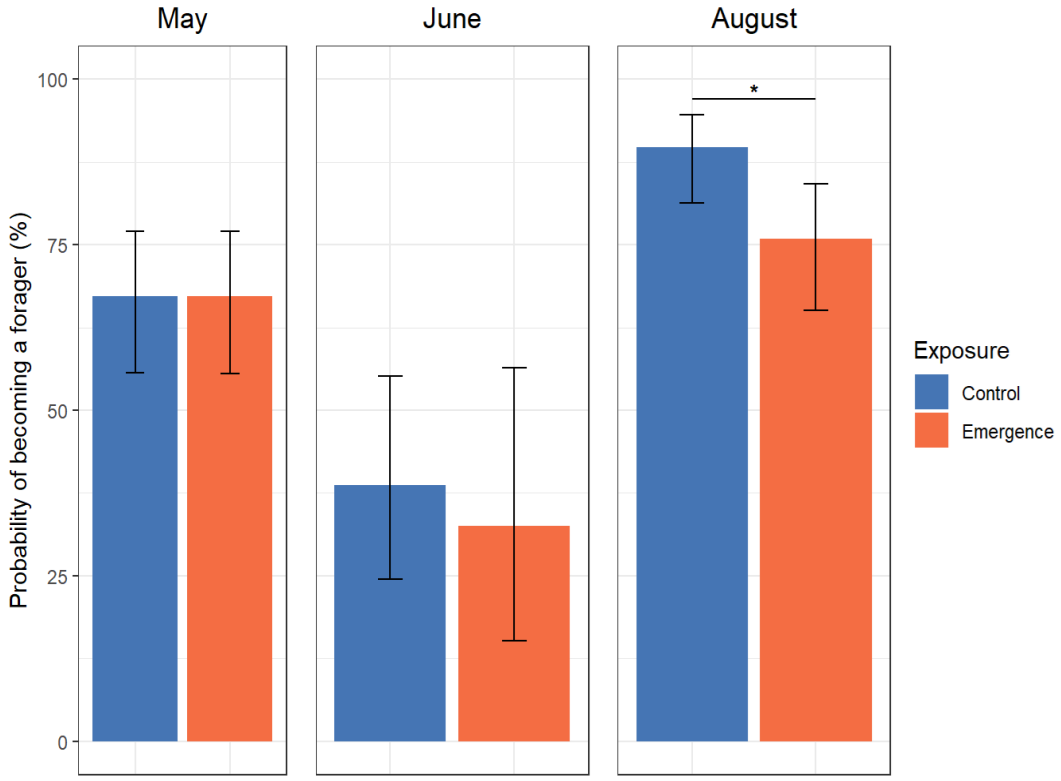
* Less success in June
* No difference between Boscalid and control bees in May
* **Significant difference between control and Boscalid in June** **(Trend only in August)**



N = 577 bees

Effects of Boscalid on *in vivo* workers

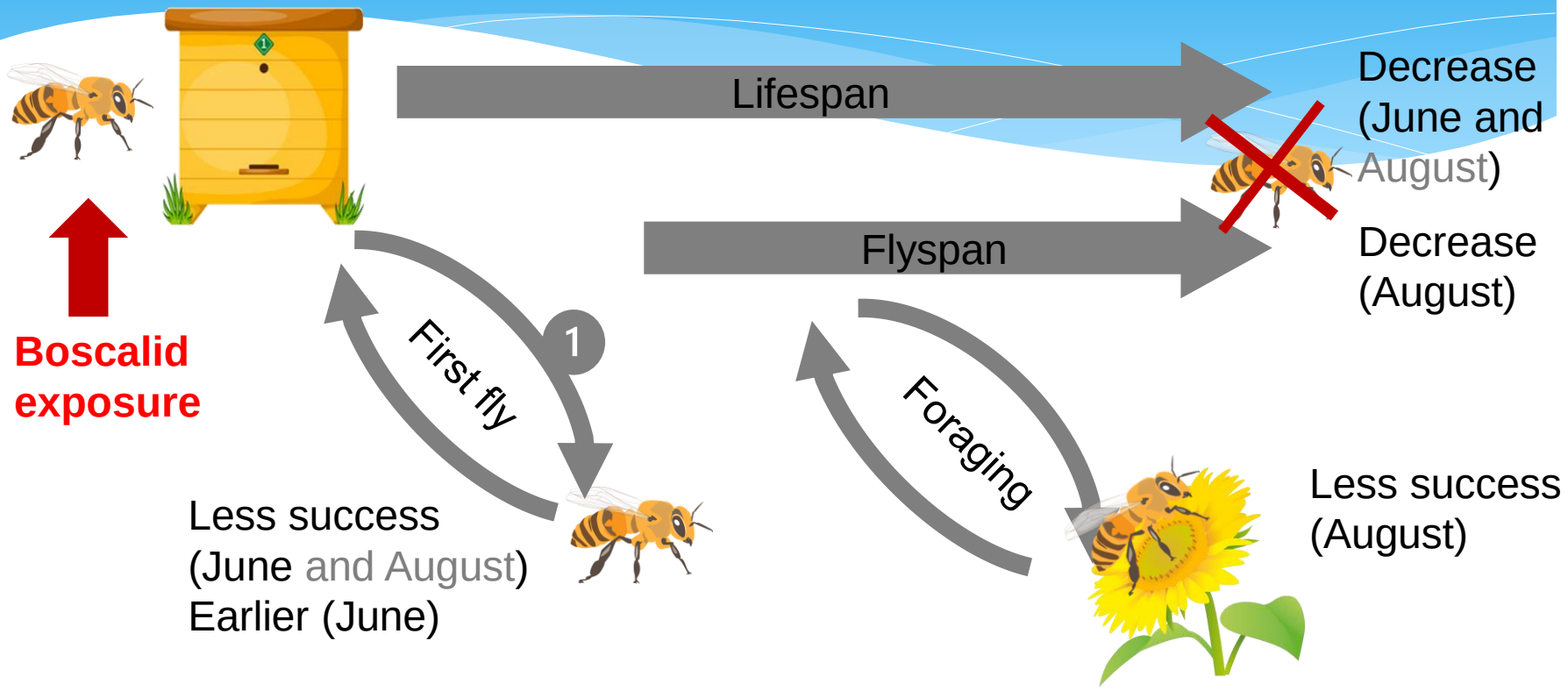
foraging success



- Less foraging in June
- No difference between exposure in May and August

N = 364 bees

Effects of Boscalid on *in vivo* workers



- The effects of pesticides are not constant throughout the season
- Boscalid impact *in vivo* worker life history
- Decrease lifespan and flyspan
- Decrease in success of fist exit, and become foraging

Icbees
International Congress on Bee Sciences

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