Fungicide Impact on Honey Bee Development

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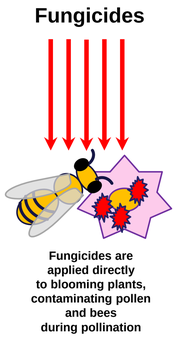
INTRODUCTION:

Do laboratory results suggesting fungicides affect bee development translate to the field?

- Most beekeepers leave almonds with healthy happy bees
- Some beekeepers report die offs in the holding yards. Nearly 40% of respondents to a recent survey reported occasional or frequent die-offs at almonds.



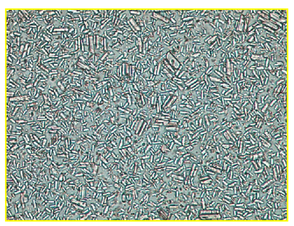
Fungicides are applied directly to blooming plants, contaminating pollen and bees during pollination

- Some beekeepers report problems with honey bee development during or after almonds
- Laboratory results suggest some fungicides may adversely affect honey bee larvae

In 2012, our preliminary data suggested that iprodione (Rovral) and chlorothalonil (Bravo, Echo) may affect larval development, and Ziram may affect queen survival, while boscalid/pyraclostrobin (Pristine) had no effect on bees. To validate these results, we expanded our study in 2013 and focused on the most-used fungicide during almond bloom, iprodione.

Iprodione (Rovral)

- Frequently used during almond bloom
- Found in pollen and wax
- Toxic to honey bee larvae in laboratory studies
- Flowable formulation (water soluble particles)



Rovral 4F at 200X

METHODS:

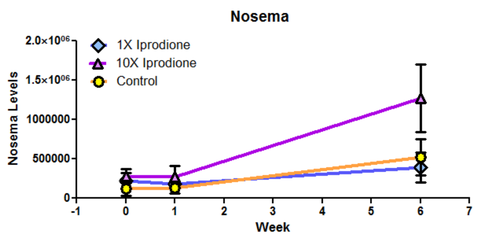
Semi-field experiments

A field concentration of iprodione was approximated from levels recorded in almond pollen and from EPA T-Rex calculation methods. 1X (30 ppm) and 10X (300 ppm) iprodione in acetone were incorporated into pollen, as well as 10X Rovral (equivalent to 300 ppm iprodione). The pollen was packed into plastic comb (Permacomb).

Each colony was evaluated for eggs, larvae, capped brood, bees, pollen, nectar, queen presence, and general health, before the treatment and weekly thereafter. The treated pollen frame was inserted in the colony, and the colony was sealed in a small flight cage for one week. 7 colonies each were treated with Control (acetone only), 1X or 10X iprodione, or 10X Rovral. The flight cage was removed after the treatment week and colonies allowed to forage normally.

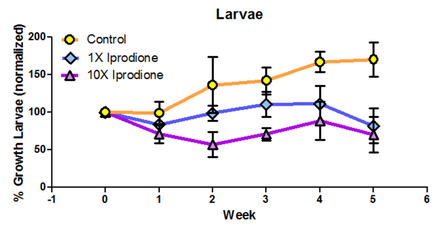
RESULTS:

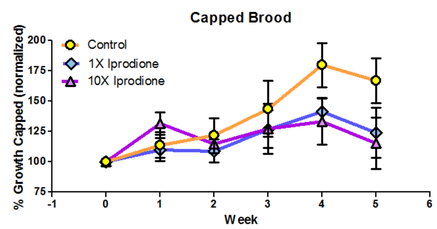
Rovral was difficult to incorporate into pollen, and results were mixed (not shown)



Nosema levels increased in 10X iprodione and 10X Rovral treatmets

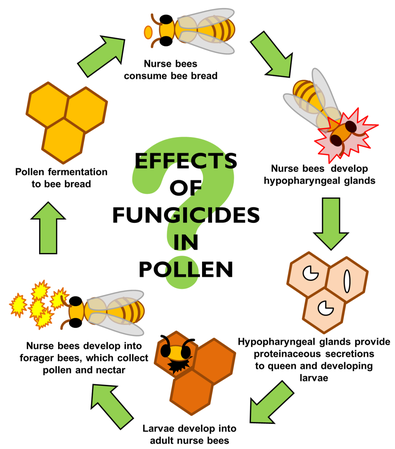
Colonies treated with either concentration of iprodione exhibited less increase of larvae and capped brood over time compared to controls, similar to our preliminary results.





CONCLUSIONS:

- **Delayed effects fit with some beekeeper reports**
- **Honey bee exposure to iprodione and other fungicides should be minimized**
- **Experimental protocols that measure delayed effects should be used to assess additional fungicides**
- **Honey bee biology is complex, and the mechanism whereby fungicides affect bees may be difficult to decipher.**



Contaminated pollen is consumed by nurse bees as well as larvae, and may potentially interfere with multiple processes critical to larval nutrition and development, including pollen fermentation to bee bread

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