Honey Bee Susceptibility to Recommended and Potential European Corn Borer Insecticides at Three Temperatures

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Introduction

•Foliar insecticides are used to control European corn borer (ECB) on sweet corn.
•Sweet corn is a source of pollen for honey bees.
•Foliar insecticides, such as carbofuran, can cause substantial bee/colony deaths.
•Pyrethroid insecticides are considered less toxic to bees but some have a negative temperature coefficient of toxicity and in cool temperatures their impact may be underestimated.

Objective

•To determine if the toxicity to honey bees of some pyrethroid (lambda-cyhalothrin, permethrin, deltamethrin) and novel (flubendiamide, chlorantraniliprole, metaflumizone) ECB insecticides is temperature dependent.

Materials and Methods

Insecticides

Currently registered:
•lambda-cyhalothrin (Matador® 120 EC; Syngenta)
•permethrin (Pounce® 3.2 EC; Bayer)
•deltamethrin (Decis® 5 EC; Bayer)
***Novel*:**
•flubendiamide (Belt® 480 SC; Bayer)
•chlorantraniliprole (Corrigin® /Rynaxypyr™; Dupont)
•metaflumizone (Alverde™; BASF)
•serial dilutions ranging from 0.5-0.05% of the recommended field rate were tested to determine the LC_{50} (experimental rate) at 23°C.

Figure 1. Sweet corn was grown in ice cream pails(a); and collecting forager-aged bees from a colony entrance(b).

Bioassay

• sweet corn was grown in 41L ice cream pails (Fig. 1a).
• corn leaves were cut to fit 14x2.5cm segments, dipped in formulated pesticide solution and dried.
• feeders contained 1:1 w/v sugar:water solution.
• Petri dishes containing filter paper, a feeder, 2 treated leaves and ¼ piece of Bee Boost® (queen mandibular pheromone) were prepared.
• forager age honey bees (>21 days old) were collected from hive entrances using a BioQuip insect vacuum (Fig. 1b).
• bees were anaesthetized with CO^2 and gently poured into Petri dishes, 10 per dish (Fig. 2a,b).
• bee filled Petri dishes were transferred to growth chambers at 18°C, 23°C, or 28°C (Fig. 2c).
• mortality was assessed at 24 h.

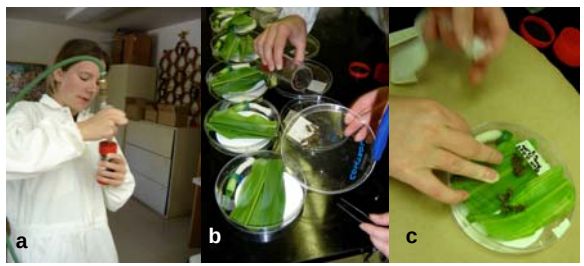

Figure 2. Anaesthetizing honey bees with carbon dioxide (a); transferring anaesthetized bees into Petri dishes (b); and securing filled Petri dishes for placement in growth chambers (c).

Results

• flubendiamide, chlorantraniliprole and metaflumizone, were all found to be non-toxic to honey bees at 23°C and further testing at other temperatures was not necessary.

• toxicity of lambda-cyhalothrin, permethrin and deltamethrin to honey bees was negatively correlated to temperature (Fig. 3).

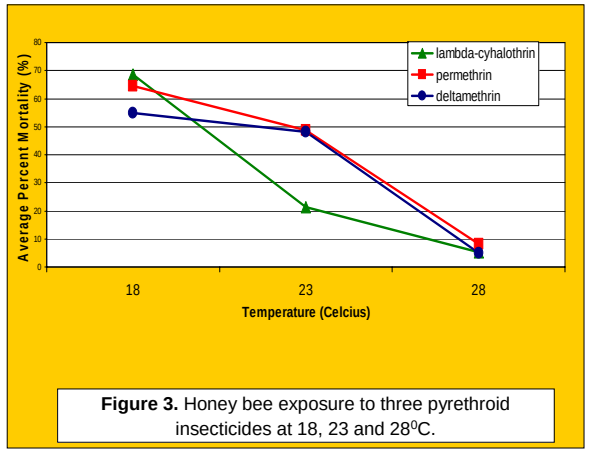

Figure 3. Honey bee exposure to three pyrethroid insecticides at 18, 23 and 28°C.

Conclusions

• The novel ECB insecticides tested were not toxic to honey bees.

• The negative temperature coefficient of toxicity of the 3 currently registered pyrethroids suggests that the typical recommendation of applying foliar insecticides early in the morning or evening (cooler temperatures) could be detrimental to foraging honey bees.

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