

How DNA Methylation Inhibitors Affect Diapause in *Megachile rotundata*

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Introduction

The alfalfa leaf cutting bee (*Megachile Rotundata*)(ALCB) is a solitary bee that when managed, proves to be vital for the alfalfa seed production industry of North America

-In the *Megachile Rotundata* life cycle, bees that overwinter are called diapausers. However, during the early season, there is an increased chance to having non-diapausing bees (bees that do not overwinter) which will result in a second generation.

-Farmers can run into issues with *Megachile Rotundata* management and alfalfa pollination due to the presence of these non-diapausers. With their early emergence, less bees are present in the following spring to pollinate alfalfa fields for seed production.

-By dosing *Megachile Rotundata* with the methylation inhibitor 5-aza-2-deoxycytidine, we hope to see an overall reduction in the amount of non-diapausers present.

Hypothesis

5-aza-2-deoxycytidine will increase rates of diapause in longer photoperiods.

Methods

Dosage Determination:

- To determine the toxicity of 5-aza-2-deoxycytidine and in turn an appropriate dosage to be fed to our field study *Megachile Rotundata*
- Based on overall high survival rate and sufficient flight performance, the medium concentration (10 μ M) was chosen for the field study



Figure 1. Male Alfalfa Leafcutting Bee.

Field Study

KEY
C = Control
T = Treated
Blue = DMSO
Red = Drug
○ = 75 ALCB

C	T
10 μ M	10 μ M
10 μ M	10 μ M
10 μ M	10 μ M



Figure 2. Model of field study feedings.

Figure 3. One of six bee boxes used in the field portion of this experiment.

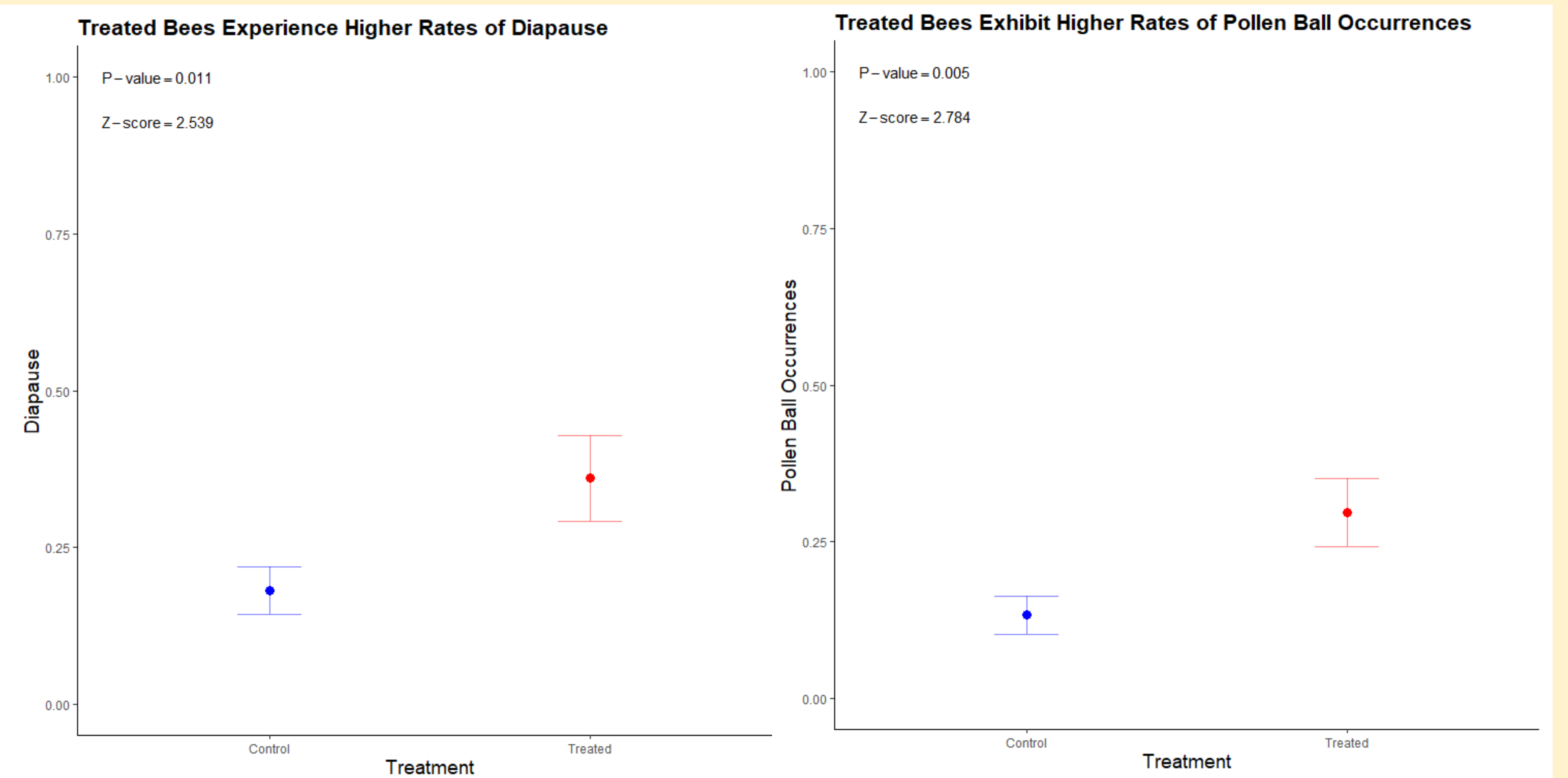
Non-diapauser



Diapausers

Figure 4. Pulled straw from a bee box containing 1 non-diapausing bee and 4 diapausing bees. Non-diapauser resembles an almost fully-fledged bee (outlined in green). Diapausers are still in their larval stages (outlined in purple).

Results



Conclusion

- Bees treated with 5-aza-2-deoxycytidine experience a higher rate of diapause compared to the control bees
- Compared to the control bees, treated bees exhibit a higher rate of pollen ball occurrences
- Our Findings correlate to results of previous studies and may suggest that this relationship can be found in a variety of insects

Future studies:

- Focus on finding a dosage to yield the highest diapause rates and lowest death rate to maximize bee populations
- Administer widespread management practices that involve farmers dosing their bees with a methylation inhibitor
- Determine the importance of increased pollen balls with treated bees as well as how to reduce their occurrence

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