Protecting Pollinators

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www.BeeLab.umn.edu

Drawing: Laura Corcoran
Multiple, Interacting Causes of Death

- Varroa Parasite
- Viruses
- Pest and Pathogen transmission
- Insecticides
- Other Pesticides
- Flowerless landscape
Varroa Parasite

Nutrition

Viruses

Insecticides

Herbicides

Pest and Pathogen transmission

Flowerless landscape
Herd Immunity

If only SOME get vaccinated... the virus spreads.

If MOST get vaccinated... spreading is contained.

Healthy, non-vaccinated
Healthy, vaccinated
Not-vaccinated, sick, contagious
Herd Immunity
For Bees

If only some colonies are treated for Varroa...

....varroa and viruses spread

If most get treated...

...spreading is contained
Beekeepers need new ways to control Varroa

The mites have gained the upper hand
Multiple, Interacting Causes of Death

Nucleus

- Varroa Parasite
- Viruses
- Pest and Pathogen transmission
- Flowerless landscape
- Insecticides
- Other Pesticides

- Nutrition
Honey bees, wild bees and other pollinators reduced to feeding on scraps

- Z. Browning
Commercial beekeeper, ND
Insecticide Use

Organophosphates
Carbamates
Organochlorines

Neonicotinoids
Pyrethroids
Insect Growth Regulators
Good, clean bee food
Bee Nutrition
Pollen provides protein and lipids

Honey bee and Bumblebee on *Dalea*
Photos: Heather Holm
Bee Nutrition

Nectar provides carbohydrates...and more

Colletes on Allium

Photo: Heather Holm
Butterflies sip nectar through long proboscis

Or lay eggs on plant

Many flies sip nectar from flowers

Flower flies are bee mimics!
What flowers should you plant for pollinators?

• Take a long, close look at flowers.
• If bees, flies or butterflies are drinking nectar, or collecting pollen from them, they are good!
• Write down exact variety of the flower
Honey bees

Nectar - Honey
Pollen
Honey constituents up-regulate detoxification and immunity genes in the western honey bee *Apis mellifera*.

Wenfu Mao\(^a\), Mary A. Schuler\(^b\), and May R. Berenbaum\(^a,1\)

Departments of \(^a\)Entomology and \(^b\)Cell and Developmental Biology, University of Illinois at Urbana–Champaign, Urbana, IL 61801

Contributed by May R. Berenbaum, March 21, 2013 (sent for review September 8, 2012)

As a managed pollinator, the honey bee *Apis mellifera* is critical to the American agricultural enterprise. Recent colony losses have thus raised concerns; possible explanations for bee decline include ..., *A. mellifera* has only 46 P450 genes (14). Honey bees metabolize phytochemicals found in honey and pollen as well as acaricides used in hives for management of *Varroa destructor*, an astopara...

- p-coumaric acid
- pinocembrin
- pinobanksin

Originate in pollen and propolis
Bees Can Detoxify Pesticides to some extent...

P-coumaric acid turns on detox genes, which make P450 enzymes, which metabolize pesticides.
Soil Nesters

Andrena on plum

Photos: Heather Holm
Dennis Briggs
Honey Bees

Vitellogenin
Vg
Honey Bee
Solitary Bee

Brood food
Larva
Seed coating with a neonicotinoid insecticide negatively affects wild bees


Understanding the effects of neonicotinoid insecticides on bees is vital because of reported declines in bee diversity and distribution and the crucial role bees have as pollinators in ecosystems and agriculture. Neonicotinoids are suspected to pose an unacceptable risk to bees, partly because of their systemic uptake in plants, and the European Union has therefore introduced a moratorium on three neonicotinoids as seed coatings in flowering crops that attract bees. The moratorium has been criticized for being based on weak evidence, particularly because effects have mostly been measured on bees that have been artificially fed neonicotinoids. Our findings have important implications for policies regulating the use of neonicotinoids as well as for risk assessments of pesticides.

We designed a study with eight pairs of landscapes surrounding 16 geographically separated (>4 km) spring-sown oilseed rape fields (Fig. 1 and Extended Data Table 1). One field in each pair was randomly assigned to be sown with seeds coated with the dose of Elado recommended by the manufacturer and a fungicide, while the other field in each pair, the control field, was sown with seeds coated only with the fungicide. At these 16 fields we estimated: (1) the density of
We need foraging areas for bees to detox!

Drawing: Laura Corcoran
Areas to Detox in Town:
Flowering Bee Lawns

• Reduce intensive inputs – water, fertilizer, mowing
• Support bee health

Research
Ian Lane

Funded by MN Environment and Natural Resources Trust Fund
How does agricultural land use affect survival of honey bee colonies?

Dr. Matthew Smart

Research

Funded USDA-NIFA
Study colony locations

<table>
<thead>
<tr>
<th>Location</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
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<td>CA almonds</td>
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<td></td>
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<tr>
<td>ND apiaries</td>
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144 colonies in 6 apiaries sampled and assessed every six weeks in ND and CA.
The landscapes:
6 apiaries from 2010-2012
When Varroa and diseases not a factor, floral resources within 2 mi of apiary has significant effect on health and survival of colonies

- Brood in Sept
- Mite load in Sept
- Grams *pollen*/ per day over summer
- Vitellogenin
- Lipid Stores
- Immune System Activation
Colony Pesticide exposure

Pollen hazard quotient (PHQ): Mean ppb of each pesticide/ honey bee contact LD$_{50}$

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<tr>
<th>Residue</th>
<th>Class</th>
<th>Site</th>
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<td>1420</td>
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<td>Chlorfenapyr</td>
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<td><strong>Total</strong></td>
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<td>1693</td>
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<td>6747</td>
<td>1410</td>
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<td><strong>Total (No Deltamethrin)</strong></td>
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<td>1266</td>
<td>6166</td>
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No neonics detected
New Bee and Pollinator Research Lab
UMN St. Paul Campus

Groundbreaking August 3
Save the Date!
Univ MN Welcomes Dr. Dan Cariveau
Pollinator Ecologist
Native Bees and Habitat
New Pollinator Discovery Center
Univ MN Landscape Arboretum
Groundbreaking this August

MSR Architects
Big Thanks to Graduate Students!

Mike Wilson       Elaine Evans   Joel Gardner   Ian Lane       Renata Borba       Mike Goblirsch

Katie Lee              Judy Wu- Smart                  Matthew Smart            Morgan Carr-Markell
Thank you

Bees, Beekeepers & Supporters

- National Science Foundation
- USDA-NIFA
- NRCS
- National Honey Board
- Almond Board

✧ General Mills
✧ MN Environmental and Natural Resources Trust Fund
✧ Minnesota and North Dakota Beekeeping Associations
✧ Individual donors

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