What is new in honey bee science?

Karl Crailsheim
Publications on bees

Web of science

“Apis or honeybee* or bee or bees” in title
Publications on bees

Web of science
“neonicot* and bee”
in topic

![Graph showing the number of publications from 2009 to 2013]
COLOSS BEEBOOK
Volume I: Standard Methods for Apis mellifera Research
Edited by Vincent Dietemann, James D. Ellis, Peter Neumann

COLOSS BEEBOOK
Volume II: Standard Methods for Apis mellifera Pest and Pathogen Research
Edited by Vincent Dietemann, James D. Ellis, Peter Neumann

UNIVERSITY OF GRAZ
Coloss Beebook

“32 peer-reviewed chapters describing some 1700 individual experimental protocols, [...] authored by 243 of the world’s leading honey bee experts from 34 different countries”

- Norman Carreck
Neonicotinoids

Nicotine, neonicotinoids (7): nAChR agonists

Casida & Durkin 2013
# Neonicotinoids

<table>
<thead>
<tr>
<th>Name</th>
<th>Temporary restrictions in EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imidacloprid</td>
<td></td>
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<tr>
<td>Thiamethoxam</td>
<td></td>
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<tr>
<td>Clothianidin</td>
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<tr>
<td>Acetamiprid</td>
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<tr>
<td>Thiacloprid</td>
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<tr>
<td>Dinotefuran</td>
<td></td>
</tr>
<tr>
<td>Nitenpyram</td>
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Neonicotinoids

Stakeholders:

- Agriculture
- Industry
- Beekeeping
- Ecology
A meta-analysis of experiments testing the effects of a neonicotinoid insecticide (imidacloprid) on honey bees

James E. Cresswell
Imidacloprid: Letale Effekte

Acute $LD_{50} \approx 4.5$ ng

Chronic $LC_{50} \approx 1.7$ ppm

Meta-Analysis Imidacloprid: Creswell, 2011
Imidacloprid: Sublethal Effects

Acute

Chronic

Performance (%)

Dose (ng)

Dose (μg L⁻¹)
Neonicotinoids

Currently banned for the duration of two years in the European Union.

Lots of critics, most experiments were performed in the laboratory

What was recently published?
Insecticide: Thiamethoxam (1.34 ng)
Varroa destructor also reduces returning rate and homing time.
I will extend my researches to the influence of pesticides on behavior and physiology of foragers.

Jasna Kralj

† 8th May 2012
Neonicotinoids affect also other pollinators: *Bombus terrestris*
Neonicotinoids affect also other pollinators: *Bombus terrestris*

Penelope R. Whitehorn, Stephanie O’Connor, Felix L. Wackers, Dave Goulson: *Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production* (2012).
Background


One example: interaction with Nosema
Nosema apis & Nosema ceranae parasite in the honey bee gut

Chen & Huang, 2010
Crop Pollination Exposes Honey Bees to Pesticides Which Alters Their Susceptibility to the Gut Pathogen *Nosema ceranae*

Jeffery S. Pettis¹, Elinor M. Lichtenberg², Michael Andree³, Jennie Stitzinger², Robyn Rose⁴, Dennis vanEngelsdorp²*
Colonies used for pollination

<table>
<thead>
<tr>
<th>Crop</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td>Rosedale, CA; Kern County</td>
</tr>
<tr>
<td>Apple</td>
<td>York Springs, PA; Adams County</td>
</tr>
<tr>
<td>Blueberry</td>
<td>Deblois, ME; Washington County</td>
</tr>
<tr>
<td>Cranberry (early season)</td>
<td>Hammonton, NJ; Atlantic County</td>
</tr>
<tr>
<td>Cranberry (late season)</td>
<td>Hammonton, NJ; Atlantic County</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Cedarville, NJ; Cumberland County</td>
</tr>
<tr>
<td>Watermelon</td>
<td>Seaford, DE; Sussex County</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>Kutztown, PA; Berks County</td>
</tr>
</tbody>
</table>
Analysis of pollen pellets:
- 35 different pesticides (mean: 9)
- 2 pesticides > LD$_{50}$

Feeding of this pollen to caged bees resulted in increased prevalence of *Nosema ceranae* compared to pesticide free controls.
Background

Colonies with many patrilines are more vital than those with fewer patrilines
Characterization of the Active Microbiotas Associated with Honey Bees Reveals Healthier and Broader Communities when Colonies are Genetically Diverse

Heather R. Mattila¹, Daniela Rios¹, Victoria E. Walker-Sperling¹, Guus Roeselers², Irene L. G. Newton³*

¹ Department of Biological Sciences, Wellesley College, Wellesley, Massachusetts, United States of America. ² Microbiology & Systems Biology group, TNO, Utrechtseweg, Zeist, The Netherlands. ³ Department of Biology, Indiana University, Bloomington, Indiana, United States of America
Genetically diverse colonies compared to genetically uniform colonies have:
1) Greater microbial diversity in the gut
2) Reduced pathogen loads
3) More putative helpful bacteria
Background

Larger Colonies can tolerate higher losses of single bees

Which other benefits?
Karl von Frisch
1) Faster start of foraging activity
2) Fastest communication
3) Massive parallel foraging!
Colony fissioning in honey bees: size and significance of the swarm fraction

J. Rangel · T. D. Seeley

Swarm size has effects on growth (i.e., comb built, brood produced, food stored, and weight gain) and the survival of mother-queen colonies.
The last papers do not report unexpected findings, but they proof and quantify benefits of strong and genetically diverse honey bee colonies.
Robert E. Page Jr.

- Vice Provost and Dean in the College of Liberal Arts and Sciences Foundation
- Professor of Life Sciences and
- Founding Director of the School of Life Sciences
- Ph.D. University of California, Davis
Robert E. Page Jr.

The Spirit of the Hive
Harvard University Press, 2013
„What is new in honey bee science?“

• Karl Crailsheim
• Thank you very much for your attention