LD₅₀ data sets (of which 11 were insecticides), discrete LD₅₀ values were determined for both honeybees and bumblebees. For all of those 18 data sets the ratio of honeybee contact LD₅₀ values divided by bumblebee contact LD₅₀ value was lower than one, demonstrating that honeybees were more sensitive to the test substances than bumblebees.

Similarly, lower or similar oral sensitivity of bumblebees vs. honeybees was determined (Figure 2). Where the endpoint was the maximum dose tested, a ratio of 1:1 was rare because the endpoint is adjusted according to actual dose consumption. For 12 (and 11 of those were insecticides) of the 52 acute oral LD₅₀ data sets, discrete acute oral LD₅₀ values were determined for both honeybees and bumblebees. Only for one insecticide a higher acute oral bumblebee sensitivity compared to honeybees was determined (for two different formulations). For this insecticide, higher tier semi-field data with *B. terrestris* is available and results do not indicate any negative impact on bumblebees or their colony development at the maximum intended use rate. *B. terrestris* worker bees are about 3-times heavier in terms of body weight than *A. mellifera* worker bees. Therefore, lower or similar contact and oral sensitivity of the bumblebee species vs. the honeybee was also found in terms of body weight.

**Conclusions**

Overall, the ECPA company data evaluation indicates for a wide range of plant protection products that bumblebees are not more sensitive than honeybees based on acute toxicity assessment supporting similar previous findings²,³.

**References**


**4.12 Impact of pesticide residue on Japanese Orchard Bees (Osmia cornifrons)

*Ngoc Phan¹*, Ed Rajotte¹, David Biddinger¹,²*

¹ Department of Entomology, Penn State University, University Park, PA 16802, USA
² Penn State Fruit Research and Extension Center, Biglerville, PA 17307, USA
* Corresponding authors (*nqp5173@psu.edu; djb134@psu.edu*)

DOI 10.5073/jka.2018.462.051

**Keywords:** Japanese orchard bee, *Osmia cornifrons*, pesticide residue, integrated pest and pollinator management, IPPM, toxicity, contact toxicity, pesticide residue

**Introduction**

Pollinators are crucial to high value crop production such as apples. Pesticide use in these crops can sometimes reduce pollinator populations. Some pesticide use is necessary to control insects and disease which threaten farm profitability and sustainability. A new approach to this problem is Integrated Pest and Pollinator Management (IPPM) which maintains adequate pest management while protecting pollinator health. Several pieces of information are needed in order to construct an IPPM program. An important piece of information is the toxicity of pesticides to various pollinator species, including wild solitary bees. To better understand the effects of pesticide application on the wild pollinators, we will evaluate the impacts of pesticide residue on the Japanese Orchard Bee (JOB), *Osmia cornifrons*, a promising alternative pollinator for the fruit industry.

Our previous work has shown that a shift in application timing to 10 days before apple bloom can reduce the pesticide levels that moves into the nectar and pollen, but still effectively control pre-
bloom pests. Present study evaluates the toxicity pesticide-contaminated pollen on the development and mortality of JOB. We have already examined the acute contact and ingestion toxicity on JOB adults, but we need to fully understand the impacts of pesticide residues in pollen stores on larval developmental stages. This research is crucial to developing an apple IPPM program that allows the safe use of pesticides for pests control without harming pollinators.

Materials and Methods

Larval JOB bioassays were conducted based on field-realistic pesticide concentrations found in flowers taken in previous years at 0.1x dose, 1x dose, and 10x dose. Treatments were mixed with homogenized provision thoroughly before partition by 0.3 grams per well. Eggs would be placed on top of prepared provisions.

Treatments for application were:

- Assail 30SG (acetamiprid) at 1.8 ppb, 18 ppb, and 180 ppb;
- Syllit (dodine) at 1.1 ppb, 11 ppb, and 110 ppb;
- Closer SC (sulfoxaflor) at 4.4 ppb, 44 ppb, and 440 ppb;
- Beleaf 50SG (flonicamid) at 51.2 ppb, 512 ppb, and 5120 ppb.

16 bees were used per replication, and there were 3 replications per treatment. A total of 672 eggs were collected from nest straws, then reared at 25°C, RH 65%. Each larva was kept separately in different clear plastic wells (12mm in diameter, 12mm in depth). Daily observations made of all individuals from egg-hatching until cocoon completion. The stages easily observed and recorded were: eggs, 1st instar (inside egg corion), 2nd instar (starts to feed on provision), 5th instar (begins defecation), initiation of cocoon spinning, and cocoon completion. Growth rate and development time were accessed. Data on the 5th instar larvae’s weights were collected daily.

a) Larva feeds on corion.    b) Larva starts to feed on pollen.

c) Mandibles develop.    d) Head capsule develop. Hairy body.
Results
Preliminary analysis indicates the relevant doses that occur from pre-bloom pesticide applications were not directly toxic to the larvae, but did significantly delay larval development. These larvae are now being evaluated for pupal mortality, adult emergence from diapause and adult weight as further effects from these field relevant doses.

Fig. 1  Development stages of Osmia cornifrons: (a) 1\textsuperscript{st} instar, (b) 2\textsuperscript{nd} instar, (c) 3\textsuperscript{rd} instar, (d) 4\textsuperscript{th} instar, (e) 5\textsuperscript{th} instar, (f) cocoon initiation.

Fig. 2  Average development time from 1\textsuperscript{st} instar to cocoon of Treatments vs. Control (N = 48 each group).
Fig. 3 Changes in average weights of 5th instar on the first 10 days (N = 48 each group)

References
Hazards of pesticides to bees
13th International Symposium of the ICP-PR Bee Protection Group
18. - 20. October 2017, València (Spain)

- Proceedings -
History ICPPR-Bee Protection Group conferences
1st Symposium, Wageningen, the Netherlands, 1980
2nd Symposium, Hohenheim, Germany, 1982
3rd Symposium, Harpenden, UK, 1985
4th Symposium, Řež, Czech Republic, 1990
5th Symposium, Wageningen, the Netherlands, 1993
6th Symposium, Braunschweig, Germany, 1996
7th Symposium, Avignon, France, 1999
8th Symposium, Bologna, Italy, 2002
9th Symposium, York, UK, 2005
10th Symposium, Bucharest, Romania, 2008
11th Symposium, Wageningen, the Netherlands, 2011
12th Symposium, Ghent, Belgium, 2014
13th Symposium Valencia, Spain, 2017
14th Symposium scheduled, Bern, 2019

Organising committee 13th conference
Dr. Jens Pistorius (Julius Kühn-Institut, Germany)
Dr. Anne Alix (Dow Agrosciences, United Kingdom)
Dr. Carmen Gimeno (Trialcamp, Spain), local organiser
Dr. Gavin Lewis (JSC, United Kingdom)
Dr. Pieter Oomen (Wageningen, The Netherlands)
Dr. Veronique Poulsen (ANSES, France)
Dr. Guy Smagghe (Ghent University, Belgium)
Dr. Thomas Steeger (US Environmental Protection Agency, USA)
Dr. Klaus Wallner (Hohenheim University, Germany)

Editors
Dr. Pieter A. Oomen, Wageningen, The Netherlands
Dr. Jens Pistorius, Braunschweig

Group photo of all symposium participants, standing in front, from left:
Thomas Steeger (new board member),
Jens Pistorius (new chairman),
Françoise & Pieter Oomen with award (editor & former chairman),
Guy Smagghe (organiser, symposium host and new board member),
Job & Margreet van Praagh with award,
Anne Alix (secretary of the board)

Foto
Pieter A. Oomen (Bumble bee *Bombus lapidarius* on thistle)

The proceedings of the symposia (such as these) are being published by the Julius Kühn Archive in Germany since the 2008 symposium in Bucharest, Romania. These proceedings are also accessible on internet, e.g. the former symposium proceedings published by JKI can be found on https://ojs.openagrar.de/index.php/JKA/issue/archive (Issues 423, 437, 450). Furthermore, proceedings of former meetings have meanwhile been digitalized and can be found on https://www.openagrar.de/receive/openagrar.mods_00032635.

Bibliografische Information der Deutschen Nationalbibliothek

ISSN 1868-9892
ISBN 978-3-95547-064-7
DOI 10.5073/jka.2018.462.000

Alle Beiträge im Julius-Kühn-Archiv sind unter einer Creative Commons - Namensnennung - Weitergabe unter gleichen Bedingungen - 4.0 Lizenz veröffentlicht.

Printed in Germany by Arno Brynda GmbH, Berlin.