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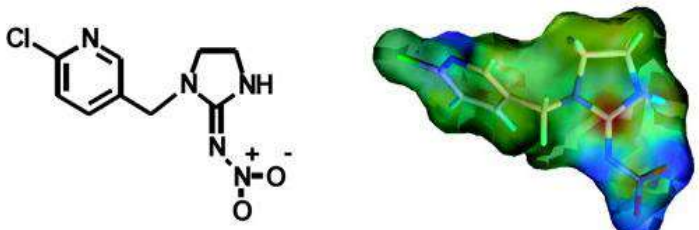
Chronic exposure to neonicotinoids reduces honey bee health near corn crops

Nadia Tsvetkov

Zayed Lab – York U

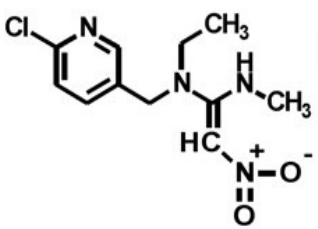
Neonicotinoids

B

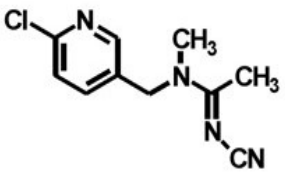


Imidacloprid

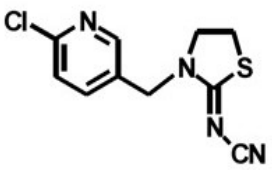
C



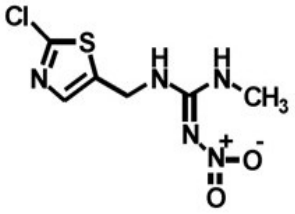
Nitenpyram



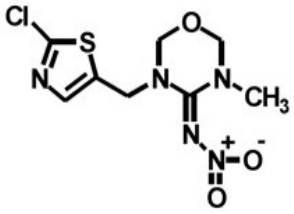
Acetamiprid



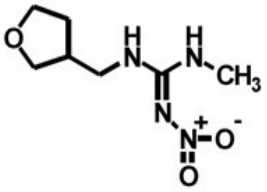
Thiacloprid



Clothianidin



Thiamethoxam



Dinotefuran

Shimomura et al. 2006

Neonics in the Lab

- Impaired learning and memory (Guez et al. 2001, 2003)
- Abnormal foraging (Yang et al. 2008, Henry 2012)
- Sucrose responsiveness (Lambin et al. 2001)
- Inhibition of mitochondrial bioenergetics (Nicodemo et al. 2014)
- Reduced immunity (Di Prisco et al. 2013)

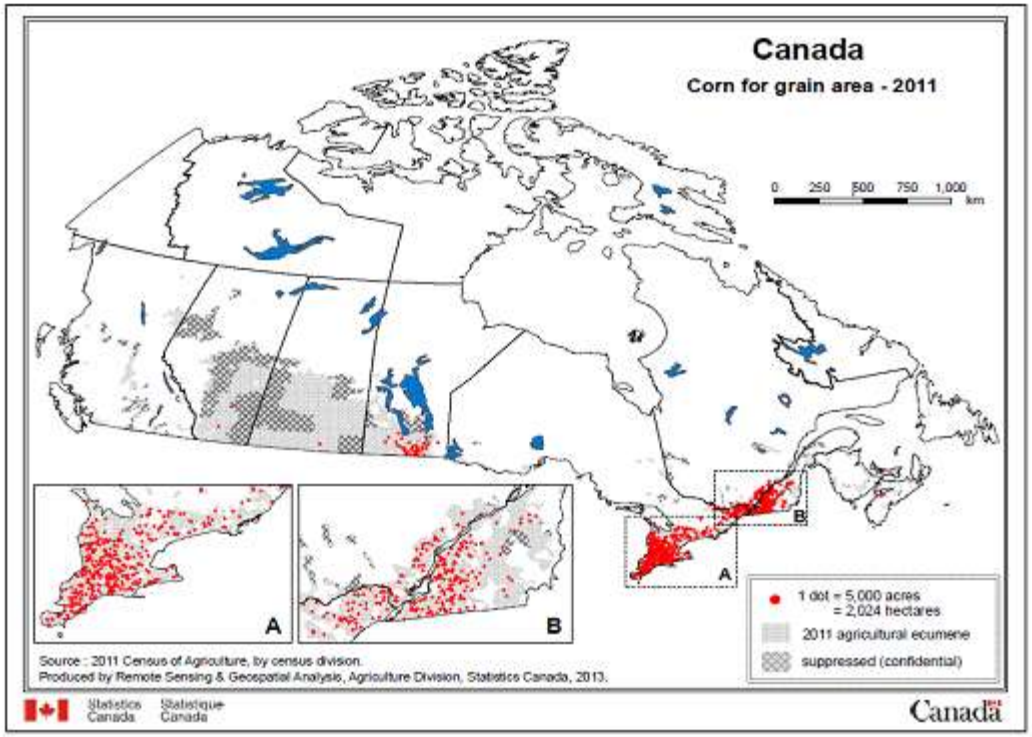
Field realistic?

Neonics in the Field

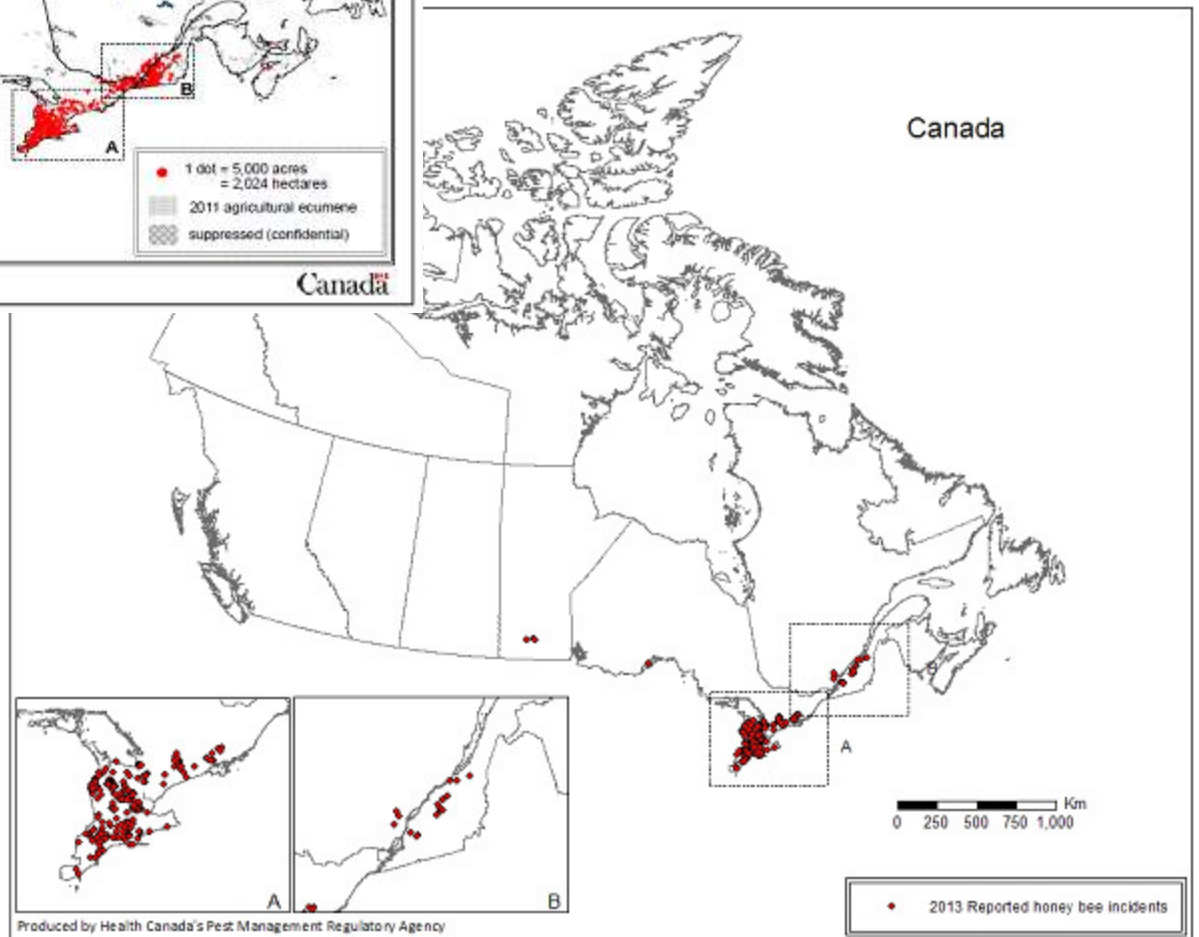
- Fail to detect effects of neonics on
  - Mortality (Nguyen et al. 2009)
  - Winter Loss (Genersch et al. 2010)
  - Mortality, longevity, or brood development (Cutler and Scott-Dupree 2007)
  - Colony weight gain, honey production, pests, mortality, brood (Cutler et al. 2014)

Field realistic?

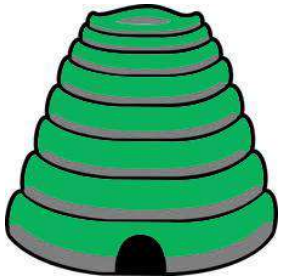
Figure 2 Principal Growing Regions of Corn in Canada, 2011



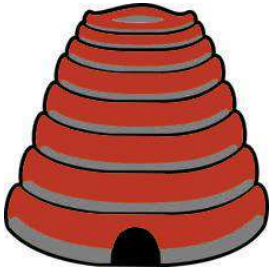
ed Honeybee Incidents Across Canada, 2013



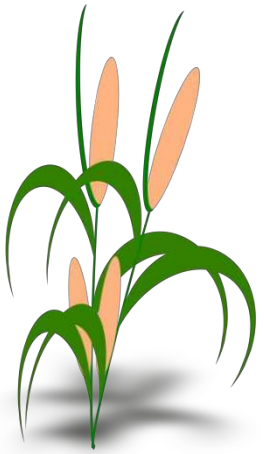
Field Study



Unexposed



Exposed



Pesticide Residues

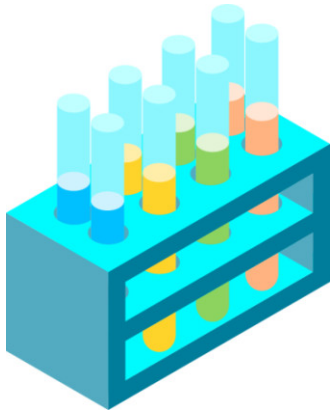
Behaviour

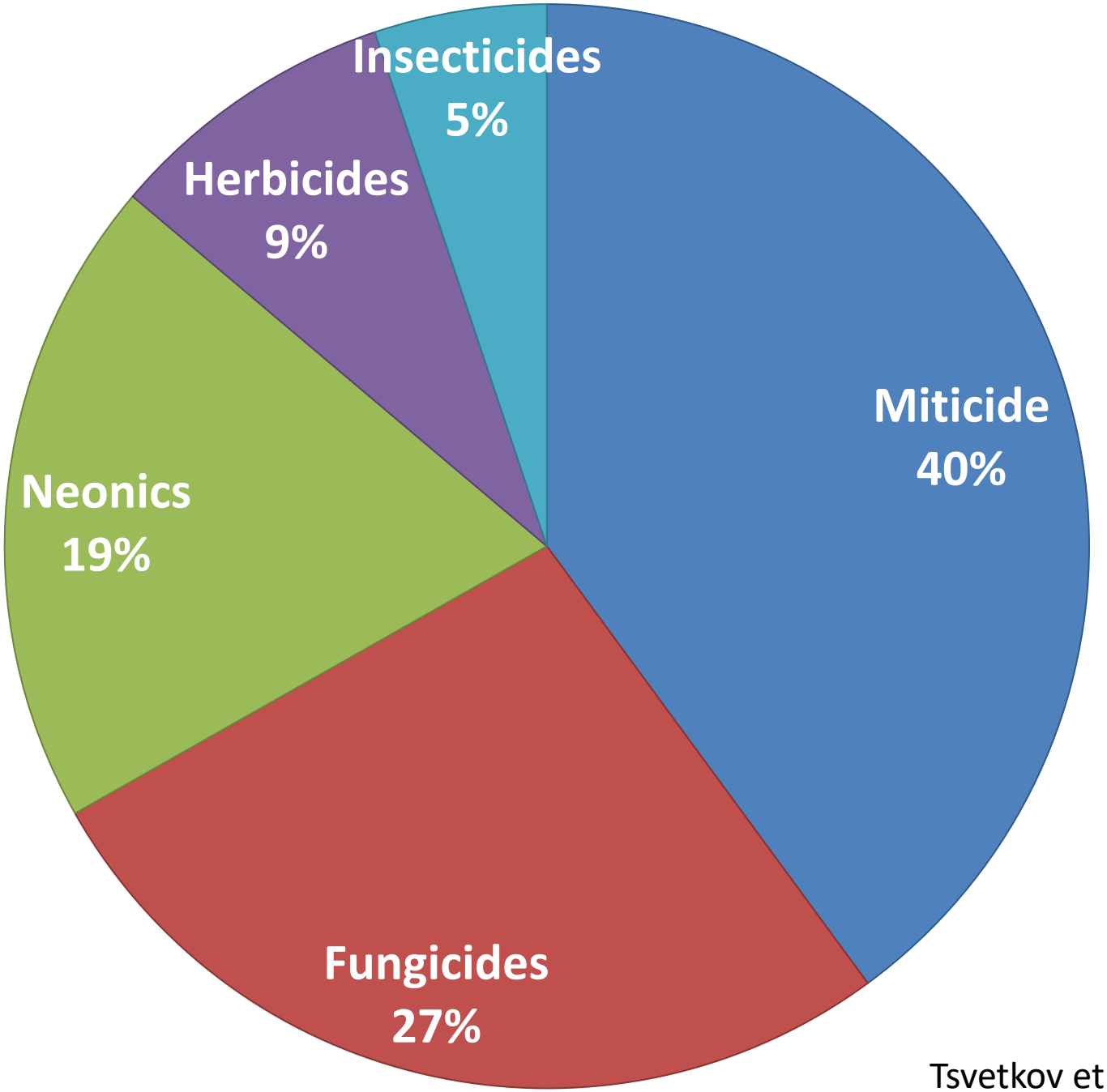
Who, When, and Where?

Results – Who?

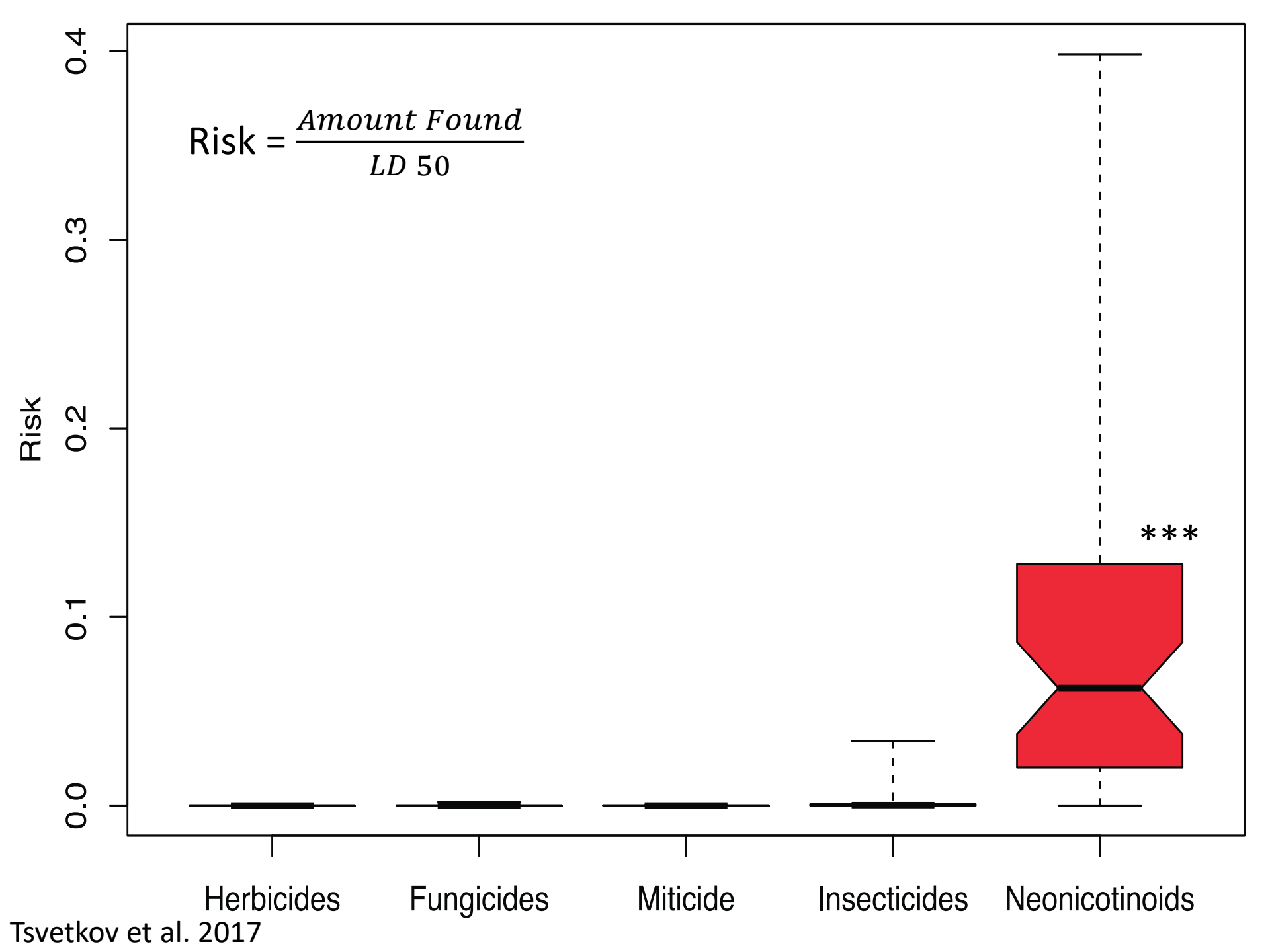
- Tested 231 different agrochemicals

- 26 different agrochemicals



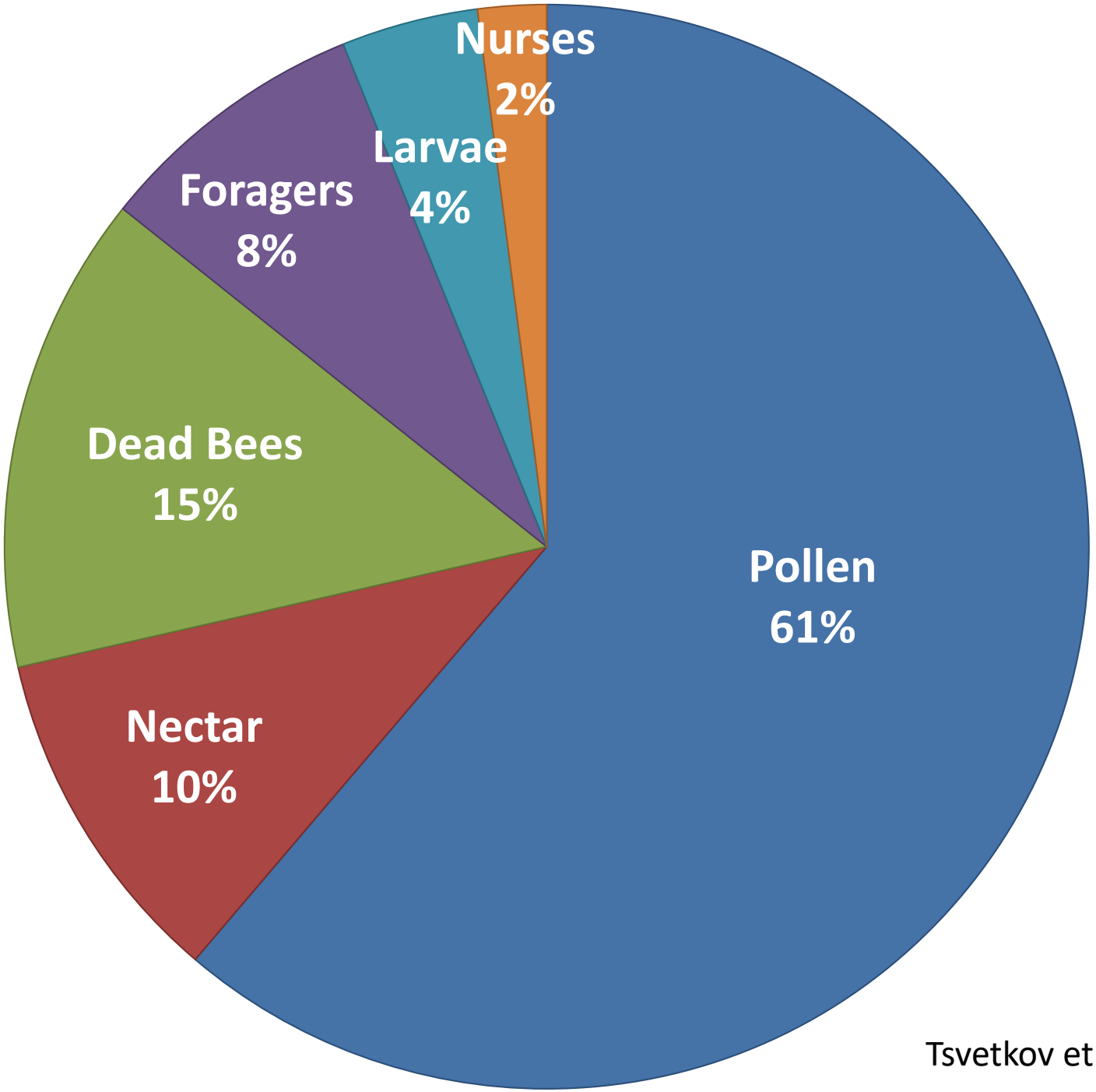


Tsvetkov et al. 2017



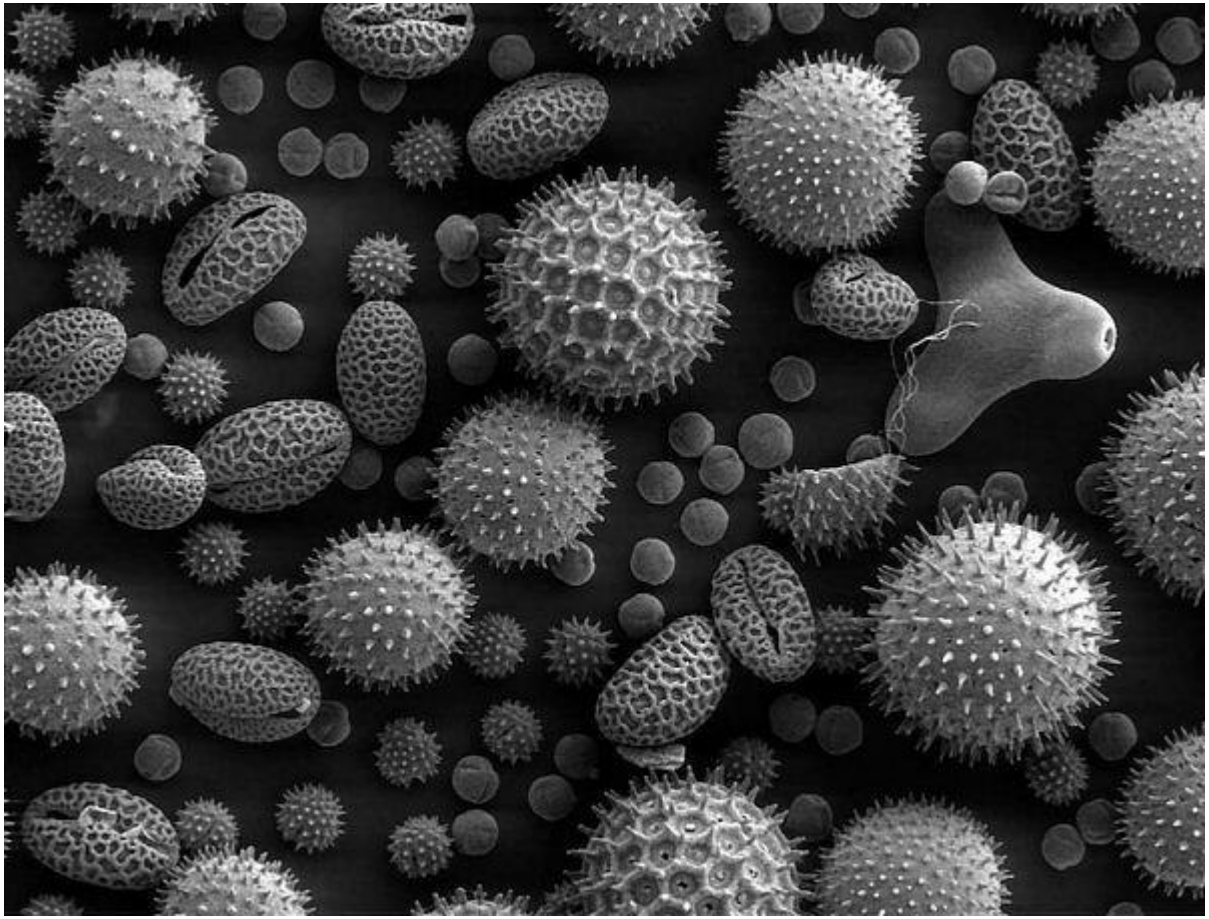
Tsvetkov et al. 2017

Results – Where?



Tsvetkov et al. 2017

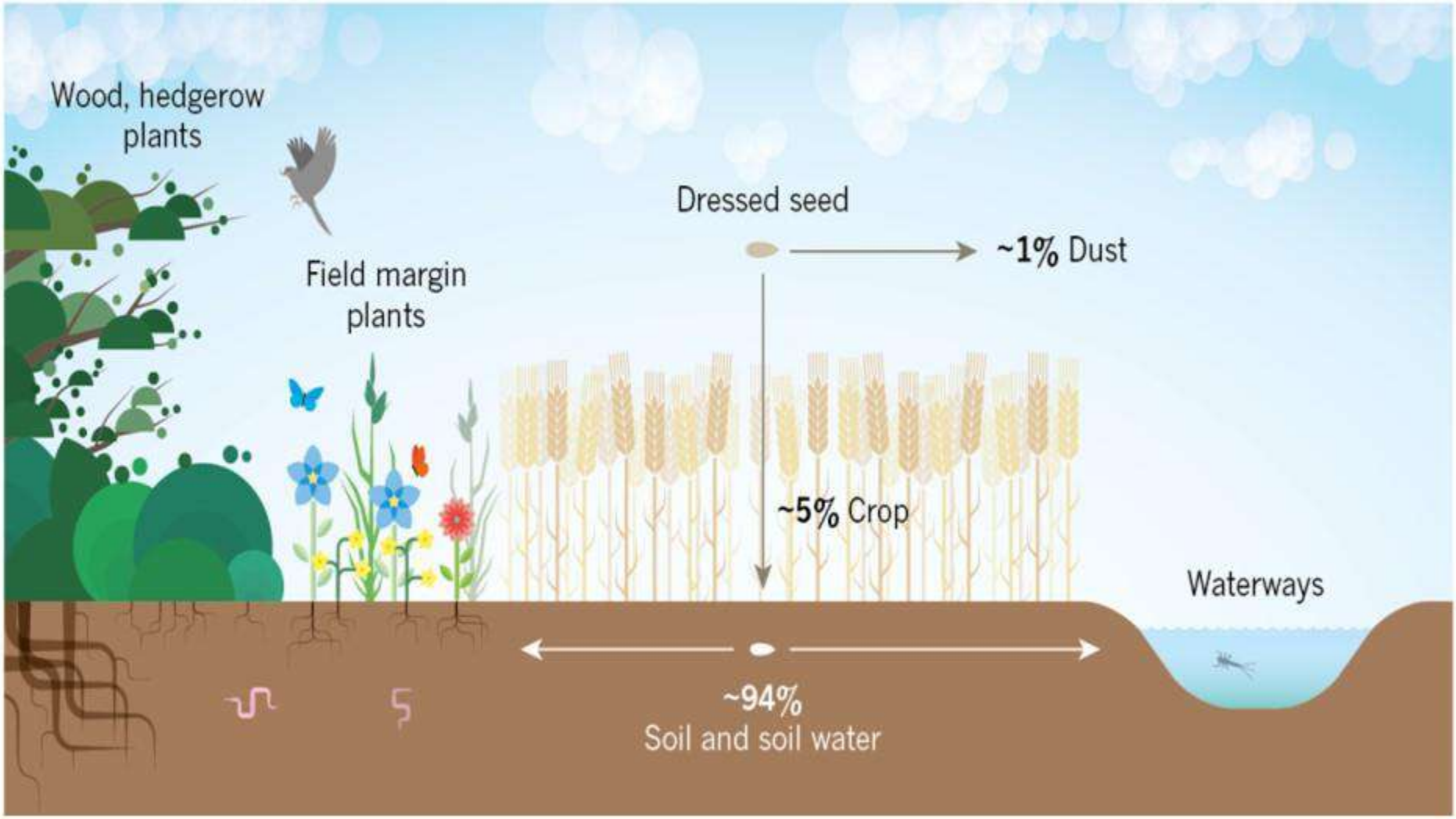
Pollen ID



Pollen ID

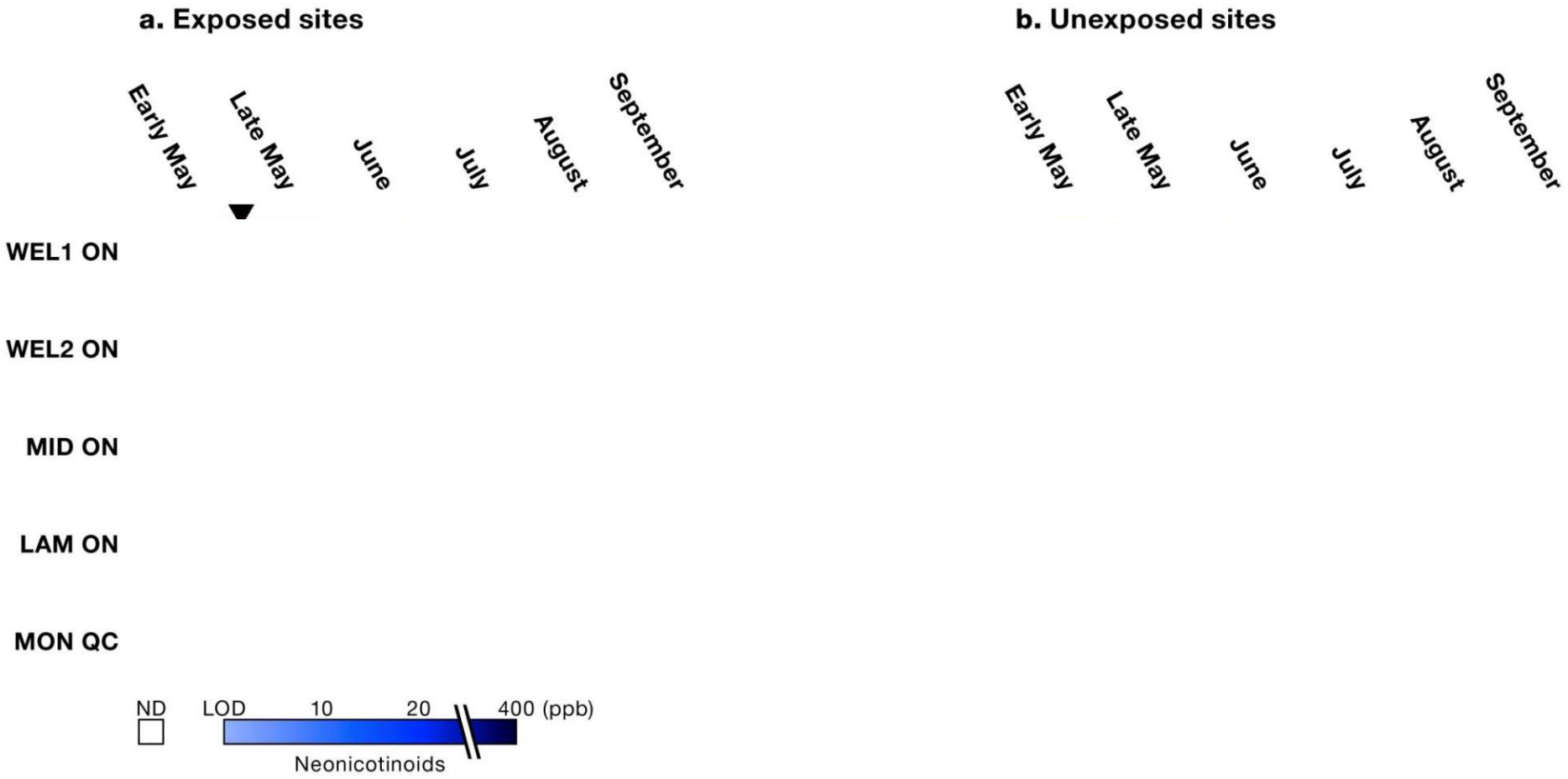
Name	Common Name	NNI Present (%)	NNI Absent (%)
Salix	**Willow**	21.98	8.56
Type Aster/Solidago	**Goldenrod**	0.92	20.31
Type Trifolium Hybridum	**Alsike Clover**	19.05	8.86
Rhamnus Type Cathartica	**Buckthorn**	15.48	2.01
Lotus	**Lotus**	5.43	10.31
Type Melilotus	**Sweet Clover**	0.92	9.67
Acer Type Negundo	**Maple Ash**	1.44	5.85
Type Brassica	**Mustard Vegetables**	5.73	1.77
Rosaceae Fruit Trees Type	**Apple**	5.56	2.29
Acer Type Rubrum	**Red Maple**	0.42	4.30
Liliaceae	**Lily**	2.82	0.36
Type Taraxacum	**Dandelion**	1.28	2.55
Type Trifolium Pratense	**Red Clover**	1.53	2.03
Other	**Other**	<2.00	<2.00

Environmental fate of neonic seed dressings



Goulson, D. 2014. *Nature*, doi:10.1038/nature13642

When?



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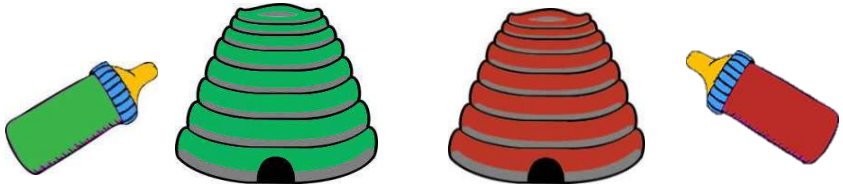
Experimental Work



Unexposed Exposed

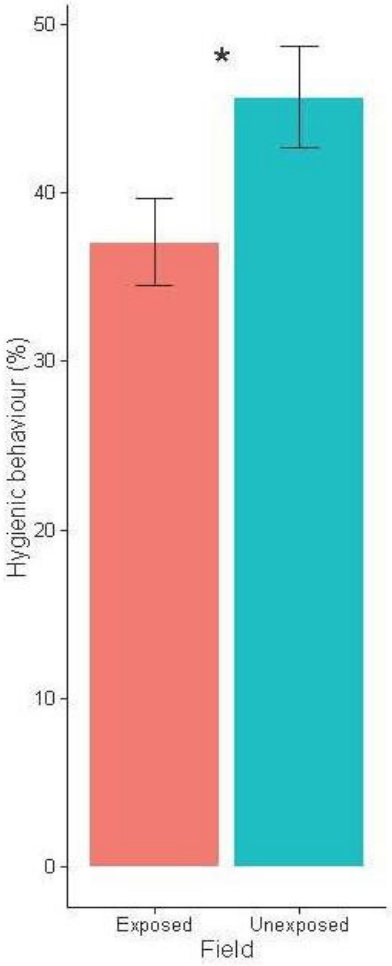
Behaviour

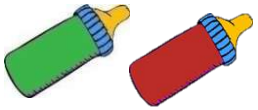
Hygiene

Hygiene

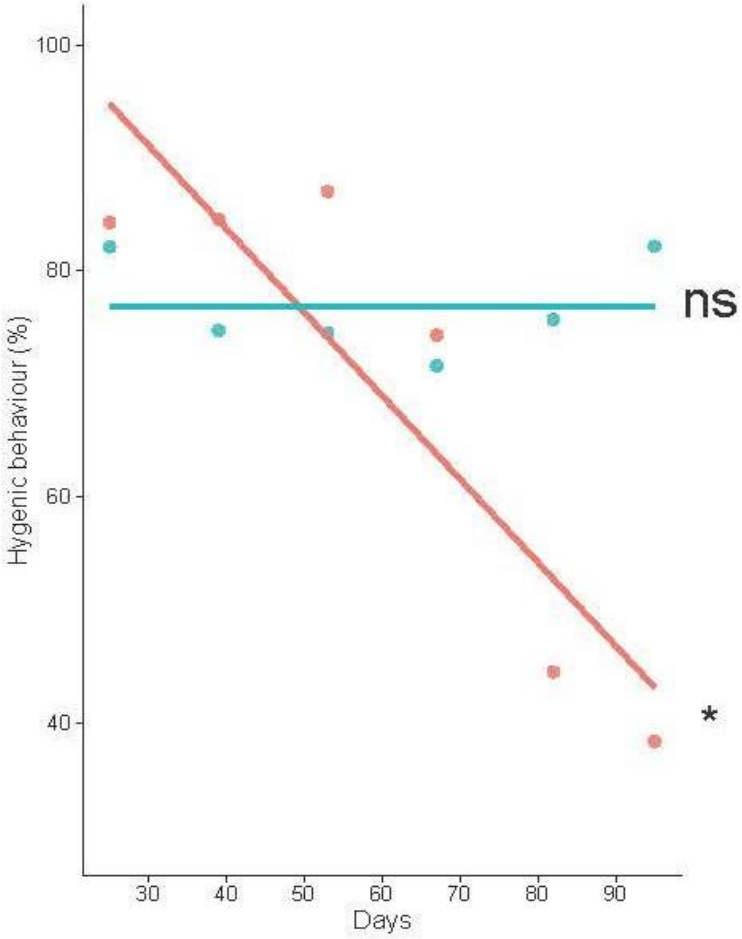
Unexposed
Exposed

2014





2015



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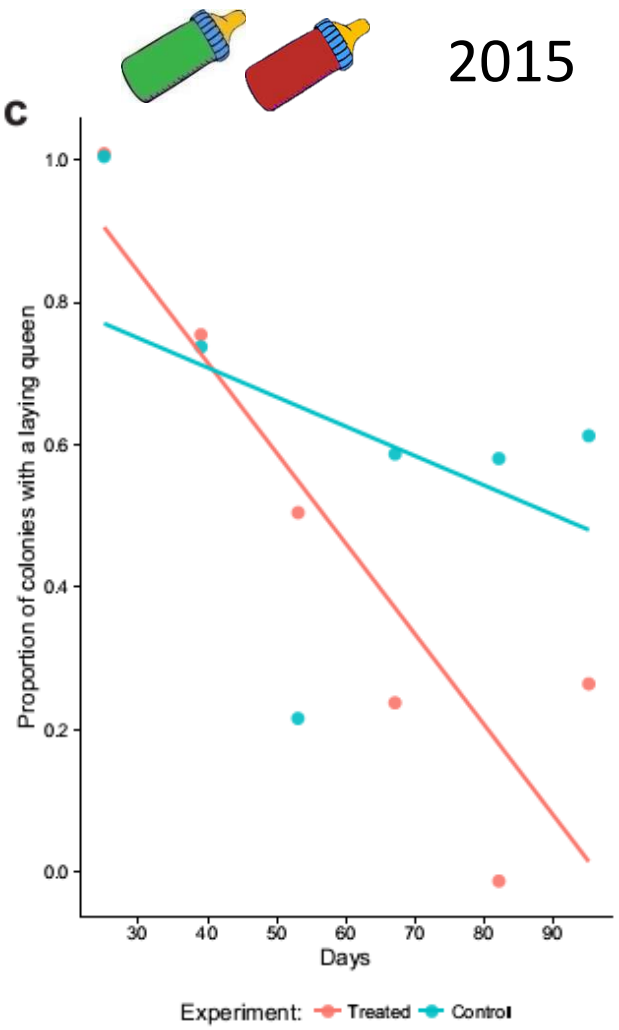
Queen

Unexposed
Exposed

2015



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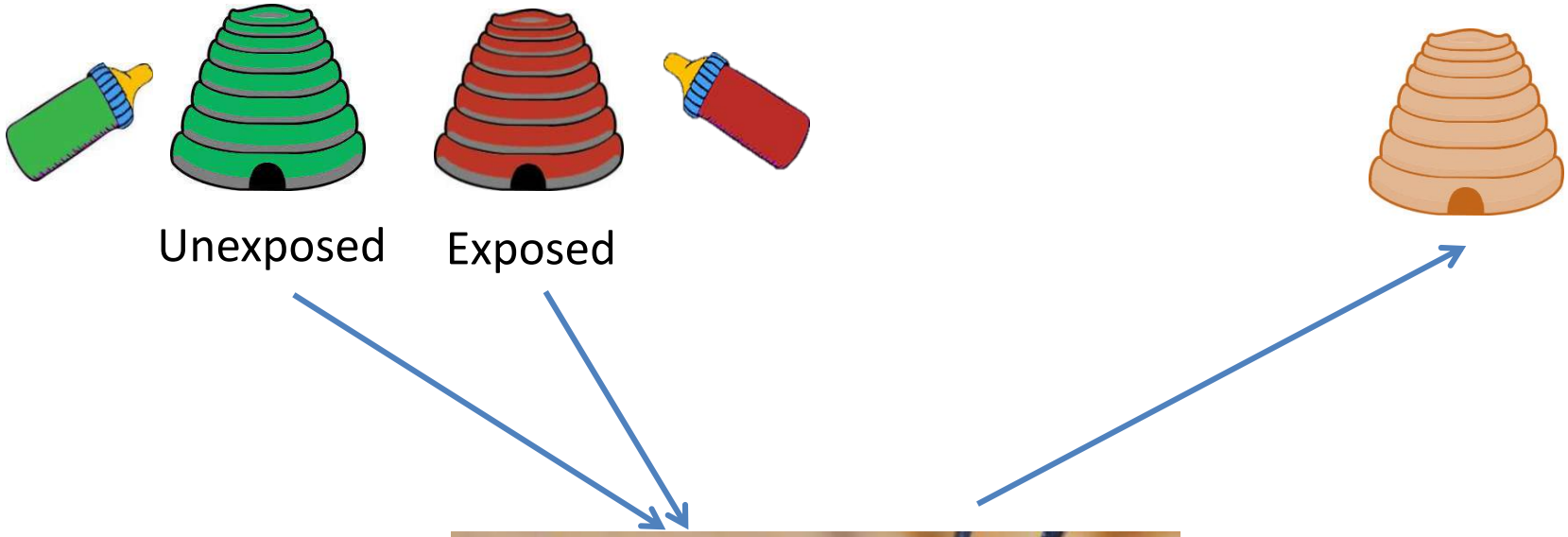
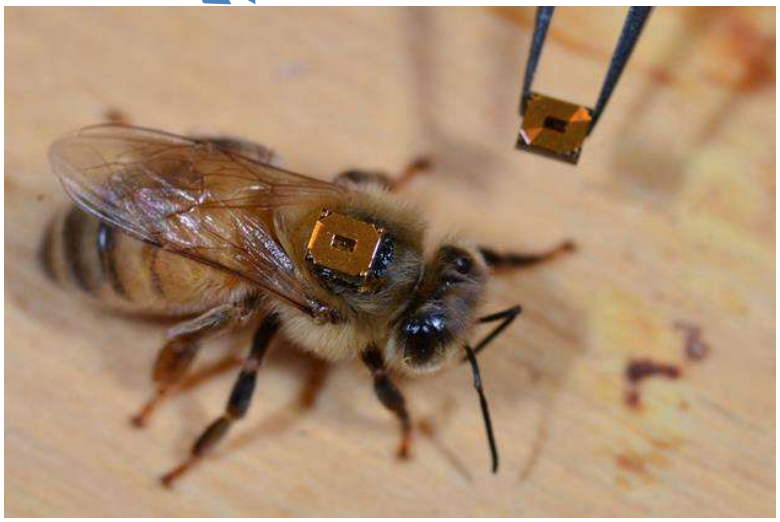
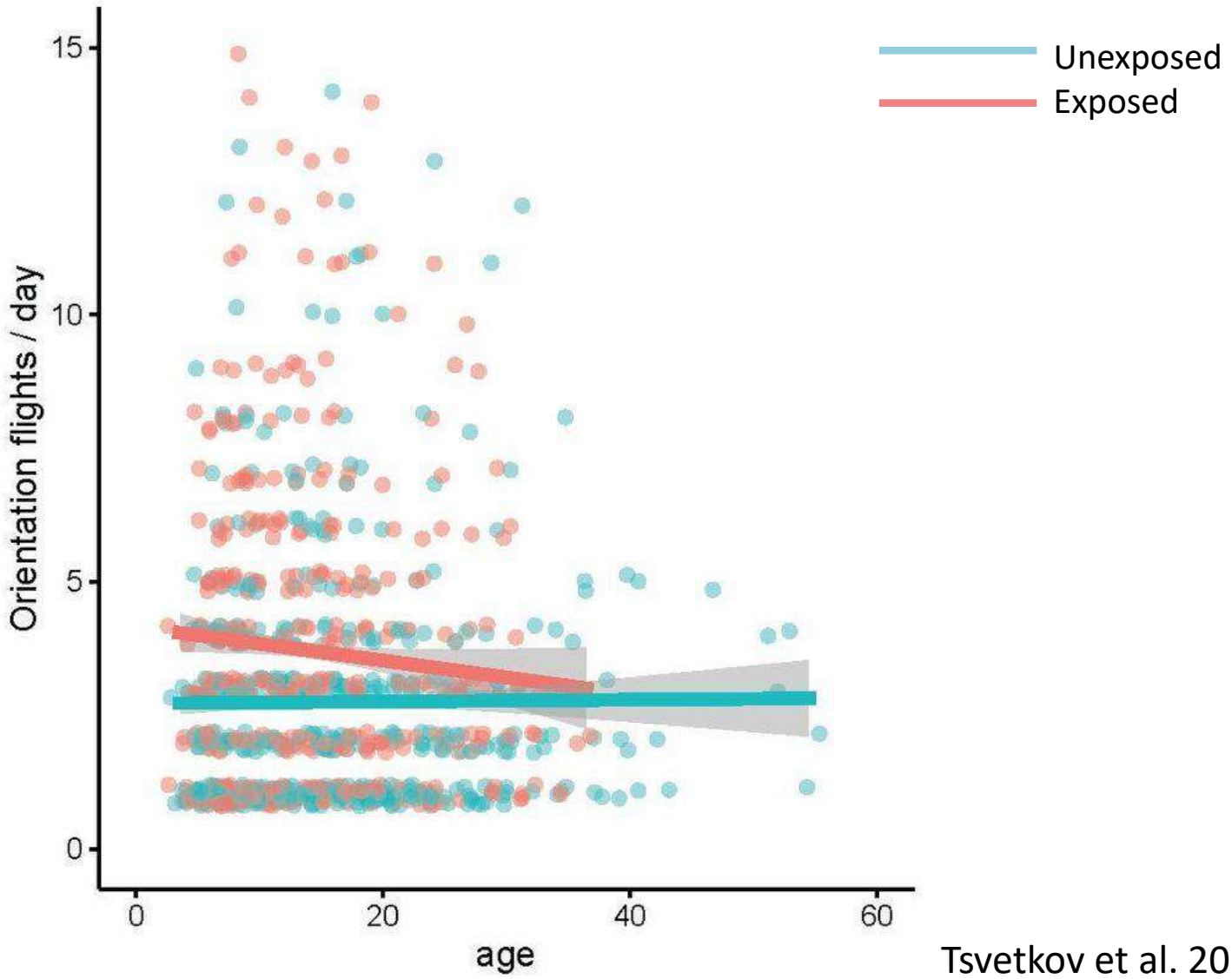
RFID





Honey Bee Flights

Orientation Flights



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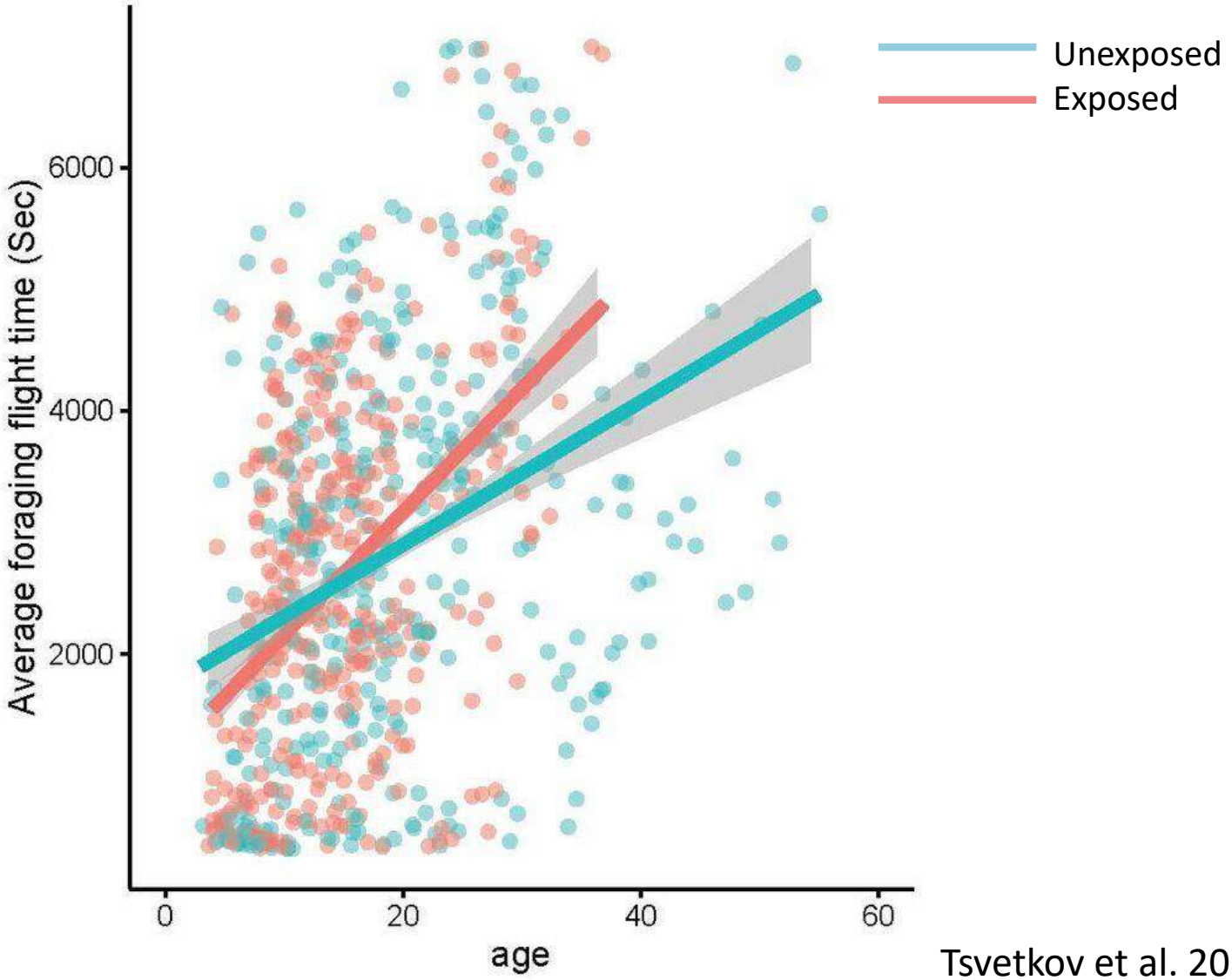
Foraging Flights



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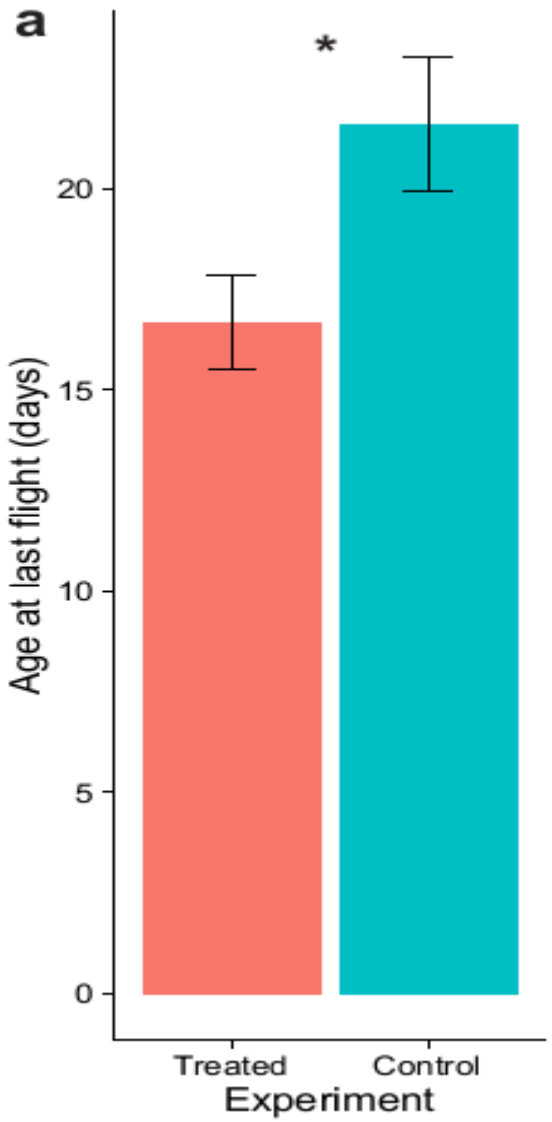
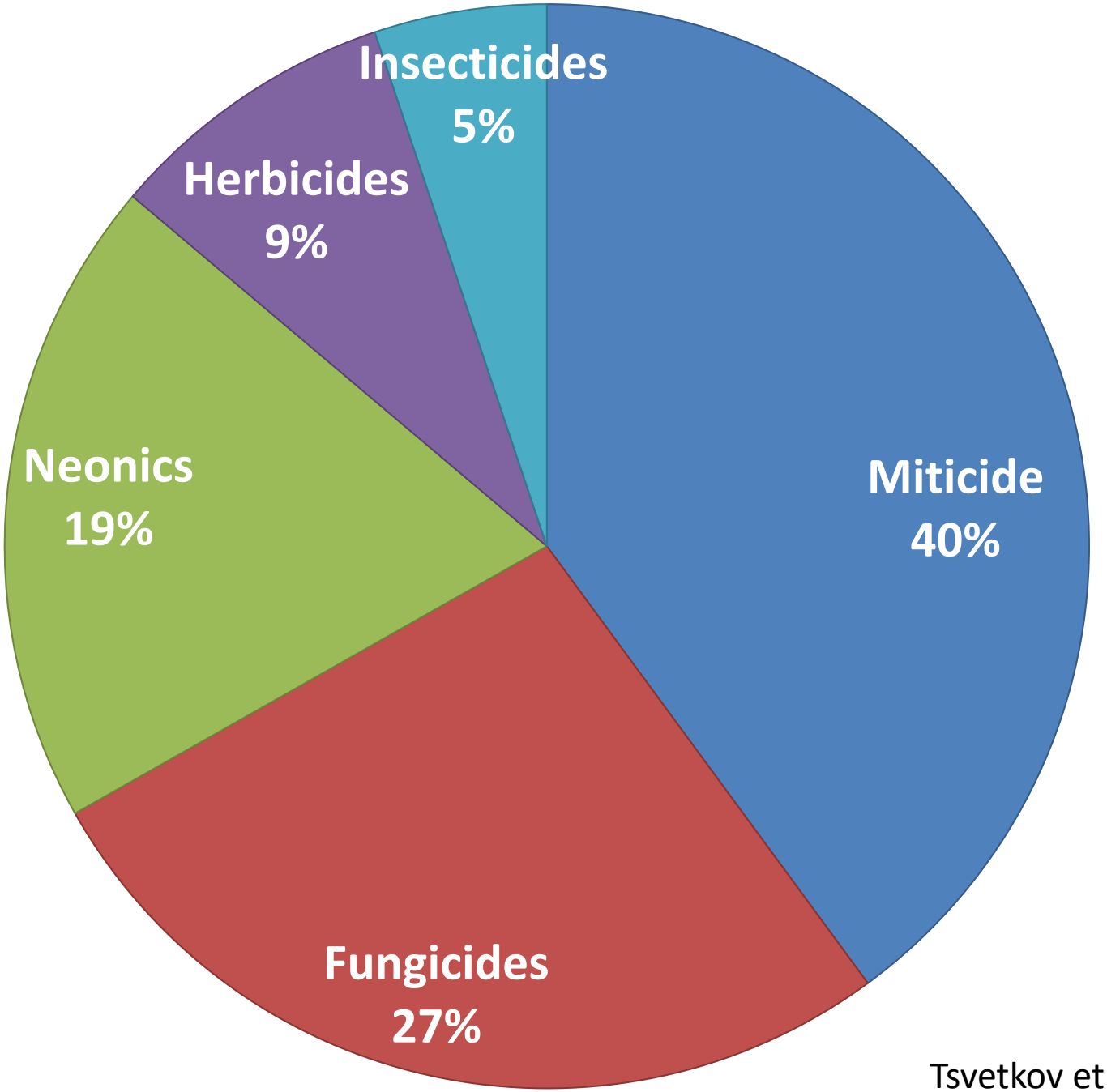
Life Expectancy



Unexposed
Exposed

Tsvetkov et al. 2017



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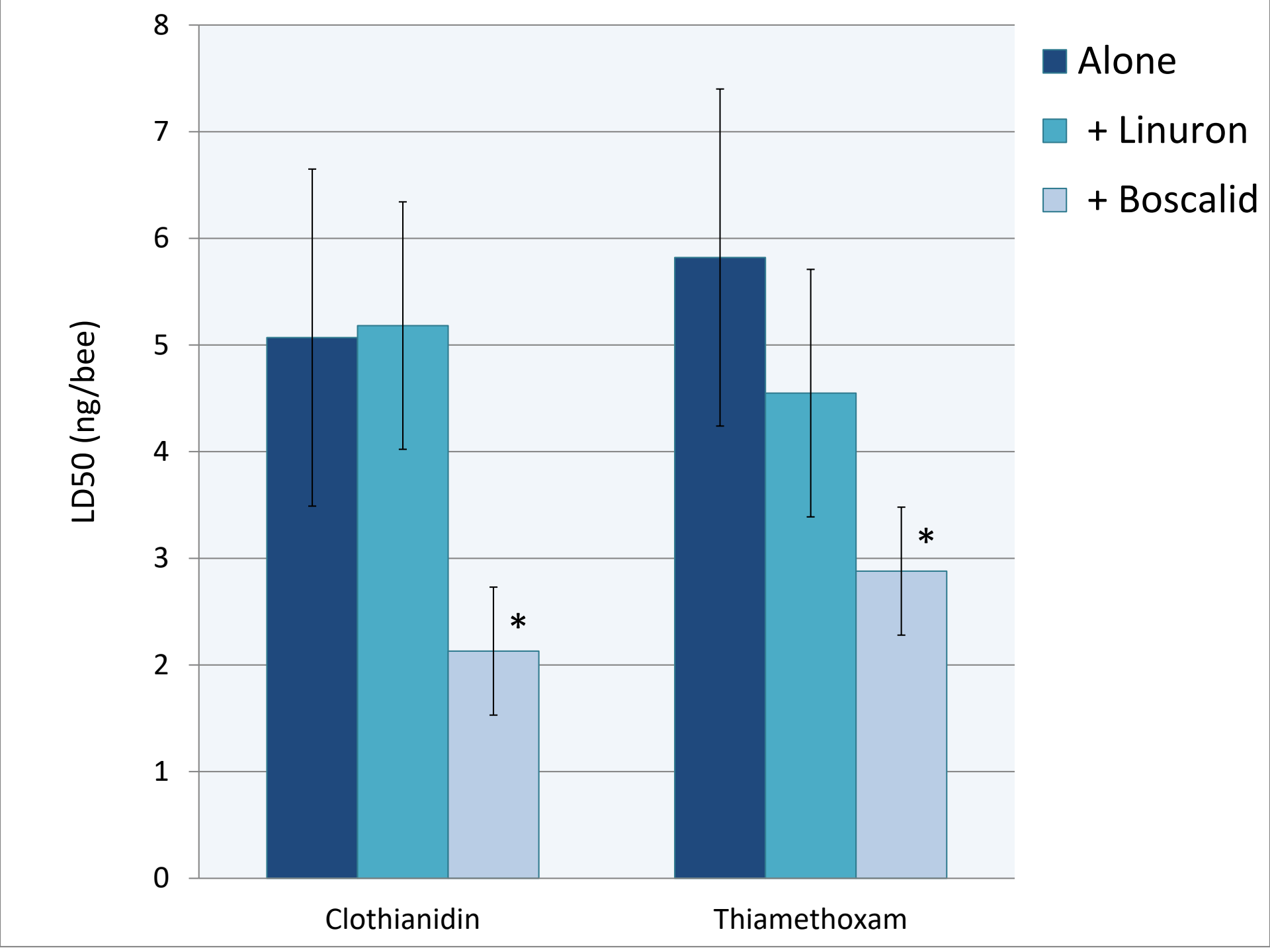
8
7
6
5
4
3
2
1
0
LD50 (ng/bee)
Alone
+ Linuron
+ Boscalid
*
*
Clothianidin
Thiamethoxam

So, What is Field Realistic?

- Exposure through pollen
- Exposure for ~ 3 months
- Exposure to a variety of pesticides at once

So, What is Field Realistic?

- Reduced hygiene
- Reduced queen replacement
- Reduced life expectancy
- Abnormal flights

Thank you

Field Team:
Keshna Sood,
Harshilkumar Patel
Philip Maciukiewicz
Olivier Samson-Robert
Valérie Fournier

LD50 Team:
Harshilkumar Patel
Danny Malena
Pratik Gajiwala

Impacts

REPORT

Chronic exposure to neonicotinoids reduces honey bee health near corn crops

N. Tsvetkov[1], O. Samson-Robert[2], K. Sood[1], H. S. Patel[1], D. A. Malena[1], P. H. Gajiwala[1], P. Maciukiewicz[1], V. Fournier[2], A. Z…
+ See all authors and affiliations

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