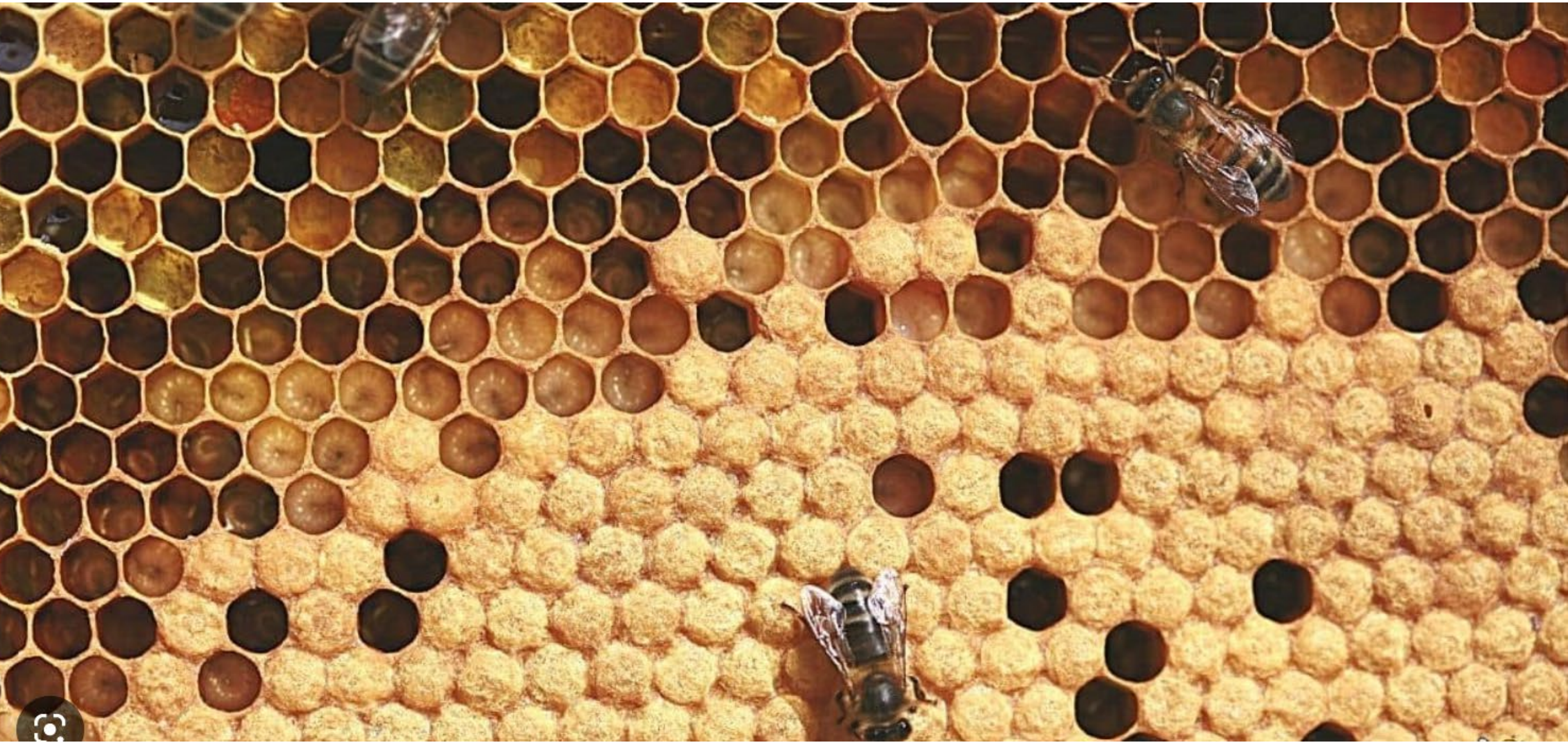
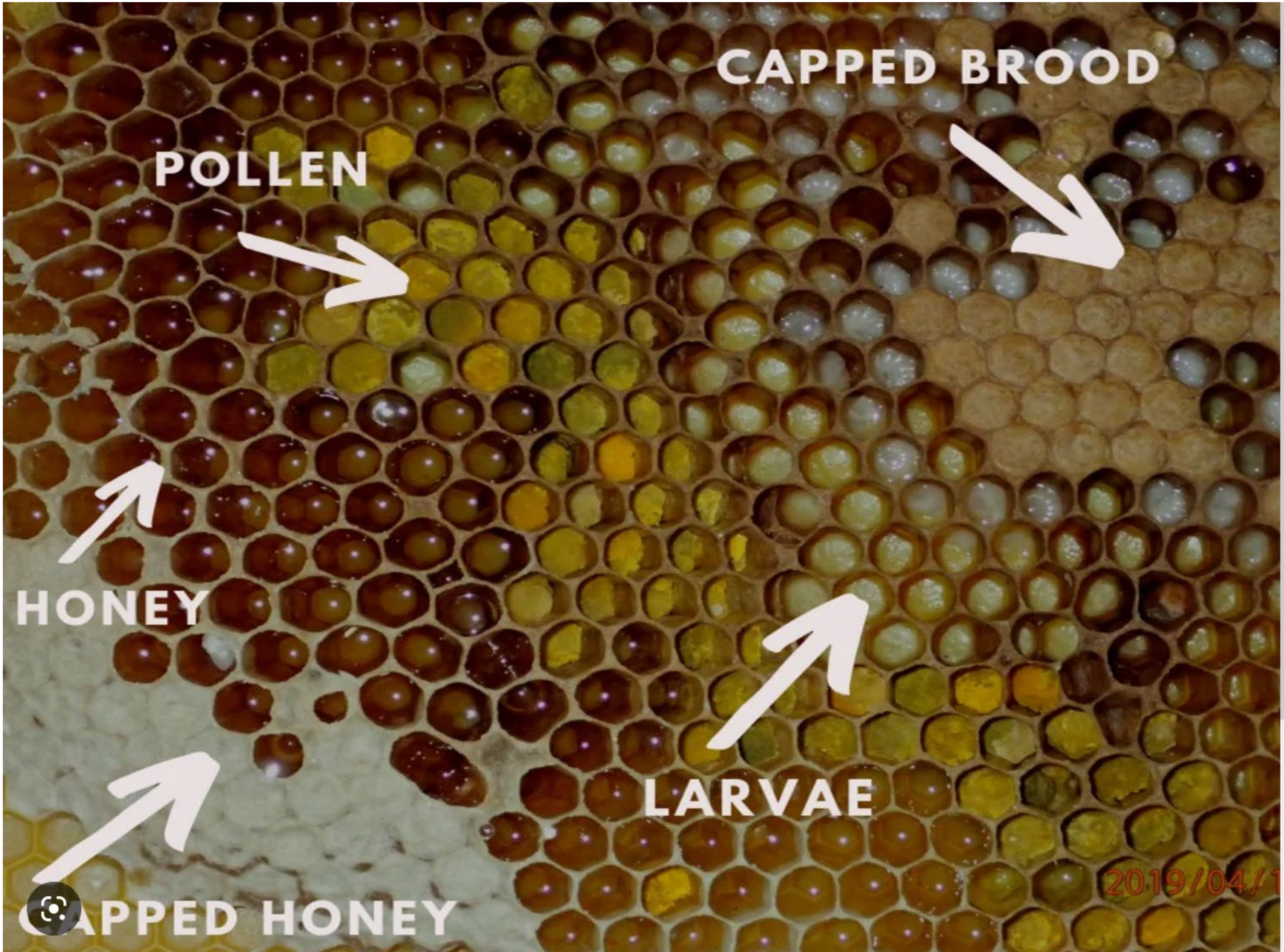
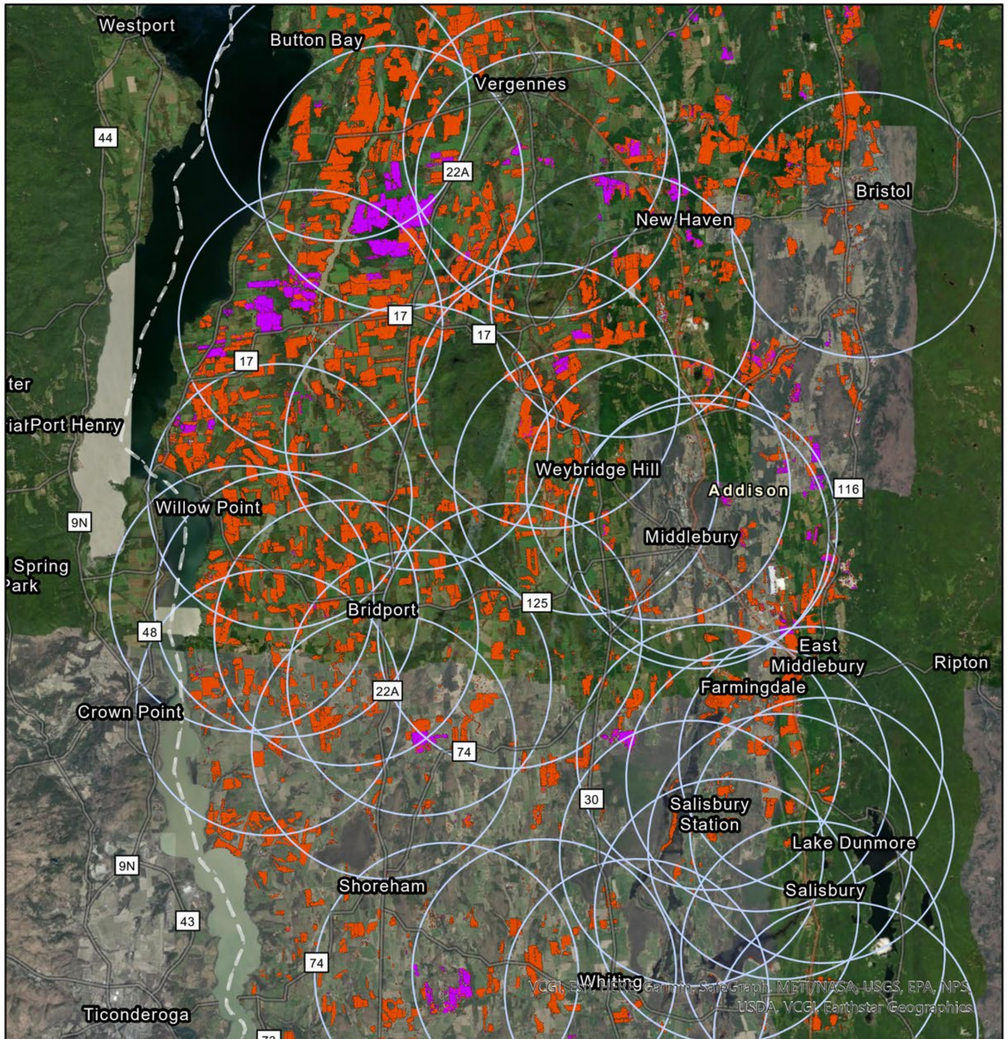



CAPPED BROOD
POLLEN
HONEY
LARVAE
CAPPED HONEY
2019/04/1

Addison Co. Vermont Corn & Soybean Crop Land Cover (2020-2022) ; Potential Neonicotinoid Pesticide Exposure Zones for Honey Bees



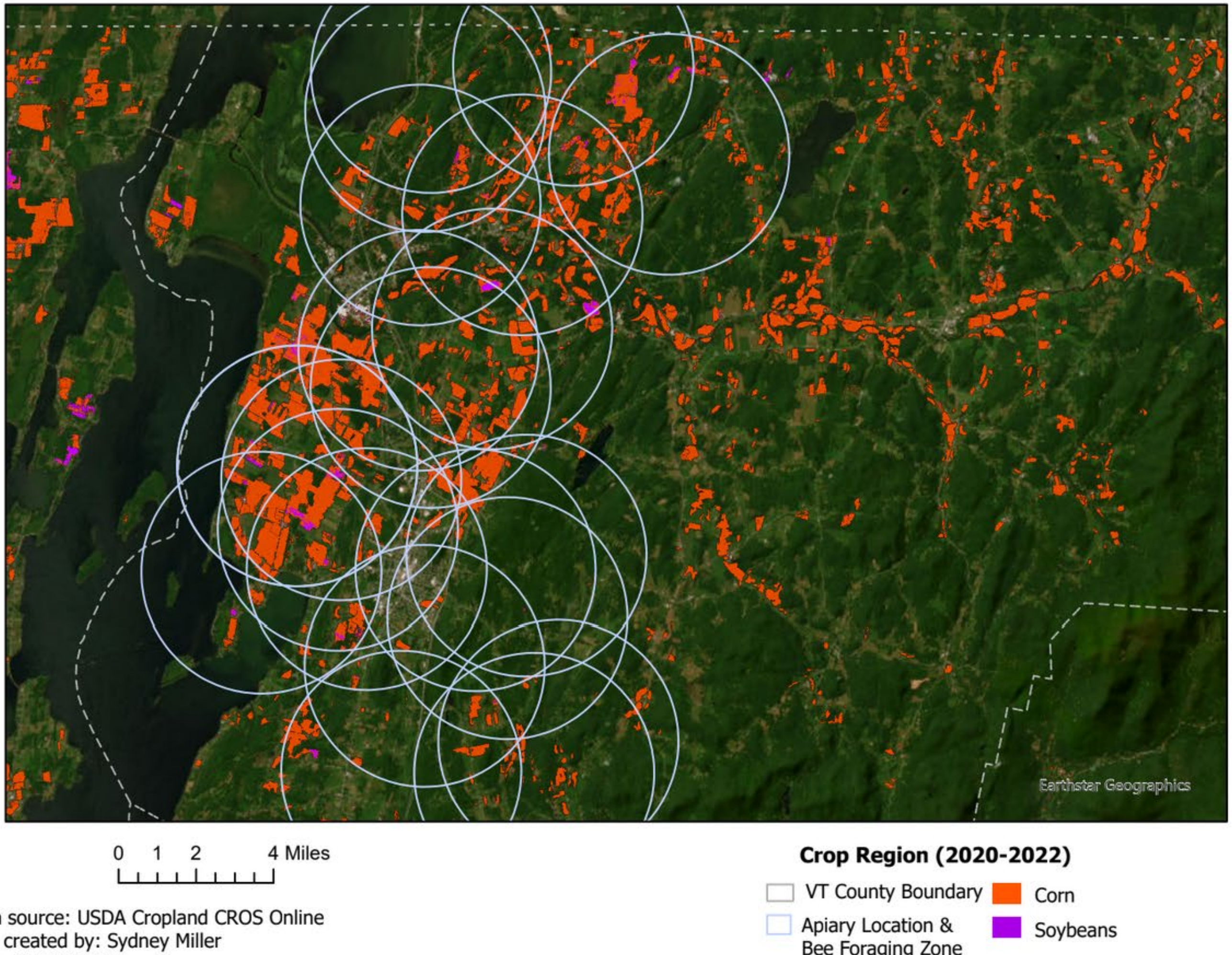
0 0.751.5 3 Miles

Crop Region (2020-2022)

- VT County Boundary
- Apiary Location & Bee Foraging Zone
- Corn
- Soybeans

Data source: USDA Cropland CROS Online
Map created by: Sydney Miller
Date: 03-21-2023

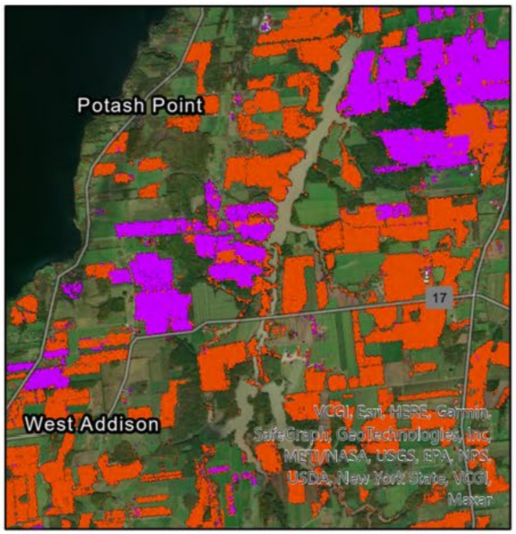
Franklin Co. Vermont Corn & Soybean Crop Land Cover (2020-2022) ; Potential Neonicotinoid Pesticide Exposure Zones for Honey Bees



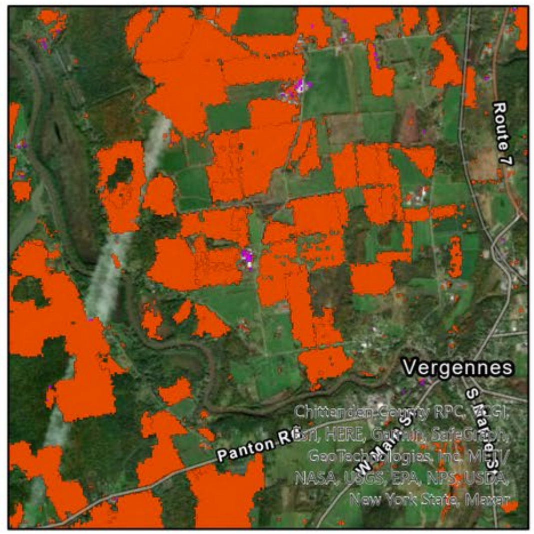
Data source: USDA Cropland CROS Online
Map created by: Sydney Miller
Date: 03-21-2023

Vermont Corn & Soybean Crop Land Cover (2020-2022) ; Potential Neonicotinoid Pesticide Exposure Zones for Honey Bees

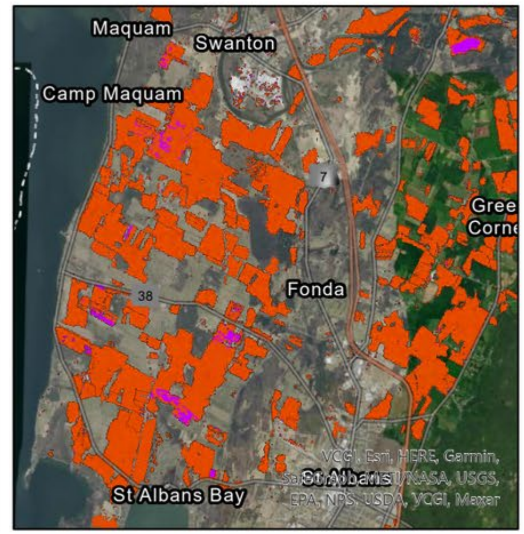
Addison, VT



Vergennes, VT



Swanton, VT



0 0.5 1 2 Miles

Crop Region (2020-2022)

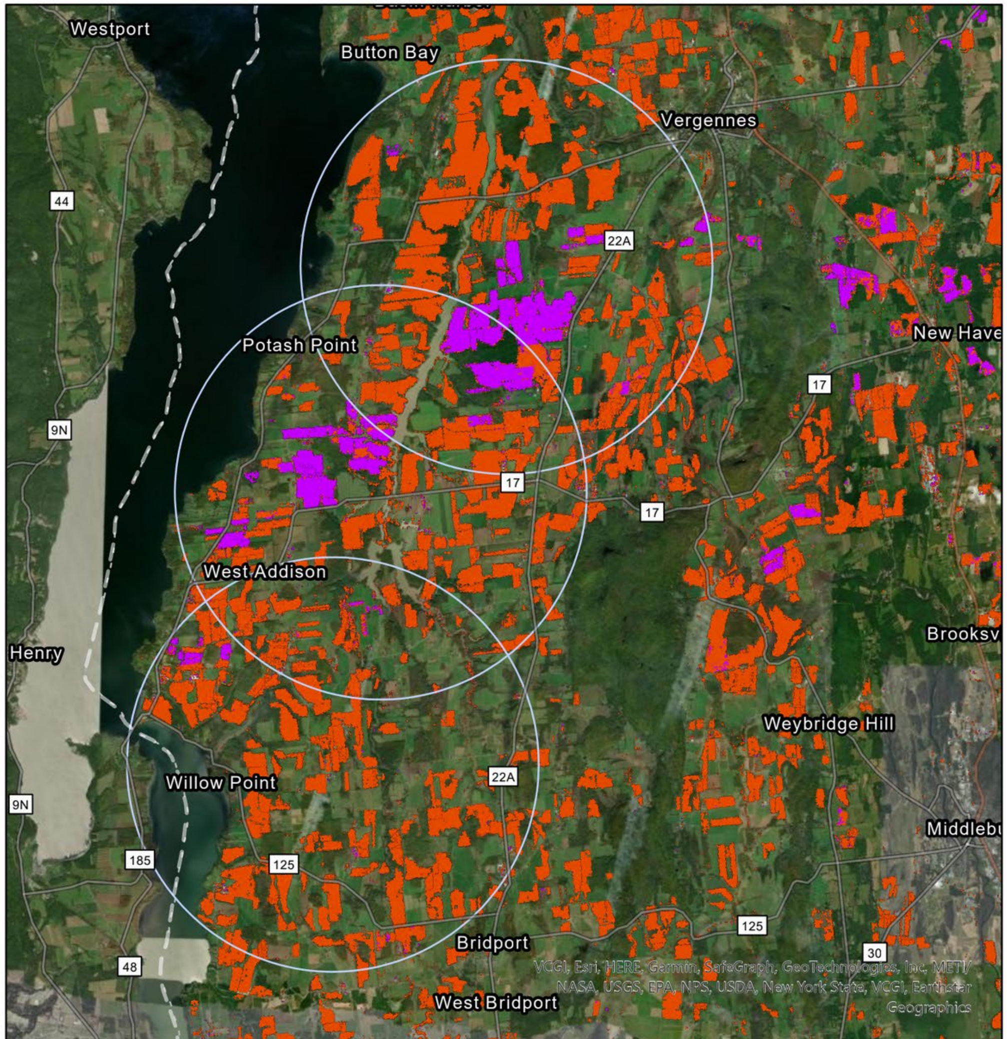
Corn

Soybeans

N

Data source: USDA Cropland CROS Online
Map created by: Sydney Miller
Date: 03-23-2023

Addison Co. Vermont Corn & Soybean Crop Land Cover (2020-2022) ; Potential Neonicotinoid Pesticide Exposure Zones for Honey Bees



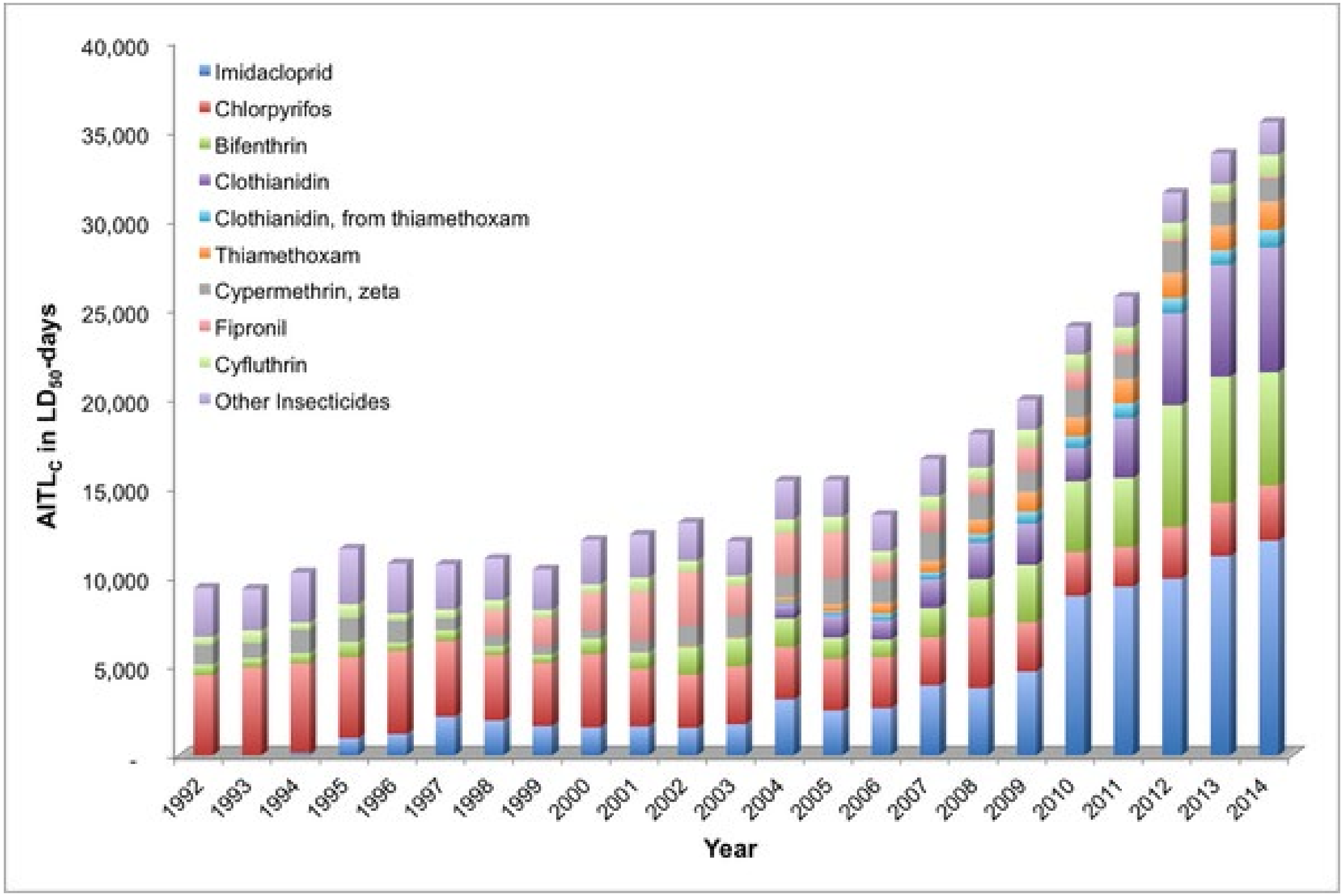
0 0.5 1 2 Miles

Crop Region (2020-2022)

VT County Boundary
Apiary Location & Bee Foraging Zone
Corn
Soybeans

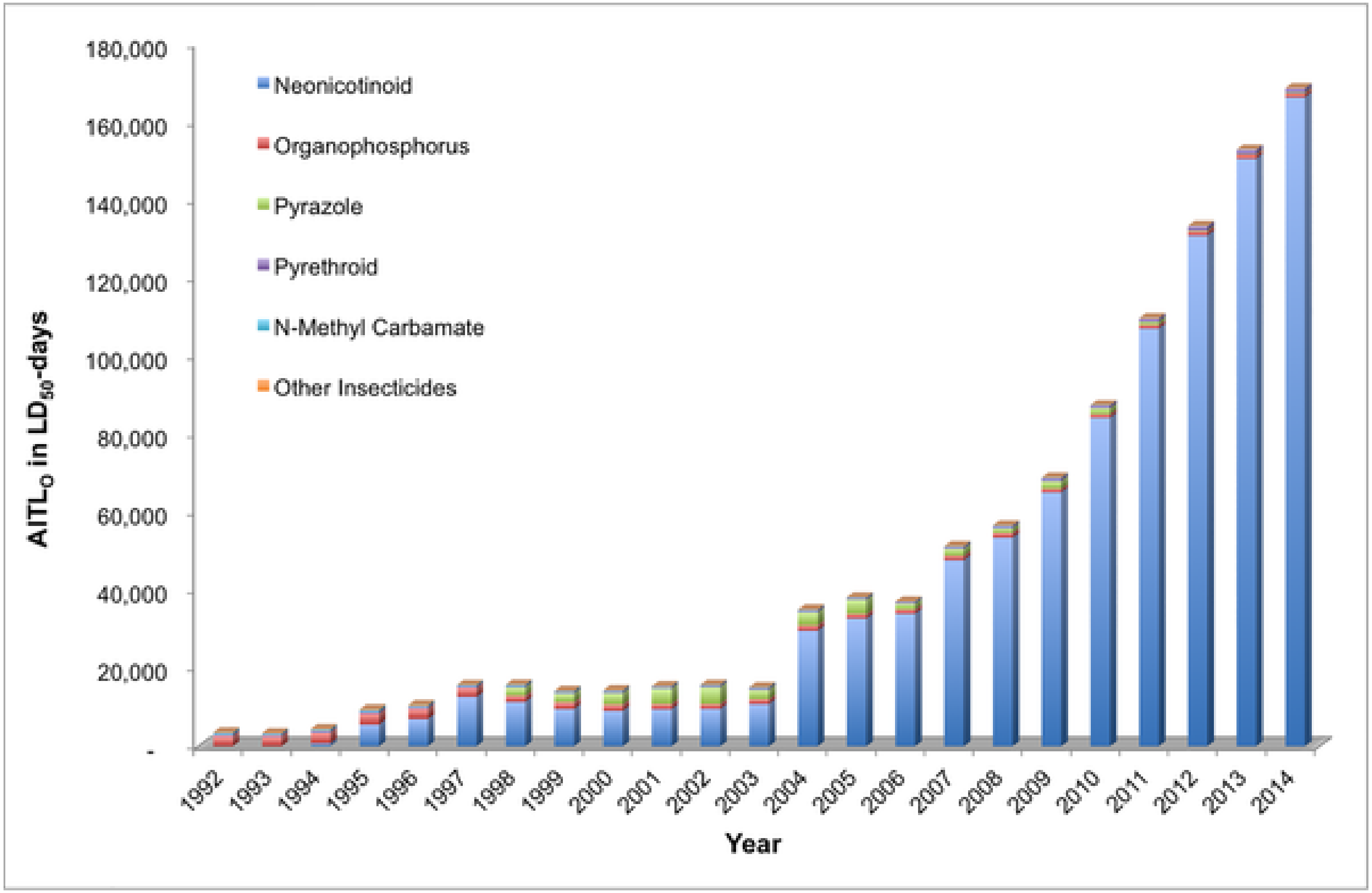
Data source: USDA Cropland CROS Online
Map created by: Sydney Miller
Date: 03-21-2023

Fig 6. Contact acute insecticide toxicity loading (AITLC) by active ingredient, 1992–2014.

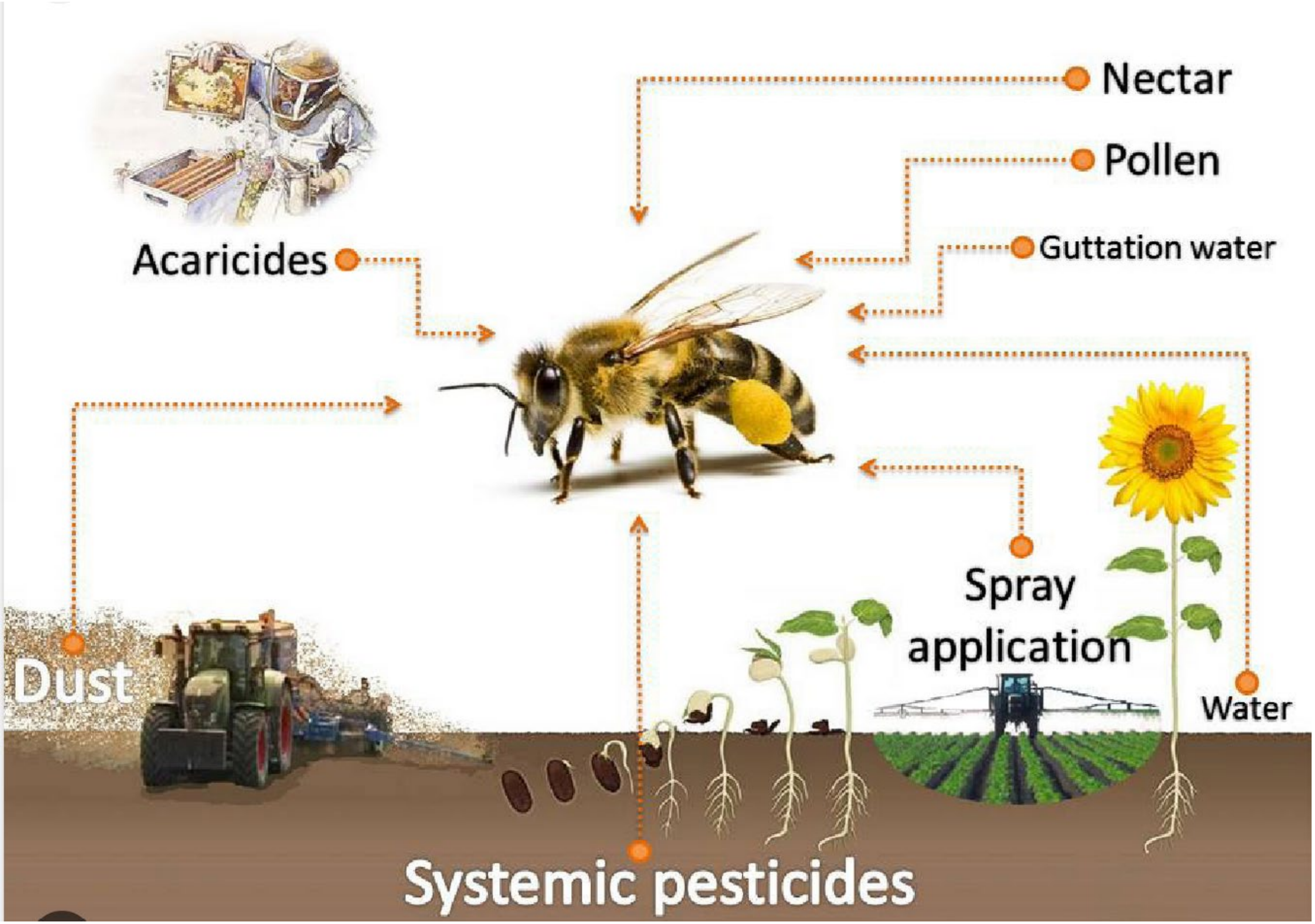


DiBartolomeis M, Kegley S, Mineau P, Radford R, Klein K (2019) An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States. PLOS ONE 14(8): e0220029. https://doi.org/10.1371/journal.pone.0220029
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0220029

Fig 5. Oral acute insecticide toxicity loading (AITLO) by chemical class, 1992–2014.



DiBartolomeis M, Kegley S, Mineau P, Radford R, Klein K (2019) An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States. PLOS ONE 14(8): e0220029. https://doi.org/10.1371/journal.pone.0220029
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0220029

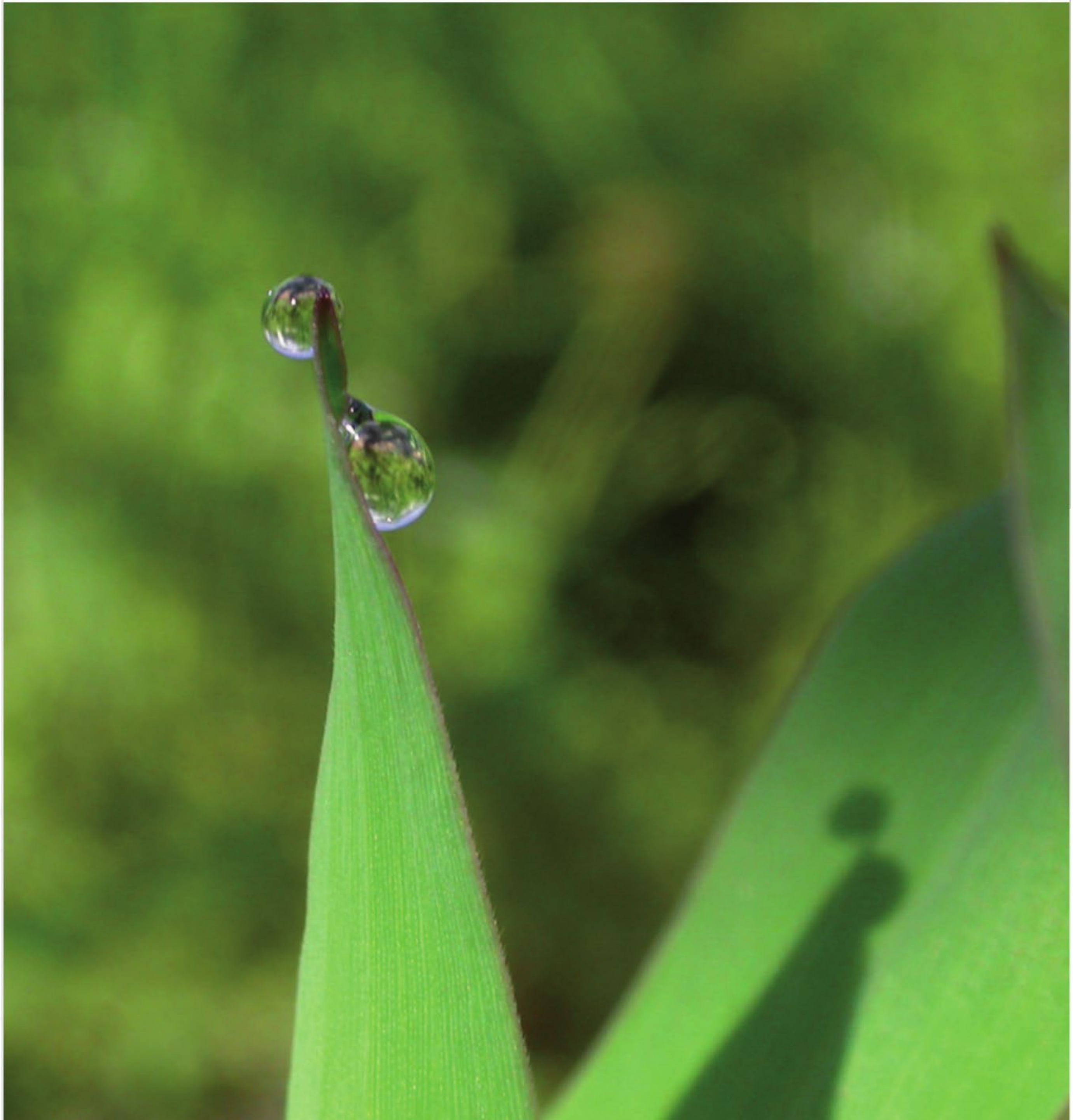

Nectar
Pollen
Guttation water
Acaricides
Spray
application
Water
Dust
Systemic pesticides


KUHN
KUHN
PLANTER 3
INSECTICIDE
MAC

Acute exposure to dust

Exposure to dust on field adjacent plants up to 9 ppb

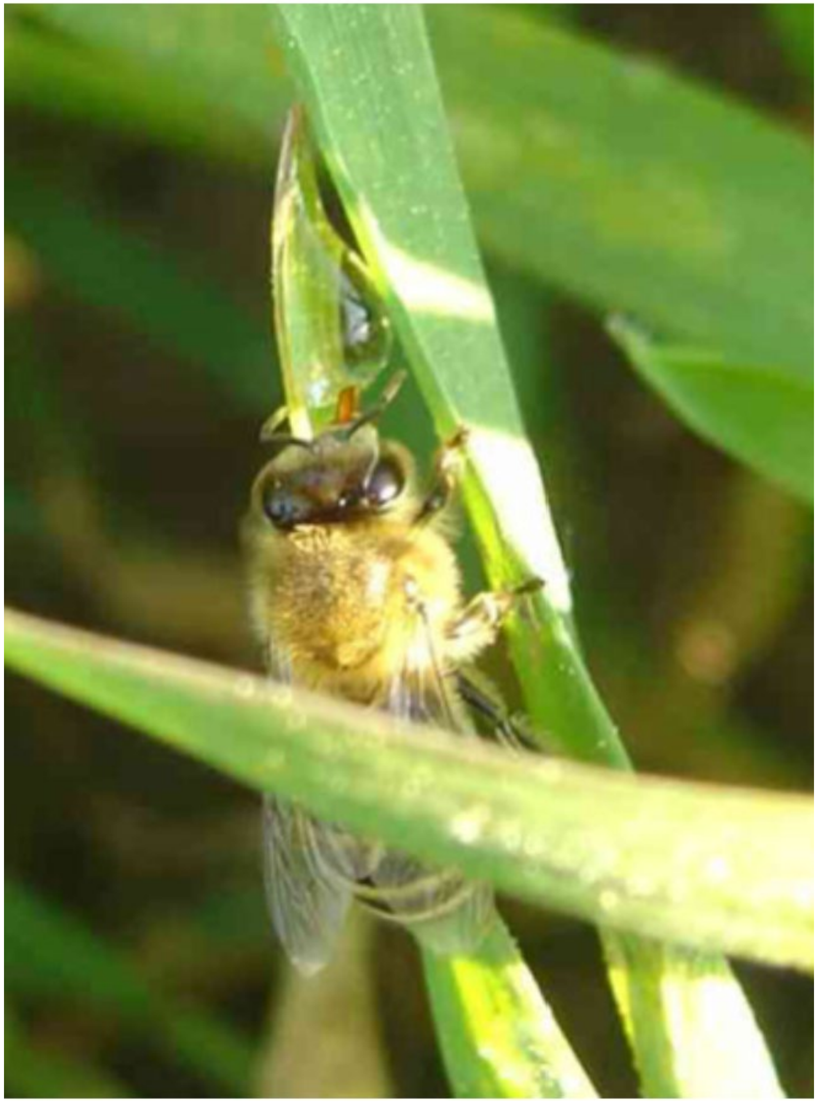
Guttation fluid



Equal to: IMD 47,000 ppb; CLO 23,300 ppb; TMX 11,900 ppb

Insecticide Content in Guttation. Chemical analyses of the guttation water from laboratory-grown corn plants during 3 wk of growth showed the presence of the corresponding seed coating neonicotinoids in all samples. Guttation drops collected on plants from neonicotinoid-coated seeds contained concentrations of each respective active ingredient of (mean $\pm$ SE) 47 $\pm$ 9.96 mg/liter for imidacloprid, 23.3 $\pm$ 4.2 mg/liter for clothianidin, and 11.9 $\pm$ 3.32 mg/liter for thiamethoxam with statistically significant differences (ANOVA: $F = 7.51$; df = 2, 15; $P = 0.005$). The amount

Always higher than 10,000ppb up to 200,000ppb



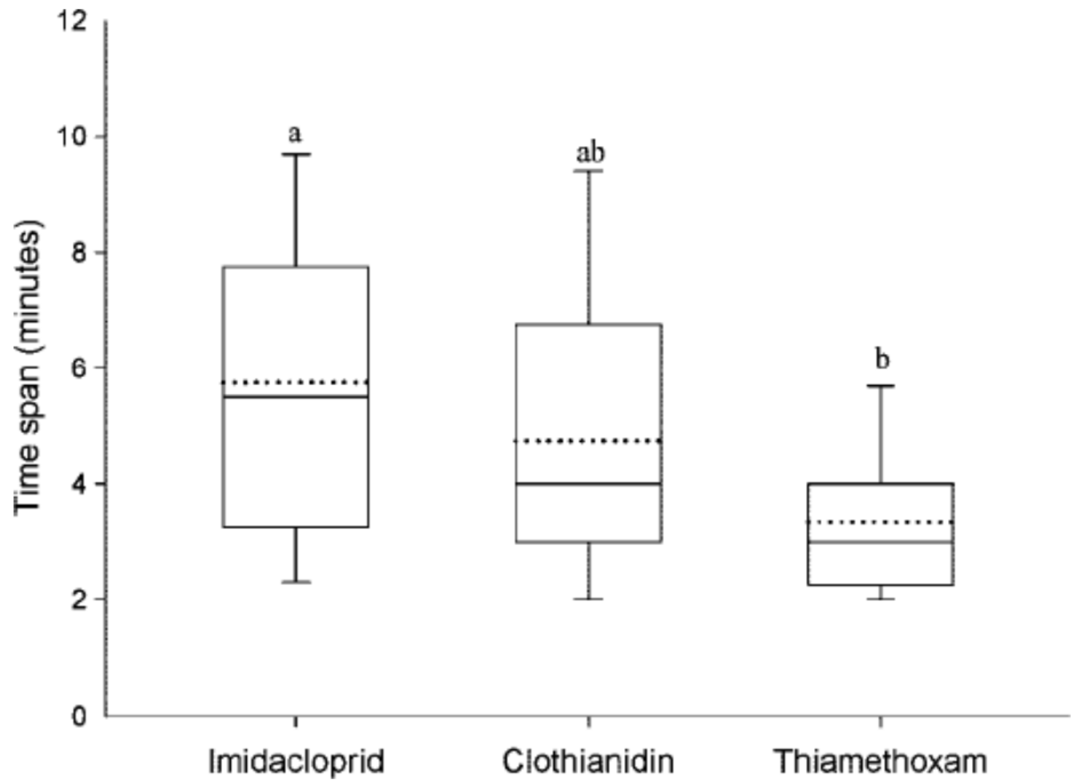
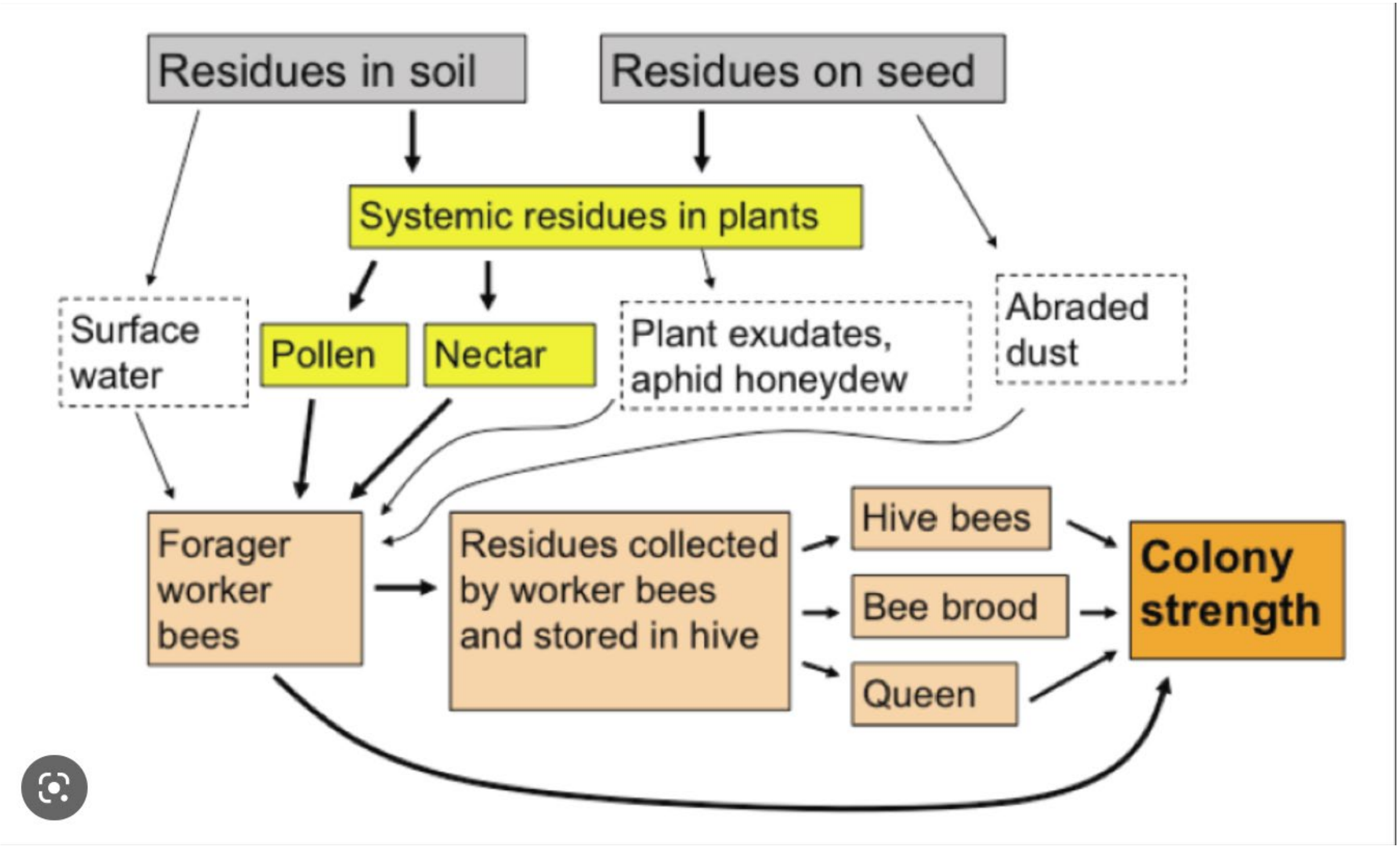


Fig. 2. Time between appearance irreversible wing-block and drinking of guttation drops collected on leaves of field corn crops, from three marketed neonicotinoid-coated. Guttation sampled on plants germinated from untreated seeds did not show any toxicity. The whisker represents the maximum and the minimum of the recorded time; the dotted line indicates the average; the upper, middle, and lower lines of the box indicate the 75, 50, and 25% of the time, respectively. Bars marked with different letters indicate significant differences ($P < 0.05$; Tukey–Kramer test).

Chronic exposure



Neonic levels in surface water from agricultural watersheds averaged 0.012 ppb

Pollen exposure

Methods: Data Collection

- Four sample apiaries throughout Vermont. Locations: Wardsboro, Addison, Cabot, Swanton
- Nectar, pollen, and flower samples collected from each yard every month from May through August/ September, with the exception of Cabot which did not get sampled until June.
- Hives weighed every month at each yard to track nectar flow with the exception of Cabot.

Pollen Collection

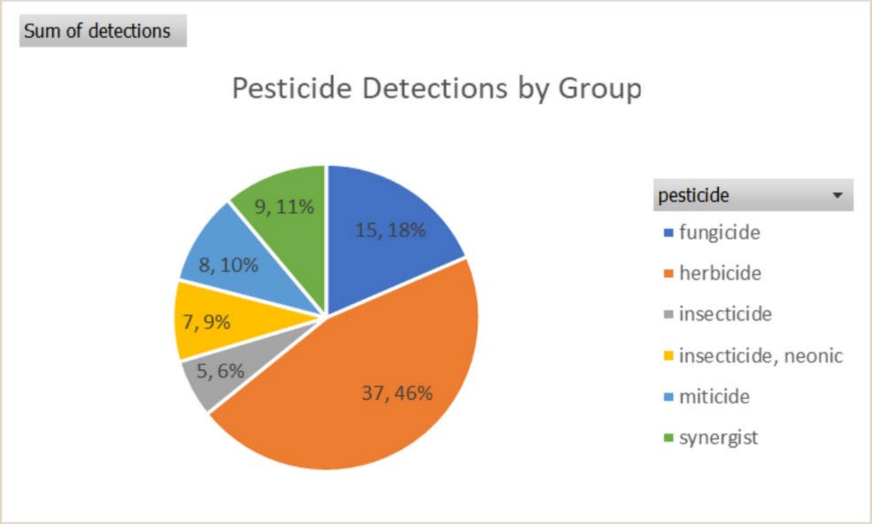
Photo Source: https://www.beeculture.com/bee-pollen-overview/

Photo source: https://www.researchgate.net/figure/Grid-on-a-pollen-trap_fig8_256472351

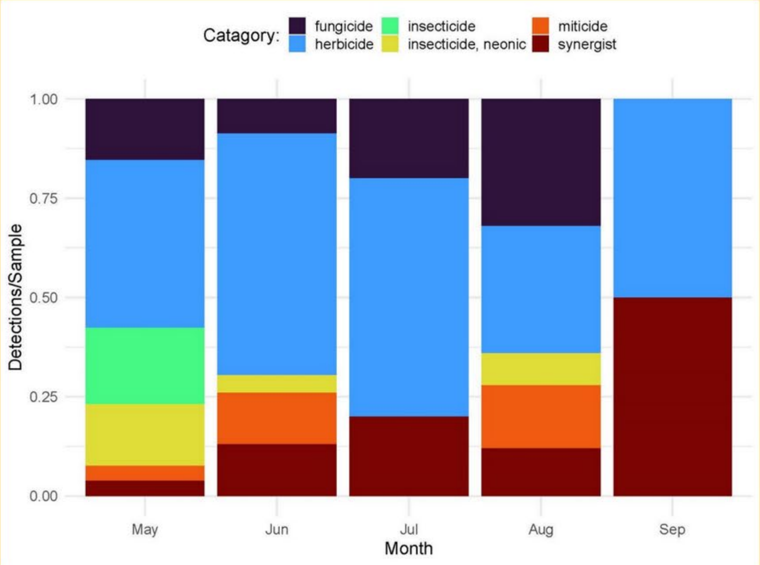
Pesticide Results

- Tested 16 pollen samples for 93 different pesticides
- **81 detections of 20 different pesticides**
- Samples ranged from having **2-13 pesticides**
- Average of **5 pesticides per sample**

Pesticide Results



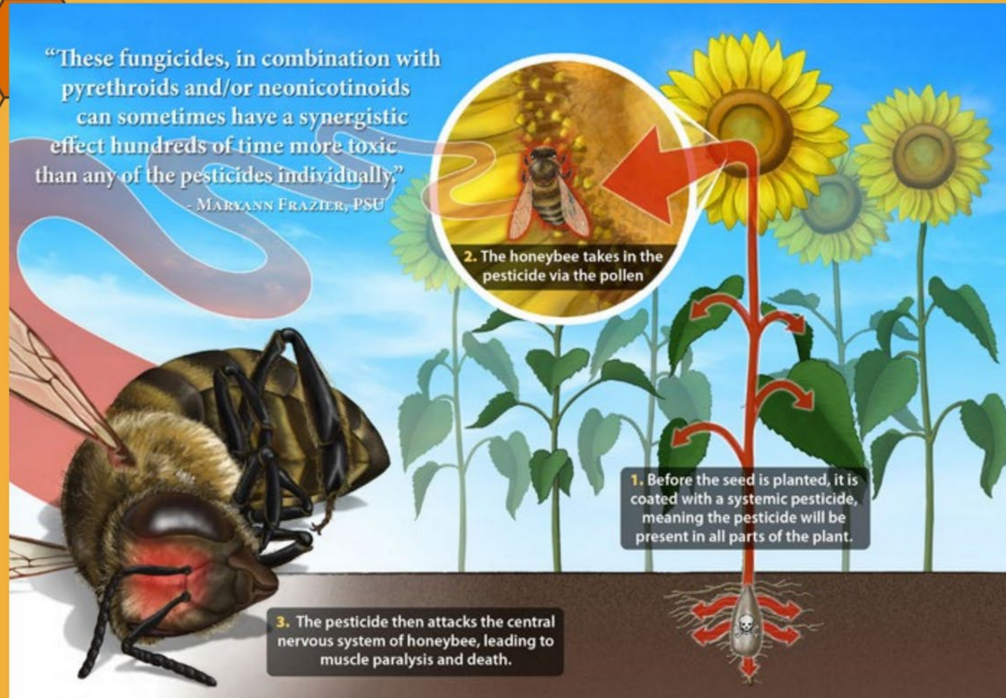
Pesticide Results



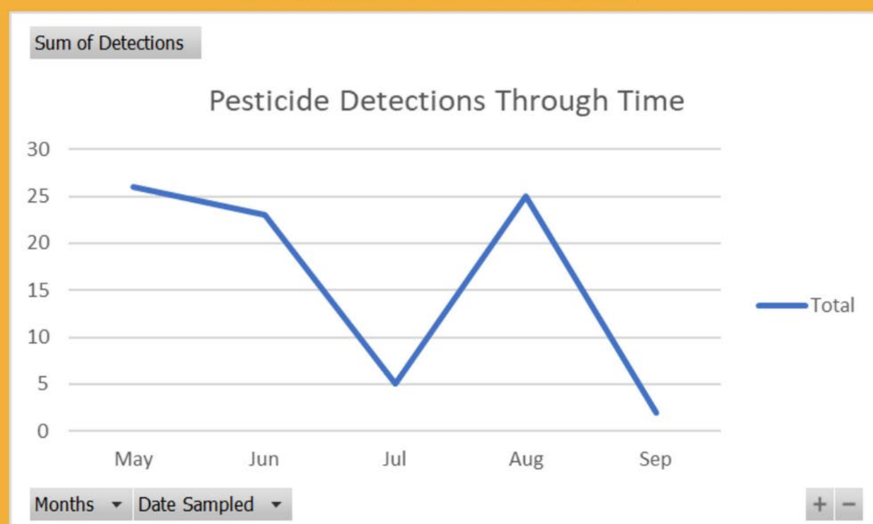
Pesticide Results

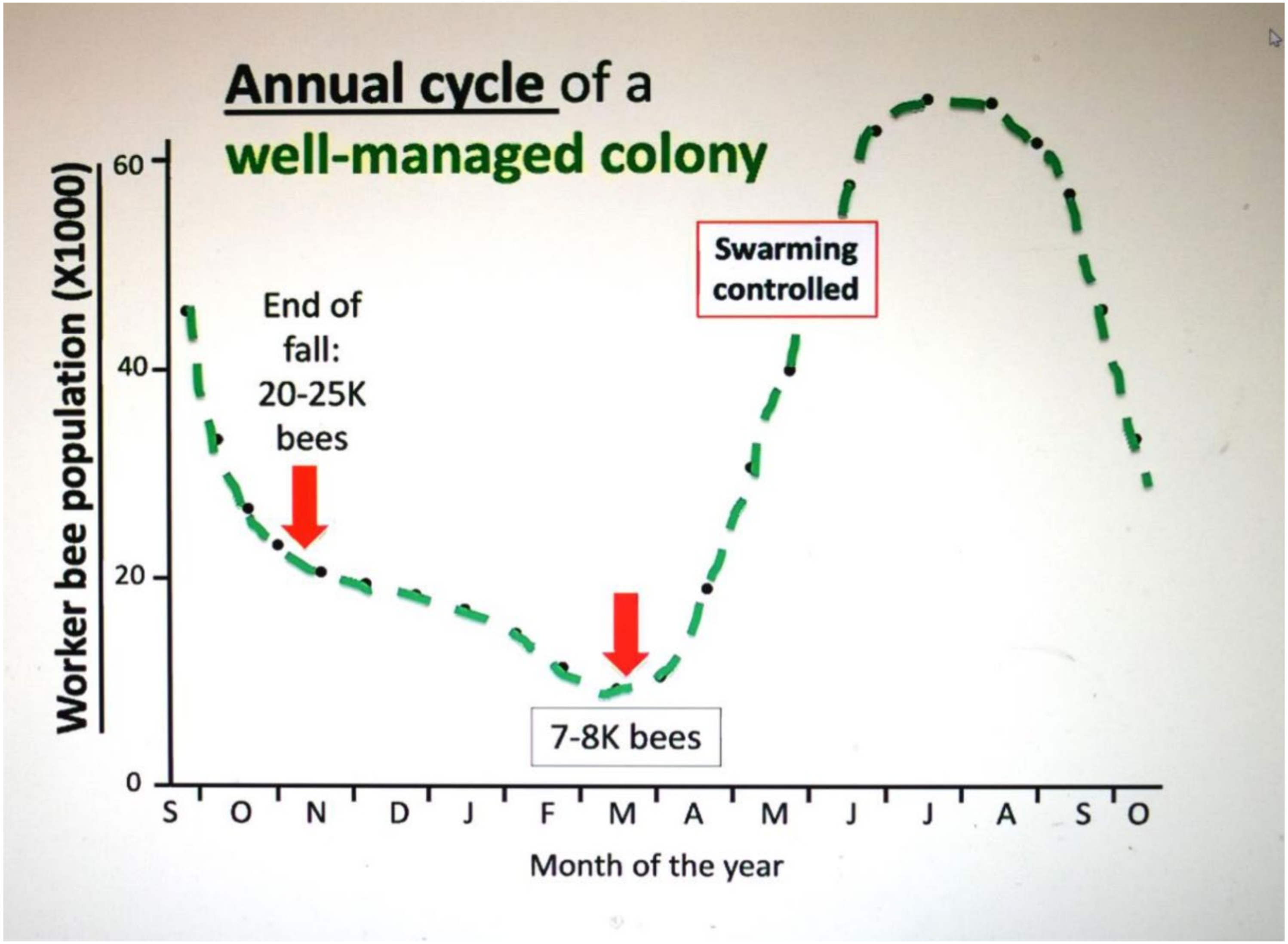
Pesticide	Detections	Group
Carbaryl	2	insecticide
Chlorantraniliprole	1	insecticide
Tebufenozide	1	insecticide
Indoxacarb	1	insecticide
Thiamethoxam	3	insecticide, neonic
Clothianidin	1	insecticide, neonic
Imidacloprid	2	insecticide, neonic
Thiacloprid	1	insecticide, neonic
2,4-DMPF	8	miticide
Piperonyl butoxide	9	synergist

Pesticide	Detections	Group
Thiabendazole	1	fungicide
Azoxystrobin	8	fungicide
Picoxystrobin	3	fungicide
Trifloxystrobin	3	fungicide
Tebuthiuron	8	herbicide
Thiophanate-methyl	2	herbicide
Atrazine	6	herbicide
Diuron	8	herbicide
Propazine	4	herbicide
Metolachlor	9	herbicide



Pesticide Results





Annual cycle of a
well-managed colony
Worker bee population (X1000)
60
40
20
0
End of
fall:
20-25K
bees
Swarming
controlled
7-8K bees
S O N D J F M A M J J A S O
Month of the year

Pesticide Results

Pesticide	Detections	Group
Carbaryl	2	insecticide
Chlorantraniliprole	1	insecticide
Tebufenozide	1	insecticide
Indoxacarb	1	insecticide
Thiamethoxam	3	insecticide, neonic
Clothianidin	1	insecticide, neonic
Imidacloprid	2	insecticide, neonic
Thiacloprid	1	insecticide, neonic
2,4-DMPF	8	miticide
Piperonyl butoxide	9	synergist

- Piperonyl butoxide increases toxicity of thiacloprid by 154-fold
- Detected in 9 samples that also have detections of highly toxic pesticides including thiacloprid.

sample_type	File.Name	Client.ID2	Mass..g.	Thiamethoxam	Clothianidin	Imidacloprid	Acetamiprid	Thiacloprid
Pollen (trap)	2022-04-13_040	S041706	5.05	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_041	S041707	4.93	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_042	S041708	5.04	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_043	S041709	5	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_044	S041710	4.95	0.202020202	0.606060606	NA	NA	NA
Pollen (trap)	2022-04-13_045	S041711	4.62	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_046	S041712	5.07	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_047	S041713	5.06	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_048	S041714	5.03	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_049	S041715	5.02	0.199203187	NA	NA	NA	0.133466135
Pollen (trap)	2022-04-13_050	S041716	5	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_051	S041717	4.97	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_052	S041718	4.96	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_053	S041719	0.2591	0.270165959	NA	NA	NA	NA
Pollen (trap)	2022-04-13_054	S041720	4.98	NA	NA	0.602409639	NA	NA
Pollen (trap)	2022-04-13_055	S041721	5.04	NA	NA	0.595238095	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_001	4.8132	NA	5.31	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_010	4.7057	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_011	4.821	NA	NA	NA	1.18	NA
Pollen (trap)	2023-04-10_SM_I	SM_012	5.0375	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_013	5.0648	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_014	4.5683	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_015	4.7021	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_016	4.6379	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_017	4.5091	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_018	7.4533	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_019	6.9484	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_002	4.9198	NA	1.361843977	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_020	6.5574	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_021	5.2068	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_022	7.6986	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_023	6.2717	NA	1.068290894	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_024	8.8519	NA	NA	NA	NA	NA

- 24% of pollen samples contained significant levels of neonics.
- 14% of plant tissue samples contained significant levels of neonics.

Table 3. Comparison of honey bee LD50's with sublethal lowest observed effect concentrations (LOEC) for neonicotinoids and related compounds.

Active Ingredient	Field/Soil Half-life (days)	LD50 Contact (μg/bee)	LD50 Oral (μg/bee)	LOEC Contact (μg/bee)	LOEC Oral (μg/bee)
Acetamiprid	3	8.1	15	0.1*	0.1*
Clothianidin	121	0.044	0.0079	0.0022*	0.0005–0.0009
Dinotefuran	75	0.03	0.04	0.0075*	NA
Imidacloprid	174	0.032	0.0037	0.0001*	0.0001–0.0015
Sulfoxaflor	2.2	0.38	0.15	NA	NA
Thiacloprid	18	26	18	NA	0.0013*
Thiamethoxam	39	0.02	0.005	0.0001–0.004	0.0004–0.002

Half-life and LD_{50} data transferred from S1 Appendix, and LOEC data from S2 Appendix.

* No range available.

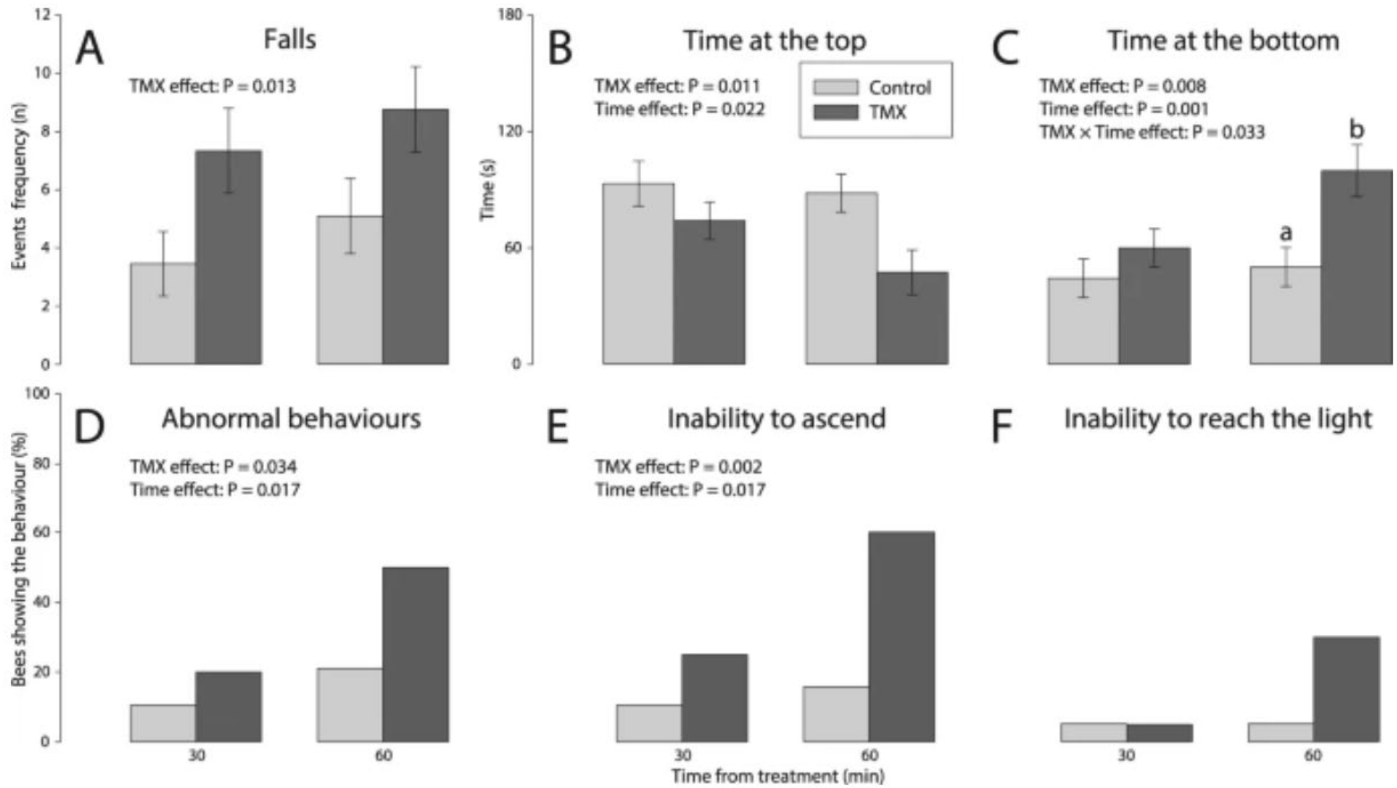
NA Not available

https://doi.org/10.1371/journal.pone.0220029.t003

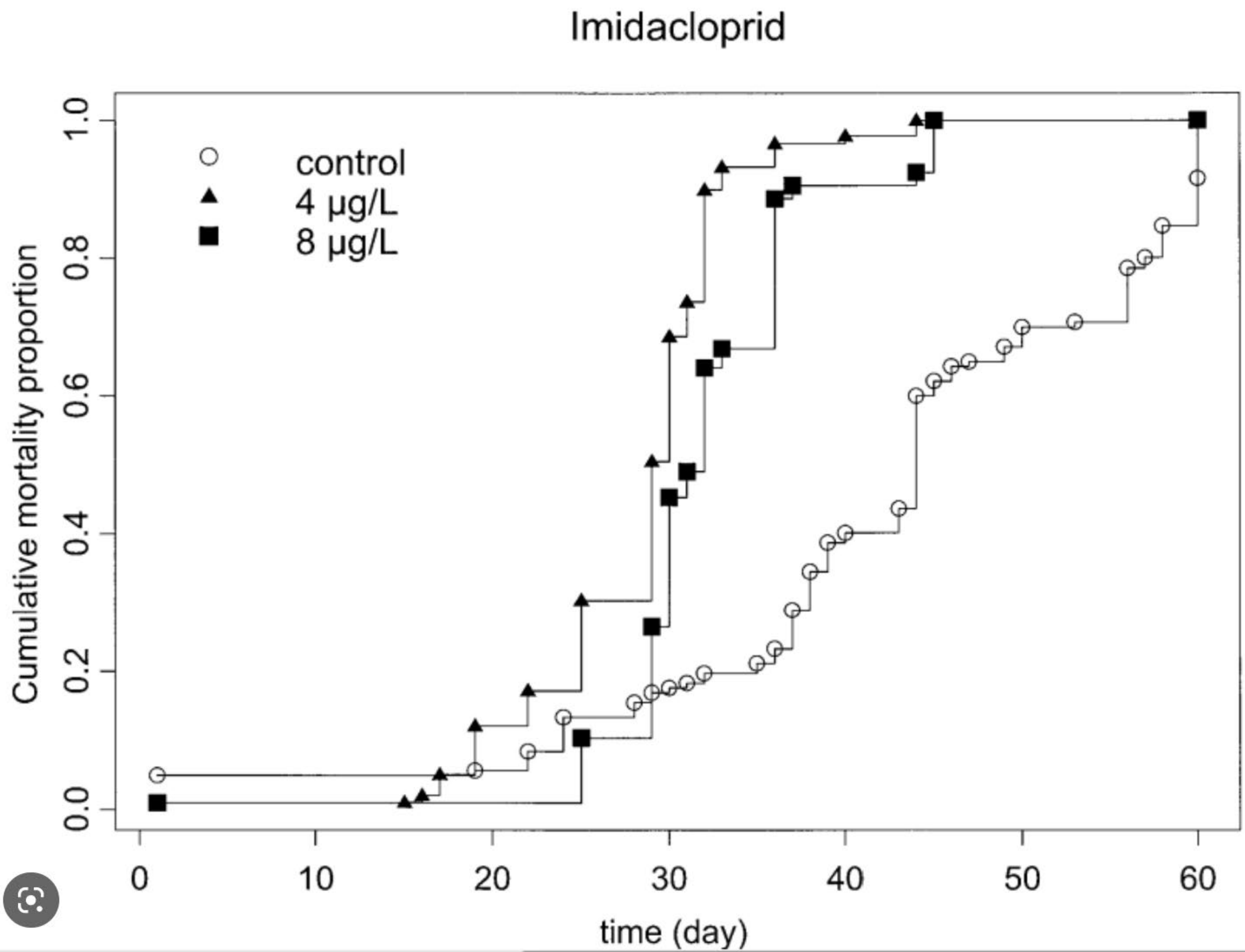
DiBartolomeis M, Kegley S, Mineau P, Radford R, Klein K (2019) An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States. PLOS ONE 14(8): e0220029. https://doi.org/10.1371/journal.pone.0220029
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0220029

Sublethal effects

Figure 3



A
Falls
TMX effect: P = 0.013
Events frequency (n)
B
Time at the top
TMX effect: P = 0.011
Time effect: P = 0.022
Control
TMX
Time (s)
C
Time at the bottom
TMX effect: P = 0.008
Time effect: P = 0.001
TMX × Time effect: P = 0.033
a
b
D
Abnormal behaviours
TMX effect: P = 0.034
Time effect: P = 0.017
Bees showing the behaviour (%)
E
Inability to ascend
TMX effect: P = 0.002
Time effect: P = 0.017
F
Inability to reach the light
Time from treatment (min)


Imidacloprid
control
4 µg/L
8 µg/L
Cumulative mortality proportion
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
60
time (day)

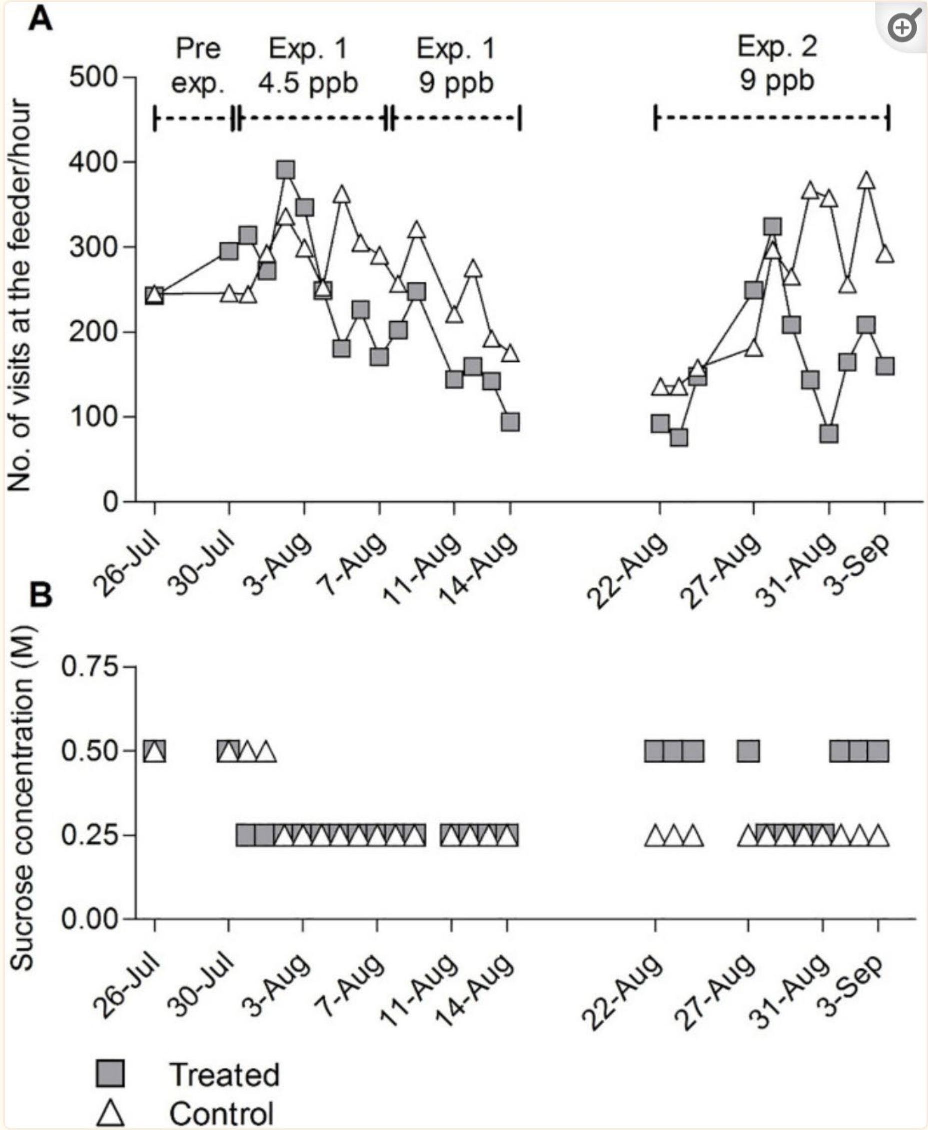
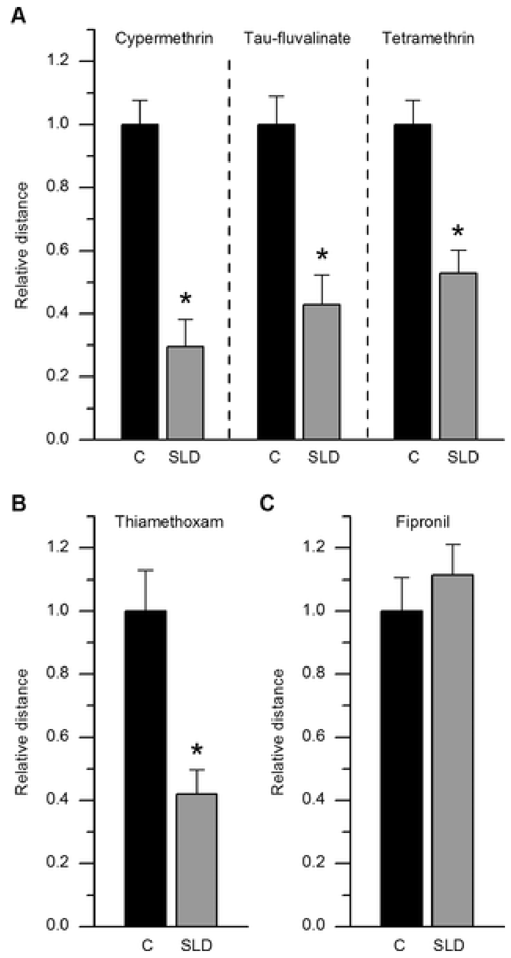


Fig 3

Foraging activity and required sucrose concentrations at the control and treated feeders.

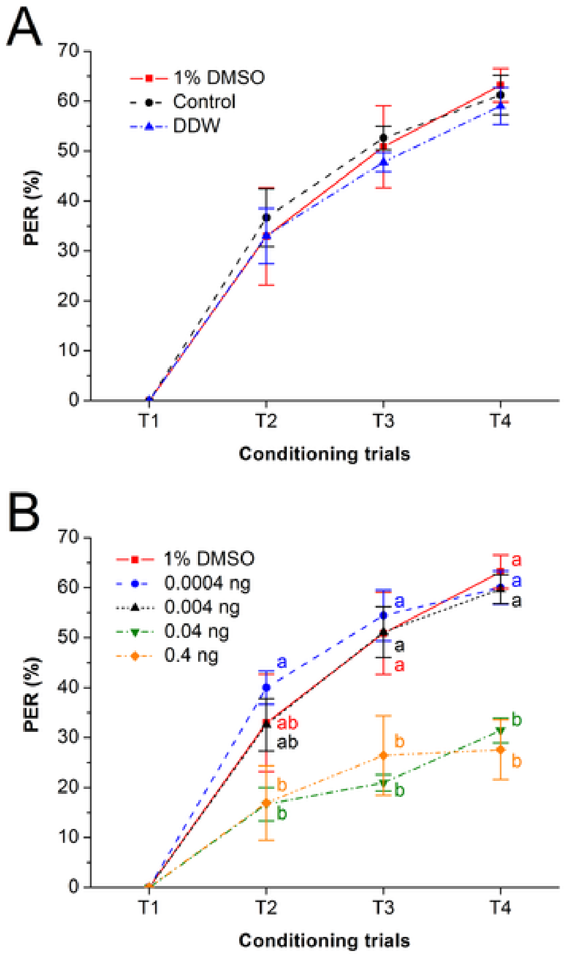
(A) Number of visits per hour recorded on the same days (*n* = 27 days) during the pre-exposure time in experiment 1 (4.5 ppb and 9 ppb) and experiment 2 (9 ppb) at both control (triangles) and treated feeders (squares). The foraging activity of the treated bees is significantly reduced by exposure to clothianidin (ANOVA of lm, $P < 0.05$). (B) Sucrose concentrations used in order to keep a similar number of foragers coming regularly to the control and treated

Fig 3. Evidence for locomotor deficits after exposure to a sublethal dose (SLD48h) of a pyrethroid or a neonicotinoid but not a phenylpyrazole.



Charreton M, Decourtye A, Henry M, Rodet G, Sandoz JC, et al. (2015) A Locomotor Deficit Induced by Sublethal Doses of Pyrethroid and Neonicotinoid Insecticides in the Honeybee Apis mellifera. PLOS ONE 10(12): e0144879.
https://doi.org/10.1371/journal.pone.0144879
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0144879

Figure 2. Impaired olfactory associative behavior in adulthood caused by the larval contamination of imidacloprid.



Yang EC, Chang HC, Wu WY, Chen YW (2012) Impaired Olfactory Associative Behavior of Honeybee Workers Due to Contamination of Imidacloprid in the Larval Stage. PLOS ONE 7(11): e49472. https://doi.org/10.1371/journal.pone.0049472
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0049472

Synergistic effects

APHIS National Honey Bee Survey
Lab Diagnostic Results

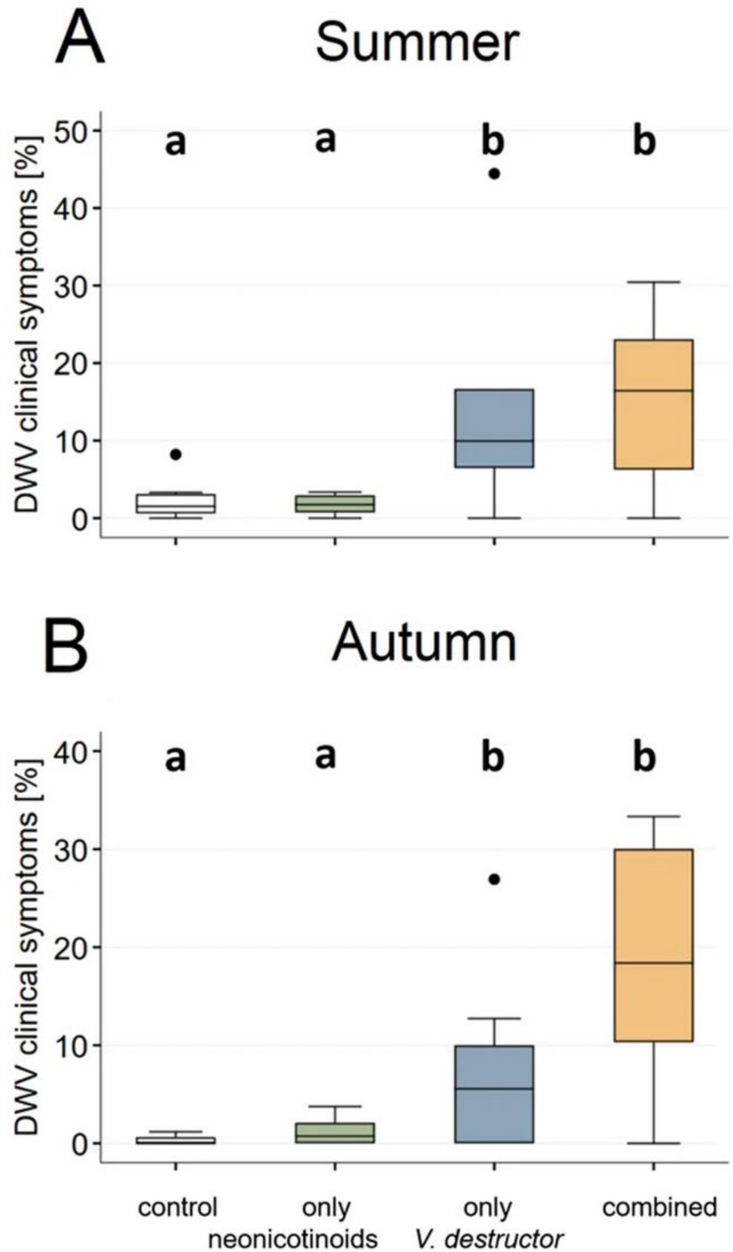
Table 2: Pest Results

Your Value	Pest	Notes
1021	Sample size (# of bees)	Total number of bees in alcohol sample
4	Total *Varroa* mites counted	Total number of *Varroa* mites counted in entire sample.
0.4	*Varroa* load (mites per 100 bees)	A frequently occuring external parasite that reproduces in brood cells and vectors viruses
0.8	*Nosema* load (millions of spores per bee)	*Nosema* spore count is determined by microscopy; *Nosema* is a unicellular gut parasite that produces spores
-	*Apis cerana*	Asian honey bee that can be an invasive pest. They are not known to be in the U.S.
-	*Tropilaelaps spp.* mites	*Tropilaelaps* mites are parasitic mites native to Asia. They are not known to be in the U.S.

The table above indicates the results of your colonies' in-lab microscopic and visual inspections conducted at the University of Maryland. This report summarizes the alcohol sample size, the *Varroa* mite count, the *Nosema* spore load, and any *Apis cerana* and *Tropilaelaps spp*. mites found. *Varroa* mite counts that exceed 3 mites per 100 bees are thought to cause damage, and colonies exceeding this threshold should be treated to reduce mite loads as soon as possible. *Nosema* spore counts in excess of 1 million spores per bee are thought to cause damage, and colonies with infection levels above this threshold should be considered for treatment depending on the season. For the most updated seasonal threshold monitoring and treatment options, see: honeybeehealthcoalition.org

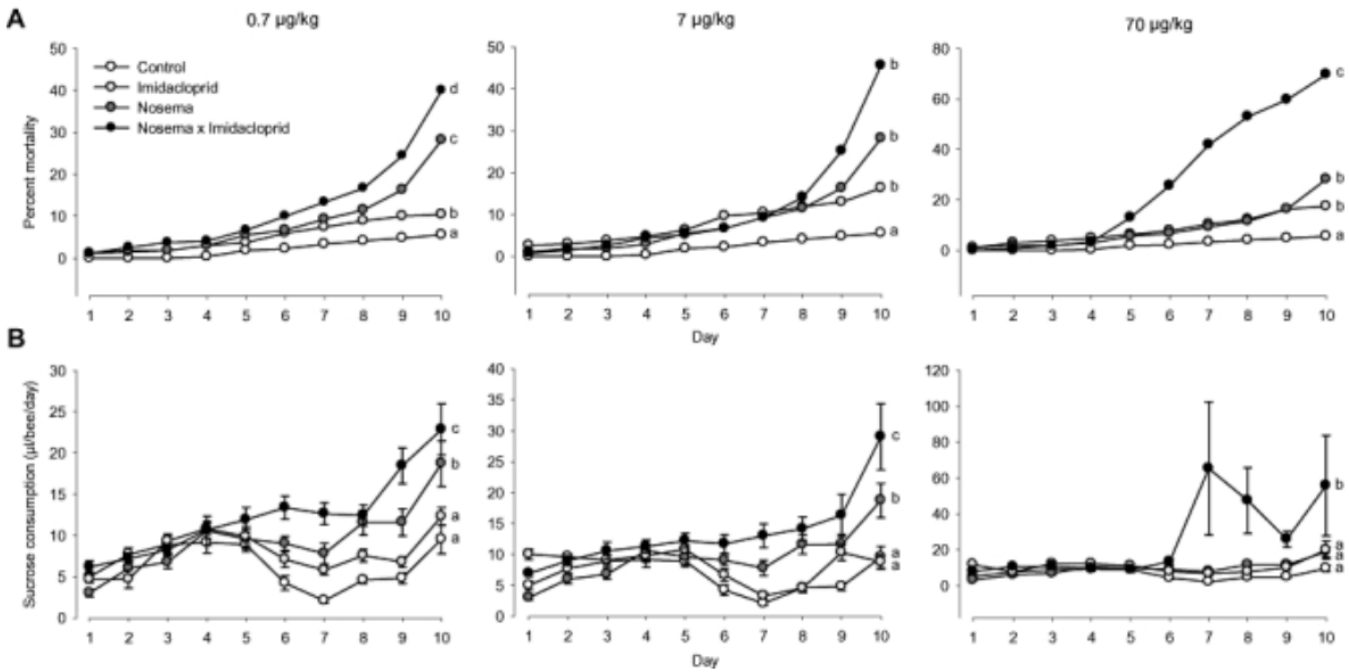
Deformed wing virus

Figure 1



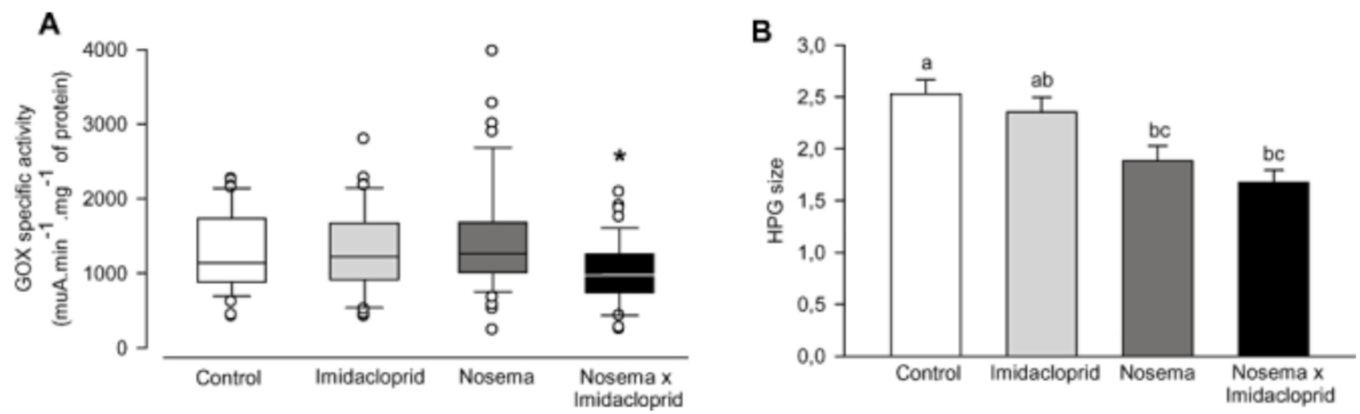
A
Summer
DWV clinical symptoms [%]
50
40
30
20
10
0
a
a
b
b
B
Autumn
DWV clinical symptoms [%]
40
30
20
10
0
a
a
b
b
control
only neonicotinoids
only *V. destructor*
combined

Fig. 1



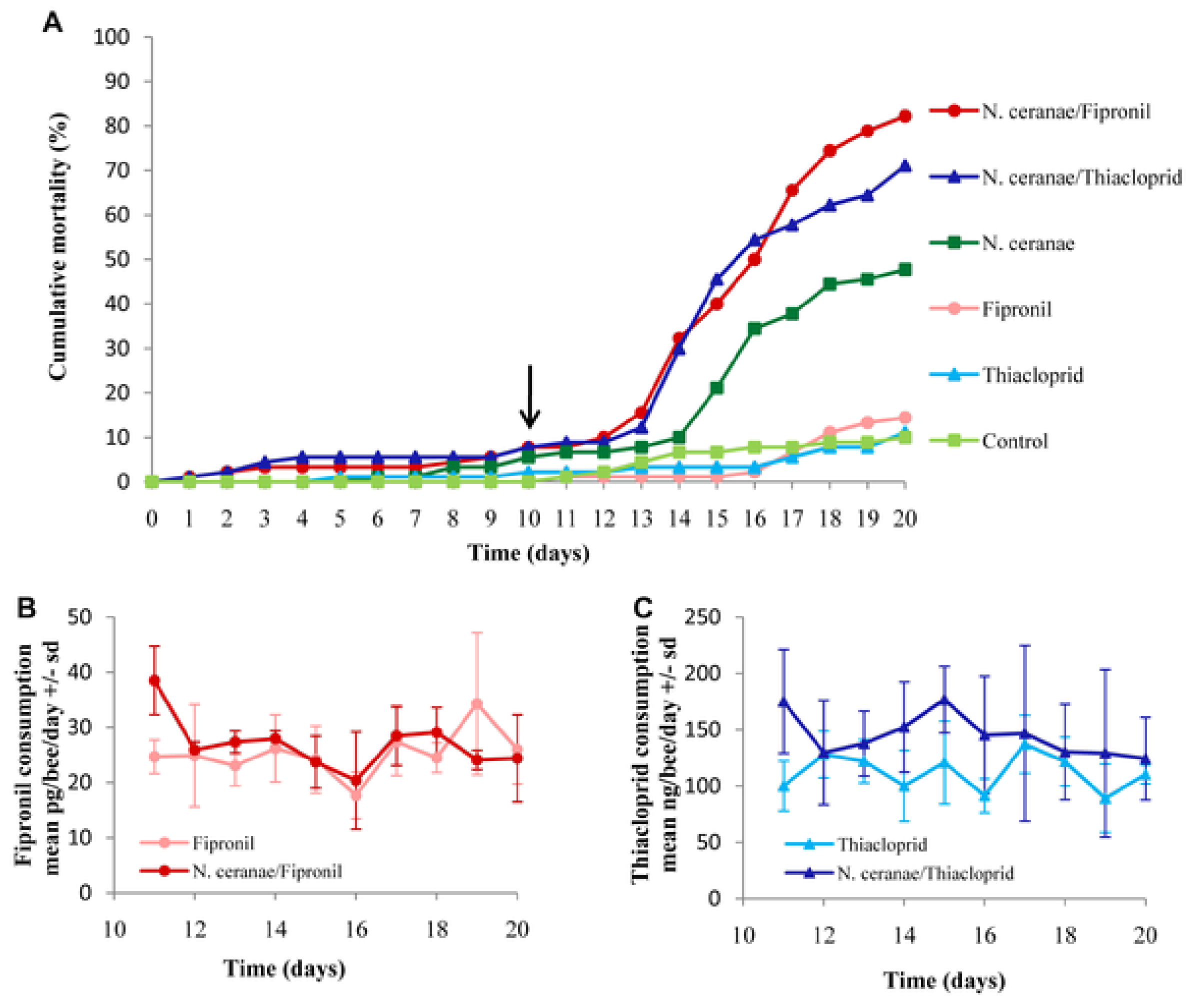
Effect of *Nosema* infection and/or exposure to imidacloprid on bee mortality and energetic demands. A. Effect on mortality. Mortality is expressed as the percentage of cumulated number of dead bees per cage and per day (n = 270 bees). Three colonies were analysed, with three cage replicates for each colony (n = 30 bees per cage). Each letter indicates significant differences between treatments ($P < 0.05$). B. Effect on energetic demand. Sucrose consumption is expressed as the amount of sucrose solution (50% w/v, *ad libitum* delivery) consumed per day and per bee (n = 30 bees per cage) during the 10 h of treatment. The same cages as in A were analysed. Each letter indicates significant differences between treatments ($P < 0.05$).

Fig. 4



Effect of *Nosema* infection and/or exposure to imidacloprid on social immunity. A. Glucose oxidase activity at day 10 on eight bees per cage for each experimental group (n = 192 bees). Boxes show 1st and 3rd interquartile range with line denoting median. Whiskers encompass 90% of the individuals, beyond which each outliers are represented by circles. *denotes significant difference between *Nosema* × imidacloprid groups and the three others groups ($P < 0.05$). B. HPG size at day 10 in seven to eight bees per cage for each experimental group (n = 191 bees). For each parameter, three colonies were analysed, with two cage replicates for each colony. The size was indexed from 1 to 5 (see *Experimental procedures*). Each letter indicates significant differences between treatments ($P < 0.05$). Data show mean ± SE.

Figure 3. Effect of N. ceranae infection on honeybee sensitivity to insecticides.



Vidau C, Diogon M, Aufauvre J, Fontbonne R, Viguès B, et al. (2011) Exposure to Sublethal Doses of Fipronil and Thiacloprid Highly Increases Mortality of Honeybees Previously Infected by Nosema ceranae. PLOS ONE 6(6): e21550. https://doi.org/10.1371/journal.pone.0021550

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0021550

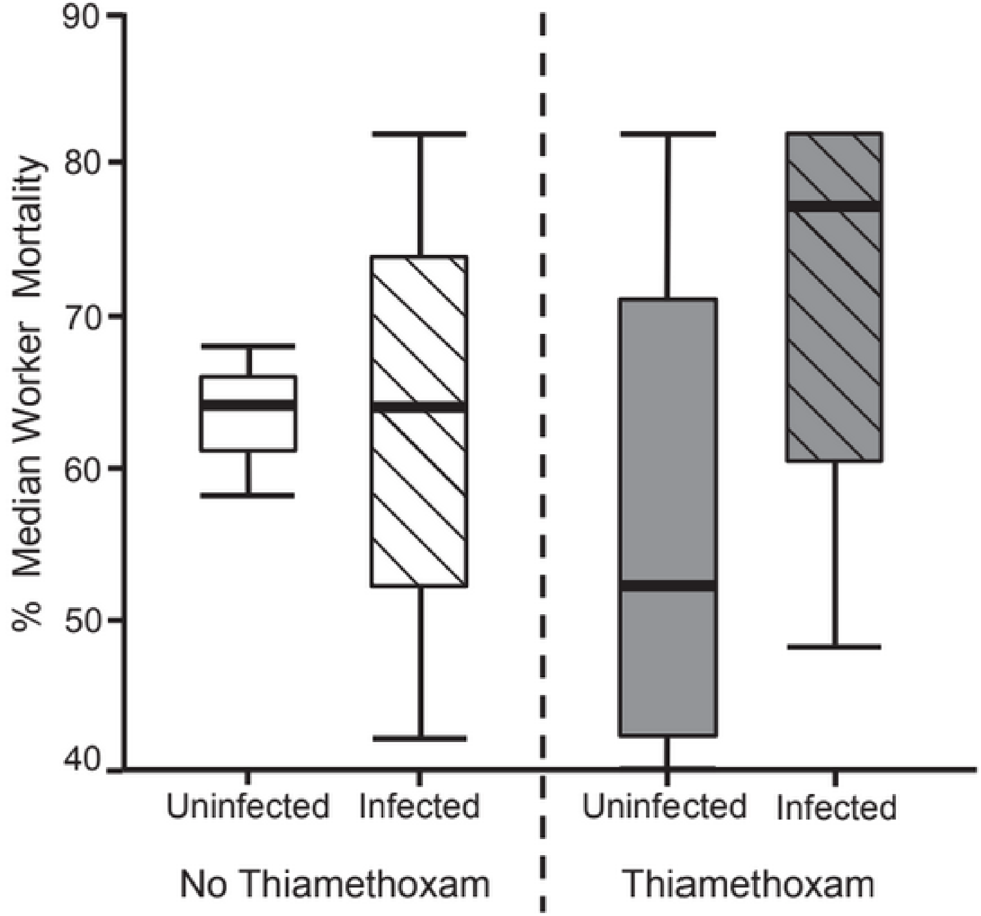
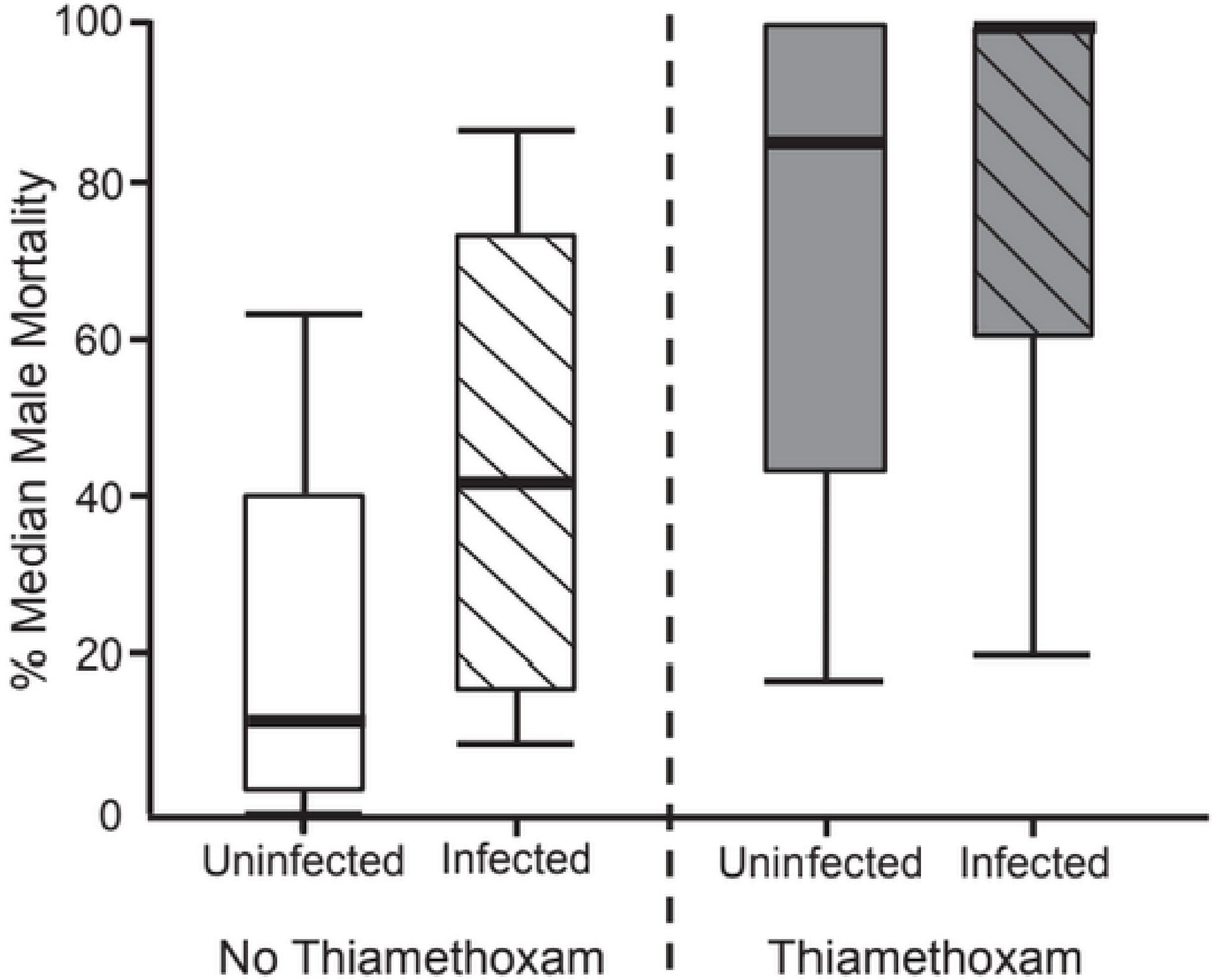


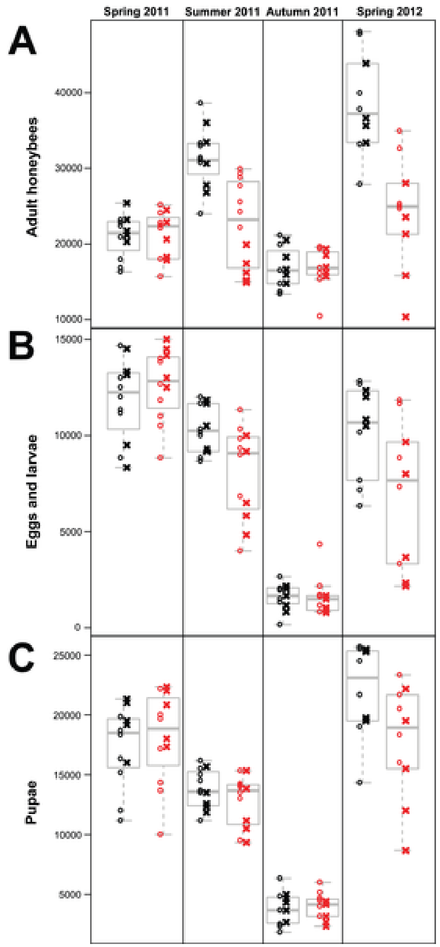
Fig. 2. Worker mortality was higher in individuals exposed to the pathogen *N. apis* and the neonicotinoid Thiamethoxam than in bees exposed to a single stressor or controls. For statistical details see Table 2, bars show median average mortalities (%) ± quartiles.



% Median Male Mortality
100
80
60
40
20
0
Uninfected
Infected
Uninfected
Infected
No Thiamethoxam
Thiamethoxam

Queens and colony strength

Figure 1. Dynamics of honeybee colony performance.



Sandrock C, Tanadini M, Tanadini LG, Fauser-Misslin A, Potts SG, et al. (2014) Impact of Chronic Neonicotinoid Exposure on Honeybee Colony Performance and Queen Supersedure. PLOS ONE 9(8): e103592. https://doi.org/10.1371/journal.pone.0103592
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0103592

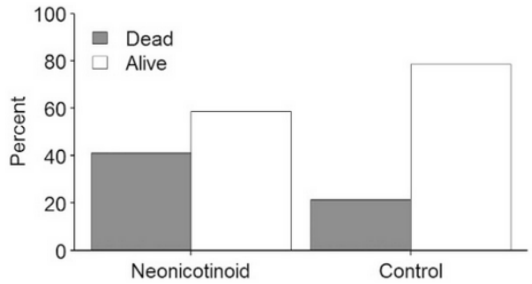


Figure 1. Queen survival after 4 weeks. Percent honey bee queens that were alive after 4 weeks. No significant difference was observed between treatments. $^{*}P \leq 0.1$, $^{**}P \leq 0.05$, $^{***}P \leq 0.01$ (comparison with Controls).

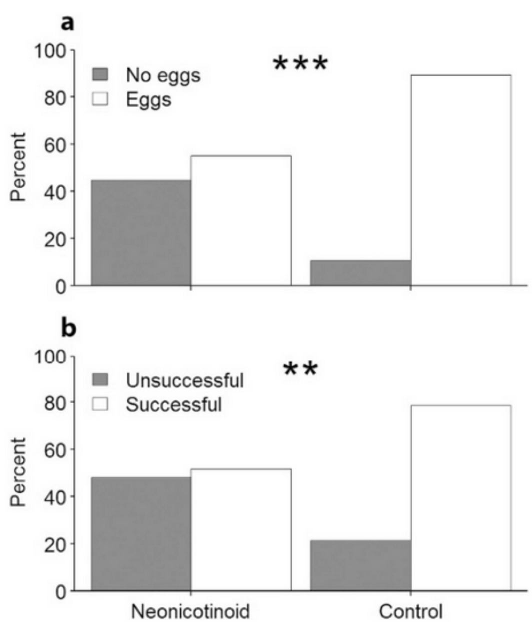


Figure 2. Queen oviposition and survival after 4 weeks. (**a**) Percent of honey bee queens that oviposited (*i.e.* laid worker eggs). (**b**) Percent of honey bee queens that were alive and had produced diploid offspring by the end of the experiment (= Successful). Significant differences between treatments denoted by $^{*}P \leq 0.1$, $^{**}P \leq 0.05$, $^{***}P \leq 0.01$.

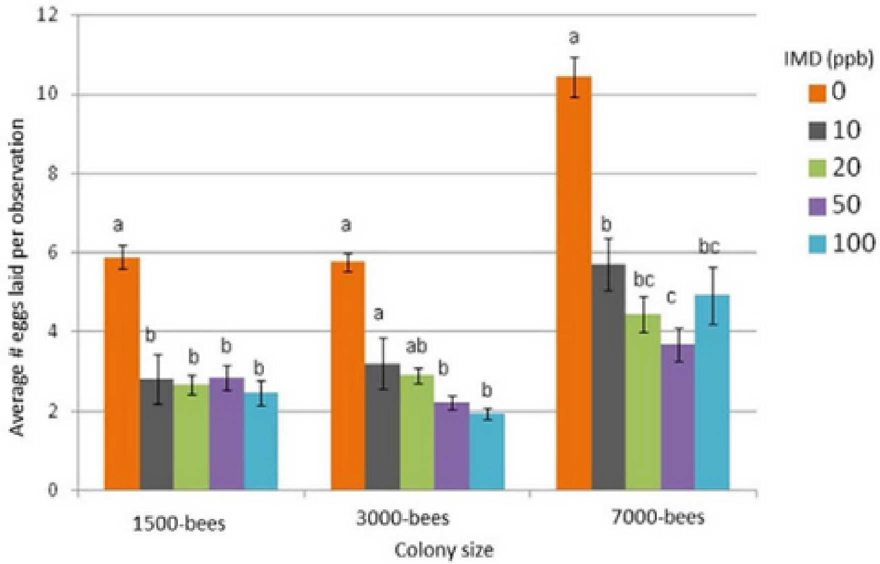


Figure 1. Average (SE) number of eggs laid by queens per 15 minute observation period pooled over three week chronic exposure of imidacloprid (IMD) (0, 10, 20 50, and 100 ppb) in 1500-, 3000-, and 7000-bee colonies ((dose*size*week) interaction: $F_{16,1053} = 0.93$; $p = 0.54$; (dose*size) interaction: $F_{8,1053} = 6.17$; $p < 0.0001$). Different letters denotes significant statistical differences among treatment levels within each colony size at $\alpha < 0.05$. Results indicate that queens in untreated colonies laid significantly more eggs than queens in treated colonies at all colony sizes.

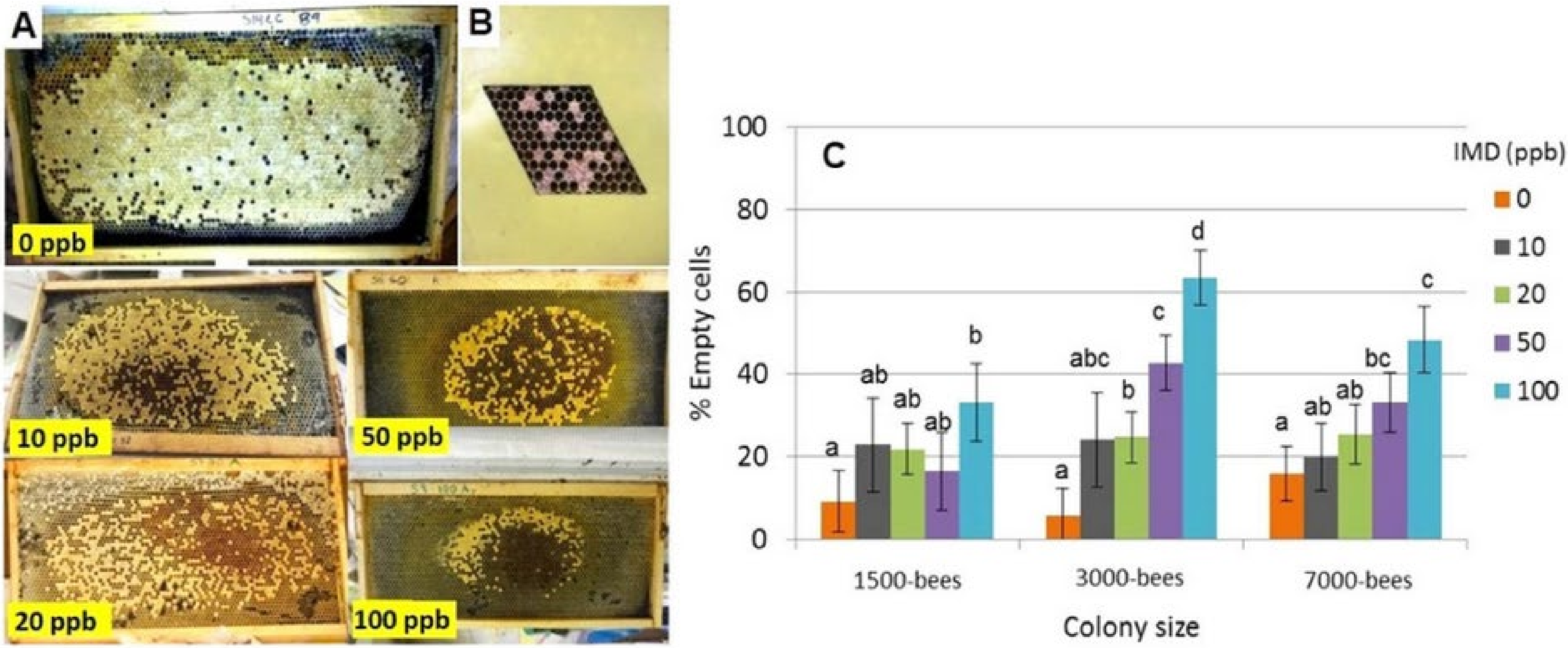
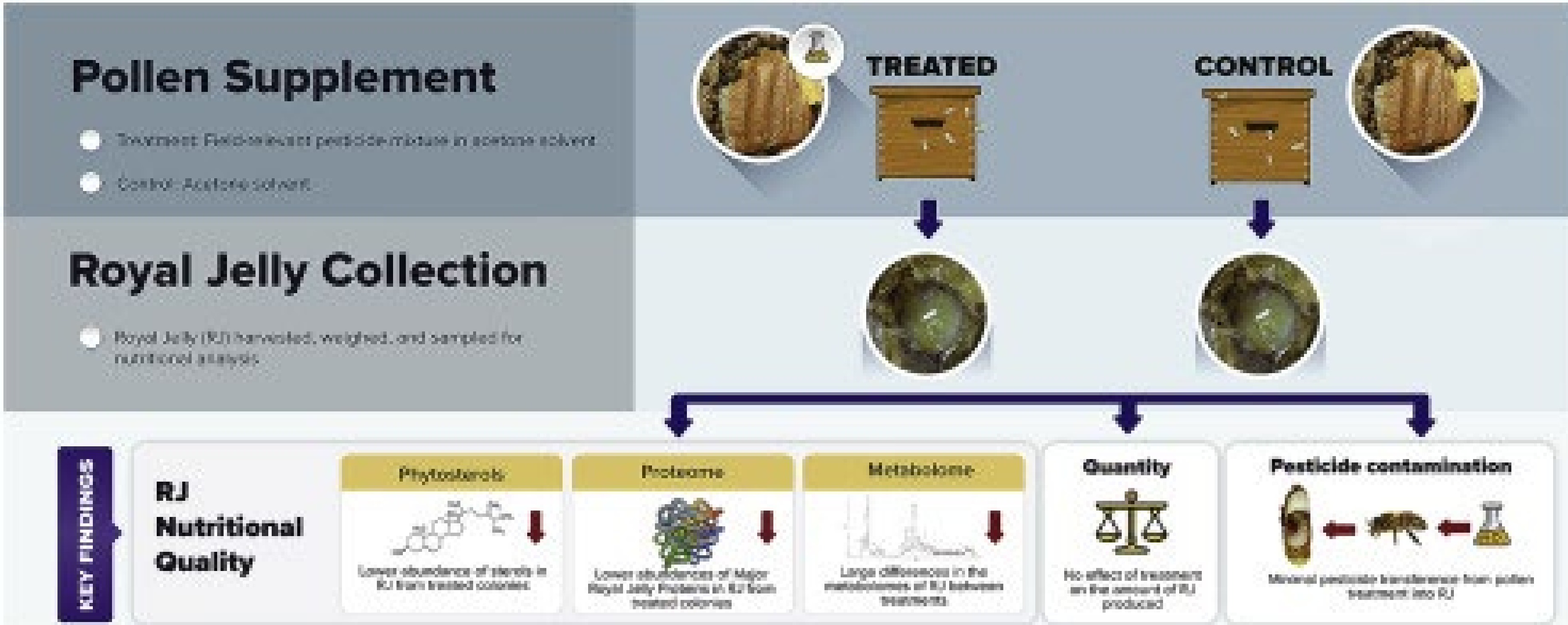
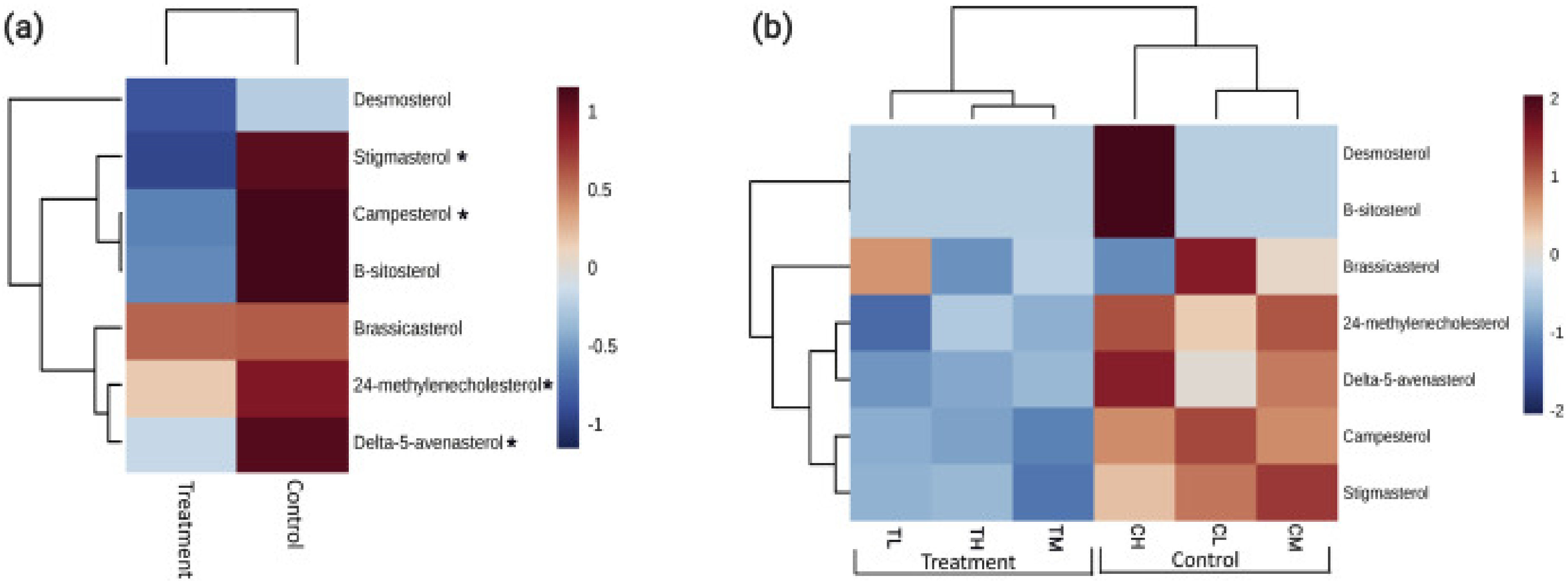


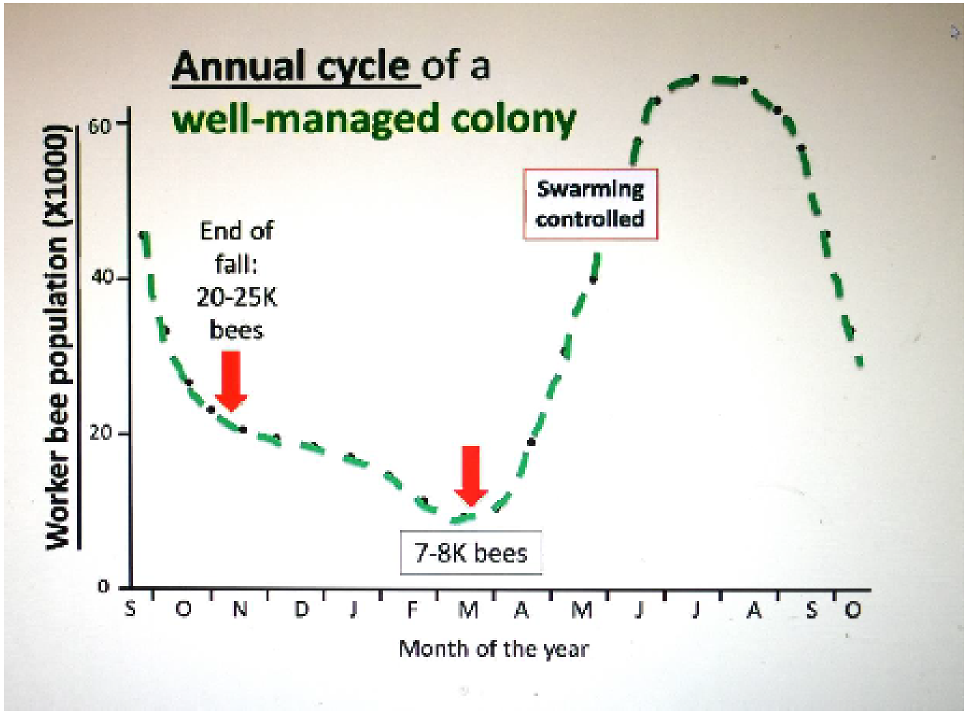
Figure 3. Examples of brood patterns from colonies chronically exposed to imidacloprid (0, 10, 20, 50 and 100 ppb) during brood rearing illustrating a dose-dependent effect where the amount of empty cells in a given brood area increases with treatment concentration (**A**); parallelogram containing 100 cells used to standardize brood pattern measures (**B**); and the average percentage (SE) of cells not containing pupae (empty) in a brood area of 100 cells separated by colony size (1500, 3000, and 7000 bees) and imidacloprid (IMD) dose (0, 10, 20, 50 and 100 ppb) (dose: $F_{4, 39} = 10.9$; $p < 0.0001$; colony size: $F_{2, 39} = 2.1$; $p = 0.14$; interaction effect: $F_{8, 39} = 1.3$; $p = 0.3$). Greater % of empty cells indicates worse brood patterns and overall brood health (**C**). Letters denote statistically significant differences among treatment levels within each colony size at $\alpha < 0.05$. Results indicate significantly worse brood pattern (more empty cells), particularly at higher treatments (50 and 100 ppb), compared to untreated colonies.


Pollen Supplement
Treatment: Field-relevant pesticide mixture in acetone solvent
Control: Acetone solvent
TREATED
CONTROL
Royal Jelly Collection
Royal Jelly (RJ) harvested, weighed, and sampled for nutritional analysis
KEY FINDINGS
RJ Nutritional Quality
Phytosterols
Lower abundance of sterols in RJ from treated colonies
Proteome
Lower abundances of Major Royal Jelly Proteins in RJ from treated colonies
Metabolome
Large differences in the metabolomes of RJ between treatments
Quantity
No effect of treatment on the amount of RJ produced
Pesticide contamination
Minimal pesticide transference from pollen treatment into RJ

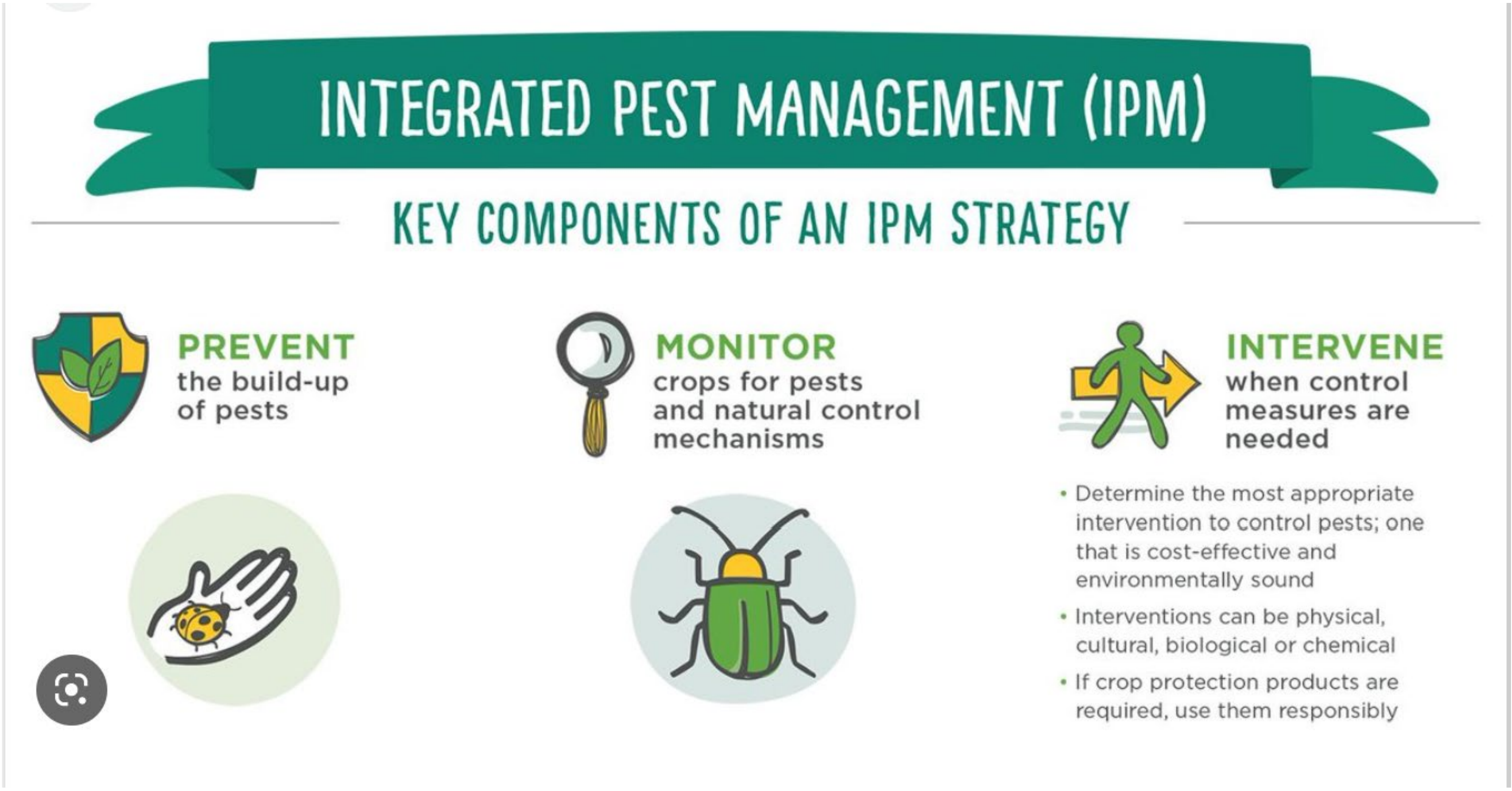

(a)
Desmosterol
Stigmasterol ★
Campesterol ★
B-sitosterol
Brassicasterol
24-methylenecholesterol★
Delta-5-avenasterol ★
Treatment
Control
1
0.5
0
-0.5
-1
(b)
Desmosterol
B-sitosterol
Brassicasterol
24-methylenecholesterol
Delta-5-avenasterol
Campesterol
Stigmasterol
TL
TH
TM
CH
CL
CM
Treatment
Control
2
1
0
-1
-2

Population data and normal dwindling calculations from Gard Otis, University of Guelph Graph below

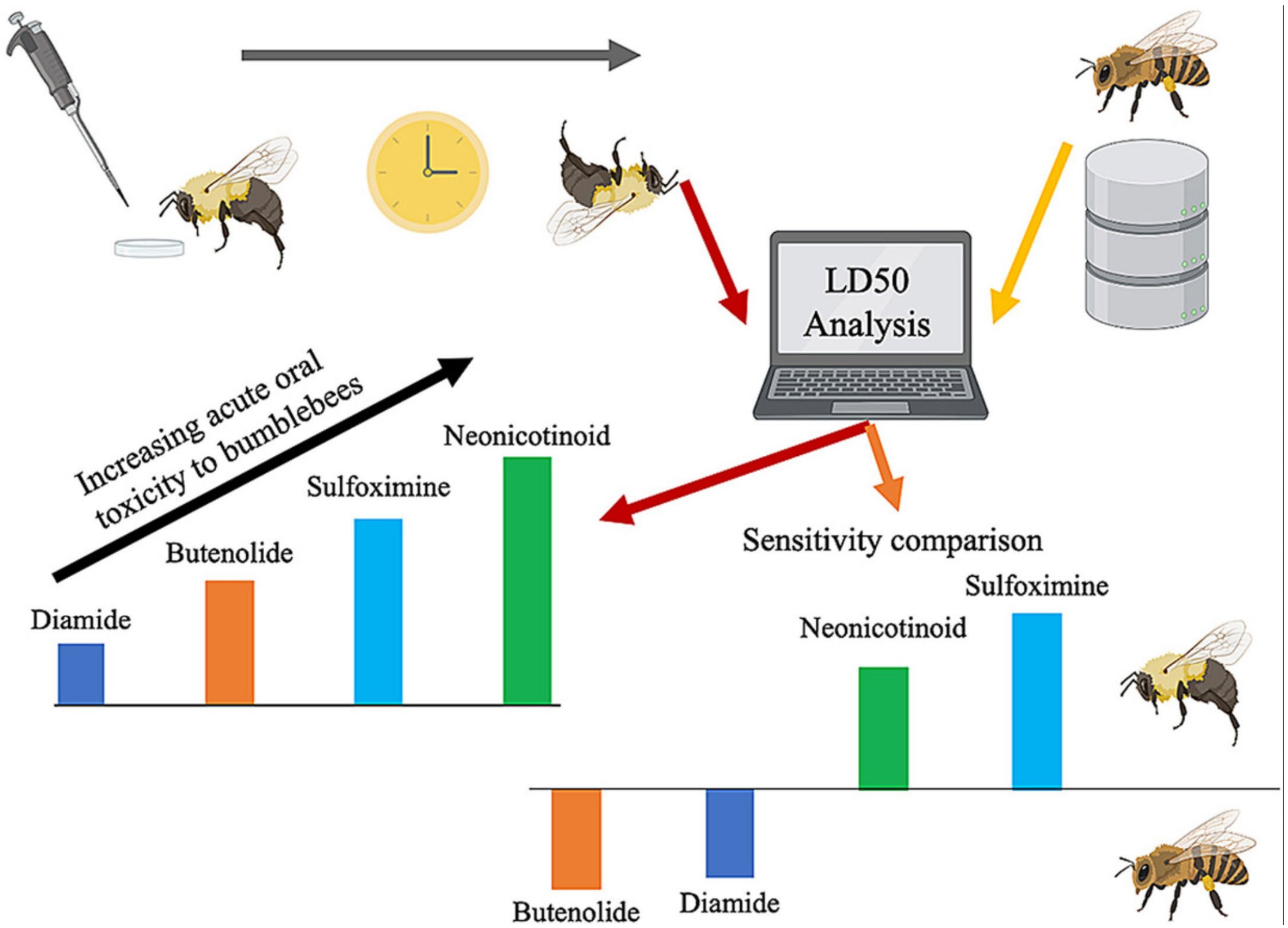
	Normal summer dwindling in healthy colony ave (8,750 bees per month)	Colony population w/ dwindling rate increased + 3% or reduction in queen productivity - 3%	Colony population w/ dwindling rate increased + 2% or reduction in queen productivity - 2%	Colony population w/ dwindling rate increased + 1% or reduction in queen productivity - 1%
Starting ave peak population Jul 15	60,000	60,000	60,000	60,000
Aug 15	51,250	49,713	50,225	50,738
Sept 15	42,500	39,734	40,646	41,568
Oct 15	33,750	30,054	31,258	32,489
Starting Population at the "end of Fall" (~Nov 15) (Gard Otis data)	25,000	20,665	22,057	23,502
	Normal Dwindling Nov-Mar in healthy colony ave (4,375 bees per month)			
Dec 15	20,625	15,801	17,329	18,936
Jan 15	16,250	11,084	12,695	14,415
Feb 15	11,875	6,507	8,153	9,940
Ending population ~March 15	**7,500**	**2,068**	**3,703**	**5,509**



IPM


INTEGRATED PEST MANAGEMENT (IPM)
KEY COMPONENTS OF AN IPM STRATEGY
PREVENT
the build-up of pests
MONITOR
crops for pests and natural control mechanisms
INTERVENE
when control measures are needed
• Determine the most appropriate intervention to control pests; one that is cost-effective and environmentally sound
• Interventions can be physical, cultural, biological or chemical
• If crop protection products are required, use them responsibly

Choose least toxic pesticide



Anthranilic Diamides

Active Ingredient (A.I.)	Model Estimates		95% Confidence Interval		Maximum Dose Tested (µg A.I./bumblebee)	Honey bee LD50 (µg A.I./honey bee)	Ratio of Bumblebee to Honey bee Estimate[a]
	LD50 (µg A.I./bumblebee)	Standard Error	Lower	Upper			
Cyantraniliprole	NA	NA	NA	NA	**0.54**	>0.1055[b]	~5.12
Flupyradifurone	2.8231	1.4070	0.0653	5.5808	**1.7**	1.2[c]	~1.42
Sulfoxaflor	**0.0177**	0.0015	0.0148	0.0205	0.089	0.146[d]	0.12
Thiamethoxam	**0.0015**	0.0002	0.0011	0.0018	0.012	0.005[e]	0.29

The value used for comparison to the honey bee LD50 is in bold.

a

VBA recommends:

- Eliminate prophylactic use of systemic pesticide treated seed.
- Only plant pesticide coated seed when IPM testing reveals a pest problem.
- Choose the least toxic pesticide for the application.
- Phase out Nitroguanidine Neonics completely within 2-3 years.

sample_type	File.Name	Client.ID2	Mass..g.	Thiamethoxam	Clothianidin	Imidacloprid	Acetamiprid	Thiacloprid
Pollen (trap)	2022-04-13_040	S041706	5.05	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_041	S041707	4.93	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_042	S041708	5.04	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_043	S041709	5	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_044	S041710	4.95	0.202020202	0.606060606	NA	NA	NA
Pollen (trap)	2022-04-13_045	S041711	4.62	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_046	S041712	5.07	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_047	S041713	5.06	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_048	S041714	5.03	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_049	S041715	5.02	0.199203187	NA	NA	NA	0.133466135
Pollen (trap)	2022-04-13_050	S041716	5	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_051	S041717	4.97	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_052	S041718	4.96	NA	NA	NA	NA	NA
Pollen (trap)	2022-04-13_053	S041719	0.2591	0.270165959	NA	NA	NA	NA
Pollen (trap)	2022-04-13_054	S041720	4.98	NA	NA	0.602409639	NA	NA
Pollen (trap)	2022-04-13_055	S041721	5.04	NA	NA	0.595238095	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_001	4.8132	NA	5.31	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_010	4.7057	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_011	4.821	NA	NA	NA	1.18	NA
Pollen (trap)	2023-04-10_SM_I	SM_012	5.0375	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_013	5.0648	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_014	4.5683	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_015	4.7021	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_016	4.6379	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_017	4.5091	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_018	7.4533	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_019	6.9484	NA	NA	NA	NA	NA
Pollen (trap)	2023-04-10_SM_I	SM_002	4.9198	NA	1.361843977	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_020	6.5574	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_021	5.2068	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_022	7.6986	NA	NA	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_023	6.2717	NA	1.068290894	NA	NA	NA
Plant Tissue	2023-04-10_SM_I	SM_024	8.8519	NA	NA	NA	NA	NA

References

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Vidau et al 2011

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