Effective Pest Treatment That Protects Pollinators

https://github.com/shivanikuckreja/CitrolaKuckrejaSaltman_ENV872_EDA_FinalProject/tree/main/Project

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1 Rationale and Research Questions

Pollination is a critical component of agriculture. Honeybees are important pollinators. Our research looks to see if there are exposure methods and chemicals that do not cause significant harm to honeybees while eliminating pests. The goal of our research is to determine potential treatment methods that reduce pests while having little to no impact on pollinators.

Questions:

1. *Is there an exposure type that is more likely to cause mortality for bees vs. non-bee insects?*
2. *Are there chemicals that are more likely to cause mortality for bees vs. non-bee insects?*

2 Dataset Information

Data Source: The dataset was pulled from a repository created for Environmental Data Analytics at Duke University in 2020. The data collected is from several EPA studies on neonicotinoids and their effects on insects. The data we will be analyzing is the type of chemical administered, how it was administered, and how both of these variables affected insects.

In the wrangling process, we selected the relevant information to our topic. This includes the chemical type, insect species, lifestage and age of the species, exposure type and the effect of the exposure.

```
## 'data.frame':    4623 obs. of  8 variables:
##  $ CAS.Number         : Factor w/ 9 levels "58842209","105843365",..: 1 1 1 1 1 1 1 1
##  $ Chemical.Name      : Factor w/ 9 levels "(1E)-N-[(6-Chloro-3-pyridinyl)methyl]-N-e
##  $ Species.Common.Name: Factor w/ 303 levels "Alfalfa Leafcutter Bee",..: 74 74 142 1
##  $ Organism.Lifestage : Factor w/ 20 levels "Adult","Cocoon",..: 1 1 19 19 19 1 19 1
##  $ Organism.Age       : Factor w/ 39 levels "<=24","<=48",..: 39 39 39 39 39 36 39 36
##  $ Exposure.Type      : Factor w/ 24 levels "Choice","Dermal",..: 23 23 11 11 11 11 1
##  $ Effect             : Factor w/ 19 levels "Accumulation",..: 16 16 16 16 16 16 16 1
##  $ Effect.Measurement : Factor w/ 155 levels "Abundance","Accuracy of learned task, p
```

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Detail	Description
Data Source	EPA ECOTOX Knowledgebase
Retrieved From	https://cfpub.epa.gov/ecotox/help.cfm
Variables Used	Chemical Name, Species Common Name, Organism Lifestage, Organism Age, Exposure Type, Effect, Effect Measurement
Date Range	1982-2019

3 Exploratory Analysis

Table 2: Species List - Sample Number

	x
Honey Bee	203
Parasitic Wasp	165
Italian Honeybee	91
Asian Lady Beetle	59
Minute Pirate Bug	52
Buff Tailed Bumblebee	47
Parastic Wasp	41
Carniolan Honey Bee	29
Braconid Wasp	26
Sevenspotted Lady Beetle	25
Bumble Bee	23
European Dark Bee	23
Mosquito	22
Parasitoid	22
Chalcid Wasp	20
Stingless Bee	20
Parasitoid Wasp	19
Fairyfly Parasitoid	18
Mulberry Pyralid	18
Spring Tiphia	18
Codling Moth	17
House Fly	14
Ox Beetle	14
Japanese Beetle	13
Predatory Bug	13
Wireworm	13
Silkworm	12
Predatory Mite	11
Spined Soldier Bug	11
Vedalia Beetle	11
Yellow Fever Mosquito	11
Braconid Parasitoid	10
Calico Scale	10
Eastern Subterranean Termite	10
Glasshouse Potato Wasp	10
Southern House Mosquito	10
Two Spotted Lady Beetle	10
Western Flower Thrips	10
Convergent Lady Beetle	9

	x
Mealybug Destroyer	9
Black-spotted Lady Beetle	8
Corn Earworm	8
Dwarf Honey Bee	8
Eulophid Parasitoid	8
Mirid Bug	8
Chilean Predatory Mite	7
Egg Parasitoid	7
Eulophid Wasp	7
Pea Aphid	7
Tooth-necked Fungus Beetle	7
Coconut Leaf Beetle	6
Elevenspotted Ladybird Beetle	6
Hemlock Woolly Adelgid Lady Beetle	6
Mite	6
Pistachio Psyllid	6
Spotless Ladybird Beetle	6
Subterranean Termite	6
Alfalfa Leafcutter Bee	5
Buff-tailed Bumblebee	5
Diamondback Moth	5
Encyrtid Wasp	5
Hornfaced Bee	5
Ladybird Beetle	5
Mason Bee	5
Oystershell Scale Parasitoid	5
Red Scale Parasite	5
Scelionid Wasp	5
Argentine Ant	4
Bee	4
Colorado Potato Beetle	4
European Honey Bee	4
Monarch Butterfly	4
Moth	4
Oriental Beetle	4
Potato Tuberworm	4
Sweetpotato Whitefly	4
Two-Spotted Spider Mite	4
Yellow-faced Bumblebee	4
Armoured Scale Family	3
Beetle	3
Citrus Leafminer	3
Delphacid Planthopper	3

	x
Egyptian Cotton Leafworm	3
Encyrtid Parasitoid	3
Formosan Subterranean Termite	3
Ichneumonid Wasp	3
Ladybird Beetle Family	3
Leaf Cutting Ant	3
Pond Wolf Spider	3
Rove Beetle	3
Soldier Beetle	3
Speckled Cutworm Moth	3
Spider	3
Sugarcane Grub	3
Tenebrionid Beetle	3
Wasp	3
Alfalfa Plant Bug	2
Alkali Bee	2
Aphid Wasp	2
(Other)	53

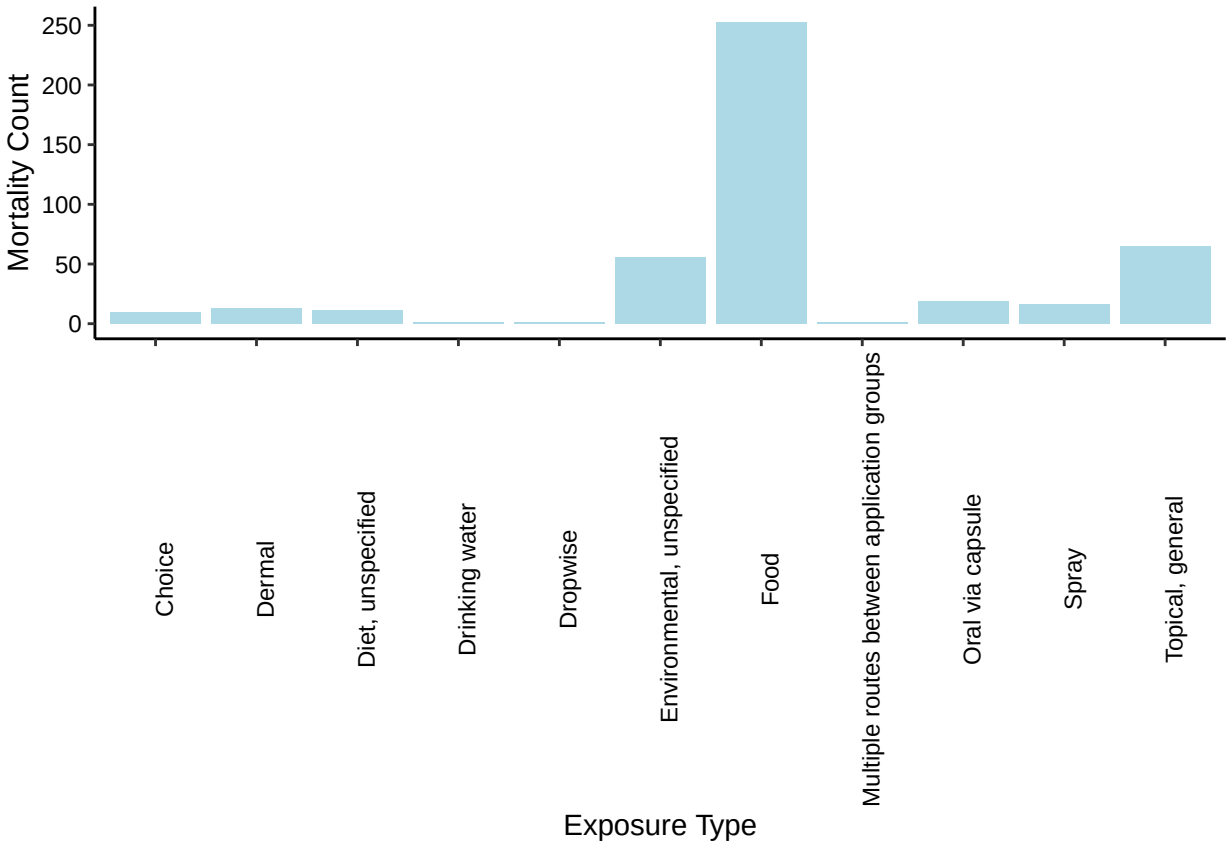

Figure 1: Bee Mortality by Exposure Type

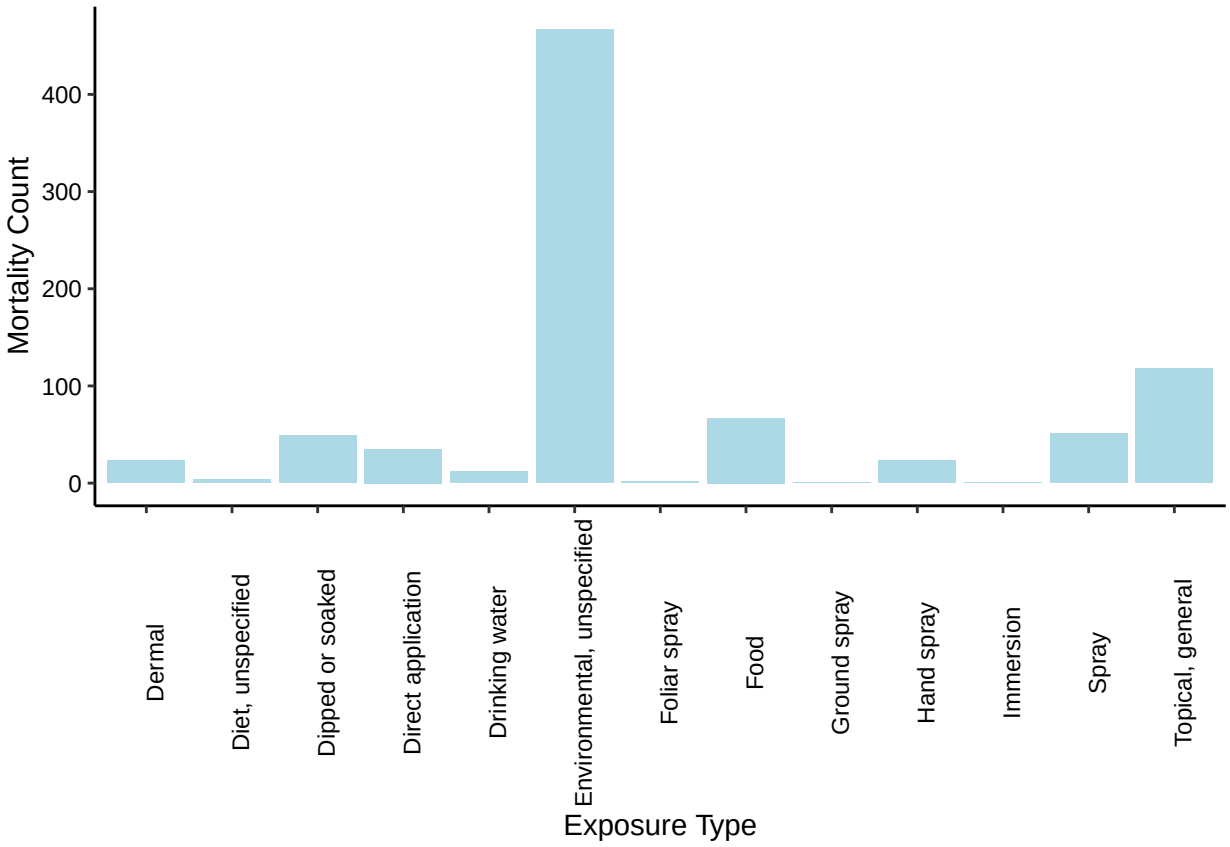

Figure 2: Non-bee Mortality by Exposure Type

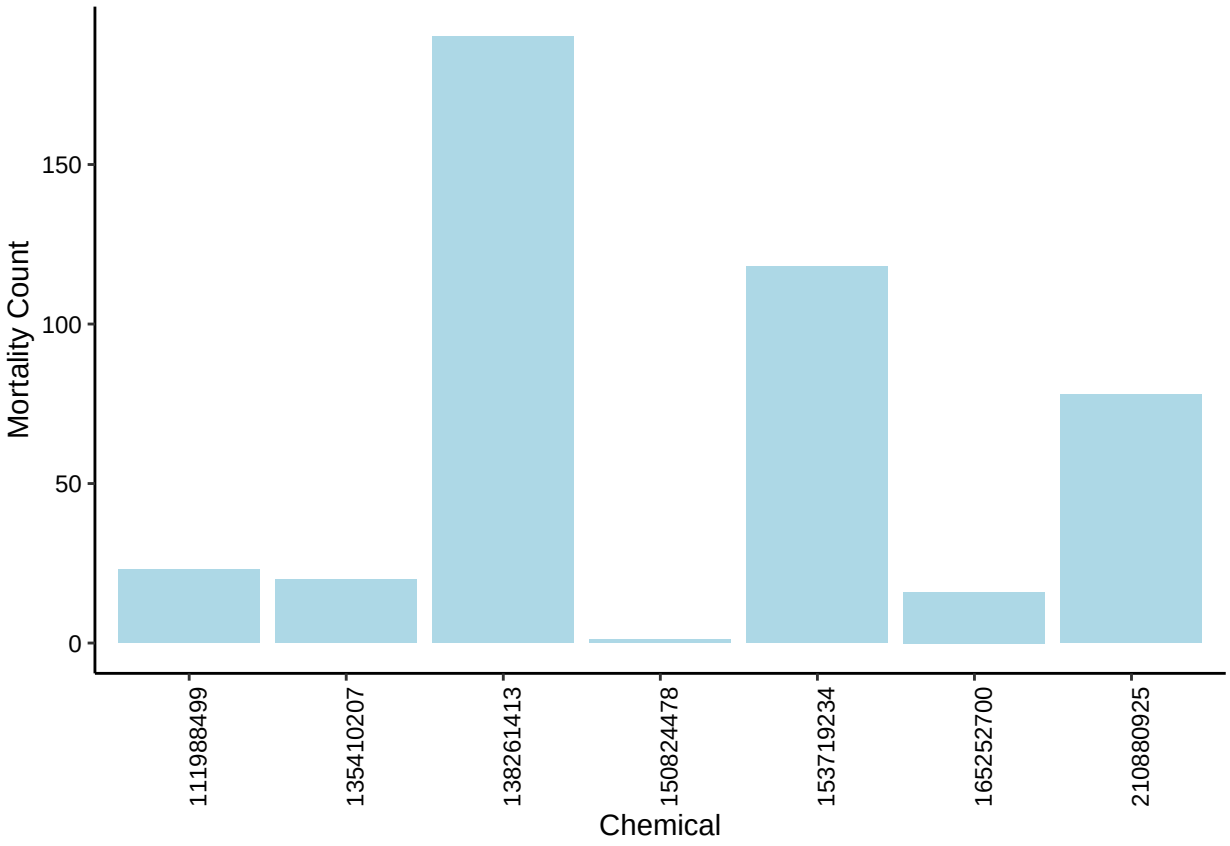

Figure 3: Bee Mortality by Chemical

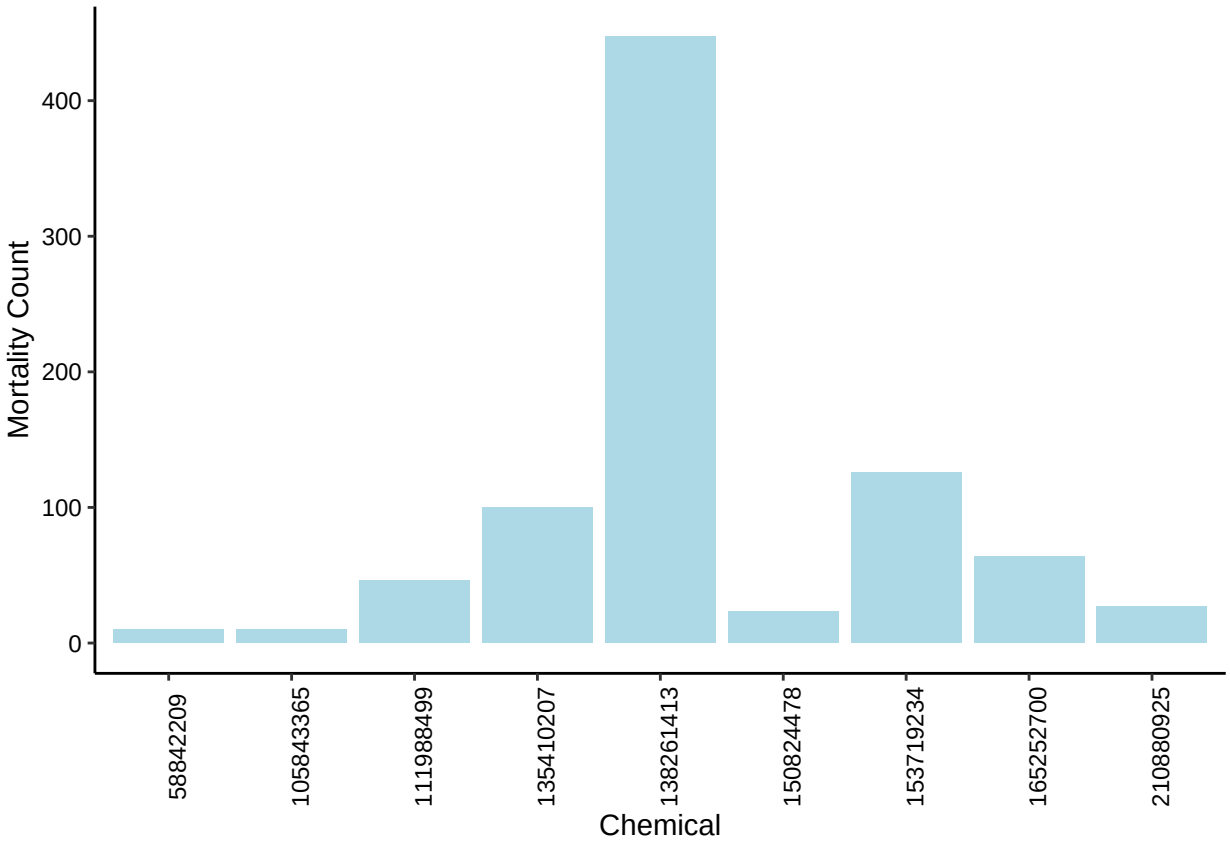

Figure 4: Non-bee Mortality by Chemical

4 Analysis

4.1 Question 1: Is there an exposure type that is more likely to cause mortality for bees vs. non-bee insects?

4.2 Question 2: Are there chemicals that are more likely to cause mortality for bees vs. non-bee insects?

5 Summary and Conclusions

6 References

<add references here if relevant, otherwise delete this section>