## Welcome!

I am Diana Obregon (She/Her/Ella), a Ph.D. candidate in Entomology in [Katja Poveda’s Lab](https://blogs.cornell.edu/katjapoveda/) at Cornell University.

My research interests include plant-insect interactions in agroecosystems, non-target pesticide exposure on pollinators, and land use effects on ecosystem services provided by insects. My field work is developed in Colombia studying stingless bees in fruit and cattle ranching farms and in the US studying squash crops and its pest and pollinators. I am also passionate about engaging with growers and beekeepers to discuss sustainable solutions in farming.

In my free time, I love hiking, dancing, and painting with watercolors.

**Research**

**Landscapes, bees, and pesticides:**

Land-use change and pesticides have been identified as two of the main causes behind pollinator decline (Goulson). Understanding how these factors affect crop pollinator communities is crucial to inform practices that generate optimal pollination and ensure sustainable food production.

Natural habitat partially mitigates negative pesticide effects on tropical pollinator communities

In this study, we investigated the effects of landscape composition and pesticide residues on bee communities and their pollination services in *Solanum quitoense* Lam. “lulo” crops in the Andean region of Colombia. We found that bee abundance and richness are reduced with the increased toxicity and concentration of pesticides found in flowers (Mainly imidacloprid) but these negative pesticide effects were less detrimental in farms with higher natural habitat proportions, suggesting a dilution effect.

Link to paper and to infographics

Landscape simplification effects on *Tetragonisca angustula* nutrition and pesticide exposure

Tetragonisca angustula is the most common stingless bee species in Latin America. In Colombia, it is distributed in all the natural regions below 2000m of altitude but is particularly abundant in the Andes. Deforestation to transform natural ecosystems into grazing land areas and simplified agricultural landscapes are rapidly increasing in the Andes but there is scant information showing how this is affecting stingless bees. In this study, we evaluated if landscape simplification is impacting bee nutrition, body size, and pesticide exposure. We found that the increment of pasture area in the landscape significantly reduces the amount of Asteraceae pollen collected by stingless bee colonies, which generates a cascade effect, leading to a decrease in trehalose concentration in the food, which is an important disaccharide in the insect’s hemolymph and the main energy source for flying, and consequently reducing bee body size. Also, more pasture area is correlated with higher concentrations of avermectins, which are insecticides used in the area to treat the cattle against parasites such as ticks and flies.

Non-target exposure of avermectins to bees in livestock dominated landscapes

Pastures for cattle ranching are currently the main cover type in the Andes, representing the biggest driver of biodiversity loss in this highly diverse region. Associated with these livestock systems, there is an extensive use of pesticides for the control of endo and ectoparasites in cattle. However, there is no information about the exposure routes and potential risks of pesticides for bees in cattle ranching systems. In previous work in Colombia, we found residues of abamectin (Molecule in the avermectin group) in 50% of pollen samples collected from *Tetragonisca angustula* colonies. We also found a positive correlation between pasture areas in the colonies’ surroundings and the concentration of abamectin in the bee food. For this follow-up project, we designed an experiment in which we found that the abamectin found in bee colonies can be a product of the collection of flowers contaminated with feces from treated cattle with avermectins (Ivermectin in particular).

**Pesticide exposure and effects on bees:**

The pest control and pollinator protection dilemma: The case of thiamethoxam applications in squash crops.

Crop pollination benefits are often enhanced under effective pest control (Lundin et al., 2013; Sutter and Albrecht, 2016) but the use of pesticides to avoid herbivore damage has shown detrimental effects on pollinators reducing the final outcome of the crops in the short or long term (Catarino et al., 2019; Stanley et al., 2015). This dilemma requires research in greater detail on the efficiency of pest management practices and their effect on pollinators.

Squash crops are entirely dependent on bee pollination to produce fruits. The most common bee species pollinating cucurbits in eastern North America are *Apis mellifera, Bombus impatiens*, and the solitary ground nesting bee *Eucera (Peponapis) pruinosa*. On the other hand, the striped cucumber beetle *Acalymma vittatum* (F.) (Coleoptera: Chrysomelidae) is the major insect pest of squash crops in the northeastern and midwestern United States and eastern Canada (Haber et al., 2021). Adult beetles feed on cotyledons, foliage, flowers, and fruits, and larvae feed exclusively on roots. Early season damage and the transmission of bacterial wilt (*Erwinia tracheiphila*) are the biggest concerns associated with this pest. Neonicotinoids are commonly applied to avoid pest damage as prophylactic measures at planting through seed treatments or soil drenches, as well as early foliar applications to provide a 2-3 week protection window. Neonicotinoids residues have been previously found in pollen, nectar, and soil of Cucurbita crops, representing a risk of exposure for bees but these residues have not been evaluated in relation to the different application methods and the pest control efficiency, with the goal of providing comprehensive recommendations to growers. The aim of this study was to evaluate how different prophylactic application methods (seed treatments, in-furrow applications, and early foliar sprays) of commercially available thiamethoxam products impact pest control, bee visitation, yield, and pesticides residues in foliage, pollen, and nectar of squash crops with the purpose of elucidating if there are uses of this insecticide that provides an efficient pest control solution for squash crops while minimizing pesticide pollinator exposure. Among the different thiamethoxam application methods, in-furrow application was the treatment that prevented defoliation the most and produced the highest fruit weight and fruit number. However, it also produced the most frequent and highest thiamethoxam concentrations in nectar and pollen, reaching lethal hazards for the bees. Our study provides evidence that under the current application methods thiamethoxam does not provide a sustainable solution for squash growers and further research in more efficient pesticide delivery methods are required as well as alternative non-pesticide pest control measurements.

Interactive effects of chlorogenic acid and thiamethoxam on bumble bee microcolonies.

Bumble bees are important crop pollinators worldwide. However, when bees are foraging in agricultural environments, they can encounter a wide range of pesticides that can affect their survival and development. Neonicotinoids are systemic insecticides, well known for their pest control efficiency but also for being highly toxic to bees. Thiamethoxam is the second most used neonicotinoid, and it has already shown that bees can be exposed to sublethal concentrations of this insecticide when visiting crops.

Flowers provide sugar and protein-based rewards for pollinators, but they also commonly contain secondary metabolites that function as deterrents or antibiotics. Moreover, early biochemical evidence in honey bees suggests that plant secondary metabolites can help bees to detoxify certain pesticide molecules increasing survival. In our study, we tested if different concentrations of chlorogenic acid, a common polyphenol produced in nectar and pollen of many crop plants, interacted with different sublethal concentrations of thiamethoxam in bumble bee colony development. We found that the probability to have a successful bumble bee microcolony with brood when simultaneously exposed to chlorogenic acid and thiamethoxam is dose-dependent.

Other research projects:

Animal pollination contribution to crop yield and quality – A global meta-analysis.

Teaching and outreach:

Teaching

Before coming to Cornell

Stingless bees (Meliponini: Apidae) are eusocial bees that form the most abundant and diverse group of bees throughout the tropics. These bees play a key role in the reproduction of many wild plants, as well as being important flower visitors of multiple crops. Indigenous and local communities use honey, pollen, cerumen, and propolis from stingless bees for their own consumption or to sell in local markets as food or medicine.

Stingless bees, as well as other wild bees, are suffering the negative impact of the loss of natural habitat, pesticides, and pathogens. Moreover, these bees are highly dependent on the forest because most of the species nest in cavities of old trees. We can help protect them by protecting their natural habitat, reducing the use of pesticides and helping communities to make a rational use of these colonies.

Stingless bee beekeeping is known as meliponiculture.