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Graduation Thesis Project

Comparison of Species Richness and Abundance of Bees (Epifamily Anthophila) in Agricultural and Natural Ecosystems of the Yeguare Valley, Honduras

Presented by:

Andrea Jimena Mazariegos Palma

Advisers

Oliver Komar Ph. D

Eric van den Berghe Ph. D

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Authorities

TANYA MÜLLER GARCÍA

Rector

ANA M. MAIER ACOSTA

Vice-president and Academic Dean

ERIKA TENORIO MONCADA

President of Environment and Development Department

HUGO ZAVALA MEMBREÑO

General Secretary

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Abstract

Bees (Epifamily Anthophilia) are insects that maintain natural vegetation and pollinate different flowers that produce many of the fruits and seeds in our diet. Due to anthropogenic activities, which directly or indirectly impact their populations, these have decreased significantly. In this study, a comparison of the diversity of bees is made through sampling carried out for two months in agricultural systems and natural ecosystems in the Yeguare Valley, in Honduras, considering the richness and abundance that they present. Using colored pan traps, a total of 82 individuals belonging to three families and 19 species and morphospecies were captured. These were analyzed using species accumulation curves for richness and a non-parametric variance test for the analysis of relative abundance (number of individuals found per species) to determine if there is a relationship between these variables and agricultural practices. To verify the efficiency of the traps in collecting specimens, they were compared with observations made in iNaturalist by Zamorano students. Significant statistical differences in species richness were only found between the ecological trail and conventional agriculture treatment (Zone 2), demonstrating the importance of biological corridors with better habitat quality for bees. The relative abundance showed apparent differences in Zone 2, having the lowest values observed in the entire study, however, no significant statistical differences were found, so it is recommended to carry out more samplings to determine whether there is a difference between them.

Keywords: Pollinators, anthropogenic activities, accumulation curves, biological corridor, colored pan traps.

Resumen

Las abejas (Epifamilia Anthophila) son insectos que mantienen la vegetación natural y polinizan diferentes flores que producen muchos de los frutos y semillas de nuestra dieta. Debido a las actividades antropogénicas, que impactan directa o indirectamente a sus poblaciones, estos han disminuido significativamente. En este estudio se realiza una comparación de diversidad de abejas mediante muestreos realizados durante dos meses en sistemas agrícolas y ecosistemas naturales en el Valle de Yeguare, en Honduras, considerando la riqueza y abundancia que estos presentan. Mediante trampas de plato de colores se capturaron un total de 82 individuos pertenecientes a tres familias y 19 especies y morfoespecies. Estas se analizaron mediante curvas de acumulación de especies para la riqueza y una prueba de varianza no paramétrica para el análisis de la abundancia relativa (número de individuos por especie) y determinar si existe relación de estas variables con prácticas agrícolas. Para verificar la eficiencia de las trampas en la recolección de especímenes, se compararon con observaciones en iNaturalist realizadas por estudiantes de Zamorano. Solo se encontraron diferencias estadísticas significativas en la riqueza de especies entre el eco sendero y el tratamiento de agricultura convencional (Zona 2), lo que demuestra la importancia de los corredores biológicos como un mejor hábitat para las abejas. La abundancia mostró diferencias aparentes en la Zona 2, teniendo los valores más bajos observados en todo el estudio, sin embargo, no se encontraron diferencias estadísticas por lo que se recomienda realizar más muestreos para determinar si hay o no diferencia entre ellos.

Palabras clave: Polinizadores, actividades antropogénicas, curvas de acumulación, corredor biológico, trampas de bandejas de colores.

Introduction

Bees live on every continent except Antarctica and are responsible for much of the pollination of the planet's vegetation and, therefore a key element in much of the food consumed by humans. About half of the animals that pollinate tropical plants are bees, and with their frequent visits to flowers, they are considered efficient pollinators that, unlike other animals making casual visits (Roubik, 1992), become the major pollinators of many wild plants and crops (Kremen et al., 2002). Because of this, their niche is critical to global agricultural productivity, and alterations in their populations could result in significant economic losses (Cutler et al., 2014).

When bees are mentioned, those that live in hives and produce honey usually come to mind. These are honeybees belonging to the genus *Apis*, which are the most important for beekeeping and have been spread throughout the world. However, there are more than 20,000 different species of bees worldwide, (Nates-Parra, 2005) most of which are little studied. In recent years, information about the pollinator crisis has increased, exposing the decrease in populations of pollinating species worldwide; this is presumed to be mainly due to the use of agrochemicals and secondly to the alteration of habitats, both of which also affect beneficial organisms (Villarreal, 2018). This crisis has affected not only honeybee colonies, but wild species.

Many investigations have been carried out regarding bees. In Europe in 2007, a study compared the effectiveness of agro-environmental schemes to improve the abundance and diversity of bumblebees in the margins of crop fields (Carvell et al., 2007). This study focused solely on bumblebee species (*Bombus*) which, despite belonging to the Apidae family, and producing its own food, it cannot be compared to honey.

Another study in the United States used a multi-year experiment replicating four agricultural environments to test whether improving the habitat around crops increased the diversity and abundance of wild bees on and off crops (at edges) and improved pollination (Nicholson et al., 2020). In this study, improved field edges were found to harbor taxonomically, and functionally more abundant, diverse, and compositionally different bee communities compared to control edges. However, these improvements did not increase the diversity of bees that visited the crops, indicating that the supply of the pollination service did not change with the improvement, which may be related to the crop, since many species of bees are specialists.

On the iNaturalist platform is an umbrella project for biodiversity at Zamorano (university) that facilitates visualization of the data accumulated in recent years on bees and other species. As of 2022, observations of more than 16,000 insects have been made, categorized into 2,490 species. This includes 511 observations of 45 bee species. Of these, the most observations have been made of the Western honeybee (*Apis mellifera*) with 169 reports, followed by the Red-tailed stingless bee (*Trigona fulviventris*) with 41 observations and in third place the Ridge-crowned carpenter bee (*Xylocopa fimbriata*) observed 14 times.

Pollination is vital for life on our planet. Bees and other pollinators have co-evolved for 80 million of years, ensuring food security and nutrition, and maintaining biodiversity and ecosystems for plants, humans, and bees themselves. Pollinators are essential to produce many of the micronutrient-rich fruits, vegetables, nuts, seeds, and oils that we eat. In fact, a large part of the food that is consumed and marketed massively today depends directly or indirectly on the pollination carried out by bees; thus, for example, it is estimated that the global economic value of this service is 217 billion dollars a year (Gallai et al., 2009).

The decline in this service is likely to impact the production and costs of vitamin-rich crops such as fruit and vegetables, leading to increasingly unbalanced diets and health problems, such as malnutrition and non-communicable diseases (Food and Agriculture Organization of the United Nations [FAO], 2018b). Through pollination, bees favor agricultural production that guarantees food security and through the products obtained from them such as honey, royal jelly and pollen that are of high nutritional value (Food and Agriculture Organization of the United Nations [FAO], 2018a).

The importance of conducting this study is to show whether the abundance of different bee species is related to agricultural practices, disturbance, or environmental quality of different ecosystems. At Zamorano, studies have been carried out on the production of honey, which includes bees as the source of this product. However, no studies have been carried out on the richness of bees in the area, therefore, the present study contributes to the inventory of Zamorano´s biodiversity. For this study the objectives are:

To compare the richness of bee species in agricultural systems and natural forests in Zamorano, Honduras, identify the differences between the relative abundance of species in the different ecosystems evaluated and compare the efficiency of colored pan traps with observations recorded on the iNaturalist platform.

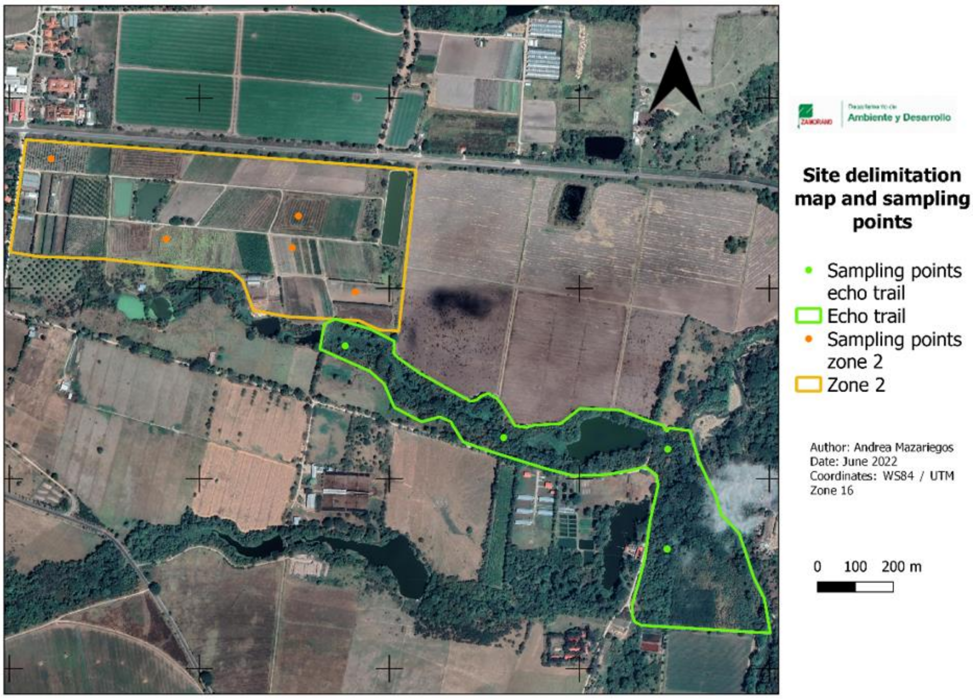
Materials and Methods

Description of the Study Area

The research was carried out in different agricultural and natural ecosystems in the Yeguare Valley, municipality of San Antonio de Oriente in the department of Francisco Morazán, Honduras. The ecosystems evaluated consisted of four sites with different characteristics. Two sites located on the central campus of Zamorano University were: (1) the eco trail, which is a natural area that functions as a biological corridor, and (2) "Zone 2" agricultural plots, which consists of a series of cultivated fields using conventional agricultural techniques to produce vegetables, fruit trees, and some grains.

Figure 1

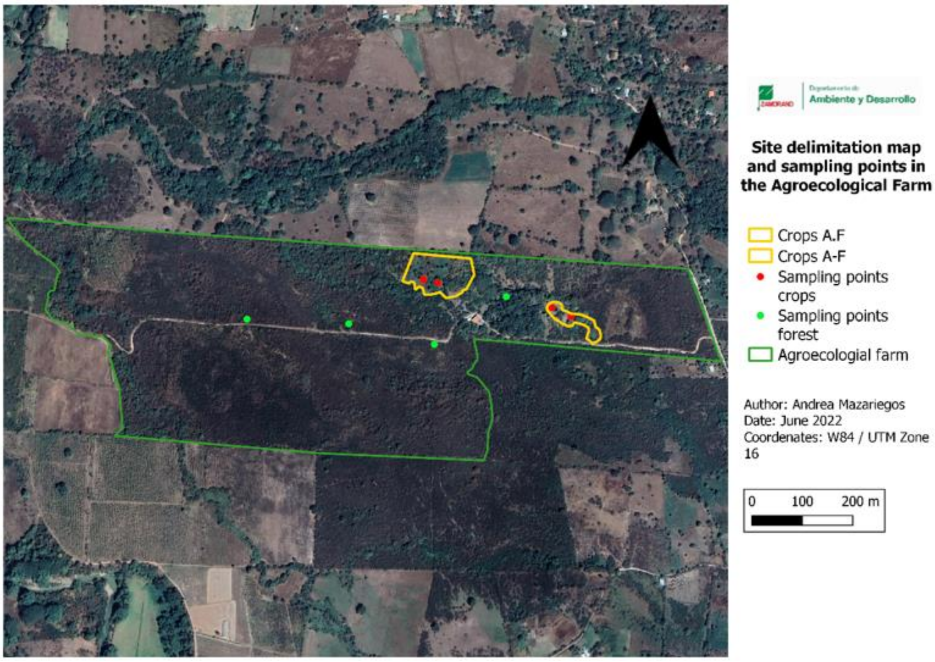
Delimitation and sampling points at the sites of Zone 2 and the eco trail, EAP Zamorano.



The remaining sites were evaluated at the Santa Inés agroecological farm, managed by the Escuela Agrícola Panamericana, Zamorano, which is located 4 km southeast of the university's central campus. Here, grain and vegetable production areas evaluated were under agroecological management, which worked maintaining maintain functional biodiversity. The forested areas of the farm were a natural ecosystem, whose vegetation cover is composed of second growth, oak forest (*Quercus oleoides*), abandoned teak plantation (*Tectona grandis*), and riparian forest (Ferrufino et al., 2018).

Figure 2

Delimitation and sampling points of the crops and the forest of the Santa Inés agroecological farm, EAP Zamorano.



For this study, the four sites were divided into plots of 2,500 m^2, and then different plots were chosen at random to establish the colored pan traps. Working under a randomized block design, four sites were sampled with colored pan traps at each site.

Colored Pan Traps

Flowering plants use color, fragrance, size, shape, and rewards like pollen and nectar to attract pollinators, and the color is among the most important attractants for pollinators (Kevan, 1972; Campbell & Hanula, 2007). Therefore, colored pan traps are useful for studying and monitoring the diversity and abundance of different species of pollinators in forests and other ecosystems. Colored pan traps have been used to capture many different types of insects. For example, yellow traps have been used to catch a wide variety of phytopathogenic insects (Kirk, 1984), and blue traps catch many Hymenopters (Pires Aguiar & Sharkov, 1997). Bees and other insects that visit flowers respond to common flower colors, associated with the floral rewards they can get (Kirk, 1984; Leong & Thorp, 1999).

The colored pan traps consist of colored pans or cups filled with water plus an additive, which can be soap or odorless liquid detergent, as well as sugar or honey as an attractant bait for pollinators (Lozano, 2021). For this study, sets of three white, yellow, and blue plates were used to make a sample unit, placing four sample units in each treatment, randomly distributed. Collections were made once a week during the months of April to June, leaving the trap in each site for at least 7 days. The samples obtained in each sampling unit were collected and placed in the same container with alcohol for preservation until identification. Each sampling unit was raised approximately 70 cm from the ground with the help of a 1 m bamboo tripod (Figure 3). Because *Apis mellifera* bees reduce the time spent on flower detection when light is increased (Telles da Silva, 2015), the traps were placed in sites that presented more direct sunlight.

Figure 3

The sampling unit is made up of three colored pans established in a crop field.

Sampling Units

For the species richness comparison study, the total number of individuals collected in the four traps placed in each treatment was used as a sampling unit, leaving them in the field for a minimum of seven days and a maximum of nine. To carry out the analysis of the efficiency evaluation of different methods (colored pan traps and iNaturalist), it was necessary to have a sampling unit for the observations in the platform and thus be able to be compared with the sampling unit of the catches done with traps. In this way, the observations made for the treatments, a total of 45 and 29 for Zone 2 and the eco trail, were grouped into five groups, nine and five individuals, respectively, making a sampling unit comparable to the captures obtained by traps.

Identification of Specimens

For the identification of the individuals, a stereoscope with lenses with 8 to 40x magnification was used. The samples captured were stored in 70% ethanol and placed in Petri dishes for observation and separation based on morphological characteristics. These samples were photographed and uploaded to the iNaturalist® platform, with date, location, and a brief description of the place where the individual was collected. Some individuals could be identified at the species level and verified by additional users of the platform. In those cases, the reports were promoted to research grade. However, specimens not reliably identified at the specie level, were identified at higher taxonomic levels (genus, family) and assigned to morphospecies.

iNaturalist

iNaturalist is a web-based, mobile-friendly citizen science platform where people can upload photographic observations of flora and fauna and identify these organisms with the aid of a huge reference database that includes photos, and range maps. Observations that are photographed from a single organism submitted by a user are annotated with metadata such as date, location, whether the organism is captive or wild, taxonomic ID, and other user-defined fields. This can be useful to scientists participating in this network as they can help estimate species distribution, develop checklists, document introduced species, and discover new species (Aristeidou et al., 2021). Zamorano has a project on the platform to document the biodiversity of different species of flora and fauna in the municipality of San Antonio de Oriente, Honduras. This project has more than 36,200 observations, in the six years beginning in 2017. Of these observations, 516 are from the Epifamily Anthophila, of which 255 observations have been identified as "research grade" and classified into 17 species.

Comparison of Species Richness

The data obtained from the samples collected in the field were tabulated in the Microsoft Excel program, counting the number of times a species was found in each treatment. For data analysis, they were first saved in a comma-delimited text format in Excel and then, processed using the EstimateS program (version 9.1.0). This program takes the data from a standardized sampling system, randomizes all the information and calculates the number of species observed and expected using estimators and considering the standard deviations from the randomization process, generating the necessary information to make accumulation curves (Ospina, 2004, 2006). These are a simple and robust methods to assess the quality of biological inventories (Jiménez & Hortal, 2003). That is why for this study, they were used to carry out a partial inventory of the bee species found in different sites of the Yeguare Valley. The program was configured to work with the classic formulas Chao1 and Chao2, to generate richness estimates, which were used to subsequently generate the graphs of the smoothed accumulation curves in Excel.

Comparison of Abundances

To determine whether there are significant differences in the abundance found at each treatment, an analysis of variance was used. The data were analyzed using the Real Statistics Excel extension to find out if the residuals were normally distributed using a Shapiro-Wilks test. Subsequently, the non-parametric Kruskal Wallis test was applied to evaluate differences between the medians of each site. An alpha value (P) of 0.05 was used to determine the significance of all tests.

Results and Discussion

Bee Species Captured

During the investigation, 82 individuals were collected and classified into 19 different bee species or morphospecies (Table 1). These were identified and can be seen in Annex A.

Table 1

Bee species captured and their total abundance by each treatment.

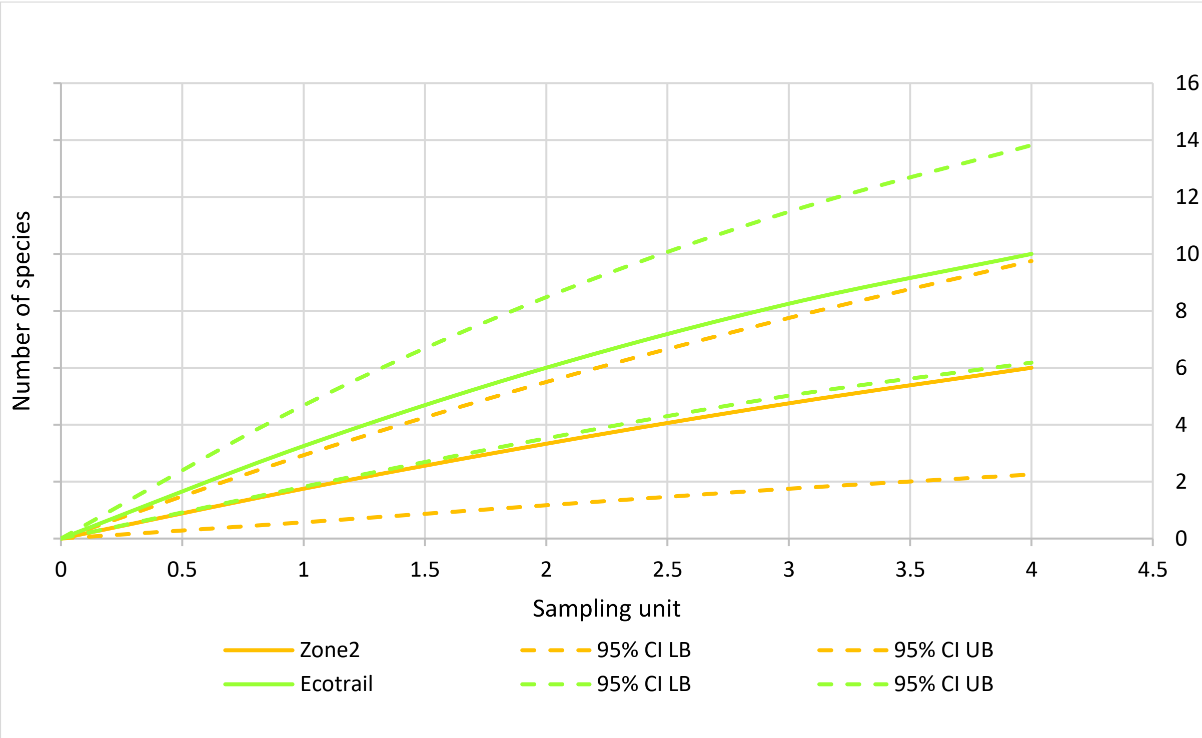
Species/Morphospecies	Treatment			
	Eco trail	Farm Forest	Zone 2	Farm Crops
Apis mellifera	2		2	6
Augochlora cf. pura				2
Augochlorella aurata			2	
Euglossa dilemma				2
Andrenidae (Morphospecies AM40)	1			
Apidae (Morphospecies AM21)	1			
Augochlora (Morphospecies AM210)	2	1		
Augochlora (Morphospecies AM211)	4			
Augochlora (Morphospecies AM212)		1		
Ceratin (Morphospecies AM50)			1	
Ceratin (Morphospecies AM51)		1		
Exomalopsis (Morphospecies AM09)				1
Exomalopsis (Morphospecies AM10)	2	1	1	6
Halictinae (Morphospecies AM101)	3	12		1
Halictinae (Morphospecies AM110)	1	1		
Lasioglossum (Morphospecies AM181)	3	2	1	3
Partamona (Morphospecies AM99)		2		
Pseudaugochlora (Morphospecies AM170)		1		
Trigona fulviventris	2	4	2	5
Total individuals captured	21	26	9	26

By the end of the study, even though most vegetation in the natural sites did not have flowers and in the agricultural production areas there were crops in bloom, captures of 10 different species were obtained in the eco trail and in the forest of the agroecological farm. On the other hand, 8 species were captured in the crop fields under agroecological management and 6 species in the Zone 2 agricultural fields.

The Zone 2 agricultural site presented significantly lower values than the eco trail site (Figure 4) since the species accumulation curve generated for Zone 2 is outside the 95% confidence intervals of the eco trail and vice versa. A study that evaluated the diversity of stingless bees (Apidae: *Meliponini*) in Costa Rica showed that their richness was greater in plots with larger trees and in the vicinity of a coffee crop (Lozano, 2021). Comparing these results with those obtained in this study, both show the importance of natural spaces close to agricultural areas, since these present better conditions for bees, including food sources and habitat quality.

Figure 4

Accumulation curves of species found in Zone 2 and the eco trail.

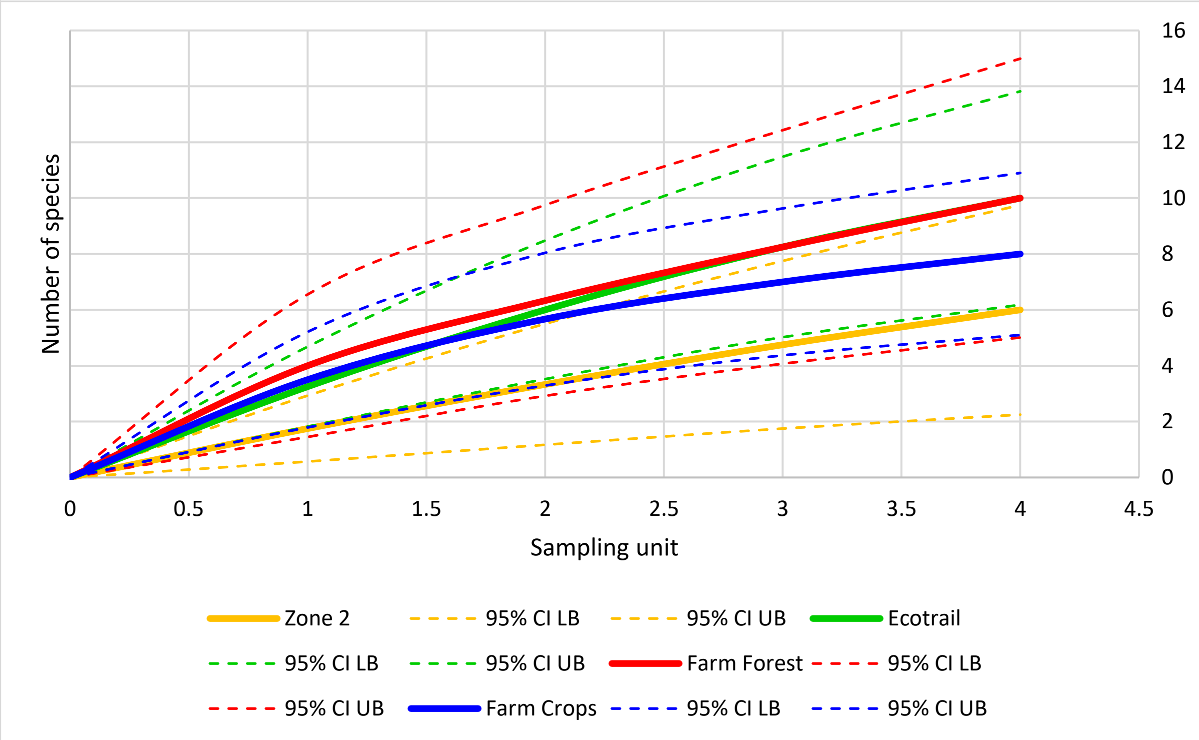


Comparing the differences in richness in each evaluated treatment (Figure 5), it can be said that the curves of both sites in the agroecological farm and the eco trail are very close and fall within the confidence limits of each other, so there is no statistical difference between them. Likewise, the

Zone 2 curve with the sites on the agroecological farm are statistically the same, although the inability to detect a difference is probably due to incomplete sampling. With more sampling the confidence intervals of the curves should diminish and provide more confidence in the species richness estimates generated. As all the curves continue to grow exponentially, more sampling effort is needed to demonstrate the species richness for these sites (Phifer et al., 2017).

Figure 5

Accumulation curves of species found in the four treatments evaluated.



The results of a study carried out in Guatemala that compared the diversity of bees found in three types of landscapes: Continuous forest, fragmented forest, and agricultural areas, show that, during the dry season, the forest presents the greatest richness of bees. On the other hand, during the rainy season, the richness of the forest and the fragmented categories showed similar richness, surpassing those found in the dry season and in the crop categories (Escobedo et al., 2014). Although in this study the fragmentation of the evaluated ecosystems was not compared, it is important to highlight that, for both investigations, higher levels of richness were found in sites with less or no fragmentation (little disturbance), since other studies also support that the remnants forested areas are important in the conservation of pollinating insects (Greenleaf & Kremen, 2006; Ricketts et al., 2004).

Comparison of Abundance Between the Sampled Sites

When evaluating the total relative abundance that was captured in each treatment, it was found that the site with the lowest abundance was Zone 2, where only 9 individuals were collected. On the other hand, in the eco trail a total of 21 individuals was obtained and, in the treatments located on the agroecological farm, 26 individuals were found in each one (Table 1). The variation in bee abundance between each treatment was not normally distributed (P<0.05) (Table 2), this required the use of a non-parametric test to compare abundance between treatments.

Table 2

Shapiro-Wilks normality test for bee abundance.

	Eco trail	Farm Forest	Zone 2	Farm Crops
w-stat	0.81	0.51	0.63	0.69
p-value	0.00203	7.18E-07	1.10E-05	4.44E-05
alpha	0.05	0.05	0.05	0.05
normal	No	No	No	No

No statistical differences in mean abundance were found across treatments (P > 0.05, Table 3). This is likely due to the small sample size nonetheless the low average abundance found in Zone 2 was expected given the lower vegetation diversity, reduced availability of breeding sites, and increased human disturbance from the intensive farming activities. Other studies report higher bee abundance in areas with greater floral diversity. A study carried out in Guatemala determined that the relatively high abundance of bee communities (Apoidea) in the forestry category is largely due to the frequency of social and semi-social species (meliponines and bumblebees of the genus *Bombus)* (Escobedo et al., 2014). Studies in Germany have also shown that both the abundance and species richness of bees are positively corelated to the plant richness of the habitat, a measure of food resources for bees (Tscharntke et al., 1998).

Table 3

Kruskal-Wallis test of variance for bee abundance.

Site	N	Means	S. D.	Medians	Average ranges	H	p
Eco trail	4	5.25	4.43	5	8.88		
Farm Forest	4	6.5	5.45	5	10		
Zone 2	4	2.25	1.5	2	5.63		
Farm crops	4	6.5	5.8	6	9.5	2.06	0.5557

A test was carried out evaluating the abundance found in Zone 2 and the echo trail, expecting to find differences between them, since they presented statistical differences in the richness found, however, the results did not show significant statistical differences (P>0.05).

Comparison of Efficiency for Richness Detection by Color Pan Traps Versus Observations in iNaturalist

To evaluate the efficiency of the colored pan traps, data for each sampling site was compared with observations made on the iNaturalist platform (Table 4), often by Zamorano students. However, the observations made for the agroecological farm on the platform were not enough to make such a comparison, since there were less than five records of observations on the farm during the six years prior to the present study. Due to this, comparisons were only made for Zone 2 and the eco trail.

Table 4

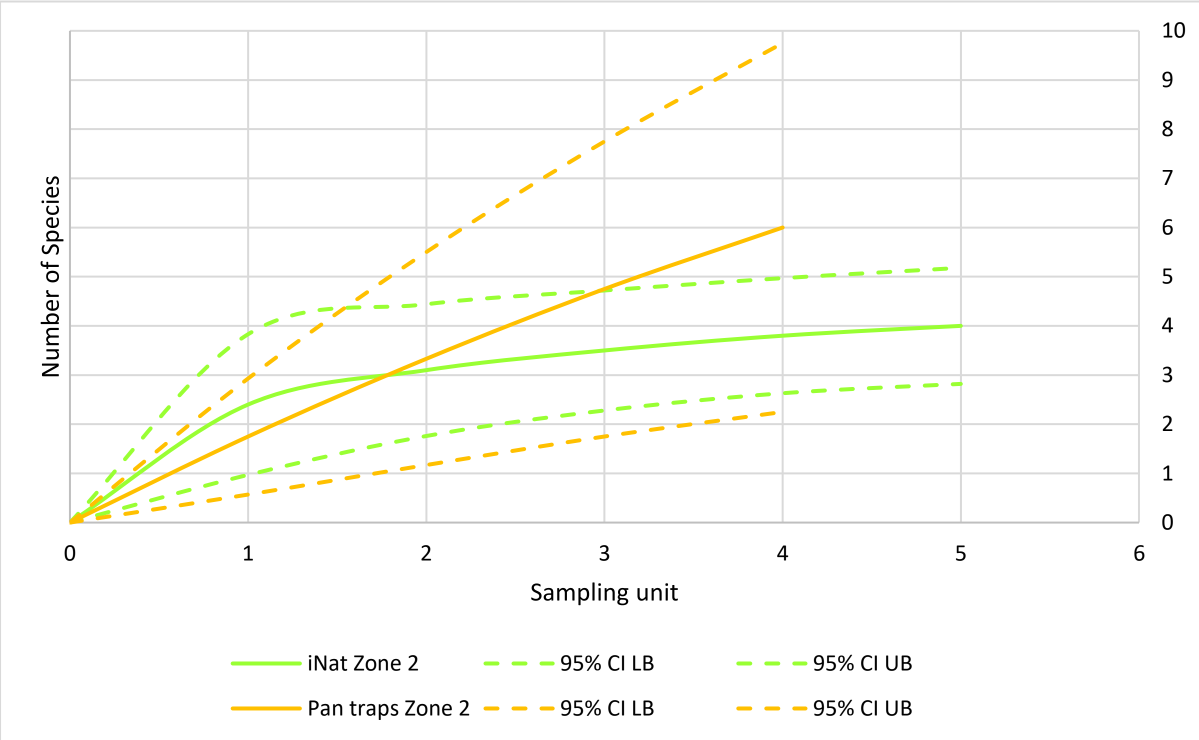
Total observations made in iNaturalist for Zone 2 and the eco trail.

Scientific name	Eco trail	Zone 2
Apidae (morphospecies AM300)		1
Apinae (morphospecies AM301)	1	
Apinae (morphospecies AM302)	1	2
Apis mellifera	14	35
Centris varia	1	
Euglossa sp.	1	
Nannotrigona perilampoides	1	
Trigona fulviventris	7	
Xylocopa cf. fimbriata	3	7

The richness data obtained by the two methods -the traps and the observations in iNaturalist- do not show significant differences (Figure 6). However, the species accumulation curve of the bee observations reported in iNaturalist reached the asymptote, and the confidence interval is much narrower, so it can be inferred that the inventory is closer to completion with this method than with the colored pan traps. However, this is not to say that observations using iNaturalist are more accurate or efficient than pan traps, but it can be said that most of the species that can be reported using this method have been reported. On the other hand, to determine the richness of species that can be captured by the traps, a greater number of sampling units in the field is required.

Figure 6

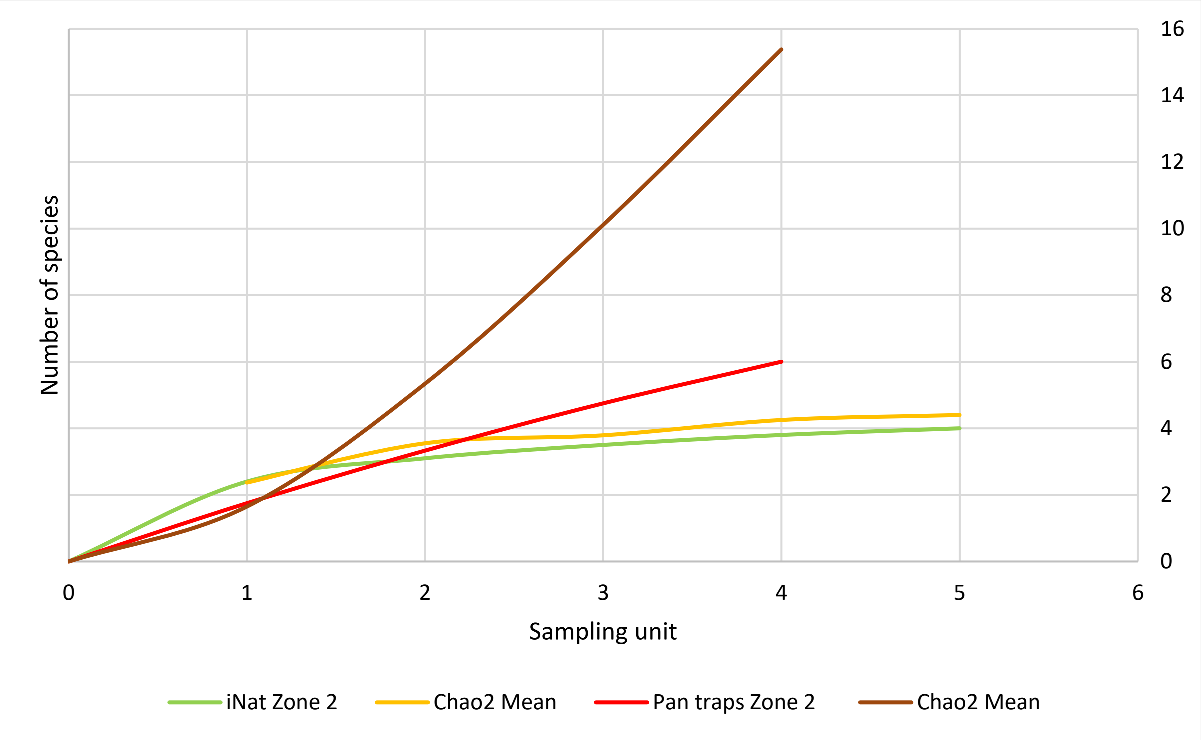
Accumulation curves of species found in Zone 2, and the observations reported in iNaturalist for the same site.



The observations with both methods in Zone 2 were compared with the estimates of the Chao2 estimator to know the incidence of the species, that is, the times that a species appears in each sampling unit (Figure 7). For observations using iNaturalist, the mean of the Chao2 estimator indicates that we are close to reporting all species that can be observed using this method. On the contrary, for the pan traps method, the Chao2 estimator may be overestimating the richness of the inventory due to its incompleteness, which indicates that more species are expected to be observed with the use of pan traps. Although the actual richness number may lie between the curves generated from the observed number and this estimator, if the estimated curve continues to rise, the actual number of observations may be higher.

Figure 7

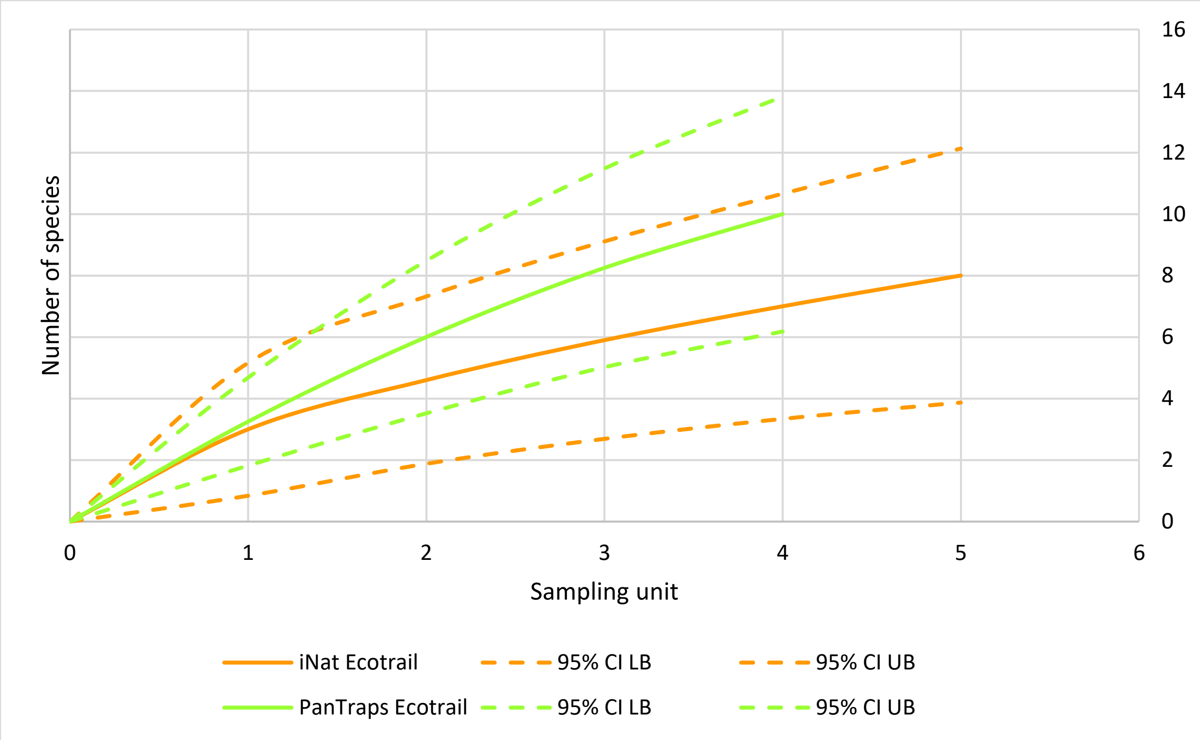
Accumulation curves of species captured with colored pan traps and iNaturalist observations for Zone 2 with the Chao2 estimator curve.



In the case of the eco trail, the curve generated for the pan traps method is higher than that obtained from the iNaturalist observations (Figure 8). Considering the results obtained with only four samplings, it can be said that there are no differences. Likewise, for both cases, the curves continue to grow exponentially and the confidence intervals for both methods are distant from each other, which indicates that more sampling is needed. By increasing these, consistent patterns can be obtained that indicate that using the pan trap method, higher species richness can be obtained than using the observations made in iNaturalist. In addition to being able to reach the asymptote and obtain closer intervals, which would indicate a complete inventory of bee species for this site.

Figure 8

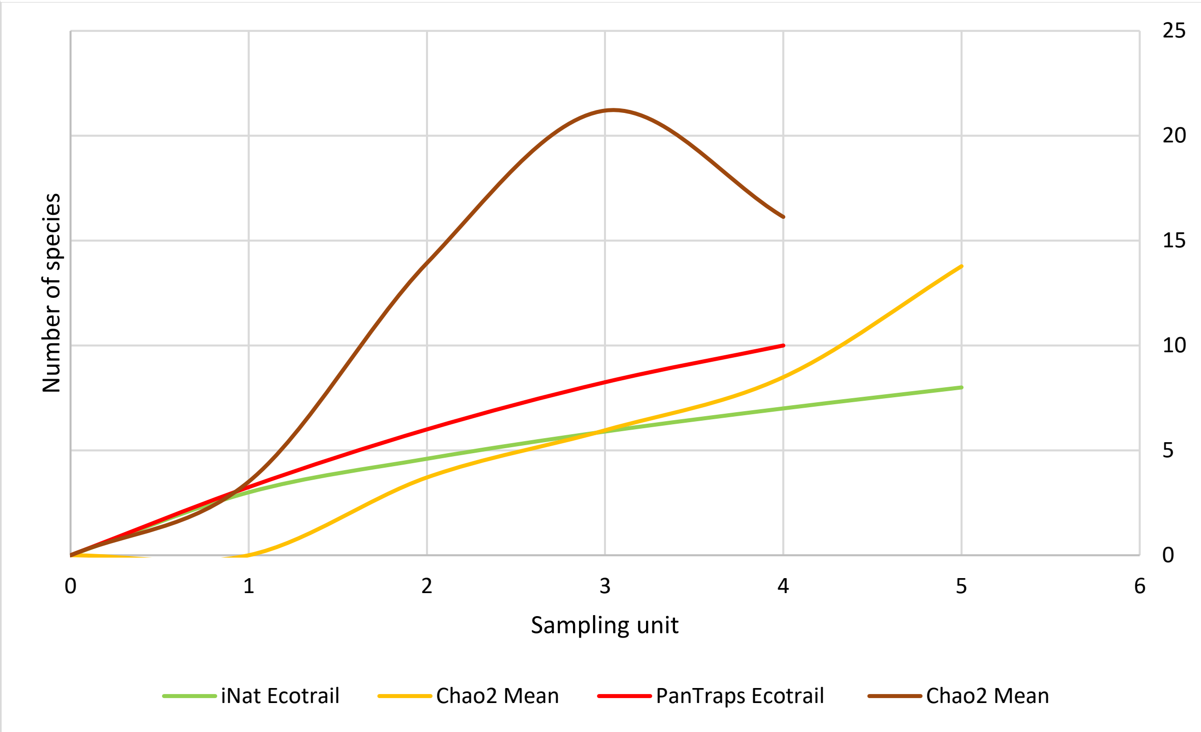
Accumulation curves of species found in the eco trail, and the observations reported in iNaturalist for the same site.



The comparison made for the sampling the eco trail with the Chao2 estimator (Figure 9), indicates that, as in Zone 2, there is a greater species richness captured with the colored pan traps than those presented in iNaturalist. The curves generated for the Chao2 estimator show that the colored pan traps are closer to the observed richness curve, indicating that it is closer to reaching the asymptote than the iNaturalist observations. However, it is not yet possible to determine which method is more likely to present a greater number of species, so there is still the opportunity to capture or observe species at both sites.

Figure 9

Accumulation curves of species captured with colored pan traps and observations in iNaturalist for the eco trail with Chao2 estimator curves.



Conclusions

During the study, 19 species and morphospecies of bees (Epifamily Anthophila) were collected. The sites that presented the greatest species richness were the eco trail and the forest of the agroecological farm, both relatively undisturbed sites. Farmed sites under agroecological and conventional management presented fewer species. The richness compared in these sites only showed statistical differences between the eco trail and the most intensively farmed site.

Overall abundance of bees captured appeared highest at the agroecological farm, followed closely by the eco trail, but the intensive agriculture site presented much fewer captures. Although the differences are not statistically significant, higher abundance was expected at sites with more diverse vegetation.

The results of the species accumulation curves show that both, can capture representative samples of bee communities. Although it is difficult to determine the efficiency of these methods due to the limited number of samplings carried out and since these did not present statistical differences. More samplings need to be carried out to determine which method is more efficient.

Recommendations

The present study was carried out for two months. It is recommended repeating this study or similar studies of bee populations during the different seasons of the year, and different years, to consider seasonal variation in climatic conditions and plant phenology, since some species of bees are specialists, and their life cycle may depend on changes in climatic conditions and habitat availability. A long-term study will be better for comparing natural to agricultural sites because it will reflect how bee communities change with different seasons and across years.

The high bee diversity and abundance observed on the eco trail demonstrates the importance of improving and maintaining biological corridors. Such spaces provide biodiversity conservation, gene flow and connectivity between ecosystems and habitats, natural or modified greater diversity of bees within the corridor suggests that it may also provide more pollination services to nearby crops.

Finally, it is recommended to study the relationship between the biodiversity of bees (Epifamily Anthophila) with variables such as habitat (floristic composition), altitude, temperature, anthropogenic activities, and proximity to bodies of water to better understand the importance of these factors for bees.

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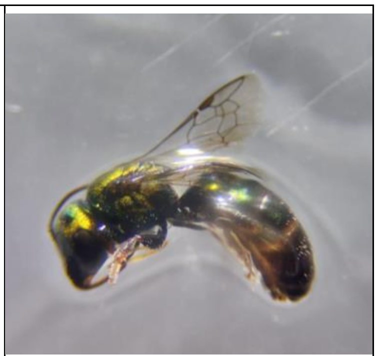
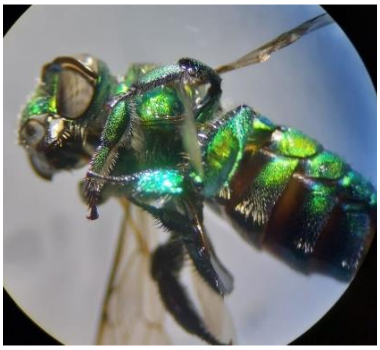
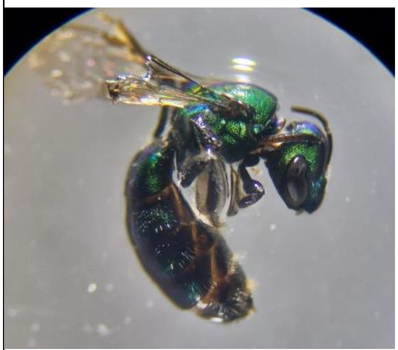
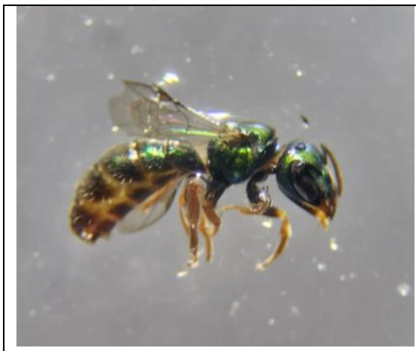
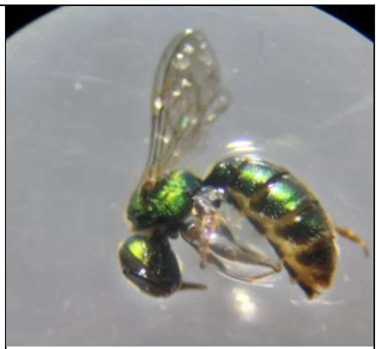
Annex

Annex A

Bee species and morphospecies captured in all the study

		
Apis mellifera	Augochlorella cf. pura	Augochlorella aurata
		
Euglossa dilemma (dorsal view)	*Euglossa dilemma* (ventral view)	AM40 Family Andrenidae
		
AM21 Family Apidae	AM210 (lateral view) Genus Augochlora	AM210 (dorsal and ventral view) Genus *Augochlora*

		
AM211 (lateral view) Genus Augochlora	AM211 (dorsal view) Genus Augochlora	AM212 Genus Augochlora
		
AM50 Genus Ceratin	AM51 Genus Ceratin	AM09 Genus Exomalopsis
		
AM10 (dorsal view) Genus *Exomalopsis*	AM10 (dorsal view) Genus *Exomalopsis*	AM101 (dorsal view) Family Halictinae

		
AM101 (lateral view) Family Halictinae	AM101 (lateral view) Family Halictinae	AM110 (lateral view) Family Halictinae
		
AM110 (dorsal view) Family Halictinae	AM181 (dorsal view) Genus *Lasioglossum*	AM181 (dorsal view) Genus *Lasioglossum*
		
AM181 (dorsal view) Genus *Lasioglossum*	AM99 Genus *Partamona*	AM171 Genus P*seudaugochlora*

		
	Trigona fulviventris	