Social perception of apiculture in an urban setting: a case study in central Veracruz, Mexico

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Abstract

Bees and other pollinizers face a serious survival threat due to a number of factors of regional and global reach. In order to design successful conservation strategies, it is necessary to assess people's interest and level of support for apiculture. Our objective here was to analyze the social perception of apiculture in an area comprising five municipalities of the center of the state of Veracruz, Mexico. We used random-sampling semi-structured surveys in each of the municipalities with apiculture activity. Qualitative data were analyzed with a contrasting coded-content analysis technique, and quantitative data were subjected to inference statistical analysis. A total of 282 people were surveyed, 89% of whom were found to have a positive perception of apiculture, due to the health benefits of consuming honey and the positive environmental effects of pollination. However, the level of their expectations, interest, experience, attitudes, and feelings was not very high, nor were their behavior tendencies conducive to conservation. Fifty-two percent of the surveyed saw apiculture as 'something' vaguely related to the environment, 48% related it to health, 43% to nutrition, 39% to culture, 37% to the economy, and 20% to education. People between 19 and 25 years of age from the municipalities of Xico and Coatepec showed the highest interest in apiculture. We concluded that an awareness-creation strategy is indispensable for the preservation of the activity, emphasizing the key role of apiculture in environmental conservation and the tangible social benefits it offers.

Keywords:
Pollinizers
Social well-being
Ecosystems
Crisis

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Resumen

Las abejas y otros polinizadores se enfrentan a una grave amenaza de supervivencia debido a una serie de factores de alcance regional y mundial. Para diseñar estrategias de conservación exitosas, es necesario evaluar el interés de las personas y el nivel de apoyo a la apicultura. Nuestro objetivo fue analizar la percepción de la sociedad sobre la apicultura en una franja de cinco municipios de la zona centro de Veracruz, México. Se emplearon encuestas semiestructuradas con un muestreo aleatorio en cada uno de los municipios con actividad apícola. Los datos cualitativos se analizaron empleando un análisis de contenido contrastivo codificado, y los cuantitativos con estadística inferencial. Se encuestó a un total de 282 personas, de las cuales se encontró que el 89% tiene una percepción positiva de la apicultura, debido a los beneficios para la salud del consumo de miel y los efectos ambientales positivos de la polinización. Sin embargo, el nivel de sus expectativas, interés, experiencia, actitudes y sentimientos no era muy alto, ni sus tendencias de comportamiento eran conducentes a la conservación. El 52% de los encuestados veía la apicultura como "algo" vagamente relacionado con el medio ambiente, el 48% la relacionaba con la salud, el 43% con la nutrición, el 39% con la cultura, el 37% con la economía y el 20% con la educación. Las personas entre 19 y 25 años de edad de los municipios de Xico y Coatepec mostraron el mayor interés por la apicultura. Concluimos que una estrategia de concientización es indispensable para la preservación de la actividad, enfatizando el papel clave de la apicultura en la conservación del medio ambiente y los beneficios sociales tangibles que ofrece.

Palabras clave:
Polinizadores
Bienestar social
Ecosistemas
Crisis

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Introduction

Apiculture is an important source of income and prosperity for many rural and urban communities around the world (FAO, 2018). The products derived from honeybees of the *Apis* genus and from native stingless bees (meliponines) have been part of the cultural heritage of many indigenous people (Ayala, Gonzalez, & Engel, 2013; Quezada-Euán, Nates-Parra, Maués, Roubik, & Imperatriz-Fonseca, 2018). In Mexico, apiculture is an important activity in the northern states, Chihuahua, Sonora and Sinaloa; the southern portion of the Yucatán peninsula; and in the states of Michoacán, Puebla, Veracruz, Guerrero, Tabasco and Oaxaca (Cano-Contreras, Martínez, & Balboa, 2013; Foster, 1942).

Bees guarantee the food security of entire populations. About 75% of agricultural produce worldwide (including fruits, vegetables, nuts and seeds) depends on the pollination of crops by bees (FAO, 2018; Hall & Martins, 2020) and Mexico is no exception (Magaña Magaña, Tavera Cortés, Salazar Barrientos, & Sanginés García, 2016). However, both native bees and honeybees are endangered species due to multi-factorial events not yet fully understood, such as the colony collapse disorder and pesticide use (Gallai, Salles, Settele, & Vaissière, 2009). The loss of bee species poses a serious risk to the survival of humans (Martínez-Puc & Merlo-Maydana, 2014). At this juncture, it is essential to ask ourselves about the role of urbanization in the conservation of bee species.

Given that more than half of humanity lives in cities, and urbanization is expected to continue growing in the coming decades (Romero-Lankao et al., 2014), the growth of cities is usually regarded as the main threat to biodiversity at the global scale. However, urban areas can also be enlisted in conservation efforts. In fact, cities are an ideal ground to explore people's perception of biodiversity and to raise awareness of the importance of preserving the environment and the many services it provides (Bennett, 2016; Castán Broto & Westman, 2020). In several parts of the world, bees (both native and honeybees) have been observed to visit urban gardens ever more frequently and in greater quantity, in clear contrasts to what happens in their usual habitat (Baldock, 2020; Hernandez, Frankie, & Thorp, 2009; Matias, Leventon, Rau, Borgemeister, & von Wehrden, 2017; Nascimento, Agostini, Souza, & Maruyama, 2020).

In a survey in agricultural societies in India, for example, Bhattacharyya, Acharya, and Chakraborty (2017), explored people's perception of native bees and found a lack of awareness about their nature and their importance as

pollinizers and their role in ecosystem services. The authors concluded that this situation could be turned around through awareness campaigns at the early stages of formal education. They identified participation of society as crucial for the conservation of bees of all types. Similar results have been reported by other studies in countries of Asia (Chanthayod, Zhang, & Chen, 2017; Kong-Wah et al., 2016; Novellino, 2002; Oldroyd & Nanork, 2009), Europe (Mwebaze et al., 2018; Schönfelder & Bogner, 2018; Sumner, Law, & Cini, 2018) and the United States (Colla & MacIvor, 2017; Ramer et al., 2019; Silva & Minor, 2017). The panorama in Mexico is even less encouraging. In a study in the state of Michoacán, Reyes-González, Camou-Guerrero, del-Val, Ramírez, and Porter-Bolland (2020) have linked the decrease in the number of beehives of native bees to the lack of interest by local communities in knowing and preserving bees of different species. Similar results have been reported in the states of Campeche (Coh-Martínez et al., 2019), Tabasco (Cano-Contreras et al., 2013) and Yucatán (González-Acereto, Quezada-Euán, & Medina-Medina, 2006).

Research on perceptions can inform courses of action to improve conservation from individual scales to national and international policy. Positive perceptions enable long-term conservation success (Bennett, 2016).

For this study of social perception, the definition proposed by Vargas (1994) will be used, who proposes that perception "is the cognitive process of consciousness that consists of the recognition, interpretation and significance for the elaboration of judgments about the sensations obtained from the physical and social environment ". According to Morris et al. (2005) all human beings have the same perceptual capacity, however, our individuality is what influences what we perceive. Therefore, perception in its psychological dimension, based on people's values, attitudes or motives, rather than the physical dimension (the sensory organs) is what determines what attracts people's attention and, therefore, a meaning (Qiong, 2017).

For Wojtarowski (2011), perceptions of society are ideas or beliefs of a cultural group with respect to its natural environment. In order to study the perceptions of society in the treatment of environmental problems, it is necessary to know the set of ideas of the study group about its environment, that is, to know the environmental perception that implies the favorable and unfavorable attitudes and feelings that are had regarding of the characteristics of the physical environment (Calixto & Herrera, 2010). In this sense, it is important to conduct research that analyzes society's perceptions of bees and beekeeping, since

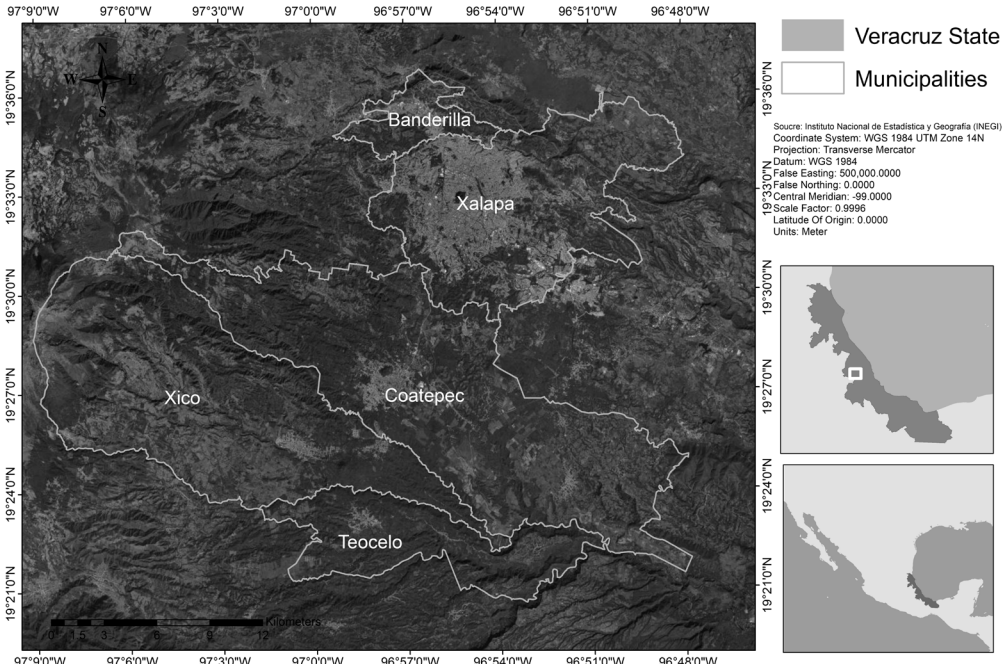
these could support both simple and complex conservation tasks depending on biocultural thinking.

In view of this, a study of people's perceptions of apiculture is in order, especially in urban pockets where people live and interact with native and honeybees (Luna Chontal et al., 2019). We have chosen to carry out our research in five municipalities of the central region of the state of Veracruz, Mexico, where no studies of this kind have been conducted so far. Our research questions are: How do people in cities perceive apiculture? What factors influence this perception? Through this survey, we hope to be able to identify the expectations, interests, attitudes, feelings, and behavior of urban dwellers in this region in relation to agriculture.

Materials and methods

The study was conducted in the municipalities of Coatepec, Banderilla, Teocelo, Xalapa, and Xico, over a mountainous strip of central Veracruz (**Figure 1**), where the production of honey, wax, and other apicultural by products is an important economic activity. The municipality of Coatepec is considered the main producer of honey and wax in the state of Veracruz (SIAP, 2018) with a production of 557 tons of honey in 2018, and an average price of $38.51 Mexican pesos per liter, generating a production value of $197 486 thousand Mexican pesos, also in Coatepec 29 tons of wax are produced per year with an average price of $85.77 Mexican pesos per kilogram generating $17 988 thousand Mexican pesos. Teocelo registered a honey production 117.71 tons per year, Xalapa 9.96 tons and Xico 56.43 tons, with a value of more than 6 million Mexican pesos (SEDARPA, 2018) and Banderilla, although it does not have a strong beekeeping production, its main characteristics are the packaging honey and activities such as acupuncture in the region (CIEGVER, 2021). Data were collected during the month of April 2019 through a random maximum-variation sampling, so as to obtain the largest possible number of social perspectives and document, locate, and establish differences and coincidences among social actors and their particularities (Hernández, Fernández, & Bamptista, 2010).

Figure 1. Study sites in a mountainous strip of central Veracruz, Mexico



The instrument was based on the content review validity of previous studies on perception and on the characteristics of perception according to Morris et al. (2005) and Vargas (1994) definition. The instrument reliability was validated with a pilot test using the Omega coefficient (McDonald, 1999), defined as the weighted sum of the standardized variables, instead of not depending on the number of items such as Cronbach's alpha (Sijtsma, 2009), therefore it reflects the true level of reliability of the instrument (Ventura-León & Caycho-Rodríguez, 2017). The Omega coefficient for our instrument was 0.886, considered very good on a scale of 0 to 1 using the R software: package "psych" (R, 2020; Revelle, 2021).

A semi-structured survey instrument was designed with 10 open and five closed questions, with the following criteria: a) no special characteristics for the people surveyed were considered, since the aim was to establish correlations between socio-demographic variables (gender, age, level of studies, and occupation); and b) perception was understood as "the cognitive process of recognizing and interpreting significant data for the elaboration of judgments about sensations obtained from the physical and social environments" (Vargas, 1994). The information obtained was classified for its analysis into qualitative content

expectations (preconceptions, and first impressions), interests (experience and cultural background), attitudes informed by beliefs (knowledge and opinions), feelings (likes and dislikes) and behavioral tendencies (behavior) (Morris, Maisto, & Salinas, 2005).

Analysis of data

For the analysis of qualitative mixed data, an exhaustive review was first carried out to debug errors and encode the answers, following which a vertical, horizontal and contrastive quantitative-qualitative analysis was conducted (Guix Oliver, 2008) using the coded-content categories previously established through dynamic tables in Microsoft Excel 2016 (Corporation, 2016) and INVIVO 10 software (International, 2019). Quantitative data was subjected to a chi-square analysis to identify differences between socio-demographic characteristics and perceptions of society, using the R software: package "psych" (R, 2020; Revelle, 2021).

Results

Socio-demographic characteristics

The survey was applied to 282 people, with the following characteristics: a) 15% were minors (12 to 17 years old), 33% were between 18 and 25, 18% between 26 and 36, 14% between 37 and 45, 11% between 46 and 55, 7% between 56 and 65, and 2% over 65 years old; b) 25% were from the municipality of Xalapa, 22% from Coatepec, 15% from Xico, 14% from Teocelo, 5% from Banderilla, 12% from other municipalities, and 7% from another state; c) 51% were male and 49% female; d) 49% worked in commerce, 32% were students, 9% professionals, 9% housewives, and only one person did not specify an occupation. The analysis of data showed that interest in apiculture concentrated in the age group between 19 and 25 years, and in the municipalities of Xico and Coatepec ($\chi^2 = 10.6$, df = 4, $p < 0.005$).

Social perceptions

Expectations

To the question, "What is the first thing that comes to mind when hearing the word apiculture?" 39% of participants responded "bees", 11% did not respond, 10% responded "I don't know", 12% responded "honey", 12% associated the term with concepts such as the environment, culture, countryside, animals and bee stings, 5% associated it with concepts not directly related to apiculture,

such as therapy, food, water, needles and paintings. “Animals” and “stings” were the least frequent answers.

Interest

Eighty-nine percent of participants said they perceived apiculture as a positive and important activity, and 11% said they did not. As for the conservation of apiculture, 97% thought it was important, and 13% said they didn’t think it was important. It was obtained that the interest that people showed about beekeeping did not depend on their gender ($\chi^2 = 6.8$, gl = 4, $p > 0.05$), but there was a relationship between the municipality and the interest, it was found that in the municipality of Coatepec (municipality with the highest beekeeping activity), people were more interested than in the other municipalities ($\chi^2 = 10.6$, gl = 4, $p < 0.005$), and the municipality that showed the least interest was Banderilla. People showed interest in the municipality of Banderilla were the age group between 12 to 36 years, in Xico from 18 to 36 years, while in Coatepec they were older than 36 years, in Xalapa from 43 to 48 years and in Teocelo from 55 years.

Attitudes

Beliefs: knowledge

Participants positioned apiculture as an activity in different fields, often in more than one: 52% of them related it to the environment, 48% to health, 43% to nutrition, 39% to culture, 37% to the economy, and 20% to education. The degree of knowledge about apiculture was low in general. Forty-four percent of participants said they could describe the concept and some characteristics of the activity, and only 5% claimed to have a substantial knowledge of apiculture. As for bees and apiculture conservation, 65% said to have no knowledge, 34% said to know something, and 1% did not answer. As for the source of their knowledge, 65% did not respond, 9% responded that they had learned it at school, 6% from friends and family, 5% from apiculturists, 5% by other means, 4% through TV documentaries and films, 4% in the Internet (mainly Facebook), and 2% by personal initiative, such as attending conferences and reading.

The municipality that showed the most knowledge on the subject was Xalapa, and the least was Coatepec ($\chi^2 = 9.48.6$, gl = 4, $p > 0.005$). It was found that people’s knowledge did not depend on formal education ($\chi^2 = 5.3$, gl = 4, $p < 0.05$).

Beliefs: opinions

Forty-seven percent of participants attributed positive adjectives to apiculture, 19% referred to its usefulness, 17% deemed it important for the environment, 6% referred to the vulnerability of bees, 6% responded with negative adjectives, such as danger of getting stung, 1% referred to some biological characteristic of the species, and 4% did not respond. As for the importance of bees for the world, 67% thought they were very important, 28% important, 3% moderately important, 1% of little importance and 1% of no importance. It was recorded that there was no relationship between the municipality and the gender of the people according to the importance they perceive of bees ($\chi^2 = 7.9$, gl = 4, $p < 0.05$). But, society as a whole (all municipalities) showed that they had a positive idea about the importance of bees for the world ($\chi^2 = 14.3$, gl = 4, $p > 0.005$).

Feelings

Fifty-one percent of participants referred to the environmental role of pollination, 24% mentioned the production of honey and other products, 9% referred to the benefits bees offer to humans, 7% referred to the healing properties of bees and honey 7% did not respond, and 4% mentioned bees' contribution to human nutrition.

Behavioral tendencies

As for involvement in the conservation of bees, 85% of participants responded that they had not undertaken any action to that effect, and 15% responded that they were doing something. Twenty-six percent of the latter group considered that not killing bees was in itself an act of conservation, 23% did not specify what actions they were taking, 17% said they were planting plants, 14% mentioned avoiding agrochemicals, 11% mentioned consuming bee products, and 9% said they respected bees.

As for the consumption of apicultural products, 97% said to consume at least one, and 3% none. Some of the participants said to consume more than one, honey being the most widely consumed (80%), followed by propolis (12%), and other products such as wax, pollen, and royal jelly (8%). Thirty-six percent of participants gave no details about their consumption motives and uses, 25% mentioned health, 20% mentioned home remedies, 19% referred to flavor, and 7% other uses and motives.

Regarding to people participation in conservation, it was observed that there was a relationship between the actions that people took in favor for bee's conservation and it was obtained that in Coatepec people take more actions (χ^2 = 17.2, gl = 4, p < 0.005) followed by the municipality of Teocelo, then the municipalities of Xalapa and Xico, where the least conservation actions are taken was the municipality of Banderilla. Likewise, the people who expressed knowing and carrying out beekeeping conservation actions, in Banderilla and Xalapa were between ages group 12 and 17 years, in Teocelo between 18 and 23 years, in Xico between 43 and 48 years, while in Coatepec they were between 61 and 78 years. However, neither the interest in the subject, nor the practice of conservation actions depended on the age of the people surveyed (χ^2 = 6.4, gl = 4, p < 0.05).

Discussion

Our results show that in the cities covered by this survey, bees and apiculture are regarded as beneficial to society, and generally perceived as something positive (See **Figure 2**). This coincides with the findings by Schönfelder and Bogner (2017), who report that bees were seen as important for food and environmental balance, and interviewees called for ways to preserve them. For their part, Lemelin, Harper, Dampier, Bowles, and Balika (2016), found that people tend to appreciate 'pleasant' insects, such as bees and butterflies, for aesthetic reasons and, as we obtained in our results, for the important role they play as pollinizers.

In our study, however, the fact that a high percentage of participants did not respond to the question of what the word apiculture brought to mind, or said they didn't know, reveals that they have a vague notion of the activity. This coincides with what Sieg, Teibtner, and Dreesmann (2018) found about bumblebees, of which people didn't know much but still showed a positive attitude.

Even the 1% of participants who related apiculture to the danger of being stung considered apiculture to be an important and worth-preserving activity, and the number of answers with positive content was high (bees are important to health, to nutrition and the environment). This coincides with other studies, where negative attitudes did not cancel love for bees (Lemelin et al., 2016; Schönfelder & Bogner, 2017).

Related concepts, in order of frequency, were: environment, health, nutrition, culture, economy, and education. In some cases, participants chose all the options, which indicates either a deep knowledge of the subject or a lack of knowledge. We opted for the latter, given that over 85% of participants said not to be involved in bee conservation, and 95% said to know nothing about the subject. This suggests that apiculture in the region has little visibility and is poorly promoted among the general population. We agree with Hall and Martins (2020) on the need to work with the press and other communication channels to bring awareness on pollinizer insects to the general public.

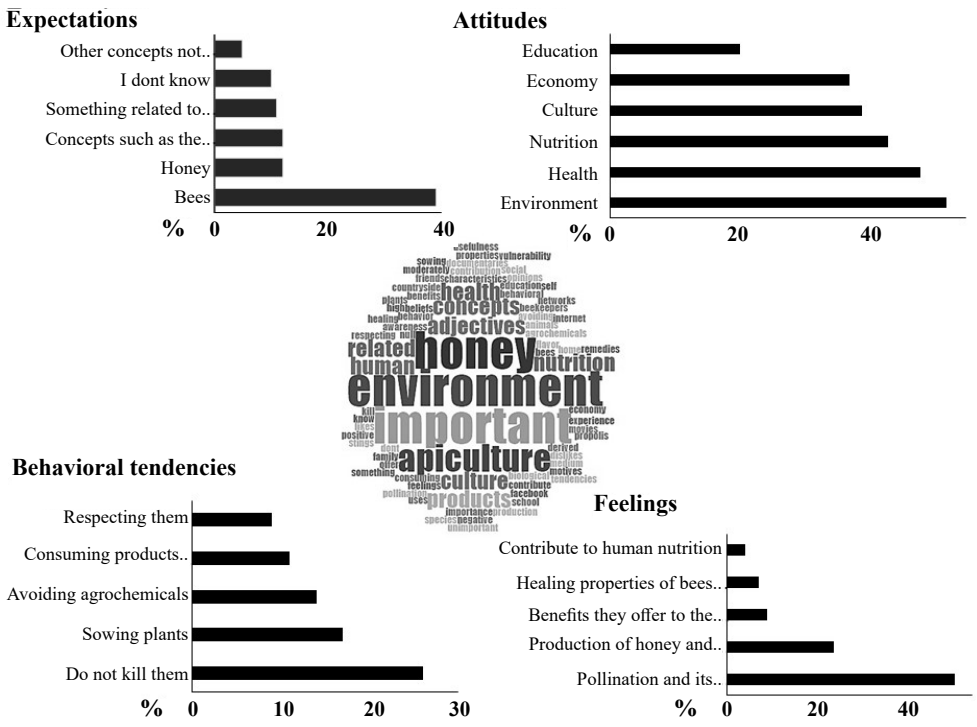
In our study, the majority of participants said to have interest on bees and that they were important for the region and the world. This coincides with what Bhattacharyya et al. (2017) and Schönfelder and Bogner (2017) report, namely that the majority of people surveyed firmly believed on the need to have bees in nature, and that they were useful and worth-preserving organisms. Our participants also said repeatedly that bees were important for their pollination services, followed by the production of honey and other products.

Although participants responded that bees “help”, “contribute”, “collaborate with the ecosystem”, “maintain environmental balance” “are part of the ecosystem”, and “help preserve the environment”, very few of them explained how bees do all that. This coincides with the findings by Bhattacharyya et al. (2017), where positive perceptions of bees (as honey producers, as pollinizers) appeared to be vaguely rooted. Other studies show that recognition of the importance of bees and other invertebrates as pollinizers and their role in food security did not correspond to a clear understanding of pollination (Djossa, Toni, Dossa, Azonanhoun, & Sinsin, 2012; Hall & Martins, 2020; Misganaw, Mengesha, & Awas, 2017).

The majority of our participants did not know about conservation measures, and less than half of them said to have learned about them at school or, in a lesser proportion, through a communication channel, mostly the Internet, Facebook and other social media, and documentaries or films on TV. This is hardly surprising, as most of the participants have access to Internet (through a smartphone) and social media, and all the instant information they provide (Osorno, 2013). It is worth mentioning that Facebook has turned into a communication channel where people can search, learn, and share knowledge on a given environmental topic, a popular, easy-to-use tool providing alternative access to different services, among other things (Patrício & Gonçalves, 2010).

Though not all the information found on the Internet is true or reliable (Osorno, 2013), participants mentioned it as an information resource. This is in line with the socio-demographic characteristics of our sample, where people between 19 and 25 years old seemed to show more interest in apiculture.

Figure 2. The coded-content analysis technique showed the main the people's perception of apiculture (% of responses) in an urban setting in central Veracruz, Mexico



No direct relation was found between knowledge about apiculture and formal education. Though most people said they had acquired their knowledge at school, the quality of this knowledge was basic and ambiguous. We agree with Osorno (2013) that social media can be a source of autonomous informal education, and that their role in this regard must not be underestimated, as they allow users to decide what they want to learn and how (Lambić, 2016). Facebook was one of the most popular and widely-used social media in the region of our study.

Apart from the notion by some participants that not killing bees is a way to contribute to their conservation, other answers referred to direct and indirect support of an agriculture free of agrochemicals, the cultivation of plants with flowers, the consumption of apicultural products, and respect for bees and their natural habitat. As several studies have shown (Drossart & Gérard, 2020; Ortiz-Sánchez, Aguado, & Ornosa, 2018; Parra & González, 2000) the protection and restoration of native flora is an alternative way to increase resources for the conservation of several species of bees in agricultural fields, urban areas, and roads (Fitch et al., 2019).

As for the need to avoid pesticide use in order to advance in the conservation of bees, our results agree with those of Bhattacharyya et al. (2017), where participants identified pesticides as the main cause driving bee extinction. In another study by Misganaw et al. (2017), participants were found to have knowledge about the impact of pesticides and herbicides in the activity of pollinizers, and that the populations of these insects showed a tendency to decline year by year mostly as a result of the use of pesticides and herbicides.

In this context, Wollaeger, Getter, and Behe (2015) found that participants gave the “bee friendly” label five times more importance than to other labels when buying a pest-control product, while Khachatryan and Rihn (2017) found that consumers of these products are interested in alternative methods of agriculture and the preservation of pollinizers, and that for these reason, synthetic pesticides have a significantly lower probability of being chosen. These findings coincide with our results that urban inhabitants do know about the effects of the use of agrochemicals in agriculture on bees and other pollinizers (See **Figure 2**).

Finally, the majority of participants mentioned that they consume one of several apicultural products such as honey, wax, pollen, royal jelly, and even honeybee venom (apitoxin). This is in line with the study by Pocol and Bolboacă (2013), where the majority of people surveyed said they appreciated honey as a delicious and healthy product and consumed it several times a month in several ways, and used it in a variety of recipes.

Limitations and future scenario

Even when previous international studies similar to this research were analyzed, one of the main limitations found when carrying out this study was

the lack of previous research on the subject in the area of interest that could have being taken as a reference for our region.

This study on social perceptions aims to provide a guideline about the consciousness of actions to contribute and to establish the guidelines for an awareness strategy the beekeeping conservation from the society perception in apiculture region. Therefore, with the information provided by this study, important points have been obtained as future lines of research:

A) Mainly arises the need for the approach of an awareness strategy for beekeeping conservation. According to the opinions of those people surveyed about the importance of bees, and the lack of knowledge about the way in which bees contribute to the environment, it is necessary to emphasize the contribution of beekeeping and bees to other dimensions of sustainable development, not only the economic one for the production of honey and specify why the bees are important for the environment and society as whole.

B) Another point to take into account is to make known, what are the activities that contribute to conservation that can be carried out by people who live in urban areas, since there is a valuable opportunity for conservation, but there is no knowledge about it, since the most of the people surveyed did not know the measures to preserve bees and beekeeping, and those who did mentioned that they had learned them on social networks.

C) Likewise, emphasis should be placed on informing about the consequences of global change such as the use of agrochemicals and human activities.

D) Another point to take into account is to question the role of man in the environment, as well as the importance of responsible consumption, mainly for the conservation of native bee species. As well as, publicize the diversity of bees that exists in Mexico and help understand why their conservation is important, even more urgent than the genus *Apis* in the study region.

Conclusions

Urban society can be said to have a positive perception of apiculture. In our study, most participants associated the activity to positive concepts; very few answers denoted fear of risk, and none of them repulsion or any other negative concept. Likewise, participants associated apiculture with the environment and nutrition, and said to consume apicultural products for their beneficial effects and medicinal properties as home remedies.

However, the majority of people surveyed did not know about measures to preserve bees and apiculture, and those who did know mentioned that they had learned them at school or through a communication channel, mainly the Internet (social media).

In a world dominated by human presence, preserving bees poses a major challenge. A deep reflection on the relationship of humans to other species in general is in order, and environmental consciousness must be part of formal and informal education. Human society must learn to coexist in harmony with the environment and all beings present in it.

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