



Conservation and Productive Yield of the Bee without Sedel as a Pollinator in Citricultural Orchards

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Abstract

This research was developed in the Municipality of Alamo, Veracruz, Mexico. With the purpose of promoting the use of the stingless bee as a pollinator in citrus orchards. Through an individualized interview directed to the producers, some techniques that are carried out for the pollination of citrus fruits were distinguished. The data were evaluated using the SWOT scheme, considering each question of the survey as a variable. As results, it can be seen that, with respect to the multiplication of stingless bee rearing for use in pollination, it places it in a position that corresponds to the first quadrant (Strengths - Opportunities), weighing the value of impacts on a scale of 3. That is, this municipality must use the internal strengths of the area in order to take advantage of opportunities and simultaneously mitigate or eliminate the effect of weaknesses, proposing actions to promote the breeding, multiplication and conservation of the stingless bee as a pollinator. From the citrus orchards of northern Veracruz.

Keywords: Stingless bee; Citrus orchards; Pollination; Conservation; Biodiversity

Introduction

The production of honey (beekeeping) in Mexico in 2017 at a commercial level positioned it in sixth place worldwide with a production of 55,900 tons, as well as in third place in terms of export [1,2]. In contrast, meliponiculture or "stingless bee farming" is a pre-Hispanic activity that has its roots in the Sierra Norte de Puebla (Cuetzalan), the Huastecas (Potosina) and the Totonacapan in Veracruz [3]. The species of the genus *Melipona* (Apidae: Meliponini) is distributed in the tropical and subtropical regions of the world [4] whose characteristics give it ecological (pollinating), nutritional [5] and also economic importance. In the State of Veracruz, the *Scaptotrigona mexicana* Guérin-Meneville species [6] and the genus *Plebeia* sp are cultivated, which has species with the potential to be used in meliponiculture and as pollinators in agriculture [7].

Pollination through stingless bees is of great importance for the maintenance of biodiversity and the balance of

ecosystems, it takes advantage of vegetation, both in its natural and altered state, as well as agricultural and forestry crops. For this reason, it has great potential to use natural resources in a friendly way with biodiversity [8]. Proper management of citrus orchards to increase floral visits by pollinating bees of the valencia orange would be very useful because the crops could benefit, renewable resources would be preserved, as well as biodiversity and the maintenance of biological balance, by not using insecticides irrationally and indiscriminately [9].

Taking advantage of the trend of increasing demand for the pollination service in crops for food production, within the framework of the updating process, some actions are defined to promote the rearing of the stingless bee and its use as a pollinator, without damaging the environment, ensuring the survival of flora and fauna. Among these strategies we can mention a) Carry out studies on the abundance and population structure of the species in order to detect the current situation of the natural populations of

the stingless bee and characterize its habitat. b) Carry out a plan of measures for the protection of the stingless bee from anthropic and climatic factors. c) Identify sources of financing for the execution of projects that contribute to the conservation and multiplication of the land bee in natural and managed conditions. d) Evaluate the influence of pollination with stingless bees for the maintenance of biodiversity in citrus orchards. e) Carry out a program to disseminate the use of meliponiculture products as a source of income [8].

Materials and Methods

This research was developed in the municipality of Alamo, located north of the state of Veracruz, Mexico. Between the parallels 20° 47' and 21° 12' north latitude, the meridians 97° 30' and 97° 56' west longitude and at an altitude that varies between ten and 500 meters. The predominant climates are subhumid with rains in summer and hot humid with abundant rains in summer. The municipality has a range of temperatures that goes from 22 to 26°C and a precipitation range of 1400 to 1600 mm. On the other hand, it occupies a total of 1,279 square kilometers [10].

To determine the main strategies that are carried out for the use and conservation of the stingless bee as a pollinator, the surveys were applied to 198 producers in the region. This was developed in several activities including a) three sessions of 6 hours each, b) organization of small groups, c)

discussions and plenary sessions. Applying the consensus idea search technique, managing to determine the Strengths, Weaknesses, Opportunities and Threats (SWOT). Relating strengths and weaknesses, with opportunities and threats, weighing the value of impacts on an incidence scale between 0 and 3. According to the highest score, it was located in one of the positions proposed by the SWOT analysis (offensive, defensive, adaptive and survival) projecting the strategies and actions that correspond to each case [4].

The Relative Value Index (IVR) of each of the variables of the SWOT matrix was calculated to determine which of them had a greater weight within it, this is the result of the quotient obtained by dividing the subtotal obtained in the aspect that is analyzed, among the total of the quadrants to which it belongs and is expressed in percent. The information obtained was recorded and processed in an Excel program spreadsheet and descriptive statistics were used for the organization and characterization of the variables under study.

Results and Discussion

In relation to the 198 surveys applied to producers, based primarily on the productive performance of the pollination of the stingless bee, the following questions were highlighted (Table 1).

High Pollination Yield	Does Not Recognize Benefits Of Pollination	Higher Performance In Honey Production
61%	25%	14%

Table 1: Productive performance of stingless bee pollination

This work differs from that presented by Cano (2013) with the application of a survey to 150 table orange producers [11], in which 85% of those surveyed are unaware of the importance of bee pollination and 15% recognize the benefits that this bee has, due to the medicinal properties that its honey has. Obtaining results superior to those reported by Guzmán et al. [12] in a study carried out in the state of Yucatán, Mexico, mentioning that 92% of those surveyed considered pollination as a contribution of bees to man and nature. In other investigations it has been shown that stingless bees carry out the pollination of some crops such as coffee, chayote, pumpkin, chili and some fruits such as watermelon and mango [3].

Magaña, et al. [1] determines that the most important contribution that any insect can make in the field of agricultural production is pollination, with bees being the most prominent pollinating insects, likewise Negrín and Sotelo [13] and Guzmán, et al. [12] address crop pollination as

a potential activity of native bee cultivation. After the results of the interviews and an extensive documentary review to conserve the breeding of stingless bees in the municipality of Alamo, Veracruz; Mexico, as a crop pollinator, identified the main weaknesses, threats, strengths and opportunities, the results of which are shown below.

Strengths

- Docility and easy handling.
- Abundant financial resources
- Environmentally friendly activity by the pollination service
- They are resistant to parasites and diseases that attack *Apis mellifera*.
- Several queens can live in the nest at the same time, the evasive swarm does not appear.
- *M. beecheii* honey has important medicinal properties used in apitherapy.

Weaknesses

- Insufficient training and information on the management and multiplication techniques of stingless bees.
- Low reproduction rate and small flight range.
- Low honey production.
- Lack of knowledge of the characteristics of its natural habitat.
- Insufficient marketing of *Melipona* species *beecheii* honey and other hive products

Opportunities

- State guidelines for Urban Agriculture subprograms that increase the demand for pollination services by stingless bees in crops for food production.
- The vegetation of the area presents a great diversity of plants of beekeeping interest that allows the support of the hives throughout the year.
- High demand in the national market for honey for its medicinal properties.
- Take advantage of the products of the hive for their economic profitability.

Threats

- Loss of floristic diversity.
- Climate change (temperature, humidity, unfavorable rainfall for beekeeping).
- Increase in agricultural areas and the use of pesticides.
- Decrease in the natural population of stingless bees.
- Predatory activity of m
- Change in customer needs or taste

Regarding the SWOT analysis (Table 1) and the multiplication of stingless bee rearing for use in pollination, it places it in a position that corresponds to the first quadrant (Strengths - Opportunities), weighing the value of impacts on a scale of 3 [14]. That is, this municipality of Alamo, Veracruz; Mexico, must use the internal strengths of the area in order to take advantage of opportunities and simultaneously mitigate or eliminate the effect of current weaknesses and threats, starting from the strengths and through the use of positive capacities, promoting nurturing, multiplication and conservation of the stingless bee.

SWOT MATRIX	STRENGTHS S1: Abundant financial resources.	WEAKNESSES W1: Low honey production.
OPPORTUNITIES O1: National and international competitor company.	STRATEGIES SO Use financial resources to increase the purchase of stingless bees and improve the company's positioning in the national and international market.	STRATEGIES WO Carry out a marketing strategy taking advantage of the low competitiveness with other companies and improve the positioning of stingless honey.
THREATS T1: Change in customer needs or taste	STRATEGIES ST Invest to adapt to market changes and improve the positioning of the company.	STRATEGIES WT There is the financial capacity to consolidate honey production and make it competitive in national and international markets.

Table 1: Swot Matrix.

In relation to the calculation of the Relative Value Index (IVR), it was determined in the first quadrant (Strengths - Opportunities) that within the strengths variable, those with the greatest weight were: a) the symbiosis of stingless bees with agriculture. b) honey has important medicinal properties used in apitherapy. c) docility and easy handling since the hives can be kept close to the house without risk [15]. Of the opportunities variable, the ones that most affect the area are a) The need for meliponic farmers to take advantage of the beehive products for their economic profitability. b) State guidelines for Urban Agriculture subprograms that increase the demand for pollination service by stingless bees in crops for food production. c) the existence of residents of the area interested in breeding stingless bees [6].

This research allowed a set of actions aimed at the promotion and use of *Melipona* specie *beecheii* in the pollination of crops. Taking advantage of the trend of increasing demand for pollination service in crops for food production, actions are defined below to promote the breeding of *Melipona* bees and their use as pollinators, without damaging the environment, ensuring survival of flora and fauna:

- Identify sources of financing for the execution of projects that contribute to the conservation and multiplication of the land bee under natural conditions and handled.
- Carry out a plan of measures for the protection of *Melipona* species *beecheii* of factors anthropic and climatic.

- Carry out a program to disseminate the use of meliponiculture products as a source of income.
- Carry out studies on the abundance and population structure of the species in order to detect the current status of natural stingless bee populations and characterize their habitat.
- Evaluate the influence of pollination with *Melipona specie beecheii* for the maintenance of biodiversity in citrus orchards.
- Emphasize directly involving farmers in the area in the use of *Melipona specie beecheii* for the pollination of their crops and the use of measures agro ecological based on the non-use of agrochemicals.
- Train the personnel in charge of the management of the *Melipona* bee, to ensure an optimal taking advantage of the pollination service.
- Promote the breeding and exploitation of the honeybee *Melipona specie beecheii*, in the citrus orchards of northern Veracruz, Mexico.
- Taking advantage of the positive conditions for the development of marketing of products obtained from hives.
- Identify the main species of plants that are used by *Melipona* bees for their food.

Conclusions

This showed that 61% of citrus producers in the north of Veracruz, Mexico recognize the benefit of the stingless bee as a pollinator of agricultural and forestry crops and identify anthropic and climatic factors as the main factors involved in the process, in turn. Once they highlight the value of medicinal use of honey, as a product of the hive.

The SWOT matrix indicated the first quadrant (Strengths-Opportunities), weighing the value of impacts on a scale of 3. That is, this municipality must use the internal strengths of the area through the use of positive capacities, promote parenting, multiplication and conservation of the stingless bee. In order to take advantage of opportunities and simultaneously mitigate or eliminate the effect of current weaknesses and threats. Likewise, have an impact on the conservation and sustainable management of citrus orchards, emphasizing directly involving farmers in the area in the use of stingless bees for pollination of their crops and the use of agro ecological measures based on non-use of agrochemicals.

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