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Meliponiculture in agroforestry systems in Belterra, Pará, Brazil

Meliponicultura em sistemas agroflorestais em Belterra, Pará

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ABSTRACT

In this study we characterized the honey production in agroforestry systems and inventing the species visited by stingless bees in the region of Belterra, Pará. We used a questionnaire applied to honey producers with questions that addressed socioeconomic conditions and the production of stingless bees, as well the plant species visited by bees. Fifteen percent of bee breeders have meliponiculture as their main economic activity and 54% live of 1 or 2 minimum wages. The time in meliponiculture activity ranges from 2 to over 40 years. According to the interviewees, they dedicate themselves to meliponiculture due to their affinity with the activity and their awareness of the environmental importance of the bees. The greatest obstacles cited was the deforestation and the use of pesticides, which, according to them, implies a reduction in the production of honey, the main product sold. The agroforestry systems (SAFs) where the meliponaries are inserted present, according to the interviewees, 38 forest species distributed in 21 botanical families. Fruit species predominated, characteristics of primary and secondary forest, indicating potential for introduction into agroforestry yards or other intercropped systems, minimizing the costs of implanting and maintaining meliponaries.

Palavras-chave:
Quintais agroflorestais
Pasto meliponícola
Agricultura urbana

RESUMO

O objetivo do estudo foi caracterizar a produção meliponícola em sistemas agroflorestais e realizar um levantamento de espécies vegetais indicadas pela visitação por abelhas sem ferrão no município de Belterra, Pará. A pesquisa foi realizada a partir de um questionário aplicado a meliponicultores com questões que abordaram aspectos socioeconômicos e da produção de abelhas sem ferrão. Em relação ao pasto meliponícola foram investigadas as espécies vegetais apontadas como visitadas pelas abelhas. Destaca-se que 15% dos criadores tem como principal atividade econômica a meliponicultura e 54% vivem com 1 ou 2 salários mínimos. O tempo na atividade de meliponicultura apresenta amplitude de 2 a mais de 40 anos. Os entrevistados afirmaram se dedicarem à meliponicultura pela afinidade com a atividade e pela consciência na importância das abelhas para o meio ambiente. Os meliponicultores apontaram que os maiores entraves enfrentados estão relacionados ao desmatamento e ao uso de agrotóxicos o que, segundo os mesmos, implica na redução na produção do mel, principal produto comercializado. Observou-se que os sistemas agroflorestais (SAFs) onde estão inseridos os meliponários apresentam, segundo os entrevistados, 38 espécies florestais distribuídas em 21 famílias botânicas. Predominaram as espécies frutíferas, características de floresta primária e secundária, o que poderá indicar potencial para introdução em quintais agroflorestais ou outros sistemas consorciados minimizando os custos de implantação e manutenção de meliponários.

INTRODUCTION

The western of Pará has undergone changes in landscapes with the expansion of the agricultural sector, mainly linked to the paving of the Cuiabá-Santarém Federal Highway (BR - 163), one of the main frontiers for the expansion of agribusiness. In the region, as well as in a considerable portion of the Amazonian territory, there was a reduction or suppression of forests, generating the occurrence of mosaics. The mosaics are based on a defined previous itinerary, followed by forest exploitation with clear cutting, burning, and implantation of pastures for breeding animals for slaughter, as

well as the spread of mechanical crops such as soybeans (LOUREIRO; PINTO, 2005; SILVA et al., 2016).

In the area of Belterra, the production system of high technological level provided the rapid growth of production based on monoculture plantations such as rice, corn and soybeans, which negatively affected the landscape of the region, and caused the forest fragmentation (VENTURIERI et al., 2007). In 2010, 6.2% (27,274 ha of planted area) of Belterra territory was occupied by crops, especially monocultures, such as rice, soybeans and corn (DEEPAST, 2020).

The unrestrained expansion is impacting family production systems and has been an obstacle for extractivists and small animal producers, such as bee, that are susceptible to forest fragmentation and intensive use of pesticides (RAYOL; MAIA, 2013). Among the species susceptible to these kind of disturbances, the bees of the Meliponini tribe can nest and forage in anthropized environments, however, they prefer environments with greater plant diversity, availability and diversification of food, being Meliponini tribe more diverse in these environments (WINFREE et al., 2009). In these environments there is a mutualistic relationship, through pollination (collection of nectar and pollen; cross-fertilization) that benefits both bees and plants. Bees and vegetables are intrinsically linked, that is, the loss of pollinating bee species, can lead to the plant species extinction (SANTOS, 2010).

The availability of nesting sites also contribute to maintaining the diversity of bees in areas subjected to human pressure (SILVA et al., 2012). Therefore, the knowledge of the species used as meliponic pasture, plant species that provide nectar and pollen for the maintenance of the colony and production of honey and other derivatives (SILVA; PAZ, 2012), is essential for conservation actions and production of honey and other by-products and services.

Characterizing meliponiculture exercised by breeders in the region of Belterra and provide information is important to support the creation of consortium systems that provide foraging, meliponiculture and multiple use, providing resources for bees with low cost of implantation for producers, also contributing with conservation strategies. Therefore, the present study aimed to characterize honey production in agroforestry systems by conducting a survey of plant species visited by stingless bees in the municipality of Belterra, Pará.

MATERIAL AND METHODS

The study was carried out in the area of Belterra, state of Pará, Brazil, in 13 agroforestry systems. The systems consisted of urban and peri-urban perimeter, that is, the surroundings of the urban area with a predominance of agricultural activities by the residents. We applied semi-structured questionnaires to 13 meliponicultors, owners of the meliponiculture. Ten are located in agroforestry yards, in the urban perimeter, and three in other agroforestry systems located in areas of family farming production, at a distance of at least 5 km from the residence, and adjacent to native forest areas.

As a criterion for data collection, we identified and interviewed the producers that remain exercising the activity of meliponiculture, by handling and extracting the honey or other products and that worked in the central area of the municipality or in the urban perimeter margins.

We adopted the *snowball* methodology (BAILEY, 1994), sampling from January 2017 to January 2018. The questionnaire covered questions about socio-economic profile of honey farmers, survey of honey pasture by the indication of species visited by stingless bee species (SBS) and beekeeping productivity data of SBS (years 2016 and 2017). The challenges and objectives of creating SBS, the technical assistance received and training in the area of meliponiculture were also investigated.

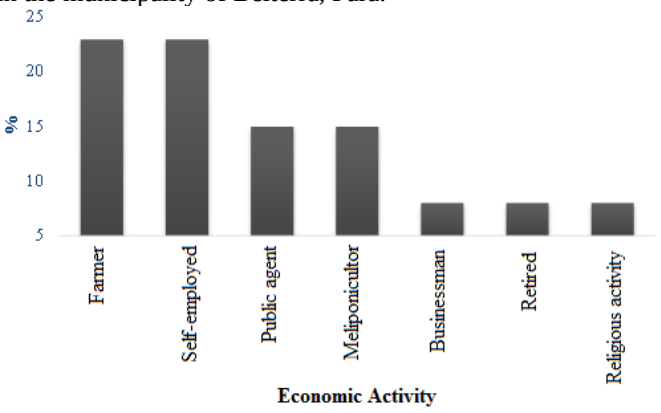
In the section on meliponic pasture, the interviewees pointed out, from personal observations, the popular names of the plant species visited by the SBS. The identification of these species was carried out with the support of technicians from the Federal University of the West of Pará with para-botanical knowledge and extensive experience in botanical identification. Subsequently, we carried out a bibliographic survey of the scientific names of the species, as well as their botanical families and use.

Meliponicultors had previously information about the scientific names of SBS, which were identified by researchers from Embrapa. All interviews read a consent form for the research and signed it. For data analysis, we used descriptive statistics for the quantitative and qualitative interpretation of the results, and identification of central tendency measures.

RESULTS AND DISCUSSION

Among the main economic activities of SBS breeders in the municipality of Belterra - PA, are agriculture (23%) and freelancers (23%) (Figure 1). For 15% of the meliponiculturists in Belterra, meliponiculture is the main economic activity, also verified by Pinto (2012) in a study of the profile of meliponiculturists in Belterra in 2010. Meliponiculture is a complementary activity in many regions of Brazil, and agriculture is in most of the time, the main source of income for honey farmers (MAGALHÃES; VENTURIERI, 2010).

Figure 1. Main sources of income of stingless bee producers in the municipality of Belterra, Pará.



Most meliponicultors (69%) are over 50 years old (Table 1), which corroborates Pinto (2012) and Siqueira (2014) who also found that most meliponiculturists are over 50 years old. We also found that the meliponicultors have been engaged in the activity for more than 10 years (38%), 38% exercise the activity for less than ten years, 8% are in the activity for over 20 years, and two of the largest meliponicultors in numbers of colonies (15%), have been carrying out the activity for more than 40 years. Meliponiculture is a traditional activity in the study region, carried out a long time ago, by the original peoples (RAYOL; MAIA, 2013), which may explain the execution of the activity for more than 40 years by 15% of the interviewees.

Most of the meliponiculturists in Belterra have only elementary (15%) or high school (46%) and 8% higher education. Regarding the monthly family income, 54% receive from 1 to 2 minimum wages, those who receive more than 5 minimum wages (23%) are retired civil servants and traders (Table 1).

Table 1. Socioeconomic profile of stingless bee producers in Belterra, Pará.

	Total respondents	
Variable	N.	%
Age range		
from 30 to 39 years	2	15
from 40 to 49 years	2	15
More than 50 years	9	69
Scholarship		
High school	6	46
Incomplete elementary school	4	31
Complete elementary school	2	15
Higher education	1	8
Family income		
Less than 1 wage	1	8
1 to 2 wages	7	54
2 to 3 wages	1	8
3 to 5 wages	1	8
More than 5 wages	3	23
Gender		
Male	13	100%

Meliponicultors generally inspect the colonies once a week, but some said they were engaged in the activity daily. Pereira et al. (2010) recommend the review of colonies at least every 30 days to check if they are moldy, with the presence of offspring and queen, availability of food, presence of natural enemies and garbage that are indicators of colony health.

Costa et al., (2012), studying meliponiculture practiced in traditional communities of Parintins/AM, observed that the breeders who inspected the colonies at least once a week had stronger and more vigorous colonies than those whose inspection was rare, which they were weak or abandoned their nests.

The creation of SBS generally occurs in line with other activities for 38.5% of the population, such as poultry (80%) or other small animals (20%). Barth (2004) and Costa et al., (2012) affirm that bees can collect material of fecal origin and, therefore, the proximity of the meliponaries to the breeding of small animals, such as poultry and pigs, is not recommended as contamination of the produced honey.

In 69.2% of the properties there is occurrence of native forest in the vicinity of the meliponary, within a radius of approximately 3 km, a determining factor for honey production. According to Silva and Paz (2012), each bee species has a different flight capacity (600 to 2,400 meters) varying according to body size. Although there is native forest in the vicinity of the studied meliponaries, the size of the vegetated areas was not specified here.

According to the producers, 76.9% learned how to manage bees without technical assistance, however, 54% of them participated in courses on SBS creation offered at different events or they looked for courses by themselves.

The majority of respondents (42%) pointed out that they create SBS to obtain products for sale. However, 29% stated that they exercise the activity only as hooby and for 29% the creation of bees aims to obtain honey for their own consumption. In addition, 46% of meliponicultors sell honey, which is the main product sold. When asked about the sale of other products, 43% stated that they sell "*samburá*", "*cerumen*" (29%) and "*propolis*" (28%).

Honey was the first SBS product to be explored by man due to its nutritional and medicinal value, which is why the product is still valued by many populations today (CORTOPASSI-LAURINO et al., 2006; MELO et al, 2010). Gehrke (2010) observed that those producers who practice meliponiculture as a hobby are apt to be effective meliponicultors.

Regarding the breeding stock, 82% of the breeders multiply their colonies to increase production. Of these, 62% sell the new colonies to other producers.

The price of honey is different for species that have recognized medicinal value by the population. In the case of the jataí species (*Tetragonisca* sp.), whose honey is indicated for the treatment of cataracts, its value reaches R$ 200.00 kg^{-1}. SBS honey has anti-inflammatory and healing properties attributed to the habit of collecting resins with medicinal properties. SBS honey also has a different characteristic from that of *Apis melifera*, with no sucrose in its composition (SANTOS, 2010; LIMA and NOGUEIRA, 2017). However, scientific studies with SBS are still very incipient when compared to studies related to *Apis melifera*, as well as the lack of development of appropriate technologies (SILVA and PAZ, 2012; SANTO et al., 2016).

The main problems faced by SBS producers were deforestation, reported by 42% of respondents, and the use of pesticides in the surrounding crops, for 34% of meliponicultors. The impacts of deforestation were studied by Brown and Oliveira (2014) who found in recent studies in the Amazon, a significant relationship between deforestation and the reduction in the richness of stingless bee species, revealing the important to discuss the advances of agribusiness in the region and their impacts on economic activities traditionally performed by the peoples of Belterra.

Freitas and Pinheiro (2010) report that the attractiveness of flowering poisoned by pesticides is the main reason for the death of pollinators (lethal effect). However, even low doses, lower frequencies of use and even flowers affected by the pesticide drift effect, that is, flowers close to the areas of application contaminated by air, can cause side effects reducing the vigor of the colony. According to the authors, in large areas of crops such as soybeans and corn, with a single application of a large amount of pesticides, the impact on bees may be more severe, because of the huge amount of poison released into the environment in a short time.

Meliponiculturists interviewed also cited as challenges the influence of seasonality in production (8%), since flower production is also conditioned by seasonal conditions, and the lack of technical training, pointed out by 4% of producers. All interviewed breeders claim not to receive continuous and permanent technical assistance from government agencies or private institutions, do not market their products with labels and do not have organic certification.

The incipient legislation was reported by 8% of the interviewees as another bottleneck for the consolidation of the activity, while the low availability of places with meliponic pasture that offer security for the installation of colonies was cited 4% of the meliponicultors. The frequent thefts of colonies reported by the interviewees makes impossible to install the

meliponaries in remote areas. The CONAMA resolution No. 346, of June 6, 2004, provides guidelines for the implementation of the activity, although it is necessary laws that regulate the activity at the state level considering regional characteristics.

Barth (2004) pointed out the advance of deforestation, use of pesticides, vandalism in rational creations as challenges to be overcome by meliponiculture. The author also cited as a limiting factor the lack of standardization in production, linked to the limitation in specific legislation for the sector. These obstacles generate discrepancies in the form of collection and packaging of SBS products leading to greater or lesser care, contamination or alteration of the quality of the product and, consequently, loss of credibility in the market.

Agroforestry yards are suitable spaces for the creation of ASF for the safety of the colonies and the possibility of developing the activity together with the family. These spaces form true refuges for pollinators, mainly bees, and the creation of these in agroforestry yards provides important sources of foraging, contributing to the preservation of these species (FERNANDES et al., 2009; IMPERATRIZ-FONSECA *et al*., 2012).

The producers revealed that despite the difficulties encountered in the creation, they are very fond of the activity and do not intend to abandon it. Another determining factor for maintaining the activity for so long is the ecological awareness that the interviewees have, since they all cited the importance of bees for the maintenance of the forest and of the man himself. This conservationist attitude of the breeders was also observed by another study (MEIRELES et al., 2018).

Most producers are owners of the site (84.6%) and 15.4% maintain the beekeeping in partnership with other meliponicultors because they do not have enough pasture on their properties or do not have enough time to inspect the SBS colonies.

We found eight species of stingless bees present in the meliponaries, the most frequent being Jataí, occurring in 10 yards and totaling 49 colonies (Table 2). However, the largest population found was *Scaptotrigrona* sp. with 814 colonies in 8 yards. Species of this genus generally have a good honey production and are easy to handle due to their low defensive behavior (COSTA et al., 2012).

Table 2. Species, occurrence and number and percentage of colonies counted of stingless bee breeding in the urban area of Belterra, Pará.

Popular name	Cientific name	Occurence*	Nº Colonies	% Colonies
"Jataí"	*Tetragonisca angustula*	10	49	5,0
"Canudo"	*Scaptotrigona* aff. xanthotricha	8	814	83,4
"Jandaíra"	*Melipona interrupta*	6	18	1,8
"Cacho de uva"	*Frieseomelitta longipes*	6	36	3,7
"Jataí mirim" or "mosquito"	*Plebeia mínima*	5	27	2,8
"Uruçu amarela"	*Melipona flavolineata*	4	10	1,0
"Uruçu cinzenta"	*Melipona sp*	2	2	0,2
"Uruçu boca de renda"	*Melipona semingra*	2	20	2,0

*Number of yards in which they occur

The products produced from the species of the genus Melipona are widely used by populations, both in food and medicinal use and when well managed, they can have their production optimized for about 1L of honey/colony/year (COSTA et al., 2012).

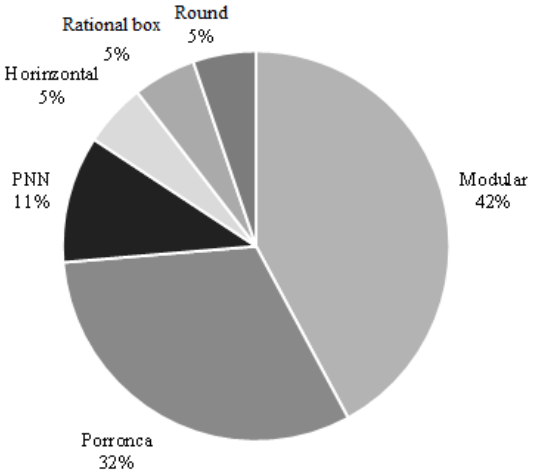
The species *Melipona semininingra* is considered endemic to the Belterra region, according to the survey carried out with the producers. It is a subspecies, which in Belterra has an orange thorax and the first abdominal segment is lighter than the subspecies *M. seminigra perningra* occurring in the eastern portion of the Amazon (VETURIERI, 2009).

The species *Frieseomelitta longipes*, according to local producers, has great potential due to the different flavor of honey, although its colony production is inferior to the "canudo" species, considered as the most productive of the listed species. However, based on the reports from the producers, the "caho de uva" species is identified as the largest producer of propolis. *F. longipes* was identified by Cordeiro and Menezes, (2014) as a good producer of pure resine propolis.

Species of the genus *Scaptotrigona* (Canudo), found in the Belterra region, are largely bred by small farmers in various regions of the country, who even have meliponaries with more than 200 boxes and with a record of productivity above 8 liters/box/ year (LOPES et al., 2005). In the present study, the largest population of "canudo" found corresponded to 300 colonies distributed over an area of 6,250 m2.

The type of modular box was the most frequent among producers (42%), followed by the "Porronca" model, with 32% of the options (Figure 2). There are places where there is more than one box model on the property, therefore, the quantity presented is related to the number of yards that have such models and not to the number of boxes installed in Belterra.

Figure 2. Percentage of option by type of stingless bee box found in the areas of honey producers in Belterra, Pará.



As for the structure of the boxes, the modular one has a nest, over-nest and beehive (Figure 3A and 3B), which presents advantages in the time of the multiplication of the swarms as ease of removal of the brood discs, and separate compartment with the necessary supply for temporary feeding of the new colony. In addition, this type of box is indicated to improve the development of the swarm, increase the production of honey and provide welfare to the bees (LIMA; NOGUEIRA, 2017).

Producers usually test new models of boxes according to the technical and empirical knowledge acquired over the years of creation. Among the new models, the round box stands out (Figure 3C), which is similar to the natural nesting of bees established in the trunk of trees and is in the experimental stage of use.

The "porronca" or "cabocla" (Figure 3D) has a more simplified structure, without compartments, has as the main advantage the possibility of expanding the nest due to the availability of space. However, the producers reported that this model presents difficulty at the time of nest multiplication, since the absence of compartments in the box structure limits the partial removal of the daughter colony without causing damage to the remaining colony.

Figure 3. Modular box (A and B) and round box (C) and "Porronca" (D) models used in Belterra, Pará.

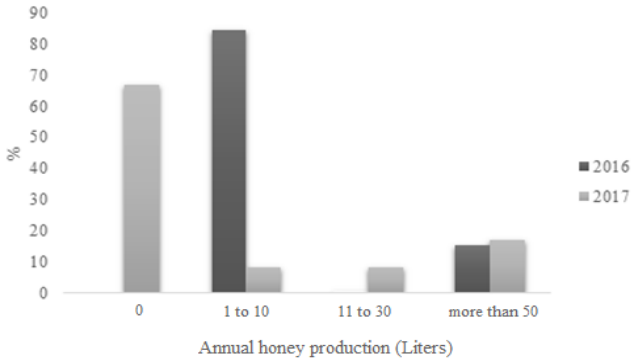
Source: Personal archive, 2017.

The average honey production per colony/year was 3.0 to 3.1 L ± 0.5. According to Maia-Silva et al. (2016) the size of the foraging area directly influences the amount of food sources, on the other hand, botanical varieties are important, as the SBS will be able to choose according to preference.

The honey collection is carried out in the least rainy period of the year, just after the end of the blooms. This product is first removed in containers, then filled in the packaging, usually glass or plastic bottles, and stored in the refrigerator or at room temperature.

Analyzing the honey production in 2016, 34% of the producers extracted 60 to 90 L, and 11% of them extracted 1,000 L in the same period, which may suggest that productivity is related not only to the number of colonies, but also with the availability of meliponic pasture. However, in 2017, the majority (67%) of producers were unable to commercialize honey because the colonies did not produce enough for the harvest and only 17% managed to obtain more than 50 L of production (Figure 4), and of these 23% reported who lost colonies due to the death of bees or abandonment of the colony.

Figure 4. Production of honey from stingless bees by meliponary per year, in the municipality of Belterra, Pará.



Two producers who owned more than one hundred colonies reported that they were giving up the activity with a commercial bias and that they would continue with few boxes due to their affinity with the creation and conservation of these. The reason for the withdrawal reflects the difficulties faced, as the increase in the production of these has come up against the lack of meliponic pasture, since the forest areas in the region

are becoming fragmented and the producers report the death of many swarms.

The analysis of the dynamics in the landscape in Belterra over 13 years, through analysis of satellite images by the Normalized Difference Vegetation Index (NDVI), concluded that there were significant changes in vegetation, mainly due to the increase in anthropized areas, which implies in loss of habitat and resources for various components of fauna, including bees (CORRÊA et al., 2011).

The use of pesticides in the vicinity of the meliponaries has been cited by producers as a preponderant to swarm deaths, becoming yet another obstacle in production, especially in peri-urban areas. In their studies Venturieri (2009) warned that in the medium term, the exploitation of trees with diameters over 50 cm would affect the density of stingless bees, causing low reproduction of tree species intrinsically dependent on these pollinators.

The plant species in the meliponaries and surroundings, identified by the producers as meliponic pasture, were 39 forest species typical of both primary and secondary forest (Table 3). These species belong to 21 different families, some of which are spontaneous and others have been introduced into the system to enrich the vegetation.

The average of plant species present in the meliponarios was approximately 12 species ± 8, with a maximum of 24 species, found in a yard of one hectare, while the lowest riches were found in 3 yards with a size of 2 ha and 0.5 ha.

Table 3. List of species, botanical families and visitation by stingless bee species, according producers in Belterra, Pará.

Popular name	Cientific name	Botanical Family	Use	Visitation by species of SBS**	Flowering period
"Tatapiririca"	*Tatapirira guianensis* Aubl.	Anacardiaceae	Wood Reforestation	All	Jun to Sep
"Cajarana"	*Cambrela canjerana*	Anacardiaceae	Food	Jataí	No information
"Taperebá"	*Spondias mombin* L.	Anacardiaceae	Food	Trigona Jataí	Aug to Nov
Mango	*Mangifera indica* L.	Anacardiaceae	Food	Canudo Jataí	No information
"Sucuuba"	*Himatanthus sucuuba* (Spruce ex Mull. Arg.) Woodson	Apocynaeae	Wood	N.I	Apr to Jul
"Marupá"	*Simarouba sp* Aubl.	Araliaceae	Wood	N.I	No information
"Açaí"	*Eutherpe oleraceae* Mart.	Arecaceae	Food	Jataí Canudo	Feb to May
"Bacaba"	*Oenecarpus bacaba* Mart.	Arecaceae	Food	N.I	Jun to Oct
"Pupunha"	*Bactris gasipaes* (Kunt)	Arecaceae	Food	N.I	No information
"Urucum'	*Bixa orellana* L.	Bixaceae	Food	N.I	No information
"Piquiá"	*Caryocar brasiliensis* (Aubl.) Pers.	Caryocaraceae	Wood Food	N.I	Aug to Oct
"Pau ferro"	*Libidibia férrea* (Mart. Ex Tul.)	Fabaceae	Wood	Jataí	No information
"Cumaru"	*Dipteryx odorata* (Aubl.) Wild.	Fabaceae	Wood Seeds Oil	N.I	Feb to Mar
"Tachi preto"	*Tachigalia paniculata* Aubl.	Fabaceae	Buildings	N.I	Dec a Feb
"Tachi branco"	*Tachigalia paraenses* (Huber) Barneby	Fabaceae	Energy RDA*	N.I	Jun to Sep
"Ingazeiro"	*Inga sp*	Fabaceae	Food	N.I	No information
"Uchi"	*Endopleura uchi* (Huber) Cuatrec.	Humiriaceae	Wood Food	N.I	Jul to Nov
"Louro"	*Laurus nobillis* L.	Lauraceae	No information	N.I	No information
Avocado tree	*Persea americana*	Lauraceae	Food	Frisiomelita	No information
"Castanha do Pará"	*Bertholethia excelsa* Bonpl.	Lecythidaceae	Food	Solitárias	Sep to Dec
"Fava de espinho"	*Não identificado*	Lecythidaceae	RDA	N.I	No information
"Muruci da mata"	*Não identificado*	Malpighiaceae	RDA	N.I	No information
"Murucizeiro"	*Byrsonima crassifólia* ((L.) Rich.)	Malpighiaceae	Food	N.I	No information

"Cupuaçu"	*Theobroma grandiflorum* (Willd. ex Spreng.) Schum.	Malvaceae	Food	Plebeia	No information
"Canela de velho"	*Miconia albicans* (Sw.) Triana	Melastomataceae	RDA Medicinal	N.I	No information
"Andiroba"	*Carapa guianensis* Aubl.	Meliaceae	Oil, seeds	N.I	Aug to Sep
"Jaqueira"	*Artocarpus heterophyllus* Lam.	Moraceae	Food	N.I	No information
Banana tree	*Musa spp* L.	Musaceae	Food	N.I	No information
"Murta"	*Myrtus spp* L.	Myrtaceae	Medicinal	N.I	No information
"Jambo"	*Syzygium jambos* (L.) Auston	Myrtaceae	Food	N.I	No information
"Araçá"	*Psidium cattleianum* Sabine	Myrtaceae	Food	N.I	No information
"Princesa da Amazônia"	*Não identificado*	Não identificado	No information	All	No information
"Pau fumaça"	*Não identificado*	Não identificado	RDA	All	No information
"Preciosa"	*Não identificado*	Não identificado	Food	All	No information
"Limão caiano"	*Averrhoa bilimbi* L.	Oxalidaceae	Food	Jataí	No information
"Limoeiro"	*Citrus limon* (L.) Burm.	Rutaceae	Food	Jataí	No information
"Rambutã"	*Nephelium lappaceum* L.	Sapindaceae	Food	N.I	No information
Non-identified	*Não identificado*	Melastomataceae	RDA	N.I	No information

* Recovery of Degraded Areas ** N.I – Non-Identified - there was no information about the stingless bee species

Table 3 shows the number of species with potential for multiple uses, which can reduce the costs of implementing the systems for producers, since the diversification of products with the potential to be commercialized can allow a faster financial return. Eighteen fruit species with food use are visited by SBS in Belterra which may indicate great potential for introduction in agroforestry yards or other intercropped systems minimizing the costs of implementation and maintenance. This diversity of species was also observed in the region by other authors (SILVA; RAYOL, 2016). The number of plant species visited by SBS in the Amazon region is high due to the coevolution of plant species with SBS, since native bees are better adapted to the pollination of native plant species.

Barth (2004) found that in the North Region, specifically in the State of Pará, the most commonly visited genera, species and families were *Artocarpus*, *Bellucia*, *Carica*, *Cassia*, *Cocos*, *Leucaena*, *Maximiliana*, *Miconia*, *Myrtaceae*, *Stachytarpheta* and *Triplaris*, *Protium*, besides *Caesalpiniaceae*, *Mimosa pudica* and *Tapirira guianensis*. *Protium*, *Borreria*, *Cassia*, *Cecropia*, *Eugenia*, *Miconia*, *Mimosa scabrella*, *Tapirira* and *Vismia* prevail in the city of Manaus.

Species such as "tatapiririca" and "cajueiro", representatives of the genera *Anacardium* and *Tatapira*, were indicated by the producers as one of the favorites by bees, with a great abundance of individuals in these species being observed during the flowering period. According to Fernandes et al. (2012), the great abundance and diversity of floral visitors in the "Tatapiririca" flowers, occur due to the high bee potential of this species, which offers pollen and nectar in volume and concentration of solutes attracting small insects.

The Jataí bee species, with the highest occurrence in the studied backyards, was defined by Cortopassi-Laurino (1982) as an eclectic species in floral visitation, while Knoll (1990) reports that the species has a preference for the Euphorbiaceae family.

Families such as Anacardiaceae, Caesalpiniaceae, Oxalydaceae, Rutaceae and Sapotaceae, may have their species visited to collect nectar and pollen (CARVALHO et al., 1995). In the interviews, the following representatives of these families were identified, respectively: "tatapiririca", "cajarana", "taperebá" and mango; no representative of the Caesalpiniaceae and Sapotaceae families and "limão caiano" were mentioned.

Maués et al. (1996) highlight that, for species such as "cupuaçu" and "cacao", there is a very high flowering concerning to the number of fruits, called "Insect gratification syndrome", an example of mutualism and coevolution, given that, there is greater pollination intensity of the plant and greater availability of resources for the insect, benefiting both.

When performing melissopalinological analyzes on species of the genus *Melipona* and *Trigona*, in forest fragments in Manaus, Oliveira et al. (2009) found that the families most visited by bees were: Caesalpiniaceae, Fabaceae, Mimosaceae, Myrtaceae, and the family with the highest frequency of visits was Melastomastaceae. Likewise, in Belterra, the interviewees also mentioned that the above mentioned botanical families are visited by bees of the genera *Melipona* and *Trigona*.

Five species of the Fabaceae family were cited by honey farmers as visited by the SBS, empirically characterizing the group with the highest frequency of species. This fact was also cited by Oliveira et al. (2009) for visitation by bees in Manaus, Amazonas.

CONCLUSIONS

Meliponiculture in the municipality of Belterra is an activity adopted by affinity and environmental commitment of the beekeepers, predominantly as an income supplement,

exercised for a long time, by experienced people and with honey as their main commercialized product.

The maintenance of meliponaries implies constant dedication carried out in line with other work activities, without having continuous technical assistance and having as main threat the deforestation and the application of pesticides, implying the indication of agroforestry yards as the best option for the development of the activity.

Fruit-bearing plant species were indicated as predominant by honey farmers, characteristics of primary and secondary forest, indicating the potential for introduction into agroforestry yards or other intercropped systems, minimizing the costs of implanting and maintaining meliponaries.

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