ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 11, Issue, 03, pp.45603-45607, March, 2021
https://doi.org/10.37118/ijdr.21392.03.2021

RESEARCH ARTICLE OPEN ACCESS

NON-CULTIVATED PLANTS WITH POTENTIAL FOR MELIPONICULTURE IN ORGANIC AGROECOSYSTEM IN THE MOUNTAIN REGION OF THE STATE OF ESPÍRITO SANTO

Eduardo Antonio Ferreira[1]; Silvério De Paiva Freitas[2]; Otávio Henrique Silva Bandeira[3]; Paula De Souza São Thiago Calaça[4]; Marcus Vinicius Sandoval Paixão[5]; Kamilla Ingred Castelan Vieira[6] and Andreia Duim Ferreira[7]

[1]IFES Campus Santa Teresa; [2]UENF; [3]FUNED; [4]FUNED; [5]IFES Campus Santa Teresa; [6]FUNED; [7]MBML

ARTICLE INFO

Article History:
Received 07th January, 2021
Received in revised form
29th January, 2021
Accepted 26th February, 2021
Published online 30th March, 2021

Key Words:
Non-cultivated plants. Pollination. *Tetragoniscaangustula.*

Corresponding author:
Eduardo Antonio Ferreira,

ABSTRACT

Non-cultivated plants that produce nectar and pollen, are already seen as important sources of food for bees, supporting the development of beekeeping and meliponiculture. Stingless indigenous bees are fundamental to ecosystems, considering their efficiency as pollinators. The objective was to identify the main botanical species of non-cultivated plants explored during the foraging of meliponines, during the four climatic seasons of the year, and the capacity of the Jataí bee (*Tetragoniscaangustula*), as pollinator of these plants. The study was conducted on a family farm in an organic system, in the Central Mountain Region of the State of Espírito Santo, in the municipality of Santa Maria de Jetibá. The methodology used consisted of going through the planting area of the property to observe, photograph and collect non-cultivated plants that were in bloom and visited by Jataí bees. The species selected for the development of the experiment was the Jataí bee, because it is characterized by its small size and because it is a species of natural occurrence in the region. Five INPA vertical standard vertical boxes were installed on the rural property, installed in the center of the cultivation area, in a covered shed, on a wooden shelf, with evaluations during the four climatic seasons of the year. The collections of flowers of the species of non-cultivated plants of the occasion were carried out, as well as samples of flower buds and flowers in anthesis to prepare a mini herbarium, in order to meet the recognition of these plant species. In all climatic seasons of the year, the foraging of Jataí bees was observed in the reported non-cultivated plant species, with a predominance of the Asteraceae family, as well as the predominant habit of herbaceous plants. Foraging occurred in greater quantities, in non-cultivated plant species that bloomed in the autumn climatic season, followed by summer, winter and spring.

Citation: ***Eduardo Antonio Ferreira; Silvério De Paiva Freitas; Otávio Henrique Silva Bandeira; Paula De Souza São Thiago Calaça; Marcus Vinicius Sandoval Paixão; Kamilla Ingred Castelan Vieira and Andreia Duim Ferreira,*** **2021.** "Non-cultivated plants with potential for meliponiculture in organic agroecosystem in the mountain region of the state of espírito santo", *International Journal of Development Research*, 11, (03), 45603-45607.

INTRODUCTION

In organic production systems, the presence of weeds and cultivated species greatly contributes to the provision of diverse floral resources throughout the year for stingless indigenous bees, also known as Meliponini (FERREIRA et al., 2020). However, the practice of intensive control in the most critical period of interference prevention with clearings or weeds, despite having great importance for agricultural production, can cause damage to stingless indigenous bees due to the reduction of their bee pasture (FERREIRA et al., 2020). The creation of these species of indigenous stingless bees, also known as meliponiculture, has been increasingly disseminated in organic agrosystems.

This activity has a low cost compared to other agricultural activities, it is undemanding in space and work, in addition to providing by-products such as honey, being profitable in the short and medium term, and they are an alternative for the conservation of agro-ecosystems (STOLZENBERG, 2012). In addition, these native bees are known to be the most important pollinator group of flowering plants in the neotropics (RAMALHO, 2004). For api¬culture (rational breeding of *Apis mellifera* bees) and meliponiculture (rational breeding of indigenous stingless bees), knowledge of the apicultural flora provides verification of the particularities of the ecosystems in which these activities are carried out, establishing productive potential and defining the management possibilities, considering that the variability of flora allows for sustainable and

profitable beekeeping or meliponiculture (MARQUES et al., 2011). Meliponiculture is a promising activity that has been gaining increasing space in agricultural activity. This sustainable activity has repercussions on the income generation of the producer, standing out as an important factor of social inclusion, enabling an alternative of family income from its products in addition to the beneficial effects of pollination carried out by bees (BUSTAMANTE et al., 2012; BARBIÉRI & FRANCOY, 2020). The great diversity of botanical species in the bee pasture, becomes fundamental for the development of meliponiculture, supplying the necessary products for the development of the colony (IMPERATRIZ-FONSECA, 2012). The relationship between bees and plants can be made through the analysis of pollen transported or that stored in brood cells or in pots of food (OLIVEIRA; ABSY; MIRANDA, 2009). This research was carried out with the objective of identifying the main botanical species of non-cultivated plants, explored as a pollen source during the foraging of Jataí bees (*Tetragoniscaangustula*), in the four climatic seasons of the year in an organic agroecosystem of the Central Mountain Region of the State of Espírito Santo.

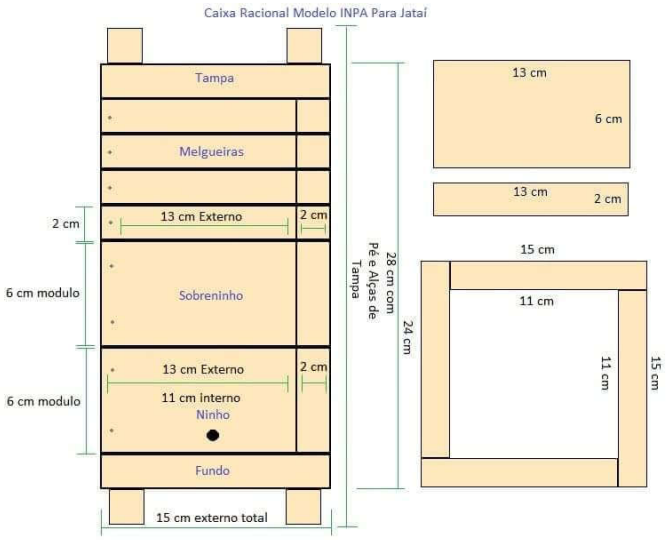
MATERIAL AND METHODS

The study was conducted on a family farm in an organic system, in the Central Mountain Region of the State of Espírito Santo, in the municipality of Santa Maria de Jetibá, District of Rio Possmoser, community of Alto Santa Maria (20°07'48"S, 40°50'13"W) with an average altitude of 944 meters. The climate of the region is classified as humid temperate, with dry winter and hot summer, Cwa, according to the classification of Köppen (ALVARES et al., 2013). The property was selected because it stands out in horticulture, in the diversified cultivation of vegetables, several species of fruit trees, medicinal, seasoning and aromatic plants, as well as preserved forest totaling an area of 5 hectares. The meliponine species selected for the development of the experiment was the Jataí bee (*Tetragoniscaangustula*) (Figure 1), as it occurs naturally in the different ecosystems of the State of Espírito Santo and its management is well known.

Source: Author's photo

Figure 1. Photoof Jataí bee (Tetragoniscaangustula)

In the rural property, five vertical standard rational type INPA (National Institute of Amazonian Research) boxes were placed, indicated for the management of the creation of the Jataí bee, with the following compositions and dimensions; Base Nest (12 cm / length x 12 cm / width x 6 cm / height), 1st Upper Nest (12 cm / length x 12 cm / width x 6 cm / height), 2nd Upper Nest (12 cm / length x 12 cm / width x 6 cm / height), 1st Honey Box (12 cm / length x 12 cm / width x 5 cm / height), 2nd Honey Box (12 cm / length x 12 cm / width x 5 cm / height), Lid (17 cm / length x 17 cm / width x 2.5 cm / height) and wood thickness of 2.5 cm (Figure 2). The boxes were installed in the center of the cultivation area, in a covered shed, arranged on a wooden shelf, 1.5 meters from the surface, with a distance of 0.5 meters between the boxes (Figure 3).



Source: INPA

Figure 2. Rational standard INPA model box for Jataí bees (*Tetragoniscaangustula*), used in the study

Source: Ferreira (2019).

Figure 3. Arrangement of the five boxes of Jataí bees (*Tetragoniscaangustula*), in the experimental meliponary installed in Santa Maria de Jetibá, ES

The botanical collection was carried out for one year, with a bimonthly frequency, between the months of March 2019 and March 2020, covering the four seasons of the year, on the following dates: 29/03/2019 and 16/05/2019, 11 / 07/07 and 08/22/2019, 10/10/2019 and 10/12/2019, 01/30/2020 and 03/18/2020. In all, we performed eight collections during the experimental period, two per season, every 45 days on average, always in the morning period from 8:00 am to 12:00 pm, obeying the time of greatest foraging of the species.
The collection was carried out with the help of pruning shears for low vegetation and high pruning shears ("Podão") for taller vegetation. Photo documentation and registration in the field book of aspects of each plant such as habit and color of the flowers, among others, were made. The collections of flowers of the species of non-cultivated plants of the occasion were carried out, as well as samples of flower buds and flowers in anthesis, to prepare a mini herbarium, in order to meet the recognition of these plant species. The collected plants were pressed and dried in an oven at the Ecology and Botany Laboratory of the Federal Institute of Espírito Santo (IFES) - Campus Santa Teresa, to be dehydrated for 3 days at 60°C. After drying, the botanical materials were identified and registered with an official registration number, by specialists in the field of botany in the collection of the Herbarium of the Mello Leitão Biology Museum (MBML), a federal government agency that operates in the area of natural sciences and in the botany. The Herbarium of theMello Leitão Biology Museum, founded in the 50s, is one of the most relevant in the country on the flora of Espírito Santo. Currently totaling 54,354 specimens in its collection. The work of digitizing the exsiccates was carried out

under the guidance of the Herbarium manager and following the Manual for Orientation of Digitization of Exsiccates elaborated by scholars of the herbarium. The exsiccates were registered in the MBML collection. In the same way, the identification of these non-cultivated plant species was made, in relation to the habit and classification of these plants in terms of size (m), with the highest occurrence being evaluated during the entire period of material collection, in the experiment area. They were collected; herbs (herbaceous), climbing plants, bushes and trees (arboreal) with some subcategories and lianas (vine). Classified as herb (herbaceous), plants with size equal to or less than 1.00 m, being plants in which all the stems and leaves above the surface of the soil, die at the end of a season, and may be annual, biannual or perennial, because there may be living components that remain in the soil, such as rhizomes or bulbs. Climbing plant, is a plant with elongated and fragile stems, which are usually supported by a substrate that serve as support, for its growth, curling on this surface, whether through tendrils (metamorphosed leaves, which serve as fixation), or because they cling to the roots.

Chart 1. Classification of plants in terms of size in meters

Classification	Size (m)
Herb	<1.00
Sub-bush	1.00 – 2.00
Bush	2.00 – 4.00
Tree	>4.00
Liana	Vines

Source: Nordi& Barreto, 2016.

The climbing plants can be annual or perennial, herbaceous or woody. Bush, it is a woody and perennial plant, there are many main stems that are born at the height of the soil, height ranging between 2.00 – 4.00 m. Sub-bush, this subcategory varies between 1.00 – 2.00 m. A tree is characterized by being a woody plant, generally tall and perennial, with a main stem, called the trunk, which grows from the height of the ground, the trees are characterized by heights equal to or greater than 4,00 m. Liana, is characterized by being a perennial and woody climbing plant. Regarding the collected plants, the classification was made as to size (m), according to Nordi& Barreto (2016, p.72) (Chart 1).

cultivated species with 32.2% of the 59 non-cultivated species, followed by Fabaceae (11.9%), Amaranthaceae, Convolvulaceae, Rosaceae and Solanaceae with 5.1% each, Lamiaceae, Verbenaceae, Malpighiaceae and Melastomataceae with 3.4% each, Oxalidaceae, Euphorbiaceae, Flacourtiaceae, Loranthaceae, Onagraceae, Myrtaceae, Phytolaccaceae, Malvaceae, Vitaceae, Liliaceae, Anacardiacee, and Passifloraceae (1.7%). First autumn collection (29/March/2019), ten non-cultivated plant species were collected and in the second autumn collection (16/May/2019), ten non-cultivated plant species, totaling twenty plants, duly registered at the Mello Leitão Biology Museum (MBML) (Table 2). In the first winter collection (11/July/2019), nine non-cultivated plant species were collected and in the second winter collection (22/August/2019), six non-cultivated plant species, totaling fifteen plants (Table 3). It is also worth mentioning that there are species of non-cultivated plants that have their floral period on occasions of prolonged drought, severe winters, such as the Assa-peixe*Vernonanthurapolyanthes* (Spreng.) AJVega&Dematt., Café do mato - *Casearia sylvestris*Sw., Caiçoba - *Erechtitesvalerianifolius* (Link exSpreng.) DC., And others, which can be important sources of pollen for bees. For this, studies evaluating the pollen carried by bees in their corbicles when entering their nests, can be an important way of determining the main plants that are used in the diet of bees throughout the year. In the first spring collection (10/October/2019), three non-cultivated plant species were collected and in the second collection (10/December/2019), five non-cultivated plant species, totaling eight plants (Table 4). First summer collection (30/January/2020), six non-cultivated plant species were collected and in the second summer collection (18/March/2020), ten non-cultivated plant species, totaling sixteen plants (Table 5). Considering the four seasons of the year, we can observe a number of 20 species of vegetables not cultivated in the fall, 15 in the winter, 8 in the spring and 16 in the summer (Graph 1). In the period from December/2019 to March/2020 (summer), high rainfall occurred in the State of Espírito Santo, mainly in the mountainous regions, in the location of the experiment, a fact that caused a smaller number of plant species with flowers, but good results are observed foraging rates of Jataí bees, in the same period (Graph 1). In relation to the plant's habit, it was observed the occurrence and its respective percentages, according to Table 6.

Table 1. Number and percentage of non-cultivated plant species in each botanical family, available to bees in melitophilous pasture of an organic agroecosystem in the mountain region of the State of Espírito Santo, municipality of Santa Maria de Jetibá

Family	Number of Species	%
Asteraceae	19	32.2
Fabaceae	7	11.9
Amaranthaceae	3	5.1
Convolvulaceae	3	5.1
Rosaceae	3	5.1
Solanaceae	3	5.1
Lamiaceae	2	3.4
Verbenaceae	2	3.4
Malpighiaceae	2	3.4
Melastomataceae	2	3.4
Oxalidaceae	1	1.7
Euphorbiaceae	1	1.7
Flacourtiaceae	1	1.7
Loranthaceae	1	1.7
Onagraceae	1	1.7
Myrtaceae	1	1.7
Phytolaccaceae	1	1.7
Malvaceae	1	1.7
Vitaceae	1	1.7
Liliaceae	1	1.7
Anacardiaceae	1	1.7
Passifloraceae	1	1.7
Cucurbitaceae	1	1.7

RESULTS AND DISCUSSION

Among all the botanical species collected, a total of 59 non-cultivated plant species were collected, belonging to 23 botanical families (Table 1). The Asteraceae family had the highest number of

The importance of bees to humanity is undeniable. Through their pollination services, they contribute ecologically and economically to humanity (OLIVEIRA, 2015) in this context, the Jataí bee, which actively participates in the pollination of various non-cultivated plant species.

Table 2. Non-cultivated plant species visited by Jataí bees (*Tetragoniscaangustula*), obtained from two collections in autumn 2019

MBML Register	Season	Popular Name	ScientificName	PlantHabit	Family
54020	Fall 1	Trevinho	*Oxalislatifolia*Kunth	Herbaceous	Oxalidaceae
54019	Fall1	Apaga fogo, corrente	*Alternantheratenella*Colla	Herbaceous	Amaranthaceae
54022	Fall1	Picão	*Bidens alba* DC.	Herbaceous	Asteraceae
54012	Fall1	Amendoim de grama	*Desmodium tortuosum* (Sw.) DC.	Herbaceous	Leguminosae/Faboideae
54013	Fall1	Roxinha	*Hyptisbrevipes*Poit.	Herbaceous	Lamiaceae
54023	Fall1	Galisoba	*Galinsogaquadriradiata*Ruiz &Pav.	Herbaceous	Asteraceae
54024	Fall1	Branquinha	*Verbena bonariensis* L.	Sub-bush	Verbenaceae
54011	Fall1	Carrapicho duas pontas	*Blainvillea biaristata* DC.	Herbaceous	Asteraceae
54007	Fall1	Lanterninha	*Lantanacamara*DC.	Herbaceous	Verbenaceae
54025	Fall1	Agrião do mato	*Acmellabrachyglossa*Cass.	Herbaceous	Asteraceae
54068	Fall2	Fedegoso	*Senna occidentalis*(L.) Link.	Bush	Leguminosae/Caesalpinioideae
54054	Fall2	Carvão branco	*Croton glandulosus*L.	Herbaceous	Euphorbiaceae
54067	Fall2	Erva macaé	*Leonurus japonicus*	Herbaceous	Lamiaceae
54065	Fall2	Ipoméia	*Ipomoeaaristolochiifolia*G. Don	Climbingplant	Convolvulaceae
54051	Fall2	No name	*Chromolaenalaevigata*(Lam.) R.M. Kinge& H. Rob.	Bush	Asteraceae
54053	Fall2	No name	*No identification*	Herbaceous	Asteraceae
54052	Fall2	Amora do mato	*Rubus brasiliensis*Martius	Sub-bush	Rosaceae
No register	Fall2	Amaranto	*Amaranthus sp.*	Herbaceous	Amaranthaceae
No register	Fall2	Quintilho,	*Nicandraphysalodes*(L.)	Herbaceous	Solanaceae
No register	Fall2	Picão	*Bidens pilosa* (L.)	Herbaceous	Asteraceae

Source: Author's data

Table 3. Non-cultivated plant species visited by Jataí bees (*Tetragoniscaangustula*), obtained from two collections in the winter of 2019

MBML Register	Season	Popular Name	ScientificName	PlantHabit	Family
54347	Winter 1	Dormideira	*Chamaecristanictitans*Moench	Herbaceous	Leguminosae / Caesalpinioideae
54346	Winter 1	Amaranto	*Alternanthera sp.*	Herbaceous	Amaranthaceae
54348	Winter 1	Assa-peixe	*Vernonanthurapolyanthes*(Spreng.)A.J.Vega&Dematt	Bush	Asteraceae
54343	Winter1	No name	*Mikania sp.*	Climbingplant	Asteraceae
54349	Winter1	Arnica	*Lychnophoraerioides*Mart.	Herbaceous	Asteraceae
54341	Winter 1	Ingá	*Ingamarginata*Wild.	Arboreal	Leguminosae / Mimosoideae
54340	Winter 1	Café do mato	*Casearia sylvestris*Sw.	Arboreal	Flacourtiaceae
54336	Winter 1	Assa-peixe branco	*Solanumsanctae-catharinae*Dunal	Arboreal	Solanaceae
54337	Winter1	Artemisia	*Artemisiavulgaris*L.	Herbaceous	Asteraceae
54338	Winter2	Jurubeba do mato	*Solanum paniculatum*L.	Bush	Solanaceae
54342	Winter 2	Maria mole	*Senecio brasiliensis* (Spreng.) Less.	Herbaceous	Asteraceae
54350	Winter 2	Macela	*Achyroclinesatureioides*(Lam.) DC.	Herbaceous	Asteraceae
54351	Winter 2	Capiçoba	*Erechtitesvalerianifolius*(Link exSpreng.) DC.	Herbaceous	Asteraceae
54344	Winter2	No name	*No identification*	Climbingplant	Malpighiaceae
54298	Winter2	Cipó cabeludo	*Mikaniahirsutissima*DC.	Liana	Asteraceae

Source: Author's data

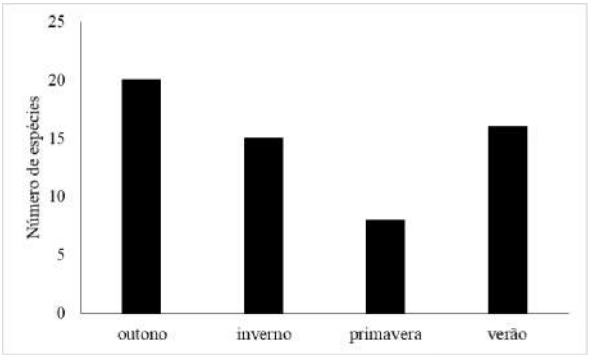
Table 4. Non-cultivated species visited by Jataí bees (*Tetragoniscaangustula*), obtained from two collections in the spring of 2019

MBML Register	Season	Popular Name	ScientificName	PlantHabit	Family
54354	Spring 1	Erva de passarinho	*Struthanthusflexicaulis*	BushHemiparasite	Loranthaceae
54345	Spring 1	Margarida do mato	*Leptostelmamaximum*D. Don.	Herbaceous	Asteraceae
54353	Spring 1	No name	*Ludwigia sp.*	Herbaceous	Onagraceae
54302	Spring 2	No name	*S/ identificação*	Herbaceous	Melastomataceae
54356	Spring2	Araçá	*Psidium sp.*	Bush	Myrtaceae
54303	Spring 2	Carirú	*Phytolaccathyrsiflora*FenzlexJ.A.Schmidt	Herbaceous	Phytolaccaceae
54300	Spring2	Maracujá do mato	*Passiflora sp.*	Climbingplant	Passifloraceae
54301	Spring 2	No name	*No identification*	Climbingplant	Malpighiaceae

Source: Author's data

Table 5. Non-cultivated species visited by Jataí bees (*Tetragoniscaangustula*), obtained from two collections in summer 2020

MBML Register	Season	Popular Name	ScientificName	PlantHabit	Family
54299	Summer 1	Mata pasto, Vassourinha	*Sida rhombifolia*L.	Herbaceous	Malvaceae
54339	Summer 1	Amorinha	*Rubusurticifolius*Poiret	Sub-bush	Rosaceae
54355	Summer 1	Uva do mato	*Cissus cf. verticillata (L.) Nicholson & C. E. Jarvis*	Climbingplant	Vitaceae
54304	Summer 1	Braúna branca	*Sena sp.*	Arboreal	Leguminosae/Caesalpinioideae
No register	Summer 1	Lírio	*LiliumalexandraeCouts*	Herbaceous	Liliaceae
54352	Summer 1	Camará	*Moquiniastrumpolimorphum*(Less.) G.Sancho	Arboreal	Asteraceae
54326	Summer 2	Calumbí	*Senegalia sp.*	Bush	Leguminosae/Mimosoideae
54327	Summer 2	Aroeira do mato	*Schinusterebinthifolius*Raddi	Arboreal	Anacardiaceae
54328	Summer 2	Quaresmeira	*Pleroma sp.*	Arboreal	Melastomataceae
54329	Summer 2	Ipoméia azul	*Ipomea sp.*	Climbingplant	Convolvulaceae
54330	Summer 2	Canela de velho	*Austroeupatorium sp.*	Arboreal	Asteraceae
54331	Summer 2	Ipoméia rósea	*Ipomea sp.*	Climbingplant	Convolvulaceae
54332	Summer 2	S/ nome	*Mimosa sp.*	Sub-bush	Leguminosae/Mimosoideae
54333	Summer 2	Alecrim do mato	*Baccharis cf. semiserrata*DC.	Bush	Asteraceae
54334	Summer 2	Amora do mato	*Rubus* cf.*urticifolius*Poiret	Sub-bush	Rosaceae
54335	Summer 2	Melão de São Caetano	*Momordicacharantia*L.	Climbingplant	Cucurbitaceae



Source: Author's data

Graph 1. Number of non-cultivated plant species collected in the seasons

Table 6. Habit of the plant/classification/size, number of occurrence and percentage of non-cultivated plants visited by Jataí bees (*Tetragoniscaangustula*), according to the family, collected in the four climatic seasons of the year

Habit of the plant/classification/size	Number of occurrence	Percentage (%)
Herbaceous	28	47.5
Climbingplant	9	15.3
Arboreal	8	13.6
Bush	8	13.6
Sub-bush	5	8.5
Liana	1	1.7

The creation of indigenous stingless bees, with meliponiculture as an activity, adds to the good practices adopted in an organic production agro-ecosystem. In organic agro-ecosystem, poisons are not used in plantations, undesirable (harmful) plants are also partially controlled, practices that signal a perfect partnership of these two activities. The use of the flowering of these plant species will greatly contribute to the development of bees managed in the same area. Non-cultivated vegetable species that appear spontaneously in the cultivated areas, many with melitophilic characteristics, contributing to the colonies of bees in their strengthening and production of honey and pollen. Another important point is the pollination of flowers, ensuring quality production in the species of cultivated vegetables (shape and size of fruits), as well as their valorization in commercialization, not to mention the production of seeds, originating from the act of pollination of flowers, guaranteeing the perpetuation of these plant species. Salis et al. (2015), evaluating the floral calendar of native honey plants in the Pantanal, in the State of Mato Grosso do Sul, concluded that the invasive plants have great potential as a honey flora. Kiill et al. (2000) found the presence of native bees visiting invasive flowers in areas cultivated with fruit trees in northeastern Brazil. These species, together with native plants, are part of the diet of these bees especially in the dry season, when food sources are reduced, making invasive plants species of great importance in the foraging of bees.

CONCLUSION

Among the non-cultivated plants that we collected, the species of the Asteraceae family were the most abundant, showing the predominance of these in the bee pasture available to bees throughout the year.

The habit of most non-cultivated species in organic agrosystems was herbaceous, which was observed in all climatic seasons of the year. This type of study is an important tool for organic agro-ecosystems that include bees in their cultivation areas.

REFERENCES

ALVARES, C.A., STAPE, J.L., SENTELHAS, P.C., GONÇALVES, J.L.M. & SPAROVEK, G. Köppen's climate classification map for Brazil. Meteorologische Zeitschrift, v.22, n.6, p.711-728, 2013.

BARBIÉRI, C.; FRANCOY, T.M. Theoretical model for interdisciplinary analysis of human activities: Meliponiculture as an activity that promotes sustainability. Ambiente & Sociedade. v. 23. 2020.

BUSTAMANTE, N.C.R.; LOPES-FERREIRA, M.C.; BARBOSA-COSTA, K. Introduzindo a Meliponicultura nos assentamentos rurais do Amazonas 19º Congresso Brasileiro de Apicultura e 5º Congresso Brasileiro de Meliponicultura, Anais..., Gramado, RS, p. 94, 2012.

FERREIRA, E. A.; FREITAS, S. P.; BANDEIRA, O. H. S.; CALAÇA, P. S. S. T.; PAIXÃO, M. V. S.L; VIEIRA, K. I. C. Plantas cultivadas com potencial para meliponicultura em agroecossistema orgânico na região serrana do Estado do Espírito Santo. Brazilian Journal of Development, Curitiba, v.6, n.11, p.88134-88144, 2020.

IMPERATRIZ-FONSECA, V.L. Meliponicultura e clima. 19º Congresso Brasileiro de Apicultura e 5º Congresso Brasileiro de Meliponicultura, Anais..., Gramado, RS, p.108, 2012.

KIILL, L.H.P.; HAJI, F.N.P.; LIMA, P.C.F. Visitantes florais de plantas invasoras de áreas com fruteiras irrigadas.ScientiaAgricola, v.57, n.3, p.575-580, 2000.

MARQUES, L. J. P. et al. Levantamento da flora apícola em Santa Luzia do Paruá, Sudoeste da Amazônia, Maranhão. Acta Botânica Brasílica, v. 25, n. 1, p. 141-149, 2011.

NORDI, J. C.; BARRETO, L. M. R. C. Flora Apícola e Polinização. Taubaté: Cabral Universitária, 2016. 79p.

OLIVEIRA F. P. M.; ABSY, M. L.; MIRANDA, I. S. Recurso polínico coletado por abelhas sem ferrão (Apidae, Meliponinae) em um fragmento de floresta na região de Manaus-Amazonas. Acta Amazonica, v. 39, n. 3, p. 505-518, 2009.

OLIVEIRA, M. O. Declínio populacional das abelhas polinizadoras de culturas agrícolas. ACTA Apicola Brasilica, v.3, n.2, p.01, 2015.

RAMALHO M. 2004. Stingless bees and mass flowering trees in the canopy of AtlanticForest: a tight relationship. Acta BotanicaBrasilica, v.18, p.37–47.

SALIS, S.M.; JESUS, E.M. de; REIS, V.D.A. dos; ALMEIDA, A.M. de; PADILHA, D.R.C. Calendário floral de plantas melíferas nativas da Borda Oeste do Pantanal no Estado do Mato Grosso do Sul. Pesquisa Agropecuária Brasileira, v.50, n.10, p.861-870, 2015.

STOLZENBERG, V. Ninhos de abelhas sem ferrão (Hymenoptera, Apoidea) Eussociais em centros urbanos – Ocorrência em Porto Alegre. 19º Congresso Brasileiro de Apicultura e 5º Congresso Brasileiro de Meliponicultura, Anais..., Gramado, RS, p. 109, 2012.

****