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BEEKEEPING CALENDAR OF THE FABACEAE FAMILY AND ITS RELATIONSHIP WITH RAINFALL IN THE MUNICIPALITY OF PARELHAS-RN

Calendário apícola da família fabaceae e sua relação com a pluviometria no município de Parelhas-RN

Calendario apicola de la familia fabaceae y su relación con las lluvias en el municipio de Parelhas-RN

Ivan de Oliveira Lima Júnior
Instituto Federal de Educação Ciência e Tecnologia do Rio Grande do Norte (IFRN)
E-mail: ivan.lima@ifrn.edu.br
Sérgio Murilo Santos de Araújo
Universidade Federal de Campina Grande (UFCG)
E-mail: sergiomurilosa.ufcg@gmail.com

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ABSTRACT

Brazilian beekeeping is an important ecological and commercial activity, with the Northeast region of the country being the second largest honey producer in Brazil. One of the factors that contributes to this is botanical biodiversity, with Fabaceae being the largest family. The Brazilian northeast has 1,794 municipalities, of which 1,254 are in the semiarid region, which is characterized by low rainfall, high temperatures and evaporation, and poor rainfall distribution. The municipality of Parelhas-RN, in the Seridó region, is part of this reality. The objective of this research is to build the beekeeping calendar of the botanical species of the Fabaceae family in the municipality of Parelhas-RN and correlate it with the rainfall reality. Fifty-two weekly visits were made to a preserved caatinga area of 51 hectares during 2023. All Fabaceae species that entered flowering during the period were observed. The flowers of the plants were photographed, exsiccate specimens were made for proper identification of the botanical species, their flowering calendar was recorded, and the relationship between the flowering season and the water regime of the locality, in 2023, was established. The climate data were collected digitally using three devices equipped with Arduinos programmed to capture temperature and humidity data (every hour) and rainfall (every minute). The relationship between the rainfall data and the flowering season of the plants was established based on the collected data.

Palavras-chave: Beekeeping; Semiarid; Climatology.

RESUMO

A apicultura brasileira é uma importante atividade ecológica e comercial, onde a região nordeste é a segunda maior produtora de mel no Brasil. Um dos fatores que contribui para essa produção apícola é a biodiversidade botânica, sendo a Fabaceae a família mais numerosa. O nordeste brasileiro possui 1794 municípios, dos quais 1254 estão inseridos no semiárido que é caracterizado climaticamente pela baixa pluviosidade, altas temperaturas e evaporação e má distribuição pluviométrica. O município de Parelhas-RN, localizado na região seridó está inserido nessa realidade. O objetivo da pesquisa é construir o calendário apícola das espécies botânicas da família Fabaceae do município de Parelhas-RN e correlacioná-lo com a realidade pluviométrica. Foram realizadas 52 visitações semanais em uma área de caatinga preservada com 51 hectares durante o ano de 2023. Foram observadas todas as espécies Fabaceaes que entraram em floração no período. As flores das plantas foram fotografadas, foram feitas exsicatas para a devida identificação das espécies botânicas, o seu calendário de floração foi registrado e a relação entre a época de floração e o regime hídrico da localidade em 2023 foi feito. Os dados climáticos foram coletados digitalmente por meio de 3 aparelhos equipados com arduínos programados para capturar dados de temperatura e umidade (a cada hora) e de pluviometria (a cada minuto). A relação entre os dados pluviométricos e a época de floração das plantas foi realizada a partir dos dados coletados.

Palavras-chave: Apicultura; Semiárido; Climatologia.

RESUMEN

La apicultura brasileña es una importante actividad ecológica y comercial, donde la región nordeste es la segunda productora de miel de Brasil. Uno de los factores que contribuye a esta producción de abejas es la biodiversidad botánica, siendo las Fabaceae la familia más numerosa. El nordeste brasileño tiene 1.794 municipios, de los cuales 1.254 están ubicados en la región semiárida, que se caracteriza climáticamente por escasas precipitaciones, altas temperaturas y evaporación y mala distribución de las precipitaciones. El municipio de Parelhas-RN, ubicado en la región de Seridó, es parte de esta realidad. El objetivo de la investigación es construir el calendario apícola de especies botánicas de la familia Fabaceae en el municipio de Parelhas-RN y correlacionarlo con la realidad pluviométrica. Se realizaron 52 visitas semanales a un área de caatinga preservada de 51 hectáreas durante el año 2023. Se observaron todas las especies de Fabaceae que florecieron durante el período. Se fotografiaron las flores de las plantas, se realizaron desecados para la adecuada identificación de las especies botánicas, se registró su calendario de floración y se realizó la relación entre el tiempo de floración y el régimen hídrico de la localidad en el año 2023. Los datos climáticos se recopilaron digitalmente utilizando 3 dispositivos equipados con Arduinos programados para capturar datos de temperatura y humedad (cada hora) y datos de lluvia (cada minuto). La relación entre los datos de lluvia y el tiempo de floración de las plantas se realizó con base en los datos recopilados.

Palabras clave: Apicultura; Semi árido; Climatología.

1. INTRODUCTION

The Brazilian semiarid region is made up of 1,477 municipalities in the nine states of the northeast and part of the northern region of the state of Minas Gerais (SUDENE, 2017). From a climatic point of view, the semiarid region is characterized by very particular

situations such as high temperatures, in addition to the scarcity and irregularity of rainfall, low humidity levels and high evaporation rates (Gurgel, 2018).

According to the delimitation of Sudene (2017), the state of Rio Grande do Norte (RN) comprises 167 municipalities, of which 147 are in the semi-arid area. Data from IBGE (2017) show that within this area there is a mesoregion called Seridó, which comprises 28 municipalities, and Parelhas is one of them.

Parelhas has a semi-arid climate, with a short rainy season that can start in January and last until July, but the highest rainfall levels generally occur between March and April. Normal rainfall is approximately 580 mm per year, average annual relative humidity is 64%, average temperature is between 28 and 32°C, and evaporation and sunshine rates are high (average of 2,400 hours per year). According to the Atlas of Areas Susceptible to Desertification in Brazil (UNDP, 2017), this municipality is susceptible to desertification in the very severe category (Beltrão *et al*., 2005; MME, 2005; IDEMA, 2008; IBGE, 2010, 2014; MI, 2017).

According to Kerr (1970), bees of the species *Apis mellifera* have adapted perfectly well to the climatic conditions of the Brazilian semi-arid region, so much so that according to data from the Brazilian Association of Honey Exporters (ABEMEL, 2022), the Brazilian northeast is in second place in the Brazilian honey export ranking, representing 31.3% of all honey exported, behind only of the South region, with 39.8%. In 2021, the average price paid per kg of exported Brazilian honey was US$3.46, while in 2022 there was an improvement, rising to US$3.73, and the value fluctuated to US$2.99 in 2023. The state of Rio Grande do Norte ranks fourth in the Northeast region in terms of honey production, behind Ceará, Piauí and Maranhão (IBGE, 2018).

Honey production in northeastern Brazil, as it mostly comes from native flowering, is highly susceptible to climate variations, so much so that according to Vidal (2014), during the dry cycle of 2012 and 2013, it suffered a 26.4% reduction, while in the Northeast region this reduction reached 52.1%. These production data highlight the need for in-depth studies of api-botanical calendars, especially in this region, to obtain consistent information related to the behavior of flowering according to the climate profile and supporting the planning of productive and sustainable beekeeping.

Since the production of honey and other beehive products is linked to the presence of flowers, it is important to know the beekeeping plants, their relationship with the local climate, flowering periods, and abundance in a given region. Therefore, characterizing these

plants and their flowering period contributes to the establishment of sustainable beekeeping (Chaves; Gomes, 2002).

Flora research should be conducted according to the region in which it is present, since plant species known as good suppliers of nectar and pollen in one region may have low productivity in others, mainly due to climatic conditions (Vidal, 2008).

In this sense, the Fabaceae botanical family is of great importance for the beekeeping chain of the Brazilian semiarid region due to its wide geographical distribution and for having the largest number of species within the flora of beekeeping interest in this region, so much so that Câmara *et al*. (2021), while studying the beekeeping flora in the municipality of Marcelino Vieira-RN, in the semiarid region of Rio Grande do Norte, found 93 species of plants distributed in 37 families, with Fabaceae being the most populous (15 species). Just like Costa *et al*. (2015), who researched botanical species that provide food for bees in northeastern Brazil, found the main source of pollen to be plants of the Fabaceae family, amounting for 15.38% of the species observed.

By studying flowering plants for beekeeping, it is possible to identify the food sources that bees use to collect nectar and pollen. This makes it possible to use resources to maintain local beekeeping pastures in areas of natural or cultivated vegetation (Wolff *et al*., 2006).

Based on knowledge of flowering, it is possible to determine the plant species that contribute to beekeeping production (mainly honey and pollen) in a given region. (Benevides; Carvalho, 2009).

For Wolff *et al*. (2006), the flowering season of the plant species most visited by bees is essential information for the development of beekeeping. Therefore, detailed regional knowledge of the beekeeping calendar of the species that are part of a location is very important because it allows beekeepers to better manage the apiary and allows them to plan for possible periods of scarcity of resources.

According to Queiroz *et al*. (2001), the environmental conditions of northeastern Brazil are favorable for beekeeping production, such as the tropical climate and a floristic diversity marked by native plants that favor the exploration of various products from the hive.

Since beekeeping is totally dependent on botanical resources and considering the ecological and productive importance of plants of the Fabaceae family for bees, this work aimed to build the beekeeping calendar of the botanical species of the Fabaceae family in the municipality of Parelhas-RN and correlate it with the rainfall reality.

2. METHODOLOGY

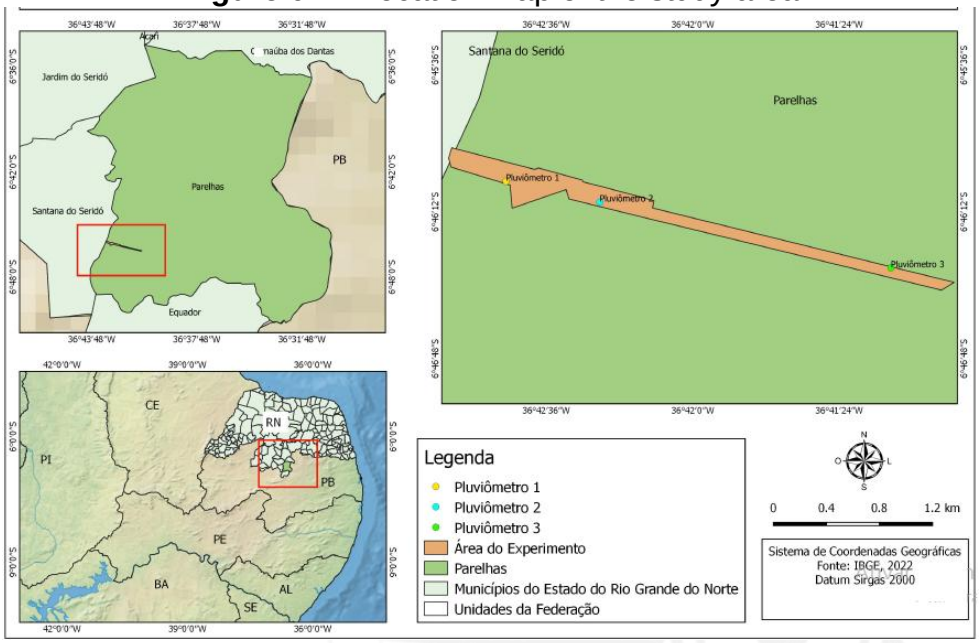
2.1 Location and description of the study area

The experiment was conducted in the municipality of Parelhas-RN, in the Seridó region of Rio Grande do Norte, with 21,577 inhabitants, a territorial area of 513.5 km², and a population density of 39.67 inhabitants/km2. Parelhas is geologically located in the Borborema Province, and is made up of the lithotypes of the Serra dos Quintos Complex.

The rural area of the municipality comprises several rural districts, one of which is the village of Quintos, where the study area is located, on private property. The site has an area of 51 hectares (Figure 1) of preserved caatinga, which has not been anthropized for just over 50 years. The only animal exploitation in the study area is beekeeping, with an emphasis on honey production.

The property has a section of riparian forest, on the banks of the Quintos River, a water reservoir that when at maximum storage capacity, occupies a water surface of approximately 55,000 square meters, and at the back of the property there is a forest of approximately 8 hectares located in the mountain range known as Serra dos Quintos (Borborema Province). In this way, the sampling of the plants found there reliably provides precise answers related to the diversity of Fabaceae and the beekeeping calendar of the region.

Figure 01 – Location map of the study area

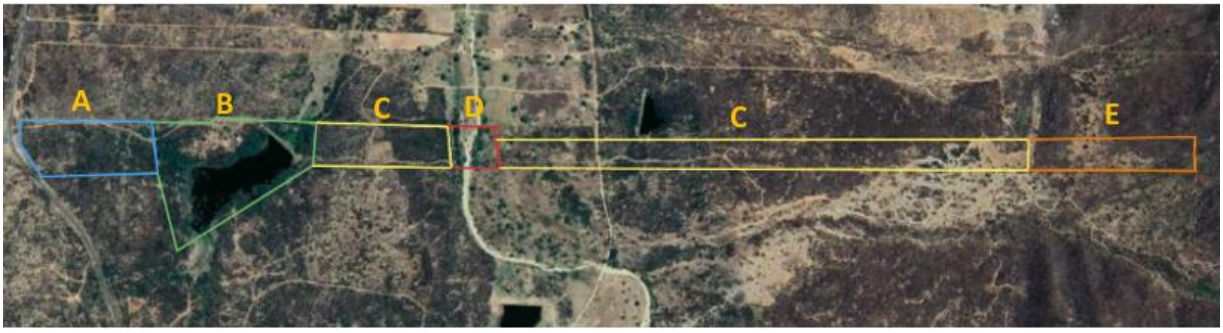


Source: elaborated by the authors (2023).

To monitor the flowering period of botanical species of the Fabaceae family, weekly visits were made to the study area for 12 months (January to December 2023) with a total of 52 visits, always on Sundays starting at 5:00 am and extending until approximately 12:00 pm. The entire area of the property was inspected, and all botanical species of the Fabaceae family found were photographed and identified.

Plants were collected in different habitats found in the study area (forest edge, lowlands, interior of the forest, riparian forest, and mountains) (Figure 2) following the methodology established by Filgueiras *et al*. 1994.

Figure 02 – Different habitats found in the study area. A. Forest edge; B. Lowlands; C. interior of the forest; D. Riparian forest; E. Mountain range



Source: Adapted from Google Earth (2023).

The plants found were photographed and collected for the obtention of exsiccate specimens; some were identified in the field, others by the Fabaceae species databases of Reflora (FLORA E FUNGA DO BRASIL, 2020) and the virtual herbarium of the Federal University of Rio Grande do Norte (UFRN), in the tab dedicated to Fabaceae species.

2.2 Monitoring of climate data in the area

To monitor the climate data of the area, three digital thermo-hygro-pluviometric devices (THP) powered by 12v batteries (Figure 3) were installed and distributed in strategic locations to climatically monitor the entire area (Figure 4).

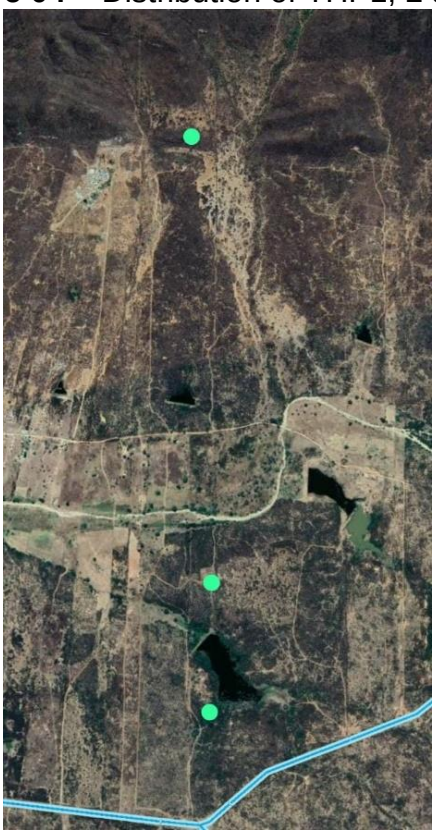
The devices were identified as THP1, THP2, and THP3, and were distributed so that THP1 was installed near the eastern end, THP2 closer to the center of the property (near the Quintos River) and THP3 at the western end, in the mountainous region. The THPs were equipped with Arduinos connected to the ESP32 platform and programmed to measure and store temperature and humidity data (every hour) and rainfall (every minute). The ESP32

platform has Wi-Fi and Bluetooth connectivity, and was chosen due to its wide use, recognized robustness in data, low energy consumption and variety of technological resources. The data was collected digitally using a Samsung A71 smartphone and transferred to Excel, where they were organized and processed.

Figure 03 – Installation of the THP3

Source: Elaborated by the authors (2023).

Figure 04 – Distribution of THP1, 2 and 3



Source: Adapted from Google Earth (2023).

The Brazilian semiarid region is characterized by irregular rainfall, whose pattern can vary considerably from one year to the next, in terms of volume, number of rainy days, and the time of year in which it occurs. For this reason, plant flowering adapts to this reality and can vary both in terms of the number of plants that flower throughout the year and the time of year in which they flower. Thus, a correlation was made between the pattern of climate data collected in the study area and that of flowering plant species.

4. RESULTS AND DISCUSSION

In 2023, plants of the Fabaceae family were found, photographed, collected, identified and a calendar for their api-botanical cycle was created. A total of 25 species were

identified (Table 1), distributed in 17 genera, with Mimosa having the largest number of species, corresponding to 16% of the total, followed by the genus Senna with 8% of the species.

The species that showed the greatest persistence in flowering throughout the year was *Parkisonia aculeata* (popularly known as Turco), having been found in bloom during ten months, including those characterized by water scarcity. In addition, it was observed that this species is quite receptive to several species of bees (including *Apis mellifera*) and other insects, thus demonstrating its ecological importance within the entomological food chain.

The identified plants showed different flowering times throughout the year. All months of 2023 presented Fabaceae species in bloom, with April having the highest number of them (21 of 25). Regarding habit, 13 species (52%) are herbaceous, 5 (20%) are shrubs, and 7 (28%) are trees.

The species of the genus Mimosa were the most numerous, with the leafiest flowering and very receptive to several insects, among them some species of native bees (of the genera Melipona and Trigona) and *Apis mellifera*. Visits were observed mainly in the early hours of the morning between 05:30 and 07:30 and their main floral resource is pollen.

The Fabaceae family is an important supplier of floral resources for *Apis mellifera* bees, especially in the caatinga region. According to Brasil (2020), bee products from the caatinga, such as bee pollen, have plants of the Fabaceae family as their main botanical origin. The same author, analyzing the botanical origin of 22 samples of propolis originating from the semi-arid region of Bahia, found Fabaceae to be the most representative botanical family with nine species, with Mimosa pudica being the most abundant one, having been found in all samples.

Avelino and Santos (2018) analyzed the botanical origin of 26 propolis samples, all from the semiarid region of the Northeast, and identified 196 pollen types. Fabaceae was the most represented family, with a total of 49 pollen types (25%).

Cordeiro and Souza (2024), in botanical research in the municipality of Sertãozinho-PB, identified 26 species of plants of the Fabaceae family, this being the most numerous in their study. Among the genera found, Mimosa was the most numerous, with a total of five species. Some authors achieved similar results, such as Rodrigues *et al.* (2020), who, researching Fabaceaes in the municipality of Serra Branca-PB, found 28 species distributed in 22 genera.

Table 01 – Calendar of botanical species of the Fabaceae family found in bloom in 2023

Nº	Scientific name	J	F	M	A	M	J	J	A	S	O	N	D
1	*Caesalpinea pyramidalis* Tul.	X	X	X	X								
2	*Arachis dardani* Krapov. & W.C.Greg,	X	X	X	X								
3	*Tephrosia purpurea* (L.)	X	X	X	X	X		X					
4	*Chamaecrista hispidula* (Vahl) H.S.Irwin & Barneby	X	X	X	X								
5	*Libdibia ferrea* (Mart. ex Tul.) L.P.Queiroz		X	X	X								
6	*Indigofera linnaei* Ali		X	X	X								
7	*Mimosa hostilis* Mart. (Benth)			X	X	X							
8	*Mimosa quadrivalvis*, var. leptocarpa (DC)Barneby		X	X	X	X							
9	*Parkinsonia aculeata* L.			X	X	X		X	X	X	X	X	X
10	*Chamaecrista nictitans* (L.) Moench			X	X	X		X					
11	*Indigofera miniata* Ortega			X	X					X			
12	*Bauhinia variegata* (L)				X					X			
13	*Senna ocidentalis* (L)				X								
14	*Mimosa pudica* (L)				X								
15	*Mimosa tenuiflora* (Willd.) Poir				X			X	X				
16	*Centrosema brasilianum* (L.) Benth				X	X							
17	*Stylosanthes guianensis* (Aubl.) Sw				X	X							
18	*Macropitilium atropurpureum* (Sessé & Moc. ex DC.).				X	X							
19	*Canavalis brasiliensis* Mart. ex Benth.				X								
20	*Arachis hipogaea* L.				X	X							
21	*Senna obitusifolia* (L.) H.S.Irwin & Barneby,				X	X							
22	*Prosopis juliflora* (Sw.) DC.					X	X	X					
23	*Neptunia oleraceae* Lour.						X	X	X				
24	*Erithryna velutina* Willd							X	X				
25	*Leucaena leucocephala* (Lam.) de Wit									X	X		

Source: elaborated by the authors (2023).

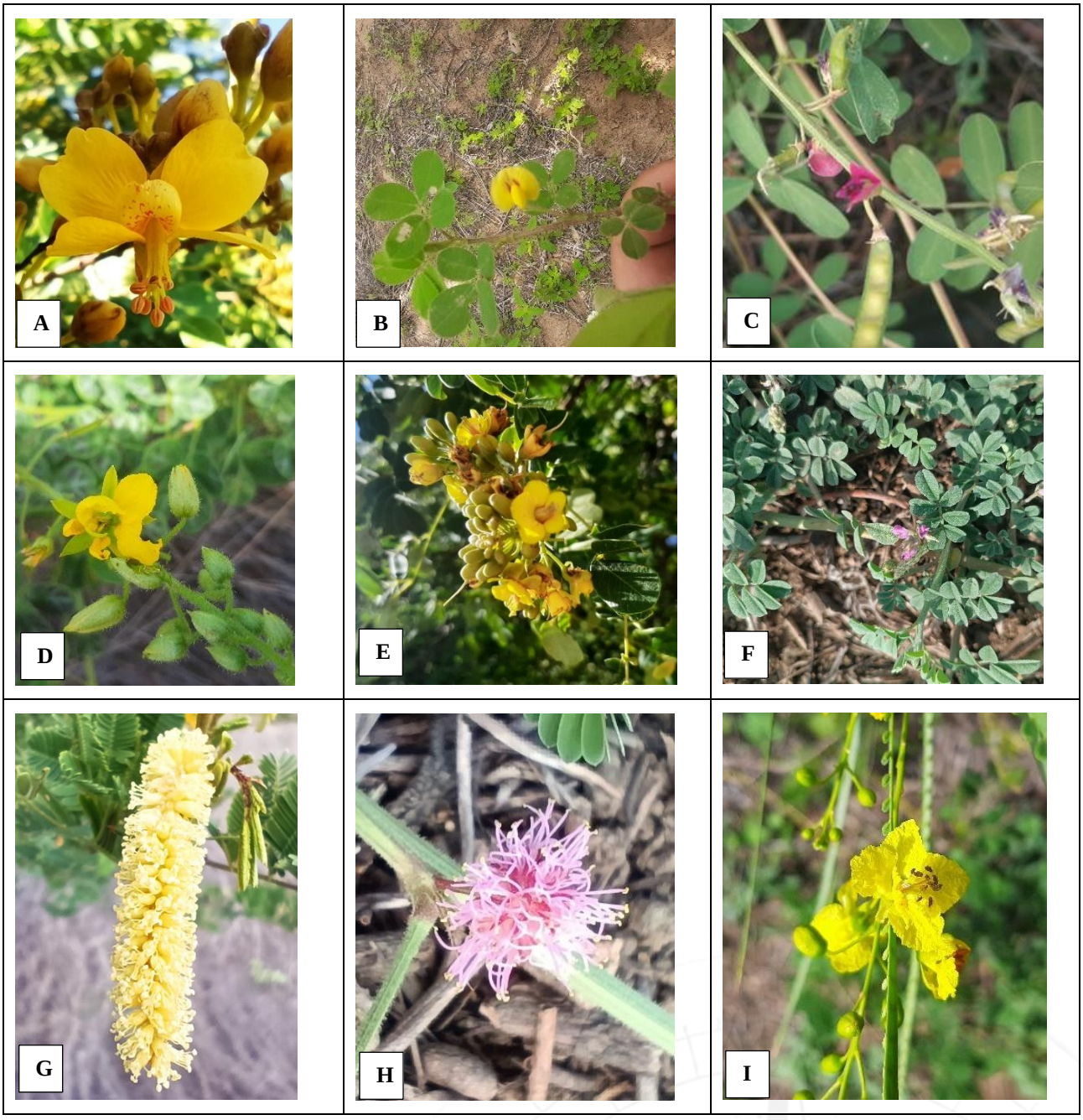
Alves (2021), when studying the beekeeping calendar in the municipality of Major Izidoro-AL for 14 months, found a variety of botanical species of beekeeping interest, with Fabaceae being the most numerous family, with 10 species out of 46.

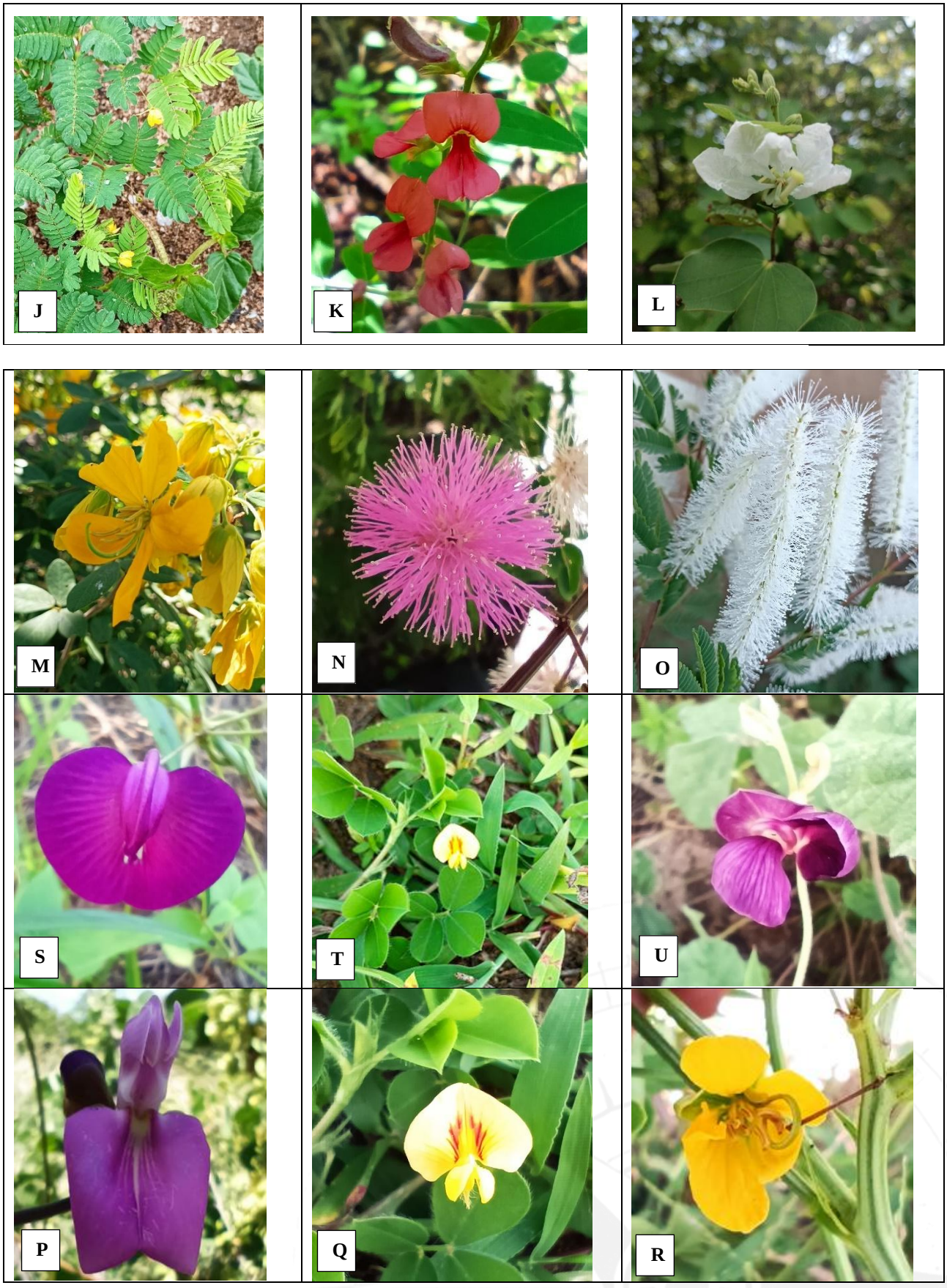
Silva et al. (2014), when studying the beekeeping calendar of the municipality of Catolé do Rocha-PB, found 107 species of plants of beekeeping interest, divided into 33 families and 78 genera, with Fabaceae being the main family found.

Cabrera (2014), when researching the beekeeping calendar in the Chaqueño Oriental Park in Argentina, found 198 flowering botanical species of beekeeping interest, of which the main family was Fabaceae, with 34 species (17.17%).

These results are similar and corroborate those found in this research. Figure 05 (from A to Y) shows Flowering species of the Fabaceae family found in our study area.

Figure 05 - (from A to Y). Flowering species of the Fabaceae family found in our study area

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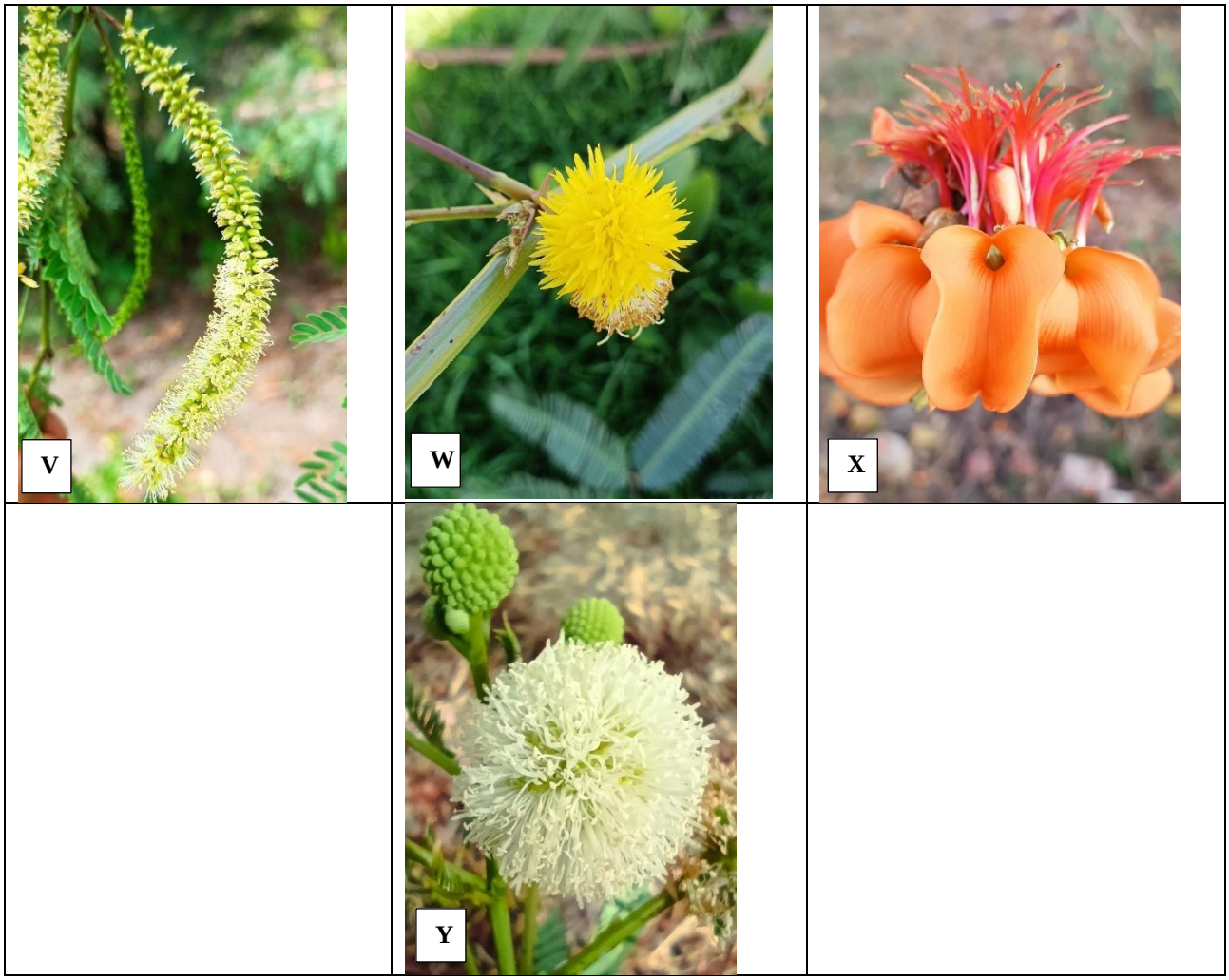


Source: elaborated by the authors (2023).

Nota: A. *Caesalpinea pyramidalis* Tul. **B**. *Arachis dardani* Krapov. & W. C. Greg, **C.** *Tephrosia purpurea* (L.), **D**. *Chamaecrista hispidula* (Vahl) H. S. Irwin & Barneby, **E**. *Libdibia ferrea* (Mart. ex Tul.) L.P. Queiroz, **F.** *Indigofera linnaei* Ali, **G.** *Mimosa hostilis* Mart. (Benth), **H**. *Mimosa quadrivalvis,* var. leptocarpa (DC) Barneby, **I**. *Parkinsonia aculeata* L., **J.** *Chamaecrista nictitans* (L.) Moench, **K**. *Indigofera miniata* Ortega, **L**. *Bauhinia variegata* (L), **M.** *Senna ocidentalis* (L), **N**. *Mimosa pudica* (L), **O**. *Mimosa tenuiflora* (Willd.) Poir., **P.** *Centrosema brasilianum* (L.) Benth, **Q**. *Stylosanthes guianensis* (Aubl.) Sw., **R**. *Macropitilium atropurpureum* (Sessé & Moc. ex DC.) Urb., **S.** *Canavalis brasiliensis* Mart. ex Benth., **T** *Arachis hipogaea* L., **U**. *Senna obitusifolia* (L.) H.S. Irwin & Barneby, **V**. *Prosopis juliflora* (Sw.) DC., **W**. *Neptunia oleraceae* Lour., **X**. *Erithryna velutina* Willd, **Y.** *Leucaena leucocephala* (Lam.) de Wit.

Geographically, plant species are adapted to their respective habitats according to the environmental/climatic conditions found there. Thus, the geographic (phytosociological) distribution of botanical species found throughout the study area (Table 02), within the division made according to the methodology of Filgueiras *et al*. (1994), occurred as follows:

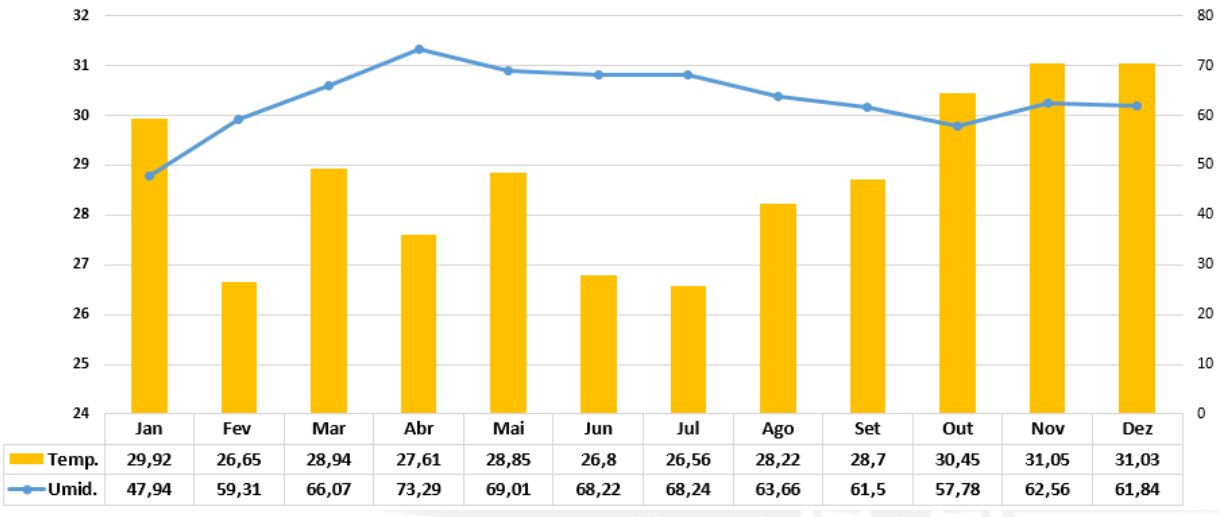
Table 02 – Phytosociological distribution of species found within the study area

Habitat	Nº de species	Species names
Forest edge	4	1. *Mimosa tenuiflora*, 2. *Centrosema brasilianum*, 3. *Senna obitusifolia*, 4 *Leucaena leucocephala*
Interior of the forest	3	1. *Caesalpinea pyramidalis*, 2. *Libdibia ferrea*, 3. *Bauhinia variegata*
Lowlands	6	1. *Tephrosia purpurea*, 2. *Indigofera linnaei*, 3. *Mimosa quadrivalvis*, 4. *Parkisonia aculeata*, 5. *Prosopis juliflora*, 6. *Neptunia oleraceae*
Riparian forest	6	1. *Arachis dardani*, 2. *Chamecrista nictitans*, 3. *Indigofera miniata*, 4. *Stylosanthes guianensis*, 5. *Macropitilium atropurpureum*, 6. *Arachis hipogaea*
Mountain range	6	1. *Chamecrista hispidula*, 2. *Mimosa hostilis*, 3. *Senna ocidentalis*, 4. *Mimosa pudica*, 5. *Canavalis brasiliensis*, 6. *Erithryna valutina*

Source: Elaborated by the authors (2023).

Regarding the average temperature and humidity throughout 2023, the behavior month by month is shown in Graph 1. Temperature and humidity are inversely proportional quantities, as one increases, the other decreases, and that there is a large variation in the data between the months analyzed.

Graph 01 - Average monthly temperature (ºC) and relative humidity (%) in 2023



	Jan	Fev	Mar	Abr	Mai	Jun	Jul	Ago	Set	Out	Nov	Dez
Temp.	29,92	26,65	28,94	27,61	28,85	26,8	26,56	28,22	28,7	30,45	31,05	31,03
Umid.	47,94	59,31	66,07	73,29	69,01	68,22	68,24	63,66	61,5	57,78	62,56	61,84

Source: Research data (2023).

The Seridó region of Rio Grande do Norte, where Parelhas is located, is characterized climatically as having a hot climate, low rainfall, high evaporation, and poor rainfall distribution (Lucena, 2018). Ab'Saber (2003) also characterizes the region climatically with maximum temperatures reaching around 38ºC and the annual average temperature of the region ranging from 27 to 30ºC.

According to Ayoade (2007), the average temperature values in latitudinal regions and with low altimetric levels are high and do not show a variation relationship according to the seasons of the year.

According to Lucena (2021), 73.5% of the Seridó region of Rio Grande do Norte has a maximum temperature index between 36 and 40ºC and, when analyzing the municipality of Caicó climatologically, the author found a maximum temperature of 37.2ºC throughout the year.

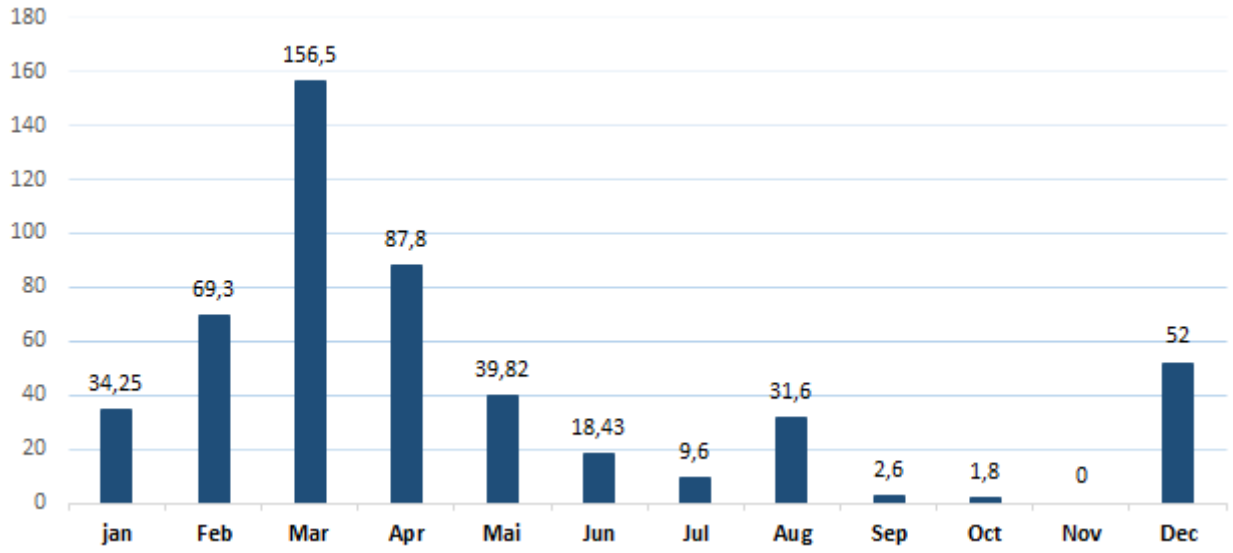
Data from INMET (2023) show that the relative humidity between the months of January and June 2023 in Caicó followed a pattern similar to the data from this research, with January presenting the lowest humidity and an increasing behavior in the three subsequent months (February, March and April), with a slight decline in May and June, results that corroborate those of this research.

All data cited related to temperature and humidity are similar and follow the same pattern as those found in this research, corroborating the authenticity and consistency of the results found.

Regarding rainfall data, the rainfall profile throughout the experimental period was increasing throughout the first three months of the year (January to March), decreasing in the following four months (April to July), with light rainfall in August, followed by a decrease in September, October and November, and another recharge in December, totaling 503.7 mm throughout the year, as shown in Graph 2.

The Seridó region of Rio Grande do Norte, despite having a totally irregular rainfall pattern regarding amount and distribution, historical rainfall data from EMPARN show that rains tend to fall more intensely between the months of March and April. In 2023, according to EMPARN data for Parelhas, rainfall increased gradually in the first three months of the year (January to March) and gradually decreased from April to July. With two recharges, one in August and another in December, and the months of September to November presented no rainfall records.

Graph 02 – Monthly rainfall during the year 2023

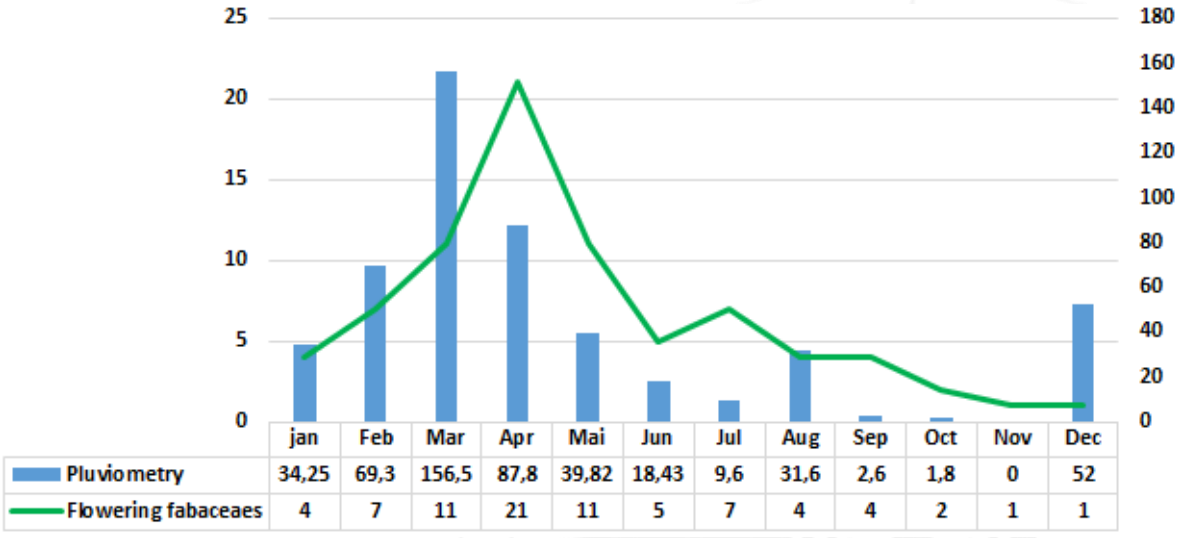


Source: Research data (2023).

Furthermore, EMPARN data for Parelhas shows that the annual rainfall in 2023 was 511mm and the months with the highest rates were March and April, concentrating 56.13% of the period's rainfall, whereas in this research the rainiest months were also March and April, accounting for 48.50% of the period's rainfall and total precipitation was 503.7mm.

When referring to the relationship between the rainfall pattern and the flowering profile found, the influence of rainfall on the flowering of botanical species is shown in Graph 3. The flowering responses always occurred in the month following the rainfall events.

Graph 03 - Rainfall and number of Fabaceae species in bloom in 2023.



	jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pluviometry	34,25	69,3	156,5	87,8	39,82	18,43	9,6	31,6	2,6	1,8	0	52
Flowering fabaceaes	4	7	11	21	11	5	7	4	4	2	1	1

Source: Research data (2023).

The effect of rainfall on the flowering of species is notable. As the experiment progressed, air humidity increased, and the average temperature decreased. Regarding rainfall, it increased during the first three months of the year and decreased in April, May and June, with a total of 503.7 mm of precipitation throughout 2023. Some species flower for more than one consecutive month, others respond positively immediately after a rain event. Some have a short flowering, others a very long one.

According to Silva (2014), rainfall plays an important role in the physiological and biochemical processes of plants, which can lead to adaptation in their flowering cycle and production season according to their water regime.

For Farias (2007), the phenology of many plant species is mainly influenced by the water regime, since the presence of humidity activates plant hormones, which are responsible for triggering vegetative processes such as flowering.

This explains why the number of flowering plants within a given month varies according to the water regime. Therefore, phenological responses always occur in the month following water events, as found in this research.

Thus, it can be suggested that there is a strong influence in relation to the climate data of a region and its flowering profile, since according to Bellard et al. (2012), studying the influence of climate on vegetation in Russia, they concluded that rainfall variations provoked behavioral responses in plants, thus having a phenological adaptation according to the climatic reality to which they were momentarily inserted. These results reinforce the thesis that guides this research.

5 CONCLUSION

Fabaceae has proven to be a very important family for the semi-arid beekeeping sector, due to factors such as the number of species found and their flowering at different times of the year, providing food for bees for long periods, in addition to many of them being efficient suppliers of pollen (protein) for bees, such as those of the Mimosa genus, and others are suppliers of energy (nectar), such as Prosopis juliflora.

The flowering season of plants is directly related to the climatic elements analyzed, mainly rainfall. The response of plant flowering always occurs proportionally in the month following rainfall. As rainfall increases throughout January, February and March, the flowering of species continues to increase. In the months of April, May and June, rainfall gradually decreases, and so does the flowering of species, proportionally over time.

From a geographical point of view, the predilection of plant species for their natural habitats according to their individual climatic requirements is noticeable.

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