Journal of Agroindustry Systems

https://editoraverde.org/portal/revistas/index.php/jas
ISSN: 2674-7464

Phytosocytological and Floristic Analysis of Caatinga Biome in Aparecida, PB, Brazil

Francisco Tales da Silva, Alan Dél Carlos Gomes Chaves, Ricardo Ricelli Pereira de Almeida , Aline Carla de Medeiros, Patrício Borges Maracaja

1 PPGSA-UFCG-CCTA-Pombal – PB – BRZIL. E-mail: f_tales@hotmail.com; *alandcgc@hotmail.com ;* ricelli2008@bol.com.br; *alinecarla.edu@gmail.com e patriciomaracaja@gmail.com;*

ABSTRACT

This study aimed to evaluate the floristic composition and the phytosociological structure in two apiaries areas on Caatinga biome: a non-preserved and a preserved area both in the municipality of Aparecida, PB, Brazil. The non-preserved area (area I) had 25 apiaries, and the preserved area had 28 apiaries (area II). A total of 110 individuals, five families, and ten species were found at area I, and 330 individuals, eight families and 12 species at area II. However, area I showed higher Shannon-Wiener diversity index (1.93) than area II (1.52). The deforestation is responsible by the low number of individuals at the area I. Our results show a diversity of shrubs and trees species with great apicultural potential to be used by family farmers from the planning of the beekeeping activity.

Keywords: Floristic composition. Apicultural activity. Vegetation of the semiarid. Plant community.

HOW TO CITE THIS PAPER

SILVA, F. T. da; , CHAVES, A. D. G..; ALMEIDA, R. R. P de; MEDEIROS, A. C. de e MARACAJA P. B. (2018) Phytosocytological and floristic analysis of caatinga biome in Aparecida, pb, Brazil . Journal of agroindustry sistems, 1, 11-23. Received: May 28, 2018 Accepted: July 29, 2018 Published: August 1, 2018 Copyright © 2018 by authors and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0). http://creativecommons.org/licenses/by/4.0/ Open Ac

DOI: https://doi.org/10.18378/2018.v1i01.2

INTRODUCTION

Phytosociology study the vegetation structure and composition and its interrelation and dependence on biotic factors in a given environment (BRAUN-BLANQUET, 1979). Silvicultural techniques are, therefore, essential for the rational use and conservation of forests based on the ecology of each type of forest formation (HOSOKAWA et al., 2008). Phytosociology study and silvicultural techniques are important for planning the use, preservation, and conservation of natural resources.

Floristic and phytosociological analyzes provide a detailed understanding of the diversity of plant species and how they are distributed in a given environment. According to Felfili and Resende (2003), phytosociological methods make a quick evaluation of the structure of the vegetation occurring in a given community. Therefore, phytosociological methods are important for silviculture and conservation of forests on the Caatinga Biome.

To perform an analysis of the horizontal structure of the plant communities the parameters of frequency, density, dominance, importance value and coverage value are used (LONGHI, 1997).

The Brazilian semi-arid region is a highly populated area in an advanced state of environmental degradation. This research aimed to evaluate the floristic composition and the phytosociological structure in an area of environmental preservation and a non-preserved area in the municipality of Aparecida (PB, Brazil) for future actions of mitigation of environmental impacts caused by the anthropic activities.

MATERIAL AND METHODS

Aparecida municipality is located at the west of Paraíba State, Brazil, with an area of 295 Km² and 7,676 inhabitants (IBGE 2010). According to CPRM (2005), Aparecida is in the "Drought Polygon", that is a semi-arid area with warm and dry climate, according to the classification of Koppen. The area has an irregular precipitation regime, with annual averages of 920 mm/year.

The area has crystalline soil, shallow and stony with limited water storage capacity in the subsoil. The sedimentary regions located on the river banks have a deeper soil. The vegetation is Caatinga, typical xerophytic, with the presence of cacti, shrubs, and trees of small and medium size.

This study was developed in two areas: a preserved (Area I) and a non-preserved area (Area II). The Area I is located at Duas Lagoas farm (06°40'44.2" S and 38°01'13.6" W, 285m of altitude), is a private area with 25 apiaries. Area II is inserted in Acauã rural settlement, east of Aparecida city (06°48'46" S and 38°04'53.3" W, 138m of altitude). Area II is a preserved area belonging to the Holy Family Congregation where beekeeping is allowed with 28 apiaries.

The research was performed from May 2017 to February 2018. We used plots in sampling unit measuring 10m x 20m, delimited by stakes, according to Muller-Dombois and Ellemberg (1974). We analyzed ten plots in each area, with a distance of 50 meters between plots. The areas were georeferenced using Garmin etrex 30. All the arboreal individuals present in each plot with a circumference greater than 10 cm were identified.

For tree and stem height we followed the methodology proposed by Leite (1999). A measuring tape was used to measure the CAB and three PVC pipes with 6 m in length and graduated every 10 cm were used to measure tree and stem height. The analyses were calculated at FITOPAC and MS Excel software. For the phytosociological parameters, we used the methodology by Oliveira and Amaral (2004).

RESULTADS AND DISCUSSION

We found 440 individuals in the floristic and phytosociological survey, 110 at area I and 330 at the area II (Table 1).

Table 1 – Number of individuals collected in Areas I and II, Duas Lagoas farm and Acauã Settlement, respectively.

AREA	Nº Plots	Nº of Individuals
I – Duas Lagoas Farm – (Apiary I)	10	110
II – Acauã Settlement - (Apiary II)	10	330

Source: Our data, 2018

The lower number of individuals at the area I concerning the area II is probably a consequence of the deforestation for agriculture and exploitation of firewood.

The species *Combretum leprosum Mart*, *Croton sonderianus Müll. Arg Mimosa tenuiflora (Willd.) Poir* occured in 100% of the studied plots (Table 2). Known by the popular name of 'mofumbo', 'marmeleiro' (quince) and 'jurema preta' they are the dominant species.

Table 2- Species occurrence in the plots, Area I and II, Aparecida-PB, Brazil.

FAMILY/SPECIES	Nº OF PLOTS AND INDIVIDUALS	
	Plots	Individuals
Apocynaceae		
Aspidosperma pyrifolium Mart.	4,6,9,10	23
Bignoniaceae		
Handroanthus impetiginosus Mattos	9,10,	6
Cactaceae		
Cereus jamacaru DC.	4,7	3
Pilosocereus gounellei (F.A.C.Weber) Byles&G.D.Rowley	7, 10	2
Capparaceae		
Cynophalla flexuosa (L.) J.Presl	10	1
Combretaceae		
Combretum leprosum Mart	1,2,3,4,5,6,7,8,9,10	82
Euphorbiaceae		
Croton sonderianus Müll. Arg	1,2,3,4,5,6,7,8,9,10	127
Jatropha mollissima (Pohl) Baill	6	7
Fabaceae		
Anadenanthera colubrine (Vell.) Brenan	4	9
Bauhinia cheilantha (Bong.) Steud.	6,9	2
Caesalpinia ferrea (var. leiostachya)	2,4	5
Caesalpinia pyramidalis Tul.	1,2,4,5,8,9	65
Mimosa tenuiflora (Willd.) Poir	1,2,3,4,5,6,7,8,9,10	106
Rhamnaceae		
Ziziphusjoazeiro Mart	4	2

Source: Our data, 2018.

We identified five families and ten species at Area I, with a Shannon-Wiener diversity index of 1.93. The value of the diversity index was higher than other impacted areas (DANTAS *et al.* 2010; HOLANDA *et al*., 2015; VASCONCELOS *et al.* 2017). The studied area shows signs of anthropic intervention but the results are acceptable concerning the values of diversity found by other studies in impacted areas of the Caatinga biome. The dominant species in Area I were: *Caesalpinia pyramidalis Tul*, Fabaceae family with 41 individuals, and *Aspidosperma pyrifolium* Mart. of the Apocynaceae family with 22 individuals (Table 3). *Aspidosperma pyrifolium* is a commonly dominant species (Amorin et al. 2005; Alcoforado-Filho 2003). The species *Pilosocereus gounellei* (F.A.C.Weber) Byles & G.D.Rowley and *Cereus jamacaru* DC from the Cactaceae family had two individuals each, and we found only one individual of *Jatropha mollissima* (Pohl) Baill, from the Fabaceae family (Table 3).

Table 3 – Species sampled in Duas Lagoas Farm - Apiary I, and the phytosociological parameters.

SPECIES	FAMILY	NInd	AbsDe	RelDe	AbsFr	RelFr	AbsDo	RelDo	IVI	IVC
Caesalpinia pyramidalis Tul	*Fabaceae*	41	205.0	35.96	80.00	20.51	0.83	16.63	73.10	52.59
Aspidosperma pyrifolium Mart.	*Apocynaceae*	22	110.0	19.30	40.00	10.26	1.09	21.93	51.49	41.23
Combretum leprosum Mart	*Combretaceae*	16	80.0	14.04	70.00	17.95	0.93	18.57	50.55	32.61
Anadenanthera colubrina (Vell.) *Brenan*	*Fabaceae*	7	35.0	6.14	30.00	7.69	0.57	11.46	25.29	17.60
Mimosa tenuiflora (Willd.) Poir	*Fabaceae*	7	35.0	6.14	30.00	7.69	0.47	9.53	23.37	15.67
Croton sonderianus Müll. Arg.	*Euphorbiacea*	7	35.0	6.14	50.00	12.82	0.18	3.57	22.53	9.71
Caesalpinia ferrea (var. leiostachya)	*Fabaceae*	5	25.0	4.39	20.00	5.13	0.04	0.79	10.31	5.18
Pilosocereus gounellei (F.A.C.Weber) Byles & G.D.Rowley	*Cactaceae*	2	10.0	1.75	20.00	5.13	0.04	0.82	7.70	2.57
Cereus jamacaru DC	*Cactaceae*	2	10.0	1.75	10.00	2.56	0.02	0.40	4.72	2.16
Jatropha mollissima (Pohl) Baill	*Fabaceae*	1	5.0	0.88	10.00	2.56	0.00	0.08	3.52	0.96

Nind (Number of individuals), AbsDe (Absolute density), RelDe (Relative density), AbsFr (Absolute frequency), RelFr (Relative frequency), AbsDo (Absolute dominance), RelDo (Relative dominance), IVI (Importance value index), IVC (Coverage value index). **Source:** PLAN I- species parameters. FPM – Our data, 2018.

We found 12 species from eight families in Area II, with a Shannon-Wiener Index of 1.52. Other studies found higher diversity index in preserved areas (LIMA 2003; GUEDES *et al*. 2012; CORDEIRO 2017).

The dominant species in Area II were: *Croton sonderianus Müll*. Arg, Euphorbiacea, with 120 individuals and *Mimosa tenuiflora* (Willd.) Poir., family Fabaceae, with 99 individuals. We found one individual of the species *Aspidosperma pyrifolium* Mart., Apocynaceae family, *Anadenanthera colubrina (Vell.) Brenan*da, Fabaceae family, *Cereus jamacaru* DC, Cactaceae family and *Cynophalla flexuosa (L.) J. Presl*, Capparaceae family.

Table 4 – Species sampled in Acauã Settlement - Apiary I, and the phytosociological parameters.

SPECIES	FAMILY	NInd	AbsDe	RelDe	AbsFr	RelFr	AbsDo	RelDo	IVI	IVC
Croton sonderianus Müll.Arg.	*Euphorbiacea*	120	600.0	36.36	100.00	22.22	6.26	31.99	90.58	68.35
Mimosa tenuiflora (Willd.) Poir	*Fabaceae*	99	495.0	30.00	100.00	22.22	6.29	32.15	84.37	62.15
Combretum leprosum Mart.	*Combretaceae*	67	335.0	20.30	100.00	22.22	2.29	11.70	54.23	32.01
Caesalpinia pyramidalis Tul	*Fabaceae*	24	120.0	7.27	50.00	11.11	1.55	7.94	26.32	15.21
Ziziphus joazeiro Mart	*Rhamnaceae*	2	10.0	0.61	10.00	2.22	1.55	7.90	10.73	8.51
Handroanthus impetiginosus Mattos	*Bignoniaceae*	6	30.0	1.82	20.00	4.44	0.09	0.44	6.70	2.26
Jatropha mollissima (Pohl) Baill	*Euphorbiacea*	6	30.0	1.82	10.00	2.22	0.31	1.58	5.62	3.39
Bauhinia cheilantha (Bong.) Steud.	*Fabaceae*	2	10.0	0.61	20.00	4.44	0.09	0.48	5.53	1.08
Cereus jamacaru DC.	*Cactaceae*	1	5.0	0.30	10.00	2.22	0.46	2.37	4.90	2.67
Aspidosperma pyrifolium Mart	*Apocynaceae*	1	5.0	0.30	10.00	2.22	0.40	2.03	4.56	2.34
Anadenanthera colubrina (Vell.) Brenan	*Fabaceae*	1	5.0	0.30	10.00	2.22	0.23	1.17	3.70	1.48
Cynophalla flexuosa (L.) J.Presl	*Capparaceae*	1	5.0	0.30	10.00	2.22	0.05	0.25	2.77	0.55

Nind (Number of individuals), AbsDe (Absolute density), RelDe (Relative density), AbsFr (Absolute frequency), RelFr (Relative frequency), AbsDo (Absolute dominance), RelDo (Relative dominance), IVI (Importance value index), IVC (Coverage value index). **Source:** PLAN II- species parameters. FPM – Our data, 2018.

Croton sonderianus Müll.Arg showed the higher relative density (RelDe = 36.36%), followed by *Mimosa caesalpiniifolia* (30.0%) and *Combretum leprosum* (20.3%) as dominant species (Table 4). The species *Aspidosperma pyrifolium Mart*, *Anadenanthera colubrina (Vell.) Brenan*, *Cereus jamacaru DC and Cynophalla flexuosa (L.) J.Presl* had 0.30 of relative density.

Lima et al. (2015) also found the species *Croton sonderianus* (33.0%), *Mimosa caesalpiniifolia* (15.7%) and *Combretum leprosum* (12.3%) as dominant species.

Phytosociological analyses play an important role in the conservation and preservation of areas and help to understand the human actions in natural environments. In Caatinga biome, several studies are identifying the floristic diversity and human impacts.

Table 5 – Species list, family and common names found in the studied areas, Duas Lagoas Farm and Acauã Settlement – Apiaries I and II, Aparecida/PB, Brazil.

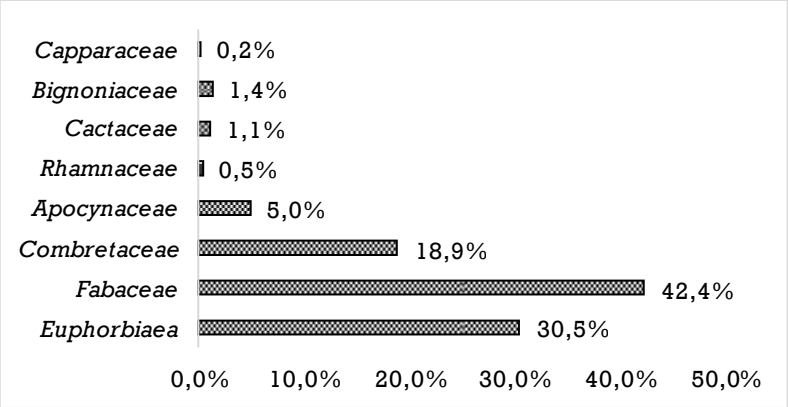
SPECIES	FAMILY	COMMON NAME
Anadenanthera colubrina (Vell.) Brenan	*Fabaceae*	Angico
Aspidosperma pyrifolium Mart.	*Apocynaceae*	Pereiro
Bauhinia cheilantha (Bong.) Steud.	*Fabaceae*	Mororó
Caesalpinia ferrea (var. leiostachya)	*Fabaceae*	Pau-ferro
Caesalpinia pyramidalis Tul.	*Fabaceae*	Catingueira
Cereus jamacaru DC.	*Cactaceae*	Mandacaru
Combretum leprosum Mart	*Combretaceae*	Mofumbo
Croton sonderianus Müll. Arg	*Euphorbiaceae*	Marmeleiro
Cynophalla flexuosa (L.) J.Presl	*Capparaceae*	Feijão-bravo
Handroanthus impetiginosus Mattos	*Bignoniaceae*	Pau d'arco roxo
Jatropha mollissima (Pohl) Baill	*Euphorbiaceae*	Pinhão – bravo
Mimosa tenuiflora (Willd.) Poir	*Fabaceae*	Jurema-preta
Pilosocereus gounellei (F.A.C.Weber) Byles & G.D.Rowley	*Cactaceae*	Xiquexique
Ziziphus joazeiro Mart	*Rhamnaceae*	Juazeiro

Source: Our data, 2018.

The families Fabaceae (42.4%), Euphorbiaceae (30.5%), Combretaceae (18.9%), presented the larger number of species covering 92.2% of the total. A similar composition of families and species were found in other studies of the region (LIMA et al., 1999; DRUMOND et al., 2002; ALCOFORADO-FILHO et al., 2003), confirming the representativeness of those families in Caatinga environments.

Other families showed lower representativeness: Bignoniaceae, 1.4%; Cactaceae, 1.1%; Rhamnaceae, 0.5%; and Capparaceae, 0.2% (Figure 1).

Figure 1 - Percentages of families in the Areas I and II (Duas Lagoas Farm and Acauã Settlement, respectively).



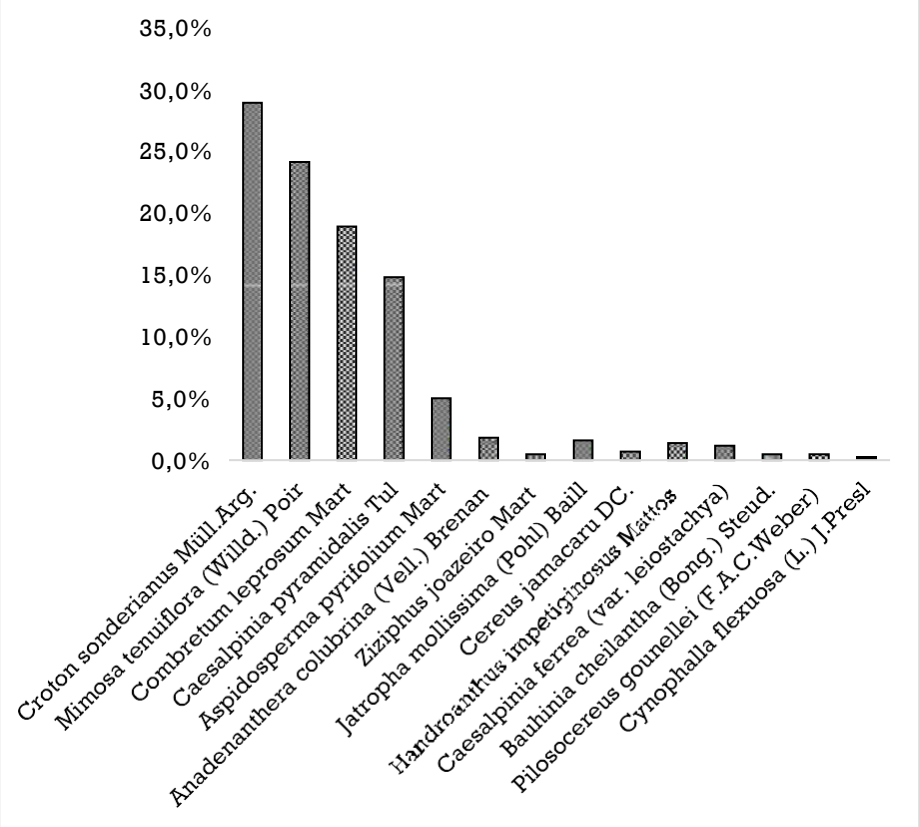
Source: Our data, 2018.

The most abundant species in both areas are *Croton sonderianus Müll.* Arg (29.9%), *Mimosa tenuiflora (Willd.)* Poir (24.1%), *Combretum leprosum* Mart *(18.9%)* and *Caesalpinia pyramidalis* Tul. *(14.8%)* totaling 87.7%. These species are primary colonizers in secondary successional processes.

The remaining species showed less than 5% of abundance: *Aspidosperma pyrifolium* Mart., 5.0%; *Anadenanthera colubrina (*Vell.*)* Brenan, 1.8%; *Jatropha mollissima (*Pohl*)* Baill, 1.6%; *Handroanthus impetiginosus* Mattos, 1.4%; *Caesalpinia ferrea (var. leiostachya*), 1.1%; *Cereus jamacaru* DC., 0.7%; *Bauhinia cheilantha* (Bong.) Steud., *Pilosocereus gounellei* (F.A.C.Weber) Byles & G.D.Rowley; *Ziziphus joazeiro* Mart, 0.5%; and *Cynophalla flexuosa (L.)* J.Presl, 0.2% (Figure 2).

These species are essential for the reestablishment of vegetation affected by human actions, since they alter the characteristics of the environment determining the establishment of species of late colonization.

Figure 2 - Percentages of species in the Areas I and II (Duas Lagoas Farm and Acauã Settlement, respectively).



Source: Our data, 2018.

The number of species and families found in this study was lower than those found by Benevides et al. (2007) who identified 16 families and 32 species in the herbaceous component of an impacted area of Caatinga and 20 families and 27 species in a semi-preserved area.

However, Maracajá et al. (2003) and Araújo et al. (2010) found lower diversity in Caatinga ecosystems in the shrub-tree physiognomy, as we saw here. This is because the herbaceous component in the Caatinga Biome presents a greater species richness concerning the shrub-tree extract (ARAÚJO et al. 2010).

The family Fabaceae had the higher species number, five species. The families Cactaceae and Euphorbiaceae had two species each, and the families Apocynaceae, Bignoniaceae, Capparaceae, Combretaceae, and Rhamnaceae had one species each (Table 3).

Table 6 – Species lists in the Areas I and II (Duas Lagoas Farm and Acauã Settlement, respectively).

FAMÍLIA/ESPÉCIES	ÁREA	NOME POPULAR
Apocynaceae		
Aspidosperma pyrifolium Mart.	I E II	Pereiro
Bignoniaceae		
Handroanthus impetiginosus Mattos	II	Pau d'arco roxo
Cactaceae		
Cereus jamacaru DC.	I E II	Mandacaru
Pilosocereus gounellei (F.A.C.Weber) Byles & G.D.Rowley	II	Xiquexique
Capparaceae		
Cynophalla flexuosa (L.) J.Presl	II	Feijão-bravo
Combretaceae		
Combretum leprosum Mart	I E II	Mofumbo
Euphorbiaceae		
Croton sonderianus Müll. Arg	I E II	Marmeleiro
Jatropha mollissima (Pohl) Baill	I E II	Pinhão – bravo
Fabaceae		
Anadenanthera colubrina (Vell.) Brenan	I E II	Angico
Bauhinia cheilantha (Bong.) Steud.	II	Mororó
Caesalpinia ferrea (var. leiostachya)	I	Pau- ferro
Caesalpinia pyramidalis Tul.	I E II	Catingueira
Mimosa tenuiflora (Willd.) Poir	I E II	Jurema-preta
Rhamnaceae		
Ziziphus joazeiro Mart	II	Juazeiro

Source: Our data, 2018.

The families Asteraceae, Convolvulaceae, Euphorbiaceae, and Leguminosae are usually abundant in areas of Caatinga under different levels of conservation (Andrade et al. 2009).

The term biodiversity in phytosociological studies refers to the number of species present in a given area, quantitatively defined as a measure of relative abundance, has been used more narrowly, considering only a certain family level.

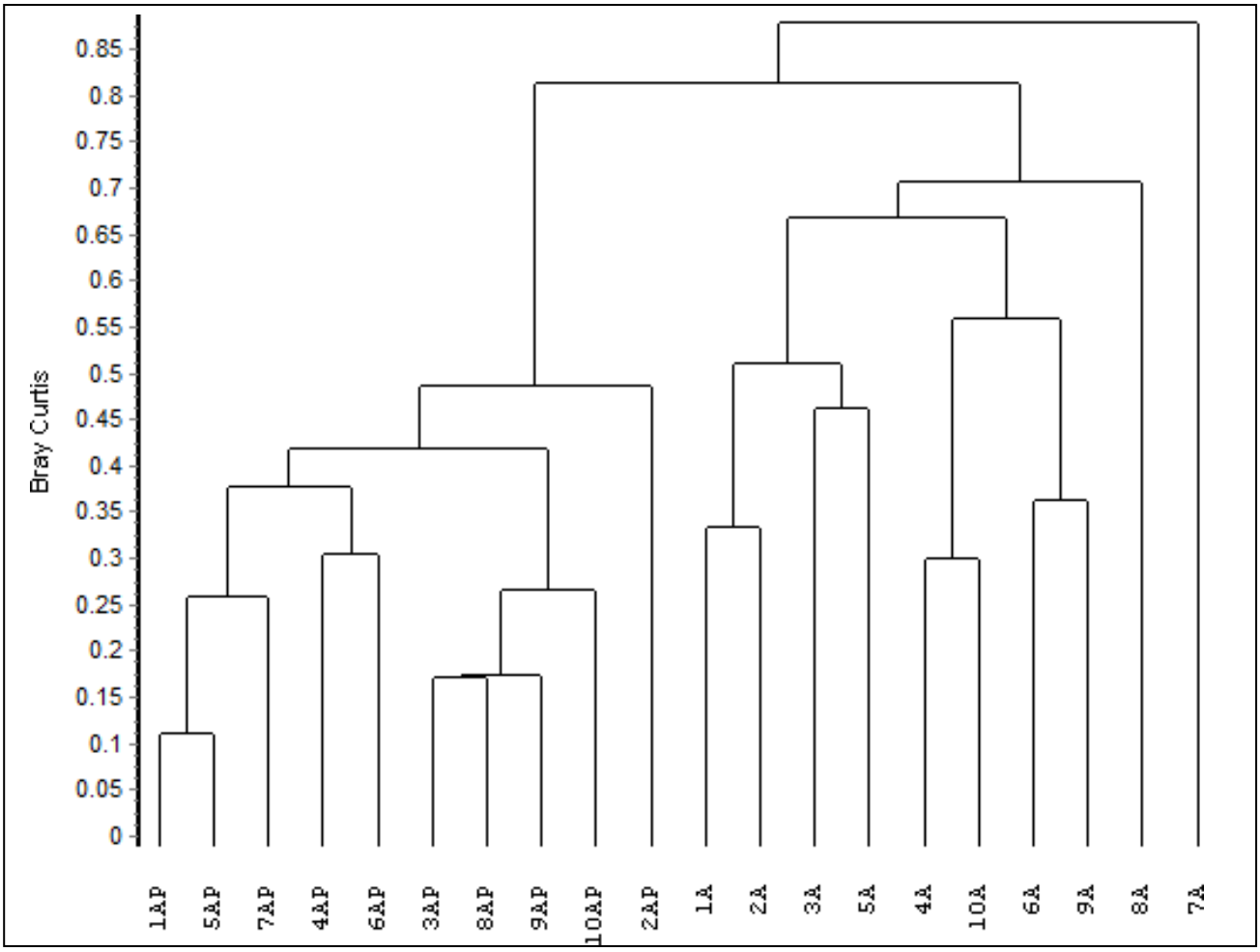
Table 7 –Phytosociological parameters of the species sampled in both Apiary I and II (Duas Lagoas Farm and Acauã Settlement, respectively).

Species	**Family**	**NInd**	**AbsDe**	**RelDe**	**AbsFr**	**RelFr**	**AbsDo**	**RelDo**	**IVI**	**IVC**
Croton sonderianus Müll.Arg.	*Euphorbiaea*	127	317.5	28.60	75.00	17.86	3.22	26.22	72.68	54.83
Mimosa tenuiflora (Willd.) Poir	*Fabaceae*	106	265.0	23.87	65.00	15.48	3.38	27.56	66.91	51.44
Combretum leprosum Mart	*Combretaceae*	83	207.5	18.69	85.00	20.24	1.61	13.10	52.03	31.79
Caesalpinia pyramidalis Tul	*Fabaceae*	65	162.5	14.64	65.00	15.48	1.19	9.70	39.82	24.34
Aspidosperma pyrifolium Mart	*Apocynaceae*	22	55.0	4.95	20.00	4.76	0.55	4.45	14.17	9.40
Anadenanthera colubrina (Vell.) *Brenan*	*Fabaceae*	8	20.0	1.80	20.00	4.76	0.40	3.26	9.82	5.06
Ziziphus joazeiro Mart	*Rhamnaceae*	2	5.0	0.45	5.00	1.19	0.77	6.30	7.94	6.75
Jatropha mollissima (Pohl) Baill	*Euphorbiacea*	7	17.5	1.58	10.00	2.38	0.16	1.27	5.23	2.85
Cereus jamacaru DC.	*Cactaceae*	3	7.5	0.68	10.00	2.38	0.24	1.97	5.03	2.65
Handroanthus impetiginosus Mattos	*Bignoniaceae*	6	15.0	1.35	10.00	2.38	0.04	0.35	4.08	1.70
Caesalpinia ferrea (var. leiostachya)	*Fabaceae*	5	12.5	1.13	10.00	2.38	0.02	0.16	3.67	1.29
Bauhinia cheilantha (Bong.) Steud.	*Fabaceae*	2	5.0	0.45	10.00	2.38	0.05	0.38	3.21	0.83
Pilosocereus gounellei (F.A.C.Weber)	*Cactaceae*	2	5.0	0.45	10.00	2.38	0.02	0.17	3.00	0.62
Cynophalla flexuosa (L.) J.Presl	*Capparaceae*	1	2.5	0.23	5.00	1.19	0.02	0.20	1.61	0.42

Nind (Number of individuals), AbsDe (Absolute density), RelDe (Relative density), AbsFr (Absolute frequency), RelFr (Relative frequency), AbsDo (Absolute dominance), RelDo (Relative dominance), IVI (Importance value index), IVC (Coverage value index). **Source:** PLAN II- species parameters. FPM – Our data, 2018.

The Shannon-Wiener Index of both areas was 1.87, a value higher than found by Holanda et al. (2015), of 0.23 and 1.50 in Caatinga remnants with different disturbance histories, and by Dantas et al. (2010) in a fragment of Caatinga, 1.33. However, it was inferior the data reported by Ferraz et al. (2014), in two areas of Caatinga with shrub-arboreal component, 2.10.

FIGURE 3 – **DENDROGRAM OF SIMILARITY (UPGMA METHOD) AMONG THE PLOTS BELONGING TO AREA I (1AP TO 10AP) AND AREA II (1A TO 10A).**



Source: FITOPAC, 2018.

A dendrogram is a phylogenetic tree that represents the genealogy and evolution of the species from a common ancestor. The family is based on this radical that will lead to the succession of different species. In the studied areas the family that presents this radical was Fabaceae with the following species *Anadenanthera colubrina* (Vell.) Brenan, *Bauhinia cheilantha* (Bong.) Steud, *Caesalpinia ferrea* (var. Leiostachya), *Caesalpinia pyramidalis* Tul. *Mimosa tenuiflora* (Willd.) Poir found in all plots, being abundant in plots 7A, 9A, 6A. These plots belong to the Acauã Settlement area.

The knowledge of the apicultural flora is essential since it determines the survival, abundance, and type of bee present (BARTH, 2005), important to understand the effects of climate changing and the absence of species with productive beekeeping potential, as reported by the beekeepers.

Nectar and pollen are basically the only food source of bees during their developmental stages, from larval to adulthood (MEYER 1985). Nectar is a natural food composed of sucrose, glucose, fructose, and water, secreted by the nectaries of the flowers and collected by the bees. Nectar is transformed into honey by the bees, and stored in combs as soon as its humidity is reduced below 20%, which allows its conservation for a long time.

Pollen grains, male flower gamete, are produced in the anthers, which are located in the terminal part of the stamens, male sex ual organ of flowers. These grains vary in size, shape, color and nutritional value according to the botanical species of origin and are used to identify the botanical origin of the honey (ALMEIDA MURADIAN; PRESOTO, 2000). Table 8 shows the species plant species used by the bees during a year.

Table 8 – Apiculture calendar of nectar, pollen and wax production in Apiary I and II, Aparecida/PB, Brazil, 2018.

SPECIES	COMMON NAMER	FLOWERING PERIOD	FORNECEDORA		
			NECTAR	POLLEN	BEESWAX
Handroanthus impetiginosus Mattos	Pau d'arco roxo	February-September	X		X
Cynophalla flexuosa (L.) J.Presl	Feijão- bravo	September-December	X		
Combretum leprosum Mart	Mofumbo	February-May	X		
Jatropha mollissima (Pohl) Baill	Pinhão – bravo	May-November	X	X	
Croton sonderianus Müll. Arg	Marmeleiro	February-May	X	X	
Mimosa tenuiflora (Willd.) Poir	Jurema-preta	June-August	X	X	
Aspidosperma pyrifolium Mart.	Pereiro	December-January	X		
Cereus jamacaru DC.	Mandacaru	November/January		X	
Pilosocereus gounellei (F.A.C.Weber)	Xiquexique	December-January		X	
Bauhinia cheilantha (Bong.) Steud.	Mororó	July	X	X	
Caesalpinia pyramidalis Tul.	Catingueira	December-January	X		
Anadenanthera colubrina (Vell.) Brenan	Angico	October-December	X	X	
Caesalpinia ferrea (var. leiostachya)	Pau- ferro	December	X	X	
Ziziphus joazeiro	Juazeiro	October-January	X		

Source: Our data, 2018.

CONCLUSIONS

The species found in the area I showed an initial stage of succession evidenced by the higher occurrence of species of the genus *Croton*, *Mimosa* and *Combretum*.

Species such as *Aspidosperma pyrifolium Mart.* (Pereiro), *Jatropha mollissima* (Pohl) Baill (pião bravo), *Anadenanthera colubrina* (Vell.) Brenan (angicos) were found in area I, and *Handroanthus impetiginosus* Mattos (pau d'arco roxo), *Cynophalla flexuosa (L.) J.Presl* (feijão bravo), *Ziziphus joazeiro* (juazeiro) and *Bauhinia cheilantha (Bong.) Steud* (mororó) in area II.

The area I present a lower species richness (10) but a higher index of diversity (1.93) than area II (N = 12 and Shannon = 1.52), which means that in the area I the individuals are more evenly distributed among species, and area 2 has greater dominance of one or more species.

Our results show a diversity of shrub and tree species with great apicultural potential for use by the family farmers from the planning of the beekeeping activity.

REFERENCES

ALCOFORADO-FILHO, F. G.; SAMPAIO, E. V. de Sá B.; RODAL, M. J. N.; Florística e fitossociologia de um remanescente de vegetação caducifólia espinhosa arbórea em Caruaru, Pernambuco. **Acta bot. bras.**, v. 17, n. 2, p.287-303, 2003.

ALMEIDA-MURADIAN, L.B.; PRESOTO, A.E.F.; Análise da composição centesimal de amostras de pólen apícola desidratado brasileiro. IN: CONGRESSO BRASILEIRO DE APICULTRA, 13, 2000, Florianópolis. **Anais...**, SC, 2000, 1 par. CD-ROM. Seção Resumos.

AMORIM, I. L. de; SAMPAIO, E. V. S. B.; ARAÚJO, E. de L.; Flora e estrutura da vegetação arbustivo-arbórea de uma área de caatinga do Seridó, RN, Brasil. **Acta bot. bras.**, v. 19, n.3, p.615-623, 2005.

ANDRADE, M.V.M.; ANDRADE, A.P.; SILVA, D.S.; BRUNO, R.L.A.; GUEDES, D.S.; Levantamento florístico e estrutura fitossociológica do estrato herbáceo e subarbustivo em áreas de caatinga no cariri paraibano. **Revista Caatinga**, v.22, n.1, p.229-237, 2009.

ARAUJO, K.D.; PARENTE, H.N.; SILVA, E.E.; RAMALHO, C.I.; DANTAS, R.T.; ANDRADE, A.P.; SILVA, D.S.; Levantamento florístico do estrato arbustivo-arbóreo em áreas contíguas de Caatinga no cariri paraibano. **Revista Caatinga**, v.23, n. 1, p.63-70, 2010.

BARBOSA, M. D.; MARANGON, L. C.; FELICIANO, A. L. P. F.; FREIRE, F. J.; DUARTE; G. M. T.; Florística e fitossociologia de espécies arbóreas e arbustivas em uma área de caatinga em Arcoverde, PE, Brasil. **Revista Árvore**, v.36, n.5, p.851-858, 2012.

BARTH O. M. **Análise polínica de mel: avaliação de dados e seu significado**. Mensagem Doce, São Paulo, p. 2-6, 2005.

BENEVIDES, D.S.; MARACAJA, P.B.; SIZENANDO FILHO, F.A.; GUERRA, A.M.N.M.; PEREIRA, T.F.C.; Estudo da Flora Herbácea da Caatinga no Município de Caraúbas- RN. **Revista Verde da Agroecologia e Desenvolvimento Sustentável**, v.2, n.1, p.33-44, 2007.

BRASIL. Ministério de Minas e Energia. Serviço Geológico do Brasil (CPRM). Projeto de Cadastro de fonte de Abastecimento por Água Subterrânea. **Diagnostico do município de Aparecida**- outubro / Org [por] João de Castro Mascarenhas, Breno Augusto Beltrão et al. Recife: CPRM/PRODEEM, 2005. Projeto de Cadastro de Fonte Abastecimento por Água subterrânea, estado da Paraíba. Disponível em <www.cprm.gov.br/rehi/atlas/ paraiba /relatorios/APAR010.pdf.>. Acesso em 15 de mar. de 2018.

BRAUN-BLANQUET, J. B.; **Fitosociologia: base para el estudio de las comunidades vegetales**. Madrid: H. Blume, 1979.

CORDEIRO, J. M. P.; SOUZA, B. I. de; FELIX, L. P.; Florística e fitossociologia em floresta estacional decidual na Paraíba, nordeste do Brasil. **Gaia Scientia**, v. 11, n. 1, p. 01-16, 2017.

DANTAS, J. G.; HOLANDA, A. C. de; SOUTO, L. S.; JAPIASSU, A.; HOLANDA, E. M. de; Estrutura do componente arbustivo/arbóreo de uma área de caatinga situada no Município de Pombal-PB. **Revista Verde,** v.5, n.1, p.134-142, 2010.

DANTAS, J. G.; HOLANDA, A. C.; SOUTO, L. S.; JAPIASSU, A.; HOLANDA, E. M.; Estrutura do componente arbustivo/arbóreo de uma área de caatinga situada no município de Pombal-PB. **Revista Verde**, v.5, n.1, p.134 – 142, 2010.

DRUMOND, M. A.; KILL, L. H. P.; RIBASKI, J.; AIDAR; S. T.; **Caracterização de conservação da Caatinga: Subsídio para programas de restauração florestal nas Unidades de Conservação da Caatinga (UCCAS).** Embrapa, Semiárido 2016. Disponível em <https://www.embrapa.br/busca-de-publicacoes/-/publicacao/1051296/caracterizacao-e-usos-das-especies-da-caatinga-subsidio-para-programas-e-restauracao-florestal-na-unidades-de-conservacao-da-caatinga-uccas>. Acessado em 20 de fev. de 2018.

FELFILI, J. M.; RESENDE, R. P.; Conceitos e métodos em fitossociologia. **Comunicações Técnicas Florestais**, v. 5, n. 1, p. 68, 2003.

FERRAZ, J. S. F.; FERREIRA, R. L. C.; SILVA, J. A. A.; MEUNIER, I. M. J.; SANTOS, M. V. F. Estrutura do componente arbustivo-arbóreo da vegetação em duas áreas de caatinga, no município de floresta, Pernambuco. **Revista Árvore**, Viçosa, v.38, n.6, p.1055- 1064, 2014.

GUEDES, R. da S.; ZANELLA, F. C. V.; COSTA JÚNIOR, J. E. V.; SANTANA, G. M.; SILVA, J. A. da S.; Caracterização florístico fitossociológica do componente lenhoso de um trecho de caatinga no semiárido paraibano. **Revista Caatinga**, v. 25, n. 2, p. 99-108, 2012.

HOLANDA, A. C. de; LIMA, F. T. D.; SILVA, B. M.; DOURADO, R. G.; ALVES, A. R.; Estrutura da vegetação em remanescentes de caatinga com diferentes históricos de perturbação em Cajazeirinhas (PB). **Revista Caatinga**, v.28, n.4, p. 142 – 150, 2015.

HOSOKAWA, R. T. et al.; **Introdução ao manejo e economia de florestas**. Curitiba: Editora UFPR, 2008. Instituto Brasileiro de Geografia e Estatística. Dados básicos do município de Aparecida, 2010. Disponível em <http://www.ibge.gov.br/cidadesat/painel/painel.php?codmun=250077#>. Acessado em 04 de out. de 2017.

INSTITUTO Brasileiro de Geografia e Estatística – IBGE; **História de Aparecida - PB.** Disponível em <http://biblioteca.ibge.gov.br/>. Acesso em 20 de out. de 2017.

LEITE, J. A. N.; ARAÚJO, L. V. C. de; ARRIEL, E. F.; CHAVES, L. de F. de C.; NÓBREGA, A. M. F. da; Análise quantitativa da vegetação lenhosa da Caatinga em Teixeira, PB. **Pesq. flor. bras.,** v. 35, n. 82, p. 89-100, 2015.

LIMA, B. G. de; COELHO, M. de F. B.; Estrutura do componente arbustivo-arbóreo de um remanescente de caatinga no estado do Ceará, Brasil. **CERNE**, v. 21 n. 4, p. 665-672, 2015. Disponível em <http://www.scielo.br/pdf/ cerne/ v21n4/2317-6342-cerne-21-04-00665.pdf>. Acessado em 20 de dez. de 2017.

LIMA, J. L. S.; CAVALCANTI, N. B.; LIMA, E. R.; CARVALHO, K. M.; ORESOTU, B. A.; OLIVEIRA, C. A. V.; **Levantamento Fitoecoloógico do Município de Petrolina-PE.** Petrolina, PE, p.23, 1999.

LIMA, M.; **Um estudo sobre as plantas apícolas de Ouricuri- PE**. Ouricuri-PE**:** CAATINGA, 2003.63p.

LONGHI, S. J.; **Agrupamento e análise fitossociológica de comunidades florestais na sub- bacia hidrográfica do rio Passo Fundo - RS**. 1997. 198 f. Tese (Doutorado em Ciências Florestais – Setor de Ciências Agrárias) – Universidade Federal do Paraná, Curitiba.

MARACAJÁ, P. B.; BATISTA, C. H. F.; SOUSA, A. H.; VASCONCELOS, W. E.; Levantamento florístico e fitossociológico do estrato arbustivo-arbóreo de dois ambientes na Vila Santa Catarina, Serra do Mel, RN. **Revista de Biologia e Ciências da Terra**, v.3, n.2, p.25-32, 2003.

MEYER, C. R.; WIESE, H.; **Breves noções de morfologia e anatomia das abelhas**. In: WIESE, H. Nova apicultura, Porto Alegre: ed. Agropecuária, Cap. 3, 1985.

MUELLER-DOMBOIS, D.; ELLENBERG, H. Aims and methods in vegetation ecology. John Wiley & Sons, New York, New York, USA. 1974.

OLIVEIRA, A.N.; AMARAL, I. L.; Florística e fitossociologia de uma floresta de vertente na Amazônia Central, Amazonas, Brasil. **Acta Amazônica**, v. 34, n. 1, p. 21- 34,2004.

VASCONCELOS, A. D. M.; HENRIQUE, I. G. N.; SOUSA, M. P. de; SANTOS, W. de S.; SANTOS, W. de S.; RAMOS, G. G. R.; Caracterização florística e fitossociológica em área de caatinga para fins de manejo florestal no município de São Francisco-PI. **Revista Acsa,** v.13, n.4, p. 329-337,2017.