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Vascular epiphytic component of "*Brejo de altitude*" in northeastern Brazil: floristic composition and phytosociological structure

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Resumo

Componente epifítico vascular de *Brejo de altitude* no nordeste do Brasil: composição florística e estrutura fitossociológica. Os brejos do nordeste brasileiro são uma importante área de biodiversidade na Floresta Atlântica. No entanto, pouco se sabe sobre a composição de espécies epífitas nesse tipo de vegetação. Este estudo teve como objetivo caracterizar a estrutura florística e fitossociológica de epífitas vasculares em uma área de Brejo do nordeste brasileiro. Todas as espécies de epífitas observadas na área foram coletadas e comparadas com outros trabalhos, por meio de uma NMDS. Para a estrutura fitossociológica de epífitas, foram instaladas 60 parcelas de amostragem de 10 x 10 m. O levantamento florístico de epífitas registrou 23 espécies, distribuídas em 19 gêneros e dez famílias. Nas parcelas, foram amostrados 65 forófitos e foram registradas a ocorrência de 197 epífitas vasculares, distribuídas em 12 espécies, 12 gêneros e cinco famílias. A composição florística difere de outras áreas da Mata Atlântica, incluindo o nordeste, tornando o *Brejo* uma área muito peculiar e com extrema necessidade de um plano para conservação destas espécies.

Palavras-chave: Brejos nordestinos; Ecologia de comunidade; Epífitas do nordeste brasileiro; Flora de epífitas

Abstract

The Brazilian Northeastern *Brejos* is an important area of biodiversity in the Atlantic Forest. However, little is known about the species composition of epiphytes in this type of vegetation. The present study aims to characterize the floristic and phytosociological structure of vascular epiphytic components in an area of the Brazilian Northeastern *Brejo*. All epiphytes occurring in the area were collected and compared with other studies through NMDS analysis. For the epiphyte phytosociological structure, sixty 10 × 10 m sampling plots were installed. The floristic survey of epiphytes recorded 23 species, distributed in 19 genera and ten families. In plots, 65 host individuals were sampled, and the occurrence of 197 vascular epiphytes, distributed in 12 species, 12 genera and five families was recorded. The floristic composition differs from other areas of the Atlantic Forest, including the northeast, making the *Brejo* a very peculiar area and with the utmost need of a plan for the conservation of these species.

Key words: *Brejos Nordestinos*; Community ecology; Epiphytes of the Brazilian Northeast; Epiphyte flora

Introduction

The Atlantic Forest is considered one of the richest sets of forest in the planet in terms of biodiversity (RIBEIRO et al., 2009). Its vegetation covers about 1.5 million kilometers along the Brazilian coast and extends to the west in smaller areas of the interior of Argentina and Paraguay (RIBEIRO et al., 2011). This forest in Northeastern Brazil can be considered an important area of endemism in South America because of the distinction (in terms of species composition) of the Atlantic Forest remnants distributed throughout Brazil (PRANCE, 1982). The Northeastern Atlantic Forest can be classified into eight biogeographical sub-regions, five as centers of endemism (Bahia, "*Brejos Nordestinos*", Pernambuco, Diamantina and *Serra do Mar*) and three as transition zones (São Francisco, Araucária and Interior Forests) (SILVA; CASTELETI, 2003). Among the subregions, the "*Brejos Nordestinos*" stands out, since they are considered "islands" of humid forest established in the semi-arid region, being surrounded by the *Caatinga* Forest (ANDRADE-LIMA, 1982).

The "*Brejos Nordestinos*", are also called "*Brejos de Altitude*" (TABARELLI; SANTOS, 2004), *Caatinga* Forest Enclaves (LEDO; COLLI, 2017), or even *Caatinga* Enclaves moist Forest (WWF; available at: http://www.worldwildlife.org). In this work, we will only refer to the term *Brejo* to simplify understanding. The *Brejos* conservation in the state of Paraíba (Brazil) is in critical condition. Fragmentation arising from sugarcane plantations, the expansion of livestock and population concentration is the main cause of degradation in these ecosystems (BARBOSA et al., 2004). The epiphytes are among the first life forms affected by deforestation because they need host trees in order to establish (SODHI et al., 2008). This group of species is sensitive to changes in environmental factors caused by anthropogenic disturbances such as forest fragmentation (WOLF, 2005) and the edge effect (BIANCHI; KERSTEN, 2014; DIAS-TERCEIRO et al., 2015).

Vascular epiphytes comprise approximately 10% of all known vascular plants, which means approximately 29,000 species; they are an important component of biological diversity of tropical forests (GENTRY; DODSON, 1987; ZOTZ, 2013a). For the Atlantic Forest, epiphytes correspond to more than 15% of the total richness in vascular plants (FREITAS et al., 2016). These species play an important role in the nutrient supply to the ecosystems since they efficiently capture atmospheric-origin nutrients (not of edaphic-origin) and subsequently make them available in the soil after the organic material decomposition process (OLIVEIRA, 2004). Their contribution is particularly noticeable in the increase of P and Ca content, in the decrease in acidity, and in the increase of C content (PEREIRA et al., 2005).

Epiphytes are also an important source of resources for canopy animals, since they provide pollen, nectar, fruit, water, and, in some cases, sites for nesting birds (BENZING, 1990; CRUZ-ANGÓN; GREENBERG, 2005; GONÇALVES-SOUZA et al., 2010). Important studies about epiphytic composition have been conducted in Southeastern and Southern Brazil (KERSTEN, 2010).

However, there is a lack of studies about vascular epiphytes in the Brazilian Northeastern region (DIAS-TERCEIRO et al., 2014; MENINI NETO et al., 2016; ARAÚJO et al., 2019). Attention in this region is mostly focused on the *Caatinga* Forest (OLIVEIRA et al., 2015; CASTRO et al., 2016) or, when in the Atlantic Forest, largely limited to tree species (RAMOS et al., 2019). Moreover, no study focusing on floristic structures has been conducted in the *Brejos*.

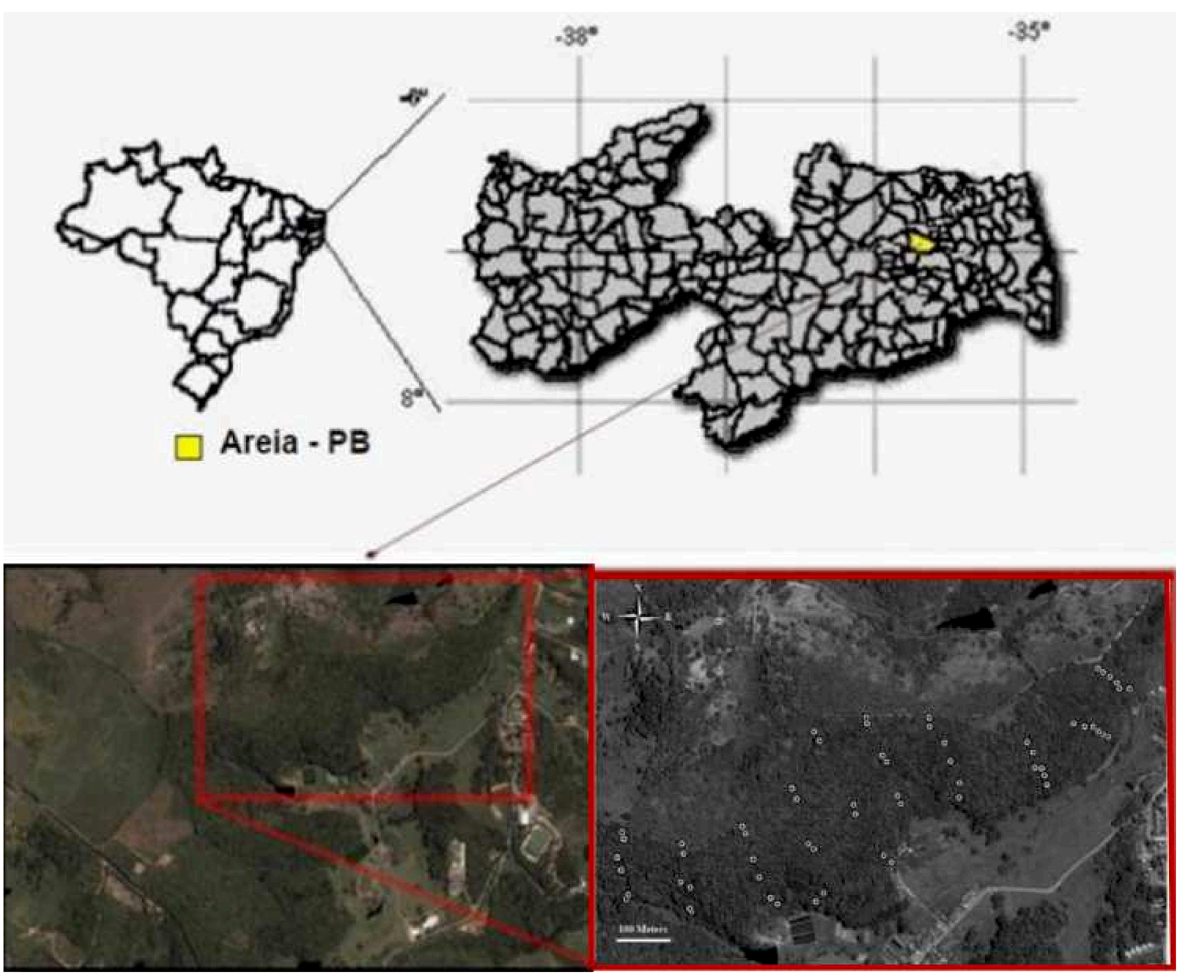
In light of the abovementioned, the aim of the current study is to characterize the floristic and phytosociological structure of vascular epiphytic components in a *Brejo* area located in the municipality of Areia, Paraíba. In addition, the floristic epiphytic composition was compared with other studies conducted in different Brazilian regions in order to provide information about similarity, and to situate this component of vegetation floristically.

Material and Methods

Study area

The studied area is located in the Agricultural Science Center (CCA in Portuguese), Campus II, at the Federal University of Paraíba (UFPB in Portuguese), Areia County, Paraíba, Brazil (06°57'46"S and 35°41'31"W), in the Brejo Paraibano microregion. The study was conducted in an 80-ha area of forest (Figure 1), at a mean altitude of 573.7 ± 32.22 m. The average annual temperature is 22°C, the relative humidity is approximately 85% and the average annual

FIGURE 1: Focus area of the study and layout of the plots for the phytosociological structure, forest of Agricultural Science Center, Campus II, UFPB, Areia, Paraíba (PB). The points represent plots. Source: Adapted from Dias-Terceiro et al. (2014).



rainfall is 1,450 mm (MAYO; FEVEREIRO, 1982). According to the Köppen classification, the climate is type As (ALVARES et al., 2013). The Autumn-Winter period is rainy; there is a water deficit of approximately five months; hydrography is characterized by small and medium watercourses with predominantly dendritic exorheic drainage (MOREIRA, 1989).

The land topography is wavy relief to strongly wavy relief. The predominant soils are Argisols (EMBRAPA, 2006). The vegetation formation in the area is the open ombrophylous forest (VELOSO et al., 1991; IBGE, 2012) due to the orographic effect of the eastern front of the Borborema Plateau, which is influenced by high precipitation and milder temperatures in comparison to the regional context (OLIVEIRA et al., 2006). Some authors consider the area as "*Brejo de altitude*" (BARBOSA et al., 2004; ANDRADE et al., 2006; OLIVEIRA et al., 2006; XAVIER et al., 2009); however, according to the IBGE (2012), "*Brejo de altitude*" are areas of high montane dense ombrophylous forest, a fact that generates conflict regarding the classification of the vegetation in the area. Thus, the presence of palm trees leads us to consider the area as montane open ombrophylous forest with palm trees (IBGE, 2012). The absolute density of vascular epiphytic species recorded in the area is 328 ind. ha^{-1} (DIAS-TERCEIRO et al., 2014).

Floristic survey

The floristic survey of vascular epiphytes required weekly sampling in the area, from August 2009 to May 2010, period in which all the observed species were collected. The collected material was herborized according to the usual floristic survey procedures and subsequently deposited in the JPB Herbarium of the Federal University of Paraiba, Campus I (João Pessoa County) and in the Jaime Coelho de Moraes Herbarium (EAN) of the Agricultural Sciences Center at the UFPB, Campus II. The angiosperm families were identified according to the APG IV system (CHASE et al., 2016) and the pteridophytes, according to PPGI (2016).

The surveyed species were classified in five ecological categories, according to Benzing (1990), based on their relationship with the host, as follows: characteristic holoepiphyte, facultative holoepiphyte, accidental holoepiphyte, primary hemiepiphyte, and secondary hemiepiphyte. Subsequently, the vascular epiphytic flora in the area was compared to that of 10 other floristic studies performed in different Brazilian areas (Table 1) in order to determine their similarity in terms of species composition. The criteria that used for the selection of areas were the most recent studies focused on evaluating the florist composition of vascular epiphytes in Brazilian Forests. Thus, we included inventories in different regions of the Atlantic Forest, as well as inventories in the Amazon Forest, to investigate possible similarities between the floras already exemplified in other studies (SANTOS et al., 2007; LEDO; COLLI, 2017).

Therefore, the vascular epiphyte species composition in each area was summarized through non-metric multidimensional scaling (NMDS; k = 2). The ranking was based on the dissimilarity between the samples calculated by the Jaccard index (BORCARD et al., 2011), using data of presence and absence of species. The R software (R DEVELOPMENT CORE TEAM, 2013) was used for statistical analysis.

Epiphyte phytosociological structure

For the quantitative survey, 60 plots, each with a dimension of 10 x 10 m, were marked. The plots were systematically distributed to cover different areas of forest (Figure 1). In these plots, all shrub and tree individuals (phorophyte or not), regardless of size, were analyzed, climbed, and all epiphytes were recorded. The *host tree* individuals present in the plots were divided in four Zones adapted from Johansson (JOHANSSON, 1974): Zone 1 (from the ground to the base of the crown), Zone 2 (from the base of the crown to the first branch), Zone 3 (from the first branch of the crown to the second) and Zone 4 (from the second branch onwards), in which all individuals of vascular epiphytes were quantified.

The epiphyte phytosociological parameters calculated were the absolute and relative frequency of epiphytic species in host tree individuals (AFi and RFi), the absolute and relative frequency of epiphytic species

TABLE 1: Areas used to evaluate the vascular epiphytic floristic composition, followed by the Authors; Veg. Form. = Vegetation Formation; Locality (Municipality/State); A.F. = Atlantic Forest; Am.F. = Amazon Forest; A.F.B. = Atlantic Forest *Brejo*.

Area	Autor	Veg. Form.	Locality (Municipality/State)
1	Waechter (1986)	A.F.	Torres, RS
2	Kersten & Silva (2002)	A.F.	Araucária, PR
3	Dittrich et al. (1999)	A.F.	Curitiba, PR
4	Dislich and Mantovani (1998)	A.F.	São Paulo, SP
5	Borgo and Silva (2003)	A.F.	Curitiba, PR
6	Rogalski and Zanin (2003)	A.F.	Marcelino Ramos, RS
7	Waechter (1998)	A.F.	Osório, RS
8	Aguiar et al. (1981)	A.F.	Montenegro e Triunfo, RS
9	Kersten and Silva (2001)	A.F.	Paranaguá, PR
10	Giongo and Waechter (2004)	A.F.	Eldorado do Sul, RS
11	Cervi et al. (1988)	A.F.	Curitiba, PR
12	Gaiotto and Acra (2005)	A.F.	Fazenda Rio Grande, PR
13	Dettke et al. (2008)	A.F.	Maringá, PR
14	Bataghin et al. (2008)	A.F.	Maximiliano de Almeida, RS
15	Kersten et al. (2009)	A.F.	Guarapuava e Pinhão, RS
16	Geraldino et al. (2010)	A.F.	Campo Mourão, PR
17	Becker et al. (2013)	A.F.	Arroio do Sal, RS
18	Buzatto et al. (2008)	A.F.	Passo Fundo, RS
19	Perleberg et al. (2013)	A.F.	Pelotas, RS
20	Boelter et al. (2014)	Am.F.	Manaus, AM
21	Obermüller et al. (2012)	Am.F.	Acrelândia, AC
22	Quaresma and Jardim (2014)	Am.F.	Maracanã, PA
23	Alves and Menini-Neto (2014)	A.F.	Serra do Cruz, MG
24	Barbosa et al. (2015)	A.F.	Serra da Babilônia, MG
25	Blum et al. (2011)	A.F.	Morretes, PR
26	Oliveira et al. (2013)	A.F.	Criciúma, SC
27	Araújo et al. (2019)	A.F.	Itabaiana, SE
28	Present study	A.F.B.	Areia, PB

in host tree species (AFj and RFj) (WAECHTER, 1998), and the absolute and relative frequency in the zone (AFz and RFz). The arithmetic mean of the three estimated relative frequencies was used to calculate the epiphytic importance value (EIV) (KERSTEN; SILVA, 2001). The analyses were done through formulas developed on an Excel spreadsheet (Microsoft Office Excel®). We would like to emphasize that, unlike other works carried out in the area (DIAS-TERCEIRO et al., 2011; 2012; 2014; 2015), this one contributes with a more complete list of species by collections, besides the plots already studied. In addition, this work includes an epiphyte phytosociological approach that is distinct from others.

Results

Floristic survey

The floristic survey recorded 23 vascular epiphyte species distributed in 19 genera and 10 families

(Table 2). The most significant families were Orchidaceae and Bromeliaceae, with six species each (26.08%) and six and three genera respectively; Polypodiaceae, with three species (13.04%) and three genera; and Moraceae, with two species (8.69%) and one genus (Figure 2). The other families – a total of six – were represented by only one species. *Tillandsia* **L.** (Bromeliaceae) was the richest genus, with four species; followed by the genus *Ficus* L. (Moraceae), with two species. The other genera (17) had only one species.

The ecological host-related categories allowed us to identify the predominance of characteristic holoepiphytes (14 species, 60.86% of the total taxa). The Bromeliaceae family (21.73% of the total species) stands out among them, since only one species (*Aechmea constantinii*) did not fit this category; as well as the Orchidaceae

TABLE 2: List of vascular epiphytic species registered in the floristic survey of the Agricultural Science Center forest, Campus II, UFPB, Areia, Paraíba, with respective Ecological Categories in relation to the host tree and the Voucher number. HLC = characteristic holoepiphyte; HLF = *facultative* holoepiphyte; HLA = accidental holoepiphyte; HMP = primary hemiepiphyte; HMS = secondary hemiepiphyte.

Family/Species	Ecological Categories	Voucher
APOCYNACEAE		
Allamanda sp. L.	HLA	15541*
ARACEAE		
Philodendron imbe Schott ex Endl.	HMS	15529*
BROMELIACEAE		
Aechmea constantinii (Mez) L.B.Sm.	HLF	15531*
Tillandsia gardneri Lindl.	HLC	15538*
Tillandsia polystachia (L.) L.	HLC	15540*
Tillandsia recurvata (L.) L.	HLC	15539*
Tillandsia sp.	HLC	15542*
Vriesea procera (Mart. ex Schult.& Schult.f.) Wittm.	HLC	15528*
CACTACEAE		
Rhipsalis floccosa Salm-Dyck ex Pfeiff.	HLC	14431*
CLUSIACEAE		
Clusia nemorosa G. Mey.	HLA	15534*
MORACEAE		
Ficus paludica Standl.	HMP	15530*
Ficus eximia Schott	HMP	15537*
ORCHIDACEAE		
Catasetum macrocarpum Rich. ex Kunth	HLC	15536*
Campylocentrum crassirhizum Hoehne	HLC	14430*
Epidendrum difforme Jacq.	HLC	14432*
Gomesa barbata (Lindl.) M.W.Chase & N.H.Williams	HLC	14428*
Polystachya concreta (Jacq.) Garay & H.R. Sweet	HLC	14429*
Vanilla schwackeana Hoehne	HMS	15535*
POLYGALACEAE		
Securidaca rivinifolia A. St.-Hil. & Moq.	HLA	15533*
POLYPODIACEAE		
Microgramma vacciniifolia (Langsd. & Fisch.) Copel.	HLC	43550**
Pleopeltis macrocarpa (Bory ex Willd.) Kaulf.	HLC	43551**
Serpocaulon triseriale (Sw.) A.R. Sm.	HLC	43549**
RUBIACEAE		
Psychotria bracteocardia (DC.) Müll.Arg.	HLA	15532*

* Species deposited in the Jaime Coelho de Moraes Herbarium (EAN). ** Species deposited in the JPB Herbarium.

(21.73%), except for the *Vanilla schwackeana* (Table 2). Accidental holoepiphytes showed the second highest occurrence among species (four species, 17.39%). The primary and secondary hemiepiphytes were represented by just two species each (8.69%). *A. costantinii* was the only facultative holoepiphyte (4.34%) and it was the only species to fit this category.

The ordination produced by the NMDS axes in the comparison between the floristic composition in the referred area and that of other Brazilian regions (Figure 3) was able to explain the 38.64% variation in species composition (stress = 0.09). The results show that the studied area is discrepant in terms of vascular epiphytic species composition.

FIGURE 2: Percentage of species per family, forest of Agricultural Science Center, Campus II, UFPB, Areia, Paraíba.

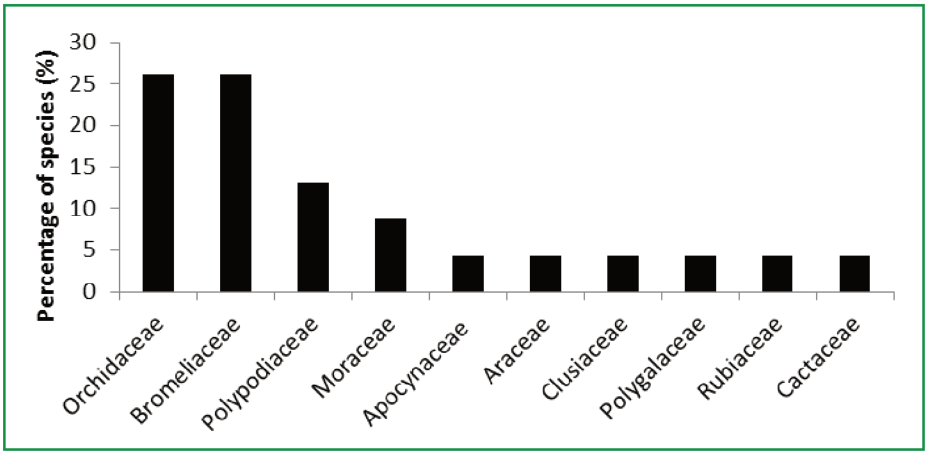
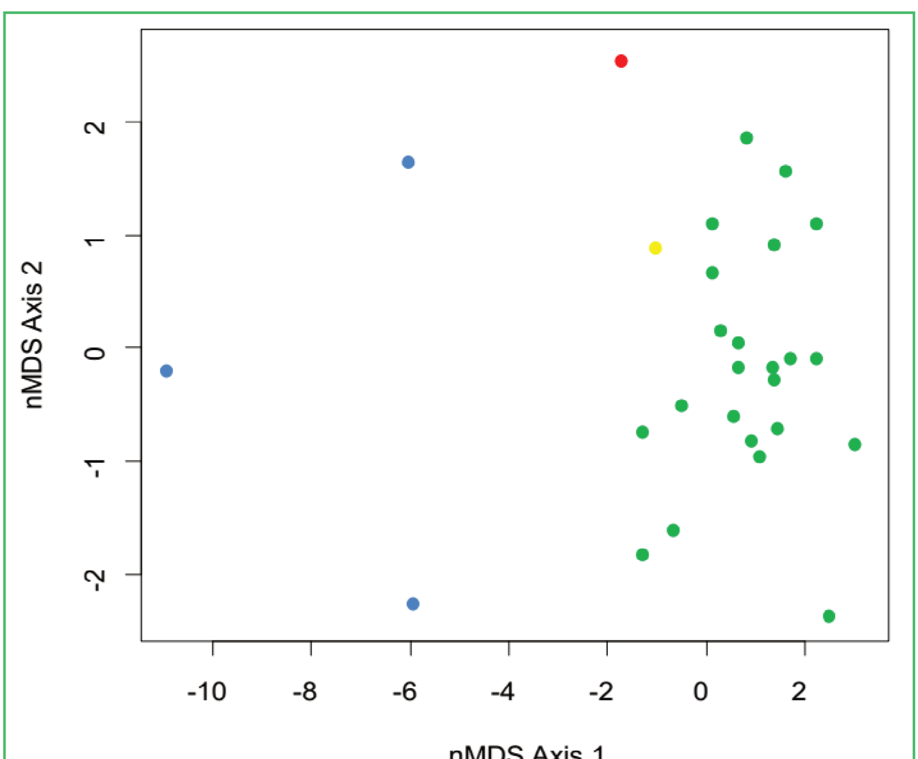


FIGURE 3: Relationship between the two axes (k = 2) generated after the ordering of the NMDS (R^2 = 38.64% stress = 0.09), summarizing 28 areas detailed in Table 1. The present study is represented by red points; blue points represent areas of the Amazon Forest; green points represent areas of the Atlantic Forest; and yellow points represent the only area of the Atlantic Forest in the Brazilian Northeast.



Epiphyte phytosociological structure

The quantitative survey recorded 197 occurrences of vascular epiphytes, which were represented by 12 species, 12 genera and five families. Table 3 depicts the frequency of the epiphytic species found in the survey. The *Microgramma vacciniifolia* species showed the highest epiphytic importance value (EIV), responding to 24.83 of the index. This species occurred in 43.07% of the hosts, 56% of the host tree species, and 19.65% of the sampled zones.

The second most important species in the current study was *Philodendron imbe*, with 16.63 EIV. The taxon occurred in 29.23% of the hosts, 48% of the host species, and 9.6% of the zones. The *Pleopeltis macrocarpa* taxon was the third most important species (EIV = 15.07) and occurred in 27.69% of the hosts, 44% of the host tree species, and 9.17% of the sampled zones. *Aechmea constantinii* showed 9.88 EIV and was found in 15.38% of the hosts, 32% of the host tree species, and 5.67% of the zones.

The *Rhipsalis floccosa* taxon showed 7.8 EIV and was present in 12.3% of the hosts, 24% of the host species, and 4.8% of the zones. *Vriesea procera* showed 4.67 EIV and occurred in 7.69% of the hosts, 16% of the host tree species, and 2.18% of the zones. *V. schwackeana* showed 3.46 EIV and occurred in 4.61% of the hosts, 12% of the host species, and 2.18% of the sampled zones. The other sampled vascular epiphyte species showed less than 2.1 EIV and together accounted for only 8.09% of the total EIV. Their frequency varied as shown in Table 3.

Discussion

According to the floristic survey conducted in the studied area, Orchidaceae was the richest taxonomic group, which corroborates other studies conducted in the Neotropics (BUZATTO et al., 2008; GERALDINO et al., 2010; BECKER et al., 2013; PERLEBERG et al., 2013; BOELTER et al., 2014; QUARESMA; JARDIM, 2014). On the other hand, Bromeliaceae and Cactaceae can be the largest families in areas subjected to anthropization (DETTKE et al., 2008). However, according to Bataghin et al. (2008), pteridophytes were the richest taxonomic group due to climate-related changes (temperature and humidity) caused by anthropic activity, besides fragment positioning (next to an extensive soybean culture and to an urban area).

TABLE 3: Species of vascular epiphytes of the Agricultural Science Center forest, Campus II, UFPB, Areia, Paraíba, in order of epiphytic importance value. Where: AFi = absolute frequency in individual host trees, RFi = relative frequency in individual host trees, AFj = absolute frequency in host tree species, RFj = relative frequency in host tree species, AFz = absolute frequency in the zone, RFz = relative frequency in the zone, EIV = epiphytic importance value.

Species	AFi	RFi	AFj	RFj	AFz	RFz	EIV
Micrograma vacciniifolia	43.07	28.57	56	21.87	19.65	24.06	24.86
Philodendron imbe	29.23	19.39	48	18.75	9.6	11.76	16.63
Pleopeltis macrocarpa	27.69	18.37	44	15.62	9.17	11.23	15.07
Aechmea constantinii	15.38	10.2	32	12.5	5.67	6.95	9.88
Rhipsalis floccosa	12.3	8.16	24	9.37	4.8	5.88	7.8
Vriesea procera	7.69	5.1	16	6.25	2.18	2.67	4.67
Vanilla schwackeana	4.61	3.05	12	4.68	2.18	2.67	3.46
Catasetum macrocarpum	3.07	2.03	8	3.12	0.87	1.06	2.07
Tillandsia polystachya	3.07	2.03	8	3.12	0.87	1.06	2.07
Alatiglossum barbatum	1.53	1.01	4	1.56	0.43	0.53	1.03
Polystachya concreta	1.53	1.01	4	1.56	0.43	0.53	1.03
Epidendrum difforme	1.53	1.01	4	1.56	0.43	0.53	1.03

Most of the vascular epiphyte surveys conducted in Brazil found the occurrence of many families with few representative species (KERSTEN; SILVA, 2001). This fact was not observed in the open ombrophylous forest of the present study, nor in other studies, such as the one conducted by Bataghin et al. (2008) and Quaresma and Jardim (2014), who observed few families and species. The genus *Tillandsia* was the most abundant in number of species. The same was observed in only one other floristic epiphyte survey (GIONGO; WAECHTER, 2004). The fact that some species of this genus have xeromorphic and heliophytic features (REITZ, 1983) that enable them to endure environments under extreme conditions may have contributed for *Tillandsia* to be the most abundant genus. Species of the *Tillandsia* genus are known to have no negative effect between continuous and fragmented habitats (SÁYAGO et al., 2018), making their colonization possible in several types of environments, including electric wires, as long as there is contact with liquid water to germinate (MONTES-RECINAS et al., 2012). It is worth highlighting that, in this study, we have also reported the occurrence of the *Epidendrum difforme* taxon, not yet registered in Brazil, according to the Brazilian List of Plants and Fungi (ZAPPI et al., 2015). This species can occur in the United States, Belize, Bolivia, the Caribbean, Colombia, Ecuador, French Guiana, Guatemala, Guyana, Honduras, Martinique, Mexico, Panama, Peru and Suriname, but had not yet been registered in Brazil (Missouri Botanical Garden; available at: www.tropicos.org).

The result obtained in the ecological host-related categories is very similar to that found in other surveys, in which there was a predominance of characteristic holoepiphytes in comparison to the other categories (BATAGHIN et al., 2008; DETTKE et al., 2008; KERSTEN et al., 2009; GERALDINO et al., 2010; ARAÚJO et al., 2019). For our region, accidental epiphytes were the second most representative group. In most studies carried out in Brazil, this second position is occupied by facultative epiphytes, but in studies carried out in disturbed areas, this situation may be altered (SANTANA et al., 2017).

Not all the epiphyte studies conducted in Brazil (OBERMÜLLER et al., 2012; BOELTER et al., 2014) used the Benzing classification. This lack of standardization makes a more accurate comparison between the areas based on the ecological categories difficult. In addition, new ways of assessing the relationship with the host trees have been suggested (ZOTZ, 2013b), a fact that makes it challenging to carry out further comparisons between epiphyte studies.

The epiphytic species composition in the studied area differs strongly from that of other studies conducted in Brazil, including in the Northeast Atlantic Forest (ARAÚJO et al., 2019). These results support the hypothesis that the *Brejos* differs from other Atlantic Forest regions of Brazil in terms of species composition (LEDO; COLLI, 2017). In addition, molecular data from invertebrates present in both the Atlantic Forest and the Amazon Forest indicate that in the Last Glacial Maximum, the *Brejos* had greater climatic similarity with Amazonian forests (LEDO; COLLI, 2017). In figure 3, Region 27 (Northeast Atlantic Forest), is closer to the Atlantic Forest of the Southeast and South of Brazil, and far from *Brejo* (being that it is closer geographically). Another important point is the fact that the *Brejo* does not present species of the Gesneriaceae family, which is decidedly present in surveys of the Atlantic Forest (ARAÚJO et al., 2019) and absent in some regions of the Amazon Forest (FREITAS et al., 2016), which makes the *Brejo* flora peculiar. Therefore, perhaps the *Brejos* epiphytes, should not be listed as Atlantic Epiphytes, as in the inventories already realized (RAMOS et al., 2019), but as epiphytes of the neotropics (MENDIETA-LEIVA et al., 2020).

It is noteworthy that the forests of the *Brejo* area in Areia County are remnants of what was once a vast Open Ombrophylous Forest. They resulted from anthropic pressure (due to population density) and from the agricultural expansion of monoculture cycles such as tobacco, sisal and, mainly, sugarcane (BARBOSA et al., 2004; OLIVEIRA et al., 2006). The studied area has no record of deforestation since 1971 (according to local residents) and, nowadays, it is intended for preservation. However, it is still subjected to the illegal extraction of firewood, a fact that hinders the regeneration and establishment of tree species and, consequently, of epiphytic species.

In regard to our area, the usage history of the region, the location in which it is inserted (surrounded by the *Caatinga* forest), the low species richness together with the high presence of accidental epiphytes, may lead us to consider that the fragment (focus of the study) is facing a high degree of degradation, or that this may be an effect of the low surrounding humidity. However, this is the first floristic study done for the *Brejo*, so it is difficult to credit the richness to these factors. It may be that the richness is intrinsic to the area. For example, Quaresma and Jardim (2014) also found a low species richness (even less than ours) in an area of environmental preservation in the Amazon (preserved area with high humidity). Therefore, only other studies in the region can say whether the low species richness is a local/environmental issue or the result of anthropogenic factors, for example.

According to the epiphytes physociological survey, the *Microgramma vacciniifolia* taxon showed the highest importance value in several surveys conducted with epiphytes in Brazil (GONÇALVES; WAECHTER, 2002; KERSTEN; SILVA, 2001; WAECHTER, 1986; 1998), and it was commonly recorded in other surveys (KERSTEN; KUNIYOSHI, 2006; BONNET et al., 2011; BECKER et al., 2013; PERLEBERG et al., 2013). Studies conducted in the area found that *M. vacciniifolia* is widely distributed in the forest investigated in the current study, and that it has high density of individuals (DIAS-TERCEIRO et al., 2014), broad ecological valence for different microclimatic factors and is able to endure environments under different conservation conditions (DIAS-TERCEIRO et al., 2012).

A floristic survey conducted at Cidade Universitária "Armando de Sales Oliveira", São Paulo, Brazil (DISLICH; MANTOVANI, 1998), found that the *Philodendron imbe* taxon occurred only in a secondary section of a semidecidual mesophytic forest and that it was quite common within the studied reservation, mainly near the banks of a stream. However, this species was not found in several surveys (BATAGHIN et al., 2008; DETTKE et al., 2008; BOELTER et al., 2014), including in those performed in similar vegetation formation areas (OBERMÜLLER et al., 2012). Similarly, to *M. vacciniifolia*, the *P. macrocarpa* taxon is widely distributed in the investigated area of study, which has high density of individuals (DIAS-TERCEIRO et al., 2014) and broad ecological valence for different microclimatic factors. It is also able to endure environments subjected to different disturbance levels (DIAS-TERCEIRO et al., 2011).

The low EIV of the Orchidaceae species was also found in other studies that have shown similar values for all species (OLIVEIRA et al., 2013; QUARESMA; JARDIM, 2014) or for most of the group (GERALDINO et al., 2010). This group of species was not found in some quantitative surveys (PINTO et al., 1995; DETTKE et al., 2008) and the degree of disturbance in these areas was considered the factor responsible for its absence.

Although it is a secondary forest, still subject to anthropogenic threats, the studied *Brejo* forest highlights the unique characteristics of the epiphytic community found. Therefore, we suggest further studies should be carried out in the Brazilian Northeastern region (especially in the *Brejos*) in order to elucidate where this region fits in the vegetation classification, identify taxon at risk of extinction and outline conservation measures for this group of species.

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