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Vascular epiphytes in the Grumari restinga, RJ: floristic and similarities between restingas in Eastern Brazil

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Abstract

The community of vascular epiphytes in the Grumari *restinga,* Rio de Janeiro state, was evaluated through surveys carried out in 2014 and supplemented with herbarium material and publications. Thirty-seven (37) vascular epiphyte species were recorded, distributed in 21 genera and six families. The richest families are Orchidaceae and Bromeliaceae, which are the most representative ones (67.6% of all record species). The richness in Grumari *restinga* is greater than the other inventories carried out in the coastal plain of the Southeastern Region of Brazil, however, lower than that of *restingas* for São Paulo, Paraná and of the coastal plain of Rio Grande do Sul. The most representative ecological category was the characteristic holoepiphyte (62%); it was followed by the facultative and accidental holoepiphytes (18% each). The Grumari *restinga* shares more species with Espírito Santo state and Rio de Janeiro than with São Paulo and Southern Region of Brazil, possibly due to the geographical distance. Our study provides the first contribution to the knowledge about the epiphytic flora in Grumari *restinga* and shows a singular flora with 40% of unique species occurring in this location, fact that justifies its importance as conservation area.
Key words: Atlantic domain, coastal vegetation, conservation, flora, taxonomy.

Resumo

A comunidade de epífitas vasculares ocorrente na *restinga* de Grumari, estado do Rio de Janeiro, foi avaliada através de coletas realizadas no ano de 2014 e complementadas com materiais de herbários e publicações. 37 espécies de epífitas vasculares foram registradas, distribuídas em 21 gêneros e seis famílias. As famílias mais ricas são Orchidaceae e Bromeliaceae, que foram as mais representativas (67,6% de todas as espécies registradas). A riqueza na *restinga* de Grumari é maior do que os outros inventários realizados na planície costeira do Sudeste do Brasil, no entanto, inferior as *restingas* de São Paulo, Paraná e da planície costeira do Rio Grande do Sul. A categoria ecológica mais representativa foi a holoepífita característica (62%) seguida por holoepífitas facultativas e acidentais com 18% cada. A *restinga* de Grumari possui mais espécies em comum com as restingas do Espírito Santo e Rio de Janeiro do que com São Paulo e região Sul do Brasil, possivelmente em função da distância geográfica. Nosso estudo traz a primeira contribuição ao conhecimento da flora epifítica da *restinga* de Grumari e evidencia uma flora singular com 40% das espécies exclusivas dessa localidade, o que justifica sua importância como Unidade de Conservação.
Palavras-chave: Domínio Atlântico, vegetação costeira, conservação, flora, taxonomia.

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Introduction

Vascular epiphytes are a well-known feature in tropical and subtropical rainforests and are important floristic, structural and functional components of these ecosystems (Gentry & Dodson 1987; Krömer *et al*. 2007; Ding *et al*. 2016), thus representing approximately 9% of the world's vascular flora (Zotz 2013). The Brazilian Atlantic Rainforest is recognized as one of the five most important world hotspots (Myers *et al*. 2000), where vascular epiphytes represent approximately 15% (2.256 species) of the known vascular plants (Freitas *et al*. 2015) from this domain, with greater richness and endemism located in the states of Rio de Janeiro and Espírito Santo (Menini Neto *et al*. 2015). In Brazil, most studies concentrate on the southern and southeastern regions, especially in ecosystems associated with the Atlantic rainforest domain, such as the dense ombrophilous forest (Blum *et al*. 2011; Freitas & Assis 2013; Hoeltgebaum *et al*. 2013; Barbosa *et al*. 2015; Furtado & Menini Neto 2015; Wängler *et al*. 2015), mixed ombrophilous forest (Kersten & Kuniyoshi 2009; Alves & Menini Neto 2014), deciduous and seasonal semideciduous forest (Rogalski & Zanin 2003;Dettke *et al*. 2008; Barbosa *et al*. 2015; Basílio *et al*. 2015; Dislich & Mantovani 2016; Couto *et al*. 2016b), *restinga* forests (Kersten & Silva 2006; Fontoura *et al*. 2009; Mania & Monteiro 2010; Staudt *et al*. 2012) and granite and gneiss inselbergs (Couto *et al*. 2016a).

Restingas represent one of the most important ecosystems of the Atlantic domain, and are characterized by a peculiar vegetation developing on sandy lithology and poor in nutrients, exposed to high temperatures, low water availability and high salinity (Scarano 2002). *Restingas* are distributed in Brazil from Amapá to southern Rio Grande do Sul, through an extension of over 9.000 kilometers across 17 states (Cunha 2005). They represent one of the most endangered ecosystems in Brazil because they were historically explored over the centuries, due to the patchy and disordered human occupation from the seashore towards the mainland (Cunha 2005).

Thus, the Grumari *restinga*, located on the outskirts of a major city (Rio de Janeiro), contributes positively to the conservation of a significant part of the *restingas* in the state of Rio de Janeiro. The lack of basic information about most floristic groups, including vascular epiphytes, which are a key group for the maintenance of tropical ecosystems (Benzing 1990), is a relevant problem for the conservation of this remnant.The aim of the present study was to inventory the vascular epiphytes in the Grumari *restinga*, to categorize species according to the ecological relationship established with their phorophytes and to evaluate the floristic similarity among other *restingas* in Brazil, where epiphytic flora was studied.

Materials and Methods

Study site

The Grumari *restinga* is located in southern Rio de Janeiro state (23º2'30''S, 43º31'W), in the Grumari Environmental Protection Area (APA Grumari - Fig. 1), between the neighborhoods of Recreio and Barra de Guaratiba. It covers a total area of 951 hectares of *restinga* vegetation and rocky outcrops (Silva & Pinheiro 2007).

The climate type is tropical, with hot, rainy summer and dry winter. The annual average temperature and rainfall correspond to 23.6º C and 1100 mm, respectively (Moreira *et al.* 2014). The soil is sandy and saline, and there are swampy areas with organic matter accumulation (Oliveira & Maia 2005). The Grumari *restinga* presents six vegetation types: halophilous, psammophilous, post-beach, open shrub, closed shrub and *restinga* forest (Moreira *et al.* 2014). We sampled the epiphytic flora in the closed shrub formation dominated by Myrtaceae and Fabaceae, which can reach up to 15 meters high. We also found dense bromeliad clumps, mainly *Aechmea sphaerocephala* Baker, in the understory.

Floristic inventory

The floristic inventory of vascular epiphytic species was performed through expeditions undertaken between January and December 2014, using a random walking method (Filgueiras *et al*. 1994), when fertile plant material samples were collected and processed according to Mori *et al*. (1989). All samples were deposited in the Federal University of Rio de Janeiro herbarium (RFA). Identifications were made based on taxonomic monographs and floras, through comparison with identified specimens in the R, RB and RFA herbaria, and through consulting with specialists on specific families. The list was supplemented with materials deposited in GUA, RFA, R and RB (see acronyms in Index Herbariorum [Thiers, continuously updated]), and with literature about the studied location (Nogueira *et al*. 2011; Arbo-Gallas & Verçoza 2012; Moreira *et al*. 2014).

The circumscription of species to family follows APG IV (2016) for angiosperms, Smith *et al.* (2006) for ferns and Christenhusz *et al.* (2011) for lycophytes. The taxa names were updated according to supplementary materials in the Brazil Flora Group review (BFG 2015) for angiosperms and Prado *et al.* (2015) for ferns and lycophytes, and to taxonomic publications, using author abbreviations suggested by Brummitt & Powell (1992) and IPNI (<http://www.ipni.org>).

The endangered species were indicated based on the official list available on the Livro Vermelho da Flora do Brasil (Red Book of Brazilian Flora) (Martinelli & Moraes 2013).

Classification of ecological categories

Epiphytes were classified in four ecological categories based on the relationship established with the phorophyte, according to Benzing (1990), with modifications by Kersten & Kuniyoshi (2009): characteristic holoepiphytes (Epi, those that spend the full life cycle on the phorophytes); facultative holoepiphytes (Fac, in the same community, which can grow as epiphytes as well as terrestrial and rupicolous); accidental holoepiphytes (Aci, usually terrestrial/rupicolous, but can casually grow as epiphytes); hemiepiphytes (Hem, only species that spend part of their lives on phorophytes).

Similarity and statistical analysis

A matrix of binary data (presence/absence) compiled from six floristic *restinga* lists (Tab. 1, Fig. 1), where all the names were updated according to the BFG (2015) was prepared in order to assess the similarity between the epiphytic flora in the Grumari *restinga* and other Brazilian *restingas*. To give more strength to the analysis, species not identified to species level and dubious identifications ("similar to" [aff.] or "check" [cf.]) were excluded and different subspecies and varieties were considered as the same species.

Selected sites were compared through cluster analysis, using the Jaccard coefficient as distance measurement (Müeller-Dombois & Ellenberg

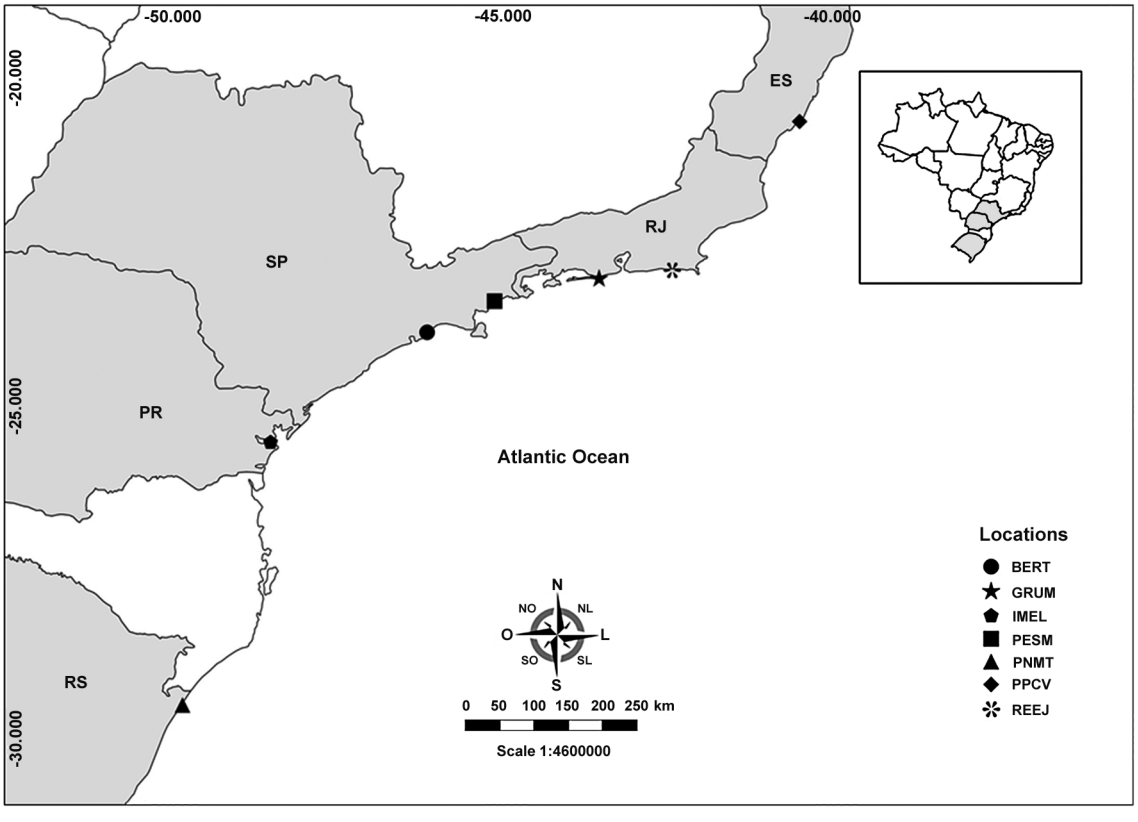

Figure 1 – Map showing the Grumari *restinga* and location of the areas compared through cluster and ordination analyses (see text for details).

Table 1 – *Restinga* data sets evaluated through multivariate analysis and their acronyms (Acr.), sites, state (UF), geographic coordinates and reference sources. (Acronyms: IMEL = Ilha do Mel; PPCV = Parque Estadual Paulo Cesar Vinha; BERT = restingas de Bertioga; REEJ = Reserva Ecológica Estadual de Jacarepiá; PESM = Parque Estadual da Serra do Mar (Núcleo Picinguaba); GRUM = restinga de Grumari).

Acr.	Sites	State	Latitude (S)	Longitude (W)	Reference
IMEL	Paranaguá	PR	25º31'67,2"	48º18'73,9"	Kersten & Silva 2001
PPCV	Setiba	ES	20º33' – 20º38'	40º23' – 40º26'	Assis *et al*. 2004
BERT	Bertioga	SP	23º44' – 23º46'	45º55' – 46º02'	Martins *et al*. 2008
REEJ	Saquarema	RJ	22º47' – 22º57'	42º20' – 42º43'	Fontoura *et al*. 2009
PESM	Ubatuba	SP	23º21' – 23º22'	44º51' – 44º52'	Mania & Monteiro 2010
PNMT	Arroio do Sal	RS	29º29'25,13"	49º50'36,12"	Staudt *et al*. 2012
GRUM	Rio de Janeiro	RJ	23º02' – 23º03'	43º31' – 43º32'	This study

1974), and unweighted pair group method with arithmetic mean (UPGMA) as clustering algorithm (Hammer *et al.* 2001). To evaluate whether the cluster adequately represents the original similarity matrix between areas the cophenetic correlation coefficient (Borcard *et al*. 2011) was estimated, through a Pearson correlation between the original similarity matrix and cophenetic matrix. A Principal Coordinates Analysis (PCA) was also performed using the same data set to evaluate the existence of groups based on flora similarity. The influence of spatial autocorrelation on the composition of epiphytic species was analyzed using a Mantel test with 10,000 permutations (Legendre & Legendre 1998) on the similarity and geographical distance between areas matrices. The cluster and PCA analyses were performed using the Paleontological Statistics - PAST v. 1.89 software (Hammer *et al*. 2001). The cophenetic correlation coefficient analysis and Matel test were performed using R (R Development Core Team 2015).

Results

We found 37 vascular epiphyte species in the Grumari *restinga*, distributed in 21 genera and six families (Tab. 2, Fig. 2). The angiosperm plants represented 32 species, 18 genera and five families, whereas ferns were represented by five species, three genera and one family. Bromeliaceae (13) and Orchidaceae (12) were the most representative epiphyte families; they were followed by the Polypodiaceae, which contributed with five species. These families represent 81% of the total species sampled. The genera with the largest number of species were *Tillandsia* (Bromeliaceae), with six species, *Microgramma* (Polypodiaceae), *Billbergia* (Bromeliaceae) and *Philodendron* (Araceae), with three species each. All other genera were represented by fewer species.

Two of the species found in this study are in the flora red list of endangered species, namely: *Anthurium luschnathianum*, listed as Endangered, and *Cattleya guttata,* listed as Vulnerable.

The distribution of epiphytic species recorded in the Grumari *restinga*, according to the ecological relationship categories with phorophytes (Tab. 1, Fig. 2) showed predominance of characteristic holoepiphytes with 23 species (61%). Among these species, only one of the Polypodiaceae species (*Serpocaulon triseriale*) was not included

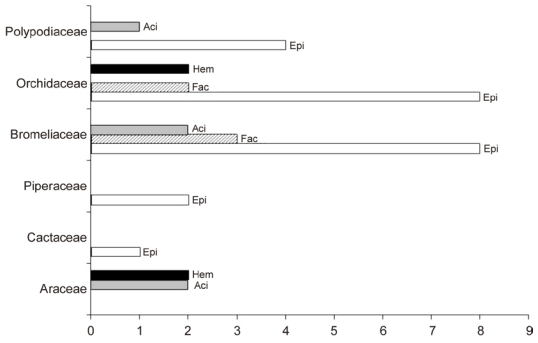

Figure 2 – Participation of vascular epiphyte ecological relationship categories with phorophytes, Grumari *restinga*, Rio de Janeiro state. Epi = characteristic holoepiphyte; Fac = facultative holoepiphyte; Aci = accidental holoepiphyte; Hem = hemiepiphyte.

Table 2 – List of vascular epiphytes sampled at the Grumari *restinga*, Rio de Janeiro state, Brazil. Cat = ecological relationship category; Epi = characteristic holoepiphyte; Fac = facultative holoepiphyte; Aci = accidental holoepiphyte; Hem = hemiepiphyte; * = Endemic to Rio de Janeiro.

Family/ species	Cat.	Voucher
Araceae (4)		
**Anthurium luschnathianum* Kunth.	Aci	D.R.Couto 2597 (RFA)
Philodendron corcovadense Kunth.	Hem	not collected
Philodendron cf. *cordatum* Kunth.	Hem	not collected
Philodendron crassinervium Lindl.	Aci	D.R.Couto 2590 (RFA)
Bromeliaceae (12)		
Aechmea nudicaulis (L.) Griseb.	Epi	D.R.Couto 3053 (RFA)
Aechmea sphaerocephala Baker	Aci	B.R.Silva 1471 (RB)
Billbergia pyramidalis (Sims) Lindl.	Fac	D.Sucre 3379 (RB)
Billbergia zebrina (Herb.) Lindl.	Epi	D.Sucre 3528 (RB)
Billbergia amoena (Lodd.) Lindl.	Aci	D.R.Couto 3048 (RFA)
Neoregelia sarmentosa (Regel) L.B.Sm.	Fac	N.Vasconcellos 28 (RB)
Tillandsia geminiflora Brongn.	Epi	D.Sucre 3514 (RB)
Tillandsia mallemontii Glaz. ex Mez	Epi	D.R.Couto 2575 (RFA)
Tillandsia recurvata(L.) L.	Epi	not collected
Tillandsia stricta Sol.	Epi	D.R.Couto 2576 (RFA)
Tillandsia tricholepsis Baker	Epi	D.R.Couto 2581 (RFA)
Tillandsia usneoides L.	Epi	D.R.Couto 2584 (RFA)
Vriesea procera (Mart. ex Schult. & Schult.f.) Wittm.	Fac	A.Oliveira 107 (RB)
Cactaceae (1)		
Hylocereus setaceus (Salm-Dyck) R.Bauer	Epi	L.Scheinvar 1306 (RB)
Orchidaceae (12)		
Alatiglossum ciliatum (Lindl.) Baptista	Epi	M.M.Moreira 28 (RFA)
Brassavola tuberculata Hook.	Fac	D.Sucre 3384 (RB)
Campylocentrum micranthum (Lindl.) Maury	Epi	M.M.Moreira 155 (RFA)
Campylocentrum sp.	Epi	not collected
Catasetum luridum Lindl.	Epi	M.M.Moreira 102 (RFA)
Cattleya forbesii Lindl.	Epi	F.P.Uribbe s.n. (RFA)
Cattleya guttata Lindl.	Fac	D.S.D.Araujo 5468 (GUA)
Epidendrum pseudodifforme Hoehne & Schltr.	Epi	D.S.D.Araujo 5085 (GUA)
Polystachya concreta (Jacq.) Garay & Sweet	Epi	not collected
*Sophronitis cernua*Lindl.	Epi	M.Nadruz 385 (RB)
Vanilla chamissonis Klotzsch	Hem	M.M.Moreira 93 (RFA)
Vanilla bahiana Hoehne	Hem	M.M.Moreira 101 (RFA)
Piperaceae (2)		
Peperomia arifolia Miq.	Epi	D.Sucre 3347 (RB)
Peperomia tetraphylla (G.Forst.) Hook. & Arn.	Epi	D.Sucre 3532 (RB)
Polypodiaceae (5)		
Microgramma aff. *persicariifolia* (Schrad.) C.Presl	Epi	not collected
Microgramma lindbergii (Mett.) de la Sota	Epi	N.F.S.Marquete 51 (RB)
Microgramma vacciniifolia (Langsd. & Fisch.) Copel.	Epi	D.R.Couto 2574 (RFA)
Pleopeltis pleopeltifolia (Raddi) Alston	Epi	D.R.Couto 2573 (RFA)
Serpocaulon triseriale (Sw.) A.R.Sm.	Aci	D.R.Couto 2588 (RFA)

in this category. Facultative holoepiphytes were represented by five species (13.5%), three Bromeliaceae and two Orchidaceae species. Five species (13.5%) were recorded as accidental epiphytes. The group was formed by species that were described as terrestrial in the literature, but were found vegetating on phorophyte structures. Hemiepiphytes totaled four species (10.8%) distributed in Araceae and Orchidaceae.

The cluster analysis indicated three groups presenting low similarity values in Rio de Janeiro and Espírito Santo (group A), in disjunct areas in São Paulo [group B (group B corresponds to Paraná and Rio Grande do Sul, would be good to standardize] and in southern Brazil [Paraná and Rio Grande do Sul states, group C (cluster C in the PCA figure corresponds to São Paulo localities, would be good to standardize)] (Fig. 3). This cluster represents clearly the similarity between the areas (cophenetic correlation coefficient r = 0.9). The PCA showed the following values and variance percentages for the first three ordination axes: 0.587 (24.47%), 0.45 (18.69%) and 0.38 (15.97%), respectively. This ordering showed the three groups (A, B and C) found through cluster analysis, as shown in Fig. 4. A significant correlation between the geographical distance and the species composition was observed in the areas (Mantel r = 0.33; p = 0.04) (Figs. 3; 4).

Group A (Grumari, Saquarema and Setiba), located in Rio de Janeiro and Espírito Santo states, shared five species (*Aechmea nudicaulis Alatiglossum ciliatum*, *Tillandsia stricta*, *T. usneoides* and *Vriesea procera*), which causes the similarity between them to be greater (Fig. 3). Of the species total, 40.5% (15 species) were exclusive to *restinga* Grumari: *Aechmea sphaerocephala*, *Anthurium luschnathianum*, *Billbergia zebrina*, *Catasetum luridum*, *Epidendrum pseudodifforme*, *Microgramma lindbergii*, *Neoregelia sarmentosa*, *Peperomia arifolia*, *Peperomia tetraphylla*, *Philodendrum cordatum*, *Sophronitis cernua*, *Tillandsia mallemontii*, *T. recurvata*, *T. tricholepis* and *Vanilla bahiana*. Only *Aechmea nudicaulis* was found in all seven areas, and *Tillandsia usneoides* in six.

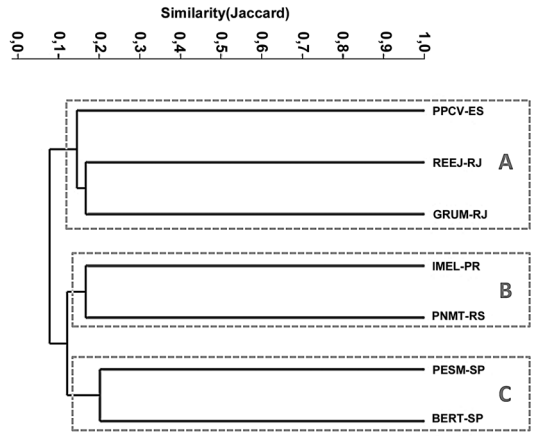

Figure 3 – Cluster analysis of results from eastern Brazil *restinga* areas based on the Jaccard similarity index, showing formation of three groups.

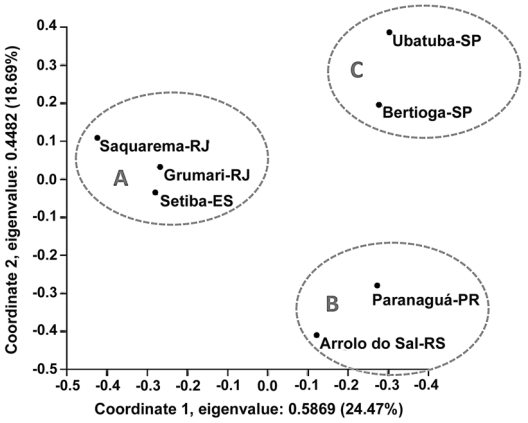

Figure 4 – Principal Coordinates Analysis (PCoA) comparing species composition from restingas at the seven studied sites (see text for details), highlighting the three groups (A, B and C) in the first two axes (43.16% of the total variance).

Discussion

The distribution of species and families follows a trend observed in the research on epiphytic flora conducted in the Brazilian Atlantic Forest, where a large number of species were found in few families (Mania & Monteiro 2010; Staudt *et al.* 2012; Blum *et al.* 2012; Leitman *et al.* 2014; Alves & Menini Neto 2014; Barbosa *et al.* 2015; Couto *et al*. 2016a; Freitas *et al*. 2016). This pattern can be explained by the low level of specialization to epiphytism by families in general, causing few families (mainly Orchidaceae, Bromeliaceae, Polypodiaceae and Araceae) to represent a significant part of species richness, such as Orchidaceae, which includes approximately 68% of the world epiphytic flora (ca. 19,000 species) (*sensu* Zotz 2013).

Bromeliaceae and Orchidaceae (67.6% of the total total recorded species) are the richest families

and also the richest groups in Brazilian *restingas* (Kersten & Silva 2001; Assis *et al*. 2004; Martins *et al*. 2008; Mania & Monteiro 2010; Staudt *et al*. 2012), as well as in other ecosystems of the Atlantic domain (Rogalski & Zanin 2003; Dettke *et al*. 2008; Kersten & Kuniyoshi 2009; Blum *et al*. 2012; Freitas & Assis 2013;Leitman *et al*. 2014; Barbosa *et al.* 2015; Couto *et al*. 2016a; Couto *et al*. 2016b). They also appear as the richest families in summaries of taxonomic composition of vascular epiphytes worldwide (Gentry & Dodson 1987; Benzing 1990; Zotz 2013) and in the Atlantic Forest (Freitas *et al*. 2016).

The epiphyte richness in Grumari *restinga* can be considered to be average, but it is greater than the epiphytic richness of other inventories carried out in the coastal plains of the southeastern and southern regions of Brazil, as recorded by Fontoura *et al.* (2009) in Rio de Janeiro (Saquarema), and by Assis *et al.* (2004) for Setiba *restingas* in Espírito Santo state (24 spp.). However, the richness was lower than that of *restingas* of São Paulo (Mania & Monteiro 2010 - 64 spp.; Martins *et al*. 2008 - 90 spp.) and Paraná states (Kersten & Silva 2001 - 77 spp.) and of the coastal plains of Rio Grande do Sul state (Staudt *et al*. 2012 - 40 spp.). The low similarity values between areas are possibly related to the different phytophysiognomic features found in the studies considered (which include different ecosystems and geographical regions), and in the level of floristic inclusion (Assis *et al*. 2004; Fontoura *et al*. 2009; Martins *et al.* 2008). In vascular epiphyte studies, the effort to register ferns and lycophytes is essential, since this group significantly supports the richness and diversity of the epiphytic flora worldwide (Zotz 2013) and in the Atlantic domain (Freitas *et al*. 2016).

Dominant physiognomy of the *restinga* in the current study is of closed shrub and dense vegetation dominated by Myrtaceae species, thus corroborating what was recorded by Araújo & Henriques (1984) when they mentioned a Myrtaceae thicket. This shrubby vegetation presents shorter individuals and lacks large phorophytes. The greatest richness observed in many studies is probably related to studied *restinga* vegetation forest types. These areas present greater availability of niches provided by forest stratification (from shrubs, treelets and trees in the understory to large trees in the upper canopy), thus offering greater heterogeneity of micro-habitats used for epiphyte colonization. The occurrence of large trees and favorable climatic factors (high humidity and mild temperatures) have been reported as the main factors related to the high diversity of epiphytes in the tropical region (Woods *et al.* 2015; Zhao *et al.* 2015; Ding *et al*. 2016).

The predominance of species in the characteristic holoepiphytes ecological category (61%) is a common pattern, and it is corroborated by several studies of the Brazilian epiphytic flora (Kersten & Silva 2001; Kersten & Kuniyoshi 2009; Mania & Monteiro 2010; Geraldino *et al.* 2010; Blum *et al.* 2011; Barbosa *et al*. 2015; Couto *et al*. 2016a; Couto *et al*. 2016b). Three out of the five species classified as facultative holoepiphytes belong to family Bromeliaceae (*Billbergia pyramidalis*, *Neoregelia sarmentosa* and *Vriesea procera*), and two to Orchidaceae, namely: *Cattleya guttata* and *Brassovala tuberculata*, which are common in the study area. Fraga & Peixoto (2004) observed *C. guttata* and *B. tuberculata* as optional holoepiphytes for shrub formations in *restinga* areas in Espírito Santo state, whereas in forest formations (hillside forest and forest on tertiary "trays") they tend to occur as characteristic holoepiphytes.

Accidental holoepiphytes were represented by five terrestrial species which are abundant in the study area, but eventually occur as epiphytes on shrubs. *Aechmea sphaerocephala* forms large thickets on the *restinga* soil. *Philodendron crassinervium* and *Serpocaulon triseriale* are also widely distributed throughout the studied area. A similar share of facultative and accidental holoepiphytes, which together account for 27% of all the analyzed species, would possibly be due to the physical characteristics of the *restinga* soil, whose surface horizon is mainly formed by non-decomposed organic matter and mycelium fungi. This forms a substrate very similar to that found in the canopy (Kersten & Silva 2001). According to Araújo & Henriques (1984) the study area has a dense shrubby vegetation physiognomy, which presents short trees and lack a defined intermediate stratum. These features facilitate the penetration of solar radiation in the "forest", and work as an important factor for establishment of epiphytes directly on soil, along with the faster drainage system observed in *restingas* areas. Other researchers (Kersten & Silva 2001; Fraga & Peixoto 2004) also highlighted the occurrence of facultative and accidental epiphyte *restingas* in southern and southeastern Brazil, which suggests that the same vegetation and substrate structural characteristics are the constraint of these occurrences.

We observed that the low similarity values influenced by the small number of species shared between areas (even between areas that are close to each other) reflects the intrinsic floristic particularities of each area. These values result from the great diversity in Brazilian *restinga* physiognomies, which are influenced by the biotic and abiotic heterogeneity (Araújo & Henriques 1984; Araújo *et al*. 2004).

The results presented by the cluster and PCA analyses and Mantel test indicated the influence of geographical distance on the similarities between the areas, thus demonstrating that geographically closer areas tend to be more similar to each other, even if they do not share similar ecological conditions. The areas forming group A, which are represented by *restingas* in Rio de Janeiro and Espírito Santo states, reinforce previous hypotheses that the *restinga* in Rio de Janeiro is more similar to that in Espírito Santo state (Araújo 2000). According to Thomas (1991) and Assis *et al*. (2004), the great similarity between the *restingas* in Rio de Janeiro and Espírito Santo is due to the phytophysionomic similarities between these states.

Our study provides the first contribution to the knowledge about the epiphytic flora in the Grumari *restinga* and shows a singular flora with 40% of unique species occurring in this location, a fact that highlights its importance as conservation area. We also show the importance of preserving the Grumari *restinga* as a way to preserve the regional flora, because it houses endangered species and indicates the need for more detailed studies on vascular epiphytic plants, including the structure of this community and the influence of different *restinga* types on the vascular epiphytic flora diversity.

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