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inventory

Epiphytic angiosperms in a mountain forest in southern Bahia, Brazil

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Abstract: The Atlantic Forest in southern Bahia State, Brazil, has high levels of diversity and vascular plant endemism. There have been few floristic surveys of the mountain forests there, however, especially those focusing on herbs and canopy plants, with studies of Atlantic Forest epiphytes having been limited to the southern and southeastern region of that country. The present study therefore surveyed the epiphytic angiosperms in the Serra das Lontras National Park (SLNP), the distribution of their species among genera and families, and their biogeographical patterns. Fieldwork was performed between February 2011 and March 2012. Collections were made along roads and trails and phorophytes were occasionally climbed and fallen trees and branches examined in order to sample canopy species. The study site demonstrated high epiphyte richness (256 spp.), one of the highest recorded in the Atlantic Forest. The richest families are Orchidaceae, Bromeliaceae, and Araceae, reaffirming the patterns reported in previous major reviews on epiphytes. The species exhibit high degrees of endemism (45%) to the Atlantic Forest, especially among the Bromeliaceae and Orchidaceae. One new occurrence to Brazil, four to the Atlantic Forest and 30 to Bahia state are registered. The SLNP shares more species with areas of southern and southeastern Brazil than with other northeastern states.
Keywords: *Atlantic forest, Araceae, Bromeliaceae, Orchidaceae, biogeographical patterns.*

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Resumo: A Floresta Atlântica do sul da Bahia apresenta elevados níveis de diversidade e endemismo de plantas vasculares. No entanto, poucos levantamentos florísticos foram realizados em áreas de floresta montana, especialmente para ervas e plantas de dossel. Estudos com epífitas estão concentrados principalmente em áreas do Sul e Sudeste do Brasil. Desta forma, o presente estudo realizou o levantamento das angiospermas epífitas do Parque Nacional da Serra das Lontras (PNSL) e verificou a distribuição das espécies pelas famílias e gêneros e seus padrões biogeográficos. As coletas foram realizadas entre fevereiro de 2011 e março de 2012 nas trilhas e estradas de acesso. Alguns forófitos foram escalados e árvores e ramos caídos foram examinados com o intuito de coletar espécies restritas ao dossel. A área de estudo apresentou alta diversidade de epífitas (256 spp.), uma das maiores já registradas para a Floresta Atlântica. As famílias com maior riqueza são Orchidaceae, Bromeliaceae e Araceae, reafirmando os padrões encontrados anteriormente em revisões do tema. As espécies apresentam alto grau de endemismo (45%) à Floresta Atlântica, especialmente em Bromeliaceae e Orchidaceae. São registradas uma nova ocorrência para o Brasil, quatro para a Floresta Atlântica e 30 para a Bahia. O PNSL possui mais espécies em comum com o Sul e o Sudeste do que com a região Nordeste.
Palavras-chave: *Floresta Atlântica, Araceae, Bromeliaceae, Orchidaceae, padrões biogeográficos.*

Introduction

Epiphytes spend most or all of their life cycles growing on other plants (phorophytes), taking advantage of their mechanical support (Benzing 1990). Epiphytes account for approximately 10% of world's vascular flora and are found in 84 angiosperm families (Gentry & Dodson 1987, Kersten 2010). Araceae, Bromeliaceae, and Orchidaceae are the most successful epiphytic angiosperm families, and the latter is responsible for over 70% of total richness.

Bromeliaceae is a typically American family, while the largest genera of Araceae and Orchidaceae (*e.g.*, *Anthurium*, *Epidendrum*, *Lepanthes*, *Philodendron* and *Pleurothallis s.l.*) are likewise endemic to that continent. The Neotropical region therefore hosts the greater part of world's epiphytic flora (> 15.500 spp.), which are mainly concentrated in Central America, the Andes, northwestern Amazonia and the Atlantic Forest (Gentry & Dodson 1987, Nieder et al. 2001). Of the 14.500 vascular plants known to inhabit the Atlantic Forest, 3.000-4.000 are epiphytes (Stehmann et al. 2009, Kersten 2010). The Atlantic Forest has large latitudinal (from 3°S to 30°S) and altitudinal (from sea level up to 2.890 m) extensions and significant rainfall variations – resulting in high habitat heterogeneity and an extraordinary diversity of organisms (Oliveira-Filho & Fontes 2000).

Southern Bahia is considered an area of great biological importance, with elevated levels of richness and endemism in its arboreal component (Mori et al. 1983, Thomas et al. 1998, Martini et al. 2007, Thomas et al. 2009, Rocha & Amorim 2012), although surveys of humid montane forests have been scarce, especially those focusing on terrestrial and epiphytic herbs (Amorim et al. 2009, Matos et al. 2010). The recently created Serra das Lontras National Park comprises a vast remnant of montane Atlantic Forest in southern Bahia (Save Brasil et al. 2009).

A preliminary survey in the park, covering only a small area, recorded 709 angiosperm species, of which 158 (22.3%) were epiphytes (Amorim et al. 2009). These authors highlighted the fact that many of the species encountered, including many epiphytes (*e.g.*, *Fuchsia regia* [Vell.] Munz, *Nematanthus lanceolatus* [Poir.] Chautems, and *Vriesea longicaulis* Mez), were previously known only from mountainous areas in southern and southeastern Brazil.

For the preliminary survey there was no effort focused on this habit, which presents peculiarities that hinder their sampling, including the height they occur on the phorophyte and the small sizes of some groups (*e.g.*, *Peperomia* and *Pleurothallis s.l.*). We therefore sought to inventory the composition of epiphytic angiosperms in the Serra das Lontras National Park to investigate their distributions into genera and families and their biogeographical patterns to increase our knowledge of this group in the park and in northeastern Brazil.

Material and methods

Serra das Lontras National Park (SLNP) is located in southern Bahia State (Figure 1), Brazil, in the municipalities of Arataca, São José da Vitória, and Una (15°07′-15°15′S and 39°15′-39°25′W). The park comprises approximately 11.000 hectares at altitudes that vary from 400 to 1.000 m. Located 30 km from the coast, the mountains act as a first barrier to humid air masses moving inland from the ocean, resulting in mean annual precipitation rates of 1.300-1.600 mm, without a marked dry season, and a mean annual temperature of 24°C (classified as Af in the Koppen system) (Peel et al. 2007, Amorim et al. 2009, Nacif et al. 2009).

Situated in the Atlantic Forest domain, the SLNP comprises a vegetation mosaic of anthropogenic areas mixed with well-preserved submontane forests (with canopies >30 m) at lower altitudes and cloud forests above 800 m with smaller trees with twisted trunks bearing bryophytes (Stadtmüller 1987).

A total floristic inventory of the SLNP has been underway for the last eight years, and preliminary results have already been published (Amorim et al. 2009; Save Brasil et al. 2009). Visits to the area were made every two months, from February/2011 to March/2012 to survey the epiphytic angiosperms. Collections were made along roads and trails in order to cover the largest possible areas, and some living phorophytes were occasionally climbed and fallen trees examined to collect canopy species. Accidental epiphytes were not considered in this survey. Informations on the type of epiphytism (characteristic holoepiphyte, facultative holoepiphyte, hemiepiphyte) were obtained from local observations and complemented with informations from literature. This was done in order to have more accurate data, since many facultative species might have been seen only as epiphytes in the area or might occur as terrestrial or rupiculous in parts of the park that were not visited. All fertile material was deposited at the RB and CEPEC herbaria, while sterile specimens were incorporated into the *ex-situ* collection at the Rio de Janeiro Botanical Garden.

Specimens collected during the general floristic inventory, as well as those from the present survey, were identified to the species level, when possible, with the help of specialists and specific literature (*e.g.*, the Flora Neotropica). Nomenclature and species concepts follow the List of Species of the Brazilian Flora - LSBF (2013). Distribution and endemism data were obtained from the LSBF for taxa identified to the species level.

A Rapid Color Guide, published by The Field Museum, was prepared and images on most species can be seen at www.fm2.fieldmuseum.org/plantguides/guideimages.asp?ID=545.

Results

The Serra das Lontras National Park shows high epiphyte richness, with a total of 256 species identified, representing 87 genera and 18 families (Table 1) – making it one of the richest sites for epiphytic angiosperms in the Atlantic Forest. Of the published checklists, only Macaé de Cima in Rio de Janeiro State reported more epiphyte species (275 spp.) (Fontoura et al. 1997).

The most important families encountered were Orchidaceae (106 spp.), Bromeliaceae (64 spp.), Araceae (31 spp.), and Piperaceae (14 spp.). Together, these families encompassed more than 80% of the epiphyte flora at SLNP. The species distributions within the families were very unequal, however, with 11 families being represented by less than five species.

The richest genera were *Vriesea* (22 spp.), *Peperomia* and *Stelis* (14 spp. each), *Anthurium* (13 spp.), *Aechmea* and *Philodendron* (12 spp. each), *Epidendrum* (11 spp.), and *Hohenbergia* (10 spp.). The species distributions within the genera were very unequal, with half of them (43 genera) being represented by only a single species, and 82% by less than five species.

With many ornamental species, 10 epiphytes registered for the SLNP are cited on the Red Book of Brazilian Flora

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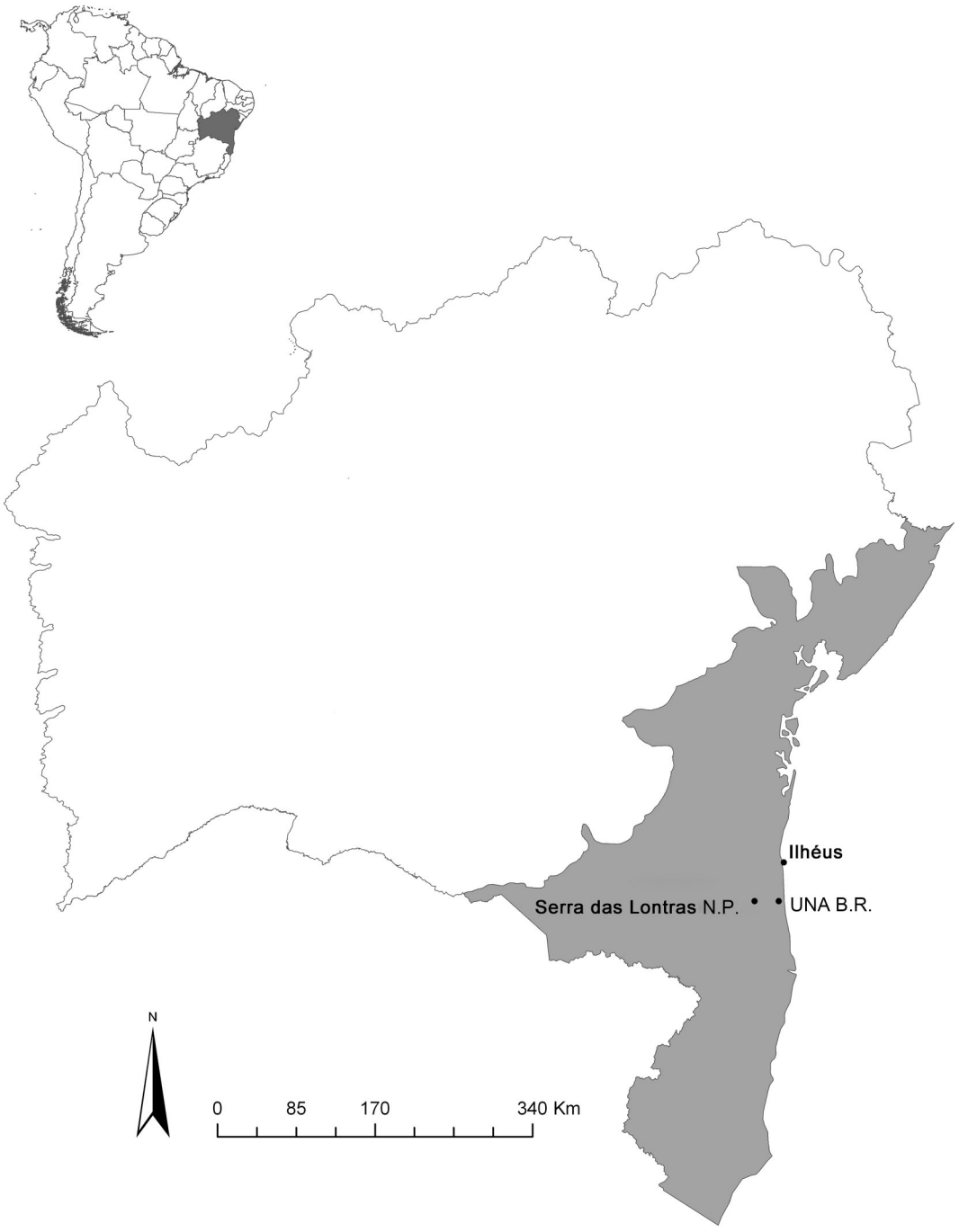

Figure 1. Map showing the location of the studied area (Serra das Lontras National Park); in gray is the Atlantic Forest limits. N.P. - National Park; B.R. - Biological Reserve/Mapa de localização da área de estudo (Parque Nacional da Serra das Lontras); em cinza está demarcado o limite da Floresta Atlântica.

(Martinelli & Moraes 2013). Of this total, three are "Critically endangered", five are "Endangered", and two are "Vulnerable". Four are considered to be "Data Deficient" (Table 1).

Discussion

The high numbers of species observed in Araceae, Bromeliaceae, Orchidaceae, and Piperaceae were consonant with global patterns of epiphytic distribution among angiosperm families, as reported by Madison (1977) and Gentry & Dodson (1987). Similar results were reported for the Neotropical region (*e.g.*, Sudgen & Robins 1979, Gentry & Dodson 1987, Wolf & Flamenco-S 2003, Küper et al. 2004) and the tropical and subtropical Atlantic Forest (*e.g.*, Fontoura et al. 1997, Borgo & Silva 2003, Giongo & Waechter 2004, Kersten & Silva 2001, Buzatto et al. 2008, Martins et al. 2008, Menini Neto et al. 2009, Mania & Monteiro 2010).

Table 2 compares the SLNP and other Atlantic Forest areas with high epiphyte richness. The elevated numbers of species of Bromeliaceae, Araceae, and Gesneriaceae is notable, representing the highest epiphyte richness ever recorded for these families in the Atlantic Forest. *Vriesea*, *Stelis*, *Anthurium*,

Table 1. Epiphytic Angiosperms registered for Serra das Lontras National Park, Bahia, Brazil. [1] *New occurence to Bahia state; ** New occurence to the Atlantic Forest; *** New occurence to Brazil. [2] AA – André M. Amorim; AF – André P. Fontana; AJ – Alessandra B. Jardim; JJ – Jomar G. Jardim; JP – José Lima da Paixão; ML – Márdel M. Lopes; PF – Pedro Fiaschi; PL – Paula Leitman; RB – Rafael X. Borges; RP – Ricardo O. Perdiz; WT – Wm. Wayt Thomas. [3] Epi – Characteristic Holoepiphyte; Fac – Facultative Holoepiphyte; Hep – Hemiepiphyte. [4] CAF – Cerrado-Atlantic Forest; Di – Disjunct distribution Amazon-Atlantic Forest; En – Endemic to Atlantic Forest; WD – Wide distribution; O – Other; "-" – not applicable. [5] CR – Criticaly endangered; DD – Data deficient; EN – Endangered; VU – Vulnerable.

Family	Specie[1]	Voucher[2]	Habit[3]	Distribution[4]	Threat category[5]
Acanthaceae	*Clistax bahiensis* Profice & Leitman	AA 5301	Hep	En	
Araceae	*Anthurium boudetii* Nadruz *	AA 6399	Fac	En	
	Anthurium gladiifolium Schott	AA 5770	Epi	En	
	Anthurium gracile (Rudge) Lindl. **	PL 211	Epi	WD	
	Anthurium intermedium Kunth	PL 165	Fac	En	
	Anthurium jilekii Schott	PL 547	Hep	O	
	Anthurium pentaphyllum (Aubl.) G.Don	AA 5770a	Hep	WD	
	Anthurium scandens (Aubl.) Engl.	ML 1473	Hep	WD	
	Anthurium solitarium Schott	AA 6610	Fac	WD	
	Anthurium sp. 1	PL 417	Epi	-	
	Anthurium sp. 2	JJ 4919	Epi	-	
	Anthurium sp. 3	PL 324	Epi	-	
	Anthurium sp. 4	JJ 4389	Epi	-	
	Anthurium sp. 5	JJ 4337	Epi	-	
	Heteropsis oblongifolia H.B.K.	JJ 4886	Hep	WD	
	Monstera adansonii Schott	JP 956	Hep	WD	
	Philodendron cordatum Kunth	AA 6580	Hep	En	
	Philodendron edmundoi G.M.Barroso *	JJ 4898	Hep	En	
	Philodendron fragrantissimum (Hook.) G.Don	ML 1449	Hep	WD	
	Philodendron hederaceum (Jacq.) Schott	AA 5960	Hep	WD	
	Philodendron insigne Schott	JJ 4896	Fac	O	
	Philodendron ornatum Schott	AA 6727	Hep	WD	
	Philodendron pedatum (Hook.) H.B.K.	AA 6599	Hep	WD	
	Philodendron propinquum Schott	PL 202	Hep	En	
	Philodendron recurvifolium Schott	PL 287	Hep	En	
	Philodendron rudgeanum Schott	AA 5296	Hep	Di	
	Philodendron surinamense (Miq.) Engl.	PL 119	Hep	Di	
	Philodendron aff. *williamsii* Hook. f.	PL 561	Hep	-	
	Rhodospatha latifolia Poepp.	JJ 4842	Hep	WD	
	Rhodospatha oblongata Poepp.	PL 428	Hep	Di	
	Stenospermation spruceanum Schott	AA 5298	Epi	Di	
	Syngonium vellozianum Schott	AA 5960a	Hep	WD	
Araliaceae	*Oreopanax capitatus* (Jacq.) Decne. & Planch.	AA 6568	Hep	WD	
Begoniaceae	*Begonia convolvulacea* A.DC.	AA 5280	Hep	En	
	Begonia fruticosa (Klotzsch) A.DC.	AA 5265	Hep	En	
	Begonia aff. *itaguassuensis* Brade	PL 338	Hep	-	
	Begonia radicans Vell.	AA 5275	Hep	En	
	Begonia grisea A.DC. **	PL 424	Fac	O	
Bromeliaceae	*Aechmea burlemarxii* E. Pereira	PL 378	Fac	En	
	Aechmea conifera L.B.Sm. *	PL 309	Fac	En	
	Aechmea froesii (L.B.Sm.) Leme & J.A.Siqueira	AA 6594	Fac	En	
	Aechmea gustavoi J.A.Siqueira & Leme	PL 262	Fac	En	CR
	Aechmea multiflora L.B.Sm.	PL 395	Fac	En	
	Aechmea nudicaulis Griseb.	AA 7217	Fac	CAF	
	Aechmea patentissima (Mart. *ex* Schult. & Schult. f.) Baker	PL 129	Fac	Di	
	Aechmea subintegerrima (Philcox) Leme	ML 1484	Epi	En	
	Aechmea tentaculifera Leme *et al.*	ML 1491	Epi	En	
	Aechmea turbinocalyx Mez	PL 141	Epi	En	
	Aechmea viridostigma Leme & H.Luther	JJ 4680	Epi	En	
	Aechmea sp.	JJ 5431	Epi	-	

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Table 1. Continued.

Family	Specie[1]	Voucher[2]	Habit[3]	Distribution[4]	Threat category[5]
	Billbergia euphemiae E.Morren	AA 5752	Fac	En	
	Billbergia saundersii Bull	JP 976	Epi	En	
	Canistrum camacaense Martinelli & Leme	AA 5751	Fac	En	EN
	Canistrum montanum Leme	AA 5269	Epi	En	EN
	Guzmania lingulata (L.) Mez	RB 591	Fac	WD	
	Hohenbergia augusta (Vell.) E.Morren *	PL 149	Fac	En	
	Hohenbergia brachycephala L.B.Sm.	PL 439	Epi	En	
	Hohenbergia capitata Schult. & Schult.f.	AA 6602	Epi	En	
	Hohenbergia edmundoi L.B.Sm. & Read	JJ 4920	Epi	En	
	Hohenbergia minor L.B.Sm.	PL 158	Epi	En	
	Hohenbergia sp. 1	PL 398	Epi	-	
	Hohenbergia sp. 2	PL 134	Epi	-	
	Hohenbergia sp. 3	PL 307	Epi	-	
	Hohenbergia sp. 4	PL 391	Epi	-	
	Hohenbergia sp. 5	PL 305	Epi	-	
	Lymania azurea Leme	JJ 5316	Epi	En	EN
	Neoregelia azevedoi Leme	AA 6624	Epi	En	
	Neoregelia crispata Leme	AA 5991	Epi	En	
	Neoregelia kerryi Leme	AA 5807	Fac	En	
	Neoregelia pauciflora L.B.Sm.	AA 6590	Epi	En	
	Neoregelia wilsoniana M.B.Foster	PL 267	Epi	En	
	Nidularium innocentii Lem.	AA 6696	Fac	En	
	Nidularium procerum Lindm.	WT 14093b	Fac	En	
	Portea filifera L.B.Sm.	PL 435	Epi	En	
	Portea nana Leme	AA 6597	Epi	En	EN
	Quesnelia clavata Amorim & Leme	AA 5351	Fac	En	
	Racinaea spiculosa (Griseb.) M.A.Spencer & L.B.Sm.	AA 5820	Epi	WD	
	Tillandsia geminiflora Brong.	AA 6391	Epi	CAF	
	Tillandsia sprengeliana Klotzsch *ex* Mez	JJ 4895	Epi	CAF	
	Tillandsia stricta Sol.	AA 6086	Epi	CAF	
	Vriesea breviscapa (E.Pereira & I.A.Penna) Leme	PL 208	Epi	En	DD
	Vriesea dictyographa Leme	AA 5303	Epi	En	
	Vriesea drepanocarpa (Baker) Mez	PL 380	Epi	En	
	Vriesea duvaliana E.Morren	JP 965	Epi	En	
	Vriesea ensiformis (Vell.) Beer	JP 975	Epi	En	
	Vriesea flammea L.B.Sm.	RB 590	Epi	En	
	Vriesea guttata Linden & André *	PL 489	Epi	En	
	Vriesea longiscapa Ule	AA 5797	Epi	En	
	Vriesea longisepala A.F.Costa	AA 6758	Epi	En	
	Vriesea paratiensis E.Pereira	AA 6646	Epi	Di	
	Vriesea procera (Mart. *ex* Schult. & Schult.f.) Wittm.	PL 368	Epi	O	
	Vriesea regnelli Mez	AA 6759	Epi	En	
	Vriesea rhodostachys L.B.Sm.	PL 301	Epi	En	DD
	Vriesea rodigasiana E.Morren	PL 205	Epi	En	
	Vriesea ruschii L.B.Sm.	PL 150	Epi	En	
	Vriesea simplex (Vell.) Beer	PL 345	Epi	O	
	Vriesea tijucana E. Pereira	AA 6097	Epi	En	
	Vriesea vagans (L.B.Sm.) L.B.Sm. *	AA 6688	Epi	En	
	Vriesea sp. 1	PL 289	Epi	-	
	Vriesea sp. 2	PL 114	Epi	-	
	Vriesea sp. 3	PL 181	Epi	-	
	Vriesea sp. 4	PL 442	Epi	-	
Cactaceae	*Epiphyllum phyllanthus* (L.) Haw.	JJ 4401	Epi	WD	
	Lepismium cruciforme (Vell.) Miq.	PL 230	Epi	O	
	Rhipsalis floccosa Salm-Dyck *ex* Pfeiff.	PL 200	Epi	En	

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Table 1. Continued.

Family	Specie[1]	Voucher[2]	Habit[3]	Distribution[4]	Threat category[5]
	Rhipsalis hileiabaiana (N.P.Taylor & Barthlott) N. Korotkova & Barthlott	PL 521	Epi	CAF	DD
	Rhipsalis lindbergiana K.Schum	PL 367	Epi	O	
	Rhipsalis neves-armondii K.Schum	PL 513	Epi	En	
	Rhipsalis oblonga Loefgr.	ML 1019	Epi	En	
Clusiaceae	*Clusia panapanari* (Aubl.) Choisy	AA 7205	Hep	O	
Cyclanthaceae	*Asplundia gardneri* (Hook,) Harling	PL 213	Hep	WD	
	Asplundia maximiliani Harling	PL 506	Hep	En	
	Evodianthus funifer (Poit.) Lindm.	ML 1464	Hep	WD	
	Thoracocarpus bissectus (Vell.) Harling	PL 427	Hep	WD	
Gesneriaceae	*Codonanthe cordifolia* Chautems	JJ 4892	Epi	CAF	
	Codonanthe gracilis (Mart.) Hanst.	PL 411	Epi	En	
	Codonanthe uleana Fritsch	AA 7221	Epi	WD	
	Columnea sanguinea (Pers.) Hanst.	RB 622	Epi	WD	
	Nematanthus albus Chautems	JJ 4907	Epi	En	
	Nematanthus corticola Schrad.	JP 973	Epi	En	
	Nematanthus lanceolatus (Poir.) Chautems	AA 5276	Fac	CAF	
Lentibulariaceae	*Utricularia jamesoniana* Oliv. **	JJ 4908	Epi	O	
Marcgraviaceae	*Marcgravia coriacea* Vahl	AA 6679	Hep	WD	
	Marcgravia polyantha Delpino	JJ 4697	Hep	CAF	
Melastomataceae	*Bertolonia alternifolia* Baumgratz *et al.*	AJ 170	Epi	En	
	Bertolonia bullata Baumgratz *et al.*	AA 5979	Epi	En	
	Bertolonia ovata DC.	WT 14581	Epi	En	
	Pleiochiton blepharodes (DC.) Reginato & Goldenberg	JJ 4921	Epi	En	
Moraceae	*Ficus arpazusa* Casar.	WT 14112	Hep	WD	
	Ficus castellviana Dugand	PF 2811	Hep	WD	
	Ficus hirsuta Schott	FF 1447	Hep	O	
Onagraceae	*Fuchsia regia* (Vand. *ex* Vell.) Munz	AA 5806	Hep	CAF	
Orchidaceae	*Acianthera auriculata* (Lindl.) Pridgeon & M.W.Chase	PL 412	Epi	En	
	Acianthera capanemae (Barb.Rodr.) Pridgeon & M.W.Chase *	PL 361	Epi	En	
	Acianthera hygrophila (Barb.Rodr.) Pridgeon & M.W.Chase *	AF 2682	Epi	Di	
	Anathallis rubens (Lindl.) Pridgeon & M.W.Chase	PL 251	Fac	WD	
	Anathallis sclerophylla (Lindl.) Pridgeon & M.W.Chase	AA 5809	Epi	WD	
	Baptistonia gutfreundiana (Chiron & V.P.Castro) Chiron & V.P.Castro	PL 376	Epi	En	
	Baptistonia truncata (Pabst) Chiron & V.P.Castro *	RP 536	Epi	En	CR
	Brachionidium restrepioides Hoehne & Pabst	JJ 4677	Epi	En	VU
	Bulbophyllum micropetaliforme J.E.Leite	PL 225	Epi	En	
	Bulbophyllum napellii Lindl.	JJ 5383	Epi	CAF	
	Camaridium carinatum (Barb.Rodr.) Hoehne	AF 2666	Epi	O	
	Camaridium cf. *micranthum* M.A. Blanco	AF 2688	Epi	-	
	Catasetum cf. *hookeri* Lindl.	JJ 4385	Epi	-	
	Catasetum purum Nees & Sinnings	PL 244	Epi	En	
	Cirrhaea cf. *seidelii* Pabst	PL 355	Epi	-	
	Coppensia flexuosa (Sims) Campacci	JJ 4922	Epi	Di	
	Coppensia hookeri (Rolfe) F.Barros & L.Guimarães	AA 6626	Epi	En	
	Dichaea brevicaulis Cogn.	PL 354	Epi	En	
	Dichaea cogniauxiana Schltr.	AA 5816	Epi	CAF	

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Table 1. Continued.

Family	Specie[1]	Voucher[2]	Habit[3]	Distribution[4]	Threat category[5]
	Dichaea pendula (Aubl.) Cogn.	PL 353	Epi	WD	
	Elleanthus brasiliensis (Lindl.) Rchb.f.	PL 549	Epi	O	
	Elleanthus crinipes Rchb.f.	AF 2673	Epi	CAF	
	Elleanthus hymenophorus (Rchb.f.) Rchb.f. ***	AA 4960	Epi	WD	
	Elleanthus linifolius C.Presl	AA 4983	Epi	WD	
	Encyclia fimbriata A.C.Bastos *et al.*	WT 14604	Epi	En	
	Encyclia patens Hook.	PL 326	Fac	CAF	
	Encyclia unaensis Fowlie	AF 2659	Epi	En	
	Epidendrum armeniacum Lindl.	AA 6581	Epi	O	
	Epidendrum densiflorum Lindl.	PL 463	Fac	WD	
	Epidendrum latilabre Lindl. *	PL 432	Epi	Di	
	Epidendrum macrocarpum Rich.	AA 6413	Epi	O	
	Epidendrum nocturnum Jacq.	ML 539	Epi	WD	
	Epidendrum ochrochlorum Barb.Rodr.	JP 971	Epi	WD	
	Epidendrum paranaense Barb.Rodr.	AA 6412	Fac	WD	
	Epidendrum ramosum Jacq.	AA 5810	Epi	CAF	
	Epidendrum saximontanum Pabst	AF 2685	Epi	En	
	Epidendrum secundum Jacq.	JJ 4901	Epi	WD	
	Epidendrum sp.	JJ 4904	Epi	-	
	Gomesa recurva Barb.Rodr.	AA 4448	Fac	CAF	
	Grandiphyllum pohlianum (Cogn.) Docha Neto *	PL 413	Epi	En	
	Heterotaxis brasiliensis (Brieger & Illg) F.Barros	PL 191	Epi	Di	
	Houlletia brocklehurstiana Lindl.	WT 14594	Epi	En	EN
	Jacquiniella globosa (Jacq.) Schltr.	AF 2675	Epi	WD	
	Koellensteinia graminea Rchb.f.	PL 555	Epi	O	
	Lankesterella longicollis (Cogn.) Hoehne *	AF 2684	Epi	En	
	Lockhartia lunifera Rchb.f.	AF 2654	Epi	Di	
	Masdevallia infracta Lindl.	WT 14097	Epi	CAF	
	Maxillaria bradei Schltr. *ex* Hoehne *	JJ 4912	Epi	En	
	Maxilaria candida Lodd. *ex* Lindl. *	ML 1023	Epi	Di	
	Maxillaria leucaimata Barb.Rodr.	AA 5329	Epi	Di	
	Maxillaria ochroleuca Lodd. *ex* Lindl.	JJ 4379	Epi	WD	
	Maxilaria aff. *ringens* Rchb.f.	PL 154	Epi	-	
	Maxillaria spiritusanctensis Pabst	JJ 4681	Epi	En	
	Maxilaria aff. *splendens* Poepp. & Endl.	PL 374	Epi	-	
	Maxilaria sp.	PL 314	Epi	-	
	Maxillariella robusta (Barb. Rodr.) M.A.Blanco & Carnevali *	PL 316	Epi	En	
	Mormolyca rufescens (Lindl.) M.A.Blanco	JJ 4683	Epi	Di	
	Nitidobulbon nasutum (Rchb.f.) Ojeda & Carnevali	AA 4970	Epi	WD	
	Octomeria concolor Barb.Rodr. *	PL 464	Epi	O	
	Octomeria crassifolia Lindl.	AF 2657	Epi	O	
	Octomeria decumbens Cogn.	PL 400	Epi	En	DD
	Octomeria geraensis Barb.Rodr. *	PL 265	Epi	En	VU
	Octomeria grandiflora Lindl.	PL 226	Epi	WD	
	Octomeria tricolor Rchb.f.	JJ 4665	Epi	En	
	Octomeria sp.	PL 493	Epi	-	
	Ornithidium rigidum (Barb.Rodr.) M.A.Blanco & Ojeda *	RP 301	Epi	Di	
	Pabstiella bradei (Schltr.) Luer *	PL 377	Epi	En	
	Pabstiella ramphastorhyncha (Barb. Rodr.) L. Kollmann	PL 360	Epi	CAF	
	Pabstiella aff. *trifida* (Lindl.) Luer	AF 2658	Epi	-	
	Pleurothallis ruscifolia (Jacq.) R.Br.	PF 2821	Epi	WD	
	Pleurothallis sp.	PL 222	Epi	-	

Continued on next page

Table 1. Continued.

Family	Specie[1]	Voucher[2]	Habit[3]	Distribution[4]	Threat category[5]
	Polycycnis silvana F.Barros	AA 5805	Epi	En	
	Polystachya estrellensis Rchb.f.	RP 294	Fac	WD	
	Promenaea silvana F.Barros & Cath.	JJ 4815	Epi	En	
	Promenaea xanthina Lindl.	RP 330	Epi	En	
	Prosthechea buerarensis (Campacci) Campacci	AF 2662	Epi	En	
	Prosthechea calamaria (Lindl.) W.E.Higgins *	AF 2674	Epi	En	
	Prosthechea fragans (Sw.) W.E.Higgins	AA 5361	Epi	WD	
	Prosthechea pachysepala (Klotzsch) Chiron & V.P.Castro	RP 335	Epi	CAF	
	Prosthechea pygmaea (Hook.) W.E.Higgins	WT 14101	Epi	WD	
	Prosthechea vespa (Vell.) W.E.Higgins *	ML 549	Fac	WD	
	Rhetinantha notylioglossa (Rchb.f.) M.A.Blanco	AA 5355	Epi	Di	
	Scaphyglottis fusiformis (Griseb.) Schultes *	PL 399	Epi	WD	
	Scaphyglottis modesta (Rchb.f.) Schltr.	AF 2672	Fac	WD	
	Scaphyglottis reflexa Lindl.	WT 14096	Epi	O	
	Sobralia cf. sessilis Lindl.	AF 2651	Epi	-	
	Specklinia grobyi Batem. *ex* Lindl.	PL 494	Epi	WD	
	Stelis aprica Lindl.	AA 6588	Epi	WD	
	Stelis caespitosa Lindl. **	PL 532	Epi	O	
	Stelis deregularis Barb.Rodr.	WT 14102	Epi	En	
	Stelis aff. *fraterna* Lindl.	PL 256	Epi	-	
	Stelis intermedia Poepp. & Endl. *	AA 5746	Epi	O	
	Stelis megantha Barb.Rodr. *	PL 135	Epi	En	
	Stelis papaquerensis Rchb.f. *	PL 430	Epi	Di	
	Stelis pauciflora Lindl. *	PL 175	Epi	Di	
	Stelis ruprechtiana Rchb.f. *	PL 359	Epi	En	
	Stelis sp. 1	PL 431	Epi	-	
	Stelis sp. 2	PL 519	Epi	-	
	Stelis sp. 3	JJ 4713	Epi	-	
	Stelis sp. 4	WT 14103	Epi	-	
	Stelis sp. 5	ML 1187	Epi	-	
	Trichopilia santoslimae Brade *	PL 221	Epi	En	CR
	Xylobium colleyi (Bateman *ex* Lindl.) Rolfe *	RP 69	Epi	WD	
	Xylobium variegatum (Ruiz & Pav.) Mansf. *	PL 310	Fac	WD	
	Zygopetalum crinitum Lodd. *	AA 7264	Epi	En	
	Zygopetalum cf. maxillare Lodd.	AF 2665	Epi	-	
Piperaceae	*Peperomia alata* Ruiz & Pav.	JJ 4346	Fac	WD	
	Peperomia corcovadensis Gardner *	PL 100	Fac	O	
	Peperomia elongata Kunth	AA 6649	Fac	WD	
	Peperomia emarginella (Sw.) C.DC.	WT 14541	Fac	O	
	Peperomia hernandiifolia (Vahl) A.Dietr.	ML 1020	Fac	WD	
	Peperomia macrostachya (Vahl) A.Dietr.	JJ 4798	Epi	WD	
	Peperomia magnoliifolia (Jacq.) A.Dietr.	AA 5952	Fac	WD	
	Peperomia obtusifolia (L.) A.Dietr.	AA 5946	Fac	WD	
	Peperomia pilicaulis C.DC.	MJ 840	Fac	WD	
	Peperomia pseudoestrelensis C.DC.	AA 6357	Fac	En	
	Peperomia serpens (Sw.) Loud	PL 548	Fac	WD	
	Peperomia tenella (Sw.) A.Dietr.	PL 421	Fac	CAF	
	Peperomia tetraphylla (G.Forst.) Hook. & Arn.	AA 6681	Fac	WD	
	Peperomia urocarpa Fisch. & C.A.Mey.	AA 5287	Fac	WD	
Rubiaceae	*Hillia parasitica* Jacq.	AA 5800	Epi	WD	
	Notopleura bahiensis C.M.Taylor	AA 5741	Epi	En	
	Schradera polycephala DC.	JJ 4851	Hep	Di	
Solanaceae	*Dyssochroma viridiflorum* (Sims) Miers	AA 4962	Hep	En	

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Table 2. Comparison of species richness for the main families and genera with epiphytic habit between Serra das Lontras National Park and other surveys carried at the Atlantic Forest. [1] N.P. – National Park; S.P. – State Park; N.R. – Natural Reserve. "-" – Information not available.

Study area [1]	**Serra das Lontras N.P., BA**	**Macaé de Cima, RJ**	**Upper Iguaçu River Basin, PR**	**Prata Moutain Range, PR**	**Ibitipoca S.P., MG**	**Carlos Botelho S.P., SP**	**Ilha do Cardoso S.P., SP**	**Vale do Rio Doce N.R., ES**
Taxon	Present study	Fontoura *et al.* 1997; Costa & Wendt 2007	Kersten & Kunyioshi 2006	Blum *et al.* 2011	Menini Neto *et al.* 2009	Breier *et al.* 2005	Breier *et al.* 2005	Coelho 2010
Total area	11,000ha	7,000ha	-	6.3ha	1,923.5ha	10.24ha	10.24ha	22.000ha
Total epiphytic Angiosperms	256	275	254	204	181	121	136	-
Orchidaceae	103	184	147	103	66	42	72	-
Bromeliaceae	62	45	39	38	22	27	33	-
Araceae	29	5	9	14	9	13	11	22
Piperaceae	15	5	24	14	3	8	6	-
Cactaceae	7	7	12	9	7	11	1	-
Gesneriaceae	7	6	3	5	2	6	3	-
Vriesea	22	18	11	18	7	12	15	-
Peperomia	15	5	22	14	3	7	5	-
Stelis	14	4	6	7	5	1	1	-
Anthurium	13	-	2	6	5	3	3	4
Philodendron	12	10	7	6	4	8	7	12
Aechmea	11	4	9	5	1	5	3	-
Epidendrum	11	10	4	12	6	4	8	-
Hohenbergia	9	0	0	0	0	0	0	-

Aechmea, and *Hohenbergia* also exhibited their greatest epiphytic species diversity in the SLNP. It is interesting that *Hohenbergia* was among the richest genera in the study area, as this genus does not commonly figure among the most species rich taxa in epiphyte surveys. The greatest diversity of this genus is encountered in southern Bahia, where 21 of its 25 Atlantic Forest species occur (Martinelli et al. 2008, Forzza et al. 2013).

In addition to *H. brachycephala* and *H. minor*, both endemic to Bahia, *H. edmundoi*, a poorly-known species from Bahia for which no habitat information was available (Smith & Downs 1979, Forzza et al. 2013), was found in a submontane forest in the SLNP; *H. augusta*, previously considered to be restricted to southeastern Brazil, was also collected. These results reaffirm the importance of southern Bahia State in the distribution and taxonomy of this genus.

Vriesea (Tillandsioideae) and *Aechmea* (Bromelioideae) represent 12% and 7%, respectively, of the total number of species in the Atlantic Forest (Forzza et al. 2013). Fontoura et al. (2012) reported that Bromelioideae taxa were encountered 1.6 times more frequently in local surveys of epiphytic species in the Atlantic Forest than representatives of Tillandsioideae. This proportion was lower in the SLNP, where *Vriesea* is very diverse, with almost the same numbers of species being encountered in each subfamily (34 spp. Bromelioideae x 30 spp. Tillandsioideae).

Another family that demonstrated elevated richness in the SLNP was Araceae, with one third of the 65 species known to the Atlantic Forest being encountered there (Coelho et al. 2013). The most diversified genera of this family were likewise well represented in the park, with more than half of the species of *Anthurium* and *Philodendron* known from Bahia being encountered in the SLNP. Additionally, two new occurrence records for Bahia State (*A. boudetii* and *P. edmundoi*), one for the Atlantic Forest domain (*A. gracile*), and five morphotypes of *Anthurium* reinforce the importance of additional studies in mountainous areas there to improve our knowledge of the distribution of this family within the state. In contrast to the high endemism levels of Bromeliaceae and Orchidaceae, representatives of Araceae exhibit wide (and sometimes disjunct) distributions (Coelho et al. 2013).

Orchidaceae is responsible for approximately 70% of the global epiphytic flora, and is always among the top families in every floristic study of that habit (Benzing 1990, Kersten 2010, Zotz 2013). Most orchid diversity is found in the tropics, especially in mountainous areas (Dressler 1993). The majority of the orchid taxa encountered in the SLNP is relatively small (*e.g.*, *Acianthera*, *Anathallis*, *Brachionidium*, *Jacquiniella*, *Lankesterella*, *Octomeria*, *Pabstiella*, *Pleurothallis*, *Promenaea*, *Specklinia*, and *Stelis*) and commonly neglected in floristic surveys – and therefore poorly represented in scientific collections (Dressler 2005). As the present study focused on epiphytes (and *ex-situ* cultivation was undertaken), high numbers of species were included on the final list – with 22 new occurrences for Bahia State (Table 1).

Northeastern Brazil represents one of the 10 areas in the world considered most likely to have undescribed species, and where models predict a 30% increase in known diversity (Joppa et al. 2011). Since initiating preliminary studies of the flora of the SLNP (Amorim et al. 2009), six new epiphyte species have

been described for the area: *Bertolonia alternifolia*, *B. bullata*, *Clistax bahiensis*, *Encyclia fimbriata*, *Quesnelia clavata*, and *Vriesea longisepala*, and one is about to be published. The present survey found other possible taxonomic novelties, and recent studies in neighboring areas encountered several new species with epiphytic habits (*e.g.*, Amorim & Leme 2009, Leme & Kollmann 2011, Costa et al. 2012, Reginato et al. 2013) – emphasizing the need of further investigations of this group in southern Bahia.

The present study expands the distribution of many taxa, with one new occurrence for Brazil (*Elleanthus hymenophorus* (Rchb.f.) Rchb.f.), four for the Atlantic Forest biome, and 30 for Bahia State (Table 1). *Utricularia jamsoniana* Oliv., a species previously known only from altitudinal regions of Central America and northern South America (Taylor 1989), was encountered in a cloud forest in the highest area of the park (Peito de Moça and Javi mountain ranges). Over half (16 spp.) of these new records were known only from collections in strictly southern and southeastern regions. The epiphytic flora of the SLNP shares more species with southern and southeastern Brazil (71 spp.) than with northeastern states (five species – four *Aechmea* and one *Hohenbergia*). This same pattern was found for ferns and lycophytes on a nearby mountainous area in the Serra Bonita Private Reserve, with almost a quarter of the surveyed species being previously restricted to southeastern Brazil (Matos et al. 2010).

Almost half of the 221 taxa identified to species level in the present study are endemic to the Atlantic Forest (100 spp. - 45%) (Table 1), and most of them belong to Bromeliaceae and Orchidaceae (44 and 32 species respectively). These two families exhibit high degrees of endemism in the Atlantic Forest, with 80% of Bromeliaceae and 63% of Orchidaceae being restricted to this domain (Martinelli et al. 2008, Stehmann et al. 2009). These high levels of endemism may be related to limited connections with the other major South American forest formation in the Amazon (Mori et al. 1981). These two forests are separated by an open area known as the "dry diagonal" (Prado & Gibbs 1993) that acts as a barrier to species dispersion, especially less drought-tolerant taxa.

On the other hand, 60 species showed broad distributions in Brazil or the Neotropical region, and 24 had disjunct distributions between the Atlantic and Amazon forests (Table 1); 19 species also occur in the "Cerrado" (Brazilian savanna) region, suggesting that dry formations do not act as barriers to all epiphyte taxa, especially those with broader ecophysiological tolerances (Oliveira-Filho & Ratter 1995, Ibisch et al. 1996). Deciduous and semi-deciduous seasonal forest patches and gallery forests that crisscross the Cerrado may offer dispersal pathways for many species and establish tenuous connections between these two major forest formations (Leitão Filho 1987, Oliveira-Filho & Ratter 1995).

All of the 10 species cited on the Red Book of Brazilian Flora (Martinelli & Moraes 2013) as threatened belong to Bromeliaceae and Orchidaceae, two very ornamental families. The five bromeliads are restricted to Northeast Brazil, and four of them are endemic to Bahia. On the other hand, the orchids indicated as threatened are new occurrences to the state. These results reinforce the importance of the park as a conservation unit and the relevance of floristic surveys, especially for often neglected groups such as epiphytes. Recent floristic studies in mountainous areas in southern Bahia have revealed large numbers of new species and new occurrences of epiphytes – pointing to the need for further investigations of this group.

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