



Geographic distribution of Leguminosae the Itacolomi

Geographic distribution patterns of Leguminosae and their relevance for the conservation of the Itacolomi State Park, Minas Gerais, Brazil

Valquíria Ferreira Dutra^{1,2,6}, Laura Cristina Pires Lima^{2,3}, Flávia Cristina Pinto Garcia²,
Haroldo Cavalcante de Lima⁴ & Ângela Lúcia Bagnatori Sartori⁵

¹Universidade Federal do Espírito Santo, Departamento de Ciências Biológicas, Setor de Botânica, Av. Fernando Ferrari 514, Goiabeiras, 29075-910, Vitória, ES, Brasil (www.ufes.br)

²Programa de Pós-Graduação em Botânica, Universidade Federal de Viçosa, Departamento de Biologia Vegetal, Av. P.H. Rolfs s.n., 36570-000, Viçosa, MG, Brasil (www.ufv.br)

³Universidade Estadual de Feira de Santana, Departamento de Biologia, Avenida Transnordestina s/n, 44031-460, Feira de Santana, BA, Brasil (www.uefs.br)

⁴Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Rua Pacheco Leão 915, 22460-030, Rio de Janeiro, RJ, Brasil (www.jbri.gov.br)

⁵Universidade Federal de Mato Grosso do Sul, Laboratório de Botânica, C.P. 549, 79070-900, Campo Grande, MS, Brasil (www-nt.ufms.br)

⁶Corresponding author: Valquíria Ferreira Dutra, e-mail: valquiria.dutra@bol.com.br

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Abstract: This study identified patterns of geographic distribution of 102 Leguminosae taxa within the Park, based on literature data and herbarium specimens. Among the taxa, 38 grow exclusively in *Campos Rupestres* (rocky fields) and 49 in the Semideciduous Forest. Eleven patterns of geographic distribution were identified, of which the West-East- Central South America pattern was the most representative, with 27 taxa. Of the 102 sampled taxa of Leguminosae, five are endemic to the Espinhaço Range and ten are included in lists of endangered species of the flora of Brazil and Minas Gerais. Information on these taxa is crucial to provide conservation practices for conserving the vegetation formations of the PEIT.

Keywords: Atlantic Forest, Espinhaço Range, Fabaceae, rocky fields, Semideciduous Forest

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Resumo: Neste estudo foram identificados os padrões de distribuição geográfica dos 102 táxons de Leguminosae ocorrentes no PEIT, com base nos dados obtidos na literatura e em material de herbário, sendo 38 exclusivos dos Campos Rupestres e 49 das Florestas Estacionais. Foram reconhecidos 11 padrões de distribuição geográfica, dos quais o padrão América do Sul Ocidental- Centro-Oriental foi o mais representativo com 27 táxons. Dos 102 táxons amostrados de Leguminosae, cinco são endêmicos da Cadeia do Espinhaço e 10 constam nas listas de espécies ameaçadas da flora brasileira ou da Flora de Minas Gerais, sendo consideradas importantes para fornecer subsídios na conservação das formações vegetacionais do PEIT.

Palavras-chave: Cadeia do Espinhaço, campos rupestres, Fabaceae, Florestas Estacionais, Mata Atlântica

Introduction

Leguminosae is the third largest family of flowering plants, comprising 727 genera and 19.325 species (Lewis et al. 2005). The high ecological plasticity of the family allows its distribution in highly diverse habitats and this peculiar feature is determinant for its great diversity in neotropical vegetation types (Lima 2000). In Brazil, the family is represented by 212 genera and 2717 species (Lima et al. 2010a), distributed in almost all vegetation types (Barroso et al. 1991). Moreover, it has been identified as one of the most representative of flowering species in the *Campos Rupestres* (rocky fields), in the *Cerrado* (Brazilian savannas) and Tropical Forests (Giulietti & Pirani 1988, Mendonça et al. 1998, Ribeiro 1998, Pirani et al. 2003, Dutra et al. 2008a), highlighting its importance for the flora of Brazil.

In floristic surveys of biomes of the state of Minas Gerais, Leguminosae has also been considered one of the most representative flowering plant families, as reported for *Caatinga* (e.g. Brandão & Gavilanes 1994), *Cerrado* (e.g. Brandão & Gavilanes 1997), *Campos Rupestres* (Dutra et al. 2008a) and areas of Atlantic Forest (Oliveira-Filho et al. 1994). Information as this about the diversity of species, together with data on the presence of endemic, threatened and rare species, has been used to determine priority conservation areas in the State and to delimit areas which require the creation and implementation of Conservation Units (Drummond et al. 2005).

The Itacolomi State Park (PEIT) is located in the southern part of the Espinhaço Range, in the so-called *Quadrilátero Ferrífero* (Peron 1989), in a vegetation transition zone between the Atlantic Forest and the *Cerrado*, representing an important migratory corridor and consisting of gallery forests between the two formations (Oliveira-Filho & Ratter 1995).

The vegetation of the Espinhaço Range includes a series of altitudinal strata, with *Campos Rupestres* and cloud forests in the highest strata, *Cerrado* and Semideciduous Forests in the intermediary strata and a varied combination of vegetation types of the adjacent lowlands (Harley 1995). The geological antiquity, geographical position and climate fluctuations that occurred during the Quaternary and allowed a vertical migration of the flora from the lower regions, as well as the physiognomy variety are the main factors related to the high biodiversity of the Espinhaço Range (Giulietti et al. 2002, Gontijo 2008). The high species richness, high landscape diversity and high degree of endemism led to the recognition of the Espinhaço Range as one of the priority areas for conservation, with special biological importance, hence the area of the PEIT has great biological relevance (Drummond et al. 2005).

The aim of this study was to analyze the endemism and habitat preference of the Itacolomy State Park flora using the Leguminosae family as a model to characterize geographic distribution patterns of specific and/or infraspecific taxa. The patterns that emerged from the analysis were used to answer the following questions: (i) What is the influence of the surrounding vegetation on the flora of the PEIT? (ii) What are the implications of the findings for the conservation of the flora of the park?

Methods

The PEIT is located in the municipalities of Ouro Preto and Mariana, State of Minas Gerais, (between 20°22'30" and 20°30'00" S and 43°32'30" and 43°22'30" W) (Fig. 1), comprising the entire Itacolomi Range (Peron 1989). The Park encompasses an area of approximately 7000 ha. The relief is characterized by steep slopes and altitudes between 700 and 1772 m (Messias et al. 1997).

The regional climate is typically tropical, Cwa and Cwb, according to Koeppen's classification, with two well-defined seasons: a dry season, from May to September, and a rainy season, from October to April. The annual rainfall is on average 2018 mm (Messias et al. 1997, Nalini Junior et al. 2006). Fog is frequent and the average annual temperature is 21 °C (maximum 33 °C, minimum 4 °C) (Messias et al. 1997).

The soils were formed by the weathering of parent material, mostly of quartzite and mica-schists of the Minas Supergroup, with latosols, where the topography is hilly, and lithosols where the relief is jagged (Messias et al. 1997).

The vegetation consists of Semideciduous Forest and *Campos Rupestres* (Messias & Sousa 2006, Fig. 2), varying with the soil, water availability, altitude and topography.

The *Campos Rupestres* practically cover the entire Park at elevations above 1000 m. They are characterized by the diversity of substrates formed by the exposure of various types of rocks, shallow, lithic, sandy, acidic and nutrient-poor soils with limited water and intense sun exposure (Giulietti & Pirani 1988, Meguro et al. 1994, Giulietti et al. 1997). The vegetation is formed by a well-developed herbaceous- shrub stratum and has a heterogeneous flora composed of many endemic species (Harley 1995, Mendonça et al. 1998).

The Semideciduous Forests that grow in highly seasonal parts of the tropics, with a severe and prolonged dry season, have mean annual precipitation below 1600 mm and 5–6 months of the year with less than 100 mm rainfall (Gentry 1995). Most species of these forests are deciduous, with 20-50% of the trees losing their leaves in the dry season (IBGE 2012). The Semideciduous Forest of the PEIT can be classified, by the altitudinal gradient, as submontane (300-700 m), lower highlands (700-1100m) and upper highlands (above 1100m) (Oliveira-Filho 2009).

The list of taxa used in this study was obtained from the floristic survey of the Leguminosae within the PEIT (Lima et al. 2007, Dutra et al. 2008b, 2008c, 2009, Lima et al. 2010c). The habit descriptions were according to Guedes-Bruni et al. (2002).

The mapping of the geographical distribution was based on the occurrence records of herbarium collections (BHCB, OUPR, RB, VIC) and specialized literature. The distribution patterns were adapted from Giulietti & Pirani (1988), Lima et al. (1997), Lima (2000) and Morim (2006): [1] Wide geographical distribution, which corresponds to the taxa that occur in Africa, Asia, Australasia, North America, Central America and South America; [2] South America, Central America and North America, taxa whose distribution is restricted to the Americas, from the United

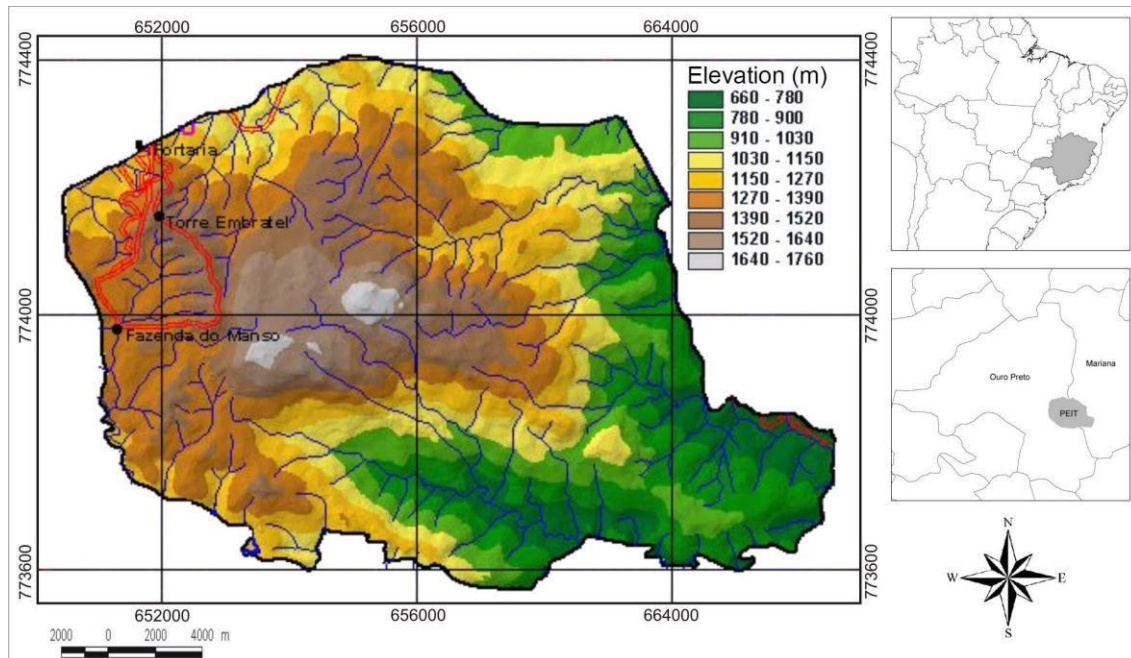


Figure 1. Location of the Itacolomi State Park.

Figura 1. Localização do Parque Estadual do Itacolomi.

States to southern Argentina; [3] Neotropical, taxa with a range of distribution in the tropics of South America, which can extend to Central America and Mexico; [4] West, Central and Eastern South America, taxa distributed across areas in the western, central and eastern South America, up to the far north of Venezuela, Suriname and Guyana; [5] Brazil-wide distribution, includes taxa widely distributed in all regions of Brazil; [6] Central-Eastern Brazil, taxa distributed in the midwest, northeast, southeast, and/or south of Brazil; [7] Atlantic-Northeast-Southeast-Southern Brazil, taxa that occur from the northeast to the south of Brazil; [8] Atlantic-Northeast-Southeastern Brazil, taxa with a range of distribution from northeast to southeastern Brazil; [9] Atlantic-Southeast- Southern Brazil, taxa distributed in the restricted range of the states of southeastern and southern Brazil; [10] Southeastern Brazil, taxa restricted to the states of Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo; and [11] Espinhaço Range, taxa restricted to the highlands of the mountain range, in the states of Minas Gerais and Bahia.

The taxa were also classified as generalist or specialist species and according to habitat preference. The species exclusive to the Atlantic domain (which includes Rain Forest, Semideciduous and Deciduous Forests and Ombrophilous Mixed Forest) were considered specialist and those from other biomes, beyond the Atlantic area, such as the Amazon, *Cerrado* and/or *Caatinga*, were considered generalist. The classification of Veloso et al. (1991) modified by Oliveira-Filho (2009) was used for the determination of the taxon habitats. The term *domain* is used here according to Joly et al. (1999).

Maps of geographical taxa distribution representing each pattern were drawn based on information available in the literature and records from herbarium collections available at *species* (CRIA, 2013).

Results

The Leguminosae family in the Itacolomi State Park is represented by 102 specific and/or infraspecific taxa of 43 genera (Table 1). Papilionoideae was the subfamily with the largest number of taxa (48), followed by Mimosoideae (33) and Ceasalpinioideae (21). One of the species found, *Trifolium repens*, is exotic and occurs sub-spontaneously in the PEIT.

The most representative genera were *Mimosa* L. (11 spp.), *Chamaecrista* Moench. (9 spp.) and *Inga* Mill. (9 spp.), the former two ones predominated in *Campos Rupestres* and the latter in the Semideciduous Forests of PEIT.

Of the sampled taxa, 38 were exclusive to the *Campos Rupestres* (elevation range of 1000–1540m), including *Andira surinamensis* (Bondt) Splitg. ex Pulle (Fig. 3a), *Chamaecrista dentata* (Vogel) H.S.Irwin & Barneby (Fig. 3b), *C. hedysaroides* (Vogel) H.S.Irwin & Barneby (Fig. 3b), *C. ochracea* (Vogel) H.S.Irwin & Barneby var. *ochracea* (Fig. 3c), *Mimosa montis-carasae* Barneby (Fig. 3c) and *M. ourobrancoënsis* Burkart (Fig. 3d).

Forty nine taxa were exclusive to Semideciduous Forests, including *Ormosia friburgensis* Taub. ex Harms (Fig. 3d), *Bionia bella* Mart. ex Benth. (Fig. 4a) and *Tachigali friburgensis* (Harms) L.G. Silva & H.C. Lima (Fig. 4a). Leguminosae were predominant in the submontane forests (elevation range of 620–700m) and less representative in lower highland and upper highland forests (elevation range of 700–1360m).

Fifteen taxa occurred in both vegetation types, such as *Crotalaria breviflora* DC. (Fig. 4b), *Abarema langsdorfii* (Benth.) Barneby & J.W.Grimes (Fig. 4c) and *Inga vulpina* Mart. ex Benth. (Fig. 4d).

Most of the identified taxa were trees (35%), followed by shrubs (31.5%), herbs (11.8%), lianas (9.9%) and vines



Figure 2. Semideciduous forest and *campos rupestres* of the Itacolomi State Park. a-d. semideciduous forest; e-h. *campos rupestres*.

Figura 2. Florestas Estacionais e campos rupestres do Parque Estadual do Itacolomi. a-d. Florestas Estacionais; e-h. campos rupestres.

(9%). The subshrub habit was the least represented, with 2.8% of the taxa. Trees, vines and lianas were prevalent in the forest areas of the Park, while the shrubs, herbs and subshrubs were most common in the *Campos Rupestres*.

The analysis of the geographical distribution of 102 specific and infraspecific Leguminosae taxa of the PEIT covered the five geographical macroregions (Table 2): Wide geographic distribution (7.8% of the taxa), South America, Central America and North America (4%), Neotropical (16.5%), West, Central and Eastern South America (26.3%), and distribution restricted to Brazil (45.6% of the taxa).

Among the taxa of occurrence restricted to the Brazilian territory, seven geographic distribution patterns were defined (Table 2): Brazil-wide distribution (2.9%), Central-Eastern Brazil (11.6%), Atlantic-Northeast-Southeast-Southern Brazil (3.8%), Atlantic-Northeast-Southeastern Brazil (6.8%), Atlantic-Southeast-Southern Brazil (2.9%), Southeastern Brazil (12.7%) and endemic to the Espinhaço Range (4.9%).

The correlation between the patterns of geographic distribution and the number of species per habitat in the PEIT (Fig. 5) showed that in the Semideciduous Forests there is predominance of species of the patterns West, Central and Eastern South America (18 spp), Central-Eastern Brazil (9 spp) and Southeastern Brazil (9 spp.). Note also that 17 species are unique patterns of the Atlantic Forest domain. In *Campos Rupestres* there is predominance of species of the patterns Neotropical (09 spp), Wide geographic distribution (7 spp), South America, Central America and North America (4 spp) and Endemic to the Espinhaço Range (5 spp).

Discussion

The diversity of Leguminosae in PEIT can be considered high compared with other areas of the Espinhaço Range, losing in number of species only to the Serra do Cipó, where 104 species were listed according to Giulietti et al. (1987). Furthermore, it contains 15% of the Leguminosae diversity in the *Campos Rupestres* reported by Dutra et al. (2008a). Considering only the grassland vegetation, the PEI is the fifth richest area of *Campos Rupestres* in Leguminosae, while considering only the areas of the Iron Quadrangle, it is the first richest area in Leguminosae (Dutra et al. 2008a).

Besides this high diversity in *Campos Rupestres* of PEIT, the high percentage of taxa (43%) in Submontane Forests corroborates the results found in the National Park of Itatiaia (PARNA Itatiaia), by Morim (2006). Elevational gradients in species diversity are nearly as ubiquitous as latitudinal gradients, and they provide a number of characteristics that make them perhaps more suitable for uncovering the underlying cause(s) of spatial variation in diversity, as the decline in species richness with increasing altitude is a common pattern in Tropical Forests (Colwell et al. 2004, Sanders & Rabbeck 2012). This was recorded for Leguminosae in areas of *Campos Rupestres* by Dutra (2005), however, in these fields, as well as altitudinal variation, other factors such as topographic variation and heterogeneity of the substrate and microclimate are also

determinants for the occurrence of species (Rapini et al. 2008)

Mimosa and *Chamaecrista*, the richest genera in number of species in the *Campos Rupestres* of the PEIT, are widely distributed in the Neotropics and characteristic of dry environments, such as the *Cerrado* (Schrire et al. 2005, Queiroz 2006). *Inga*, the most representative genus in the Semideciduous Forests of the PEIT, is prevalent in tropical and subtropical forests of Tropical America and has high diversity in the Atlantic Domain, with 22 species cited for secondary forests (León 1966, Garcia & Fernandes 2013). The genera *Lupinus* and *Calliandra*, cited as diverse in the *Campos Rupestres* by Giulietti et al. (1997), were not found in the *Campos Rupestres* of the PEIT. The low representation or absence of species of these genera in other *Campos Rupestres* within the Iron Quadrangle had already been recorded by Dutra et al. (2008a).

The highest percentage of shrub and herbaceous species found in the *Campos Rupestres* is mainly due to the presence of representatives of *Desmodium*, *Stylosanthes*, *Aeschynome* and *Zornia*, among others, which are among the genera with high species richness in tropical grasslands. The richness of these genera in the extensive herbaceous-shrub stratum prevalent in *Campos Rupestres* has been observed in other studies and is consistent with the percentage of habit variation in forest and grassland formations (Pirani et al. 2003, Zappi et al. 2003, Ferreira & Forzza 2009).

The analysis of the geographical distribution of Leguminosae taxa in the PEIT showed a high percentage of taxa distribution restricted to the Brazilian territory, with predominance, under the phytogeographical aspect, of components of the flora of areas of *Cerrado* and Atlantic Forest. Morim (2006) reported that 65% of the species recorded in the Itatiaia National Park (RJ) are restricted to Brazil. Filardi et al. (2007) and Nunes et al. (2007) found that 44% of the Leguminosae-Papilionoideae taxa growing in the National Park Serra da Canastra (MG) and 54% of the Leguminosae-Mimosoideae taxa in the State Park of Rio Doce (MG) are unique to the flora of Brazil.

The species with the widest distribution patterns (Wide Geographic Distribution, South America, Central America and North America and Neotropical), are mostly herbaceous plants and subshrubs of *Campos Rupestres* and correspond to ruderal species that occur in different types of vegetation, mainly as weeds in degraded areas, being considered generalists (Miotto 1987, Fortuna-Perez 2010, Lima et al. 2010b) and well represented in the *Campos Rupestres* of the Iron Quadrangle (Dutra et al. 2008a). The wide distribution can also be explained by the presence of neotropical species that have the riverbanks as preferred habitat, such as *Inga marginata* and *Inga vera* subsp. *affinis* that occur in Submontane and Upper Highland Forests, respectively, corroborating Pennington (1997), who explained the occurrence of the wide distribution of these species in the Neotropics by the dispersal of fruits through hydrochory or zoochory.

In the distribution pattern Western, Central and Eastern South America, 56 % of the species are restricted to semi-deciduous forests of the PEIT, among them, the specie *Anadenanthera colubrina* var. *colubrina* is referred as representative in the Semideciduous Forests of Brazil.

Table 1. Specific and infraspecific Leguminosae taxa of the Itacolomi State Park, their geographic distribution patterns, habits and vegetation types. He = herbaceous; Li = lianas; Sb = subshrubs; Tr = trees; Sh = shrubs; Vi = vines. CRP = *campos rupestres*; SLF = Semideciduous lower highland forest; SMF = semideciduous submontane forest; SUF = Semideciduous upper highland forest.

Tabela 1 Táxons específicos e infra-específicos das Leguminosae do Parque Estadual do Itacolomi, seus padrões de distribuição geográfica, hábitos e formações vegetacionais. He = ervas; Li = lianas; Sb = subarbustos; Sh = arbustos; Tr = árvores; Vi = trepadeiras. CPR = campos rupestres; SLF = Floresta Estacional Montana; SMF = Floresta Estacional Submontana; SUF = Floresta Estacional Altimontana.

Distribution pattern	Specific and infraspecific taxa ^{†*}	Habit	Vegetation type
Wide geographic	<i>Citoria falcata</i> var. <i>falcata</i> Lam.	Vi	CRP/SMF
distribution	<i>Desmodium adscendens</i> (Sw.) DC. ^{2, 20}	He	CRP/SUF/SLF/ SMF
	<i>Desmodium barbatum</i> (L.) Benth. ^{2, 20}	He	CRP
	<i>Desmodium incanum</i> DC. ^{2, 20}	He	CRP
	<i>Desmodium uncinatum</i> (Jacq.) DC. ^{2, 20}	Sb	CRP/SUF/SLF
	<i>Mimosa pudica</i> var. <i>hispida</i> Brenan [†]	Sb	CRP
	<i>Zornia reticulata</i> Sm ¹	He	CRP
	<i>Trifolium repens</i> L. ^{8, 20}	He	SUF
South America, Central America and North America	<i>Centrosema virginianum</i> (L.) Benth. ^{3, 4, 3}	Vi	CRP
	<i>Chamaecrista rotundifolia</i> var. <i>rotundifolia</i> (Pers.) Greene ²⁸	He	CRP
	<i>Indigofera suffruticosa</i> Mill. ^{1, 2, 20}	Ab	CRP/SMF
	<i>Stylosanthes viscosa</i> (L.) Sw. ^{1, 2, 20}	He	CRP
Neotropical	<i>Aeschynomene elegans</i> var. <i>elegans</i> Schtdl. & Cham. ²⁰	He	CRP/SUF
	<i>Anadenanthera peregrina</i> L. (Speg.) ^{1, 10, 20}	Tr	SUF
	<i>Andira surinamensis</i> (Bondt) Splitg. ex Pulle ^{39, 41}	Ab	CRP
	<i>Calopogonium mucunoides</i> Desv. ^{1, 3}	Vi	CRP
	<i>Crotalaria micans</i> Link ²²	Ab	CRP
	<i>Desmodium affine</i> Schtdl. ^{2, 20}	He	CRP
	<i>Inga marginata</i> Willd. ^{24, 40}	Tr	SMF
	<i>Inga vera</i> subsp. <i>affinis</i> (DC.) T.D.Penn ^{24, 40}	Tr	SUF/SMF
	<i>Machaerium hirtum</i> (Vell.) Stellfeld ^{20, 40, 22}	Tr	SMF
	<i>Mimosa diplotricha</i> var. <i>diplotricha</i> C.Wright ex Sauvalle [†]	Ab	CRP
	<i>Platypodium elegans</i> Vogel ^{29, 31, 30}	Tr	SMF
	<i>Poiretia punctata</i> (Willd.) Desv. ⁴³	Li	SMF
	<i>Pterocarpus rohrii</i> Vahl ^{29, 34}	Tr	SMF
	<i>Rhynchosia reticulata</i> (Sw.) DC. ⁴⁰	Vi	CRP
	<i>Stylosanthes guianensis</i> (Aubl.) Sw. ^{1, 2, 20}	He	CRP
Western - Central-Eastern South America	<i>Vigna peduncularis</i> (Kunth) Fawc. & Rendle ³⁰	Vi	CRP/SUF
	<i>Anadenanthera colubrina</i> (Vell.) Brenan var. <i>colubrina</i> ^{1, 20}	Tr	SMF
	<i>Bauhinia longifolia</i> (Bong.) Steud. ³¹	Tr	SMF
	<i>Bauhinia unguilata</i> var. <i>cuiabensis</i> (Bong.) Vaz ²⁰	Ab	CRP/SLF/SMF
	<i>Bowdichia virgilioides</i> Kunth ²⁰	Tr	SMF
	<i>Calliandra parvifolia</i> (Hook. & Arn.) Speg. ³	Tr, Ab	SMF
	<i>Chaetocalyx longiflora</i> Benth. ex A.Gray ³⁰	Vi	SMF
	<i>Chamaecrista langsfordii</i> (Kunth ex Vogel) Britton ex Pittier ²⁰	Ab	CRP
	<i>Chamaecrista trichopoda</i> (Benth.) Britton & Rose ex Britton & Killip ²⁰	He	CRP
	<i>Camptosema scarlatinum</i> var. <i>pohlianum</i> (Mart. ex Benth.) Burkart ²⁰	Vi	CRP
	<i>Copaifera reticulata</i> Ducke ^{1, 1}	Tr	SUF/SLF/SMF
	<i>Crotalaria paulina</i> Schrank ²²	Sb	SMF
	<i>Dalbergia frutescens</i> var. <i>frutescens</i> (Vell.) Britton ¹⁴	Ab/Li	CRP/SUF
	<i>Dalbergia revoluta</i> Ducke ¹⁴	Tr	SMF
	<i>Desmodium subsericeum</i> Malme ^{2, 20}	He	CRP
	<i>Dioclea violacea</i> Mart. ex Benth. ¹³	Li	SMF
	<i>Inga cylindrica</i> (Vell.) Mart. ^{24, 40}	Tr	SUF/SLF/SMF
	<i>Inga edulis</i> Mart. ^{24, 40}	Tr	SMF
	<i>Inga ingoides</i> (Rich.) Willd. ^{24, 40}	Tr	SLF/SMF
	<i>Machaerium aculeatum</i> Raddi ⁴⁰	Li	CRP/SLF/SMF
	<i>Machaerium brasiliense</i> Vogel ^{40, 22}	Tr/Ab	CRP/SLF/SMF
	<i>Machaerium nyctitans</i> (Vell.) Benth. ⁴²	Tr	SUF/SLF
	<i>Machaerium villosum</i> Vogel ²⁰	Tr	SUF/SLF/SMF
	<i>Mimosa pigra</i> var. <i>dehiscens</i> (Barneby) Glazier & Mackinder [†]	Ab	CRP
	<i>Periandra mediterranea</i> (Vell.) Taub. ²⁰	Ab	CRP
	<i>Piptadenia adiantoides</i> (Spreng.) J.F.Macbr. ²⁰	Li	SUF/SMF
	<i>Senna pendula</i> var. <i>glabrata</i> (Humb. & Bonpl. ex Willd.) H.S.Irwin & Barneby ²⁰	Ab	CRP/SUF
	<i>Sesbania virgata</i> (Cav.) Pers. ²⁰	Ab	CRP
Brazil-wide distribution	<i>Crotalaria breviflora</i> DC. ²³	He/Ab	CRP/SUF
	<i>Inga sessilis</i> (Vell.) Mart. ²³	Tr	SUF
	<i>Phanera radiata</i> (Vell.) Vaz ³⁰	Li	SLF
Central-Eastern Brazil	<i>Andira fraxinifolia</i> Benth. ⁴¹	Tr	SLF/SMF
	<i>Cassia ferruginea</i> (Schrad.) Schrad. ex DC. var. <i>ferruginea</i> ²⁰	Tr	SMF
	<i>Centrosema coriaceum</i> Benth. ³	Vi	CRP
	<i>Crotalaria velutina</i> Benth. ²²	He	CRP
	<i>Dalbergia villosa</i> (Benth.) Benth. var. <i>villosa</i> ²¹	Ab/Tr	CRP/SUF/SLF/SMF
	<i>Machaerium oblongifolium</i> Vogel ²¹	Li	SUF/SMF
	<i>Mimosa bimucronata</i> (DC.) Kuntze var. <i>bimucronata</i> ^{4, 10}	Ab	SLF/SMF
	<i>Mimosa dolens</i> Vell. var. <i>dolens</i> ^{4, 10}	Ab	CRP
	<i>Piptadenia gonoachantha</i> (Mart.) J.F.Macbr. ^{34, 41, 56}	Tr	SUF/SMF

		44		
	<i>Senegalia martusiana</i> (Steud.) Seigler & Ebinger		Li	SMF
	<i>Senna macranthera</i> var. <i>nervosa</i> (Vogel) H.S.Irwin & Barneby ²⁸		Tr	SUF/SMF
	<i>Multijuga</i> var. <i>lindleyana</i> (Gard.) H.S.Irwin & Barneby ³⁸		Tr	SUF
Atlantic - Northeast-Southeast-Southern Brazil	<i>langsdorffii</i> (Benth.) Barneby & J.W.Grimes ⁶		Ab/Tr	CRP/SUF/SLF/SMF
	<i>Dalbergia nigra</i> (Vell.) Alemao ex Benth.		Tr	SLF/SMF
	<i>Inga vulpina</i> Mart. ex Benth.	24, 46	Tr/Ab	CRP/SUF
	<i>Swartzia oblata</i> R. S. Cowan	37	Ab	CRP
Atlantic - Northeast-Southeastern Brazil	<i>Chamaecrista mucronata</i> (Sprang.) H.S.Irwin & Barneby	54	Ab	CRP
	<i>Melanoxylon brauna</i> Schott		Tr	SMF
		36, 40	Ab	CRP
	<i>Mimosa aurivillus</i> Mart. var.		Vi	CRP
	<i>aurivillus</i>	4, 16	Tr	SMF
		4, 16	Tr/Ab	CRP/SUF/SLF/SMF
	<i>contorta</i> (DC.) G.P.Lewis & M.P.Lima	30	Tr	SUF
Atlantic - Southeast-Southern Brazil	<i>Senna reniformis</i> (G.Don) H.S.Irwin & Barneby	55	Li	SLF/SMF
	<i>Tachigali rugosa</i> (Mart. ex Benth.) Zarucchi & Pipoly	33	Ab	CRP
Southeastern Brazil	<i>Dalbergia brasiliensis</i>		Tr	SUF
		4, 16	Tr	SUF/SLF/SMF
	<i>Inga barbata</i> Benth.	25	Vi	SUF/SLF/SMF
	<i>Mimosa scabrella</i> Benth.		Ab	CRP
	<i>Abarema obovata</i> (Benth.) Barneby & J.W.Grimes ⁶		Tr/Ab	SUF
	<i>Bionia bella</i> Mart. ex Benth.	49	Ab	CRP
	<i>Chamaecrista multipennis</i> (H.S.Irwin & Barneby) H.S.Irwin & Barneby	27	Ab	CRP
	<i>Inga schinifolia</i> Benth.	24, 46	Ab	CRP
		4, 16	Tr	SUF
	<i>Mimosa aurivillus</i> var. <i>calocephalus</i> (Mart. ex Benth.) Barneby	35, 51	Li	SUF/SMF
	<i>Mimosa ourobrancoensis</i> Burkart		Ab	CRP
	<i>Ormosia friburgensis</i> Taub. ex Harms		Ab	SUF
	<i>Piptadenia micracantha</i> Benth.	7, 9, 56	Tr	SLF/SMF
	<i>Senna neglecta</i> var. <i>oligophylla</i> (Benth.) H.S.Irwin & Barneby ²⁸		Tr	SUF
	<i>Senna pneumatica</i> H.S.Irwin & Barneby	28	Tr	SUF/SLF
Endemic to the Espinhaço Range	<i>Stryphnodendron polyphyllum</i> Mart.	53	Ab	CRP
	<i>Swartzia pilulifera</i> Benth.	37	Ab	CRP
	<i>Tachigali friburgensis</i> (Harms) L.G. Silva & H.C. Lima	33	Ab	CRP
	<i>Chamaecrista dentata</i> (Vogel) H.S.Irwin & Barneby	27	Ab	CRP
	<i>Chamaecrista hedysaroides</i> (Vogel) H.S.Irwin & Barneby	27	Ab	CRP
	<i>Chamaecrista ochracea</i> (Vogel) H.S.Irwin & Barneby var. <i>ochracea</i>	28	Ab	CRP
	<i>Chamaecrista rotundata</i> var. <i>grandistipula</i> (Vogel) H.S.Irwin & Barneby	28	Ab	CRP
		16		
	<i>Mimosa montis-carasae</i> Barneby			

+ Species threatened by extinction according to Biodiversitas (2005) and Brasil (2008).
 * References of the geographic distributions: ¹Altshul (1964), ²Azevedo (1981), ³Barbosa -Fevereiro (1977), ⁴Barneby (1991), ⁵Barneby (1998), ⁶Barneby & Grimes (1996), ⁷Barroso (1965), ⁸Benth (1859), ⁹Benham (1876), ¹⁰Brandão (1992), ¹¹Brandão (1996), ¹²Brandão & Costa (1979), ¹³Burkart (1970), ¹⁴Carvalho (1997), ¹⁵Carvalho-Oskano & Leitão-Filho (1985), ¹⁶Dutra & Morim (2011), ¹⁷Dwyer (1951), ¹⁸Eisinger (1987), ¹⁹Fantz (1980), ²⁰Fernandes (1996), ²¹Filardi (2011), ²²Flores (2004), ²³Flores (2011), ²⁴Garcia (1998), ²⁵Garcia & Fernandes (2013), ²⁶ILDIS (2011), ²⁷Irwin & Barneby (1978), ²⁸Irwin & Barneby (1982), ²⁹Lewis (1987), ³⁰Lewis & Lima (1991), ³¹Lima (2000), ³²Lima (2011a), ³³Lima (2011b), ³⁴Lima et al. (1994), ³⁵Lima et al. (2010c), ³⁶Lorenzi (1992), ³⁷Mansano et al. (2011), ³⁸Maréchal et al. (1978), ³⁹Mattos (1979), ⁴⁰Mendonça-Filho (1996), ⁴¹Mendonça et al. (1998), ⁴²Mendonça-Filho et al. (2007), ⁴³Miotto (1987), ⁴⁴Morim & Barros (2011), ⁴⁵Muller (1984), ⁴⁶Pennington (1997), ⁴⁷Pennington (2003), ⁴⁸Poston (1980), ⁴⁹Queiroz (1999), ⁵⁰Rudd (1958), ⁵¹Rudd (1965), ⁵²Sartori & Tozzi (1998), ⁵³Scalon (2007), ⁵⁴Souza & Bortoluzzi (2011a), ⁵⁵Souza & Bortoluzzi (2011b), ⁵⁶Tamashiro (1989), ⁵⁷Vaz & Tozzi (2003), ⁵⁸Vaz (2011).

It is also considered as a specialist species of the Atlantic domain by Lima (2000). However, this taxon is found in areas of *Caatinga* in northeastern Brazil and in part of Minas Gerais and Maranhão, in Seasonal Forests in the states of Mato Grosso do Sul and Parana, as well as in northeastern Argentina and southeastern Bolivia (Prado & Gibbs 1993); these vegetation types are currently recognized as Seasonally Dry Tropical Forests (SDTF), according to Pennington et al. (2000, 2004, 2006) and Miles et al. (2006).

In the pattern Central-Eastern Brazil there is also predominance of species of Semideciduous Forests of the PEIT, such as *Andira fraxinifolia* and *Piptadenia gonoacantha*, which are generalist species, corroborating Oliveira-Filho & Ratter (1995) that describe this area as an important migratory corridor, through the gallery forests of the *Cerrado* and Atlantic Forest. Although PEIT lies in a transition zone between the Atlantic Forest and areas of *Cerrado*, its legume species indicate that the Atlantic Forest domain has a greater number of taxa than the *Cerrado*.

In the pattern Southeastern Brazil, of the 13 taxa identified, nine were exclusive to the Semideciduous Forests. *Abarema obovata* and *Bionia bella* occur in upper highlands, lower highlands and submontane forests of the PEIT and are restricted to the Atlantic Forest domain, growing in submontane or seasonal forests and highland areas related mainly to the Mantiqueira Range, respectively (Barneby & Grimes 1996, Queiroz 1999, 2008). *Inga schinifolia*, *Ormosia friburgensis* and *Senna pneumatica* are specialist species and occur only in the upper highland forests of the PEIT, confirming reports by Rudd (1965), Garcia (1998) and Irwin & Barneby (1982).

Among the endemic species of the Espinhaço Range, all were exclusive to the *Campos Rupestres*, some can be considered microendemic because they occur only in two or three localities. *Chamaecrista dentata* is restricted to the Cipó Range and Itacolomi Range (Irwin & Barneby 1978); *C. hedysaroides* occurs in the region of Diamantina, Ouro Preto and Caraça Range (Irwin & Barneby 1978);

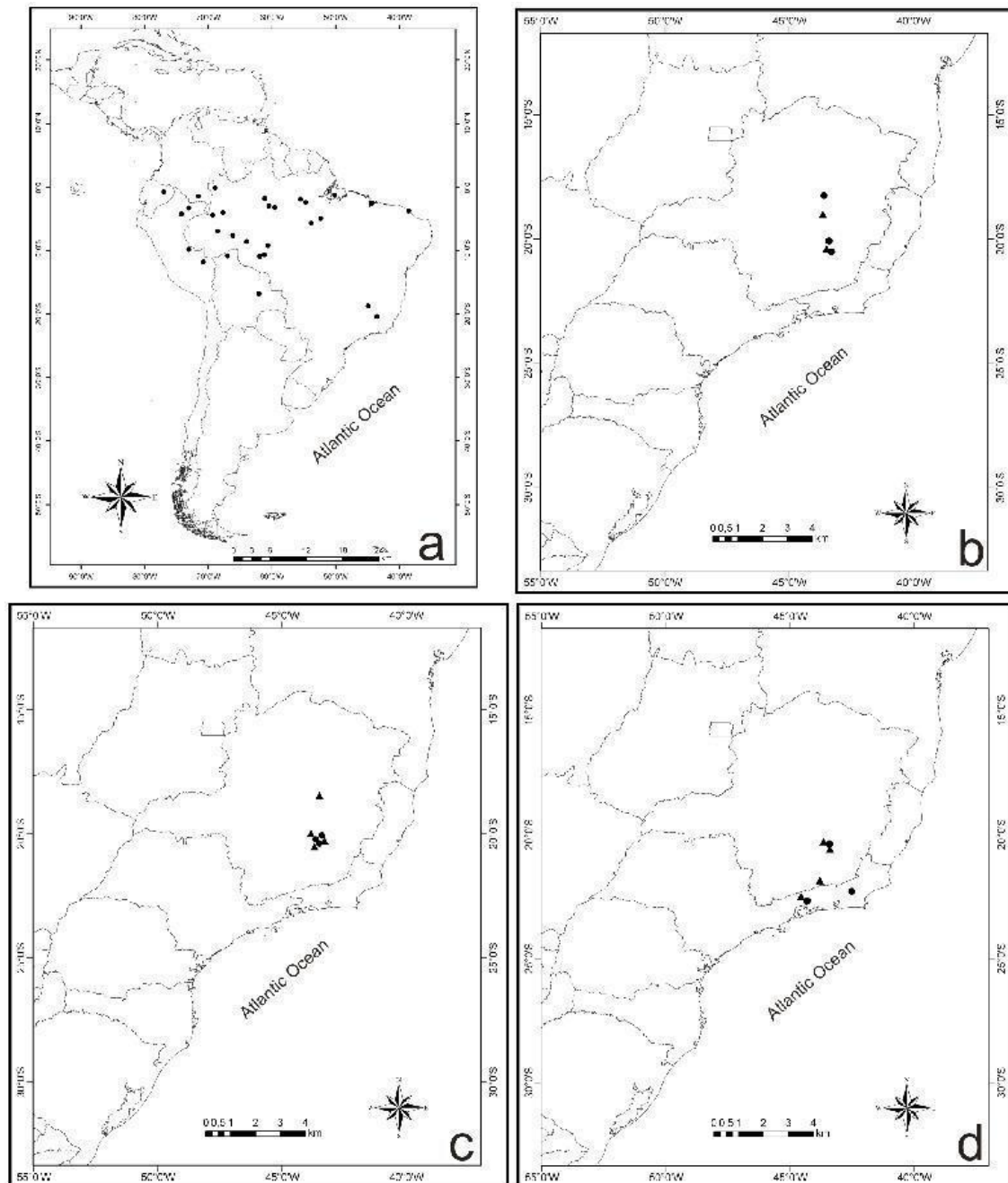


Figure 3. Distribution patterns a. Neotropical *Andira surinamensis* (Source: Pennington 2003, Mattos 1979); b. Endemic to the Espinhaço Range *Chamaecrista dentata* (▲) and *Chamaecrista hedysaroides* (●) (Source: Irwin & Barneby 1982); c. *Chamaecrista ochracea* var. *ochracea* (▲) and *Mimosa montis-carasae* (●) (Sources: Irwin & Barneby 1982, Dutra 2009); d. Southeastern Brazil *Mimosa ourobrancoensis* (▲) and *Ormosia friburgensis* (●) (Sources: Dutra 2009, Rudd 1965).

Figura 3. Padrões de distribuição a. Neotropical *Andira surinamensis* (Fontes: Pennington 2003, Mattos 1979); b. Endêmicas da Cadeia do Espinhaço *Chamaecrista dentata* (▲) e *Chamaecrista hedysaroides* (●) (Fonte: Irwin & Barneby 1982); c. *Chamaecrista ochracea* var. *ochracea* (▲) e *Mimosa montis-carasae* (●) (Fontes: Irwin & Barneby 1982, Dutra 2009); d. Brasil Sudeste *Mimosa ourobrancoensis* (▲) e *Ormosia friburgensis* (●) (Fontes: Dutra 2009, Rudd 1965).

C. ochracea var. *ochracea* grows in Nova Lima, Ouro Branco Range and Itacolomi Range (Irwin & Barneby 1978, Dutra et al. 2008b); *C. rotundata* var. *grandistipula* is limited to the region of Diamantina, Cipó Range and Itacolomi Range (Rando & Pirani 2011); and *Mimosa montis-carasae*, unique to Caraça Range and Itacolomi Range (Barneby 1991, Dutra et al. 2008c).

In the PEIT, 45% of the listed *Chamaecrista* species

are endemic to the Espinhaço Range, confirming the high degree of endemism of the genus for the flora of this mountain system, showing a pattern already identified for mainly the families of Eriocaulaceae, Velloziaceae, Xyridaceae, and Lythraceae (Giulietti et al. 1987). The states of Bahia and Minas Gerais are cited as a center of diversity for *Chamaecrista*, mainly the *Cerrado* and *Campos Rupestres*, especially the portion of the Espinhaço

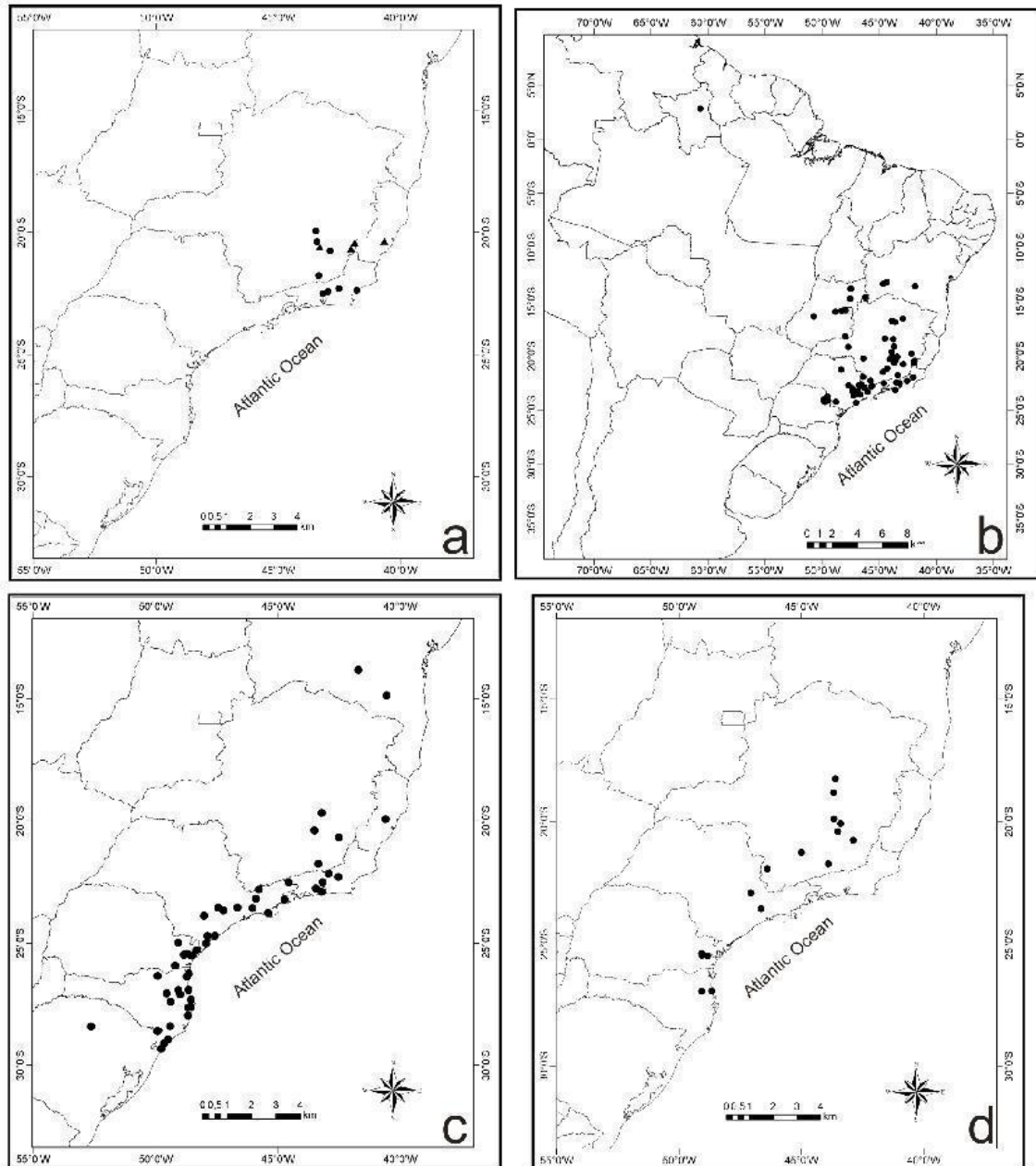


Figure 4. Distribution patterns a. Southeastern Brazil *Bionia bella* (▲) and *Tachigali friburgensis* (●) (Sources: Queiroz 1999, 2008, Silva 2007); b. Brazil-wide distribution *Crotalaria breviflora* (Source: Flores 2004, 2011); c. Atlantic-Northeast-Southeast-Southern Brazil *Abarema langsdorfii* (Source: Barneby & Grimes 1996); d. Atlantic-Northeast-Southeast-Southern Brazil *Inga vulpina* (Source: Garcia 1998).

Figura 4. Padrões de distribuição a. Brasil Sudeste *Bionia bella* (▲) e *Tachigali friburgensis* (●) (Fontes: Queiroz 1999, 2008, Silva 2007); b. Brasil ampla distribuição *Crotalaria breviflora* (Fontes: Flores 2004, 2011); c. Brasil Atlântico-Nordeste-Sudeste-Sul *Abarema langsdorfii* (Fonte: Barneby & Grimes 1996); d. Brasil Atlântico-Nordeste-Sudeste-Sul *Inga vulpina* (Fonte: Garcia 1998).

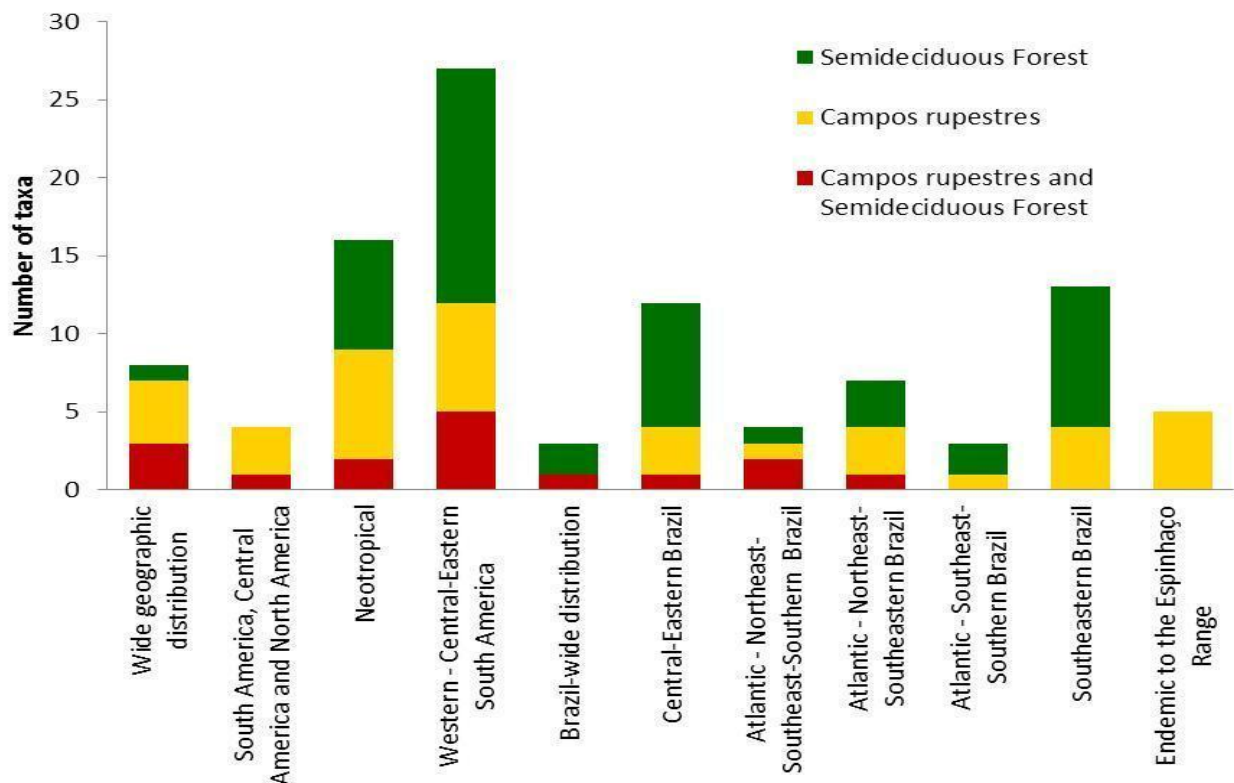
Table 2. Number of specific and infraspecific Leguminosae taxa in the Itacolomi State Park and percentage of geographic distribution patterns.**Tabela 2.** Número de táxons específicos e infra-específicos de Leguminosae do Parque Estadual do Itacolomi e porcentagem dos padrões de distribuição geográfica.

Distribution pattern	Nr. of taxa	% of taxa
Wide geographic distribution	8	7.8
South America, Central America and North America	4	4.0
Neotropical	16	15.7
West, Central and Eastern South America	27	26.5
Restricted to Brazil	47	46.0
Brazil-wide distribution	3	2.9
Central-Eastern Brazil	12	11.6
Atlantic-Northeast-Southeast-Southern Brazil	4	3.8
Atlantic-Northeast-Southeastern Brazil	7	6.8
Atlantic-Southeast-Southern Brazil	3	2.9
Southeastern Brazil	13	12.7
Endemic to the Espinhaço Range	5	4.9

Range in Minas Gerais, which has several endemic species (Irwin & Barneby 1982, Lewis 1987, Giulietti & Pirani 1988, Harley 1988, Dutra et al. 2008a, Rando & Pirani 2011). In this region, some series of the genus had a significant diversification, which may have been caused by periods of climatic fluctuations that occurred in the Quaternary and resulted in the irregularity in the gene flow between populations and in the evolution of new species (Giulietti et al. 1997).

The distribution patterns of Leguminosae taxa in the Park show that its flora consists of floristic elements of both the Atlantic Forest and the *Cerrado*, the two Brazilian

biomes considered hotspots (Mittermeier et al. 2005). The Semideciduous Forests of the PEIT receive the combined contribution of elements from different forest types, especially from those of the Atlantic Forest domain, since the distribution patterns of about 25% of the species were restricted to the Atlantic Forest. The *Campos Rupestres*, however, besides the high number of endemic taxa of the Espinhaço Range, receive the contribution of elements from the *Cerrado* and the Atlantic Forest, due to the presence of Semideciduous Forests that occur in the lower parts of the PEIT, corroborating Santos et al. (2011) that point out the geographical proximity as one of the factors influencing the

**Figure 5.** Correlation between geographic distribution patterns and number of taxa found in vegetation types of the Itacolomi State Park.**Figura 5.** Correlação entre os padrões de distribuição geográfica e o número de espécies encontradas nas fitofisionomias do Parque Estadual do Itacolomi.

phytogeographic patterns in the *Quadrilátero Ferrífero* and also, as proposed by Harley (1995), the sectorization of the Espinhaço Range. Harley (1995) referred the *Campos Rupestres* that are restricted to the higher and isolated areas and have more humid climate, with greater contact with the Semideciduous Forests than the *Cerrado*, to the southern sector of the Range, which comprises the south of Belo Horizonte and the Ouro Preto region.

Despite the presence of species endemic to the Espinhaço, the analysis of distribution patterns of the Leguminosae in the PEIT does not support the distribution patterns typically found in other areas of the Espinhaço Range, in which forest species are predominantly of wide distribution and the herbaceous-shrub species exhibit stricter standards (Giulietti & Pirani 1988) caused by the history of the region, such as migration routes and past climate changes occurred in southeastern Brazil during the Pleistocene, which promoted the isolation of species (Giulietti et al. 1997).

Among the species found in the Park, 15 are of interest for the conservation of PEIT, because five are endemic to the Espinhaço mountain range and ten appear in the lists of endangered species of the flora of Brazil and Minas Gerais (Table 2). In areas of *Campos Rupestres* within the Park, the species *Chamaecrista dentata*, with only two populations, and *Mimosa ourobrancoënsis*, with a single population, are noteworthy. In these forest formations, many species have a very restricted distribution or are rare.

Senna pneumatica and *Ormosia friburgensis* are restricted to the Upper Highland Forests, and *Melanoxylon brauna* occurs in Submontane Forests. So far, only one population of each of these species has been found. *Dalbergia nigra* occurs in Lower Highlands and Submontane Forests with two populations identified. *Bionia bella* grows in Lower Highlands, Submontane and Upper Highland Forests, with scarce populations scattered throughout the forest formations. It is worth mentioning that the occurrence of all these taxa is restricted to the Atlantic Forest domain.

The representatives of the genera *Abarema*, *Bionia*, *Chamaecrista*, *Inga*, and *Mimosa* have ornamental potential, whereas *Dalbergia nigra* and *Melanoxylon brauna* have timber potential. Therefore, these results do not only reinforce the important role of the PEIT in the conservation of the flora in the southern Espinhaço Range, but also highlight the existence of stocks of species threatened by extinction or with potential for sustainable use.

The presence of distinct and heterogeneous floras in vegetational gradients makes the PEIT an area with high biological diversity. Messias & Souza (2006) reported 80 species of Leguminosae for the PEIT. This study shows an increase of 27.5% in the number of species within the park, which demonstrates the importance of research involving knowledge of biodiversity at the local scale.

Despite being a fully protected conservation unit, difficulties of managing the park prevents effective species protection and the vegetation of the PEIT is still subject to different impacts by uncontrolled urban sprawl, frequent fires, invasion of exotic species and firewood extraction (Messias & Souza 2006). Within the park,

it deserves attention, in the areas of *Campo Rupestre*, the trails Calais and the water catchment in Serrinha, home to endemic species of the Espinhaço, and in the Semideciduous Forests, the upper highlands forests, home to most of the forest species of the PEIT that are threatened with extinction.

The findings of this study on the Leguminosae family demonstrate the importance of conserving the vegetation of the Itacolomi Range and the need for studies on other plant families, with a view to the implementation of effective protection policies for the forests and fields of the PEIT.

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