



Nota Científica / Short Communication

Ferns and lycophytes in Brazil's semi-arid region¹

As samambaias e licófitas no semiárido do Brasil

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Abstract

Little knowledge has been gathered on ferns and lycophytes occurring in the semi-arid region of Brazil known as the Caatinga, perhaps due to the widespread idea that a semi-arid climate would be incompatible with environmental demands of ferns and lycophytes (high humidity and shade). Ferns and lycophytes are represented in the semi-arid region of Brazil by at least 41 species, 20 genera and 11 families, distributed in the northeastern states (except Maranhão) and Minas Gerais. In this region, most of the species were recorded in moist, shaded microhabitats: cracks in rocks, ravines in shaded areas, springs, temporary lakes or areas with temporarily flooded soil. Although the majority of species recorded are widely distributed throughout Brazil, the high representation of aquatic species and low representation of epiphytes demonstrate the unique identity of the fern and lycophyte flora of the semi-arid region.

Keywords: Caatinga, pteridophytes, flora, Northeastern Brazil.

Resumo

Pouco se sabe sobre as samambaias e licófitas ocorrentes na Caatinga do Brasil, talvez devido à idéia comumente difundida de que o clima semiárido seja incompatível com as exigências ambientais destas plantas, geralmente associadas a alta umidade e sombreamento. As samambaias e licófitas estão representadas na região semiárida do Brasil por pelo menos 41 espécies, 20 gêneros e 11 famílias, distribuídas nos estados do Nordeste (exceto Maranhão) e Minas Gerais. Na região semiárida do Brasil, a grande maioria das espécies de samambaias e licófitas ocorrem de fato em microhabitats úmidos e sombreados: fendas de rochas, barrancos em áreas sombreadas, nascentes, lagoas temporárias ou áreas com solos temporariamente alagados. Apesar da maioria das espécies registradas serem amplamente distribuídas no Brasil, a alta representatividade de espécies aquáticas e o baixo número de epífitas evidenciam um perfil da flora de samambaias e licófitas do semiárido.

Palavras-chave: Caatinga, pteridófitas, flora, Nordeste do Brasil.

Although ferns and lycophytes may occur in a diversity of habitats, the vast majority are concentrated in tropical rainforests, which offer ideal conditions for the establishment of species, such as high humidity and shade (Page 1979; Tryon & Tryon 1982; Xavier & Barros 2005). These conditions are essential to the lifecycle of these plants, which have free-swimming gametes and external fertilization (Páusas & Sáez 2000).

Little knowledge has been gathered on ferns and lycophytes occurring in the semi-arid region

of Brazil known as Caatinga (Barros *et al.* 1988; Ambrósio & Melo 2001; Prado 2003), perhaps due to the idea that a semi-arid climate would be incompatible with the environmental demands of ferns and lycophytes (high humidity and shade). Thus, the aim of this study is to broaden the list of fern and lycophyte species from the semi-arid region of Brazil and discuss floristic composition.

From the indigenous Tupi-Guarani *Caa* (woods) + *tinga* (white), the current use of the denomination Caatinga is characterized by the

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physiognomic aspect of the vegetation in the dry season, which is characteristically xeromorphic and deciduous, sometimes with cacti and/or bromeliads (Andrade-Lima 1981; Fernandes & Bezerra 1990). Occupying basically northeastern Brazil, with some areas in the northern portion of the state of Minas Gerais (southeastern Brazil) (Leal *et al.* 2003), the phytogeographic province of the Caatinga (*sensu* Cabrera & Willink 1980) encompasses an area of approximately 10% of Brazil (CNRBC 2004), characterized by the savanna biome in Brazil, in conjunction with the Cerrado (Coutinho 2006).

Ferns and lycophytes are represented in the semi-arid region by at least 42 species, 20 genera and 11 families, distributed in the northeastern states (except Maranhão) and Minas Gerais (Tab. 1). The families Pteridaceae and Anemiaceae stood out as the most representative in the semi-arid region, with nine and eight species, respectively. The genus *Anemia* Sw. had the greatest species richness in the semi-arid region (eight), as was reported by Windisch (1990), who states that many species of this genus are characteristic of semi-arid environments, exhibiting a set of xeromorphic characteristics. The genera *Marsilea* L. (four species), *Salvinia* Ség. (three species) and *Azolla* Lam. (three species) also stood out in terms of richness. These genera share the aquatic habitat, such as artificial lakes and temporary ponds. According to Kornás (1985), aquatic or amphibious species are curiously adequate for surviving in semi-arid regions such as the Caatinga and are usually the most numerous and diversified ecological group in such environments. The likely cause of this expressive representation may be related to the adaptation strategies mentioned by Kornás (1985), surviving the dry season as spores inside underground corms in the case of *Isoetes luetzelburgii*, or as sporocarps in the case of Salviniales (*Azolla*, *Salvinia* and *Marsilea*). According to Johnson (1986), among the amphibious plants of the genus *Marsilea*, there is no evidence of the existence of persistent, viable rhizomes in the dry season, and species survive this season in the form of sporocarps.

In the semi-arid region of Brazil, most of the species were recorded in moist, shaded microhabitats: cracks in rocks, ravines in shaded areas, springs, temporary lakes or areas with temporarily flooded soil. Few species tolerate the driest environments of the semi-arid region;

these include *Adiantum deflectens* Mart., *Anemia oblongifolia* (Cav.) Sw., *Doryopteris concolor* (Langsd. & Fisch.) J. Sm., *Pleopeltis polypodioides* (L.) E. B. Andrews & Windham, *Selaginella convoluta* (Arn.) Spring and *Selaginella sellowii* Hieron.. Except for *Adiantum deflectens* (deciduous), the species are poikilohydric, that is, they roll up their leaves in the dry season to potentially protect themselves from potential desiccation.

Cited in a number of studies over the years (Rawitscher *et al.* 1952; Barros *et al.* 1989; Ambrósio & Melo 2001), *Selaginella convoluta* is mentioned as one of the plants best adapted to the semi-arid climate, especially because of its clear poikilohydric seasonal pattern. Regarding this topic, Braga (1960) *apud* Andrade-Lima (1989) states, “During the dry season, the “fronds” coil up and become brittle, resembling a rose of Jericho, which is from where it gets its common name. When receiving even the smallest amount of moisture, they open up and cover the ground like a green carpet.”

Species of epiphytic habitats are rare, with occurrence records only for *Phlebodium decumanum* (Willd.) J. Sm., *Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf., *P. polypodioides* (L.) Andrews & Windham and *Serpocaulon triseriale* (Sw.) A. R. Sm., living preferentially on *Syagrus coronata* (Mart.) Becc., which is a typical palm of the region (Rufino *et al.* 2008).

Based on field observations and labels on voucher specimens, altitude appears to be an important factor for the establishment of many species of the semi-arid region, as there is greater floristic richness beginning at 400 m. Moreover, areas of the semi-arid region that are closer to wetter vegetation pertaining to the Atlantic Forest or Cerrado also appear to be favorable for the establishment of many species, which explains the occurrence and distribution of these taxa in the semi-arid region of Brazil.

The reason why a large part of the species of the semi-arid region of Brazil are widely distributed in other types of vegetation in the country may be associated with the fact that the northeastern region of Brazil is the “end point” of diverse systems of atmospheric currents (Nimer 1972) – the winds that converge in the semi-arid region come from other parts of the country. As the dispersion of spores is generally greater than that of seeds (Smith 1993)

Table 1 — Unified list of ferns and lycophytes of the semi-arid region of northeastern Brazil and the state of Minas Gerais. States: MG- Minas Gerais; BA- Bahia; SE- Sergipe; AL- Alagoas; PE- Pernambuco; PB- Paraíba; RN- Rio Grande do Norte; CE- Ceará; PI- Piauí. *Added to the online list of ferns and lycophytes occurring in the Semi-Arid Region of Brazil, access on 16 Feb. 2011 (Prado & Sylvestre, 2010).

Táxon	States	Source literature	Voucher samples
FERNS			
Anemiaceae			
<i>Anemia dardanoi</i> Brade	BA	Barros <i>et al.</i> (2010)	-
<i>Anemia dentata</i> Gardner ex Field & Gardner *	AL, BA	-	Sarmiento 364 (IPA)
<i>Anemia ferruginea</i> Humb., Bonpl. ex Kunth. *	PE	-	Pontual s.n. (PEUFR)
<i>Anemia hirsuta</i> (L.) Sw.	BA, CE, MG, PE	-	Félix et Dornelas 987 (EAN)
<i>Anemia oblongifolia</i> (Cav.) Sw.	AL, BA, CE, MG, PB, PE, PI, RN	-	Xavier <i>et al.</i> 232 (PEUFR)
<i>Anemia pastinacaria</i> Moritz ex Prantl	PB	-	Luetzelburg 36-27040 (PEUFR)
<i>Anemia rigida</i> Sehnem	BA	Barros <i>et al.</i> (2010)	-
<i>Anemia tomentosa</i> (Sav.) Sw.	BA, PB, PE, PI	-	Xavier <i>et al.</i> 228 (PEUFR)
Blechnaceae			
<i>Blechnum serrulatum</i> Rich. *	AL	-	Xavier <i>et al.</i> 213 (PEUFR)
Gleicheniaceae			
<i>Dicranopteris linearis</i> (Burm. f.) Underw. *	BA, PE	-	Melo s.n. (BHCB)
Marsileaceae			
<i>Marsilea ancylopoda</i> A. Braun *	BA, MG	-	Salino <i>et Stehmann</i> 3348 (BHCB)
<i>Marsilea deflexa</i> A. Braun *	RN, SE	-	Carneiro 680 (ASE)
<i>Marsilea minuta</i> L. *	PE	-	Pontual 80-1700 (PEUFR)
<i>Marsilea polycarpa</i> Hook. & Grev. *	BA, SE	-	Viana 702 (ASE)
Ophioglossaceae			
<i>Ophioglossum nudicaule</i> L. f. *	PB, PI	-	Barbosa <i>et al.</i> 2702 (JPB)
Polypodiaceae			
<i>Phlebodium decumanum</i> (Willd.) J. Sm. *	BA	-	Correia <i>et al.</i> s.n. (HUEFS)
<i>Pleopeltis macrocarpa</i> (Bory ex Willd.) Kaulf. *	BA, SE	-	Xavier <i>et al.</i> 244 (PEUFR)
<i>Pleopeltis polypodioides</i> (L.) Andrews & Windham *	BA, CE, PB, PE, AL	-	Andrade-Lima 71- 6328 (IPA)
<i>Serpocaulon triseriale</i> (Sw.) A.R. Sm.	BA, PE	-	França <i>et al.</i> 1850 (HUEFS)
Pteridaceae			
<i>Acrostichum danaeifolium</i> Langsd. & Fisch. *	BA, PE	-	Xavier <i>et al.</i> 209 (PEUFR)
<i>Adiantum deflectens</i> Mart. *	BA, CE, MG, PB, PE, PI, RN	-	Júnior <i>et al.</i> 01 (ALCB)
<i>Adiantum delicatulum</i> Mart.	PI, BA	Prado (2010)	-
<i>Cheilanthes eriophora</i> (Fée) Mett. *	BA, PE, PI	-	Thomas <i>et al.</i> s.n. (CEPEC)

Táxon	States	Source literature	Voucher samples
<i>Doryopteris concolor</i> (Langsd. & Fisch.) J. Sm. *	AL, BA, CE, PB, PE, PI, RN, SE	-	Xavier et Melo 208 (PEUFR)
<i>Doryopteris ornithopus</i> (Hook. & Baker) J. Sm. *	BA, PE	-	Andrade-Lima 75-8056 (IPA)
<i>Hemionitis tomentosa</i> (Lam.) Raddi *	AL, BA, MG, PE, PI, SE	-	Lyra-Lemos et Prado 3736 (MAC)
<i>Pityrogramma calomelanos</i> (L.) Link *	BA, MG, PE, PI	-	Salino 3031 (BHCB)
<i>Trachypteris gilliana</i> (Baker) Svenson	BA, MG, PE	-	Harley et Giullietti 54749 (HUEFS)
Salviniaceae			
<i>Azolla caroliniana</i> Willd.	BA, MG, PB, PE	-	Sousa 2311 (JPB)
<i>Azolla filiculoides</i> Lam.	BA, PB, PE	-	Xavier 221 (PEUFR)
<i>Azolla microphylla</i> Kaulf.	PE, SE	-	Souza s.n. (ASE)
<i>Salvinia auriculata</i> Aubl. *	BA, CE, MG, PB, PE, RN, SE	-	Xavier <i>et al.</i> 231 (PEUFR)
<i>Salvinia minima</i> Baker *	BA	-	França <i>et al.</i> 2372 (HUEFS)
<i>Salvinia oblongifolia</i> Mart.	BA, MG, PE, SE	-	Pontual 78-1685 (PEUFR)
Thelypteridaceae			
<i>Thelypteris interrupta</i> (Willd.) K. Iwats. *	BA, CE, MG, PE	-	Fernandes et Nunes 8867 (UFP)
<i>Thelypteris opposita</i> (Vahl) Ching	MG	Salino & Almeida (2010)	-
LYCOPHYTES			
Isoetaceae			
<i>Isoetes luetzelburgii</i> U.Weber in Luetzelb. *	PE, PB	-	Araújo 148 (IPA)
Selaginellaceae			
<i>Selaginella convoluta</i> (Arn.) Spring	AL, BA, CE, MG, PB, PE, PI, RN, SE	-	Bauptista 737 (HRB)
<i>Selaginella erythropus</i> (Mart.) Spring	CE, PI, RN	-	Oliveira <i>et al.</i> 1144 (MOSS)
<i>Selaginella sellowii</i> Hieron.	BA, PE	-	Sotero et Novacosque 01 (PEUFR)
<i>Selaginella simplex</i> Baker	CE, PE	Hirai (2010)	-

and the direction of spore dispersal is closely related to systems of atmospheric currents, it is not difficult to suppose that much of the fern and lycophyte flora of the semi-arid region comes from the Amazon Forest, Cerrado and, especially, the Atlantic Rainforest, which is considered to be one of the largest centers of diversity, speciation and endemism in the Neotropical region (Tryon 1972), with numerous projections into the natural semi-arid region.

The fern and lycophyte flora of the semi-arid region of Brazil has certain particularities, such

as the expressive richness of the genus *Anemia*, as well as high representation of aquatic species and heterosporate species, survival strategies in some species (poikilohydric and deciduous seasonal patterns and therophytic life form) and low representation of epiphytes. Together, these characteristics reveal the unique identity of the fern and lycophyte flora of the semi-arid region.

Some ferns named on the online list of the flora of Brazil (Tab. 1) merit a more detailed analysis with regard to their actual occurrence in the semi-arid region of northeastern Brazil.

Based on a significant sampling effort and a survey carried out of all herbaria representative of northeastern Brazil and the state of Minas Gerais (Xavier 2007), a need was identified for a revision of the occurrence of certain species in the domains of the semi-arid region, such as *Asplenium pumilum* Sw., *Blechnum occidentale* L., *Blechnum polypodioides* Raddi, *Cochlidium pumilum* C. Chr., *C. serrulatum* (Sw.) L. E. Bishop and *Ctenitis ampla* (Willd.) Ching. These species have also been found in surveys carried out in the field and at herbaria, but were discarded from the present study because they were invariably located in disjunct areas of evergreen tropical forest inserted in the domains of the semi-arid region. These areas are known as areas of exception (Lins 1989; Rodrigues *et al.* 2008) and they occur characteristically at altitudes above 600 m, with cooler temperatures and perennial access to water at many sites. *Anemia mirabilis* Brade should also be highlighted; this species is included on the online list of species of Brazilian flora (Barros *et al.* 2010), and is being updated as *Anemia dentata* Gardner in the present study.

Thus, the present study adds 22 species of ferns and lycophytes and updates the name of one species on the list of plants of the semi-arid region, totaling 47 species. On the other hand, with the removal of ferns interpreted in the present study as not occurring in this region, the total number of species of the semi-arid region of northeastern Brazil currently encompasses 41 species.

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