



Reestablishing *Dicranopteris spissa* (Gleicheniaceae, Polypodiopsida) from synonymy, an endemic species from Brazil

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Abstract

We recognized *Dicranopteris spissa* (Fée) L.V.Lima & Salino *comb. nov.* as a segregate species distinct from *Dicranopteris rufinervis* and other gleichenioid ferns occurring in Brazil. This study provides taxonomic background, descriptions, images, maps, and comments regarding the morphology, ecology, and distribution of *D. spissa*, as well as an identification key for all Brazilian species of *Dicranopteris*.

Key words: Espinhaço range, Serra do Mar, ferns, Flora of Brazil, Gleicheniales

Introduction

Dicranopteris Bernhardt (1805: 38) is a terrestrial fern genus belonging to the leptosporangiate fern family Gleicheniaceae (PPG I 2016). Five species out of the ca. 20 currently recognized species occur in the Neotropics (Lima & Salino 2018). Current taxonomic research focusing on this genus must resolve two key questions. Firstly, monophyly of the genus has not been confirmed due to the lack of comprehensive phylogenetic studies (PPG I 2016, Li *et al.* 2010). However, the currently employed morphological diagnostic characters enable unambiguous identification of the genus by rhizomes and laminar buds covered exclusively by hairs, by having a pair of opposite branches at the main ramifications, and tetrahedral spores with trilete aperture (Mickel & Smith 2004, Lima & Salino 2018). The next question to be addressed is delimitation of all species. The taxonomy of this genus is very intricate, mostly due to several cases of morphological convergence, species with high morphological plasticity, and putative semi-cryptic species. For example, Holttum (1957) recognized nine varieties for the widespread paleotropical *D. linearis* (Burm. f.) Underwood (1907: 250).

Usually, *Dicranopteris* species, like *D. flexuosa* (Schrad.) Underwood (1907: 254) and *D. dichotoma* (Thunb.) Bernhardt (1805: 38), are widely distributed and often occupy anthropogenic habitats. However, other species have more restricted distribution, such as *D. nervosa* (Kaulf.) Maxon (1922: 49), which occurs in forest edges at high elevations in southern and southeastern Brazil, Bolivia, and Peru (Tryon & Stolze 1989, Kessler & Smith 2018, Lima & Salino 2018). Similarly, *Dicranopteris rufinervis* (Mart.) Ching (1940: 275) occurs in the highlands of the Cerrado and Atlantic Forest open formations, like Campos Rupestres and Campos de Altitude. These are restricted and endangered habitats containing many endemic taxa. Therefore, it is paramount to improve species delimitation as a prerequisite to manage the conservation of putatively threatened species, the basic units for conservation acts (Rojas 1992).

Due to highly improved sampling and a reinterpretation of type materials, we have evidence that supports the separation of *Dicranopteris spissa* from *D. rufinervis*. Therefore, we provide descriptions, images, maps, and comments regarding the morphology, ecology, and distribution of *D. spissa*, to clarify the distinctiveness of this taxon from other species of the genus in Brazil.

Materials & Methods

We studied specimens of all species of *Dicranopteris* mentioned below, including type materials from the following herbaria: B, BHCN, BM, K, P, and RB (acronyms according to Thiers 2021). Descriptive terms used follow Lellinger (2002) with the exception of the terminology applied to describe the complex leaves of Gleicheniaceae, to which the definition of Andersen & Øllgaard (1996) was applied with modifications as used in Lima & Salino (2018). The distribution map was generated using ArcGIS (ESRI 2011) based on voucher specimens with reliable location information. The IUCN Red List Status was evaluated using the algorithms implemented in Geocat (<http://geocat.kew.org/>, Bachman et al 2011) to access the conservation status of *D. spissa* and *D. rufinervis*.

Taxonomic treatment

Dicranopteris spissa (Fée) L.V.Lima & Salino, *comb. nov.* (Figure 1–2)

Mertensia spissa Fée (1869: 200). Type:—BRAZIL. Rio de Janeiro. Nova Friburgo. Macaé de Cima. *Glaziou 2468* (lectotype designated by Lima & Salino 2018, P [P00633241] photo!, isoelectotypes P [P00633243], [P00623242] photos!).

Plants terrestrial or epipetric. **Rhizomes** 1.5–5.20 mm thick, with reddish-brown rigid simple or branched hairs, glabrescent to tomentose. **Fronde** scrambling, 2–4(6)-forked; **ultimate branches** 12.5–30.5 cm × 2.8–5.5 cm, lanceolate, apex pinnatifid, base asymmetric, inner side with reduced segments, external side with conform segments; **ultimate segments** linear 3–16 cm × 2–2.5 cm, margins revolute; abaxial surface green or pruinose; pubescent, rarely glabrescent, with reddish, rarely whitish, multicellular hairs, on the segments midrib, bacilliform glandular hairs on the midrib, secondary veins and laminar tissue. **Buds** covered by reddish multicellular hairs; pseudostipule present, accessory branches simple to pinnatisect. **Veins** 3–4-forked. **Sori** median, with paraphyses, spores tetrahedral.

Distribution and habitat:—*Dicranopteris spissa* is endemic to southeastern Brazil, occurring usually on edges of high montane forests of the south part of the Espinhaço Range, and Serra de Ibitipoca in Minas Gerais state as well as in the Serra do Mar in the states of Rio de Janeiro and São Paulo, between 900 – 1800 m (Fig. 2). In contrast, *D. rufinervis* has a distribution restricted to the mountains of the Espinhaço range in the north of Minas Gerais and Bahia, between 600 – 1500 m.

Notes:—*Dicranopteris spissa* is morphologically related to *D. rufinervis* and it is mainly differentiated from that species by the following characters. Accessions of *D. spissa* have sparse pale-yellow to reddish hairs occurring only at the base of the segment on midrib (Fig. 1 D-G) versus red hairs densely spread through the segment's midrib in *D. rufinervis* (Fig. 3 C-E). Secondary veins usually are deeply immersed at the laminar tissue with bacilliform glandular hairs versus secondary veins usually not sunk in the laminar tissue, usually with sparse red hairs in *D. rufinervis*. Finally, the rachis is glabrescent in *D. spissa* but pubescent in *D. rufinervis*.

Conservation status:—*Dicranopteris spissa* and *D. rufinervis* are endemic to Brazil. Both species were categorized as endangered species according to IUCN Red List criteria. However, the records of the two species may be subsampled due to their resemblance with *D. flexuosa*, the most widely distributed species of the genus in Brazil. In contrast to the later, these two species do not occur in anthropogenic habitats and thus they are more sensible to environmental change. They occur in highland formations, usually near rock outcrops or in forest edges.

Specimens examined:—BRAZIL. Minas Gerais: Lima Duarte, Parque Estadual de Ibitipoca, 21°42'33"S 43°53'38"W, 1300m, 7 February 2017, *Lima et al. 213* (BHCN, CESJ); Lima Duarte, Parque Estadual de Ibitipoca, 21°40'18"S 43°52'22"W, 1484m, 22 June 2007, *Almeida et al. 1221* (BHCN); Catas Altas, Parque Natural do Caraça, 20°06'31"S 43°27'31"W, 1800m, 19 May 2001, *Salino et al. 6835* (BHCN); Catas Altas, Parque Natural do Caraça, 20°05'44"S 43°29'03"W, 1349m, 13 October 2016, *Lima 199* (BHCN); Catas Altas, Parque Natural do Caraça, 20°05'44"S 43°29'03"W, 1349m, *Lima 200* (BHCN); Catas Altas, Parque Natural do Caraça, 07 October 2000, *Salino 5755* (BHCN); São Gonçalo do Rio Preto, Parque Estadual do Rio Preto, 18°12'53"S 43°20'06"W, 1600-1700m, 07 August 2003, *Salino et al. 9350* (BHCN); São Gonçalo do Rio Preto, Parque Estadual do Rio Preto, 19 October 2000, *Salino 5801* (BHCN); Itamarandiba, Parque Estadual da Serra Negra, 18°00'55"S 42°45'14"W, 1570-1600m, 04 July 2006, *Salino et al. 10899* (BHCN); Felício dos Santos, 18°12'37"S 43°17'05"W, 1150-1350m, 31 October 2004, *Salino et al. 90406* (BHCN); Santo Antônio do Itambé, Parque Estadual do Pico do Itambé, 18°24'05"S 43°18'57"W, 1357m, 07 October 2006, *Almeida et al. 596* (BHCN). Rio de Janeiro: Nova Friburgo, Macaé de Cima, *Glaziou 4456* (RB);

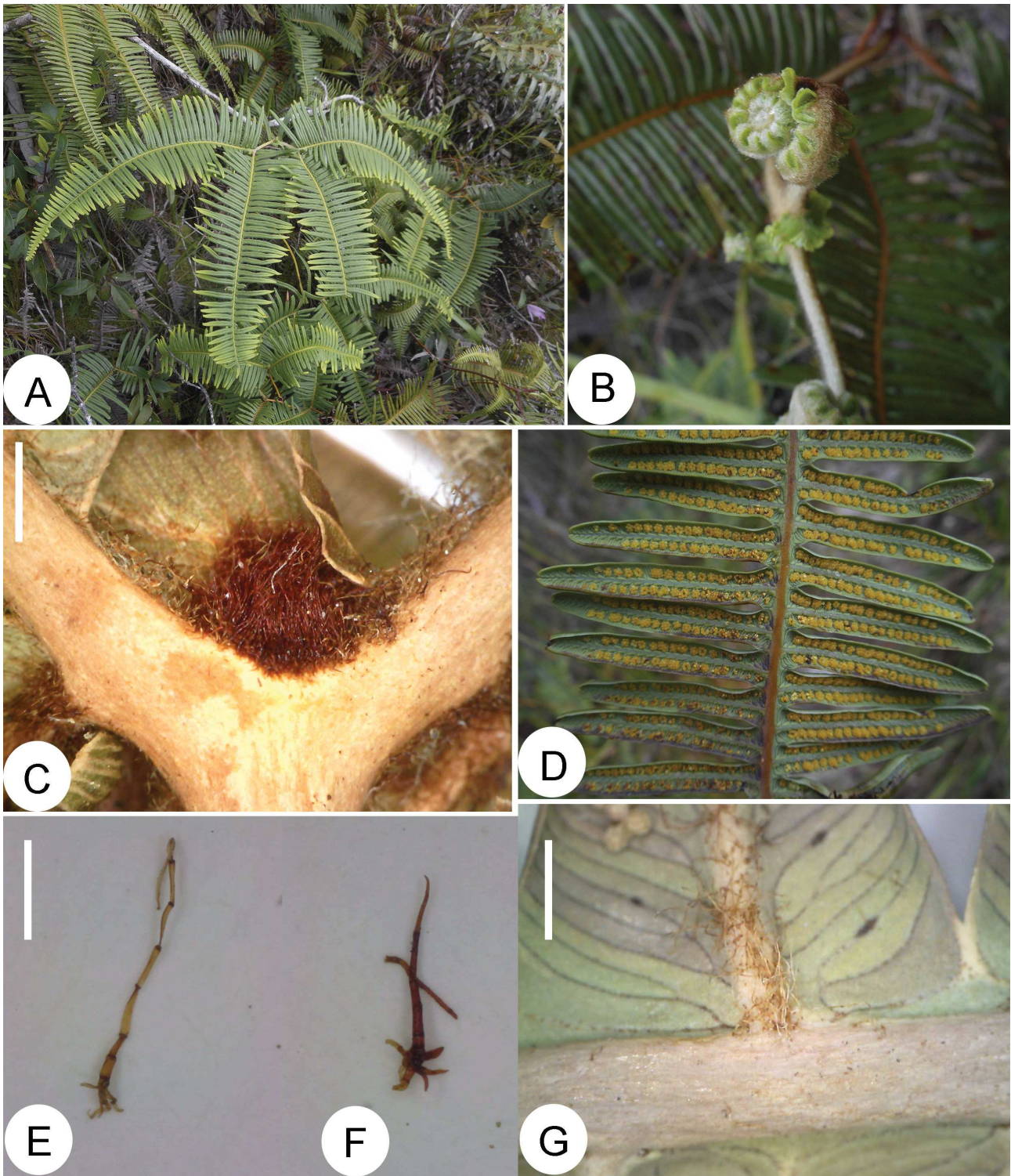


FIGURE 1. *Dicranopteris spissa* (Lima et al. 213). **A.** Habit. **B.** Fiddlehead. **C.** Detail of the main bifurcation showing the dormant bud covered with hairs. **D.** Abaxial surface showing the sori. **E.** Bud hair. **F.** Rhizome hair. **G.** Detail of a segment midrib. Scale bar: C and G = 1mm, E= 0.2 mm.

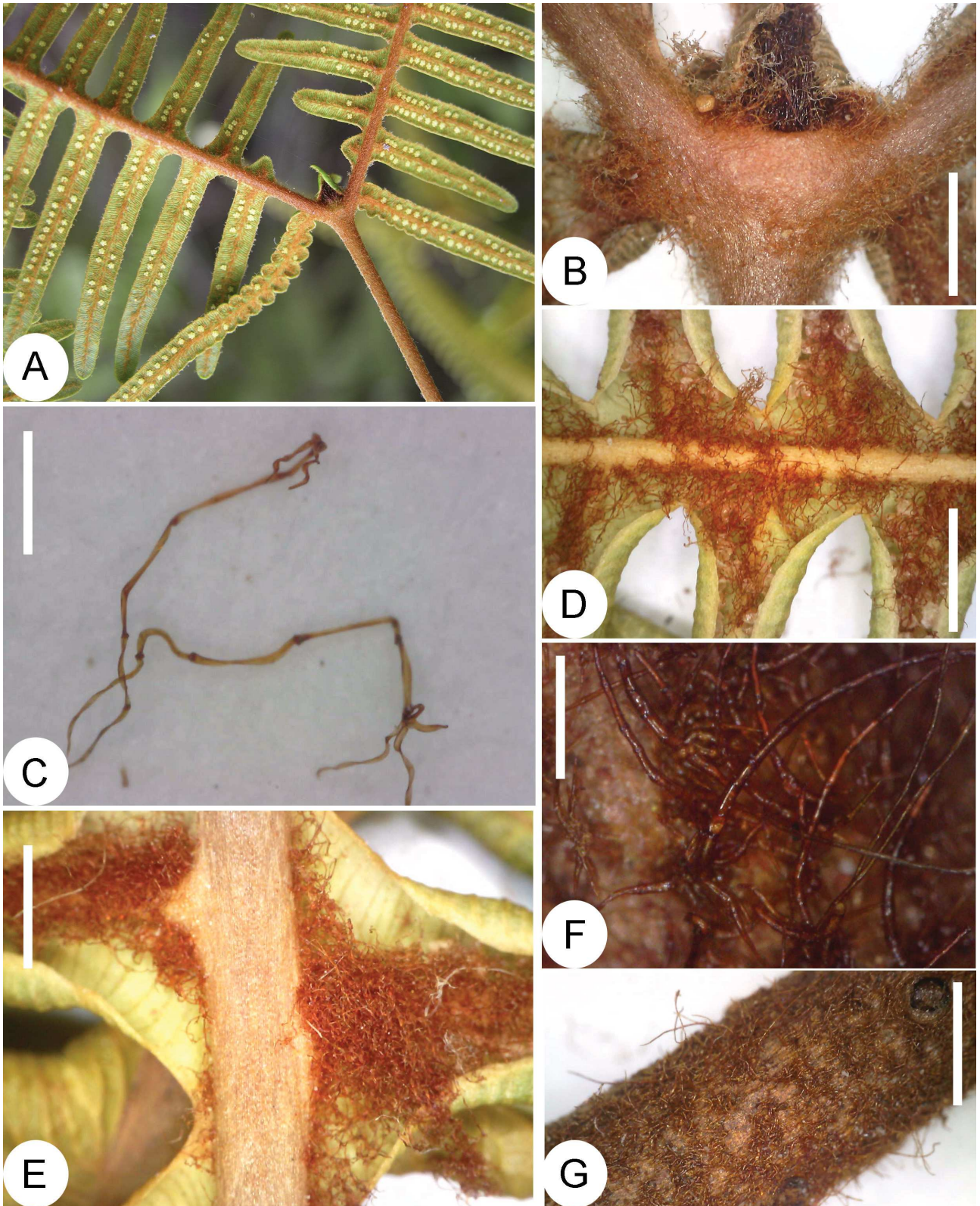


FIGURE 2. *Dicranopteris rufinervis* (Salino 16256). **A.** Abaxial surface. **B.** Detail of the main bifurcation showing the dormant bud covered with hairs. **C.** Bud hairs. **D–E.** Detail of the abaxial surface showing the indument. **F.** Detail of a rhizome hair. **G.** Rhizome. Scale bar: B, D, E and G = 1mm, C and F = 0.2 mm.

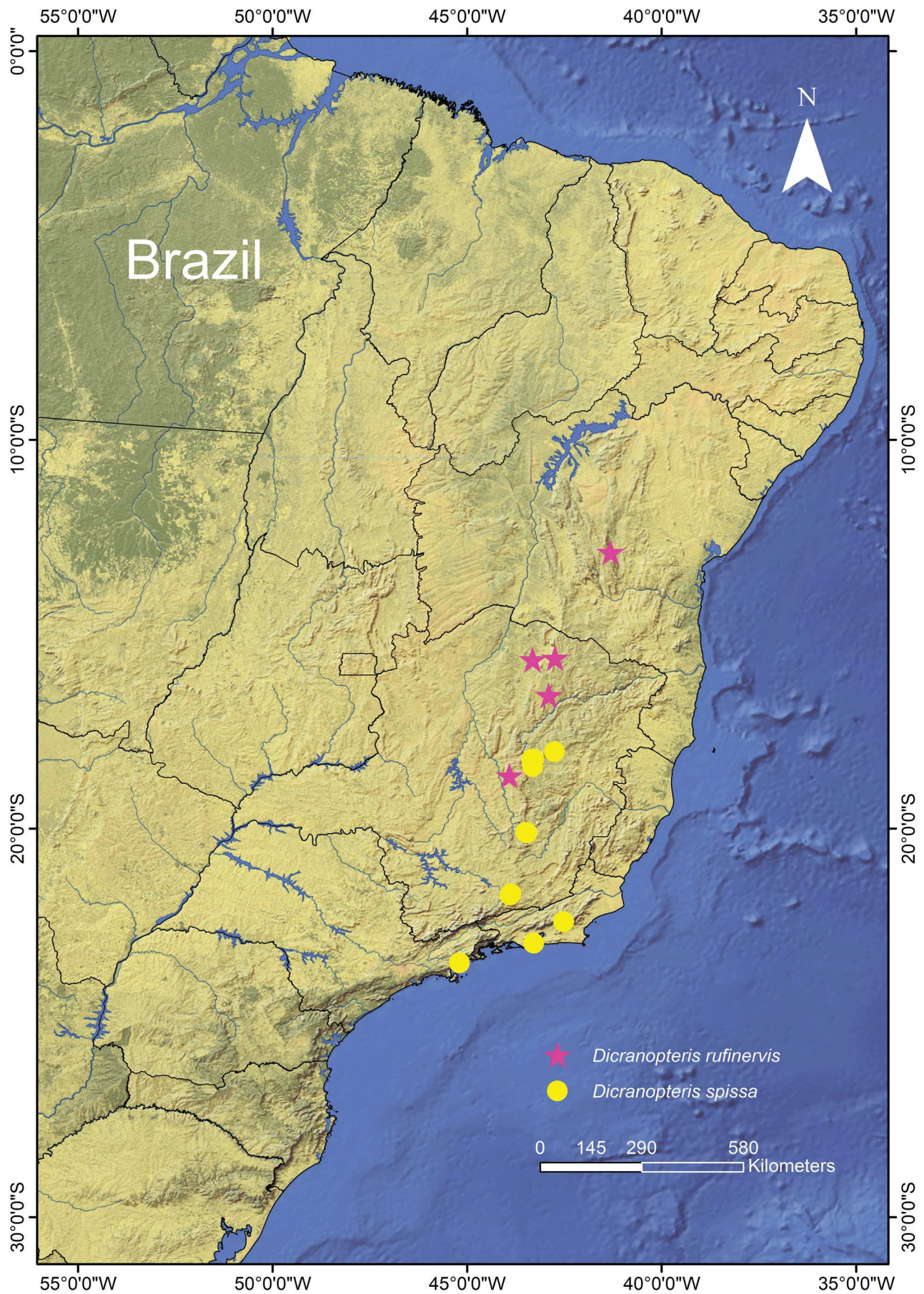


FIGURE 3. Map showing the distribution of *Dicranopteris spissa* and *Dicranopteris rufinervis*, endemic species of Brazil.

Rio de Janeiro, Parque Nacional da Tijuca, Pico da Tijuca, 14 June 1933, *Brade 12555* (RB); Santa Maria Madalena, Serra da Forquilha, 4 February 1935, *Brade 14354* (RB); . São Paulo: Natividade da Serra, Parque Estadual da Serra do Mar, núcleo Santa Virgínia, 23°26'56"S 45°11'35"W, 900-1150m, 01 November 2001, *Salino et al. 7830* (BHCB); Ubatuba, Parque Estadual da Serra do Mar, Núcleo de Picinguaba, Trilha do Pico do Cuscuzeiro, próximo ao marco da divisa entre Rio de Janeiro e São Paulo, 23°21'33.7"S, 44°50'53.0"W, 07 August 2001, *Salino et al. 7317* (BHCB).

Key to the Brazilian species of *Dicranopteris*

1. Laminae glabrous abaxially, only with unicellular globose glandular hairs *D. flexuosa*
- Laminae pubescent abaxially, with multicellular hairs or, when present, unicellular bacilliform glandular hairs on secondary veins 2
2. Plants erect; fronds forked once (rarely twice); ultimate branches with caudate apex; accessory branches entire to slightly lobed at the base, dissimilar to the ultimate branches *D. nervosa*
- Plants scrambling; fronds forked two to several times; ultimate branches with pinnatifid apex; accessory branches pinnatisect, similar to the ultimate branches 3
3. Segments patent to strongly retroflex (northern Brazil, Guiana Shield) ... *Dicranopteris seminuda* (Klotzsch) Maxon (1933: 140)
- Segments ascendant, occasionally almost patent (southeast and northeast Brazil) 4
4. Segments with hairs restrict to the midrib base; secondary veins glabrous or with bacilliform glandular hairs *D. spissa*
- Segments with hairs all through the midrib; secondary veins with hairs *D. rufinervis*

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