



## Original Paper

# Ferns and lycophytes of the Cerrado State Park, Paraná, Brazil

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### Abstract

We present a checklist of the ferns and lycophytes from the Cerrado State Park, Jaguariaíva, Paraná, Brazil. This region represents the southernmost limit of Cerrado vegetation in Brazil. The park is located along the Devonian Escarpment, one of the most iconic geological formations in southern Brazil. The remnants of Cerrado in Paraná are relics of a colder and drier climate that occurred during the Last Glacial Maximum, about 5,600 years ago. They are now surrounded by natural grasslands and Araucaria Forest, which is typical of southern Brazil. We recorded 112 species (102 ferns and ten lycophytes), from 51 genera and 16 families. Ten species were first recorded in the Devonian Escarpment, and *Ctenitis bigarellae* and *Tryonia areniticola* are rare. None of the species are endemic to the Cerrado and most are typical of the humid forests of Eastern Brazil. We provide notes and illustrations for all species.

**Key words:** biodiversity, Brazilian savannah, Devonian Escarpment, pteridophytes, taxonomy.

### Resumo

Apresentamos uma lista de samambaias e licófitas do Parque Estadual do Cerrado, Jaguariaíva, Paraná, Brasil. Esta região representa o limite sul do Cerrado no Brasil. O parque está localizado na Escarpa Devoniana, uma das formações geológicas mais típicas do sul do Brasil. Estes remanescentes de Cerrado são relictos de um clima frio e seco durante o último glacial máximo, cerca de 5.600 anos atrás. Agora são cercados por campos naturais e a típica Floresta com *Araucaria* do Sul do Brasil. Registramos 112 espécies (102 samambaias e dez licófitas) em 51 gêneros e 16 famílias. Dez espécies foram registradas pela primeira vez na Escarpa Devoniana, *Ctenitis bigarellae* e *Tryonia areniticola* são espécies raras. Nenhuma das espécies é endêmica dos Cerrados, e a maioria é encontrada em florestas úmidas da costa leste do Brasil. Apresentamos comentários e ilustrações para todas as espécies.

**Palavras-chave:** biodiversidade, Escarpa Devoniana, pteridófitas, savana brasileira, taxonomia.

## Introduction

Paraná state, southern Brazil, is composed of a mosaic of forests and grasslands that includes the Atlantic Rain Forest, natural grasslands, and remnants of the Cerrado (Brazilian savannah) (Maack 1948). This mosaic is the result of not only differences in soil types and climate, but also rich and complex climatic variations during glacial and interglacial periods in the Holocene (Behling 1997).

During the Last Glacial Maximum, the temperature and precipitation rates were much lower than today, favoring an herbaceous flora and inducing the migration of tropical forest, and most of its arboreal species, towards equatorial regions (Behling 2002). As climatic conditions began to change during the interglacial period, as seen today, tropical elements migrated back south, expanding tropical forests into areas that were then covered by natural grasslands (Behling

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& Negrelle 2001; Behling 2002). Therefore, the occurrence of Cerrado in Paraná can be considered as relics of this drier ancient climate, which is currently represented by small fragments in the northern region of the state (Maack 1947). One of these remnants is protected as a reserve, called the Cerrado State Park (CSP), in the municipality of Jaguariaíva (IAP 2004).

Besides representing an important relic of the Cerrado in Paraná, the CSP is also located in one of the most important geological formations in southern Brazil, known locally as the Devonian Escarpment (Maack 1947; IAP 2004). As the name suggests, this geological formation originated during the Devonian period, when parts of Paraná were submerged (Maack 1948). This region is composed mainly of sedimentary rocks that, for millions of years, have been eroded by wind and water creating a unique geography of canyons and deep valleys (Bigarella & Salamuni 1967; Bodziak & Maack 2001; Souza & Souza 2002). Because of its geological origin, the Devonian Escarpment is a key center for the diversification of many plants, some of which are endemic (Labiak 2014).

Previous studies have recorded over 150 species of ferns and lycophytes in the Devonian Escarpment. For instance, Schwartzburd & Labiak (2007) recorded 152 species in the Vila Velha State Park in Ponta Grossa, two of which were newly described: *Ctenitis bigarellae* Schwartzb. *et al.* and *Tryonia areniticola* Schwartzb. & Labiak. Furthermore, Michelin & Labiak (2013) recorded 164 species in the Guartelá State Park, in Tibagi, and Michelin *et al.* (2018) recorded 129 species in the municipality of Carambeí, both in Paraná. However, these studies are restricted to only three specific locations along the Devonian Escarpment, and it is likely that other species occur throughout this formation.

As for the CSP, botanical studies have concentrated on flowering plants (Uhlmann *et al.* 1998; Von Linsingen *et al.* 2006; Ritter *et al.* 2010), and no information is available on the diversity of ferns and lycophytes. Our main goal is to present a floristic survey of the ferns and lycophytes that occur within the CSP, and provide taxonomic and ecological comments, as well as illustrations of all species.

## Material and Methods

The Cerrado State Park (CSP) is located in the northeast portion of Paraná state and occupies an area of 420.4 hectares in the municipality of

Jaguariaíva (24°15'04"S, 49°42'21"W; Fig. 1) (IAP 2004). It is part of the Devonian Escarpment geological formation formed by deposits during the Paleozoic period (Maack 1948), with a generally flat relief mixed with steep slopes carved by river erosion. Elevation in the park ranges from 750 to 900 meters above sea level (Uhlmann 1995), and average temperatures vary from 21.2 °C to 24.3 °C in the summer, and 13.3 °C to 16.6 °C in the winter. Annual average precipitation is about 1,400 mm, with approximately 86 rainy days per year (Maack 2017; Águas Paraná 2018).

The soils are usually low fertility, with a dark red dystrophic latosol in the flatter and upper elevations, and red-yellow dystrophic latosol in the valleys (Uhlmann *et al.* 1997). Along the Jaguariaíva and Santo Antônio Rivers, hydromorphic and semi-hydromorphic soils also occur, as well as litoric soils and rocky outcrops (Uhlmann *et al.* 1997). The geomorphology includes rocks of the Paraná group (Ponta Grossa and Furnas formations) and Itararé group (Mineropar 2001). Mostly near to the rivers, the rocky outcrops form waterfalls, canyons, caves, and crevices (Fig. 2a-f), (IAP 2004).

The main vegetation type is Cerrado (Fig. 3a-f), with both its forested and grassland subdivisions (Uhlmann 1995). Surrounding the Cerrado there are also many fragments of Araucaria Forest, and many of the species from this forest biome contribute to the diversity in the CSP (Uhlmann *et al.* 1998).

Samples were collected between 2017 and 2019. Specimens were prepared according to standard procedures for vascular plants and were deposited at the UPCB Herbarium. Specimens were identified in the laboratory through specific literature, and comparison with herbarium specimens. Some genera were sent to experts of each group for verification (see Acknowledgments). Historical collections in the UPCB and MBM Herbarium were examined, and added to list. Voucher informations: MN - M.G. Nunes; PL - P.H. Labiak; PS - P.B. Schwartzburd; EL - E.D. Lozano; AG - A.L. Gasper. The classification follows PPG I (2016).

The geographic distribution for species to Brazil was prepared using the BFG (2018), and for outside of Brazil, we used general flora and taxonomic revisions. Species were identified as under threat of extinction following the "Centro Nacional de Conservação da Flora" (CNCFlora <<http://cncflora.jbrj.gov.br>>).

Mapping was conducted using the Quantum GIS software, version 3.2.0 (QGIS Development Team 2013), and cartographic bases were obtained from IBGE (2017).

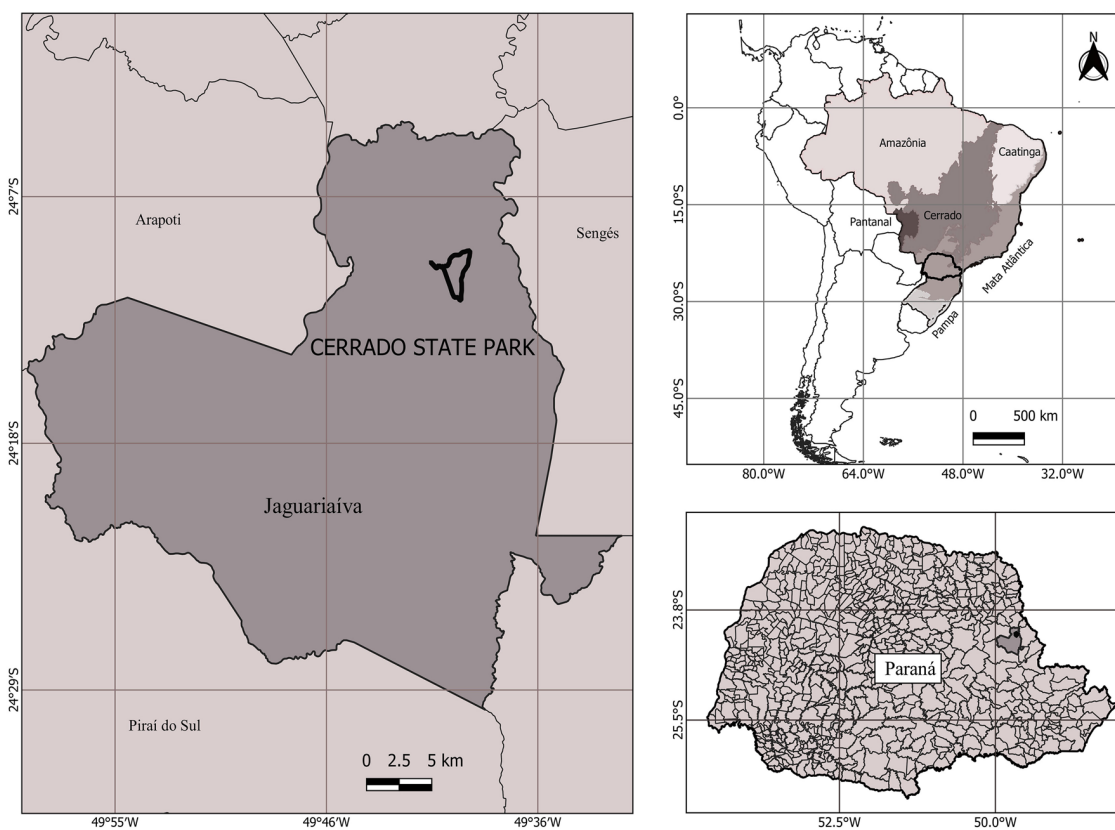
### Results and Discussion

We recorded 112 species for the CSP, representing 51 genera and 16 families of ferns and lycophytes. Of these, 102 are ferns and ten are lycophytes. The most representative families are Polypodiaceae with 17 species, followed by Pteridaceae (15 spp.), and Dryopteridaceae and Hymenophyllaceae (11 spp. each). The most representative genera are *Amauropelta*, *Asplenium*, and *Elaphoglossum* (6 spp.), *Blechnum* and *Pecluma* (5 spp. each), followed by *Cyathea*, *Doryopteris*, *Lindsaea*, *Hymenophyllum*, *Selaginella*, *Serpocaulon*, and *Trichomanes* (4 spp. each).

The number of species is relatively low when compared to other parks along the Devonian Escarpment. For instance, Michelon & Labiak (2013) recorded 164 species from Guartelá over

an area of 798.97 ha, Schwartzburd & Labiak (2007) identified 152 species from Vilha Velha over an area of 3,803.28 ha, and Michelon *et al.* (2018) recorded 129 species over an area of 64,967.9 ha. Although the CSP has a smaller number of species, it represents a significant portion of the species found in the Devonian Escarpment (75%), especially when we consider the small size of this reserve. Furthermore, 10 species were identified that were recorded for the first time in studies on the Devonian Escarpment: *Amauropelta neglecta*, *Amauropelta regnelliana*, *Cheiroglossa palmata*, *Diplazium lindbergii*, *Elaphoglossum glabellum*, *Hymenophyllum microcarpum*, *Polyphlebium hymenophylloides*, *Serpocaulon laetum*, *Serpocaulon fraxinifolium*, and *Trichomanes cristatum*. (Schwartzburd & Labiak 2007; Michelon & Labiak 2013; Michelon *et al.* 2018).

Most of the species found in the CSP are distributed across the Neotropics (72 species, 64%), but 17 species (15%) are endemic to Brazil, and two species (2%) are rare and associated with the



**Figure 1** – Location of the Cerrado State Park, Paraná, Brazil.





**Figure 2** – a-f. Main landscapes in the Cerrado State Park – a. canyon of the Jaguariáiva River; b. bedrocks along the Jaguariáiva River; c. waterfall of the Santo Antônio River; d. sandstone crevices; e. cavern; f. trail.





**Figure 3** – a-f. Types of vegetation in the Cerrado State Park – a. cerrado; b. natural grasslands; c. *Araucaria* forest; d. hydromorphic soils with natural grasslands; e. rocky outcrops; f. riparian forest.



sandstone formations of the Devonian Escarpment (*Ctenitis bigarellae* and *Tryonia areniticola*) (Schwartzburd & Labiak 2008; Schwartzburd *et al.* 2007). Eleven species are pantropical, and *Deparia petersenii*, *Macrothelypteris torresiana*, and *Pteris vitatta* are considered invasive in the Neotropics.

In terms of life forms, 47% of the species are terrestrial, 24% epiphytic, 11% epipetric, 1% scandent, and about 17% of the species can be considered as generalists. Among the epiphytes, Polypodiaceae (12 spp.) and Hymenophyllaceae (7 spp.) were the most diverse families, and among the terrestrial, Pteridaceae (10 spp.) and Thelypteridaceae (8 spp.) were the most diverse.

Although Cerrado vegetation covers the majority of the Park's area, most species were found in shaded and humid areas of Araucaria Forest fragments and river valleys. For instance, 31% of the species were recorded in Araucaria Forest, 20% in river valleys, 19% in natural grasslands and rock outcrops, 26% in sandstone formations, and only 5% in the Cerrado *s.s.* We attribute these differences to the preference of ferns for humid and shady places, which favor the establishment of gametophytes and, subsequently, sporophytes.

Synopsis of the species of ferns and lycophytes in the Cerrado State Park, Paraná, Brazil

#### **Anemiaceae**

*Anemia ferruginea* Humb. & Bonpl. *ex* Kunth var. *ferruginea*. Fig. 4a-b

Terrestrial, in sandy soils along trails. *Anemia ferruginea* var. *ferruginea* is similar to *Anemia raddiana* Link. In *A. raddiana* the fertile and sterile pinnae are remote and hairs of the rhizome are brown, whereas in *A. ferruginea* var. *ferruginea* the fertile and sterile pinnae are proximate and the rhizome hairs vary from brown to red (Mickel 2016).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 188.

*Anemia phyllitidis* (L.) Sw. Fig. 4c-d

Terrestrial, common in disturbed grasslands and along trail edges. It is easily recognized by its 1-pinnate laminae and anastomosing veins. In Brazil, *Anemia lancea* H. Christ. is the most similar species but differs from *A. phyllitidis* due to its free veins (Mickel 2016).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 155.

#### **Aspleniaceae**

*Asplenium abscissum* Willd. Fig. 4e-f

Epipetric, on rocks at the edge of streams, in remnants of Araucaria Forest. It is very similar to *Asplenium inaequilaterale* Willd. but differs in the margin of the pinnae, which are cuneate in *A. abscissum* and crenate in *A. inaequilaterale*.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 362.

*Asplenium clausenii* Hieron. Fig. 4g-h

Terrestrial or epipetric, found in Araucaria and riparian forests along the Jaguaiaíva River and sandstone formations. It is similar to *Asplenium sellowianum* (Hieron.) Hieron., in which the apex of the laminae is proliferous, but non-proliferous and attenuated-caudate in *A. clausenii* (Sylvestre 2001).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 300.

*Asplenium incurvatum* Fée. Fig. 4i-j

This species was found near to sandstone formations on soil with humus. It appears more robust than other species of the genus and is recognized by its pendent fronds. It is similar to *Asplenium serra* Langsd & Fisch and *Asplenium campos-portoi* Brade, but both species differ due to the symmetric base of the pinnae (asymmetric in *A. incurvatum*) (Sylvestre 2001).

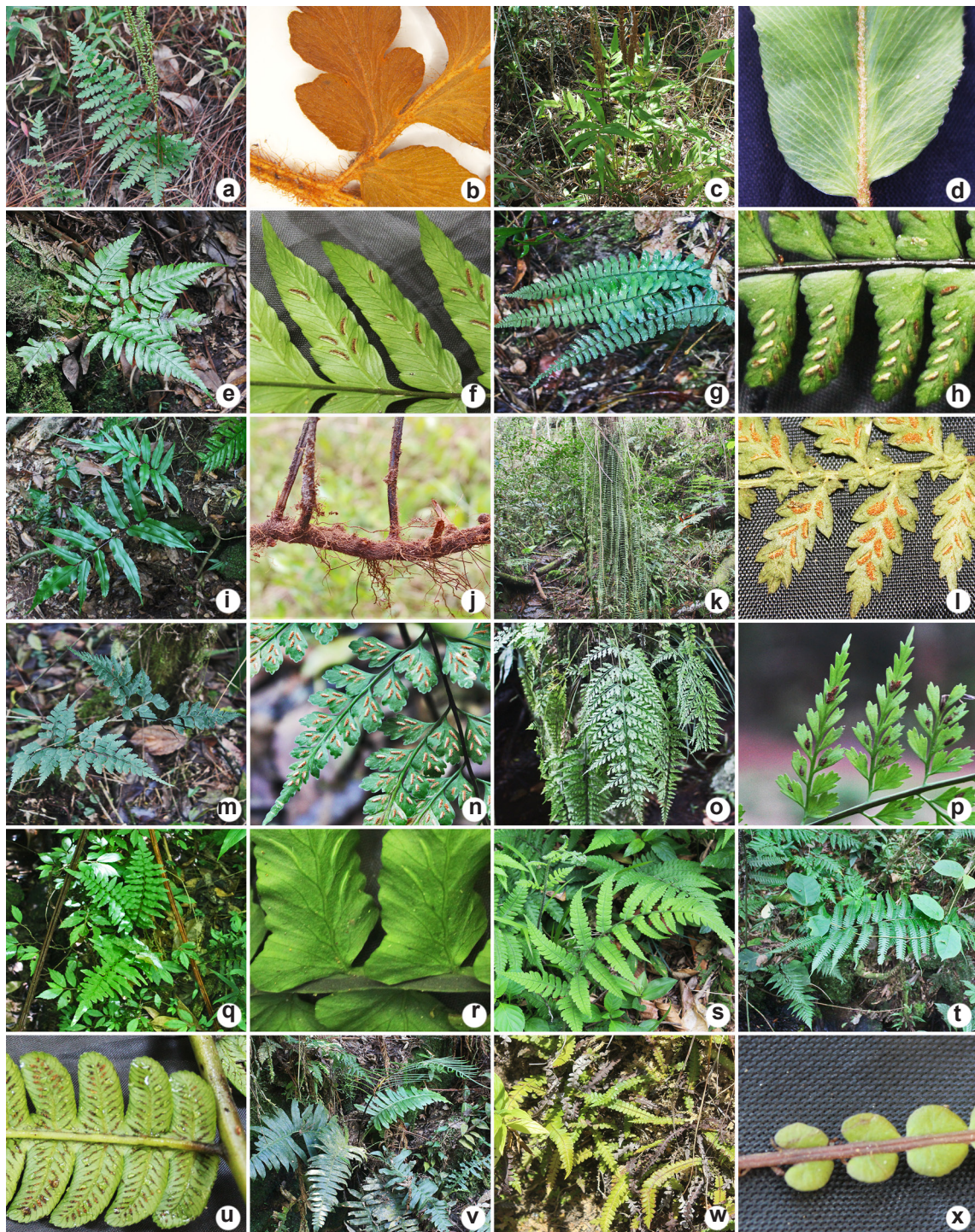
Geographic distribution: endemic of Brazil. Conservation status: not evaluated. Voucher: MN 379.

*Asplenium mucronatum* C. Presl. Fig. 4k-l

Epiphytic, in trunks of Cyatheaceae. It occurs in Araucaria Forest and humid valleys, and is easily recognized by the long, pendent fronds that are over one meter long. It is similar to *Asplenium pteropus* Kaulf. but can be distinguished by the shape of the pinnae: serrate-crenate in *A. pteropus* and mucronate in *A. mucronatum* (Sylvestre 2001).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 242.





**Figure 4** – a-b. *Anemia ferruginea* var. *ferruginea*. c-d. *Anemia phyllitidis*. e-f. *Asplenium abscissum*. g-h. *Asplenium claussenii*. i-j. *Asplenium incurvatum*. k-l. *Asplenium mucronatum*. m-n. *Asplenium pseudonitidum*. o-p. *Asplenium scandiacum*. q-r. *Hymenasplenium triquetrum*. s. *Deparia petersenii*. t-u. *Diplazium lindbergii*. v. *Austroblechnum divergens*. w-x. *Blechnum asplenioides*.



***Asplenium pseudonitidum*** Raddi. Fig. 4m-n

Terrestrial, on moist and humid soils in Araucaria Forest or on the edges of the Jaguariaíva River. It is similar to *Asplenium wacketii* Rosenst. which has 3-segment pinnate (at least on the base) vs. bipinnate-pinnatifid in *A. pseudonitidum*.

Geographic distribution: endemic of Brazil. Conservation status: not evaluated. Voucher: MN 243.

***Asplenium scandicinum*** Kaulf. Fig. 4o-p

Epiphytic, near watercourses. It is similar to *Asplenium gastonis* Fée but differs as it has fronds with 3–4 pinnate (at least on the base) and maroon rhizome hairs, whereas in *A. gastonis* the laminae are 2-pinnate and the hairs of the rhizome are yellowish.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 311.

***Hymenasplenium triquetrum*** (N.Murak. & R.C. Moran) L. Regalado & Prada. Fig. 4q-r

Epipetric, on rocks along streams. It is similar to *Asplenium alatum* Humb. & Bonpl. ex Willd., a species that also has winged rachis, but can be differentiated by the erect rhizome and apex of the laminae proliferous (vs. apex non-proliferous and creeping rhizome in *H. triquetrum*) (Sylvestre 2001).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 377.

**Athyriaceae*****Deparia petersenii*** (Kunze) M.Kato. Fig. 4s

Terrestrial in ravines, along rivers, and other shaded and disturbed places. This species is native to Asia and widely distributed throughout the world (Kuo *et al.* 2018).

Geographic distribution: pantropical. Conservation status: not evaluated. Voucher: MN 209.

***Diplazium lindbergii*** (Mett.) Christ. Fig. 4t-u

Terrestrial, along streams. It resembles *Diplazium striatastrum* Lellinger, but differs due to laminae with evident hairs and indusia. In contrast, *D. lindbergii* has glabrous laminae and inconspicuous or absent indusia (Sakagami 2006).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 385.

**Blechnaceae*****Austroblechnum divergens*** (Kunze) Gasper & V.A.O Dittrich. Fig. 4v

Terrestrial, along the Jaguariaíva and Santo Antônio Rivers, or epipetric on sandstone crevices. According to Dittrich *et al.* (2017), this species resembles *Austroblechnum organense* (Brade) Gasper & V.A.O. Dittrich, differing due to its larger, light brown and dull rhizome scales (*A. organense* has smaller, nigrescent and shiny rhizome scales).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 210.

***Blechnum asplenioides*** Sw. Fig. 4w-x

Epipetric, in sandstone crevices, gallery forests, or ravines along the Jaguariaíva River. This species is similar to *Blechnum polypodioides*, which differs in that the basal pinnae are fully adnate to rachis and medial pinnae ascending in *B. asplenioides*. In *B. polypodioides* the basal pinnae are partly adnate to rachis, the medial pinnae patent or slightly ascending (Dittrich *et al.* 2005).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 156; PL 195.

***Blechnum austrobrasilianum*** de la Sota. Fig. 5a-b

Terrestrial, in ravines of the Jaguariaíva River or trail edges of the Cerrado. It is similar to *Blechnum occidentale* but differs by having the first pair on the acroscopic side adnate to rachis (in *B. austrobrasilianum* the first pair of pinnae is fully pinnate). It is also similar to *Blechnum laevigatum* Cav., which differs by the densely pilose laminae throughout (glabrous or sparsely hairy in *B. austrobrasilianum*) (Dittrich 2005).

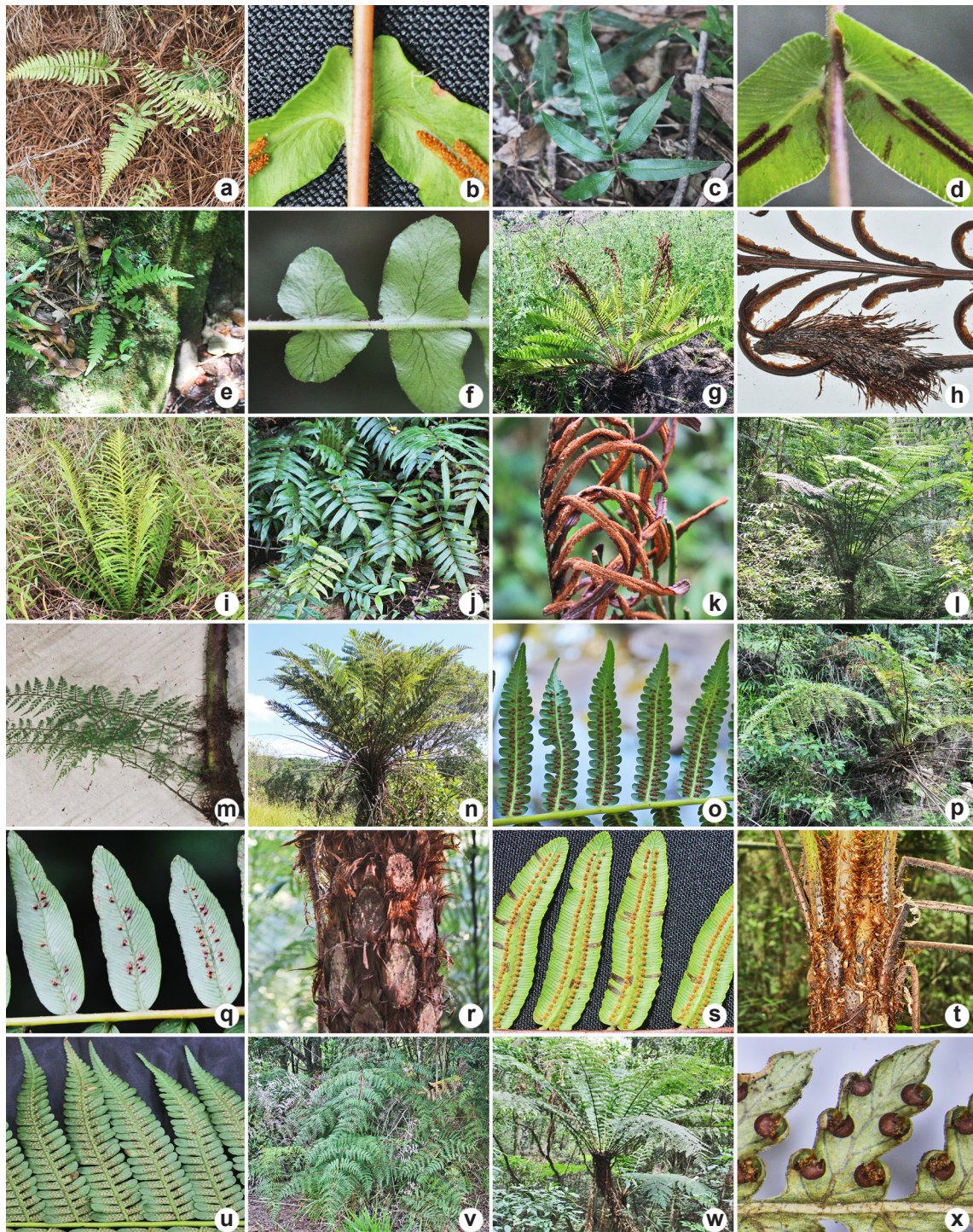
Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 245.

***Blechnum gracile*** Kaulf. Fig. 5c

Terrestrial, in sandy soils along the Jaguariaíva River. According to Dittrich *et al.* (2017), it resembles *Blechnum x caudatum*, a hybrid between *Blechnum occidentale* and *Blechnum gracile*. It can be distinguished from this hybrid by a fewer number of pinnae pairs (3–5 vs. 7), and a pinnate lamina (vs. pinnatisect).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 359.





**Figure 5** – a-b. *Blechnum austrobrasilianum*. c. *Blechnum gracile*. d. *Blechnum occidentale*. e-f. *Blechnum polypodioides*. g-h. *Lomariocycas schomburgkii* (habit, petiole scales and fertile pinnae). i. *Neoblechnum brasiliense*. j-k. *Parablechnum cordatum*. l-m. *Alsophila setosa*. n-o. *Cyathea atrovirens*. p-q. *Cyathea corcovadensis*. r. *Cyathea delgadii*. s. *Cyathea feeana*. t-u. *Cyathea phalerata*. v. *Pteridium arachnoideum*. w-x. *Dicksonia sellowiana*.



***Blechnum occidentale* L.** Fig. 5d

Terrestrial, along trails in the Cerrado, along rivers, and less often in grassland and sandstone crevices. It is similar to *B. austrobrasilianum* and *B. laevigatum*. Additional comments are provided under *B. austrobrasilianum*.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 211.

***Blechnum polypodioides* Raddi.** Fig. 5e-f

Commonly found as terrestrial in remnants of Araucaria Forest, but also along riverbanks, waterfalls, or sandstone formations as epipetric. It is similar to *B. asplenoides*; see for further comments.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 212.

***Lomariocycas schomburgkii* (Klotzsch) Gasper & A.R. Sm.** Fig. 5g-h

A subarborescent species, found mainly in the grasslands of the Jaguariáiva River canyon. It is the only species of the genus in Brazil (Dittrich *et al.* 2018).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 190.

***Neoblechnum brasiliense* (Desv.) Gasper & V.A.O. Dittrich.** Fig. 5i

Terrestrial, near waterfalls or trail edges. It is easily distinguished from the other species by its subarborescent habit, black rhizome scales, and monomorphic fronds. This latter characteristic distinguishes it from *Lomariocycas schomburgkii*, another subarborescent Blechnaceae species found in the area.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 103.

***Parablechnum cordatum* (Desv.) Gasper & Salino.** Fig. 5j-k

Commonly found along riverbanks in open areas of humid grasslands. It is similar to *Parablechnum glaziovii* (Christ) Gasper & Salino, which differs due to its sessile pinnae (*vs.* petiolated in *P. cordatum*).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 158; PL 51, 180.

**Cyatheaceae*****Alsophila setosa* Kaulf.** Fig. 5l-m

This species was found in Araucaria and riparian forests. It is easily recognized by the small, green aphebiae at the base of the petiole.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 259.

***Cyathea atrovirens* (Langsd. & Fisch.) Domin.** Fig. 5n-o

Common in the grasslands, river valleys, or disturbed areas. It is the most abundant species of the family in CSP. It is similar to *Cyathea phalerata* but differs due to predominantly simple veins and chartaceous texture of the laminae (in *C. phalerata* the veins are predominantly forked and the laminae are membranaceous). In addition, *C. phalerata* prefers shaded environments, whereas *C. atrovirens* is commonly found in open areas.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 104; PL 192; PS 874.

***Cyathea corcovadensis* (Raddi) Domin.** Fig. 5p-q

This species was found in riparian forests. In Brazil, *Cyathea feeana* and *Cyathea miersii* are similar to *C. corcovadensis*. However, in *C. corcovadensis* the margin of the pinnae are entire, whereas in *C. feeana* they are slightly serrate, and pinnatifid in *C. miersii* (Lehnert & Weigand 2013).

Geographic distribution: endemic of Brazil. Conservation status: least concern. Voucher: MN 191.

***Cyathea delgadii* Sternb.** Fig. 5r

Common in Araucaria and gallery forests along the Jaguariáiva River. The specimens were the largest among the Cyatheaceae, with individuals measuring up to 12 m. It is easily recognized as it creates large, evident scars of the petioles along the trunk.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 178.

***Cyathea feeana* (C.Chr.) Domin.** Fig. 5s

This species was found in riparian forests. It is similar to *C. corcovadensis*, however, besides the margin of the pinnae being serrate (which is entire in *C. corcovadensis*), *C. feeana* has a more robust rhizome and the fronds are less arched (Weigand & Lehnert 2016).



Geographic distribution: endemic of Brazil.  
Conservation status: not evaluated. Voucher: MN 135.

***Cyathea phalerata*** Mart. Fig. 5t-u

This species occurs in Araucaria Forest, gallery forests, or sandstone crevices. It is similar to *Cyathea atrovirens*; see for further comments.

Geographic distribution: endemic of Brazil.  
Conservation status: not evaluated. Voucher: MN 294; PL 193.

### Dennstaedtiaceae

***Pteridium arachnoideum*** (Kaulf.) Maxon.

Fig. 5v

A common species forming large and dense populations, usually in disturbed areas.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 193.

### Dicksoniaceae

***Dicksonia sellowiana*** Hook. Fig. 5w-x

This tree fern is associated with Araucaria Forest, where it grows in shaded places in the understory. It can be distinguished from other tree ferns, which belong to the Cyatheaceae family, as it has hairs at the base of the petioles, instead of scales, and lacks spines on the stem and petioles. This species is considered endangered (EN), mainly due to illegal extraction over the years (CNCFlora 2012).

Geographic distribution: neotropical.  
Conservation status: endangered. Voucher: MN 197.

***Lophosoria quadripinnata*** (J.F.Gmel.) C.Chr.

Fig. 6a-b

This species was found along the canyons of the Jaguariaíva River. Unlike *Dicksonia sellowiana*, this species does not have an arborescent habit, and it has fronds up to 2 m.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 247; PL 166.

### Dryopteridaceae

***Ctenitis bigarellae*** Schwartsb., Labiak & Salino.

Fig. 6c-d

Epipetric, on rocks in streams of the Araucaria Forest, or in sandstone formations. It can be recognized by its epipetric habit associated with sandstone and membranaceous laminae (Schwartzburd *et al.* 2007).

Geographic distribution: endemic of Brazil.  
Conservation status: not evaluated. Voucher: MN 366.

***Elaphoglossum burchellii*** (Baker) C.Chr.

Fig. 6e-f

Terrestrial, in ravines of the Jaguariaíva River or epipetric in sandstone crevices, always forming large populations. It is easily recognized by the membranaceous texture of its laminae. This species resembles *Elaphoglossum flaccidum* (Fée) T. Moore but differs due to the sterile base of the laminae which is non decurrent (*vs.* long decurrent in *E. flaccidum*).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 297.

***Elaphoglossum glabellum*** J.Sm. Fig. 6g

Epiphytic, on trees in Araucaria Forest. Among the species of *Elaphoglossum* in the CSP, it is easily recognized by its narrow laminae (up to 0.8 cm wide). It is similar to *Elaphoglossum gayanum* (Fée) T. Moore, differing by the length of fertile laminae that are generally twice as long as the sterile, whereas in *E. gayanum* the sterile and fertile laminae are of equal length.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 301; PL 179.

***Elaphoglossum hymenodiarum*** (Fée) Brade.

Fig. 6h-i

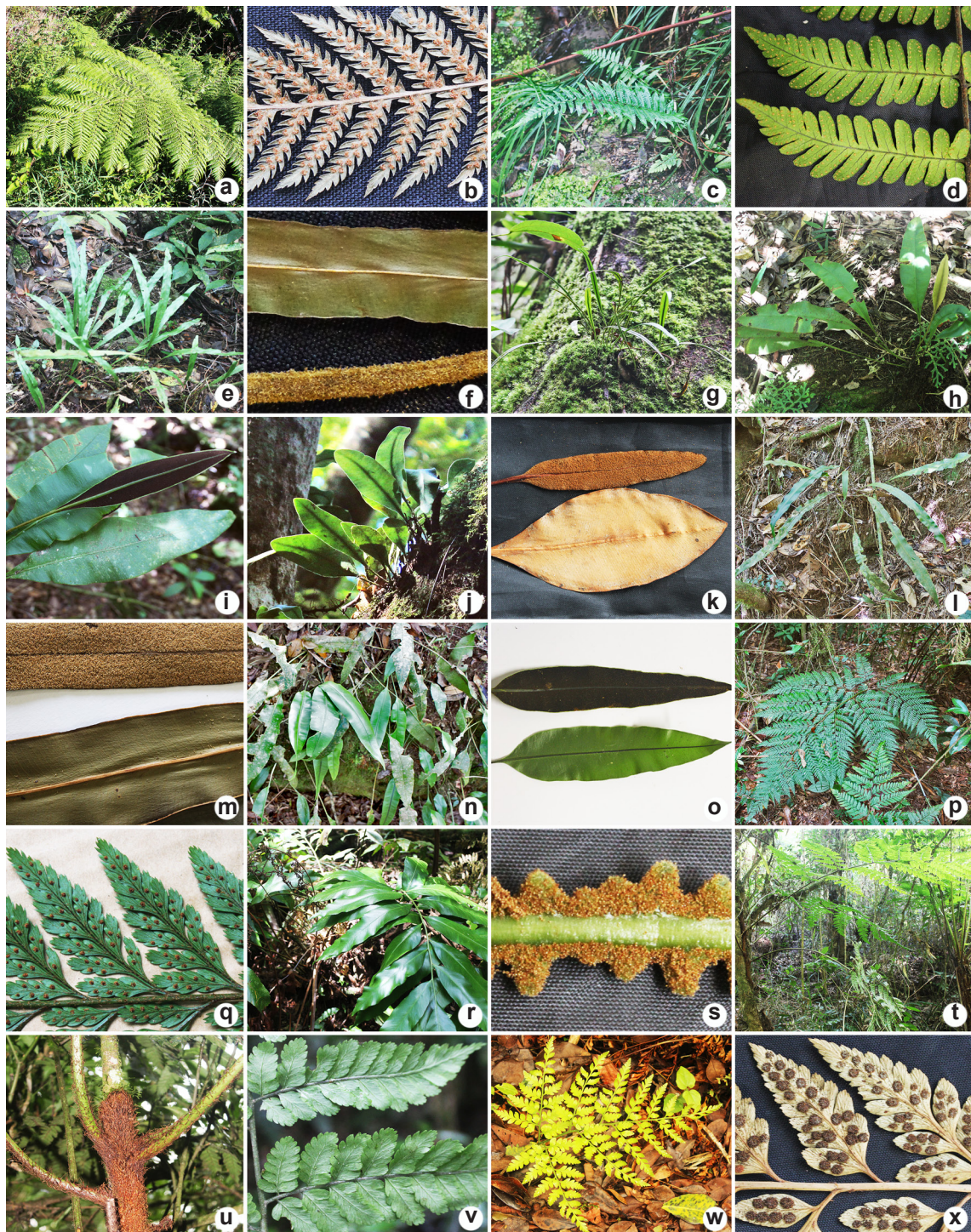
Common along river valleys as terrestrial, or epipetric in sandstone crevices or gallery forests. This is the most common and the largest species of *Elaphoglossum* in the CSP (up to 40 cm in length). Besides its size, it can also be recognized by the anastomosing veins along the medial or upper portion of the laminae.

Geographic distribution: endemic of Brazil.  
Conservation status: not evaluated. Voucher: MN 139.

***Elaphoglossum lingua*** (C.Presl) Brack. Fig. 6j-k

Epiphytic in Araucaria and riparian forests. It is similar to *Elaphoglossum vagans* (Mett.) Hieron. and *Elaphoglossum itatiayense* Rosent. but can be distinguished by the lanceolate rhizome scales, brown to nigrescent, with a short acuminate apex. In *E. vagans* the rhizome scales are ovate, light-brown, with a long-attenuate apex. In *E. itatiayense* they are lanceolate, castaneous, and with a long-acuminate apex (Rubio 2012).





**Figure 6** – a-b. *Lophosoria quadripinnata*. c-d. *Ctenitis bigarellae*. e-f. *Elaphoglossum burchellii*. g. *Elaphoglossum glabellum*. h-i. *Elaphoglossum hymenodiatrum*. j-k. *Elaphoglossum lingua*. l-m. *Elaphoglossum pachydermum*. n-o. *Elaphoglossum vagans*. p-q. *Lastreopsis amplissima*. r-s. *Olfersia corcovadensis*. t-v. *Polybotrya cylindrica*. w-x. *Rumohra adiantiformis*.



Geographic distribution: endemic of Brazil.  
 Conservation status: not evaluated. Voucher: MN 179.

***Elaphoglossum pachydermum*** (Fée) T.Moore.

Fig. 6l-m

Terrestrial or epipetric, in sandstone crevices and riparian forests. It is similar to *Elaphoglossum iguapense* Brade, but distinguishable by the hyaline and revolute margin of the laminae (vs. non-hyaline and flat in *E. iguapense*).

Geographic distribution: endemic of Brazil.  
 Conservation status: not evaluated. Voucher: MN 308.

***Elaphoglossum vagans*** (Mett.) Hieron.

Fig. 6n-o

Epipetric in sandstone crevices, or terrestrial along river valleys. It is similar to *Elaphoglossum lingua*; see for further comments.

Geographic distribution: endemic of Brazil.  
 Conservation status: not evaluated. Voucher: MN 303.

***Lastreopsis amplissima*** (C.Presl) Tindale.

Fig. 6p-q

Common as terrestrial along river valleys. It is easily recognized by its highly dissected laminae, yellowish glands of the veins and laminar tissue, and the presence of indusia. It is similar to *Parapolystichum effusum* (Sw.) Ching, which differs due to the presence of a bud at the frond apex and the absence of indusia.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 161; PL 201.

***Olfersia corcovadensis*** Kaulf. ex Raddi.

Fig. 6r-s

Epipetric, on rocks in watercourses of Araucaria Forest. The species is characterized by dimorphic fronds and large sterile pinnae (up to 20 cm) with veins interrupted by a marginal collecting vein.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 295.

***Polybotrya cylindrica*** Kaulf. Fig. 6t-v

This species was found only in Araucaria Forest. It was the only scandent species found in the CSP. Besides its long-creeping, scandent rhizomes and dimorphic fronds, it is also distinct due to its

appressed, rigid and dark brown rhizome scales (Canestraro & Labiak 2015).

Geographic distribution: endemic of Brazil.  
 Conservation status: not evaluated. Voucher: MN 361.

***Rumohra adiantiformis*** (G.Forst.) Ching.

Fig. 6w-x

Terrestrial, in open areas. It can be recognized by its coriaceous fronds and rounded sori with peltate indusia.

Geographic distribution: pantropical.  
 Conservation status: not evaluated. Voucher: MN 138.

**Gleicheniaceae**

***Dicranopteris flexuosa*** (Schrad.) Underw.

Fig. 7a-b

A common species occurring as terrestrial in grassland areas, forming large populations in sloping for rivers.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 251; PL 167.

***Sticherus bifidus*** (Willd.) Ching. Fig. 7c-d

Terrestrial, in sandstone crevices and grasslands, usually in humid places. It is similar to *Sticherus squamosus* (Fée) J. Gonzales, differing due to rhizome scales with ciliate and petiole without scales, whereas in *S. squamosus* the rhizome scales are dentate and the petioles conspicuously scaly.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 249.

***Sticherus lanuginosus*** (Fée) Nakai. Fig. 7e

This species is very common, forming large populations usually in dry places, on Cerrado trail edges or grasslands near to rivers. It is easily recognized by its erect fronds, densely covered by a whitish indument.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 163; PS 872.

***Sticherus pruinosus*** (Mart.) Ching. Fig. 7f-g

Epipetric on sandstone formations or terrestrial in trails throughout the Cerrado. Among the species of *Sticherus* in the Park, *S. pruinosus* has the smallest fronds (not exceeding 0.60 m in height). It is similar to *Sticherus gracilis* (Mart.)



**Figure 7** – a-b. *Dicranopteris flexuosa*. c-d. *Sticherus bifidus*. e. *Sticherus lanuginosus*. f-g. *Sticherus pruinosus*. h-i. *Abrodictyum rigidum*. j. *Hymenophyllum elegans*. k. *Hymenophyllum hirsutum* (petiole). l-m. *Hymenophyllum microcarpum*. n-o. *Hymenophyllum pulchellum*. p. *Poliphlebium angustatum*. q. *Polyphlebium hymenophylloides*. r-s. *Trichomanes anadromum*. t-u. *Trichomanes cristatum*. v-w. *Trichomanes pilosum*. x. *Trichomanes polypodoides*.



Copel but differs in that the rachis are densely coated by orange scales and have strongly revolute margins (*vs.* glabrous or sparsely scaly rachis with flat margins in *S. gracilis*).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 162.

### Hymenophyllaceae

***Abrodictyum rigidum*** (Sw.) Ebihara & Dubuisson. Fig. 7h-i

Terrestrial or epipetric in sandstone formations. Its general morphology resembles small specimens of *Trichomanes elegans*, but differs in having non-winged rachises (*vs.* narrow-winged rachises in *A. rigidum*) (Windisch 2014).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 112; PL 171.

***Hymenophyllum elegans*** Spreng. Fig. 7j

Epiphytic in Araucaria Forest or epipetric in sandstone formations. It resembles *Hymenophyllum fragile* (Hedw.) C.V Morton, differing in non-alate petiole, stellate or forked hairs present only on the rachis, veins, and margins of the laminae. In contrast, *H. fragile* only has stellate hairs that are also present on the laminar tissue between the veins (Gonzatti & Windisch 2018).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 224.

***Hymenophyllum hirsutum*** (L.) Sw. Fig. 7k

Epiphytic or epipetric in sandstone formations. It is similar to *Hymenophyllum microcarpum* but differs in that it has winged petiole throughout, and hairs on both surfaces of the laminae, whereas in *H. microcarpum* the petioles are winged only in the distal portion and the abaxial surface is glabrous.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 263.

***Hymenophyllum microcarpum*** Desv. Fig. 7l-m

This species was found as epipetric in sandstone formation or epiphytic in Araucaria Forest, usually along watercourses. It is similar to *H. hirsutum*; see for further comments.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 265.

***Hymenophyllum pulchellum*** Schtdl. & Cham.

Fig. 7n-o

Epiphytic in Araucaria Forest. It is similar to *Hymenophyllum rufum* Fée but differs due to a lack of stellate hairs on the laminar tissue (which are limited to rachis, veins, and lamina margin) (Gonzatti & Windisch 2018).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 296.

***Polyphlebium angustatum*** (Carmich.) Ebihara & Dubuisson. Fig. 7p

Epiphytic, on *Cyathea* in Araucaria Forest. It is similar to *Polyphlebium hymenophylloides* (Bosch) Ebihara & Dubuisson, differing through non-winged rachis on the distal portion (*vs.* fully winged in *P. hymenophylloides*).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 223.

***Polyphlebium hymenophylloides*** (Bosch) Ebihara & Dubuisson. Fig. 7q

Epiphytic in Araucaria Forest and gallery forests of Jaguariaíva River. It may be mistaken for *Polyphlebium diaphanum* (Kunth) Ebihara & Dubuisson, which has winged petiole throughout, whereas in *P. hymenophylloides* the petiole is winged only on its distal portion.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 306.

***Trichomanes anadromum*** Rosenst. Fig. 7r-s

Epiphytic in Araucaria Forest, preferentially on trunks of *Cyathea feaana* and *Alsophylla setosa*. This species is similar to *Trichomanes polypodioides*, differing in the position of the sori: at the axil of the segments in *T. anadromum*, and at the apex of the segments in *T. polypodioides* (Windisch 2014).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 225.

***Trichomanes cristatum*** Kaulf. Fig. 7t-u

Terrestrial, near watercourses, in very humid and shaded soils. It is easily recognized by the erect fronds and 1-pinnate laminae.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 264; PL 170.

***Trichomanes pilosum* Raddi.** Fig. 7v-w

Epipetric, forming large populations in rock crevices. It is one of the most common species of Hymenophyllaceae in the CSP. It can be mistaken for *Trichomanes crispum* L., but it differs through the uniformly expanded border of the indusia (vs. with a lateral lobe in *T. crispum*) (Windisch 1996). Also, the fronds are erect in *T. crispum* and arcuate in *T. pilosum*.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 113; PL 184; PS 879.

***Trichomanes polypodioides* L.** Fig. 7x

This species was found as epiphytic in Araucaria Forest on species of *Cyathea* or *Dicksonia sellowiana*. It is similar to *T. anadromum*; see for further comments.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 307.

**Lindsaeaceae*****Lindsaea botrychioides* A. St.-Hil.** Fig. 8a-b

This species was found as terrestrial in humid and shaded places, near streams and sandstone formations. It is distinguished from other species of the genus by its 1-pinnate frond and flabellate pinnae.

Geographic distribution: endemic of Brazil. Conservation status: not evaluated. Voucher: MN 363.

***Lindsaea divaricata* Klotzsch.** Fig. 8c-d

Terrestrial in sandstone crevices, in humid places. It is similar to *Lindsaea quadrangularis* subsp. *terminalis*, both with dark brown petiole, canaliculate only on the adaxial surface. However *L. divaricata* has semilunar medial pinnae with flat margins, whereas *L. quadrangularis* subsp. *terminalis* has trapeziform medial pinnae with crenate margins (Kramer 1957).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 115.

***Lindsaea lancea* (L.) Bedd.** Fig. 8e

Terrestrial in sandstone crevices, near watercourses. Among the other species of the genera, *L. lancea* appears as the most robust. It is also characterized by its pale to greenish petiole, canaliculate on both surfaces.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 114; PL 169.

***Lindsaea quadrangularis* subsp. *terminalis* Radii.**

Fig. 8f-g

Terrestrial and epipetric along streams in the interior of forests. It is similar to *L. divaricata*; see for further comparisons.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 165; PS 849.

**Lycopodiaceae*****Lycopodiella longipes* (Grev. & Hooker) Holub.**

Fig. 8h

Terrestrial, found exclusively in grasslands. It is easily recognized by its straight and simple, non-bifurcated branches, and long strobili (up to 18 cm).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 200; PS 868; EL 2056 (MBM).

***Lycopodium clavatum* L.** Fig. 8i

Terrestrial, in sloping grassland areas near the Jaguariaíva River canyon and trail edges, in humid areas.

Geographic distribution: pantropical. Conservation status: not evaluated. Voucher: MN 117; AG 235 (MBM).

***Palhinhaea camporum* (B. Øllg. & P.G. Windisch) Holub.** Fig. 8j-k

Terrestrial, in grassland or disturbed areas with *Pinus sp.*, forming large populations. It is similar to *Palhinhaea cernua*, differing in that the first branches are erect, whereas the first branches in *P. cernua* are arched.

Geographic distribution: pantropical. Conservation status: not evaluated. Voucher: MN 118; PS 873.

***Palhinhaea cernua* (L.) Franco & Vasc.** Fig. 8l

Terrestrial, often found in grassland areas along rivers. It is similar to *P. camporum*; see for comparison.

Geographic distribution: pantropical. Conservation status: not evaluated. Voucher: MN 181; PL 187.

***Phlegmariurus reflexus* (Lam.) B. Øllg.**

Fig. 8m-n

Terrestrial on banks of the rivers or epipetric in waterfalls. It is easily recognized as it does not form strobili at the apex of the segments. It is similar to *Phlegmariurus christii* (Silveira) B. Øllg., differing due to reflexed microphylls (ascending in *P. christii*).





**Figure 8** – a-b. *Lindsaea botrychioides*. c-d. *Lindsaea divaricata*. e. *Lindsaea lancea*. f-g. *Lindsaea quadrangularis* subsp. *terminalis*. h. *Lycopodiella longipes*. i. *Lycopodium clavatum*. j-k. *Palhinhaea camporum*. l. *Palhinhaea cernua*. m-n. *Phlegmariurus reflexus*. o-p. *Pseudolycopodiella meridionalis*. q-r. *Cheiroglossa palmata*. s. *Campyloneurum austrobrasiliense*. t-u. *Campyloneurum nitidum*. v-w. *Cochlidium serrulatum*. x. *Microgramma squamulosa*.



Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 266.

***Pseudolycopodiella meridionalis*** (Underw. & Loyd) Holub. Fig. 8o-p

Terrestrial, in grassland areas along rivers. The rhizomes are firmly adhered to moist soils, and it is often associated with carnivorous plants of the Droseraceae. It is similar to *Pseudolycopodiella carnososa* (Silveira) Holub, which differs due to the fleshy rhizome, with its surface exposed by the spaced microphylls. In *P. meridionalis* the microphylls cover the rhizome surface.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 201; PL 53.

### Ophioglossaceae

***Cheiroglossa palmata*** (L.) C.Presl. Fig. 8q-r

This seems to be a rare species, found exclusively in Araucaria Forest as epiphytic in small trees. It is easily recognized by the synangia at the base of a palmate laminae.

Geographic distribution: pantropical.  
 Conservation status: least concern. Voucher: MN 182.

### Polypodiaceae

***Campyloneurum austrobrasilianum*** (Alston) de la Sota. Fig. 8s

Epiphytic, in Araucaria or riparian forests. It is easily recognized by the narrow laminae, not exceeding 1 cm in width, and also by the presence of white dots on the adaxial side of the laminae.

Geographic distribution: endemic of Brazil.  
 Conservation status: not evaluated. Voucher: MN 305.

***Campyloneurum nitidum*** (Kaulf.) C.Presl.

Fig. 8t-u

Species found as terrestrial, epiphytic, or epipetric in river valleys, Araucaria Forest, and trails throughout the Cerrado. It is similar in size to *Campyloneurum crispum* Fée, which differs due to its long-creeping rhizome and membranaceous laminae (*vs.* short-creeping rhizome and coriaceous laminae in *C. nitidum*).

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 268.

***Cochlidium serrulatum*** (Sw.) L.E.Bishop.

Fig. 8v-w

Epipetric, on the margins of the Jaguariaíva and Santo Antônio Rivers. It is similar to *Cochlidium punctatum*, (Raddi) L.E. Bishop, a species of similar size that is also found in the Devonian Escarpment. However, in *C. serrulatum* the margins of the laminae are serrate, and entire in *C. punctatum*.

Geographic distribution: pantropical.  
 Conservation status: not evaluated. Voucher: MN 254; PL 181.

***Microgramma squamulosa*** (Kaulf.) de la Sota.

Fig. 8x

Often found as epiphytic in trees along the edges of the Cerrado or in disturbed areas, always forming a large population. It is easily recognized by the simple laminae with anastomosing veins.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 309; PL 52.

***Microgramma vacciniifolia*** (Langsd. & Fisch.) Copel. Fig. 9a-b

Epiphytic. It is similar to *Microgramma squamulosa* but differs as it has smaller fronds (up to 3 cm in sterile laminae and 4.5 cm in fertile laminae). It is characterized by a marked dimorphism, with sterile fronds ranging from oval to elliptical, whereas the fertile fronds are linear, with a notable decrease in the number of areolas (up to 3 series in sterile and one in fertile) (Assis & Labiak 2009).

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 387.

***Niphidium crassifolium*** (L.) Lellinger. Fig. 9c-d

Epiphytic, in riparian forests of the Jaguariaíva River. It is similar to *Niphidium rufosquamatum* Lellinger. They differ due to rhizome scales with entire margins in *N. crassifolium* and dentate margins in *N. rufosquamatum* (Lellinger 1972).

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 360.

***Pecluma pectinatiformis*** (Lindm.) M.G.Price.

Fig. 9e-f

Epiphytic, in Araucaria Forest, near watercourses. It is similar to *Pecluma paradiseae*





**Figure 9** – a-b. *Microgramma vacciniifolia*. c-d. *Niphidium crassifolium*. e-f. *Pecluma pectinatiformis*. g-h. *Pecluma recurvata*. i. *Pecluma sicca*. j-k. *Pecluma singeri*. l-m. *Pecluma truncorum*. n-o. *Pleopeltis hirsutissima* (habit and lamina scales). p. *Pleopeltis pleopeltifolia*. q-r. *Serpocaulon catharinae* (habit and rhizome scales). s-t. *Serpocaulon fraxinifolium*. u-v. *Serpocaulon laetum* (pinnae and rhizome scales). w-x. *Serpocaulon vacillans*.



(Langsd & Fisch) M.G.Price, however, this species has more robust aspect and twice to three-times forked veins (*vs.* once-forked in *P. pectinatiformis*).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 267.

***Pecluma recurvata*** (Lindm.) M.G. Price.

Fig. 9g-h

Epiphytic in *Araucaria* Forest or terrestrial next to sandstone formations. It is easily recognized by the presence of stolon and laminae non-reduced at the base.

Geographic distribution: endemic of Brazil. Conservation status: not evaluated. Voucher: MN 298.

***Pecluma sicca*** (Lindm.) M.G. Price. Fig. 9i

Epiphytic on species of *Cyathea*, along riparian forests of the Jaguariaiva River and Araucaria Forest. It is similar to *Pecluma singeri*, which has forked veins and stoloniferous rhizome (*vs.* simple veins and non-stoloniferous rhizomes in *P. sicca*).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 382.

***Pecluma singeri*** (de la Sota) M.G. Price.

Fig. 9j-k

Epiphytic near streams inside Araucaria Forest. It is similar to *Pecluma sicca*; see for further comparisons.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: PL 185.

***Pecluma truncorum*** (Lindm.) M.G.Price.

Fig. 9l-m

Epiphytic on trunks of *Cyathea* in Araucaria Forest. It is similar to *Pecluma filicula* (Kaulf.) M.G. Price but differs as its fronds are usually longer than 20 cm (up to 15 cm in *P. filicula*). It is also similar to *Pecluma dispersa* (A.M. Evans) M.G. Price, differing due to the base of the laminae with basal pinnae extremely reduced, whereas *P. dispersa* has basal pinnae reduced to half the length of the medial pinnae (Assis & Labiak 2009).

Geographic distribution: endemic of Brazil. Conservation status: least concern. Voucher: MN 230.

***Pleopeltis hirsutissima*** (Raddi) de la Sota.

Fig. 9n-o

Epiphytic or rarely terrestrial. This is one of the few species that also occurs on trees of the Cerrado vegetation, such as *Stryphnodendron sp.* (Barbatimão) and *Anaderanthera sp.* (Angico-do-cerrado). It is characterized by the presence of gonfoid and deltoid-lanceolate scales on the laminae (Assis & Labiak 2009).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 310; PL 176.

***Pleopeltis pleopeltifolia*** (Raddi) Alston. Fig. 9p

Epiphytic. It is recognized by strongly pinnatissect fronds and ascending segments.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 119.

***Serpocaulon catharinae*** (Langsd. & Fisch.)

A.R.Sm.

Fig. 9q-r

Epiphytic. Along with other species of Polypodiaceae, this is one of the few species that also occurs on trees of the Cerrado. It is similar to *Serpocaulum vaccilans* and *Serpocaulon latipes*, but these species are usually terrestrial and larger (fronds up to 1 m long), whereas *S. catharinae* is epiphytic and has smaller fronds (up to 40 cm long).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 121; PL 173; PS 870.

***Serpocaulon fraxinifolium*** (Jacq.) A.R. Sm.

Fig. 9s-t

Epiphytic on *Cyathea*, usually close to streams. It is easily recognized by its 1-pinnate laminae, long-creeping rhizome, and anastomosing veins.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 378.

***Serpocaulon laetum*** (C. Presl) A.R.Sm &

Schartsb.

Fig. 9u-v

Epiphytic on *Cyathea*, in Araucaria Forest and near watercourses. It is easily distinguished from other species of *Serpocaulon* by its laminae that are notably papyraceous and dark green (especially after drying).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 383.



***Serpocaulon vacillans* (Link) A.R.Sm.**

Fig. 9w-x

Terrestrial on the edges of trails, in the interior of the cerrado, in grasslands, as well as in disturbed areas. It is similar to *Serpocaulon latipes* (Langsd. & Fisch.) A.R. Sm., which differs by its glabrous laminae (pubescent in *S. vacillans*).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 148; PS 869.

**Pteridaceae*****Adiantopsis chlorophylla* (Sw.) Fée.** Fig. 10a-b

Terrestrial in disturbed grassland. It is similar to *Adiantopsis cheilanthoides* R.M. Senna, which differs by due to its size (up to 24 cm), rigid fronds, and segments that are roundish and entire. In contrast, *A. chlorophylla* grows up to 80 cm, with flexuous fronds, and segments are triangular, pinnatisect-pinnatifid (Senna 2004).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 174; PL 186.

***Adiantopsis radiata* (L.) Fée.** Fig. 10c-d

Terrestrial in Araucaria Forest, near waterfalls. In Brazil, *Adiantopsis timida* and *A. trifurcata* have the same palmate architecture of the fronds. They can be distinguished from *A. radiata* as they have smaller pinnae (3–7 mm long) and lunate to subcupidate pseudoindusia or triangular pseudoindusia (Link-Pérez & Hickey 2011). In *A. radiata* the pinnae are 7–13.5 mm long and the pseudoindusia are lunate.

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 187.

***Adiantum raddianum* C.Presl.** Fig. 10e-f

This species was found mainly in ravines along the Jaguariaíva and Santo Antônio Rivers as terrestrial or epipetric. It is similar to *Adiantum pseudotinctorum* Hieron., which has long-creeping rhizomes (short-creeping in *A. raddianum*).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 223; PL 194.

***Doryopteris patula* Fée.**

Fig. 10g-h

Terrestrial near the Jaguariaíva River canyon. It can be mistaken for *Doryopteris nobilis* (T. Moore) C. Chr. but differs due to the presence of a prolific bud at the base of the laminae.

Geographic distribution: neotropical.

Conservation status: not evaluated. Voucher: MN 389.

***Doryopteris pentagona* Pic Serm.** Fig. 10i-j

Terrestrial, along the canyons of the Jaguariaíva River. It is recognized by the absence of a bud on the laminae and by the darker and pubescent petiole. *Doryopteris lorentzii* (Hieron.) Diels is a similar species that differs as it has continuous sori (interrupted in *D. pentagona*).

Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 388.

***Lytoneuron crenulans* (Fée) Yesilyurt.**

Fig. 10k-l

Common as terrestrial in several environments such as riverbanks, grasslands, in humid or dry places. It is often associated with populations of *Palhinhaea camporum* and *Palhinhaea cernua*.

Geographic distribution: neotropical. Conservation status: date deficient. Voucher: MN 127.

***Lytoneuron lomariaceum* (Klotzsch) Yesilyurt.**

Fig. 10m

Commonly found as terrestrial in humid or dry grassland, also in the Cerrado. It is easily recognized by the narrow and long fertile segments (0.5 cm wide and 12 cm long).

Geographic distribution: neotropical. Conservation status: least concern. Voucher: MN 381.

***Pityrogramma calomelanos* (L.) Link.**

Fig. 10n-o

This species occurs in disturbed areas of the CSP. It is easily recognized by the whitish wax present on the abaxial surface of the laminae. It differs from *Pityrogramma trifoliata*, a similar species, due to its more decompound fronds (2–3-pinnate), with a pinnatifid apex.

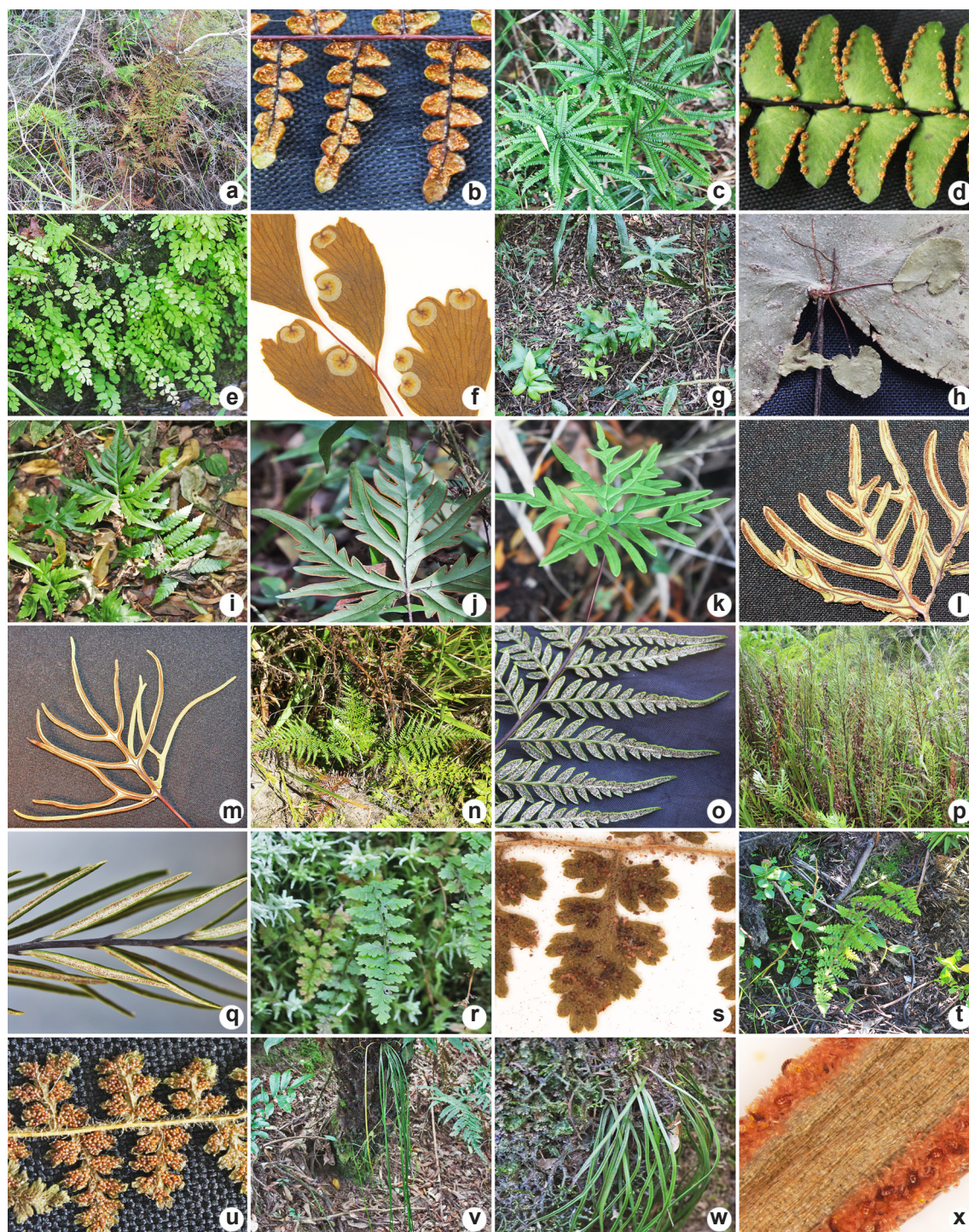
Geographic distribution: neotropical. Conservation status: not evaluated. Voucher: MN 236.

***Pityrogramma trifoliata* (L.) R.M.Tryon.**

Fig. 10p-q

Species found in grasslands, in disturbed areas. It is easily recognized by the bifoliate pinnae (at least at the base of the rachis) and simple terminal segments with apical pinnae conform.





**Figure 10** – a-b. *Adiantopsis chlorophylla*. c-d. *Adiantopsis radiata*. e-f. *Adiantum raddianum*. g-h. *Doryopteris patula* (habit and bud). i-j. *Doryopteris pentagona*. k-l. *Lytoneuron crenulans*. m. *Lytoneuron lomariaceum*. n-o. *Pityrogramma calomelanos*. p-q. *Pityrogramma trifoliata*. r-s. *Tryonia arenitcola*. t-u. *Tryonia myriophylla*. v-w. *Vittaria lineata*. x. *Vittaria graminifolia*.



Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 171; PS 867.

***Pteris lechleri* Mett.** Fig. 11a

Terrestrial in sandy soils. It is similar to *Pteris decurrens* C. Presl but this species has glabrous laminae, whereas *P. lechleri* has a densely pilose laminae.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 304.

***Pteris vittata* L.** Fig. 11b

Epipetric or terrestrial, being one of the most common ferns in disturbed places. It is native to East Asia and was introduced and naturalized in the tropical and subtropical regions of the New World, and is widely distributed in Brazil (Prado & Windisch 2000).

Geographic distribution: pantropical.  
 Conservation status: not evaluated. Voucher: MN 186.

***Tryonia arenitcola* (Schwartzb. & Labiak) Schuettp., J.Prado & A.T.Cochran.** Fig. 10r-s

Epipetric, in sandstone formations. It is similar to *T. myriophylla* but can be distinguished by its smaller size (usually 5–15 cm long) and indument of the petiole and lamina composed of non-glandular hairs. In contrast, *T. myriophylla* has longer fronds (usually over 30 cm long) and glandular hairs present on the petiole and lamina (Schwartzburd & Labiak 2008).

Geographic distribution: endemic of Brazil.  
 Conservation status: not evaluated. Voucher: MN 170; PL 182; PS 880.

***Tryonia myriophylla* (Sw.) Schuettp., J.Prado & A.T.Cochran.** Fig. 10t-u

This species was found as terrestrial in the grassland areas on the edge of the Jaguariaíva River canyon. It is similar to *T. arenitcola*: see for further comments.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 204.

***Vittaria lineata* (L.) Sm.** Fig. 10v-w

Epiphytic in Araucaria Forest. It is similar to *Vittaria graminifolia*, differing mainly it is due to its spores, which are monoletes in *V. lineata* and triletes in *V. graminifolia* (Nonato & Windisch

2004). In general, the fronds of *V. lineata* easily measure 1 m, whereas in *V. graminifolia* they do not exceed 0.20 m.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 255.

***Vittaria graminifolia* Kaulf.** Fig. 10x

Epiphytic in Araucaria Forest or epipetric mainly in rock crevices, near watercourses. It is similar to *V. lineata*; see for further comparisons.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 125.

**Selaginellaceae**

***Selaginella decomposita* Spring.** Fig. 11c-d

Epipetric or terrestrial, on riverbanks or on rocks along rivers. Among the species of the genus in the CSP, it is easily recognized by its erect habit.

Geographic distribution: endemic of Brazil.  
 Conservation status: not evaluated. Voucher: MN 203.

***Selaginella flexuosa* Spring.** Fig. 11e-f

Epipetric and terrestrial, widely distributed in the CSP, especially in sandstone crevices where it forms large populations. It is characterized mainly by the dorsal microphylls, which have hyaline margins and arched apex (Hirai & Prado 2000).

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 169.

***Selaginella microphylla* (Kunth) Spring.**

Fig. 11g-h

This species was found as epipetric in waterfalls near the Jaguariaíva River. It is similar to *Selaginella selowii* Hieron., which has monomorphic microphylls that are spirally adpressed to the rhizome. *Selaginella microphylla* also possesses a spirally pattern of the leaf arrangement, but the microphylls are dimorphic.

Geographic distribution: neotropical.  
 Conservation status: not evaluated. Voucher: MN 149.

***Selaginella muscosa* Spring.** Fig. 11i

Terrestrial or epipetric along the banks of the Jaguariaíva River. It is similar to *Selaginella tenuissima* Fée, differing due to the asymmetrical dorsal microphylls with serrate margins, without teeth at the base (symmetrical microphylls with





**Figure 11** – a. *Pteris lechleri*. b. *Pteris vittata*. c-d. *Selaginella decomposita*. e-f. *Selaginella flexuosa*. g-h. *Selaginella microphylla*. i. *Selaginella muscosa*. j-k. *Amauropelta amambayensis* (bud). l. *Amauropelta neglecta*. m. *Amauropelta opposita*. n-o. *Amauropelta ptarmica*. p-q. *Amauropelta regnelliana*. r-s. *Amauropelta rivularioides*. t. *Christella conspersa*. u. *Christella dentata*. u-v. *Christella dentata*. w. *Christella hispidula*. x. *Macrothelypteris torresiana*.



serrate margins with long teeth at the base for *S. tenuissima*) (Hirai & Prado 2000).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 386.

### **Thelypteridaceae**

*Amauropelta amambayensis* (Christ) Salino & A.R. Sm. Fig. 11j-k

Terrestrial in Araucaria Forest. In the CSP, this is the only species of *Amauropelta* that presents prolific buds at the apex of the fronds.

Geographic distribution: endemic of Brazil.  
Conservation status: not evaluated. Voucher: MN 299.

*Amauropelta neglecta* (Brade & Rosenst.) Salino & T.E.Almeida. Fig. 11l

Epipetric, on sandstone formations. It is similar to *Amauropelta ptarmica*, however, *A. neglecta* has sessile pinnae, whereas *A. ptarmica* has petiolulate pinnae.

Geographic distribution: endemic of Brazil.  
Conservation status: not evaluated. Voucher: PL 178.

*Amauropelta opposita* (Vahl) Pic. Serm. Fig. 11m

Terrestrial in disturbed areas, near the entrance of the CSP. The species of this genus can be recognized by the gradually reduced pinnae towards the base of the laminae, but in *A. opposita* this characteristic is very evident (as much as 10 pairs extremely reduced).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 258.

*Amauropelta ptarmica* (Kunze ex Mett.) Pic. Serm. Fig. 11n-o

Terrestrial in Araucaria Forest, or epipetric in sandstone crevices. It is characterized mainly by the presence of uncinete hairs at least in the petiole and the generally linear to elliptic sori (Salino 2000). It is similar to *A. neglecta*; see for further comparisons.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 256.

*Amauropelta regnelliana* (C.Chr.) Salino & T.E.Almeida. Fig. 11p-q

Terrestrial in disturbed places. It can be confused with specimens of *Amauropelta raddii*

(Rosenst.) Salino & T.E. Almeida, which has uncinete hairs restricted to laminar tissue and indusia with setiform hairs. In *A. regnelliana* the uncinete hairs are found throughout the fronds, including the indusia.

Geographic distribution: endemic of Brazil.  
Conservation status: not evaluated. Voucher: MN 269.

*Amauropelta rivularioides* (Fée) Salino & T.E Almeida. Fig. 11r-s

Terrestrial, in grassland. It is similar to *Amauropelta eriosorus* (Fée) Salino & T.E. Almeida but differs due to the uncinete hairs on the abaxial surface between veins and usually forked veins. In *A. eriosorus* the uncinete hairs are absent and the veins are simple (Salino 2000).

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 205.

*Christella conspersa* (Schrad.) Á.Löve & D.Löve. Fig. 11t

This species is common along edges of trails and grasslands.

Geographic distribution: neotropical.  
Conservation status: not evaluated. Voucher: MN 257.

*Christella dentata* (Forssk.) Brownsey & Jermy. Fig. 11u-v

Terrestrial, in grassland and disturbed areas. It is similar to *C. hispidula* but differs as it has hairs that are uniform in length along the costa and laminar tissue (vs. hairs of varying sizes in *C. hispidula*) (Ponce 2007).

Geographic distribution: pantropical.  
Conservation status: not evaluated. Voucher: MN 206.

*Christella hispidula* (Decne.) Holttum. Fig. 11w

Terrestrial, at the edges of trails in shaded places. It is similar to *Christella dentata*; see for further comments.

Geographic distribution: pantropical.  
Conservation status: not evaluated. Voucher: MN 176; PL 191.

*Macrothelypteris torresiana* (Gaudich.) Ching. Fig. 11x

Terrestrial, commonly in disturbed areas. It differs from the remaining genera of the family by it is 2-pinnate pinnatisect fronds. This species

was introduced and is now widely naturalized in tropical and subtropical forests of Brazil (Smith 1992; BFG 2018).

Geographic distribution: pantropical. Conservation status: not evaluated. Voucher: MN 240; PL 190.

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