

Publication status: Preprint has been published in a journal as an article
DOI of the published article: <https://doi.org/10.1590/2236-8906e152022>

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<https://doi.org/10.1590/2236-8906-15/2022>

Submitted on: 2022-11-22

Posted on: 2022-11-23 (version 1)

(YYYY-MM-DD)

Fern flora of Viçosa, Minas Gerais State, Brazil: Dennstaedtiaceae, Lindsaeaceae and Saccolomataceae

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Running title: **Fern flora of Viçosa: Dennstaedtiaceae, Lindsaeaceae and Saccolomataceae**

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¹ Part of the Doctoral Thesis of the first Author

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ABSTRACT – (Fern flora of Viçosa, Minas Gerais State, Brazil: Dennstaedtiaceae, Lindsaeaceae and Saccolomataceae). As part of an ongoing project treating the ferns and lycophytes from the region of Viçosa, Minas Gerais State, Brazil, we here present the taxonomic treatment of the early divergent lineages of the leptosporangiate ferns: the families Dennstaedtiaceae, Lindsaeaceae and Saccolomataceae. We have been sampling the remnant forest patches since 2012; we also fully reviewed the collection of herbarium VIC and other online collections: F, IAN, NY, PH, RB, U, UC, UPCB, US, and WTU. In the region of Viçosa, six taxa belonging to those families occur *Dennstaedtia cicutaria* and *Pteridium esculentum* subsp. *arachnoideum* (Dennstaedtiaceae); *Lindsaea lancea* var. *lancea*, *L. quadrangularis* subsp. *quadrangularis*, and *L. stricta* var. *stricta* (Lindsaeaceae); and *Saccoloma elegans* (Saccolomataceae). Among these taxa, only *L. quadrangularis* subsp. *quadrangularis* and *S. elegans* are endemic to the Brazilian Atlantic Rainforest; the remaining are widespread in the Neotropics. We present keys, descriptions, illustrations, examined specimens, and comments.

Keywords: Brazilian Atlantic Rainforest, Polypodiales, pteridophytes, southeast Brazil, taxonomy

RESUMO – (Flora de samambaias de Viçosa, Estado de Minas Gerais, Brasil: Dennstaedtiaceae, Lindsaeaceae and Saccolomataceae). Como parte de um projeto em andamento sobre samambaias e licófitas da região de Viçosa, Estado de Minas Gerais, Brasil, o tratamento taxonômico das primeiras linhagens divergentes de samambaias leptosporangiadas: as famílias Dennstaedtiaceae, Lindsaeaceae e Saccolomataceae são apresentadas. Expedições de campo foram realizadas desde 2012 em remanescentes florestais da região. Também foi realizada uma revisão completa da coleção do herbário VIC, cuja data de início é 1930, bem como de outras coleções online de herbários: F, IAN, NY, PH, RB, U, UC, UPCB, US, and WTU. Na região de Viçosa, existem seis táxons pertencentes a essas famílias: *Dennstaedtia cicutaria* e *Pteridium esculentum* subsp. *arachnoideum* (Dennstaedtiaceae); *Lindsaea lancea* var. *lancea*, *L. quadrangularis* subsp. *quadrangularis* e *L. stricta* var. *stricta* (Lindsaeaceae); e *Saccoloma elegans* (Saccolomataceae). Dentre esses táxons, apenas *L. quadrangularis* subsp. *quadrangularis* e *S. elegans* são endêmicos da Mata Atlântica brasileira; as demais estão amplamente distribuídas na região Neotropical. São apresentadas chaves, descrições, ilustrações, materiais examinados e comentários.

Palavras-chave: Mata Atlântica brasileira, Polypodiales, pteridófitas, sudeste do Brasil, taxonomia.

Introduction

At the end of the era in which the plant Classification Systems were mostly based on morphological data, Dennstaedtiaceae was considered a big family, comprehending three subfamilies (or tribes) and about 17 genera (Tryon & Tryon 1982, Kramer 1990). With the advent of molecular data, those subfamilies were raised to family-level, some families were created, and now the early-diverging leptosporangiate ferns are represented by Cystodiaceae (one genus), Dennstaedtiaceae with a stricter circumscription (11-12 genera), Lindsaeaceae (seven genera), Lonchitidaceae (one genus), Saccolomataceae (one or two genera), as well as the great Pteridaceae (+50 genera) (Smith *et al.* 2006, PPG I 2016, Shang *et al.* 2018, Schwartsburd *et al.* 2020).

Brazil is represented by Dennstaedtiaceae with eight genera and 26 species, Lindsaeaceae with one genus and 34 spp., Lonchitidaceae with one genus and one sp., and Saccolomataceae with one genus and nine spp., leaving Pteridaceae apart (which is subject to another paper) (Kramer 1957, Pena *et al.* 2020, Schwartsburd 2020, Schwartsburd & Pena 2020). In general, these plants present characters considered plesiomorphic that are typical of the early-diverging lineages of Polypodiales, such as solesnotelic rhizomes clothed with hairs or primitive scales, large, highly dissected leaves, the sori that are truly marginal and protected by inner and outer indusia, and trilete spores (Tryon & Tryon 1982, Kramer 1990, PPG I 2016, Schwartsburd *et al.* 2020).

Pteridium is spread all across the globe (except for Antarctic) and may be the one most important to mankind by if directly affects the local human populations: it behaves as a pioneer weed invading croplands; it spreads its underground rhizomes making it hard to be removed; it intoxicates the cattle and horses; and it also intoxicates humans, when ingested - some studies also pointed out the transmission of its toxins (the psilatoquinis) via cow milk (e.g., Tryon 1941, Evans 1976, Page 1976, Marrs *et al.* 2000, Martini-Santos *et al.* 2010, Oliveira *et al.* 2018, Schwartsburd *et al.* 2018).

In the State of Minas Gerais, Dennstaedtiaceae is represented by 14 species, Lindsaeaceae by 11 spp., and Saccolomataceae by three spp. (Pena *et al.* 2020 Schwartsburd 2020, Schwartsburd & Pena 2020, Schwartsburd 2022). Here, we present the taxonomic treatment of these families for the region of Viçosa, Minas Gerais State, Brazil, as part of the ongoing project on the Fern Flora of this region with fascicles in preparation and others already published: Miranda & Schwartsburd (2016 - Salviniales), Rabelo & Schwartsburd (2016 - Schizaeales), and Gonçalves da Silva & Schwartsburd (2017 - Polypodiaceae).

Material and methods

In the region of Viçosa, Minas Gerais State, Brazil, the remaining forest patches are classified as Semi-Deciduous Seasonal Forest (IBGE 2012). The local elevation ranges from 600 to 900 m.a.s.l. (pers. obs.), and the annual temperatures range from 5° to 30°C (INMET 2021).

We have been sampling the remnant forest patches since 2012. Specimens were collected and dried according to usual methods for fern collections (Windisch 1992) and then incorporated in herbarium VIC (acronyms following Thiers, continuously updated), with duplicates to be sent to other herbaria. We also fully reviewed the collection of herbarium VIC and collections of other herbaria online: F, IAN, NY, PH, RB, U, UC, UPCB, US, and WTU. Although the classification system adopted for the previous fascicles was based on an adaptation of Kenrick & Crane (1997) and Smith *et al.* (2006), we here adopt the system of PPG I (2016). Morphological terms are according to Lellinger (2002).

Results and Discussion

Dennstaedtiaceae, Lindsaeaceae, and Saccolomataceae, presented a total of four genera and six species occurring in the region of Viçosa. Four of those species have also infra-specific classifications, which were adopted here. The six taxa are: *Dennstaedtia cicutaria* (Sw.) T. Moore, and *Pteridium esculentum* subsp. *arachnoideum* (Kaulf.) J.A. Thomson (Dennstaedtiaceae); *Lindsaea lancea* (L.) Bedd. var. *lancea*, *L. quadrangularis* Raddi subsp. *quadrangularis*, and *L. stricta* (Sw.) Dryand. var. *stricta* (Lindsaeaceae); and *Saccoloma elegans* Kaulf. Among them, only *L. quadrangularis* subsp. *quadrangularis* and *S. elegans* are endemic to the Brazilian Atlantic Rainforest; the remaining taxa are widespread in the Neotropics. Differently from the other studied families: Salviniaceae (Miranda & Schwartsburd 2016); Anemiaceae (Rabelo & Schwartsburd 2016); Polypodiaceae (Gonçalves da Silva & Schwartsburd 2017), we have not recollected half of the taxa involved in this paper, which were collected on the 1930s and never again. Probably, they went locally extinct due to forest fragmentation and disturbance. We have not recollected *D. cicutaria*, *L. lancea* var. *lancea*, nor *L. quadrangularis* subsp. *quadrangularis*.

Key to taxa of Dennstaedtiaceae, Lindsaeaceae and Saccolomataceae from the region of Viçosa

1. Sori born at the tip of single veins
 2. Laminae 1-pinnate; sori along the laminar margins, parallel to each other *Saccoloma elegans* (Saccolomataceae)
 2. Laminae 3-pinnate-pinnatifid to 4-pinnate; sori born on sinuses of the segments *Dennstaedtia cicutaria* (Dennstaedtiaceae)
1. Sori born at the tip of multiple veins (on a commisural vein)
 3. Rhizomes with hairs; laminae 3-4-pinnate-pinnatifid *Pteridium esculentum* subsp. *arachnoideum* (Dennstaedtiaceae)
 3. Rhizomes with scales; laminae 1-2-pinnate (or rarely 3-pinnate) (Lindsaeaceae)
 4. Stipes abaxially terete, adaxially flattened *Lindsaea stricta* var. *stricta*
 4. Stipes quadrangular in cross section
 5. Stipes and rachises reddish-brown; sori interrupted *Lindsaea quadrangularis* subsp. *quadrangularis*
 5. Stipes proximally dark brown, stramineous above; rachises stramineous; sori not interrupted *Lindsaea lancea* var. *lancea*

Dennstaedtiaceae

Rhizomes generally long-creeping, solenostelic or rarely dictyostelic or polycyclic, bearing hairs or rarely with primitive scales. Leaves monomorphic; stipes often with epipetiole buds, usually with a omega-shaped vascular strand; laminae 2-5-pinnate, rarely less dissected; veins free or rarely anastomosing and then without included veinlets; indument formed by hairs or glandular hairs, or absent. Sori marginal or submarginal, linear or discrete, introrse or extrorse, protected by outer and/or inner indusia or rarely not protected; spores tetrahedral and trilete, or reniform and monolet (Smith *et al.* 2006).

The family is cosmopolitan, composed of eleven genera and ca. 270 species (PPG I 2016, Shang *et al.* 2018, Schwartsburd *et al.* 2020). The clade containing *Dennstaedtia*, *Leptolepia*, *Microlepia*, and *Oenotrichia* still needs recircumscriptions, due to a polyphyletic *Dennstaedtia* (Schwartsburd *et al.* 2020).

Dennstaedtia Bernh.

Rhizomes short to long-creeping, glabrous or with catenate hairs. Leaves large, to 4 m long; laminae 2-4-pinnate; veins free; indument formed by catenate hairs, acicular hairs, or absent; sori marginal, discrete, at the tip of single veins; inner and outer indusia fused into purse- or cup-shaped or hemi-globose indusia (Smith *et al.* 2006).

Dennstaedtia is polyphyletic in current circumscription (Schwartzburd *et al.* 2020), with about 70 species. In Brazil occur six species (Schwartzburd & Pena 2020), but there are probably about eight to ten species (pers. obs.).

Dennstaedtia cicutaria (Sw.) T. Moore, Index Fil. (T. Moore) 2: xcvi. 1857.

Figure 1 a-c

Plants terrestrial. Rhizomes long-creeping, with brownish catenate hairs. Leaves 1-3.5 m long; stipes 0.5-2.5 m long, proximally brown, lighter brown above, with acicular hairs or glabrescent; laminae 0.5-2 m long, proximally 3-pinnate-pinnatifid to 4-pinnate; rachises light brown, pilose, with brownish catenate hairs, without proliferous buds; basal pinnae 25-100 cm × 12-35 cm, subequilateral; pinnules sessile, lanceolate to oblong, margins dentate; costae abaxially and adaxially pilose, with light brown to reddish catenate hairs; costules abaxially and adaxially pilose, with light brown to reddish catenate hairs; veins free, abaxially and adaxially hirsute, with erect, light brown to reddish acicular hairs; laminar tissue between the veins abaxially and adaxially with catenate and acicular hairs; sori oblong or rounded, born at the tip of single veins, in sinuses of segments; indusia purse-shaped, commonly with acicular and catenate hairs.

Geographical distribution: Neotropical.

Specimens examined: BRAZIL. MINAS GERAIS: Viçosa: Agricultural College land, Horticultural Hill, 670 m, 7-VII-1930, *Y. Mexia 4846* (F, MO-n.v., U, UC, US); Escola Superior de Agricultura e Veterinária, base of Horticultural Hill, 668 m, 17-VII-1930, *Y. Mexia 4866* (IAN, F, U, UC, US, VIC, WTU); Escola Superior de Agricultura e Veterinária, I-1934, *J.G. Kuhlmann s.n.* (VIC-1309).

Dennstaedtia cicutaria is recognized by veins and laminar tissue between the veins densely with catenate and acicular hairs, indusia purse-shaped with acicular and catenate hairs.

Pteridium Gled. ex Scop., *nom. cons.*

Rhizomes long-creeping, with setose hairs. Leaves large, to 4.5 m long; laminae 3-5-pinnate; veins free; indument formed by catenate hairs, acicular hairs, arachnoid hairs, and/or minute gnarled hairs; sori marginal, linear, continuous along the laminar margins, born on commissural veins; inner indusia vestigial; outer indusia linear (Smith *et al.* 2006).

Two species plus two species with hybrid origin are currently recognized (Thomson 2012, Zhou *et al.* 2014, Schwartzburd *et al.* 2018, 2020). In addition, a total of ca. 20 morpho-taxa are also recognized as infra-specific entities, such as subspecies, varieties, forms, or combinations of more than one rank (e.g., Tryon 1941, Page 1976, Thomson 2012, Schwartzburd *et al.* 2018). In Brazil, the following taxa are currently recognized: *Pteridium caudatum* (L.) Maxon, *P. esculentum* subsp. *arachnoideum*, *P. esculentum* subsp. *campestre* (Schrad.) Schwartzb. & J. Prado, *P. esculentum*

subsp. *gryphus* Schwartsb., *P. esculentum* var. *harpianum* Schwartsb. & A. Yañez, and *P. esculentum* var. *paedomorphicum* Schwartsb. & J. Prado (Schwartzburd 2020). The most common taxon in southeastern Brazil is *P. esculentum* subsp. *arachnoideum*, which invades crops and is toxic for cattle, horses, and human ingestion (Schwartzburd *et al.* 2018).

Pteridium esculentum* subsp. *arachnoideum (Kaulf.) J.A. Thomson, *Telopea* 14: 45. 2012.

Figure 1 d-g

Plants terrestrial, ticket-forming. Rhizomes long-creeping, with ciliform hairs. Leaves 1.5-4.5m long; stipes 0.75-2.5 m long, proximally dark brown, stramineous above, glabrous; laminae 0.75-2.5m m long, proximally 3-4-pinnate-pinnatifid; rachises stramineous, glabrous; basal pinnae 60-100 × 25-70cm, equilateral; pinnae and pinnules distally with free lobes between the segments; compound distal segments inequilateral, irregularly dissected, caudate at apex; simple distal segments linear, up to 3(-4) cm long; costae abaxially with reddish catenate hairs, adaxially glabrous; costules abaxially with reddish catenate hairs, adaxially glabrous; veins abaxially lanose, with lax, arachnoid hairs, adaxially glabrous; laminar tissue between the veins abaxially and adaxially glabrous; sori marginal, linear, along segment margins, born at the tip of multiple veins; inner indusia vestigial; outer indusia linear.

Geographical distribution: Neotropical.

Specimens examined: BRAZIL. MINAS GERAIS: Viçosa: Entre Viçosa e Visconde do Rio Branco, 11-V-2013, *P.B. Schwartzburd et al.* 2837 (VIC); idem, 11-V-2013, *P.B. Schwartzburd et al.* 2838 (VIC); State Agricultural School, 24-II-1957, *H.S. Irwin* 2721 (F, TEX-n.v., UC, US, VIC); Escola Superior de Agricultura e Veterinária, 1943, *P. Alvin s.n.* (VIC-3537); Universidade Federal de Viçosa, Fazendinha, 11-IX-1977, *Rosane & Rosângela s.n.* (VIC-7962, 7963, 7964, 7965); idem, Mata do Paraíso, Trilha dos Alpes, 9-II-2017, *P.B. Schwartzburd et al.* 3877 (VIC); idem, Mata do Paraíso, Trilha dos Alpes, 9-II-2017, *P.B. Schwartzburd et al.* 3879 (VIC); idem, Mata da Biologia, 27-III-2019, *N.T.L. Pena et al.* 783 (VIC); idem, Mata da Biologia, 27-III-2019, *N.T.L. Pena et al.* 784 (VIC).

Pteridium esculentum subsp. *arachnoideum* is recognized by the pinnae and pinnules distally with free lobes between the segments, veins abaxially with arachnoid hairs, and glabrous laminar tissue between the veins. The outer indusia is always present, even in sterile leaves.

Lindsaeaceae

Rhizomes short to long-creeping, protostelic with internal phloem, or rarely solenostelic, bearing basally attached, nonclathrate scales or hairs. Leaves monomorphic; laminae simple to 3-pinnate or rarely more dissected; veins usually free, occasionally anastomosing and then without

included veinlets; indument generally absent or formed by 2-celled glandular hairs. Sori marginal or submarginal, extrorse, elongate to linear, protected by outer (not modified) and inner (modified) indusia; spores tetrahedral and trilete, or rarely bilateral and monolet (Smith *et al.* 2006).

***Lindsaea* Dryand. ex Sm.**

Rhizomes short-creeping, with primitive scales. Leaves small to medium-sized, ca. 20 cm to 1 m long; laminae simple to 3-pinnate; indument absent or formed by 2-celled glandular hairs; veins generally free; sori marginal or submarginal, elongate, born on commissural veins; inner indusia modified, elongate; outer indusia not modified (Smith *et al.* 2006).

About 180 species, with 34 spp. occurring in Brazil (Kramer 1957, PPG I 2016, Pena *et al.* 2020).

***Lindsaea lancea* (L.) Bedd. var. *lancea*, Suppl. Ferns S. Ind. 6.: 292. 1876.**

Figure 2 a-d

Plants terrestrial. Rhizomes short-creeping, with dark brown, lanceolate scales. Leaves 30-50 cm long; stipes 15-25 cm long, dark brown proximally, stramineous above, quadrangular, proximally with dark brown, acuminate scales and sparse 2-celled glandular hairs; laminae 15-25 cm long, 2-pinnate; rachises not winged, stramineous, with sparse 2-celled glandular hairs; basal pinnae 10-15cm × 2.5-3.5cm equilateral; pinnules petiolulate, dimidiate, 1.5-2 cm long; costae abaxially and adaxially with sparse 2-celled glandular hairs or glabrescent; veins abaxially and adaxially glabrous; laminar tissue between the veins abaxially and adaxially glabrous; sori continuous, born at the tip of multiple veins; inner indusia membranaceous to papyraceous, the margins entire, wavy, glabrous.

Geographical distribution: Neotropical.

Specimens examined: BRAZIL. MINAS GERAIS: Viçosa, 1930, *Y. Mexia 4639-a* (GH-n.v., UC, US, VIC).

All *Lindsaea* spp. from Viçosa are similar in having 2-pinnate laminae and dimidiate pinnules. *Lindsaea lancea* var. *lancea* differs from the other two by having continuous sori; *L. quadrangularis* subsp. *quadrangularis* differs from the other two by having reddish-brown, winged rachises; and *L. stricta* var. *stricta* differs from the other two by having petioles that are terete abaxially. In addition, pinnule lengths are different between the three taxa: 1.5-2 cm in *L. lancea* var. *lancea*, 1.2-1.5 cm in *L. quadrangularis* subsp. *quadrangularis*, and to 1 cm in *L. stricta* var. *stricta*.

Lindsaea quadrangularis Raddi subsp. *quadrangularis*, Opusc. Sci. 3: 294. 1825.

Figure 2 e-h

Plants terrestrial. Rhizomes short-creeping, with light brown, lanceolate scales. Leaves 40-75 cm long; stipes 25-40 cm long, entirely reddish-brown, quadrangular, proximally with light brown, acuminate scales and sparse 2-celled glandular hairs; laminae 20-40 cm long, 2-pinnate; rachises winged, reddish-brown, with sparse 2-celled glandular hairs; basal pinnae 10-18 × 2-3 cm; pinnules short-petiolulate, dimidiate, 1.2-1.5 cm long; costae abaxially and adaxially with sparse 2-celled glandular hairs; veins abaxially and adaxially glabrous; laminar tissue between the veins abaxially with sparse 2-celled glandular hairs, adaxially glabrous; sori interrupted, born at the tip of multiple veins; indusia membranaceous, the margin dentate, glabrous.

Geographical distribution: endemic to the Brazilian Atlantic Forest.

Specimens examined: BRAZIL. MINAS GERAIS: Viçosa: Agricultural College lands, Hillside of Cha-Cha Valley, 1-III-1930, *Y. Mexia 4410-a* (UC, US-*n.v.*); s.l., 1935, *J.G. Kuhlmann s.n.* (VIC-1894).

Lindsaea stricta (Sw.) Dryand. var. *stricta*, Trans. Linn. Soc. London 3: 42. 1797.

Figure 3 a-d

Plants terrestrial. Rhizomes short-creeping, with dark brown, lanceolate scales. Leaves 35-80 cm long; stipes 15-50 cm long, dark brown proximally, stramineous above, abaxially terete, adaxially flattened, proximally with dark brown, acuminate scales; laminae 20-35cm long, 2-pinnate or rarely 1- or 3-pinnate; rachises not winged, stramineous, with sparse 2-celled glandular hairs or glabrescent; basal pinnae 12-25 cm × 1-2 cm; pinnules short-petiolate, dimidiate or flabellate, to 1 cm long; costae abaxially and adaxially with sparse 2-celled glandular hairs or glabrescent; veins abaxially and adaxially with sparse 2-celled glandular hairs or glabrous; laminar tissue between the veins abaxially and adaxially with sparse 2-celled glandular hairs or glabrous; sori interrupted, born at the tip of multiple veins; inner indusia membranaceous, the margins dentate, glabrous.

Geographical distribution: Neotropical.

Specimens examined: BRAZIL. MINAS GERAIS: Viçosa: road to Cajurí, Moro Grande, 750 m, 7-I-1931, *Y. Mexia 5486* (B-*n.v.*, BM-*n.v.*, C-*n.v.*, F, G-*n.v.*, GH-*n.v.*, K-*n.v.*, MO-*n.v.*, NY-*n.v.*, PH-*n.v.*, S-*n.v.*, TEX-*n.v.*, U-*n.v.*, UC, US, VIC); Silvestre, 10-IV-1999, *M.G. Bovini 1624* (VIC); Universidade Federal de Viçosa, Mata da Silvicultura, em direção ao Cristo, 740 m, 20°46'S, 42°52'W, 31-X-2014, *P.B. Schwartsburd et al. 3421, 3423* (VIC); idem, Mata do Paraíso, Trilha dos Alpes, 9-II-2017, *P.B. Schwartsburd et al. 3881* (VIC); idem, Recanto das Cigarras, 8-VII-2019, *N.T.L. Pena et al. 1049* (VIC).

Saccolomataceae

Rhizomes erect or rarely short-creeping, sometimes forming small trunks, dictyostelic, bearing peltate scales. Leaves monomorphic; stipes with an omega-shaped vascular strand; laminae 1-4-pinnate; veins free; indument formed by caduceus scales or rarely by scattered catenate hairs. Sori marginal or submarginal, discrete, extrorse, protected by outer (not modified) and inner (modified) indusia; spores tetrahedral-globose and trilete (Smith *et al.* 2006).

One pantropical genus with about 24 species (Rojas-Alvarado 2010, Luong *et al.* 2015, Schwartzburd 2020, Schwartzburd 2022). The adoption of genus *Orthiopteris* for the Paleotropical species is phylogenetically justified, but lacks morphological support; thus, regarding only *Saccoloma* in Saccolomataceae is more convenient (Schwartzburd 2022). In Brazil, nine species are currently recognized (Schwartzburd 2022).

Saccoloma Kaulf.

Saccoloma elegans Kaulf., Berlin. Jahrb. Pharm. Verbundenen Wiss. 21: 51. 1820.

Figure 1 e-l

Plants terrestrial. Rhizomes erect to decumbent, stout to trunk-like, glabrescent; leaves 1.2-2.2 m long; petioles proximally burgundy, stramineous above, 40-80 cm long, proximally wrinkled to minutely spiny; petiolar scales peltate, blackish, with or without lighter, dentate margins; laminae 1-pinnate 80-140 cm long; rachises stramineous, glabrous; basal pinnae 15-25 × 2.5-3.5 cm; costae abaxially and adaxially glabrous; veins commonly 1-furcate, rarely simple or 2 or 3-furcate (at the base of pinnae), abaxially and adaxially glabrous; sori marginal, discrete, born at the tip of single veins, placed side by side, opening extrorsely; outer indusia not modified; inner indusia hemi-umbonate, commonly forming wings connecting adjacent sori.

Geographical distribution: Endemic to the Brazilian Atlantic Forest, from Pernambuco to Santa Catarina.

Specimens examined: BRAZIL. MINAS GERAIS: Viçosa: Estrada São Miguel-Viçosa [Road to São Miguel], 25-IV-1930, *Y. Mexia* 4639 (F, IAN, MO-*n.v.*, NY, PH, VIC, UC, US); Escola Superior de Agricultura e Veterinária, s.d., *Y. Mexia* 4964 (MO-*n.v.*, NY, US, VIC); woods on slope, 710 m, 6-X-1930, *Y. Mexia* 5385-*a* (UC-2 sheets); Viçosa-Coimbra, km 120, Sítio Bom Sucesso, 13-IX-2002, *G.E. Valente & M.L. Batista* 1071 (VIC); Mata do Seu Nico, 20°47'S, 42°51'W, 800 m, 6-XI-2012, *P.B. Schwartzburd & E. Guatimosin* 2618 (NY, RB, UPCB, VIC).

Saccoloma elegans is recognized by the 1-pinnate laminae and the discrete sori placed side by side, opening extrorsely.

Acknowledgements

We thank Universidade Federal de Viçosa (UFV) and Programa de Pós-Graduação em Botânica; the Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG) for the PhD scholarship to Nelson Túlio Lage Pena; the International Association for Plant Taxonomy (IAPT) for the “Grant 2020” to Nelson Túlio Lage Pena; the students and staff at Herbarium VIC; and Reinaldo Pinto for the illustrations.

Author Contributions

Nelson Túlio Lage Pena: Substantial contribution in the concept and design of the study; Contribution to data collection; Contribution to data analysis and interpretation; Contribution to manuscript preparation.

Pedro Bond Schwartzburd: Substantial contribution in the concept and design of the study; Contribution to critical revision, adding intellectual content.

Conflicts of interest

There is no conflict of interest.

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Editora Associada: Regina Yoshie Hirai
Submissão: 01/05/2022
Aceite: 15/11/2022

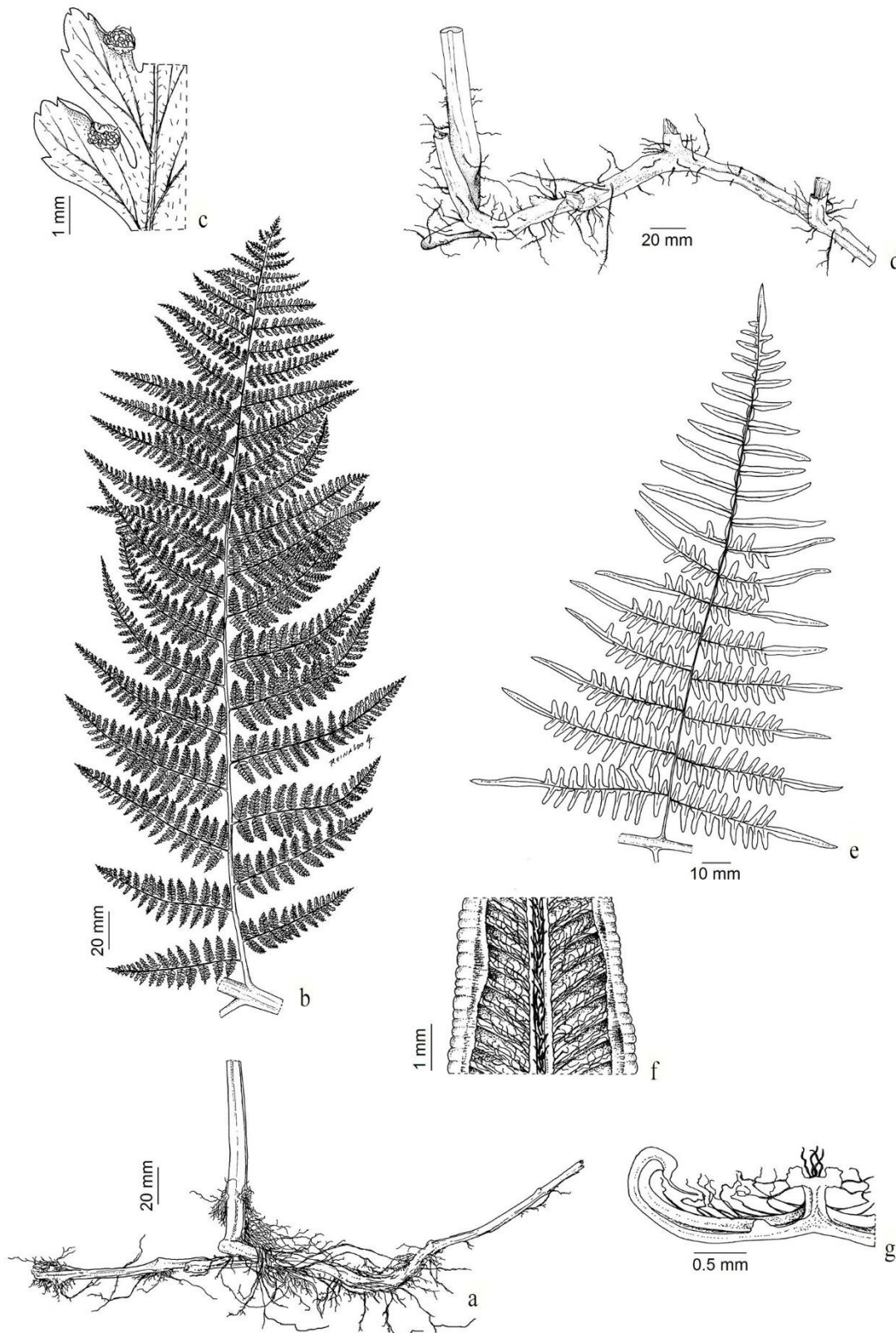


Figure 1. a-c. *Dennstaedtia cicutaria* (Sw.) T. Morre. a. rhizome. b. basal pinna. c. segments, abaxially, showing indument and sori. d-g. *Pteridium esculentum* subsp. *arachnoideum* (Kaulf.) J.A. Thomson. d. rhizome. e. pinna. f. segment, abaxially, showing indument and sori. g. segment in cross section, showing indument and outer indusium (abaxial surface up).

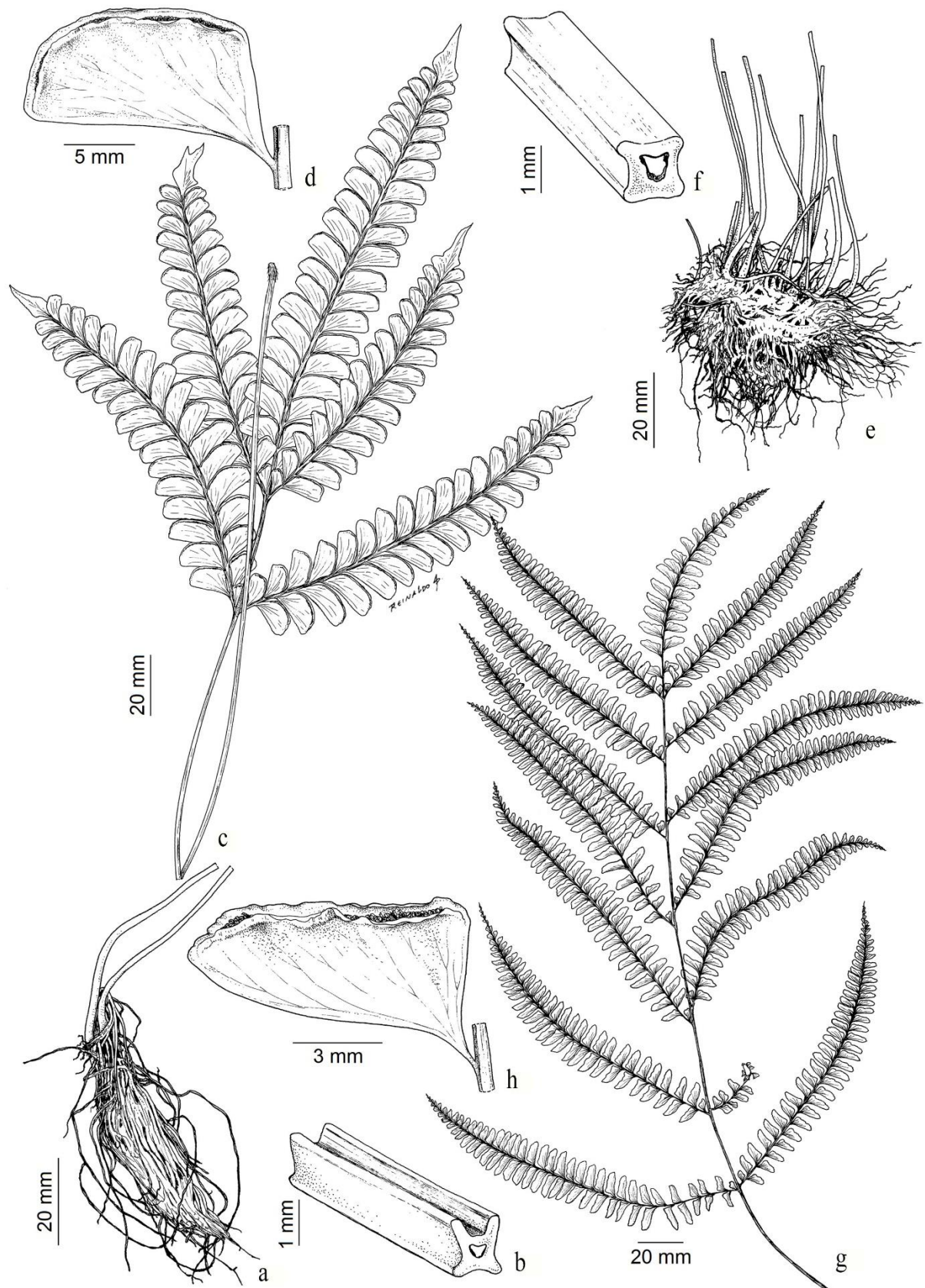


Figure 2. a-d. *Lindsaea lancea* (L.) Bedd. var. *lancea*. a. rhizome. b. petiole, in cross section. c. leaf. d. pinnule, abaxially, showing sorus. e-h. *Lindsaea quadrangularis* Raddi subsp. *quadrangularis*. e. rhizome. f. petiole, in cross section. g. leaf. h. pinnule, abaxially, showing sorus.

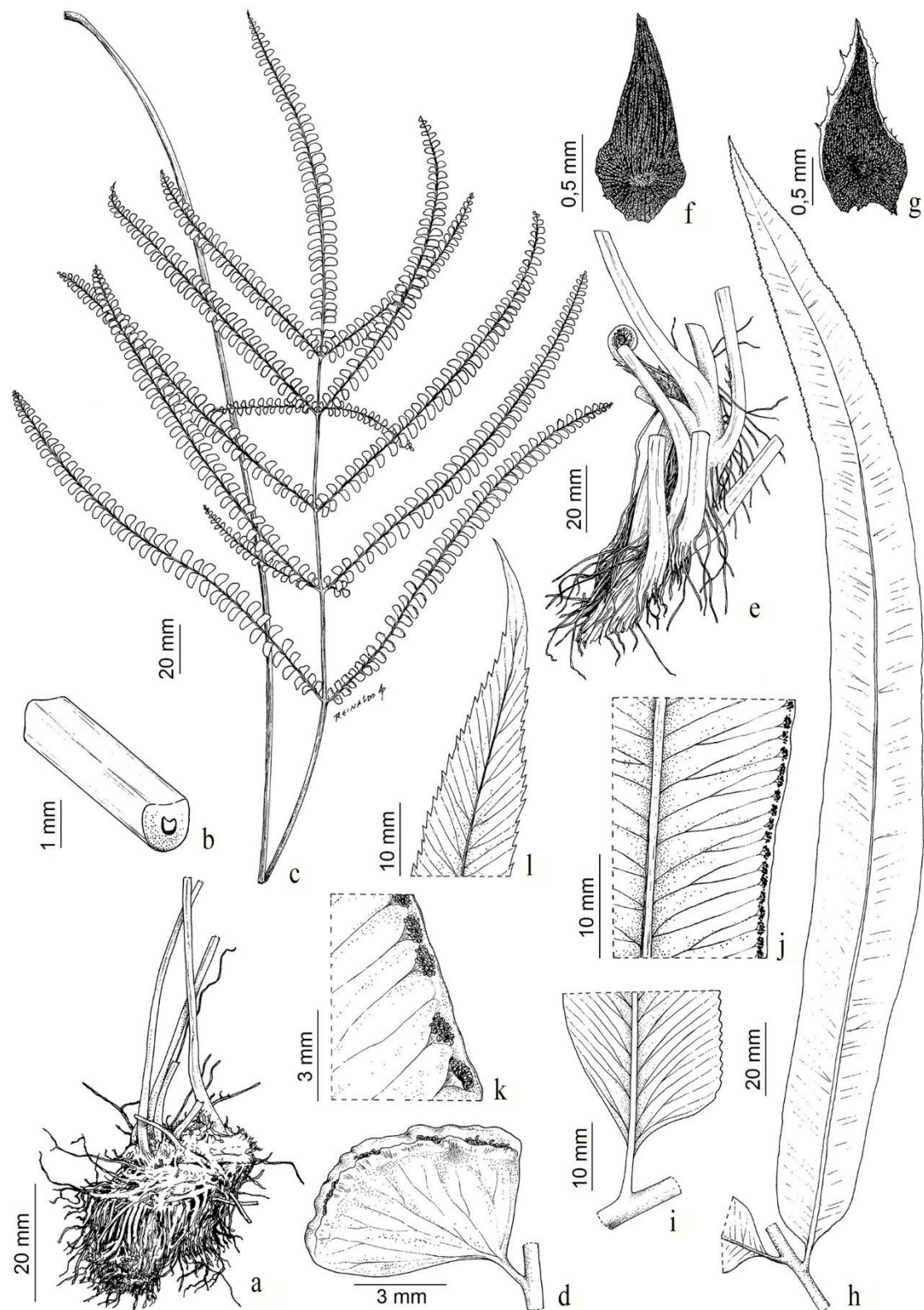


Figure 3. a-d. *Lindsaea stricta* (Sw.) Dryand. var. *stricta*. a. rhizome. b. petiole, in cross section. c. leaf. d. pinnule, abaxially, showing sori. e-l. *Saccoloma elegans* Kaulf. e. rhizome. f. and g. petiolar scales. h. medium pinna. i. base of pinna. j. pinna, abaxially, showing venation pattern. k. pinna, abaxially, showing sori. l. apex of pinna.

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