



ECOSYSTEMS

Amauropelta yabotiensis (Thelypteridaceae), a new species from Biosphere Yabotí Reserve (Misiones, Argentina) and its taxonomic relationships

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Abstract: The Yabotí Biosphere Reserve (Prov. Misiones, Argentina) with 221,155 ha, represents one of the southernmost relicts of the Paranaense forest. Currently, a project is being developed in the area to inventory and describe the ferns and lycophytes. As a result of these studies, we identify a new species of *Amauropelta*, *A. yabotiensis*. Within this genus, it belongs to the group of species with uncinat hairs and presents a unique combination of diagnostic features, including the type of pubescence on the rhizome scales, the shape of the fronds and segments and type of venation. Here, we described and illustrated the species and we analyzed its taxonomic affinities and geographic distribution. Additionally, we provided a distribution map and a key to distinguish it from other *Amauropelta* species from Misiones province. With this new finding, we highlighted the importance of the Yabotí Reserve as a reservoir of biodiversity in the region.

Key words: *Amauropelta*, floristic, Paranaense forest, Southern Cone, taxonomy, *Thelypteris*.

INTRODUCTION

Amauropelta Kunze is a genus of Thelypteridaceae that comprises about 215 species, mainly distributed in tropical and subtropical America, with some species from Africa, Madagascar, Sri Lanka, and Polynesia (PPG I 2016, Almeida et al. 2016). The genus is distinguished by laminae with gradually, or sometimes, abruptly reduced proximal pinnae, the basalmost pairs often small, hastate, auriculate or glanduliform; adaxial grooves of petioles and rachises frequently hairy; basal pairs of veins reaching the margin above the sinuses; reticulate spore ornamentation, and a base chromosome number of $x = 29$.

Although long treated as a subgenus of *Thelypteris* Schmidel in several systematic and

floristic works (Smith 1983, Tryon & Tryon 1982, Smith 1992, Ponce 1998), we now follow the scheme of Pichi Sermolli (1977), PPG I, and other recent accounts in recognizing *Amauropelta* at generic rank. Recent phylogenetic studies carried out in Thelypteridaceae based on molecular and morphological data (Smith & Cranfill 2002, Alvarez-Fuentes 2010, Almeida et al. 2016) support the monophyly of *Amauropelta*. In this large and heterogenous genus, Smith (1974) observed several morphological variants and recognized nine sections within *Thelypteris* subg. *Amauropelta*: *Adenophyllum* A. R. Sm., *Amauropelta* A. R. Sm., *Apelta* A. R. Sm., *Blennocaulon* A. R. Sm., *Blepharitheca* A. R. Sm., *Lepidoneuron* A. R. Sm., *Pachyrachis* A. R. Sm., *Phacelothrix* A. R. Sm., and *Uncinella* A.

R. Sm. These sections are based on rhizome habits, the presence, type, and distribution of trichomes, laminae shapes, form and number of proximal pinnae, the presence of aerophores and buds, and soral and indusial types. In this study, Smith highlighted the diagnostic value of uncinete trichomes (Smith 1974, Fig. B, pg. 85) and grouped the species that bear them in sect. *Uncinella*.

Of 32 *Amauropelta* species known from southeastern South America (S-SE Brazil, Paraguay, Uruguay, and Argentina) 16 belong to the group with uncinete trichomes (Ponce 1995, 2007, 2016, Salino & Semir 2004, Paixão 2013).

Amauropelta is the most species-rich genus of Thelypteridaceae in Argentina. Until now, 20 taxa were registered in this country, predominantly in the subtropical region; six are exclusively from northwestern Argentina and six occur only in the northeast part of the country (Ponce 1998, 2016). In total, including species with broad distributions, there are 10 species of *Amauropelta* in the northeast (Ponce & Zanotti 2018).

The Yabotí Biosphere Reserve is located in Provincia Misiones Northeastern Argentina (26°37'–27°12'S and 53°40'–54°18'W), and covers 221.155 ha. This reserve contains one of

the southernmost relictual fragments of the Paranaense forest (Fig. 1a). Ongoing efforts to document fern and lycophyte diversity in the Yabotí Biosphere Reserve have recently included field trips to less-explored areas of the reserve, in efforts to document previously overlooked taxa (Kelly et al. 2019). These expeditions have resulted in an improved understanding of the fern diversity of the area, and new records for Argentina have been discovered (Yañez et al. 2011, Marquez et al. 2016, 2020). The current contribution describes and illustrates a species of *Amauropelta* new to science and found in the core area (Parque Provincial Esmeralda) of Yabotí Biosphere Reserve. We compare this newly recognized taxon with morphologically similar species and those from the same region of South America, as well as examine its taxonomic affinities.

MATERIALS AND METHODS

Study area

Esmeralda Provincial Park, Dep. San Pedro, Prov. Misiones, Argentina (26°50'S, 54°02'W). In February of 2018, we explored the southern portion of the Yabotí-miní stream, which borders the southwestern limits of the reserve

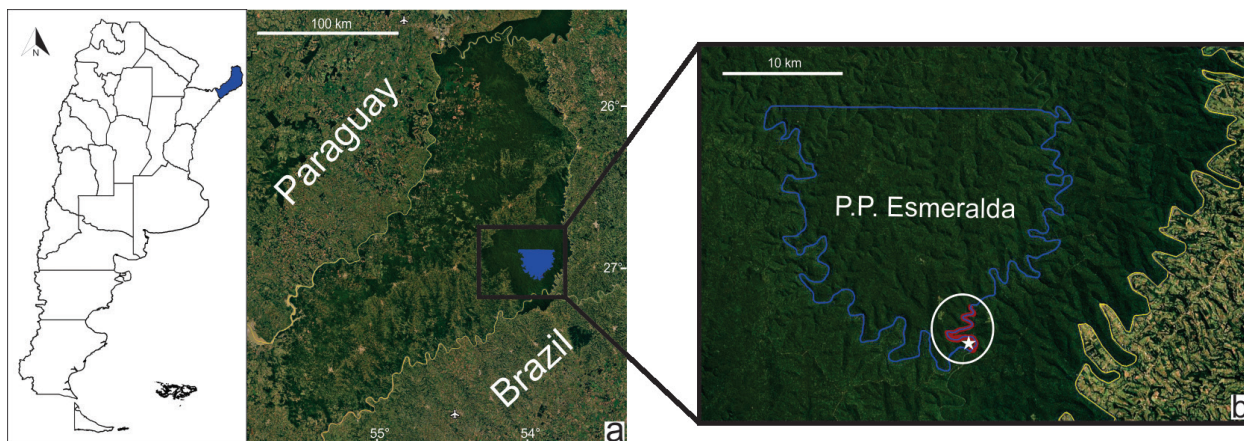


Figure 1. Study area. a. Black square = Yabotí Biosphere Reserve; b. Detail of Esmeralda Provincial Park, surveyed area of the Yabotí-miní river colored in red within white circle. The star indicates the type locality.

(Figure 1). The vegetation is characterized by semi-deciduous subtropical forest, and the predominant climate is subtropical without a dry season, with annual precipitation of 2500 mm and average temperatures of 22°C.

Specimens examined

We collected the specimens studied during the aforementioned expedition, and we prepared herbarium samples with standard techniques and deposited it in LP (Museo de Ciencias Naturales de La Plata), SI (Instituto de Botánica Darwinion) and MO (Missouri Botanical Garden) (Thiers 2020).

In order to identify the new-found specimens, we compared *Amauropelta* species that occur in Argentina and neighboring areas (South and Southeastern Brazil, Bolivia, Paraguay, Uruguay) using floristic and taxonomic works from Argentina (Ponce 2016), Brazil (Salino & Semir 2004, Ponce 1995, 2007, Paixão 2013) and Bolivia (Smith & Kessler 2017), as well as local floras of Misiones (Kelly et al. 2019). We also examined other morphologically similar taxa from elsewhere in the Neotropics.

The main set for the comparative study included the specimens of *Amauropelta* that most resemble the unidentified material, housed in BA, LP, and SI. We also consulted types and additional images available in JSTOR and collection databases of B, G, M, MBM, NY, P, and UC.

A complete list of the specimens examined is reported in Appendix 1.

Morphological comparisons

For comparative analyses and to discriminate among taxa, we examined diagnostic characters such as rhizome type and form, color, texture, and indument of the rhizome scales, lamina type and division, pinnae and segments tips and margin, type and distribution of the trichomes, aerophores and buds presence/absence,

position and size of the sori and indusia, and spore ornamentation, on representative herbarium specimens. The spores were studied without previous chemical treatment using light microscope (LM) at 100× magnification.

We followed Stearn (1992) and Lellinger (2002) for the terminology used.

Conservation status

We evaluated the conservation status of the new species following the guidelines and threat categories defined by the IUCN.

RESULTS

Taxonomic treatment

Amauropelta yabotiensis Ponce & Yañez, sp. nov. (Figures 2, 3).

Type. Argentina. Prov. Misiones: Depto. San Pedro, Parque Provincial Esmeralda (27°3'10.8"S, 53°52'47.3"W), borde de arroyo Yabotí-Miní, 21/2/2018, G. J. Marquez et al. 563 (holotype: LP!; isotypes: SI!, MO!).

Diagnosis. Differs from *Amauropelta recumbens* by the distal portion of the petioles, abaxial rachis, and laminar tissue glabrous; whitish acicular or setiform trichomes on the adaxial surface of the rachis, adaxial costae, and indusia; the triangular-lanceolate pinnae with basally elongate and auriculate-crenate segments; lack of aerophores; absence of laminar buds (vs. petioles, rachis, costae, laminar tissue, and indusia abaxially with uncinete trichomes; elliptic-lanceolate pinnae with shortened basal segments, aerophores present; laminar buds present in *Amauropelta recumbens*).

Description: Plants herbaceous. **Rhizomes** robust, creeping to decumbent, 13–16 mm diam, with scales 7–8 mm long, these brownish, subclathrate, linear–lanceolate, with entire margins, abaxial face densely pubescent with

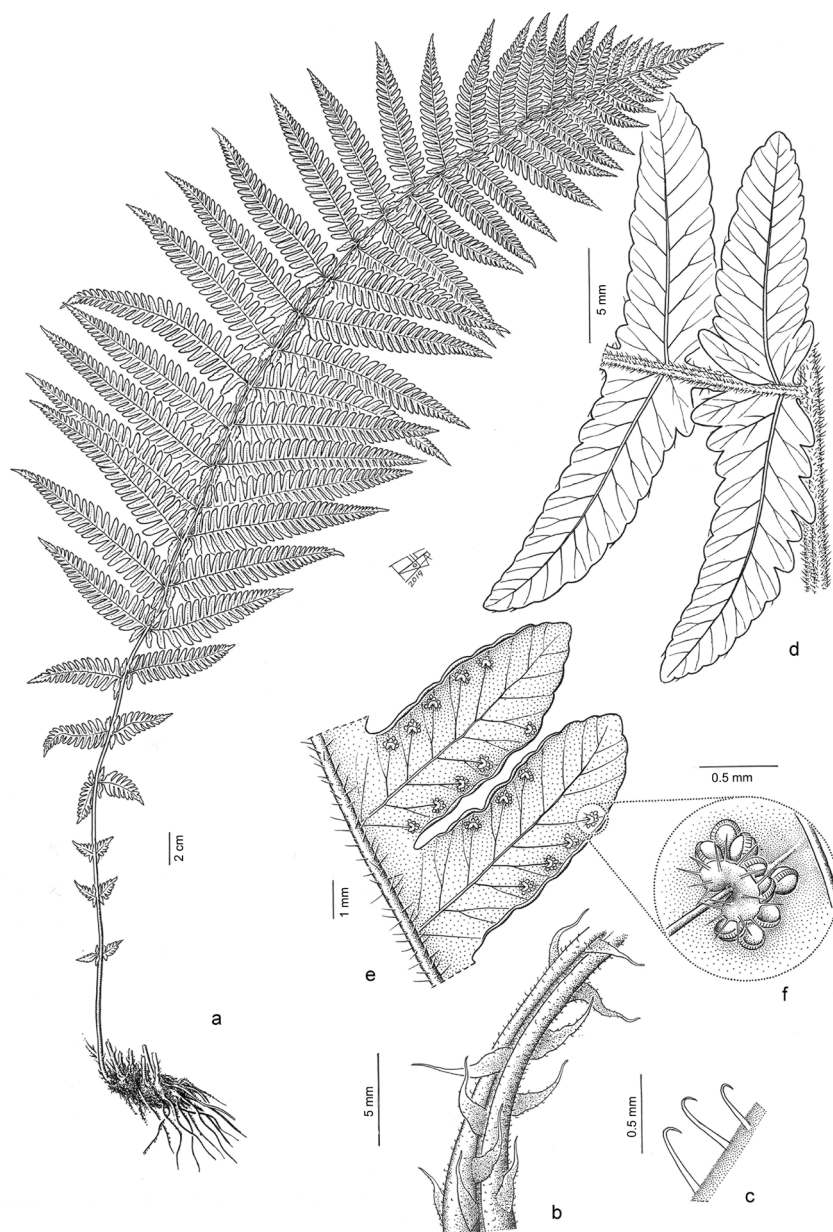


Figure 2. *Amauropelta yabotiensis* Ponce & Yañez sp. nov. a. General aspect. b. Proximal portion of the petiole. c. Uncinate trichomes of the petiole. d. Adaxial side of the two pairs of basal segments. e. Abaxial side of fertile segments. f. Detail of sorus and sporangium.

uncinate, white trichomes. **Fron**ds fasciculate, 60–100 cm. **Petioles** 5–8.5 × 0.3 cm, dark brown, with minute uncinat

reaching the costae, lamina apex gradually reduced. Rachises stramineous, darkened towards the base, adaxially sulcate, grooves densely hairy, with whitish acicular trichomes, trichomes slightly antrorse, rachises abaxially smooth and glabrous, scales absent. **Pinnae** 24–30 pairs, middle pinnae 8–14 × (0.8–)1.5–3.5 cm, sessile, middle and distal ones ascending, proximal ones generally sub-reflexed or

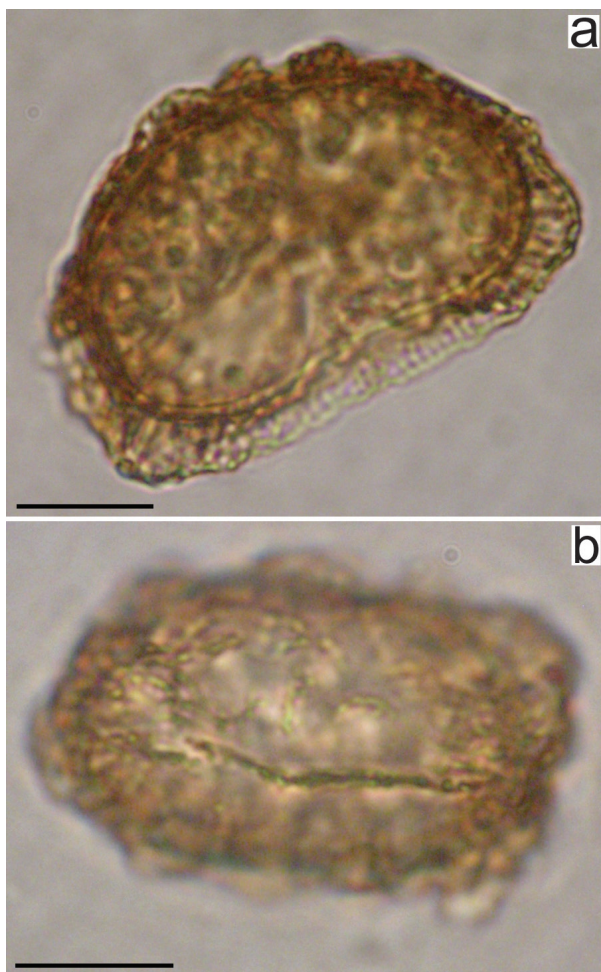


Figure 3. Spores of *A. yabotiense* as seen with a light microscope at 100× magnification. **a.** Equatorial view. **b.** Distal view.

reflexed, triangular-lanceolate, with truncate base and acute apex, (4–)6–8 pairs of proximal pinnae sub-abruptly reduced; pinnae with hastate to auriculate segments towards laminar base, without vestigial proximal pinnae; costae adaxially with acicular, antrorse trichomes, abaxially with sparse, thin acicular trichomes.

Segments 10–20 pairs per pinna, to 1–2.4 × 0.3–0.5 cm, oblong, adnate, slightly decurrent to the costa, opposite at the pinna bases, alternate at the apices, ascending, with crenate or serrate margins, occasionally entire, apices acute or somewhat apiculate; proximal segments longer or equal to distal segments on the same pinna

(never smaller), notably crenate margin, the middle pinnae usually with an acroscopic auricle; costulae adaxially glabrous, abaxially with very sparse, thin, whitish acicular trichomes; veins usually furcate on the largest fronds, usually simple on smallest fronds, those of the proximal segments ending on each pinna above the sinus; laminar tissue between veins glabrous on both surfaces. **Sori** submarginal, round, with indusia orbicular, densely hairy, hairs acicular or setiform, whitish, without glandular trichomes; sporangia glabrous; spores monolete, polar diameter 20–27.4 μm, major equatorial diameter 36.6–41.1 μm, minor equatorial diameter 19.1–22.1 μm, elliptic at polar view, ornamented with folds.

Distribution, habitat, and conservation status. The species grows in the understory of humid forest and is known only for the type locality, in Esmeralda Provincial Park. According to the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2019, section 8.1), if a taxon is only known from its type locality and there is no information on its current status or possible threats, the taxon should be listed as DD (Data Deficient). Because the type locality of *A. yabotiensis* is located in a hard-to-reach area within a protected reserve, is probably not under threat of anthropogenic nature. However, it is necessary to better study its distribution to consider applying any of the criteria proposed by the IUCN.

Phenology. Fertile material was collected in February.

Etymology. The name of the new species refers to the protected area where it was found.

Morphological comparisons

The comparative analysis shows that there are ten species with morphologically similar characters to the new species from northeastern Argentina. In general, they are species that inhabit neighboring areas of southern and

southeastern Brazil, Bolivia, Paraguay and Uruguay, and northeastern Argentina, although a few also have a wide distribution (Table I).

Among these, three tropical and subtropical (extra-Argentinean) species have gross morphology similar to *A. yabotiensis*: *A. eriosorus* (Fée) Salino & T.E. Almeida, *A. patula* (Fée) Salino & T.E. Almeida [= *Thelypteris glaziovii* (Christ) C.F. Reed] (Salino et al. 2020), and *A. pteroides* (Klotzsch) A.R. Sm. The last two species belong to sect. *Lepidoneuron* that is characterized by the abruptly reduced to vestigial proximal pinnae. These species resemble *A. yabotiensis* in having large fronds, similar appearance of proximal pinnae, and veins sometimes bifurcate; but they are substantially different. *Amauropelta eriosorus* differs from *A. yabotiensis* by possessing setiform trichomes on the rhizome scales and on both sides of the laminar tissue (vs. uncinata trichomes on rhizome scales and glabrous laminar tissue). *Amauropelta patula* presents setiform trichomes on whole petiole and laminar tissue, the pinnae and ultimate segments inserted into the rachis or costae by a narrowed base, and the proximal segments are slightly smaller than the ones (vs. distal part of petiole and laminar tissue glabrous, adnate segments, generally ascending pinnae and ultimate segments, and proximal segments equal or larger than the adjacent in *A. yabotiensis*). Additionally, *A. patula* has mammilla-like aerophores at the pinna bases. *Amauropelta pteroides* differs from *A. yabotiensis* in having larger and semi-scandent fronds, the ultimate segments gradually reduced toward the pinna bases, trichomes setose on rhizome scales (never trichomes uncinata) and lanceolate scales on abaxial costae.

Another similar species is *Dryopteris organensis* Rosenst., that was included within Thelypteridaceae by Ching (1941, under *Thelypteris organensis* (Rosenst.) Ching), and by Smith (1974) under sect. *Adenophyllum*. This

is a little-known taxon from southeastern Brazil and its relatives need a taxonomic revision. It resembles *A. yabotiensis* in the shape and size of the fronds and in having falcate segments. But in *T. organensis* the segments at the pinna bases are not or only somewhat enlarged, aerophores are present abaxially at the pinna bases, and the sori bear small indusia that are long-ciliate (vs. elongate and sometimes auriculate basal segments, aerophores absent, and indusia minutely hairy in *A. yabotiensis*).

Among the *Amauropelta* species from southeastern South America that bear uncinata trichomes, *A. pleiophylla* (Sehnem) Salino & T.E. Almeida has uncinata trichomes only on petioles and rhizome scales like *A. yabotiensis*, but differs by having long, pluricellular, sericeous trichomes covering the petioles, and ultimate segments that are 6–7 mm long (vs. petiole base glabrous and ultimate segments to 2.4 cm long in *A. yabotiensis*).

In the same eco-region of South America including Argentina, Paraguay and South Brazil, there are five *Amauropelta* species have uncinata trichomes, resemble *A. yabotiensis*: *A. amambayensis* (Christ) Salino & A. R. Sm., *A. regnelliana* (C. Chr.) Salino & T.E. Almeida, *A. recumbens* (Rosenst.) Salino & T.E. Almeida, *A. rivularioides* (Fée) Salino & T.E. Almeida, and *A. burkartii* (Abbiatti) Salino & T.E. Almeida. Excluding *A. burkartii*, which is absent in Misiones and known only from Buenos Aires and Entre Ríos (Argentina) and Rio Grande do Sul (Brazil), differences between these species and *A. yabotiensis* are presented in a key practically propose for all species of *Amauropelta* of Misiones (Argentina). *A. burkartii* mainly differs from *A. yabotiensis* by the narrower laminar (to 0.15 m) and glabrous indusia.

Finally, we arrive at the two species with trichomes uncinata most similar to *A. yabotiensis* are *A. rivularioides* and *A. recumbens*. The

Table 1. List of Amauropelta species morphologically resembling *A. yabotiensis* and their distribution in South America. E=East, CE=Center-east, CS=Center-south, CW=Center-west, S=South, SE=Southeast, NE=Northwest. (*) 1. Size ranges. 2. Form of attachment to the costa. 3. Form of the most basal segments.

	Frond size	Frond shape	Laminae division	Aerophores	Proximal pinnae	Pinnae and segments orientation	Segments(*)	Venation	Indument	Indusia shape and indument	Laminar buds	Distribution
<i>A. yabotiensis</i>	0.60-1 x 0.15-0.30 m.	Elliptic to elliptic-lanceolate.	Pinnate-pinnatifid.	Absent.	(4-)6-8 pairs sub-abruptly reduced, the basalmost auriculiform. Vestigial absent.	Generally ascending.	10-25 x 3-5 mm Adnate Basal, equal or larger than the adjacent. Elongate and sometimes auriculate.	Simple or furcate on the largest fronds.	Trichomes uncinatate on rhizome scales and petiole base. Trichomes acicular on axes.	Orbicular, minutely, with trichomes acicular or setiform.	Absent.	NE Argentina.
<i>A. amambayensis</i>	0.40-1 m x 0.9-0.22 m.	Elliptic or narrowly-elliptic	Pinnate-pinnatifid.	Papillate or mammilla-like.	3-5 pairs sub-abruptly reduced.	Horizontal to sub-oblique.	6.5-12 x 2.5-4.5mm. Adnate Basal equal or mildly larger than the adjacent.	Simple.	Trichomes acicular and uncinatate on rhizome scales. Trichomes uncinatate and setiform on axes and laminar tissue.	Absent.	Present.	NE Argentina, S-SE Brazil, CS-NE Paraguay.
<i>A. burkartii</i>	0.25-0.75 m x 0.7-0.15 m.	Elliptic or narrowly-elliptic	Pinnate-pinnatifid.	Absent.	2-4 pairs gradual to sub-abruptly reduced, the lesser auriculiform.	Oblique-arched.	7-9 x 2.5-3.6mm. Adnate. Basal midly larger than adjacent.	Simple.	Absent or trichomes setiform on axes. Trichomes uncinatate occasionally on the abaxial laminar tissue.	Reniform or «subthyrioid», glabrous.	Absent.	CE Argentina, CW-S-SE Brazil.
<i>A. eriosorus</i>	1.10 - 2.10 x 0.16 - 0.26 m.	Elliptic-lanceolate	Pinnate-pinnatifid.	Absent or inconspicuous, papillate or mammilla-like.	2-4 pairs abruptly reduced, auriculiform.	Perpendicular to slightly ascending.	7.5 - 15.1 mm. Adnate.	Simple or furcate.	Trichomes setiform on the rhizome scales and on both sides of the laminar tissue.	Reduced to a fascicle of trichomes setiform.	Absent.	SE Brazil.
<i>A. patula</i>	0.95 - 2.37 x 0.74-1.80 m.	Widely elliptic-lanceolate.	Pinnate-pinnatifid to 2-pinnate-pinnatifid.	Papillate or mammilla-like.	3-5 pairs abruptly reduced, auriculiform. Vestigial pinnae present.	Pinnae ascending, segments perpendicular each other.	10 - 28. 6 x 4-6 mm. Adnate to attached by a narrowed base. Basal slightly smaller than the adjacent.	Simple or furcate.	Trichomes setiform on petiole, laminar tissue and axes. Sometimes scales on axes.	Reniform or orbicular with trichomes setiform.	Absent.	S-SE Brazil.

	Frond size	Frond shape	Laminae division	Aerophores	Proximal pinnae	Pinnae and segments orientation	Segments(*)	Venation	Indument	Indusia shape and indument	Laminar buds	Distribution
A. pleiophylla	0.49 - 0.51 m x 0.12 - 0.14 cm	Elliptic.	Pinnate-pinnatifid.	Absent.	6-10 pairs gradually reduced	Perpendicular to slightly ascending.	6-7 x 3-4 mm. Adnate. Basal-most auriculate, larger than the adjacent segments	Simple.	Trichomes uncinata on petioles and rhizome scales. Trichomes long, pluricellular and sericeous on petioles.	Reniform or orbicular with trichomes setiform.	Absent.	S Brazil
A. pteroidea	1.5-5	Widely elliptic	2-pinnate proximally, pinnate-pinnatifid distally.	Absent.	7 pairs abruptly reduced.	Ascending or arched	20-30 x 4-6 mm Attached by a narrowed base or shortly petiolulate. Basal-most shorter and gradually reduced.	Simple furcate or 2-furcate.	Trichomes setose on rhizome scales. Trichome setose, antrorse on abaxial costae and veins. Lanceolate scales on abaxial costae.	Absent.	Absent.	Colombia, Ecuador, Venezuela, Cuba
A. recumbens	0.30-1.20 x 0.8-0.25 m	Narrowly elliptic	Pinnate-pinnatifid.	Papillate or mammilla-like.	2-4(-5) sub-abruptly to abruptly reduced, basalmost auriculiform.	Perpendicular to slightly ascending.	6.5 - 14 x 2.5-4 mm. Basal-most equal or shorter than the next-adjacent.	Simple.	Trichomes uncinata on rhizome scales, petiole bases, axes and sometimes laminar tissue. Trichomes acicular on costae and veins.	Reniform, uncinulate-hairy.	Present.	NE Argentina, S Brazil, E Paraguay
A. regnelliana	0.36-1.30 x 0.14-0.19 m	Elliptic.	Pinnate-pinnatifid.	Absent or not fully developed.	4-6 pairs sub-abruptly reduced, basalmost auriculiform.	Perpendicular to slightly ascending.	6.4 - 8.9 x 2.6-7 mm. Adnate. Basal-most shorter than the next adjacent.	Simple.	Trichomes uncinata, acicular and setose on rhizome scales, petioles, axes and laminar tissue.	Reduced to a fascicle of setiform, rarely uncinulate hairs, or absent.	Absent.	NE Argentina, S-SE Brazil.

	Frond size	Frond shape	Laminae division	Aerophores	Proximal pinnae	Pinnae and segments orientation	Segments(*)	Venation	Indument	Indusia shape and indument	Laminar buds	Distribution
<i>A. rivularioides</i>	0,30-1,10 x 0,6-1,7 m	Narrowly elliptic to linear-lanceolate.	Pinnate-pinnatifid.	Absent.	4-8 pairs gradually reduced.	Perpendicular to slightly ascending.	5,7 - 9 x 2,5-3,5 mm. Adhate. Basal-most longer than the next-adjacent	Simple or furcate on the largest segments.	Trichomes sericeous on petioles. Trichomes acicular, setiform or uncinata on the abaxial laminar tissue and veins. Trichomes acicular and setiform on axes.	Reniform with trichomes glandular, acicular and uncinata.	Absent.	NW-NE-CE Argentina, S-SE-CW-NE Brazil, S - E - NE Paraguay, E Uruguay, E- S Bolivia
<i>Doryopteris organensis</i>	1 x 0,22 m	Linear-ovate-lanceolate	Pinnate-pinnatifid.	Present, at the pinnae bases.	6-8 pairs abruptly reduced, vestigial.	Perpendicular each other.	7-8 x 2-3 mm Adhate. Basal-most not or mildly enlarged.	Simple	Trichomes setiform on axes.	Not seen, small and long-ciliate in the original description.	Absent.	SE Brazil

former is similar in the shape of its pinnae and venation type; the later resembles *A. yabotiensis* in gross morphology of the lamina and uncinata indument of rhizome scales. *Amauropelta rivularioides* differs from *A. yabotiensis* by having frond gradually reduced proximally, with pinnae more distant among them than those of *A. yabotiensis*, and by having abaxial surface of the veins and laminar tissue hairy. *Amauropelta recumbens* differs from *A. yabotiensis* by the characters indicated in the diagnosis.

Key of *Amauropelta* species from Misiones province, Argentina

1. Plants with trichomes uncinata; glandular trichomes usually absent, if present pedicellate, hyaline..... 2
 - Plants without trichomes uncinata; trichomes glandular, if present, sessile, yellowish or orange, occasionally with resinous appearance..... 6
2. Sori elliptical, at least in the proximal portion of each segment, without indusia..... ***Amauropelta amambayensis***
 - Sori circular, with indusia reniform or orbicular (these hairy), or indusia occasionally reduced to a fascicle of trichomes..... 3
3. Rachises with trichomes uncinata; laminae with abrupt or sub-abruptly reduced proximal pinnae; petioles 1/4-1/2 the frond length..... 4
 - Rachises with trichomes acicular or setiform; laminae with proximal pinnae sub-abruptly to gradually reduced; petioles 1/6-1/10 the frond length..... 5
4. Buds present; petioles and rachises with trichomes uncinata 0.05-0.2 mm long (at least in adaxial grooves); indusia with uncinata hairs..... ***Amauropelta recumbens***

- Buds absent; petioles and rachis with acicular and trichomes uncinata, to 0.5 mm long; indusia setose, rarely with trichomes uncinata, or absent ***Amauropelta regnelliana***

5. Petiolar bases with scales and trichomes 1 celled to pluricellular, sericeous, 0.5–2 mm long; abaxial laminar tissue with trichomes unicellular, hairs acicular or setiform, sometimes uncinata and occasionally capitate.....***Amauropelta rivularioides***

- Petiolar bases only with sparse, scattered scales; abaxial laminar tissue glabrous.....

Amauropelta yabotiensis

6. Sori elliptic or linear with indusia “athyroid” to “subathyroid”, these with trichomes acicular and orange, glandular, margins entire.....***Amauropelta decurtata***

- Sori circular with orbicular, indusia reniform or “subathyroid”, these with only trichomes orange, glandular, occasionally mixed with acicular, or only with setiform trichomes, or glabrous, margins entire or papillate
..... 7

7. Rhizomes short to long-creeping; with fronds pseudo-distichous or laxly fasciculate, usually 30–75 cm long; laminae without trichomes glandular; aerophores absent or weakly developed.....***Amauropelta sanctae-catharinae***

- Rhizomes erect or decumbent, with fronds polystichous, 40–150(–200) cm long; laminae with trichomes glandular, sessile, orange or yellowish or glabrous; aerophore present
..... 8

8. Laminae with 3–4 pairs of abruptly reduced proximal pinnae; indusia reniform and “subathyroid”, covered by large 1–3 cellular acicular trichomes, occasionally with glandular trichomes; segments triangular, oblique, 7–13 mm long, each with an acute apex.....
..... ***Amauropelta metteniana***

- Laminae with 5–10 pairs of gradually reduced proximal pinnae; indusia reniform, with glandular and setiform 1-celled, marginal trichomes; segments ovate or ovate-triangular, 3–8 mm long, each with a sub-acute to rounded apex.....***Amauropelta opposita***

DISCUSSION AND CONCLUSIONS

Amauropelta yabotiensis presents a unique combination of characters that has not been observed in any other species of *Amauropelta*. The species is characterized by having medium to large fronds (0.60–1 m long), basal segments of middle pinnae markedly longer than the next segments, sometimes acroscopically auriculate, with crenate margin, and veins are forked in the larger segments.

This new taxon belongs to the uncinata group (Smith 1974): it has uncinata trichomes distributed exclusively on the rhizome scales and petiolar bases. Laminar tissue (between veins) abaxially is glabrous, with veins bearing a few very thin acicular trichomes.

In summary, and on the basis of general morphology, the closest species are *A. recumbens*, belonging to sect. *Uncinella*, and *A. rivularioides*, included in sect. *Adenophyllum* according to Smith’s classification (1974). The author pointed out that this last section represents a heterogeneous group of species that normally does not bear uncinata hairs, although *A. rivularioides* sometimes has them on the abaxial side of the lamina. Additionally, *A. yabotiensis* resembles *A. rivularioides* in the shape of the pinnae and segments.

Recent molecular phylogenetic analysis show that the sections recognized by Smith (1974) do not always configure monophyletic groups and that, although *Amauropelta* is reconstructed as a natural group, the relationships between the species within the clade are not yet fully

defined (Alvarez-Fuentes 2010, Almeida et al. 2016). Some of the polytomies found inside it involve species distributed in southern South America, which highlights the need to continue studying the systematics and evolution of the group in the area.

Nevertheless, more studies of potentially informative morphological characters are necessary, such as the shape of the fronds, types of hairs, aerophores, and sporangial hairiness, to test the evolution of morphological traits within the genus.

Finally, this new finding highlights the importance of continuing the study of Yabotí Biosphere Reserve biodiversity in order to better understand and conserve this Paranaense forest relict.

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APPENDIX 1

Additional specimens studied

Amauropelta amambayensis (Christ) Salino & T.E. Almeida

Paraguay: Amambay: Sierra de Amambay, in silvis humidis Esperanza, 8/1909, *Hassler & Rojas* 10411b (holotype G00349541!, isotype S06-548!).

Argentina: Misiones: Depto. General Manuel Belgrano, Ruta Nac. 101, 8 km de Bernardo de Irigoyen hacia San Antonio, Salto Andrecito, 15/10/1996, *Morrone et al.*1402 (SI); Depto. San

Pedro, Parque Prov. Cruce Caballero, 17/10/1996, *Morrone et al.*1551 (SI).

Amauropelta burkartii (Abbiatti) Salino & T.E. Almeida

Argentina: Buenos Aires: Pdo. Tigre, Delta Del Paramá, Río Capitán, 28/2/1934, *Burkart* 5965 (holotype: SI000118!, isotype: SI000122!).

Amauropelta eriosorus (Fée) Salino & T.E. Almeida
Brasil: Rio De Janeiro: Itatiaia, 5/6/1871, *Glaziou* 5265 (Syntypes: P00643591!, P00643592!, P00742567!); *Glaziou* 5264 (Syntypes: P 00643593!, P 00643594!).

Thelypteris glaziovii (Christ) C.F. Reed

Brazil: Río De Janeiro: Itatiaia, A. F. *Glaziou* 5267 (Syntypes: K000633509! (*Aspidium pterioideum*), P01608935!; P01608936!; P643518!; P00643519!; P00643520!; B_20_0057117!). São Paulo: Itapetininga, Itapetininga, 26/5/1914, A. C. *Brade* 7597 (NY816013 photo!); Campos do Jordão, 05/2/1937-20, P. C. *Porto* 3067 (NY 816015 photo!). Rio de Janeiro: Teresópolis, Trilha da Pedra do Sino, próximo ao Abrigo 3. Parque Nacional da Serra dos Órgãos, 23/8/2010, R. *Engelmann RE et al.* 907 (NY 02687380 photo!); Itatiaia, Maromba, 22/5/1935, A. C. *Brade* 14502 (NY 816011 photo!, NY 816012 photo!); 1913, A. C. *Brade* 6552 (NY 816014 photo!).

Amauropelta pleiophylla (Sehnem) Salino & T.E. Almeida

Brazil: Paraná: Tijucas do Sul, Vossoroca, 14/2/1974, R. *Kummrow* 327 (MBM 29614 photo!).

Amauropelta pterioidea (Klotzsch) A.R. Sm.

Venezuela: Galipan, *Moritz* 291 (Syntypes: B 200064066!, B 200064067!, B_20_0064069!, B 200064070!, B 200064071!, K000633562!, K000633561!). Venezuela or Colombia, Karsten 40 (Coll. II) (Syntype B 200064068!).

Amauropelta recumbens (Rosenst.) Salino & T.E. Almeida

Brazil: Rio Grande Do Sul: Santa Cruz do Sul, Arroio Castilhaninho, 80 m, Jürgens & *Stier* 172 (lectotype chosen by Ponce (2016): UC 441652!,

isolectotype: ICN, NY 00149148!, NY 00149150!, PH 00009934!).

Argentina: Misiones: Depto. San Pedro, Parque Provincial Esmeralda, 18/2/2017, *Marquez, Yañez & OcampoTerraiza* 414 (LP); 5/2014, *Kelly, Yañez & Marquez* 51 (LP). Depto. Gral. Manuel Belgrano, Salto Andresito, 6/9/1985, *M. E. Múlgura et al.* 409bis (SI).

Amauropelta regnelliana (C. Chr.) Salino & T.E. Almeida

Brazil: Minas Gerais: *Mosén* 2165 (lectotype: S-R-1762!, isolectotype: BM 000937717!, fragment)

Amauropelta rivularioides (Fée) Salino & T.E. Almeida

Brazil: Rio de Janeiro? Alto Macaché, 20/5/1868, *A. F. Glaziou* 2358 (holotype: P00633630!; isotype: P 00633629!, S 05-11054!). Rio Grande do Sul: Santa Cruz, II.1904, *Jürgens* 33 (S05-11056!).

Argentina: Misiones: Depto. San Pedro, Parque Provincial Esmeralda, II.2016, *A. Yañez & G.J. Marquez* 159 (LP). Entre Ríos, Federación, Santa Ana, 12/12/1965, *A. Burkart & N. Troncoso* 26114 (SI). Uruguay: Depto. San José, Barra de Sta. Lucía, 4/1927, *F. Herter* 806 (SI).

Amauropelta patula (Fée) Salino & T.E. Almeida

Brazil: Serra dos Órgãos, 8/9/1968, *A. F. Glaziou* 2822 (syntypes: P 00643581!; P 00643582!; P 00643583!)

Dryopteris organensis Rosenst.

Brazil: Rio de Janeiro: Costa Gama, 04/1912, *Luetzelburg* 12836 (holotype: M-0244378!).

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