

Description of a New African
Fern Species Belonging to
Triplophyllum (Tectariaceae)

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Introduction



http://www.kew.org/science/tropamerica/imagedatabase/large1/cat_single1-4325.htm

FERNS ARE FERNTASTIC!

- *Triplophyllum* (Tectariaceae)
- 26 previously described species
- Africa, Madagascar, and South America



http://tcf.bh.cornell.edu/imgs/robbin/r/Dryopteridaceae_Triplophyllum_dicksonioides_21370.html

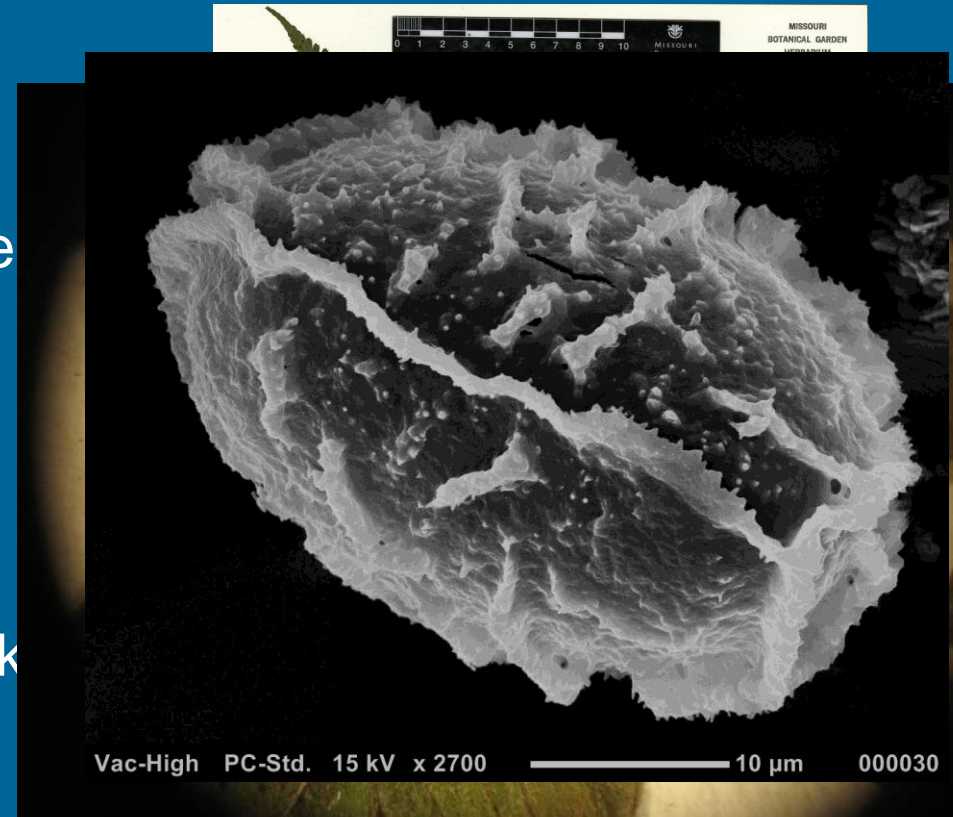


<http://odt.org/hdp/>

Triplophyllum

- Described by Richard E. Holttum in 1986
- Originally belonged to *Ctenitis* and *Tectaria*

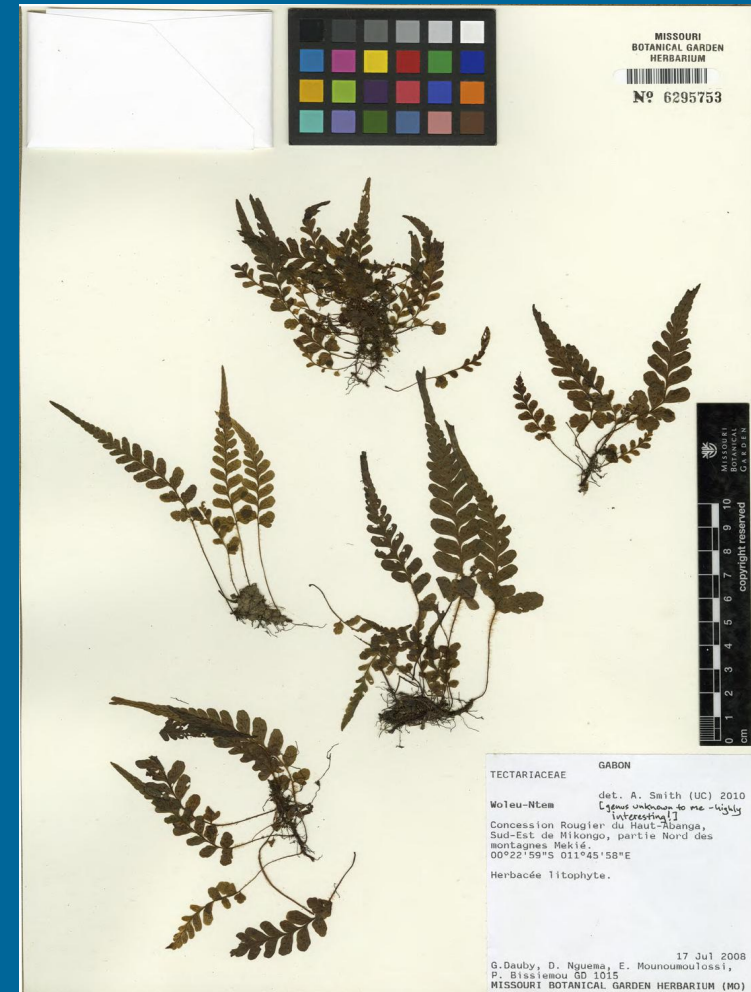
1. Long creeping rhizome
2. Deltoid-pentagonal/ elongate lamina
3. Ctenitoid hairs present
4. Veins usually free
5. Sori round
6. Ellipsoid spores with wing-like surface ornamentation



New species

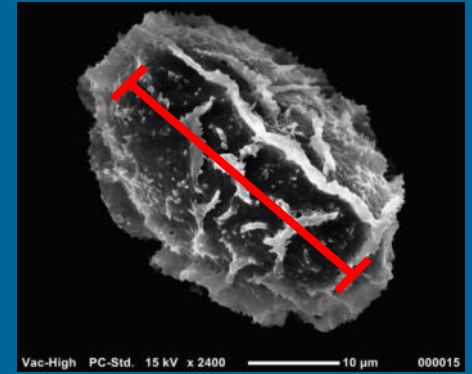
- Collected in 2008, from Gabon
- Fern experts unable to identify

det. A. Smith (UC) 2010
[genus unknown to me - highly
interesting!]
en du Haut Abanga



Overview of Project

1. Spore Morphological Analysis
 1. Surface Morphology Comparison
 2. Size Comparison (In longest dimension)
2. Gross-Morphological Analysis
 1. Character Matrix
 2. Description



Spores

- Comparison of Surface Morphology



http://www.tedpella.com/SEM_html/SEMsupply.htm

- Comparison of Size

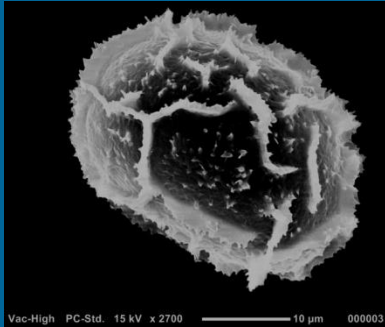


Collection

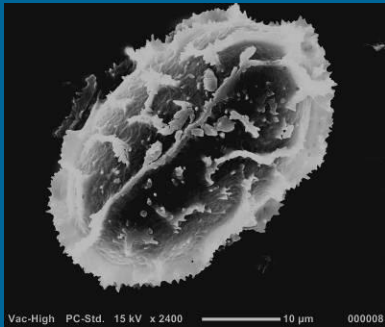
- 3 sporangia
- Glycerol or Double-sided tape
- Sporangia broken open



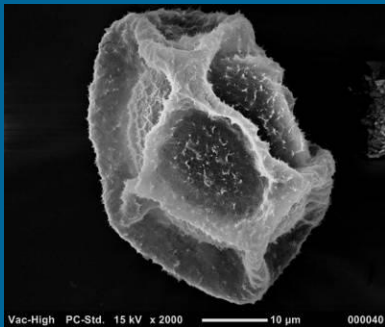
Surface Morphology



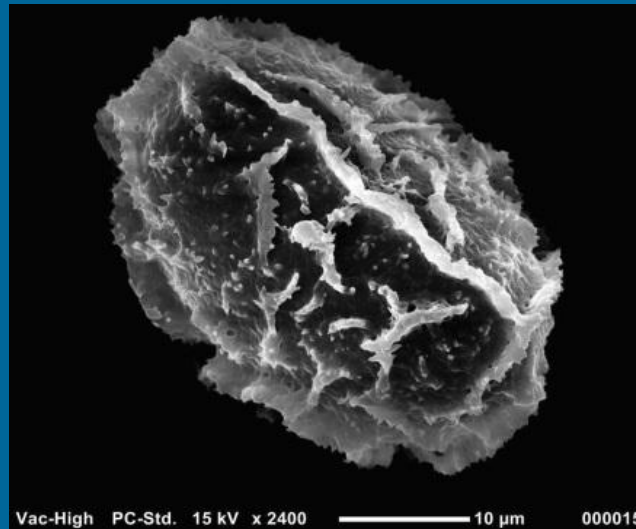
Tectaria angelicifolia



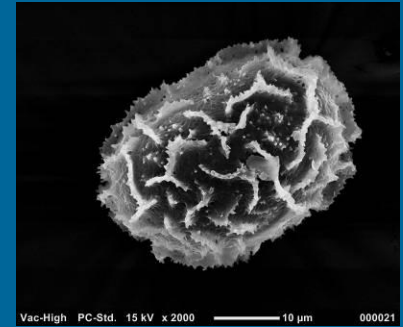
Ctenitis cirrhosa



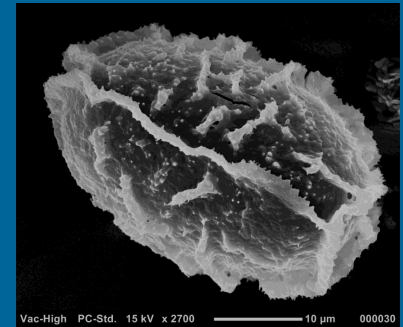
Triplophyllum securidiforme



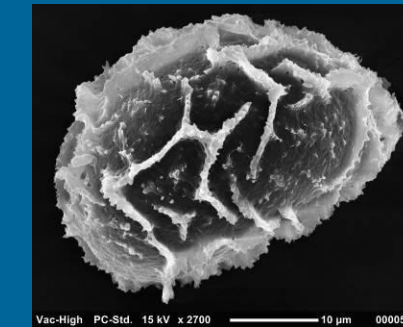
Triplophyllum sp.



Triplophyllum buchholzii



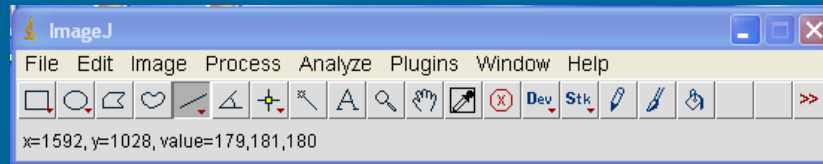
Triplophyllum vogelii



Triplophyllum protensum

Size

- 15 Spores/ species
- 14 species sampled
- ImageJ

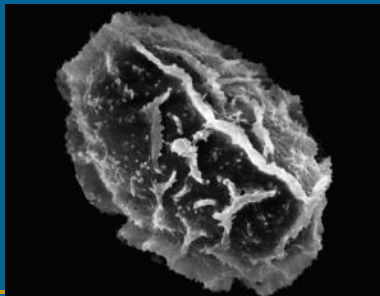


Species	Average (μm)
<i>T. pentagonum</i>	29.078
<i>Triplophyllum sp.</i>	29.907
<i>T. glabrum</i>	31.184
<i>T. boliviense</i>	31.965
<i>T. gabonense</i>	33.505
<i>T. vogleii</i>	34.044
<i>T. dicksonioides</i>	34.107
<i>T. securidiforme</i>	34.409
<i>T. fraternum</i>	36.505
<i>T. pilosissimum</i>	37.639
<i>T. funestum</i>	39.13
<i>T. varians</i>	41.472
<i>T. heudelotii</i>	43.529
<i>T. buchholzii</i>	58.433

Spore Discussion

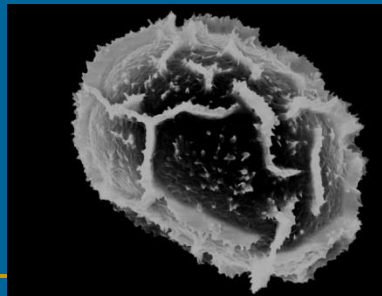
- Spore Morphology of related genera more variable than originally thought
- *Tectaria*, *Ctenitis*, and *Triplophyllum* have similar spores

Triplophyllum sp.

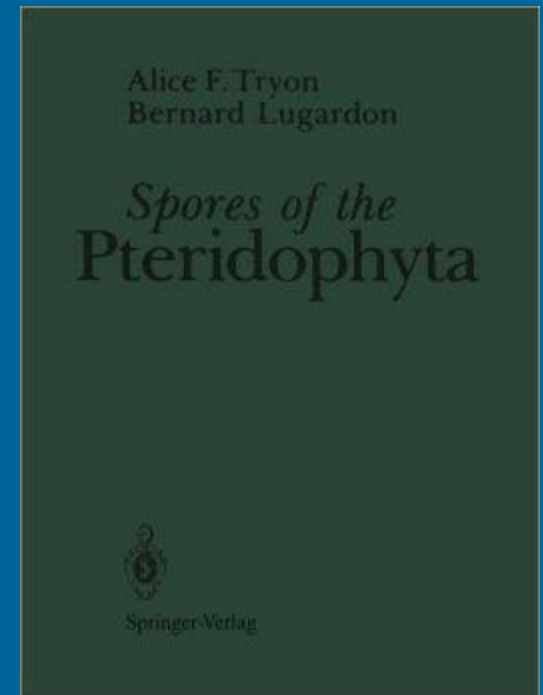


Vac-High PC-Std. 15 kV x 2400 10 µm 000015

Tectaria



Vac-High PC-Std. 15 kV x 2700 10 µm 000003

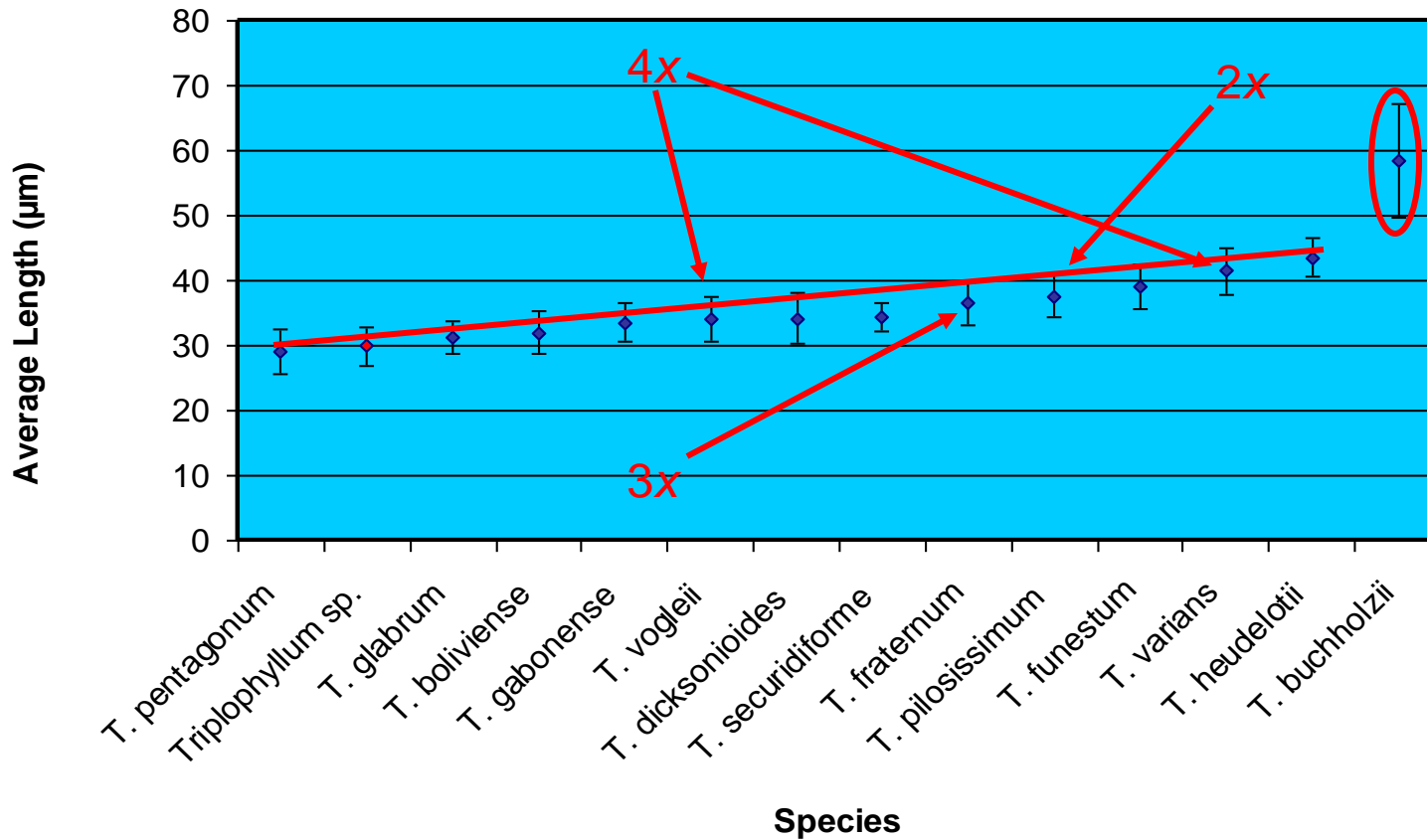


<http://www.barnesandnoble.com/w/spores-of-the-pteridophyta-alice-f-tryon/1111669815?ean=9781461389934>

Size Comparison

30-60 μm

The Average Spore Length of Species in the genus *Triplophyllum* (Tectariaceae)



Gross Morphology

1. Character Matrix

New species

1 *Tectaria*

1 *Ctenitis*

+ 4 *Triplophyllum*

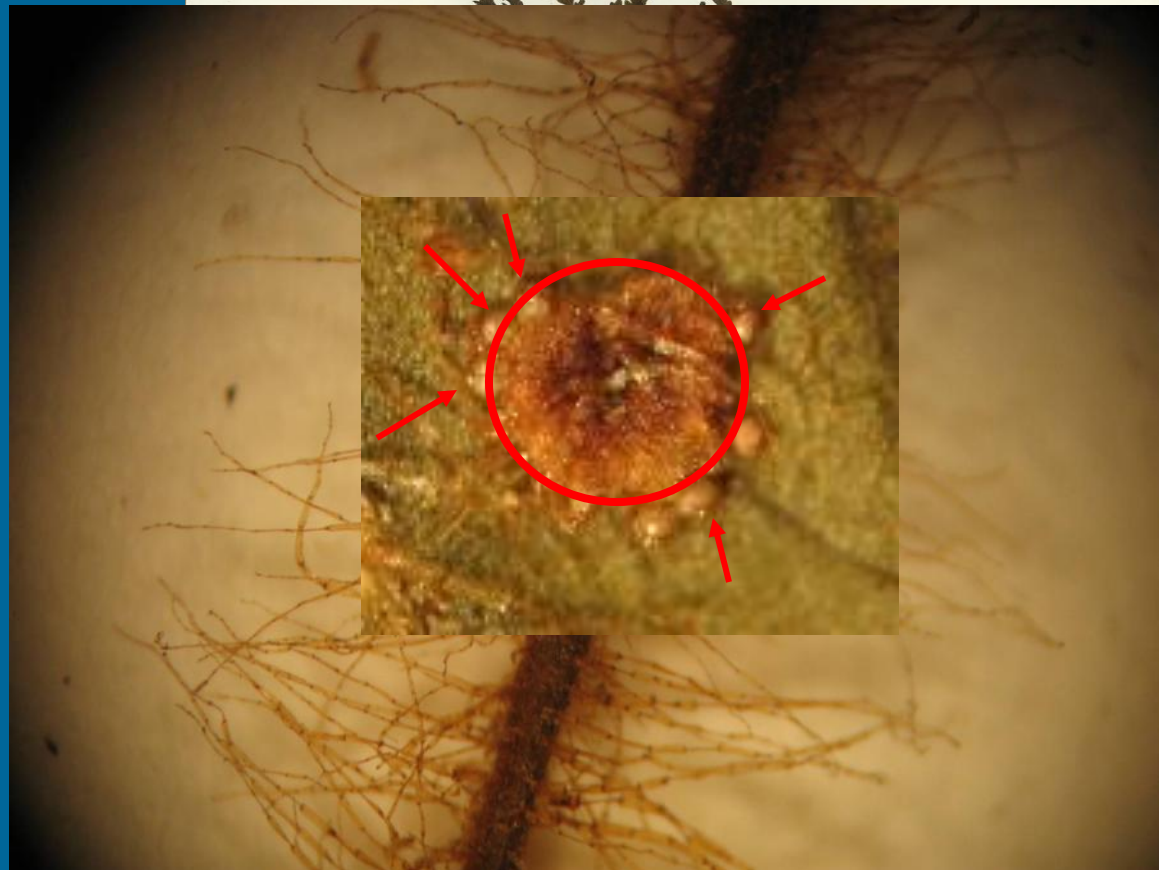
7 Species

2. Description

1. Key to Morphological Groups

Fern Morphology

1. Rhizome
 1. Scales
2. Stipe (Petiole)
 1. Scales
 2. Hairs
3. Lamina (Blade)
 1. Pinnae
 1. Pinnules
4. Sori
 1. Indusia
 2. Sporangia



Character Matrix

107 characters!
7 Species

Character	Units	<i>T. parvum</i>	<i>Tectaria angelicifolia</i>	<i>Ctenitis cirrhosa</i>	<i>T. lanigera</i>	<i>T. jenseniae</i>	<i>T. securidiforme</i>	<i>T. hirsutum</i>
Rhizome Length	cm	2.1-3.7	5.1	2.5	3.0-11.6	5.6	1.4	2.3
Rhizome Diameter (Width)	mm	2	3	20	2.0-4.0	0.7-1.3	2	4
Rhizome Creeping	yes/no	yes	yes	no?	yes	yes	yes	yes
Rhizome Scale Color	color	atrocastaneous	atrocastaneous	atrocastaneous	rocastaneous	rocastaneous	atrocastaneous	rocastaneous
Rhizome Scale Length	mm	1.5	0.7-1.0	12.0-15.0	2.0-2.5	2.0-4.0	1.0-1.2	1.5-2.0
Rhizome Scale Type	scale types	fibrillose	fibrillose	fibrillose	fibrillose	fibrillose	fibrillose	fibrillose
Rhizome Scale Density	scales/ mm ²	1.0-3.0	1.0-4.0	~20.0	3	5.0-8.0	2.0-5.0	2.0-4.0
Rhizome Scale Margins	description	entire	entire	entire	entire	entire	entire	entire
Stipe Length	cm	3.1-4.3	10.5-22.0	30.8-35.4	8.0-38.0	47.6-50.2	15.7-22.6	9.6-21.4
Stipe Color	color	atrocastaneous	stramineous	castaneous	rocastaneous	castaneous	castaneous	castaneous
Stipe Cross-Section Shape	Circular, Grooved (Blunt)	Circular	Circular	Circular	circular	Circular	grooved; Blunt Ridge	Circular
Stipe Scale Placement	description	rhizome; sparse	scattered near base	and abaxial (Dorsal)	half near base	Near rhizome	Near Rhizome	Sparse
Stipe Scale Length	mm	1.5-2.0	2.0-2.5	3.2-7.5	2.0-2.5	3.0-5.0	1.5-2.5	1.5-3.0
Stipe Scale Type	scale types	fibrillose	fibrillose	fibrillose	fibrillose	fibrillose	fibrillose	fibrillose
Stipe Scale Color	color	atrocastaneous	atrocastaneous	atrocastaneous	rocastaneous	rocastaneous	atrocastaneous	rocastaneous
Stipe Scale Density	scales/ mm ²	me= 3.0; Near Rhizome	At Base= >1.0	~15.0-20.0	1.0-2.0	1.0-3.0	1.0-3.0	1.0-3.0
Stipe Scale Margins	description	entire	entire	entire	entire	entire	entire	entire
Stipe Hair Placement	description	of stipe near rachis	Dense near rachis	se (smaller than sense near rachis)	axial and abaxial	axial and abaxial	axial and abaxial	axial and abaxial
Stipe Hair Length- Adaxial	mm	1.8-2.3	0.3-1.5	0.7-1.2	0.2-1.5	0.1-0.3	0.1-0.3	0.1-0.2
Stipe Hair Length- Abaxial	mm	2.0-2.5	0.7-1.0	0.7-1.2	0.3-1.0	0.1-0.3	0.1-0.3	0.2-0.5
Stipe Hair Cell Number- Adaxial	numbers	10.0-13.0	5.0-8.0	4.0-10.0	2.0-5.0	1.0-3.0	2.0-4.0	3.0-4.0
Stipe Hair Cell Number- Abaxial	numbers	12.0-15.0	5.0-7.0	4.0-10.0	3.0-5.0	1.0-3.0	2.0-3.0	3.0-6.0
Stipe Hair Color	color	atrocastaneous	with atrocastaneous	with atrocastaneous	rocastaneous	castaneous	with atrocastaneous	atrocastaneous
Stipe Hair Type	hair types	ctenitoid	ctenitoid	ctenitoid	ctenitoid	ctenitoid	ctenitoid	ctenitoid
Stipe Hair Density	hair/ mm ²	8.0-12.0	12.0-20.0	2.0-5.0	10.0-15.0	~20.0	8.0-12.0	10.0-15.0
Stipe Hair Configuration in Mass	description	Pubescent	Densely Pubescent	Pubescent	sely Pubescent	sely Pubescent	densely Pubescent	sely Pubescent
Frond Architecture	description	Pinnate	ternate	Pinnate	Pinnate	Pinnate	Ternate	Ternate
Lamina Length	cm	7.5-9.5	6.1-16.6	21.12-30.3	12.0-21.2	30.7-38.2	13.0-16.1	10.0-14.9
Lamina Width	cm	1.0-3.0	13.5-24.4	24.7	14.5-28.1	35.4-46.0	17.8-21.8	9.4-17.9
Lamina Shape	shape	at base; lobate	near base; Lobate	near base; Lobate	Pinnate	ase; Pinnate	Pinnate	Pinnate
Lamina Order of Division	1st, 2nd, etc.	1st	Partially 3rd	3rd	3rd	3rd	3rd	4th
Lamina Segments Dentate	yes, no	no	no	no	no	no	no	no
Lamina Segments Ciliate/ Eciliate	ciliate, eciliate	Sparsely ciliate	Sparsely ciliate	Sparsely ciliate	eciliate	eciliate	eciliate	sparsely ciliate
Lamina Adaxial Surface Glandular/Eglandular	glandular, eglandular	eglandular	glandular?	eglandular	glandular	eglandular	eglandular	eglandular
Lamina Abaxial Surface Glandular/Eglandular	glandular, eglandular	eglandular	glandular?	eglandular	glandular	eglandular	eglandular	eglandular
Lamina Apex Form	description	lobate	lobate	Pinnate	Pinnatisect	lobate	Pinnate	lobate
Lamina Base Form	description	pinnatisect	pinnate	Pinnate	Pinnate	Pinnate	Pinnate	Pinnate
Lamina Hair Placement	description	axial and abaxial	veins and rachis only	Margins	abaxial	N/A	N/A	N/A
Lamina Hair Length- Adaxial	mm	1.0-1.5	N/A	0.2-0.4	N/A	N/A	N/A	N/A
Lamina Hair Length- Abaxial	mm	1.5-2.0	N/A	0.2-0.4	0.1-0.3	N/A	N/A	N/A

Key to Morphological Groups

1. Fronds of mature plants elongate, basal pinnae not greatly longer than pair next above them
 2. Anastomosis of veins. **T. varians group** (T. varians, T. buchholzii)
 2. No anastomosis of veins
 3. Basal pinnae pinnate **T. fraternum group** (T. fraternum, T. jenseniae, T. dimidiatum)
 3. Basal pinnae slightly lobate to entire **Triplophyllum sp.**
1. Fronds of mature plants tripartite or broadly deltoid-pentagonal, basal pinnae much longer than the next pair
 4. Fronds tripartite **T. securidiforme group** (T. securidiforme)
 4. Fronds deltoid-pentagonal
 5. Teeth present at the end of most veins **T. heudelotii group** (T. heudelotii, T. pentagonum)
 5. No teeth present at the end of veins
 6. 5th order of frond division represented by quinary lobes
. **T. gabonense group** (T. gabonense, T. batesii,
T. perpilosum, T. dicksoioides, T. speciosum)
 6. 4th order of frond division represented by quaternary lobes **T. funestum group**
(T. funestum, T. boliviense, T. attenuata, T. angustifolium, T. subquinquefidum T. crassifolium, T. chocoense, T. hirsutum, T. glabrum, T. principis T. pilosissimum, T. troupinii, T. vogelii)

Description

Triplophyllum parvum Z. Rhodes, E.A. Hooper & Yatsk., *sp. nov.* Type: Gabon. Woleu-Ntem: Concession Rougier du Haut-Abanga, Sud-Est de Mikongo, partie Nord des montagnes Mekié; 00 22'59"S 011 45'58"E; 17 July 2008, G. Dauby, D. Nguema, E. Mounoumoulossi & P. Bissiemou GD-1015 (holotype: LBV; isotypes: DUKE, MO, NY, UC, UPCB).

Rhizomes long-creeping, 21–37 1–2 mm., moderately to densely scaly; scales 1.2–1.5 mm, narrowly lanceolate-triangular to nearly linear above a short, expanded, cordate and slightly decurrent base, subclathrate with narrow elongate cells, concolorous, yellowish brown to dark brown, margins entire or remotely few-toothed. **Leaves** well-spaced along adaxial side of rhizome. **Petioles** 2.0–4.3 cm, shorter than the blade, slender, terete, atrocastaneous, densely scaly near the base, the scales progressively sparser and more reduced distally; scales at petiole base 1.5–2.0 mm, otherwise similar to those of the rhizome, but not or only slightly broadened at base, progressively shorter and narrower distally; also with dense ctenitoid hairs distally, hairs 1.8–2.5 mm long, consisting of 10–15 cells, atrocastaneous in color. **Laminae** 3.8–9.5 0.9–3.0 cm wide, narrowly oblong-triangular, pinnate or pinnatisect proximally, progressively less lobed and attenuate distally, the narrow apical portion merely slightly undulate, lacking proliferous buds; rachises adaxially and abaxially with moderate to dense ctenitoid hairs, these 1.5–2.0 mm long consisting of 5–9 cells; free pinnae 6–22 3–7 mm, about as long as to somewhat larger than the adjacent pinnae, oblong to oblong-triangular, rounded at tip, symmetrically or asymmetrically cuneate at base (sometimes the basisopic margin nearly straight, the acroscopic margin noticeably curved), shallowly to moderately crenate, sometimes with a short basal basisopic lobe; adaxial and abaxial surfaces eglandular and lacking scales, moderately pubescent with ctenitoid hairs on and between veins, the trichomes 1–2 mm, consisting of 6–8.0 cells; margins ciliate with scattered ctenitoid hairs 0.3–0.5 mm and consisting of 3–6 cells; venation free, the costae scarcely thicker than the secondary veins, these mostly once or twice dochotomously branched, terminating at the margin. **Sori** medial, in a single series on either side of costa, circular in shape, 0.7–1.0 mm; indusia reniform, 0.6–1.0 mm diameter, persistent, but sometimes becoming somewhat shriveled at maturity, margins slightly erose, often with 1–3 ctenitoid hairs attached in notch, these 1.0–1.3 mm long consisting of 5–8 cells. **Spores** 64 per sporangium, 24–36 µm in longest dimension, monolete, oblong-ellipsoid, perispore cristate-rugulose with finely erose winglike folds.

Distinct Morphological Characters

1. Small Size
2. Basal pinnae not greatly developed
3. Ctenitoid hairs longer



Further Studies

- Sequencing of *rbcL*
 - Comparing DNA to related species
 - Key to the genus
-
- Further work on *T. buchholzii* to determine the reason for increased spore size
-

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- David Bogler
- Justin Zweck
- Lisa Hooper
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