

Supplementary electronic materials

Title: A comparison of interspecific and intraspecific phenotypic variation in spectral signatures of ferns with robust versus uncertain species boundaries

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Table S1 – Specimens used for spectral data capture. Herbaria acronym follows Thiers (2025 continually updated: <https://sweetgum.nybg.org/science/ih/>).

Species	Country	Voucher
<i>Microgramma dictyophylla</i>	Brazil	Vida 739 (BHCB145204)
<i>Microgramma dictyophylla</i>	Brazil	Almeida 2230 (BHCB136581)
<i>Microgramma dictyophylla</i>	Brazil	Almeida 2605 (BHCB144728)
<i>Microgramma dictyophylla</i>	Brazil	Cowan 38507 (NY00880074)
<i>Microgramma dictyophylla</i>	Ecuador	Gilmartin 320 (MO1799919)
<i>Microgramma dictyophylla</i>	Guyana	Maguire 40547 (NY03961499)
<i>Microgramma dictyophylla</i>	Peru	Foster 7419 (MO3232987)

<i>Microgramma dictyophylla</i>	Venezuela	Liesner 24298 (NY03961515)
<i>Microgramma latevagans</i>	Bolivia	Smith 13487 (MO4008613)
<i>Microgramma latevagans</i>	Bolivia	Rodriguez 1263 (MO6145673)
<i>Microgramma latevagans</i>	Bolivia	Antezana 1438 (MO04857892)
<i>Microgramma latevagans</i>	Bolivia	Lewis 881089 (MO4008174)
<i>Microgramma latevagans</i>	Peru	Sánchez Vega 5979 (MO3292118)
<i>Microgramma latevagans</i>	Peru	Dillon 6092 (NY03230430)
<i>Microgramma latevagans</i>	Peru	Bennett 2601 (NY03349971)
<i>Microgramma nana</i>	Brazil	Almeida 2732 (BHCB149816)
<i>Microgramma nana</i>	Brazil	Silva 168 (INPA113289)
<i>Microgramma nana</i>	Brazil	Carvalho UAT83 (INPA226341)
<i>Microgramma nana</i>	Brazil	Almeida 2632 (BHCB144755)
<i>Microgramma nana</i>	Costa Rica	Grayum 4884 (MO3324161)
<i>Microgramma nana</i>	Ecuador	Aulestia 128 (MO6016797)
<i>Microgramma nana</i>	Ecuador	Pérez 1185 (NY03962278)
<i>Microgramma nana</i>	Mexico	Campos Villanueva 1011 (MO5069443)
<i>Microgramma nana</i>	Suriname	Maguire 24002 (MO1312664)
<i>Microgramma nana</i>	Suriname	Herrera 10088 (MO6069412)
<i>Microgramma nana</i>	Venezuela	Davidse 3042 (MO2982712)
<i>Microgramma percussa</i>	Brazil	Fraga 3104 (BHCB150254)
<i>Microgramma percussa</i>	Brazil	Dittrich 842 (BHCB64514)
<i>Microgramma percussa</i>	Brazil	Barreto 2595 (BHCB154070)
<i>Microgramma percussa</i>	Brazil	Almeida 372 (BHCB101385)
<i>Microgramma percussa</i>	Brazil	Salino 1988 (BHCB29357)
<i>Microgramma percussa</i>	Brazil	Madison 618 (INPA85192)

<i>Microgramma percussa</i>	Colombia	Croat 79621 (MO6027011)
<i>Microgramma percussa</i>	Colombia	Luteyn 10469 (NY03961982)
<i>Microgramma percussa</i>	Mexico	Hernández 445 (NY03961228)
<i>Microgramma percussa</i>	Panama	McDaniel 8077 (MO6576856)
<i>Microgramma percussa</i>	Peru	Campos 3991 (MO5302244)
<i>Microgramma piloselloides</i>	Bonaire	Boom 11057 (NY02099903)
<i>Microgramma piloselloides</i>	Costa Rica	Rojas 2067 (MO5900546)
<i>Microgramma piloselloides</i>	Cuba	Underwood 831 (NY01842269)
<i>Microgramma piloselloides</i>	Cuba	Britton 5165 (NY01842276)
<i>Microgramma piloselloides</i>	Dominica	Chambers 2501 (NY01842425)
<i>Microgramma piloselloides</i>	Grenada	Broadway s.n. (MO5446677)
<i>Microgramma piloselloides</i>	Jamaica	s.c/s.n. (MO5462147)
<i>Microgramma piloselloides</i>	Jamaica	s.c/s.n. (MO5462145)
<i>Microgramma piloselloides</i>	Jamaica	Hitchcock s.n. (MO5446665)
<i>Microgramma piloselloides</i>	Jamaica	s.c/s.n. (MO5446680)
<i>Microgramma piloselloides</i>	Puerto Rico	Ahlquist 45 (BHCB173388)
<i>Microgramma piloselloides</i>	Puerto Rico	Britton 2062 (NY00989767)
<i>Microgramma piloselloides</i>	Puerto Rico	Underwood 11 (NY00989773)
<i>Microgramma piloselloides</i>	Puerto Rico	Shafer 3139 (NY00989780)
<i>Microgramma piloselloides</i>	Puerto Rico	Vincent 15355 (NY02150502)
<i>Microgramma piloselloides</i>	Haiti	Nash 217 (NY01842393)
<i>Microgramma piloselloides</i>	Dominican Republic	Mejía 7508 (MO3859988)
<i>Microgramma piloselloides</i>	Dominican Republic	Zanoni 28119 (NY01842360)
<i>Microgramma piloselloides</i>	St Vicent and The Grenadines	Badger s.n. (MO5484127)

<i>Microgramma reptans</i>	Brazil	Daly 1352 (INPA118203)
<i>Microgramma reptans</i>	Brazil	Matos 11468 (CEPEC15838)
<i>Microgramma reptans</i>	Brazil	Fraga 3090 (BHCB150244)
<i>Microgramma reptans</i>	Brazil	Fraga 2971 (BHCB143826)
<i>Microgramma reptans</i>	Colombia	Molina 18c716 (MO1626606)
<i>Microgramma reptans</i>	Costa Rica	Lesica 4136 (MO3416567)
<i>Microgramma reptans</i>	Ecuador	Aulestia 1560 (MO05055185)
<i>Microgramma reptans</i>	Guyana	MC Dowell 4809 (MO04621215)
<i>Microgramma reptans</i>	Nicaragua	Urbina 70 (MO6710204)
<i>Microgramma reptans</i>	Panama	Salino 15879 (BHCB173590)
<i>Microgramma reptans</i>	Panama	Stern 646 (MO1817771)
<i>Microgramma reptans</i>	Panama	Kennedy 3232 (MO3014609)
<i>Microgramma reptans</i>	Peru	Schunke-Vigo 3469 (INPA133051)
<i>Microgramma reptans</i>	Peru	King 451 (INPA123964)
<i>Microgramma tecta</i>	Brazil	Krieger 8862 (BHCB165025)
<i>Microgramma tecta</i>	Brazil	Salino s.n. (BHCB43418)
<i>Microgramma tecta</i>	Brazil	Salino 10145 (BHCB91558)
<i>Microgramma tecta</i>	Brazil	Salino 13779 (BHCB124333)
<i>Microgramma tecta</i>	Brazil	Mota 3160 (BHCB105182)
<i>Microgramma tecta</i>	Brazil	Schmitt 334 (BHCB142994)
<i>Microgramma tecta</i>	Brazil	Kollmann 4051 (BHCB108513)
<i>Microgramma tecta</i>	Brazil	Matos 415 (BHCB97283)
<i>Microgramma tecta</i>	Brazil	Salino 13595 (BHCB122753)
<i>Microgramma tecta</i>	Brazil	Salino 8637 (BHCB81163)
<i>Microgramma tecta</i>	Brazil	Cadorin 2121 (BHCB142972)

<i>Microgramma tobagensis</i>	Brazil	Thomas 9304 (MO04895073)
<i>Microgramma tobagensis</i>	Brazil	Mori 11468 (NY00674449)
<i>Microgramma tobagensis</i>	Brazil	Amorim 4205 (NY01241079)
<i>Microgramma tobagensis</i>	Brazil	Matos 1577 (NY02064119)
<i>Microgramma tobagensis</i>	Ecuador	Gudiño Jara 2256 (MO04911176)
<i>Microgramma tobagensis</i>	Ecuador	Clark 575 (MO5149584)
<i>Microgramma tobagensis</i>	Ecuador	Vargas lópez 5138 (MO6389474)
<i>Microgramma tobagensis</i>	Guatemala	Türkheim 125 (NY03961400)
<i>Microgramma tobagensis</i>	Peru	Klug 2539 (NY03966108)
<i>Microgramma tobagensis</i>	Trinidad and Tobago	Broadway 9959 (NY02027319)
<i>Microgramma tobagensis</i>	Trinidad and Tobago	Jermy 2870 (NY02027320)
<i>Microgramma tobagensis</i>	Trinidad and Tobago	Jermy 2680 (MO04642633)
<i>Microgramma tobagensis</i>	Venezuela	Steyermark 61888 (NY03966137)

Table S2 – Within species comparison of fertile and sterile fronds based on spectral means using a Generalized Linear Model (GLM) with Gamma distribution and logarithmic link function. Results are presented on the natural logarithm scale, with *p-values* adjusted using Tukey's method for multiple comparisons. SE = standard error, df = degrees of freedom, t.ratio = t-Statistic.

Comparison	Species	Estimate	SE	df	t.ratio	<i>p-value</i>
Fertile - Sterile leaf	<i>M. dictyophylla</i>	0.17094	0.177	171	0.967	0.3347
Fertile - Sterile leaf	<i>M. latevagans</i>	0.23698	0.197	171	1.205	0.2297
Fertile - Sterile leaf	<i>M. nana</i>	0.77819	0.151	171	5.164	<.0001
Fertile - Sterile leaf	<i>M. percussa</i>	0.11773	0.151	171	0.781	0.4357
Fertile - Sterile leaf	<i>M. piloselloides</i>	0.06194	0.118	171	0.526	0.5997
Fertile - Sterile leaf	<i>M. reptans</i>	1.4882	0.134	171	11.142	<.0001
Fertile - Sterile leaf	<i>M. tecta</i>	0.83061	0.151	171	5.512	<.0001
Fertile - Sterile leaf	<i>M. tobagensis</i>	0.71927	0.134	171	5.385	<.0001

Table S3 – Between-species pairwise comparisons within each frond type (fertile vs. sterile) based on spectral means using a Generalized Linear Model (GLM) with Gamma distribution and logarithmic link function. Results are presented on the natural logarithm scale, with *p-values* adjusted using Tukey's method for multiple comparisons. SE = standard error, df = degrees of freedom, t.ratio = t-Statistic.

Comparison	Frond type	Estimate	SE	df	t.ratio	<i>p-value</i>
<i>M. dictyophylla</i> - <i>M. latevagans</i>	Fertile	-0.31197	0.183	171	-1.706	0.6836
<i>M. dictyophylla</i> - <i>M. nana</i>	Fertile	-0.90001	0.164	171	-5.481	<.0001
<i>M. dictyophylla</i> - <i>M. percussa</i>	Fertile	-0.39773	0.164	171	-2.422	0.2375
<i>M. dictyophylla</i> - <i>M. piloselloides</i>	Fertile	-0.16836	0.15	171	-1.121	0.9514
<i>M. dictyophylla</i> - <i>M. reptans</i>	Fertile	-1.1375	0.157	171	-7.263	<.0001
<i>M. dictyophylla</i> - <i>M. tecta</i>	Fertile	-0.95346	0.164	171	-5.806	<.0001
<i>M. dictyophylla</i> - <i>M. tobagensis</i>	Fertile	-0.7279	0.157	171	-4.647	0.0002
<i>M. latevagans</i> - <i>M. nana</i>	Fertile	-0.58804	0.171	171	-3.442	0.0163
<i>M. latevagans</i> - <i>M. percussa</i>	Fertile	-0.08576	0.171	171	-0.502	0.9996
<i>M. latevagans</i> - <i>M. piloselloides</i>	Fertile	0.14361	0.157	171	0.912	0.9846
<i>M. latevagans</i> - <i>M. reptans</i>	Fertile	-0.82553	0.164	171	-5.046	<.0001
<i>M. latevagans</i> - <i>M. tecta</i>	Fertile	-0.64149	0.171	171	-3.754	0.0057
<i>M. latevagans</i> - <i>M. tobagensis</i>	Fertile	-0.41593	0.164	171	-2.543	0.1850
<i>M. nana</i> - <i>M. percussa</i>	Fertile	0.50228	0.151	171	3.333	0.0229
<i>M. nana</i> - <i>M. piloselloides</i>	Fertile	0.73164	0.135	171	5.41	<.0001
<i>M. nana</i> - <i>M. reptans</i>	Fertile	-0.23749	0.142	171	-1.668	0.7078
<i>M. nana</i> - <i>M. tecta</i>	Fertile	-0.05345	0.151	171	-0.355	1.0000
<i>M. nana</i> - <i>M. tobagensis</i>	Fertile	0.17211	0.142	171	1.209	0.9284
<i>M. percussa</i> - <i>M. piloselloides</i>	Fertile	0.22937	0.135	171	1.696	0.6899
<i>M. percussa</i> - <i>M. reptans</i>	Fertile	-0.73977	0.142	171	-5.196	<.0001
<i>M. percussa</i> - <i>M. tecta</i>	Fertile	-0.55572	0.151	171	-3.688	0.0072
<i>M. percussa</i> - <i>M. tobagensis</i>	Fertile	-0.33017	0.142	171	-2.319	0.2896
<i>M. piloselloides</i> - <i>M. reptans</i>	Fertile	-0.96914	0.126	171	-7.696	<.0001
<i>M. piloselloides</i> - <i>M. tecta</i>	Fertile	-0.78509	0.135	171	-5.805	<.0001
<i>M. piloselloides</i> - <i>M. tobagensis</i>	Fertile	-0.55954	0.126	171	-4.443	0.0004
<i>M. reptans</i> - <i>M. tecta</i>	Fertile	0.18404	0.142	171	1.293	0.9006

<i>M. reptans</i> - <i>M. tobagensis</i>	Fertile	0.4096	0.134	171	3.067	0.0503
<i>M. tecta</i> - <i>M. tobagensis</i>	Fertile	0.22556	0.142	171	1.584	0.7592
<i>M. dictyophylla</i> - <i>M. latevagens</i>	Sterile	-0.24593	0.191	171	-1.289	0.9020
<i>M. dictyophylla</i> - <i>M. nana</i>	Sterile	-0.29276	0.164	171	-1.783	0.6325
<i>M. dictyophylla</i> - <i>M. percussa</i>	Sterile	-0.45094	0.164	171	-2.746	0.1162
<i>M. dictyophylla</i> - <i>M. piloselloides</i>	Sterile	-0.27737	0.15	171	-1.847	0.5890
<i>M. dictyophylla</i> - <i>M. reptans</i>	Sterile	0.17976	0.157	171	1.148	0.9451
<i>M. dictyophylla</i> - <i>M. tecta</i>	Sterile	-0.29379	0.164	171	-1.789	0.6283
<i>M. dictyophylla</i> - <i>M. tobagensis</i>	Sterile	-0.17957	0.157	171	-1.147	0.9454
<i>M. latevagens</i> - <i>M. nana</i>	Sterile	-0.04683	0.179	171	-0.261	1.0000
<i>M. latevagens</i> - <i>M. percussa</i>	Sterile	-0.20501	0.179	171	-1.143	0.9462
<i>M. latevagens</i> - <i>M. piloselloides</i>	Sterile	-0.03143	0.167	171	-0.189	1.0000
<i>M. latevagens</i> - <i>M. reptans</i>	Sterile	0.42569	0.172	171	2.469	0.2162
<i>M. latevagens</i> - <i>M. tecta</i>	Sterile	-0.04786	0.179	171	-0.267	1.0000
<i>M. latevagens</i> - <i>M. tobagensis</i>	Sterile	0.06636	0.172	171	0.385	0.9999
<i>M. nana</i> - <i>M. percussa</i>	Sterile	-0.15818	0.151	171	-1.05	0.9659
<i>M. nana</i> - <i>M. piloselloides</i>	Sterile	0.0154	0.135	171	0.114	1.0000
<i>M. nana</i> - <i>M. reptans</i>	Sterile	0.47252	0.142	171	3.319	0.0240
<i>M. nana</i> - <i>M. tecta</i>	Sterile	-0.00103	0.151	171	-0.007	1.0000
<i>M. nana</i> - <i>M. tobagensis</i>	Sterile	0.11319	0.142	171	0.795	0.9932
<i>M. percussa</i> - <i>M. piloselloides</i>	Sterile	0.17357	0.135	171	1.283	0.9039
<i>M. percussa</i> - <i>M. reptans</i>	Sterile	0.6307	0.142	171	4.43	0.0004
<i>M. percussa</i> - <i>M. tecta</i>	Sterile	0.15715	0.151	171	1.043	0.9671
<i>M. percussa</i> - <i>M. tobagensis</i>	Sterile	0.27137	0.142	171	1.906	0.5488
<i>M. piloselloides</i> - <i>M. reptans</i>	Sterile	0.45713	0.126	171	3.63	0.0088
<i>M. piloselloides</i> - <i>M. tecta</i>	Sterile	-0.01642	0.135	171	-0.121	1.0000
<i>M. piloselloides</i> - <i>M. tobagensis</i>	Sterile	0.0978	0.126	171	0.777	0.9941
<i>M. reptans</i> - <i>M. tecta</i>	Sterile	-0.47355	0.142	171	-3.326	0.0235
<i>M. reptans</i> - <i>M. tobagensis</i>	Sterile	-0.35933	0.134	171	-2.69	0.1327
<i>M. tecta</i> - <i>M. tobagensis</i>	Sterile	0.11422	0.142	171	0.802	0.9928