Evolutionary and morphological relationships in Magnoliaceae: an update

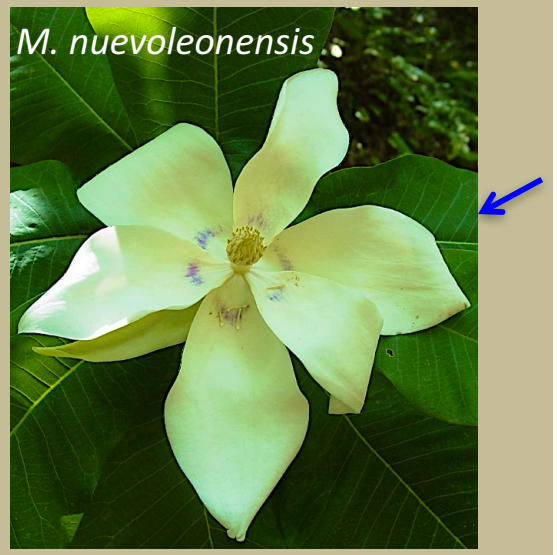
Ernesto De Castro-Arce,
Gerardo Hernández-Vera
J. Antonio Vázquez-García

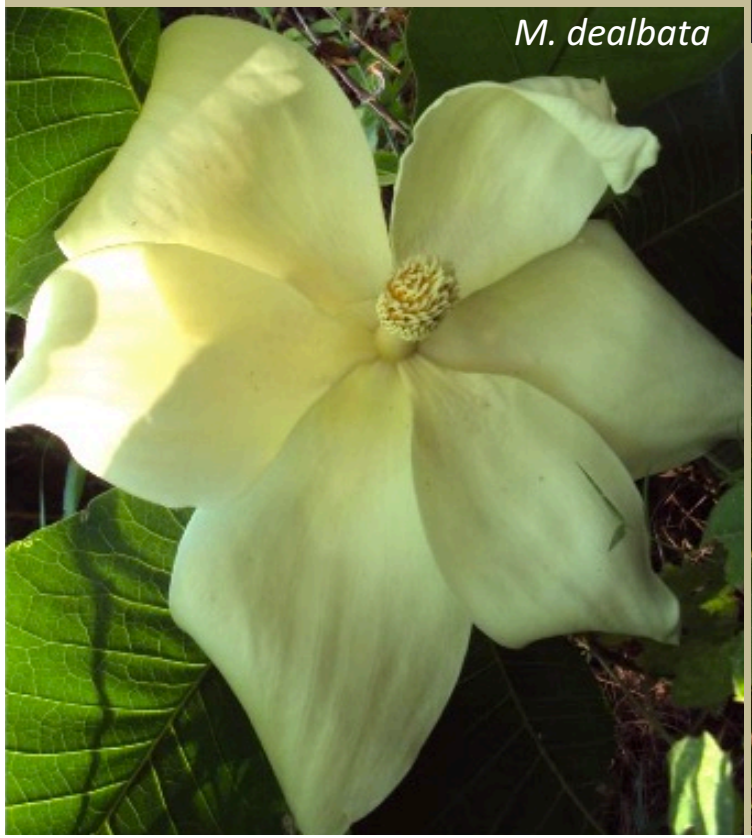
1651 [1577]. **Eloxóchitl** Hernández

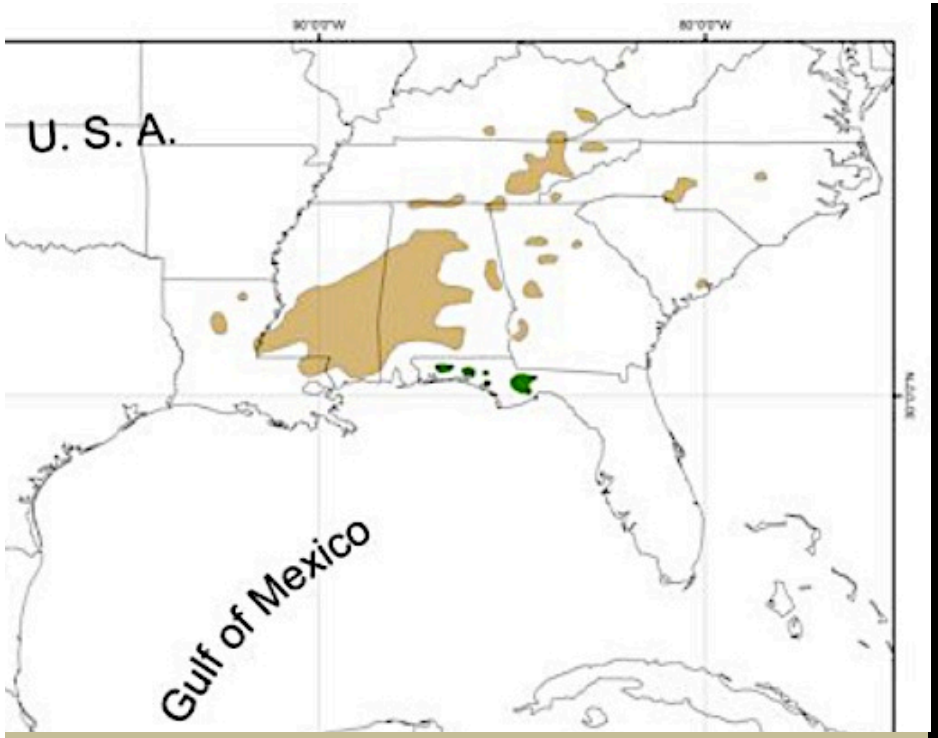
"here we see branch of a tree with banana like leaves, olive green above and pale beneath, with nodes like a palm"

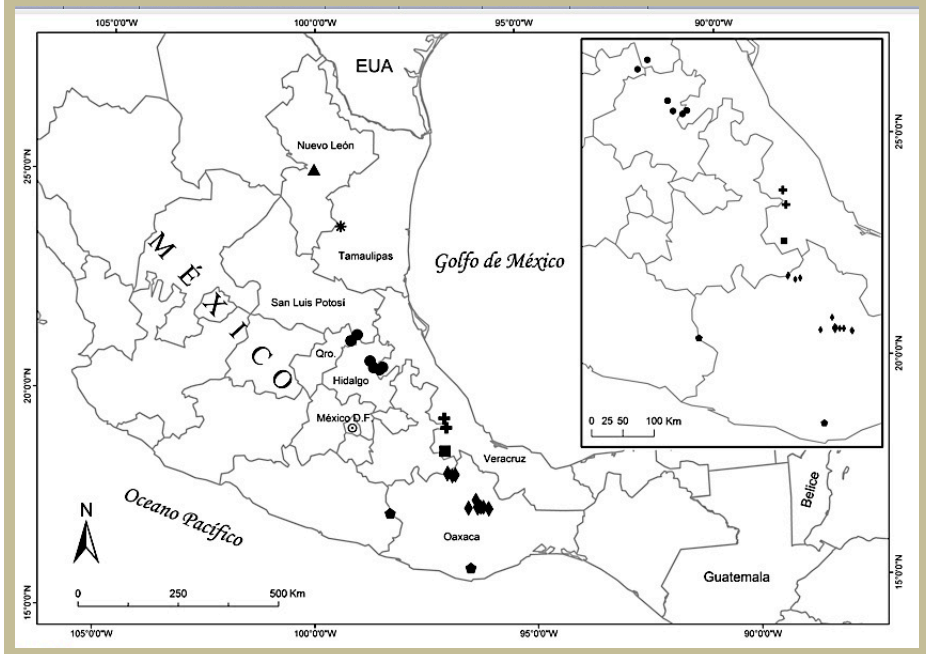
1837, Formally described as ***Magnolia dealbata*** by Zuccarini

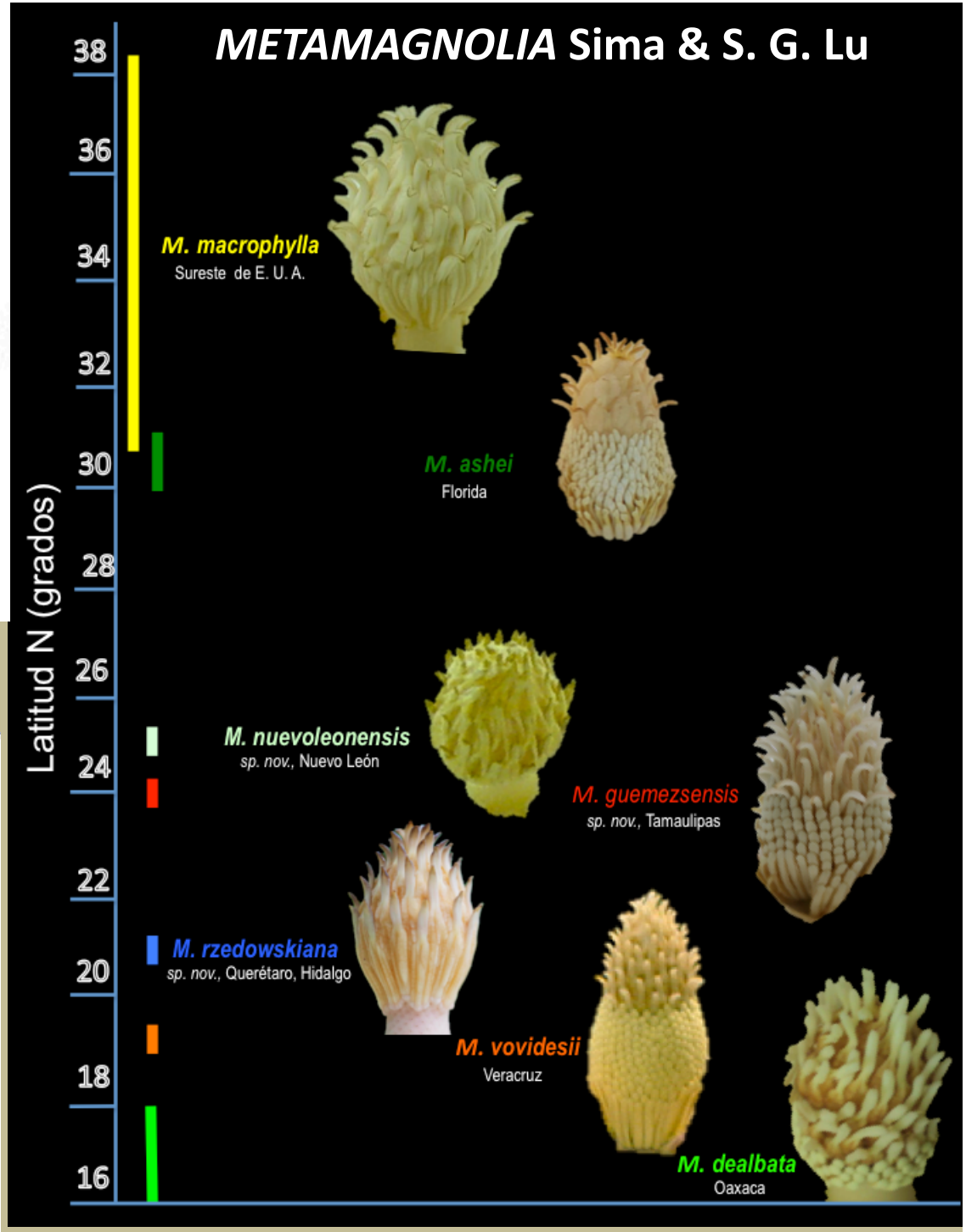
Sect. Macrophylla






U. S. A.
Gulf of Mexico


EUA
Nuevo León
Tamaulipas
San Luis Potosí
Qro.
Hidalgo
México D.F.
Veracruz
Oaxaca
Golfo de México
Océano Pacífico
Belice
Guatemala
M É X I C O
N
0 250 500 Km
0 25 50 100 Km


METAMAGNOLIA Sima & S. G. Lu
Latitud N (grados)
38
36
34
32
30
28
26
24
22
20
18
16
M. macrophylla
Sureste de E. U. A.
M. ashei
Florida
M. nuevoleonensis
sp. nov., Nuevo León
M. guemezsensis
sp. nov., Tamaulipas
M. rzedowskiana
sp. nov., Querétaro, Hidalgo
M. vovidesii
Veracruz
M. dealbata
Oaxaca

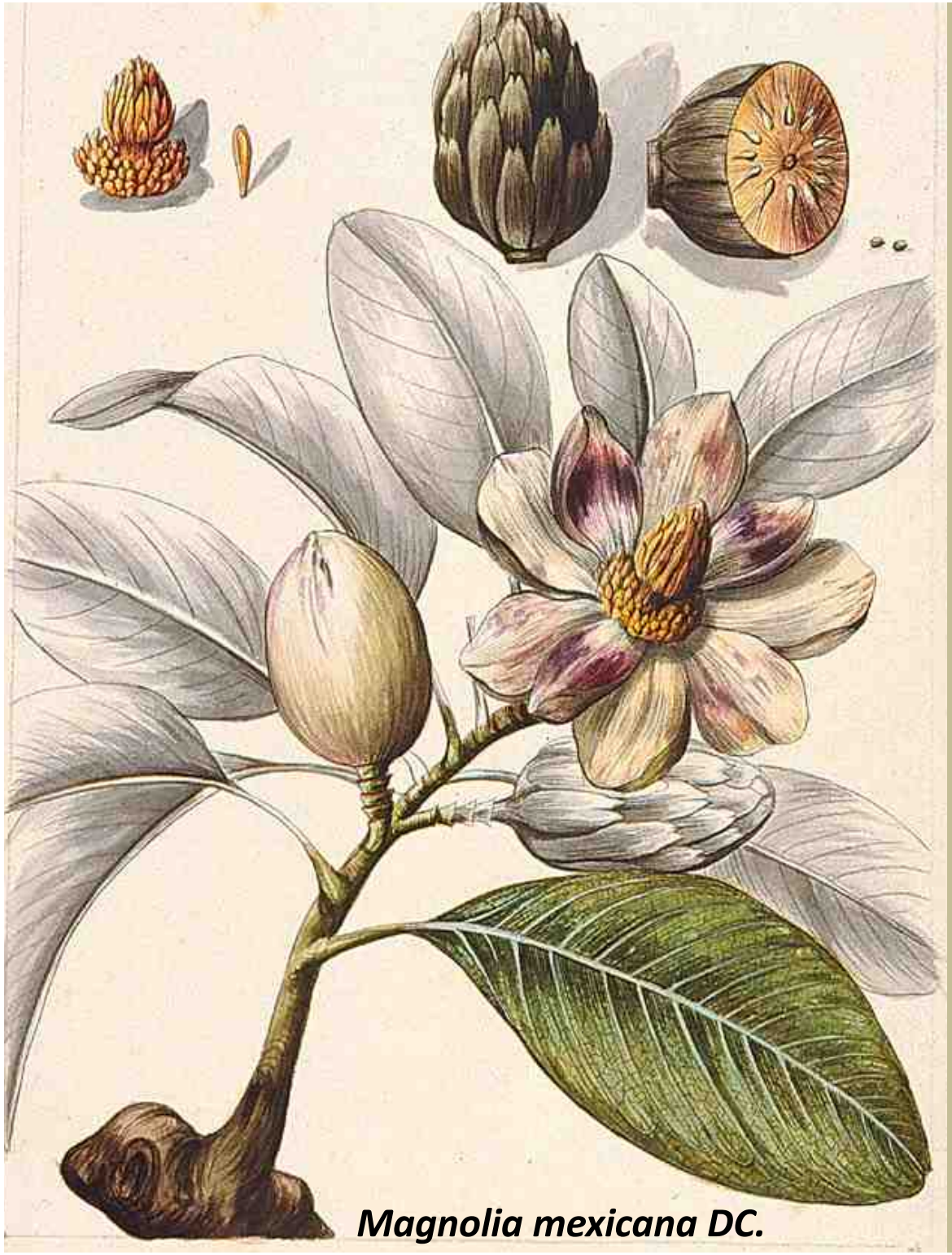
Moctezuma Emperor

1651 [1577]. **Yoloxochitl** Hernández

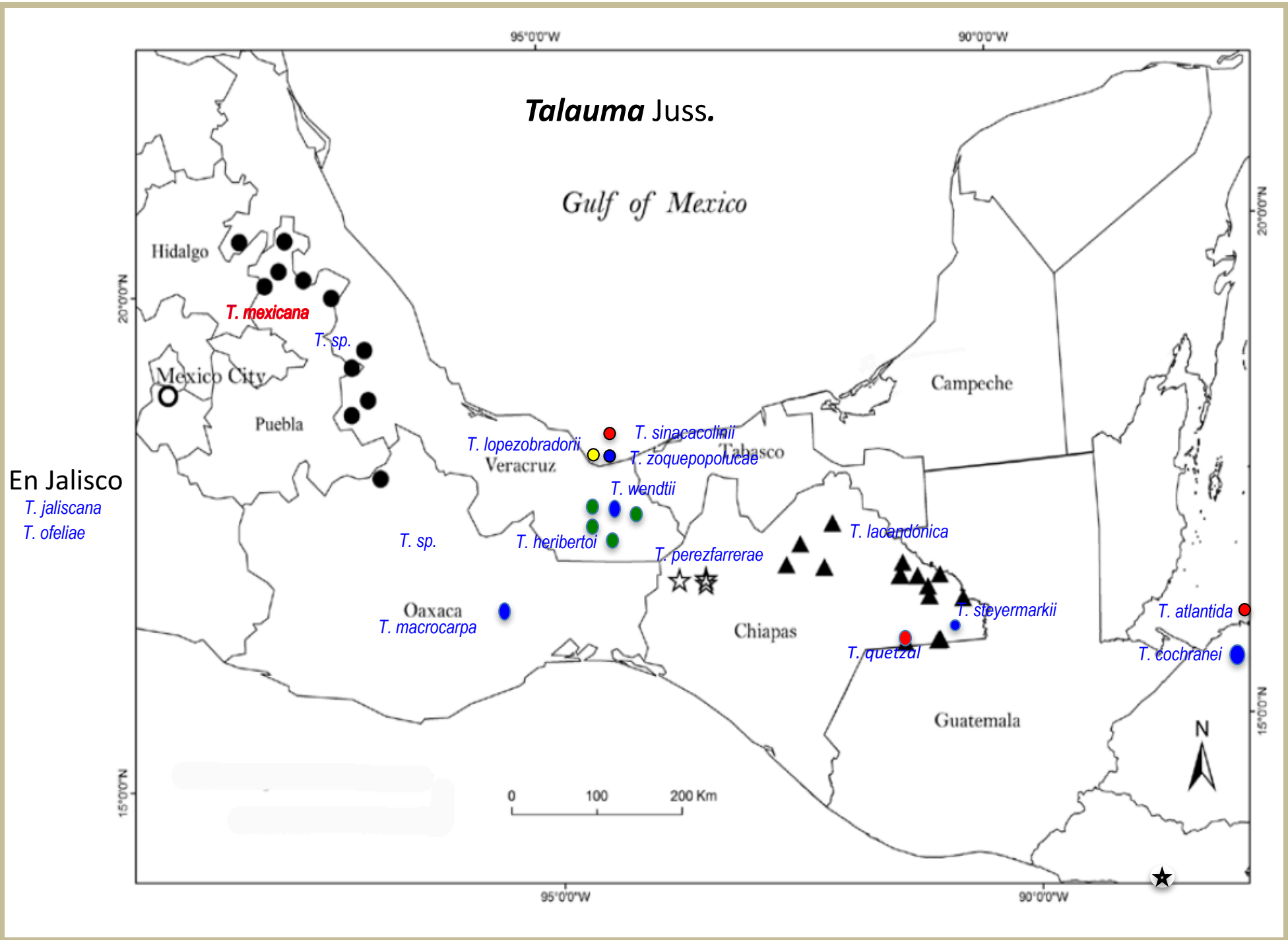
DE YOLOXOCHITL Aristochyea.
Cap. XX.

ARBOR est magna *Yoloxochitl*, foliis Mali Medicæ, duplò tamen longioribus, vmbilico, ac flore, cordis figura, multis foliis superato candidis, intrinsecus rubescentibus, pinguibus, lenibus, tenacibus, adstringentibus, glutinosis, & suauiter odoratis. Natitur temperatis regionibus, qualis est Mexicana, campestribus, atque humilibus locis. poderq; quarum coniectura assequi valeo, in horto Philippicos, seu Carpentarios, seu Hispalenses transferri. Floris folia calidæ sunt, & siccæ temperiei, quæ adiuntur decoctis, aut ipsi potioni *Cacauatl* non sine cordis, & ventriculi corroboratione, atque adstrictione fluentes alui (si opus est) eximia. ius decoctis cordis eius *Mecatxochitl*, *Mexochitl*, *Xochinacaztli*, *Tlalxochitl*, & *Cuoparis*, cum Cauda *Tlacuatzin* vtero infusum, eximium

1817



Magnolia mexicana DC.

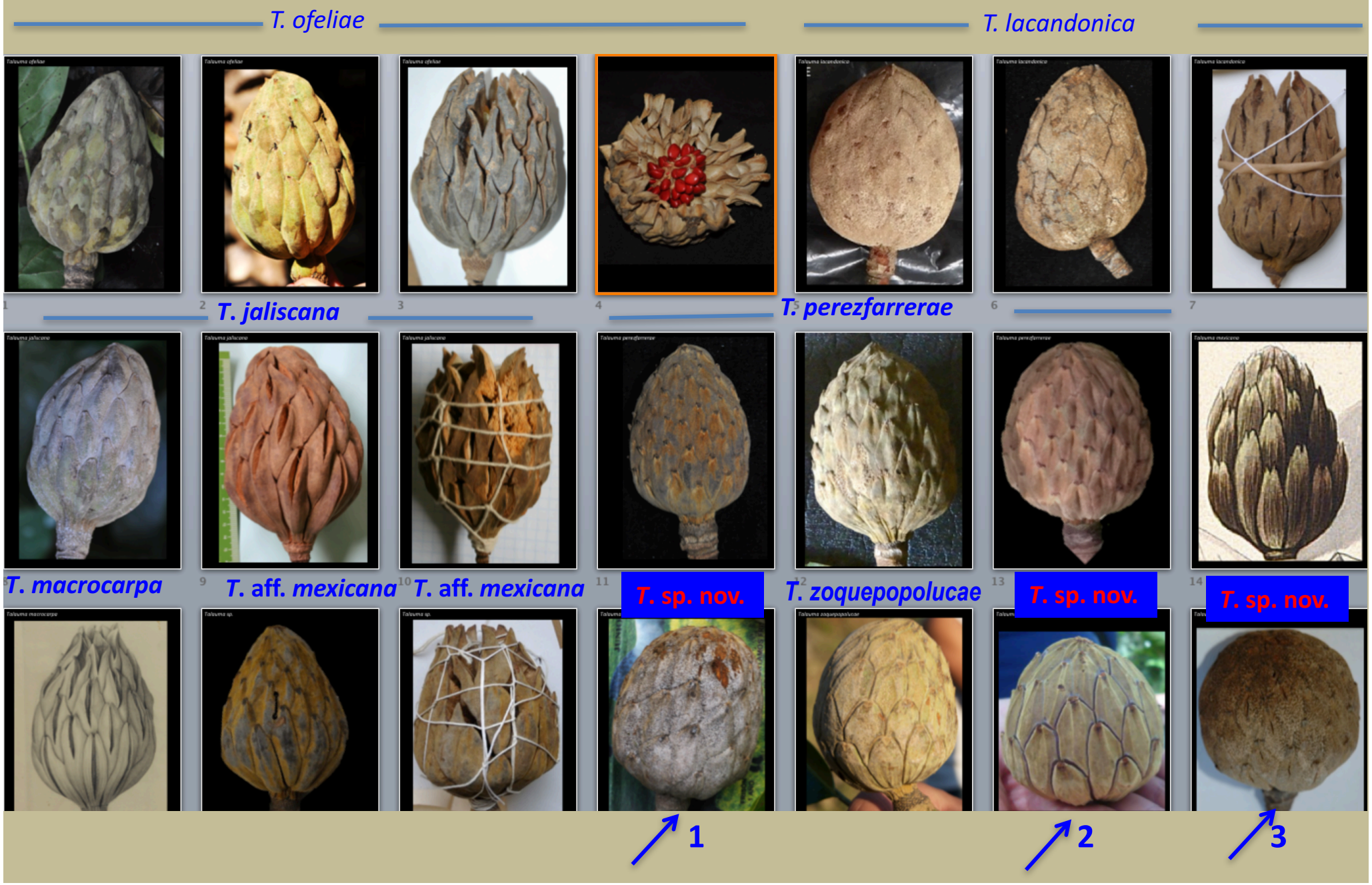


En Jalisco

T. jaliscana

T. ofeliae

Talauma Juss.




M. cubensis


M. mahechae


M. llanganatensis


CORANTIOQUIA

T. jaliscana

T. ofeliae

T. lacandonica

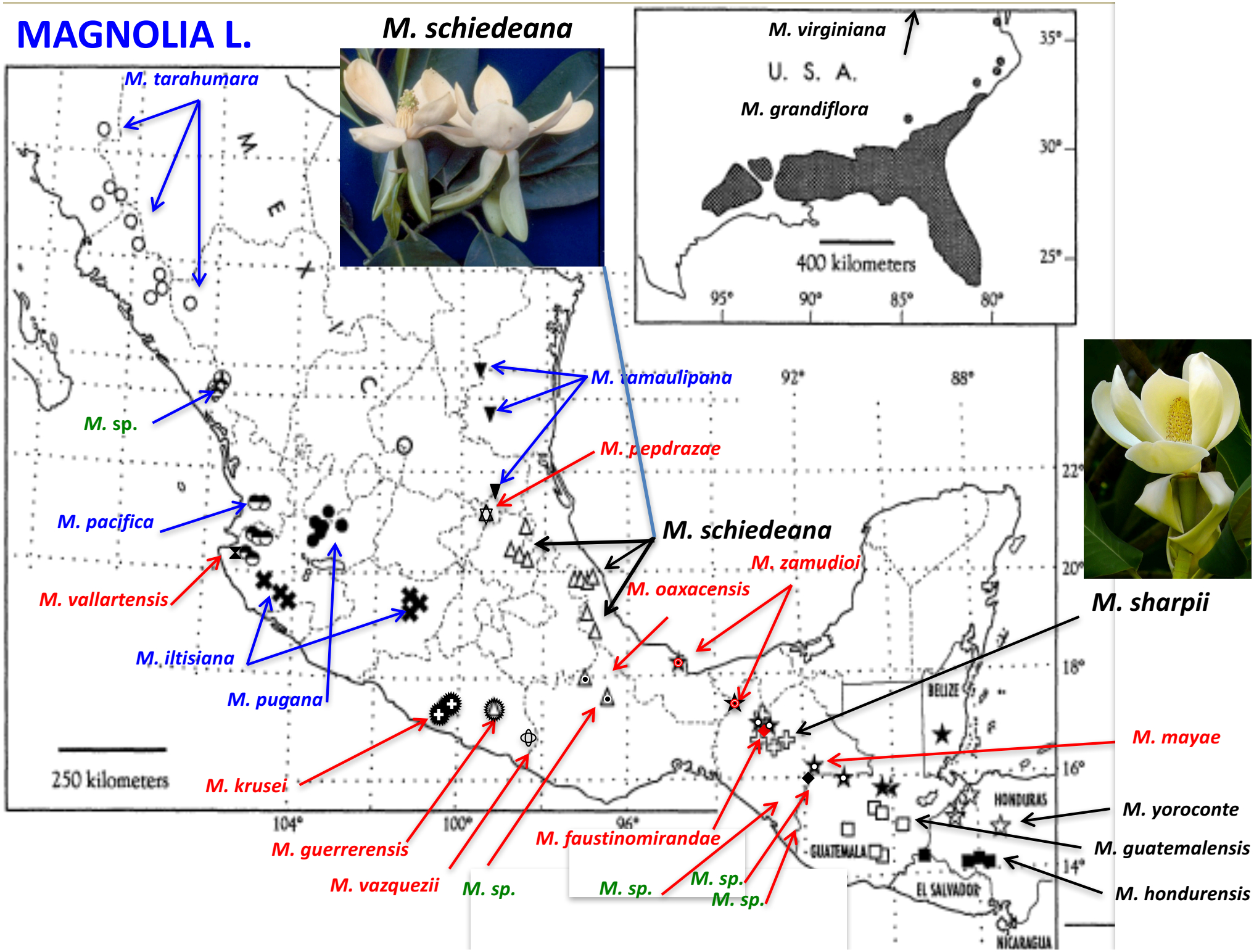
T. zoquepopolucae

T. quetzal

T. sinacacolinii

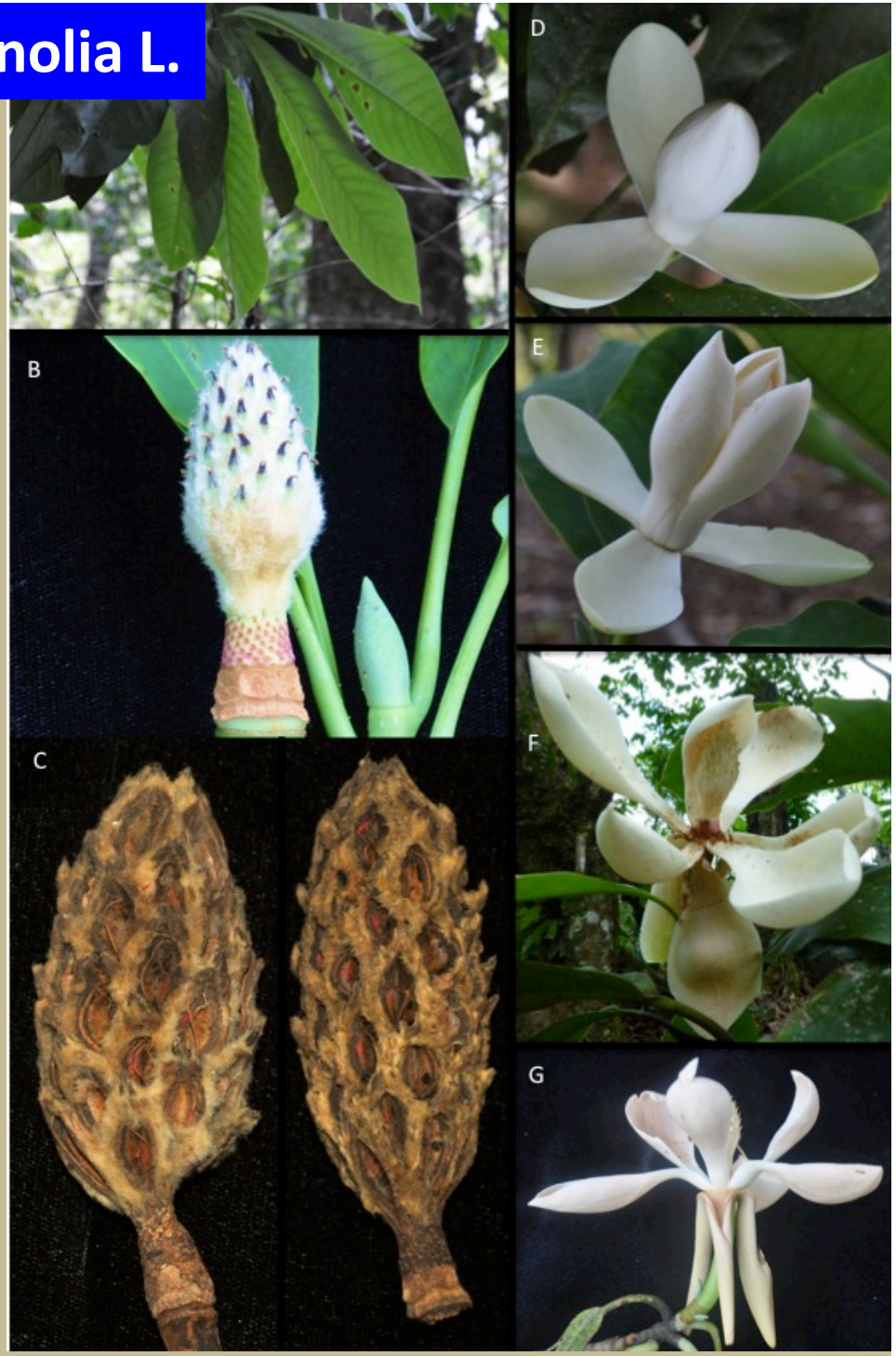
T. perezfarrerae

MAGNOLIA L.

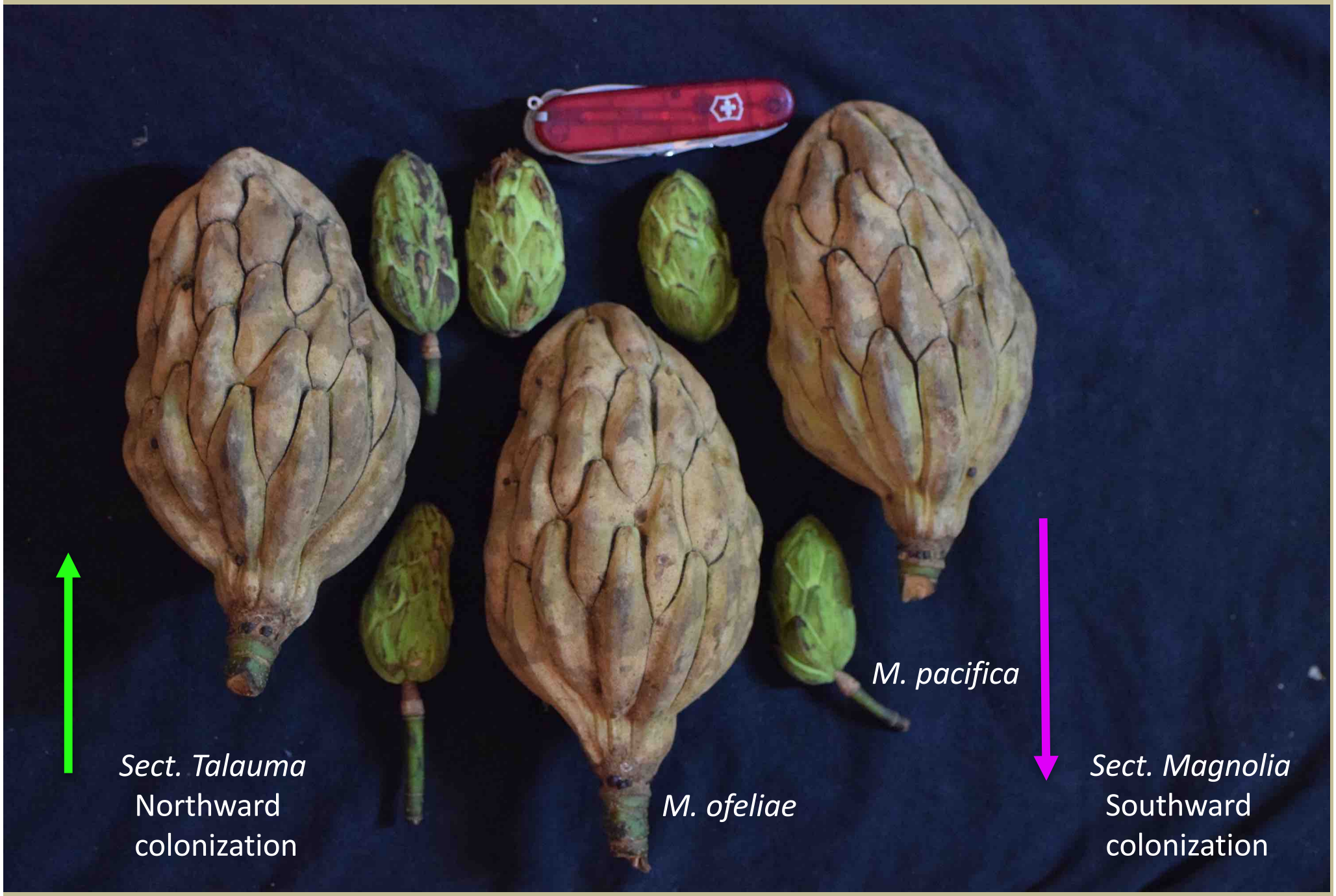

M. schiedeana
M. virginiana
U. S. A.
M. grandiflora
400 kilometers
35°
30°
25°
95°
90°
85°
80°
M. tarahumara
M. tamaulipana
M. sp.
M. pepdrazae
M. pacifica
M. schiedeana
M. zamudioi
M. oaxacensis
M. vallartensis
M. sharpii
M. iltisiana
M. pugana
M. mayae
250 kilometers
M. krusei
M. yoroconte
M. guatemalensis
M. hondurensis
M. guerrerensis
M. faustinomirandae
M. vazquezii
M. sp.
M. sp.
M. sp.
M. sp.
92°
88°
22°
20°
18°
16°
14°
104°
100°
96°
BELIZE
HONDURAS
GUATEMALA
EL SALVADOR
NICARAGUA

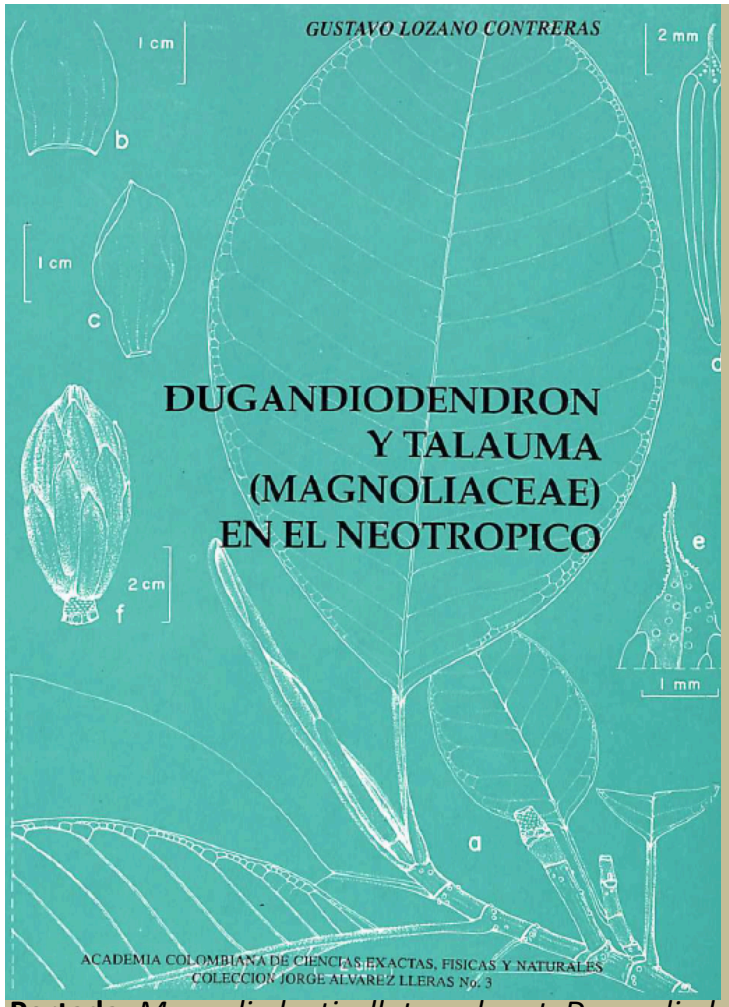
Magnolia L.

M. vallartensis



M. mayae


Sect. Talauma
Northward
colonization
M. ofeliae
M. pacifica
Sect. Magnolia
Southward
colonization



Portada: *Magnolia lenticellata subsect. Dugandiodendron*

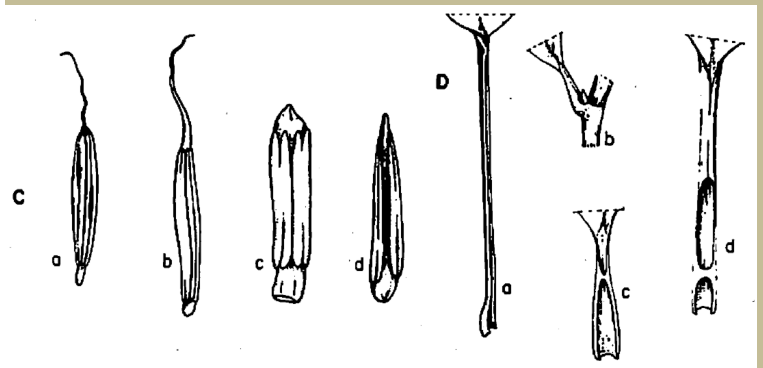
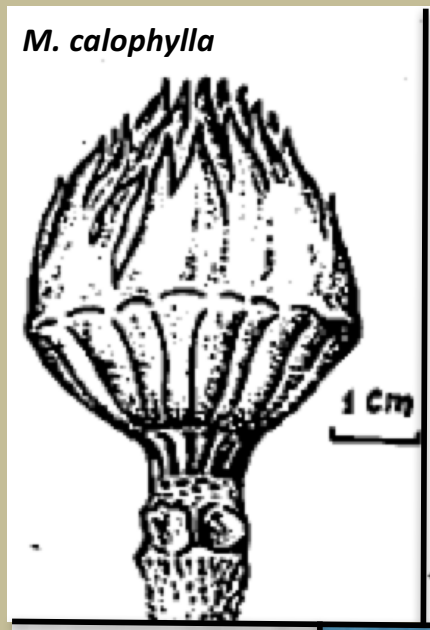
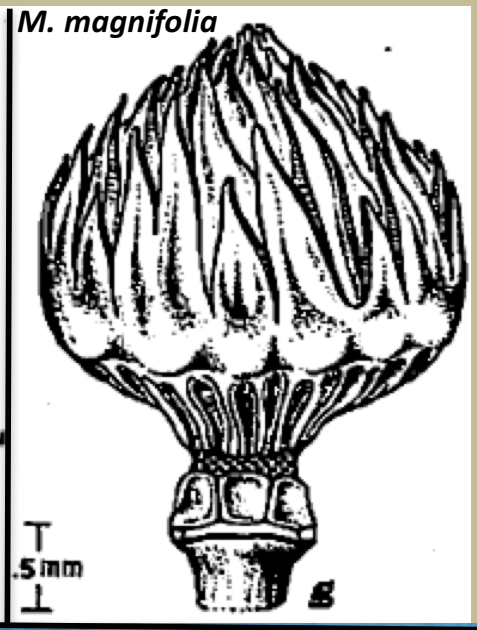


Fig. 1. Aa-d, variación de los pétalos; Ba-d, variación de los sépalos; Ca-b, estambres de *Dugandiodendron*; Cc-d, estambres de *Talauma*; Da-b, pecíolo sin cicatriz de *Dugandiodendron*; Dc-d, pecíolo con cicatríz adaxial de *Talauma*.

Four species did not fit the *Dugandiodendron* circumscription

1) a-b Inconspicuous stipular scar
2) c-d Lack of long thread like connectives
3) Globose fruit
4) All from the chocó biogeographical region ECU & COL





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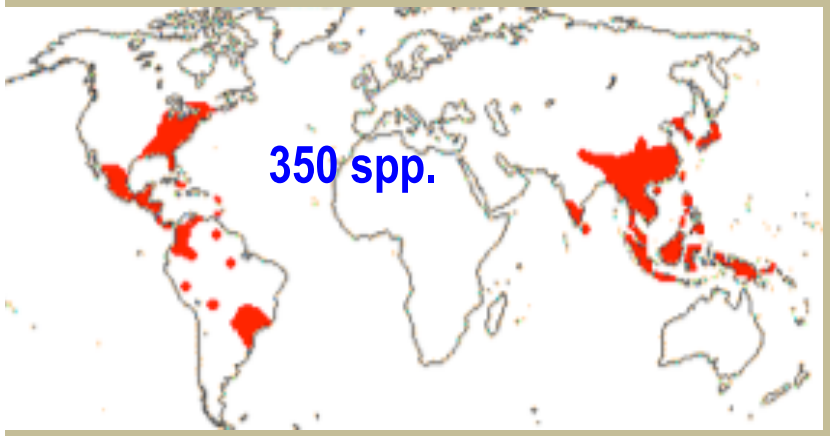
Magnolia chiguila and *M. mashpi* (Magnoliaceae): two new species and a new subsection (*Chocotalauma*, sect. *Talauma*) from the Chocó biogeographic region of Colombia and Ecuador

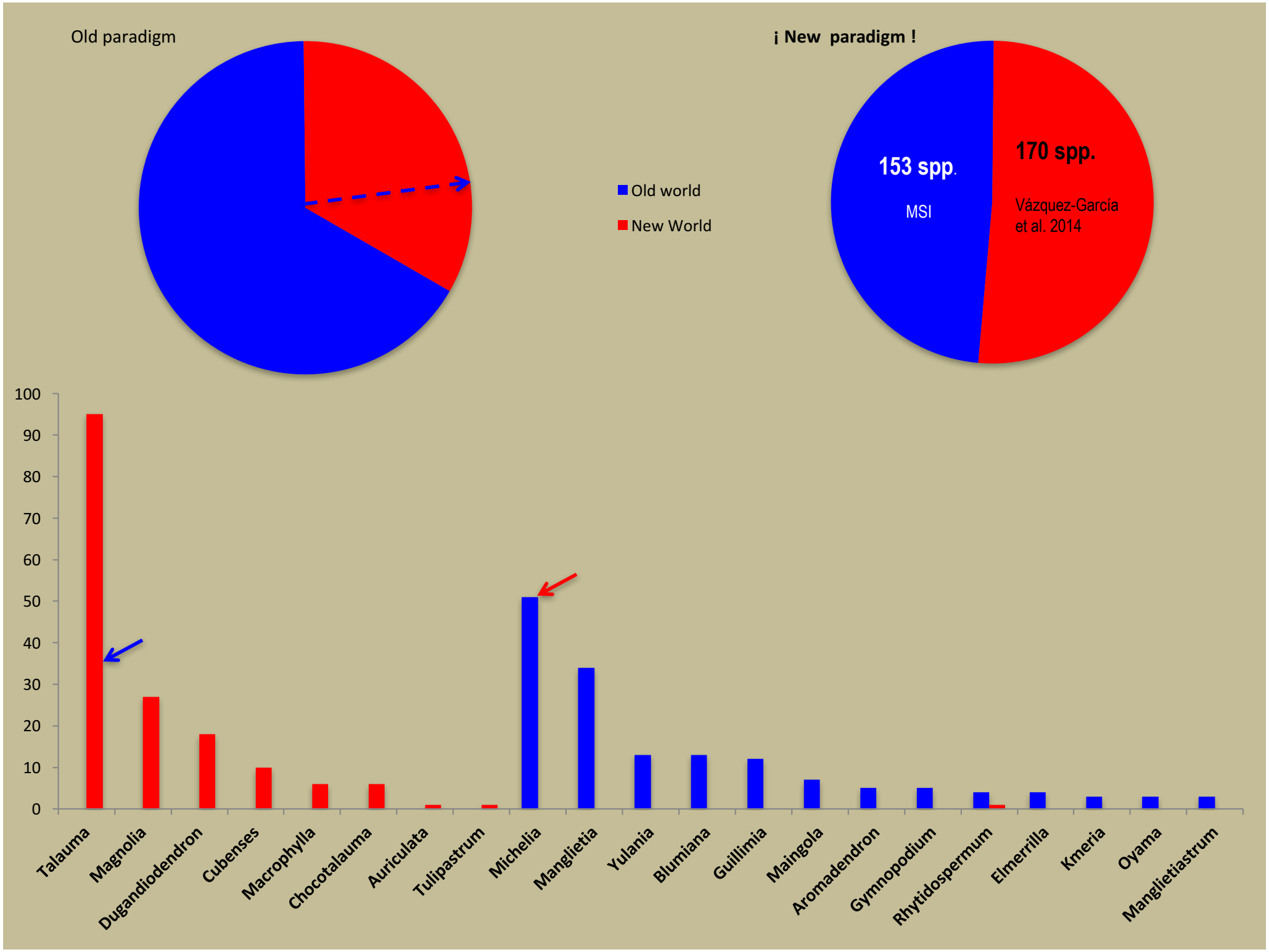
ÁLVARO. J. PÉREZ[1], FRANK ARROYO[2], DAVID A. NEILL[3] & J. ANTONIO VÁZQUEZ-GARCÍA[3,4]

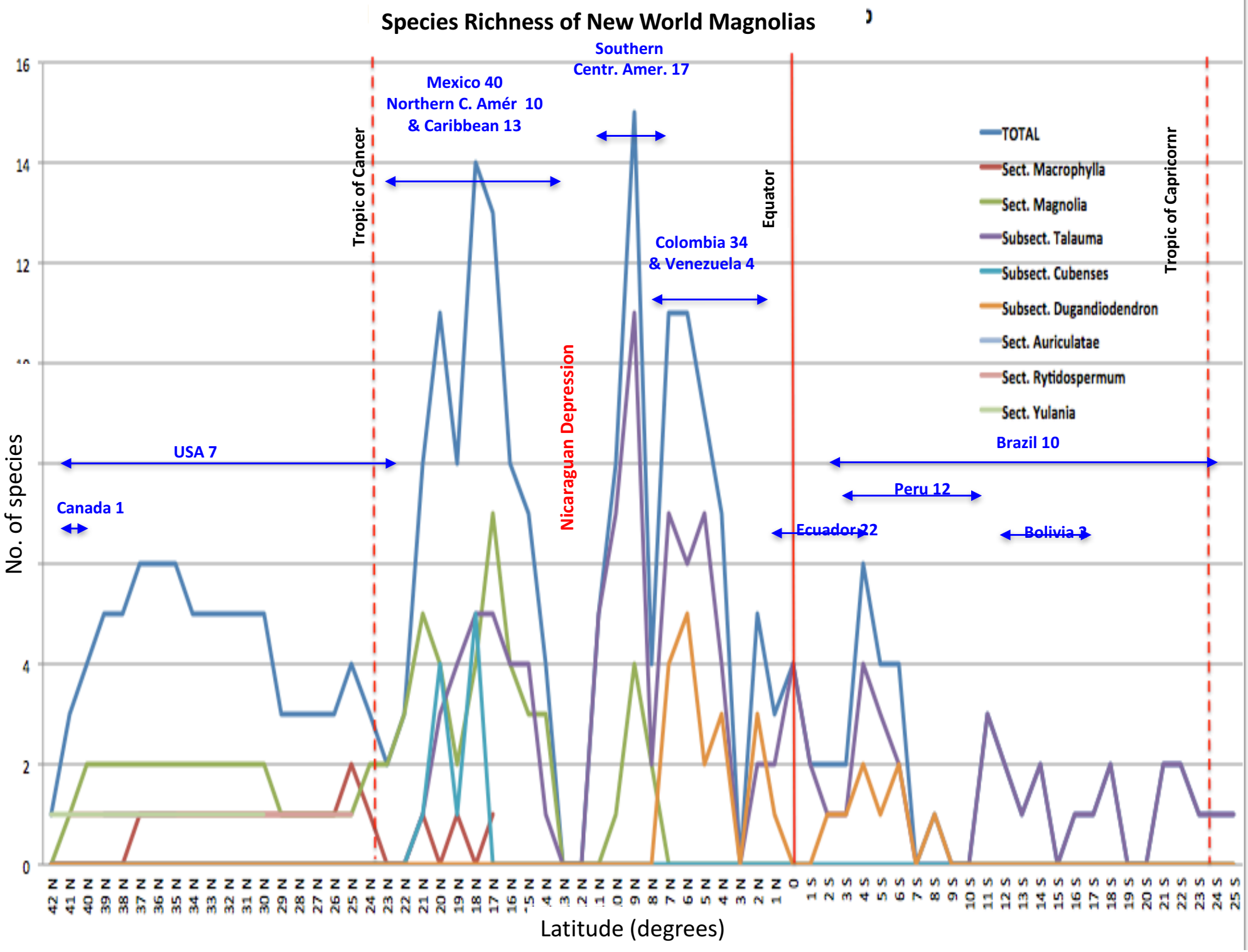
World wide

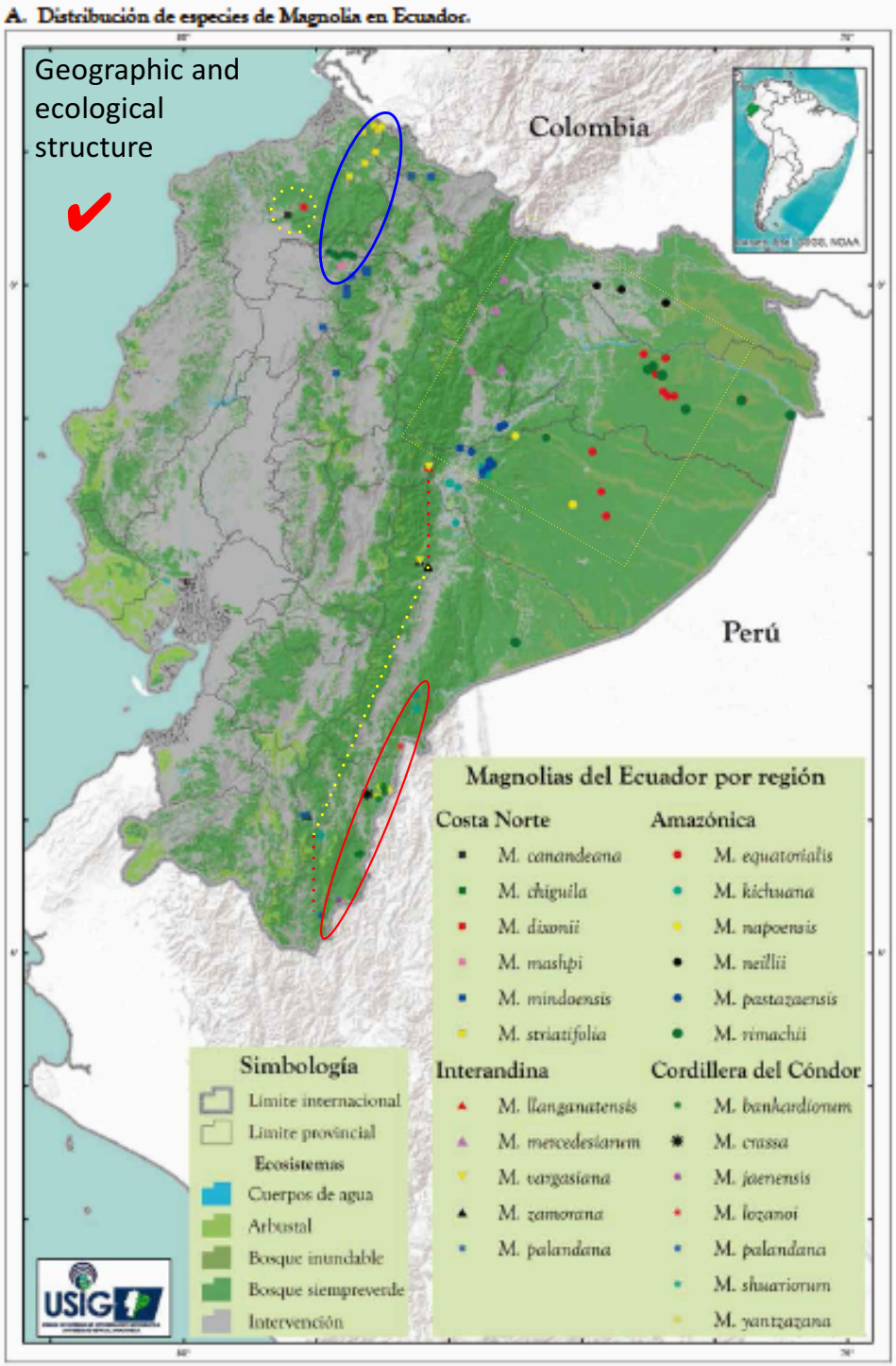


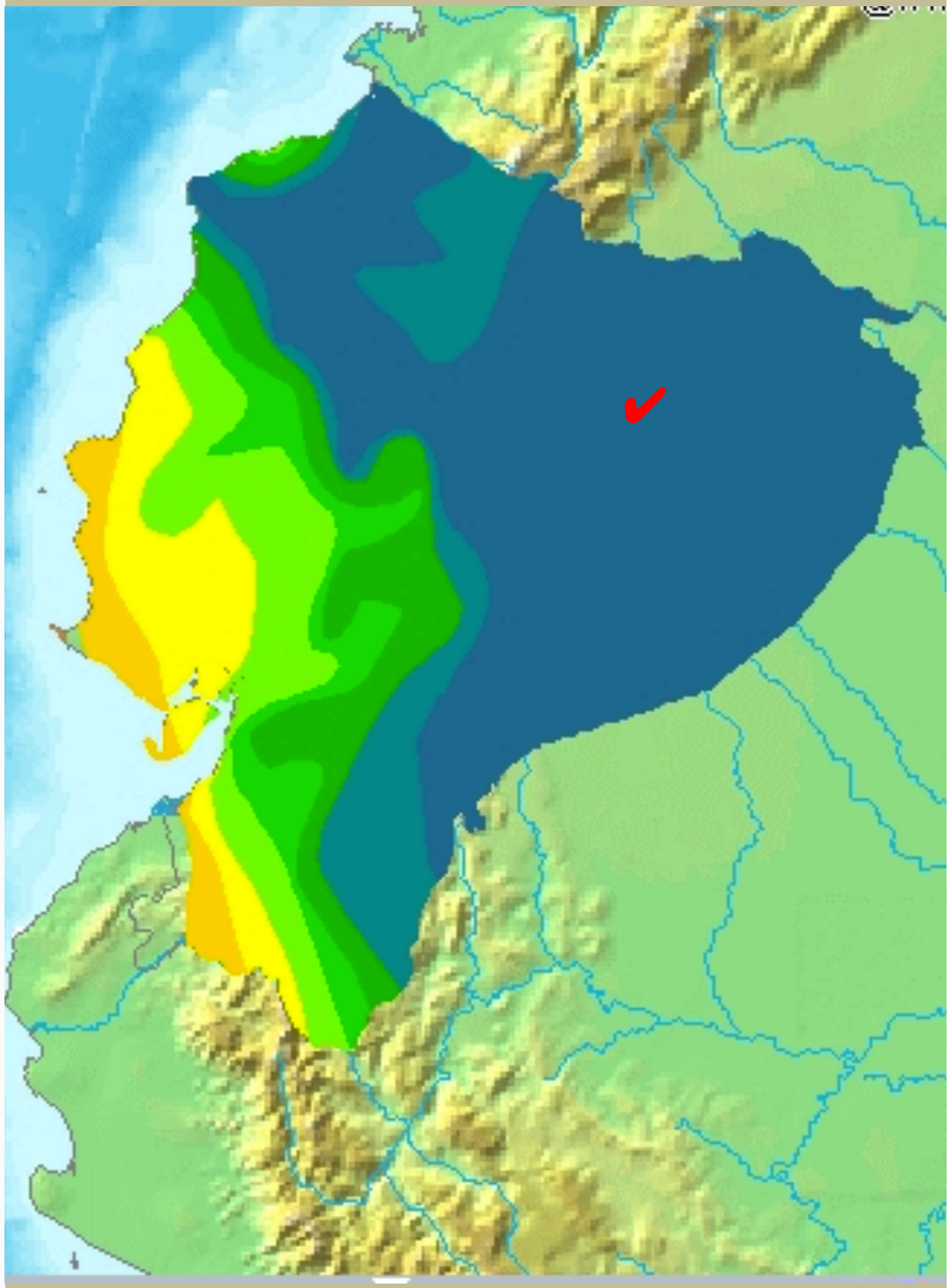
New World

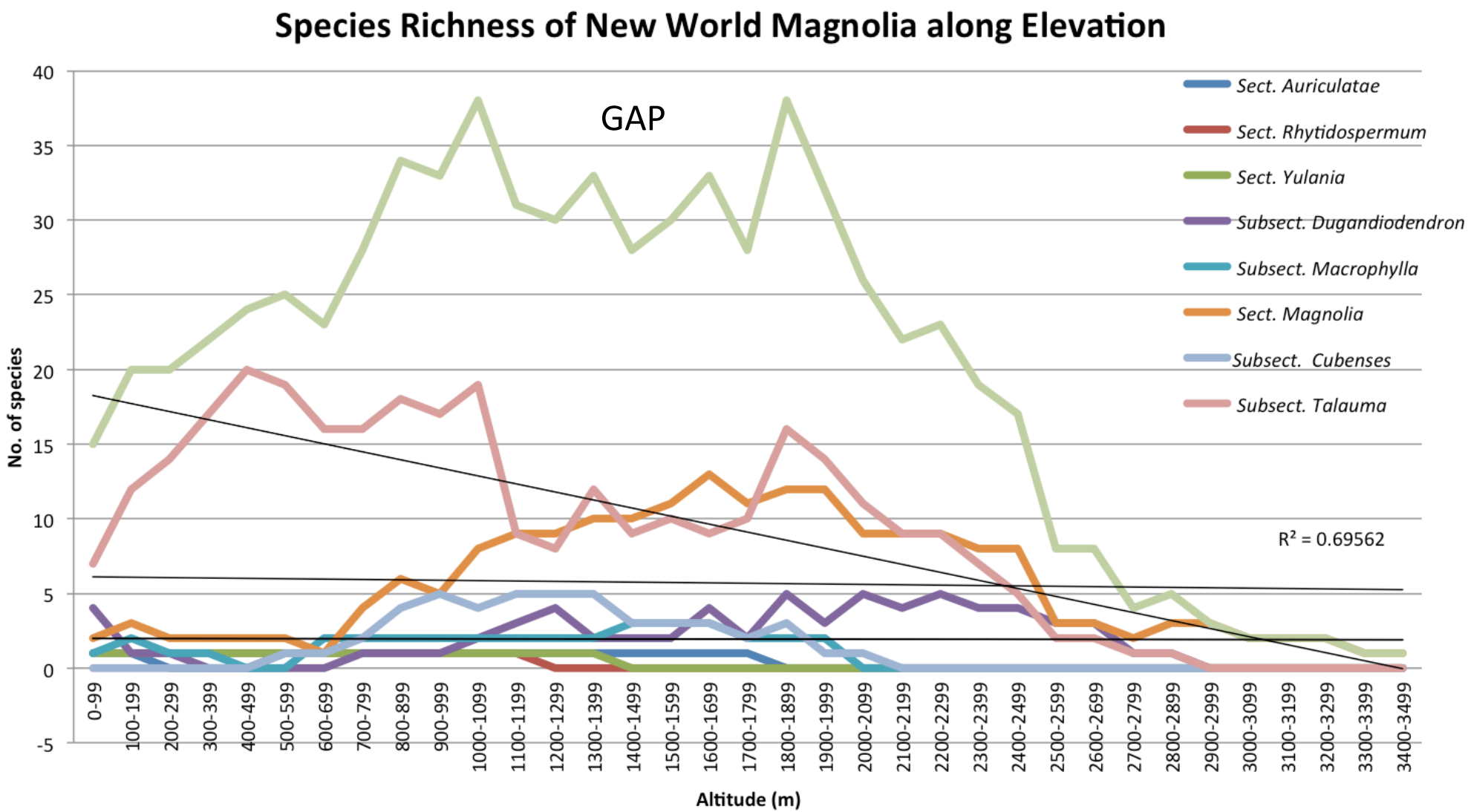
170 spp., 6 sect., 3 subsect.
70 degrees of latitude
67 degrees of longitude
>10-3000 m in elevation
Allopatric speciation pattern
Barochorous dispersal
Strong geographic Structure
Evolutionary history >100 MY


Old paradigm
¡ New paradigm !
Old world
New World
153 spp.
MSI
170 spp.
Vázquez-García
et al. 2014
100
90
80
70
60
50
40
30
20
10
0
Talauma
Magnolia
Dugandiodendron
Cubenses
Macrophylla
Chocotalauma
Auriculata
Tulipastrum
Michelia
Manglietia
Yulania
Blumiana
Guillimia
Maingola
Aromadendron
Gymnopodium
Rhytidospermum
Elmerrilla
Kmeria
Oyama
Manglietiastrum


Species Richness of New World Magnolias
No. of species
Latitude (degrees)
Tropic of Cancer
Equator
Tropic of Capricornr
Nicaraguan Depression
Southern
Centr. Amer. 17
Mexico 40
Northern C. Amér 10
& Caribbean 13
Colombia 34
& Venezuela 4
USA 7
Canada 1
Brazil 10
Peru 12
Ecuador 22
Bolivia 3
TOTAL
Sect. Macrophylla
Sect. Magnolia
Subsect. Talauma
Subsect. Cubenses
Subsect. Dugandiodendron
Sect. Auriculatae
Sect. Rytidospermum
Sect. Yulania

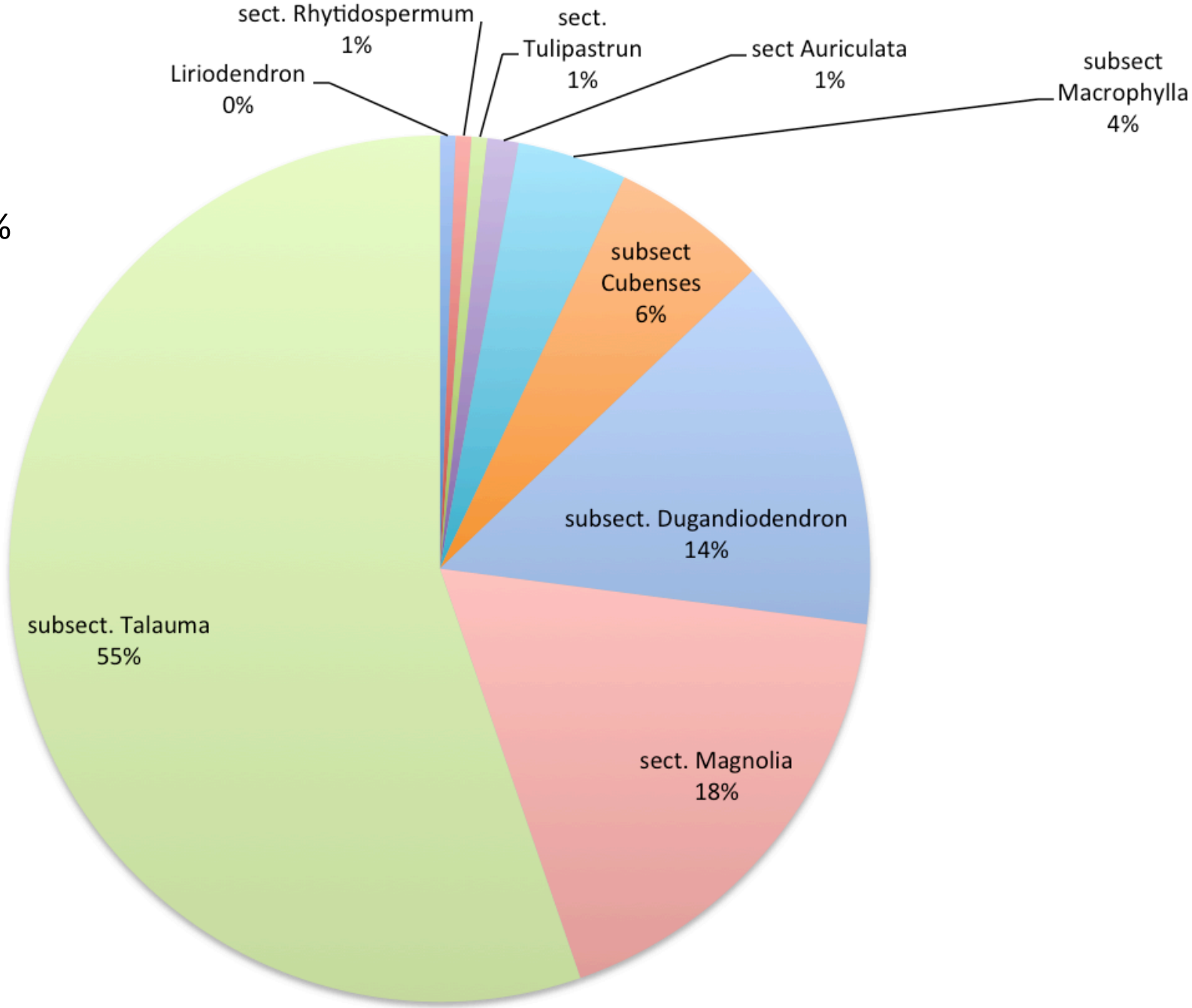

A. Distribución de especies de Magnolia en Ecuador.
Geographic and ecological structure
Colombia
Perú
Magnolias del Ecuador por región
Costa Norte
M. canandeana
M. chiguila
M. dixonii
M. mashpi
M. mindoensis
M. striatifolia
Amazónica
M. equatorialis
M. kichuana
M. napoensis
M. neillii
M. pastazaensis
M. rimachii
Interandina
M. llanganatensis
M. mercedesianum
M. vargasiana
M. zamorana
M. palandana
Cordillera del Cóndor
M. bankardionum
M. crassa
M. jaenensis
M. lozanoi
M. palandana
M. shuariorum
M. yantzazana
Simbología
Límite internacional
Límite provincial
Ecosistemas
Cuerpos de agua
Arbustal
Bosque inundable
Bosque siempreverde
Intervención
USIG

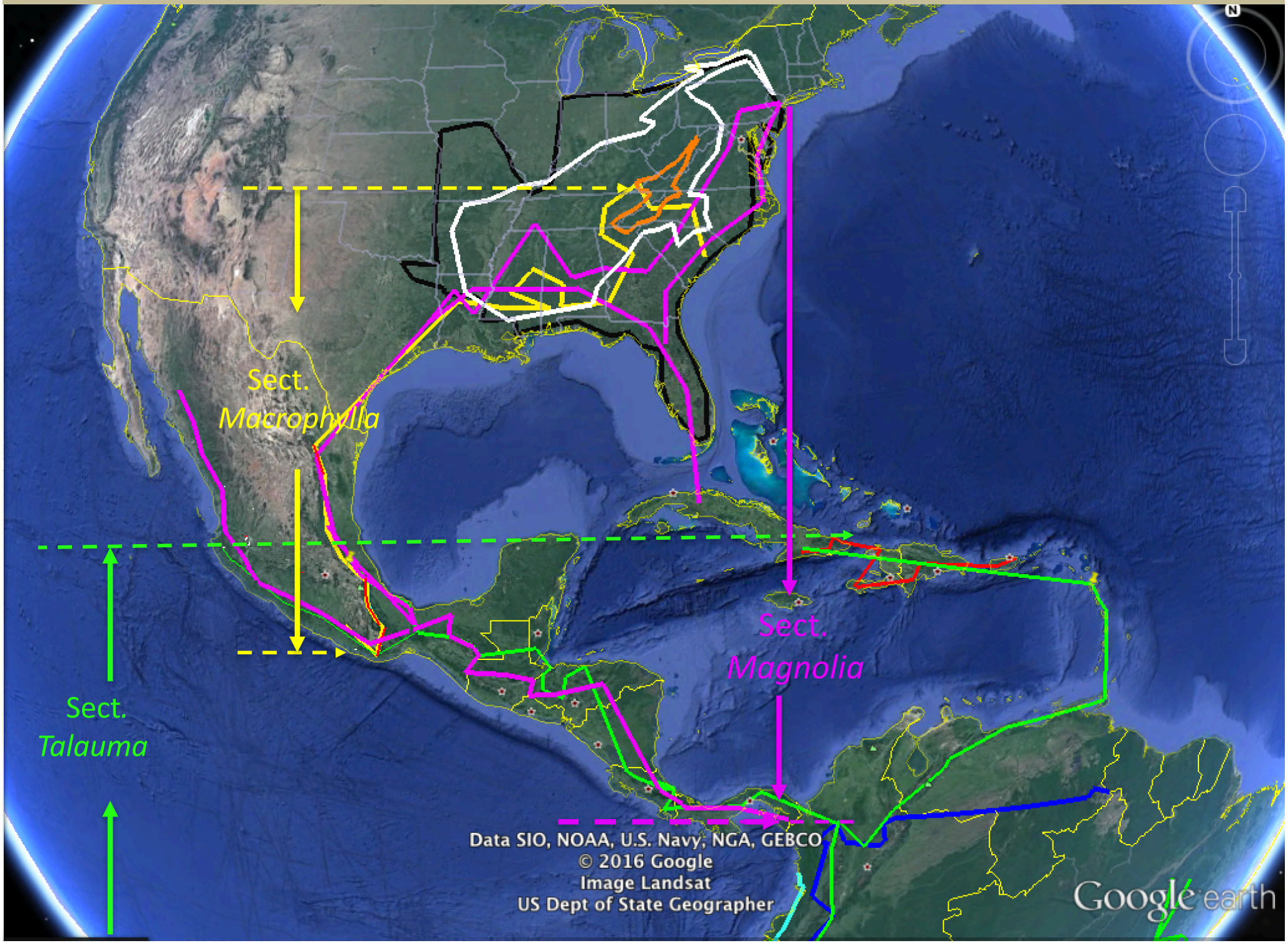



Species Richness of New World Magnolia along Elevation
GAP
Sect. Auriculatae
Sect. Rhytidospermum
Sect. Yulania
Subsect. Dugandiodendron
Subsect. Macrophylla
Sect. Magnolia
Subsect. Cubenses
Subsect. Talauma
R² = 0.69562
No. of species
Altitude (m)
40
35
30
25
20
15
10
5
0
-5
0-99
100-199
200-299
300-399
400-499
500-599
600-699
700-799
800-899
900-999
1000-1099
1100-1199
1200-1299
1300-1399
1400-1499
1500-1599
1600-1699
1700-1799
1800-1899
1900-1999
2000-2099
2100-2199
2200-2299
2300-2399
2400-2499
2500-2599
2600-2699
2700-2799
2800-2899
2900-2999
3000-3099
3100-3199
3200-3299
3300-3399
3400-3499

Taxonomic richness of New World Magnoliaceae

170 spp
Sect. *Talauma* 75%




Sect.
Macrophylla
Sect.
Magnolia
Sect.
Talauma
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2016 Google
Image Landsat
US Dept of State Geographer
Google earth


Sect.
Magnolia
Sect.
Talauma
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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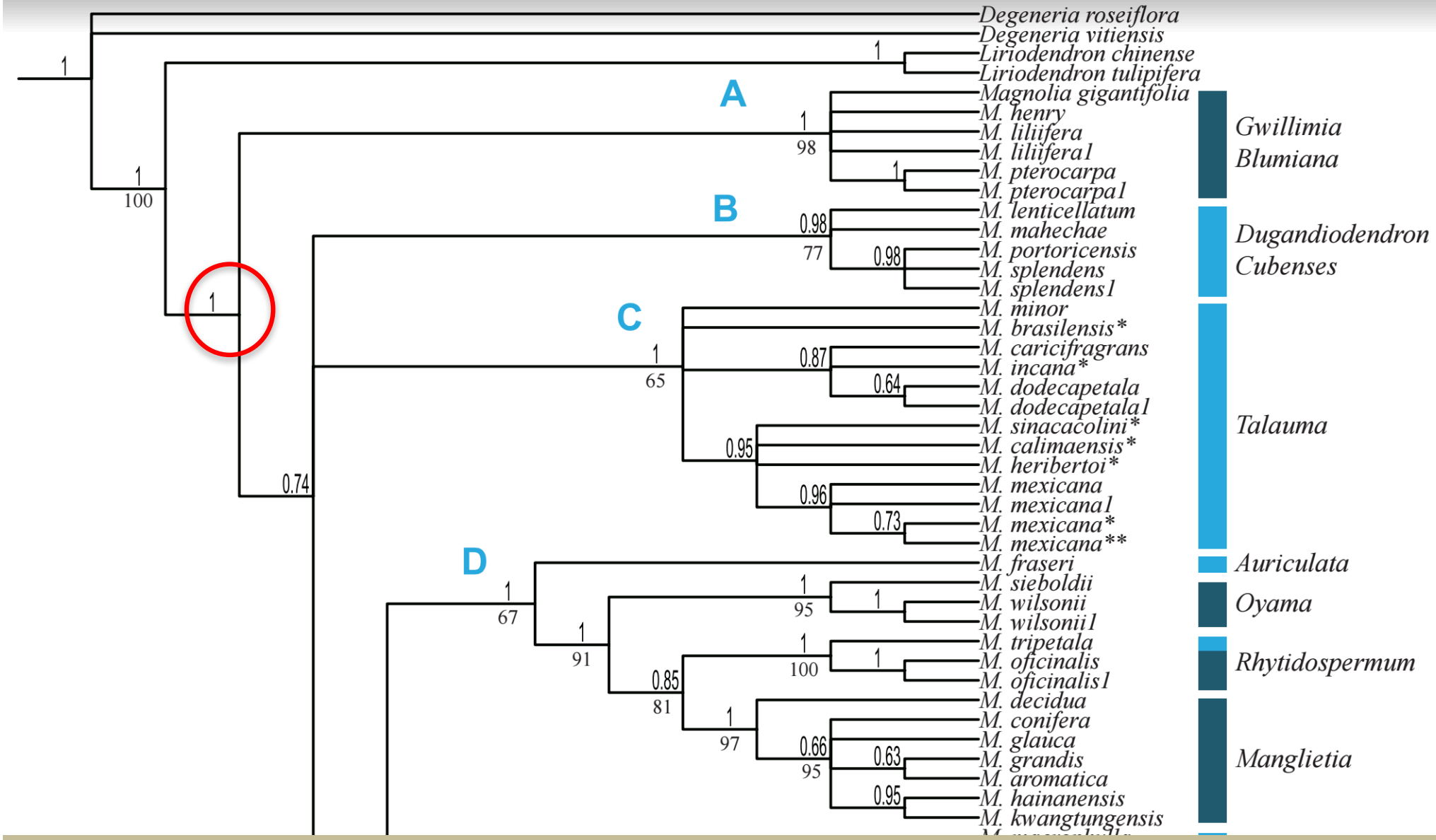
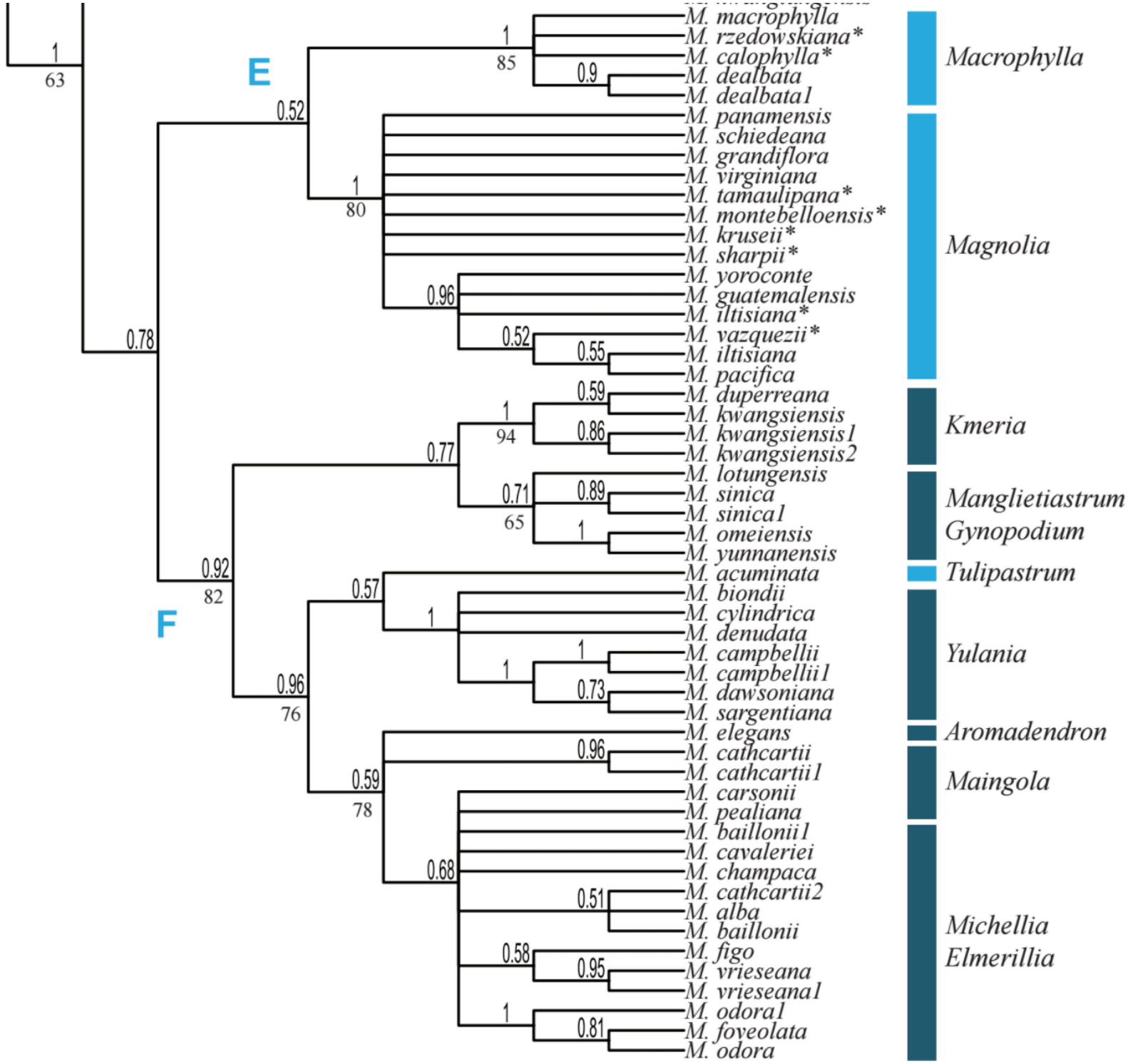
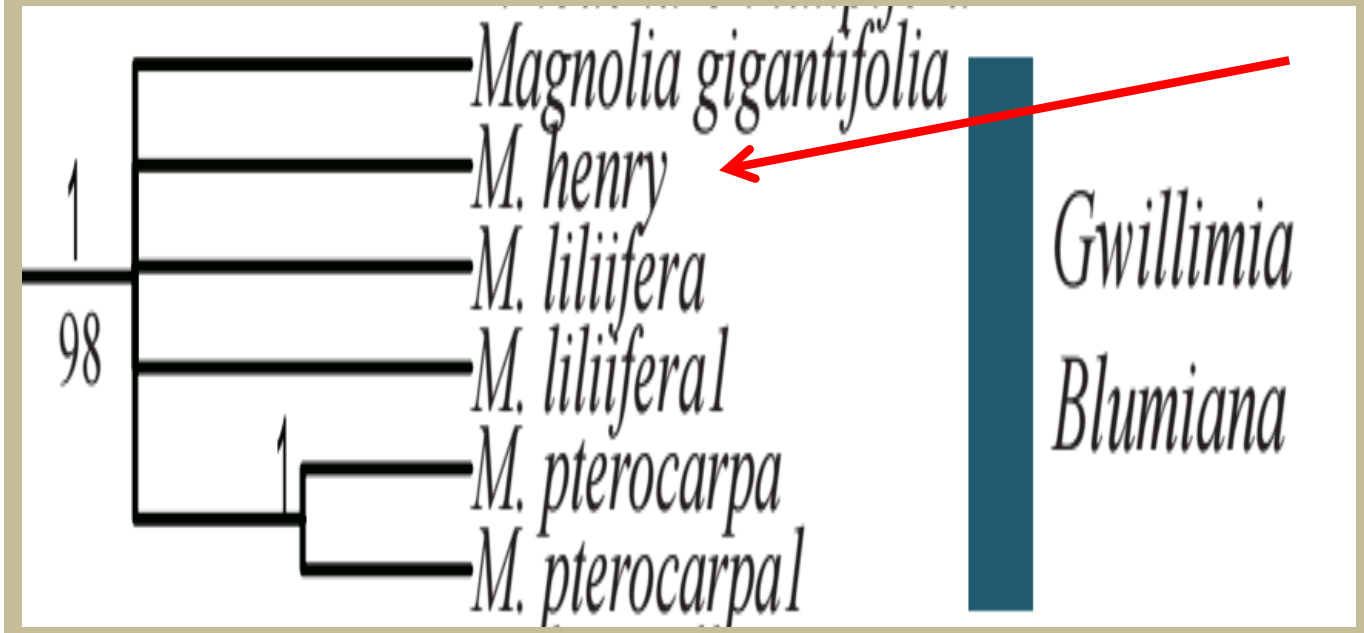
US Dept of State Geographer
Goog

Genomic region	No. of taxa	No. of char. (bp)	No. of Var. sites	% of Var. sites	No. of Pi.	% of Pi.	Substitution Model
*mat*K	92	1458	164	11.2	126	8.6	GTR+G+I
GAI	41	1291	251	19.	165	12.8	HKY+G
PHYA	41	1015	111	10.9	87	8.6	KY+I+G
*psb*A	65	426	87	20.4	41	9.6	GTR+G
ORF 350	53	520	85	16.3	60	11.5	HKY+G
Five regions Concatenated	92	4710	698	14.8	479	10.1	Mixed

No. char=sequence length in base pairs (bp); Var.sites=number of variable sites; %Var.sites=proportion of variable sites; Pi. = Parsimony-informative sites; Substitution Model=best substitution model from JModelTest.


Degeneria roseiflora
Degeneria vitiensis
Liriodendron chinense
Liriodendron tulipifera
Magnolia gigantifolia
M. henry
M. liliifera
M. liliifera1
M. pterocarpa
M. pterocarpa1
M. lenticellatum
M. mahechae
M. portoricensis
M. splendens
M. splendens1
M. minor
M. brasilensis*
M. caricifragrans
M. incana*
M. dodecapetala
M. dodecapetala1
M. sinacacolini*
M. calimaensis*
M. heribertoi*
M. mexicana
M. mexicana1
M. mexicana*
M. mexicana**
M. fraseri
M. sieboldii
M. wilsonii
M. wilsonii1
M. tripetala
M. oficinalis
M. oficinalis1
M. decidua
M. conifera
M. glauca
M. grandis
M. aromatica
M. hainanensis
M. kwangtungensis
A
B
C
D
Gwillimia
Blumiana
Dugandiodendron
Cubenses
Talauma
Auriculata
Oyama
Rhytidospermum
Manglietia


E
F
1
63
0.78
0.52
1
85
0.9
1
80
0.96
0.52
0.55
0.92
82
0.77
1
94
0.59
0.86
0.71
65
0.89
1
0.57
1
1
1
0.73
0.96
76
0.59
78
0.96
0.68
0.51
0.58
0.95
1
0.81
M. macrophylla
M. rzedowskiana*
M. calophylla*
M. dealbata
M. dealbata1
M. panamensis
M. schiedeana
M. grandiflora
M. virginiana
M. tamaulipana*
M. montebelloensis*
M. kruseii*
M. sharpii*
M. yoroconte
M. guatemalensis
M. iltisiana*
M. vazquezii*
M. iltisiana
M. pacifica
M. duperreana
M. kwangsiensis
M. kwangsiensis1
M. kwangsiensis2
M. lotungensis
M. sinica
M. sinica1
M. omeiensis
M. yunnanensis
M. acuminata
M. biondii
M. cylindrica
M. denudata
M. campbellii
M. campbellii1
M. dawsoniana
M. sargentiana
M. elegans
M. cathcartii
M. cathcartii1
M. carsonii
M. pealiana
M. baillonii1
M. cavaleriei
M. champaca
M. cathcartii2
M. alba
M. baillonii
M. figo
M. vrieseana
M. vrieseana1
M. odora1
M. foveolata
M. odora
Macrophylla
Magnolia
Kmeria
Manglietiastrum
Gynopodium
Tulipastrum
Yulania
Aromadendron
Maingola
Michellia
Elmerillia



Subsect. *Guillimia*

Subsect. *Blumiana*

Subssect. *Cubenses* (1991)

Subsect. *Dugandiodendron* (2004)

M. cubensis

Dorsal sutures

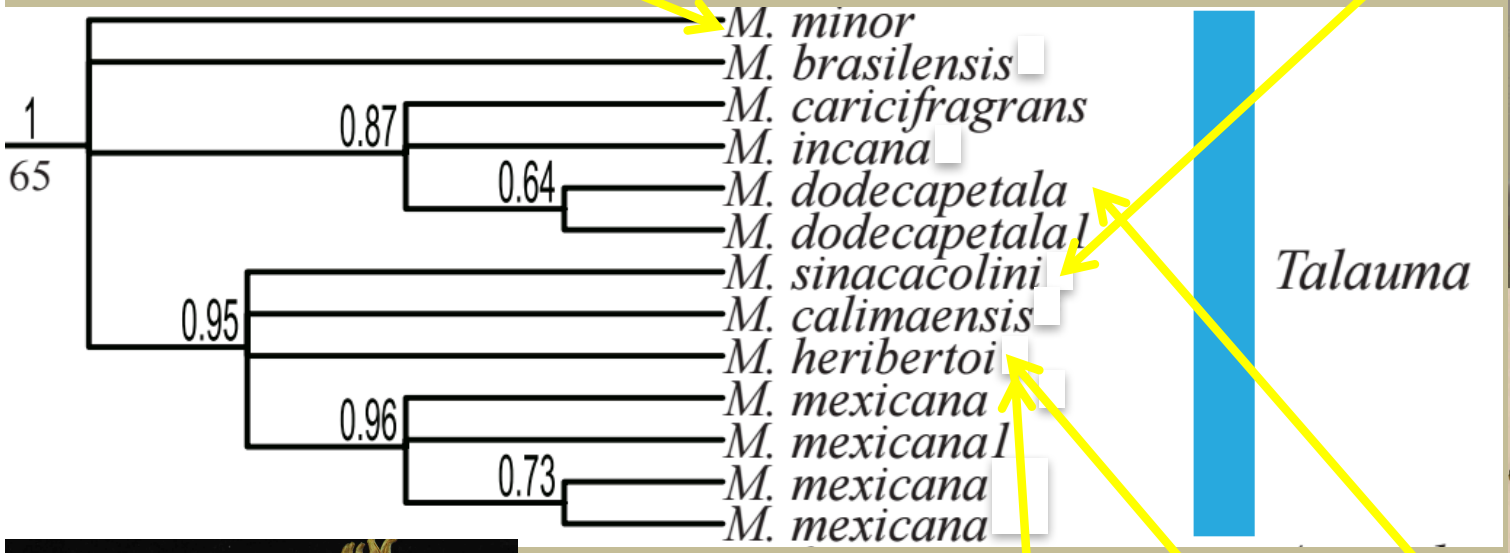
M. ptaritepuiana

M. bankardiorum

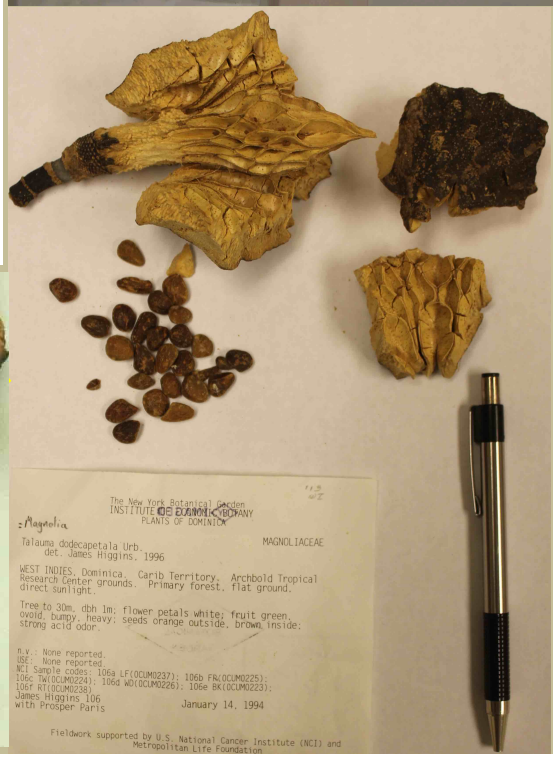
Subssect. *Cubenses* *Imkaniskaya*

Sima & Lu 2012, Considering the Priority Principle, merged the Caribbean magnolias within the genus *Dugandiodendron Lozano*


M. boliviana
The New York Botanical Garden
Plants of BOLIVIA
113
5A
Magnoliaceae
Talauma


M. minor
M. brasilensis
M. caricifragrans
M. incana
M. dodecapetala
M. dodecapetala1
M. sinacacolini
M. calimaensis
M. heribertoi
M. mexicana
M. mexicana1
M. mexicana
M. mexicana
1
65
0.87
0.64
0.95
0.96
0.73
Talauma


HERBARIO LOS TUXTLAS
U.N.A.M.
PLANTAS DE MÉXICO: Veracruz
MAGNOLIACEAE


The New York Botanical Garden
INSTITUTE OF ECONOMIC BOTANY
PLANTS OF DOMINICA
Magnolia
Talauma dodecapetala Urb.
det. James Higgins, 1996
MAGNOLIACEAE
WEST INDIES, Dominica. Carib Territory. Archbold Tropical Research Center grounds. Primary forest, flat ground, direct sunlight.
Tree to 30m, dbh 1m; flower petals white; fruit green, ovoid, bumpy, heavy; seeds orange outside, brown inside; strong acid odor.
n.v.: None reported.
USE: None reported.
NCI Sample codes: 106a LF(OCUM0237); 106b FR(OCUM0225); 106c TW(OCUM0224); 106d WD(OCUM0226); 106e BK(OCUM0223); 106f RT(OCUM0238)
James Higgins 106
with Prosper Paris
January 14, 1994
Fieldwork supported by U.S. National Cancer Institute (NCI) and Metropolitan Life Foundation

Summary

1. Molecular phylogenetic tree covering all sectional and subsectional groups including new subsection Chocotalauma

2. Subsection Guillimia Guillimia-Blumiana *was found basal* with high bootstrap support value. Then, the clade is sister to subsection *Talauma*.

3. We need to include sufficient species of all four subections of *Talauma* to achive a robust molecular phylogeny.

4. We need to re-evaluate morphological character specific to the groups supposed by the molecular phylogenetic analysis, and then reconstract the classification of *Magnolia*.

International Magnolia Symposia / 22 years

1) **1996**. April 12-13, Royal Holloway, University of London, Egham, Surrey, UNITED KINGDOM [Proceedings 1998].

2) **1998**. May 18-22, Guangzhou (Canton), CHINA. [Proccedings 2000].

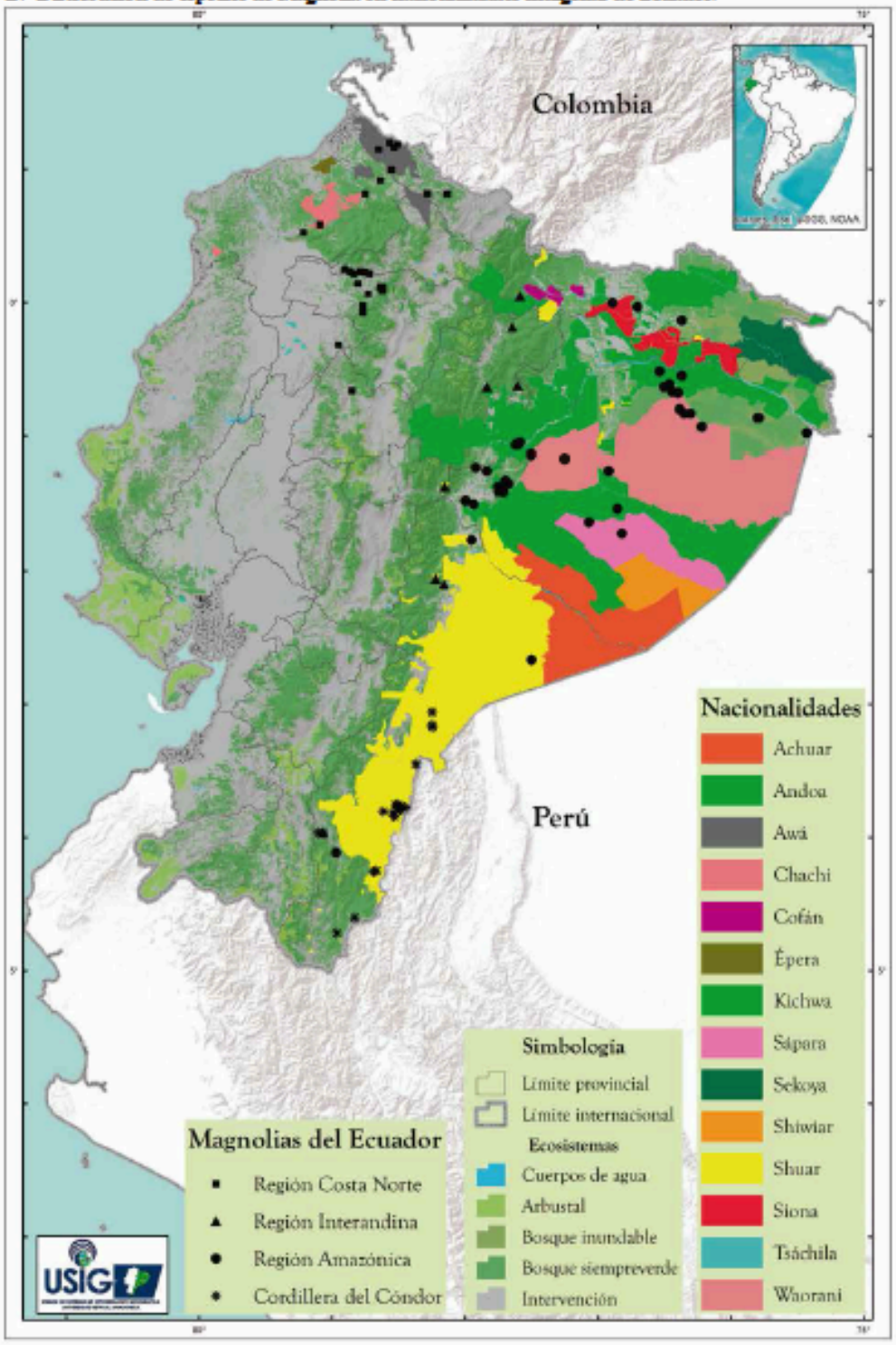
3) **2009**. May 5-8, Guangzhou (Canton), CHINA. [Proceedings 2012]

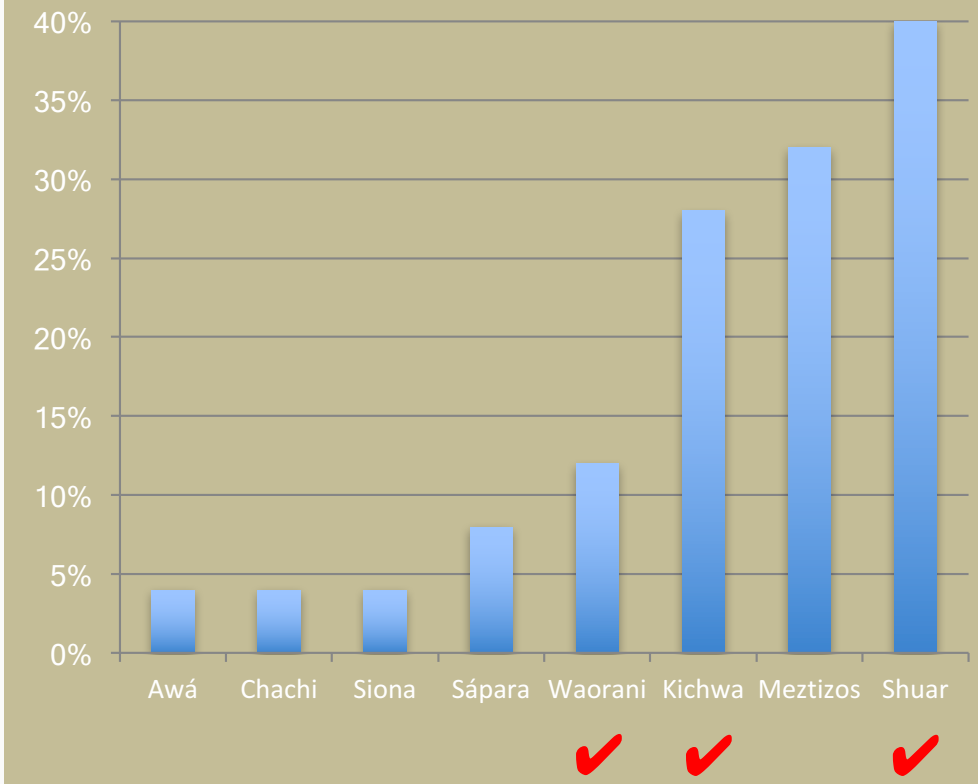
4) **2015**. July 8-14, Univ. Estatal Amazónica, Puyo, ECUADOR [Proceedings in progress !, Presentations available]
Today

5) **2016**. Nov. 28-December 2. Varadero, CUBA

6) **2017**. Forthcoming, July 23-29, Shenzhen, CHINA

B. Distribución de especies de Magnolia en nacionalidades indígenas de Ecuador.





¿Conservation or an utopy?

Unless we support training of
Kichwan, Shuari and Waorani,
starting with English language,
and in relevant fileds of science
for research thesis, or
Conservation projects for saving
Ecuadorian magnolias and their megadiverse
Ecosystems become an utopy

Acknowledgements

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Prometeo Program, SENECYT, Ecuador

Soc. Bot. Cuba, MSI, & Planta !

Thanks Cuba,
Please, keep shining world wide
with your wisdom and joy,
for a better humankind