Genetic characterization of *Magnolia rzedowskiana* (Magnoliaceae): a heterogeneous complex on Sierra Madre Oriental, Mexico

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Segregated species of the *Magnolia dealbata* complex

Species	Distribution	Reference
M. dealbata Zucc	North of Oaxaca	Zucc. (1836)
M. vovidesii	Center of Veracruz	Vázquez-García *et al*. (2013)
M. rzedowskiana	Hidalgo; Querétaro, S.L.P., Veracruz	Vázquez-García *et al*. (2015)
M. nuevoleonensis	Nuevo León	Vázquez-García *et al*. (2016)
M. alejandrae	Tamaulipas	García-Morales *et al*. (2017)

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MAGNOLIA RZEDOWSKIANA (MAGNOLIACEAE), UNA ESPECIE NUEVA DE LA SECCIÓN *MACROPHYLLA* DE LA PARTE CENTRAL DE LA SIERRA MADRE ORIENTAL, MÉXICO

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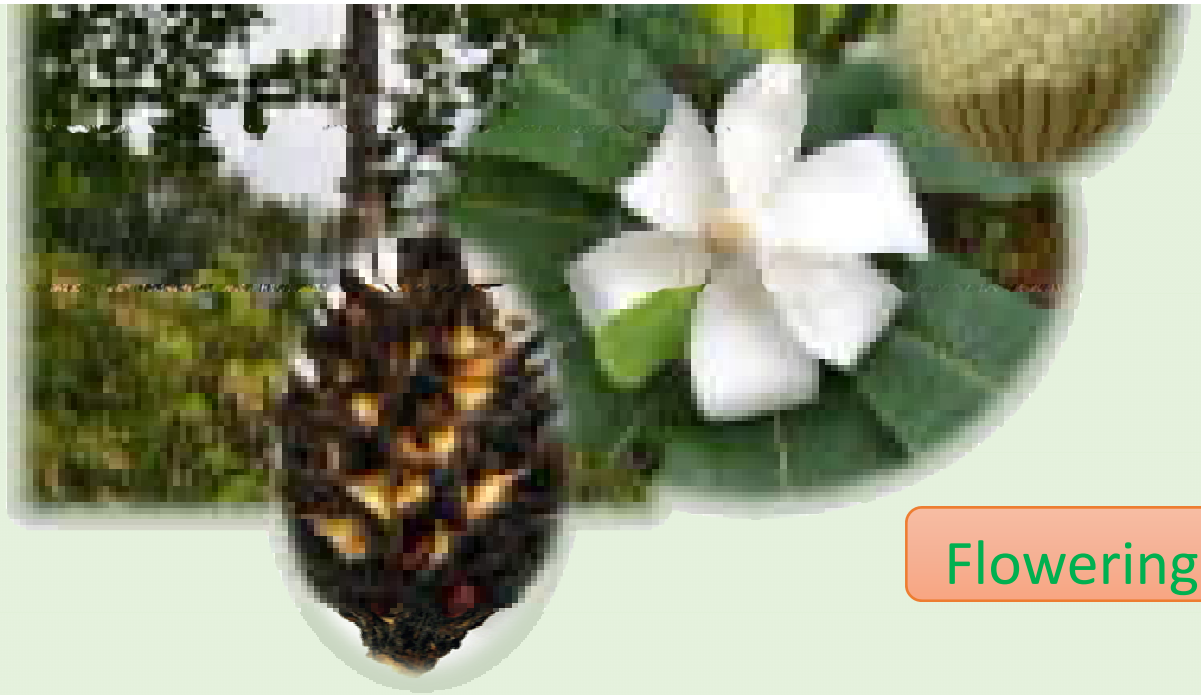


carpels

✓Smalleer fruit size

Flowering: March - September

✓ *M. rzedowskiana*

✓ Endemic species

✓ Cloud Forest

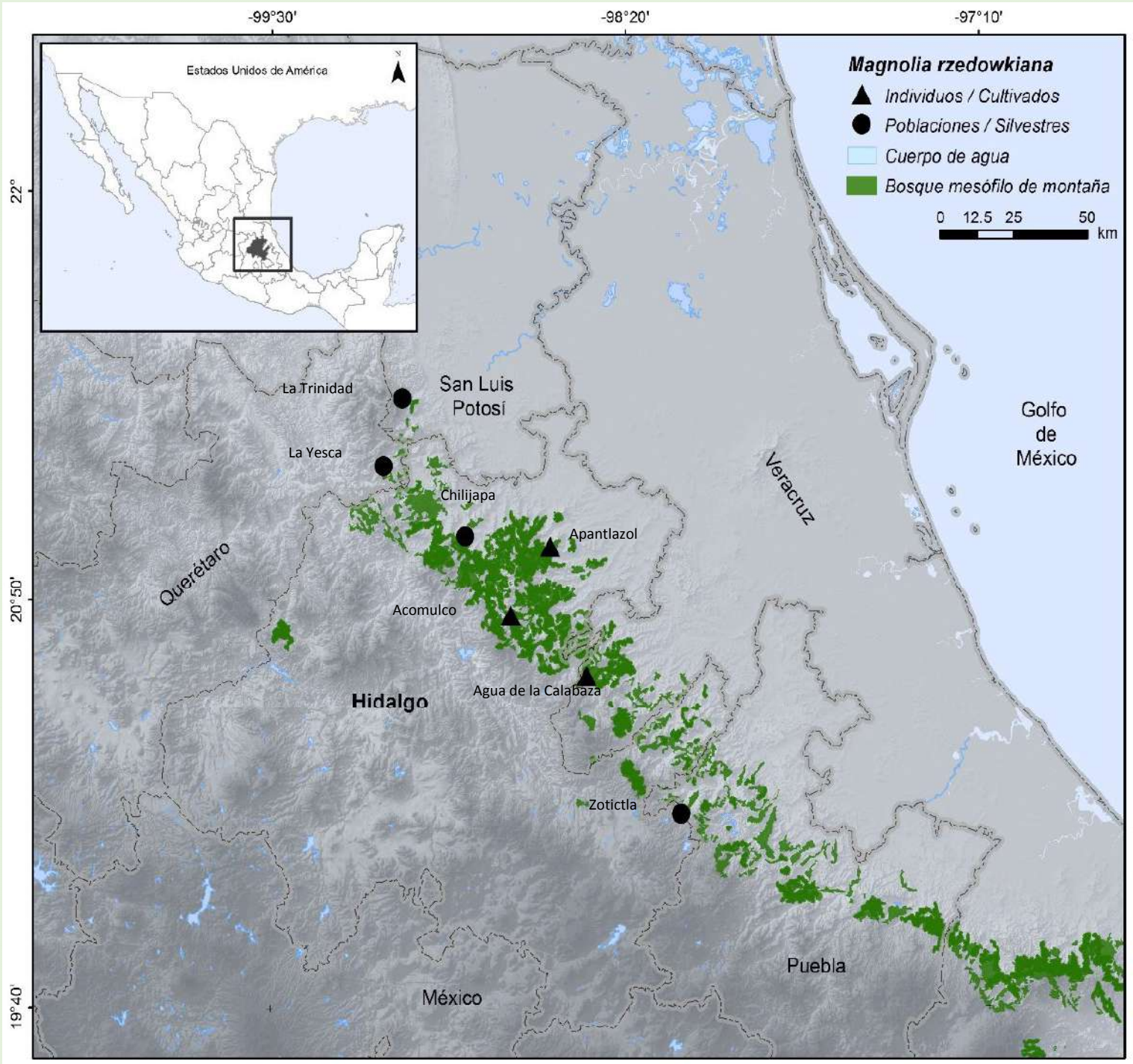
✓ Economic and medicinal value

NOM-059-SEMARNAT-2010/UICN

Vázquez-García *et al.* (2015)

STUDY AREA

Magnolia rzedowskiana **distribution on SMO**



METHODS

DNA extraction → PCR Amplification (8 microsatellites) *M. obovata* (Isagui et al 2000)

GENETIC DIVERSITY

Average alleles per locus, efective number of alleles per locus, observed and expected heterozygosity, fixation index, HWE (Peakall and Smouse, 2006).

GENETIC STRUCTURE

AMOVA (Fst), Nei's distance, migrants by generation (Nm), Bayesian assignation of individuals per population, Discriminant Analysis of Principal Components (Pritchard et al. 2000, Jombart et al., 2010).

OTHER EVOLUTIONARY FORCES

Genetic Drive (Bottkeneck Analysis, Cournet and Liukart, 1996).

Natural Selection (Atypical alleles in Dirichlet model, Bernard, 2005).

RESULTS-DISCUSION

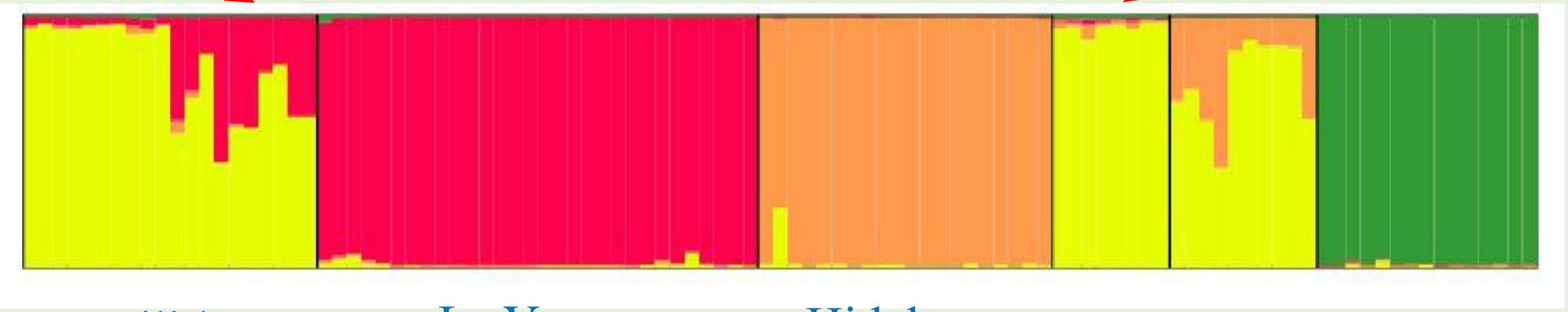
Genetic variation in populations of *Magnolia rzedowskiana* (SMO)

State/Region	N	Na	Ne	Ho	He	f
Xilitla, SLP.	20	4.12 ± 0.66	2.85 ± 0.53	0.50 ± 0.1	0.56 ± 0.07	0.19 ± 0.14
La Yesca, Qro.	30	3.87 ± 0.61	2.25 ± 0.2	0.43 ± 0.12	0.53 ± 0.04	0.19 ± 0.23
North Hgo.	20	4.12 ± 0.61	3.01 ± 0.48	0.65 ± 0.11	0.58 ± 0.08	-0.14 ± 0.13
South Hgo.	10	3.62 ± 0.56	2.72 ± 0.32	0.57 ± 0.12	0.60 ± 0.03	0.08 ± 0.19
Huayacocotla, Ver.	8	3.25 ± 0.64	2.44 ± 0.43	0.5 ± 0.13	0.48 ± 0.09	0.02 ± 0.17
M. dealbata, Oax.	15	3.62 ± 0.65	2.55 ± 0.4	0.39 ± 0.12	0.52 ± 0.08	0.24 ± 0.17

Paired analysis of molecular variance among *M. rzedowskiana* populations (Fst: index of differentiation, Nm: number of migrants per generation, Nei D: Nei´s genetic distance)

Pop1	Pop2	Fst	Nm	Nei D
Xilitla, SLP	La Yesca. Qro.	0.26*	0.71	0.62
Xilitla, SLP	North Hidalguense region	0.26*	0.68	0.79
La Yesca. Qro.	North Hidalguense region	0.31*	0.53	0.96
Xilitla, SLP	Huayacocotla, Ver.	0.09	2.39	0.19
La Yesca. Qro.	Huayacocotla, Ver.	0.31*	0.54	0.79
North Hidalguense region	Huayacocotla, Ver.	0.33*	0.50	1.07
Xilitla, SLP	Southeast Hidalguense region	0.09*	2.28	0.24
La Yesca, Qro.	Southeast Hidalguense region	0.31*	0.53	1.08
North Hidalguense region	Southeast Hidalguense region	0.19*	1.02	0.55
Huayacocotla, Ver.	Southeast Hidalguense region	0.09^{ns}	2.31	0.23
Xilitla, SLP	*Magnolia dealbata*	0.30*	0.55	0.93
La Yesca. Qro.	*Magnolia dealbata*	0.32*	0.511	0.91
North Hidalguense region	*Magnolia dealbata*	0.34*	0.472	1.30
Huayacocotla, Ver.	*Magnolia dealbata*	0.31*	0.540	0.83
Southeast Hidalguense region	*Magnolia dealbata*	0.29*	0.613	0.95

Hibryds?, Common ancestral species?



Xilitla

La Yesca

Cryptic Sp. 1

Hidalgo North

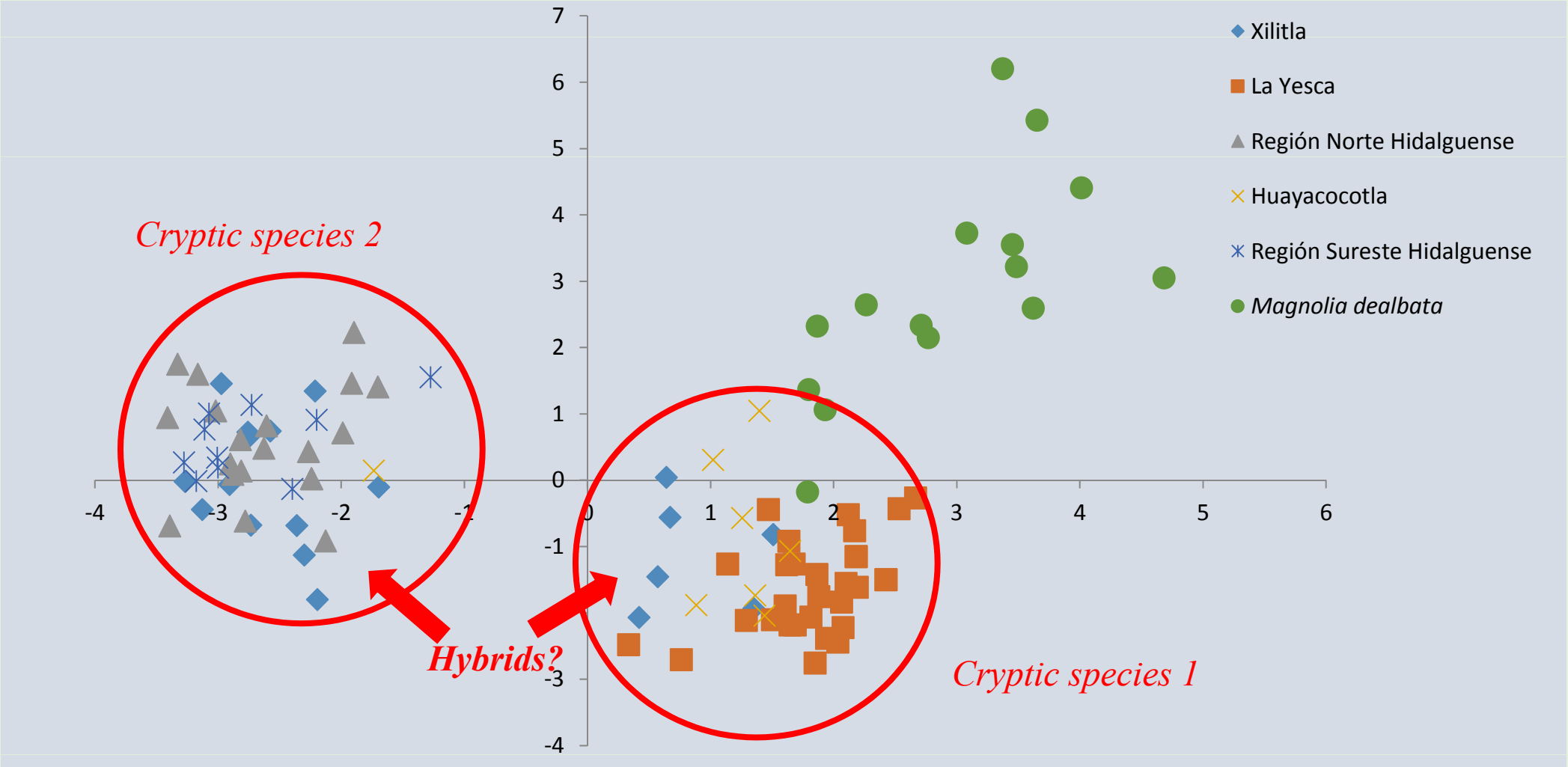
Cryptic Sp. 2

Huayacocotla

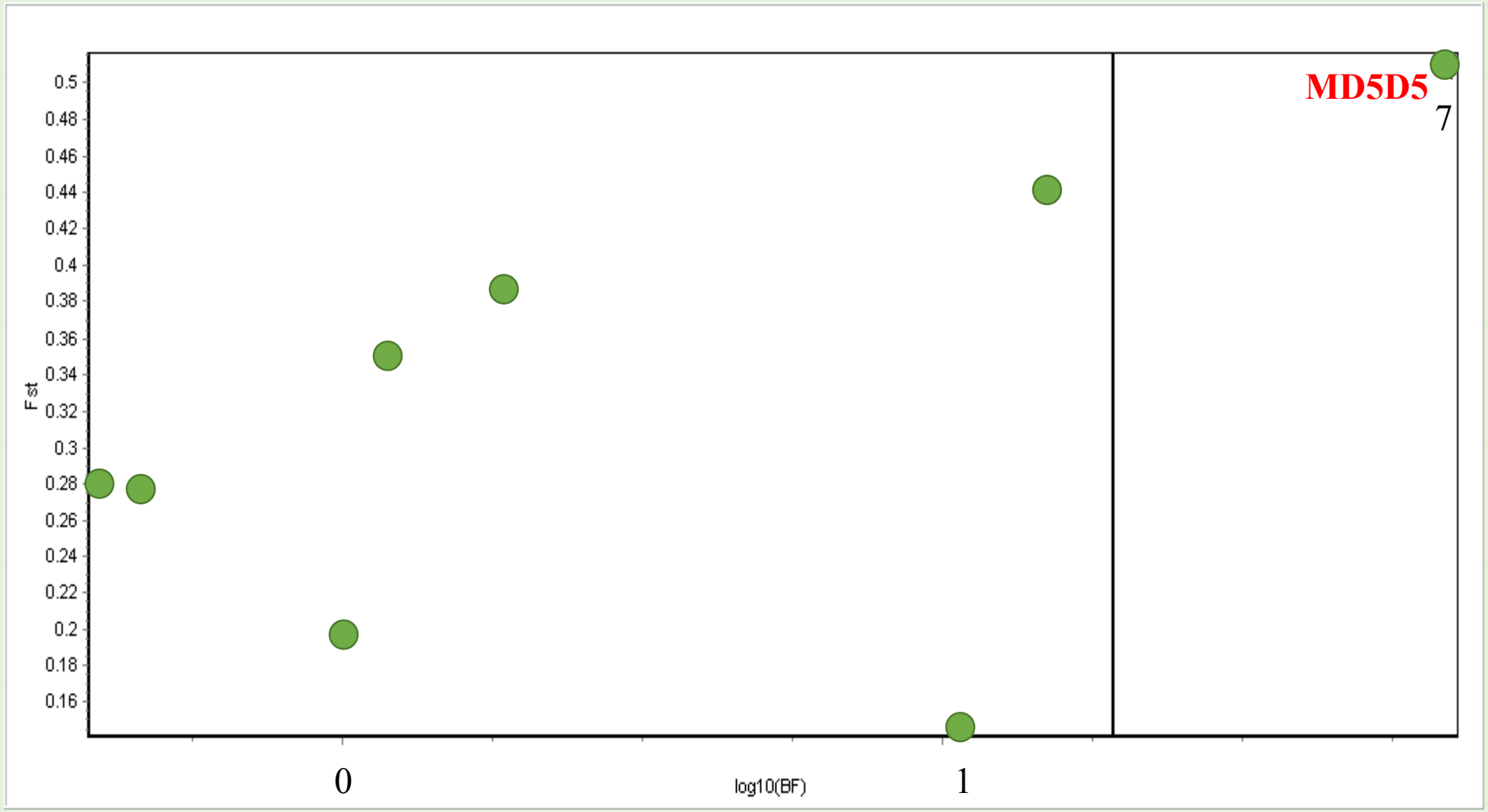
Hidalgo Southeast

M. dealbata

Analysis of Bayesian allocation for the five populations of *M. rzedowskiana* and a population of *M. dealbata* for a value of K = 4



Discriminating Analysis of Principal Components for five populations of *M. rzedowskiana* and one population of *M. dealbata*



Detection of atypical loci using BayeScan in *M. rzedowskiana*; log10 (BF): decision factor in logarithmic scale (base 10) to determine the selection, the vertical line indicates the final point of loci external to a model under neutrality

Allelic and genotypic frequencies of the MD5D5 locus, associated with natural selection processes, in populations of *M. rzedowskiana* (5) and *M. dealbata* (1)

		Populations					
Locus	Allele	Xilitla	La Yesca	North Hidalgo	Huayacocotla	South Hidalgo	*M. dealbata*
M15D5	n	20	30	20	8	10	15
	100	0.9	0.56	---	0.75	0.6	0.46
	105	0.1	0.44	1.0	0.25	0.4	---
	110	---	---	---	---	---	0.53*
		Against heterozygote?, Disruptive selection?					
Ho		0.00	0.00	0.00	0.00	0.00	0.26
He		0.18	0.49	0.00	0.37	0.48	0.49

Directional selection

Bottleneck analysis in *Magnolia rzedowskiana* y *M. dealbata*

Population	LD	LE	H	P	CB
Xilitla	1	7	2.10	0.017	*
La Yesca	2	6	1.93	0.026	*
North Hidalgo	0	7	2.94	0.001	**
Huayacocotla	1	6	1.44	0.073	ns
South Hidalgo	0	8	3.00	0.001	**
M. dealbata	0	7	2.17	0.014	*

Management?

CONCLUSIONS

Magnolia rzedowskiana its a different complex respect to *M. dealbata.*

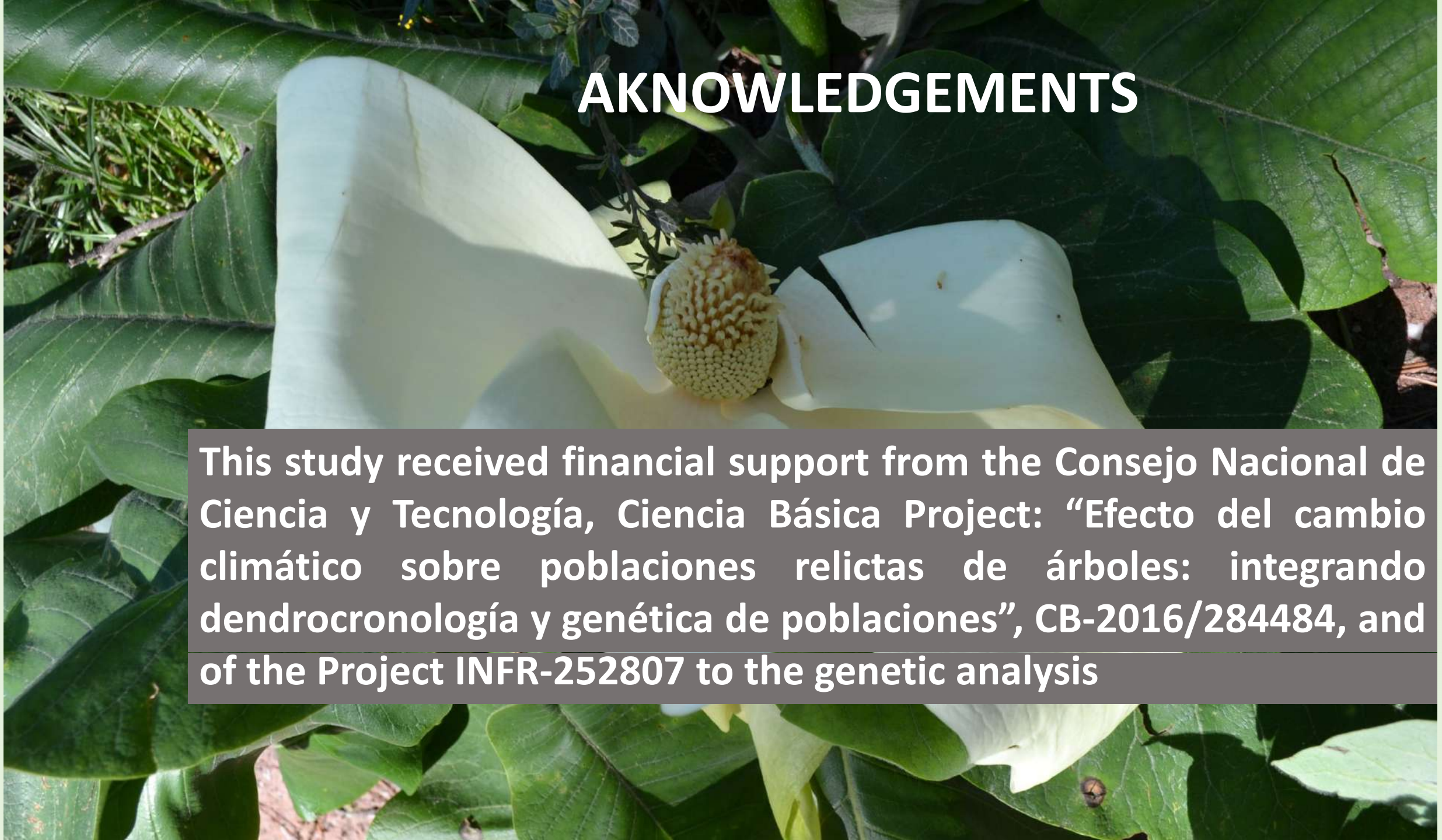
Two cryptic species were found in the northern distribution.

A directional and/or disruptive selection caused the differentiation among populations of M. rzedowskiana.

Hybridation zones would exist in north and south regions.

Major threats are found in the Northern Hidalgo populations.



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