Abstracts and Posters

Quercus repanda

Quercus ×dysophylla

Quercus trinitatis

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Quercus castanea photo©Guy Sternberg

Quercus laeta photo©Guy Sternberg

Allometric Relationships of Two Oak Species Under Management for Traditional Charcoal Making

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One of the main economic activities of rural communities in the Cutizeo basin in Central Mexico is charcoal making using traditional techniques. Among the most frequently used species are *Quercus castanea* Née and *Q. laeta* Liebm., which are the most representative (along with *Q. deserticola*) in terms of distribution, abundance and basal area.

Forests and rangelands managed for charcoal making in the study area show the typical morphology of sprouting oaks. No allometric equations have been reported so far for oak sprouts, although it would be expected that DBH *vs* biomass relationships vary with respect to unharvested oaks.

A regression equation was calculated for each species being wood-suitable for charcoal, making (log(Y)) a function of sprouts' DBH (Log(X)). A third equation was developed for both species. Data was collected taking advantage of business-as-usual harvesting of oaks during charcoal making. Equations resulted as follows: *Q. castanea* (logY=9.52+2.63logX, R^2= 0.97, n=115); logY = 9.52564 + 2.63loyX *Q. laeta* (logY=9.39+2.69logX, R^2=0.98, n=17); and mixed equation (logY=9.41+2.59logX, R^2=0.96, n=132).

Currently, we are completing the study with data from *Q. deserticola* (n=40). Results from the present analysis will be used to estimate the sprouting productivity within experimental plots with varying startup regrowth dates (harvest events occurring since 1975 to present). The final objective of the project is to help design sound management strategies for oak rangelands in the study area.

Gene flow through pollen in a fragmented Mexican landscape

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INTRODUCTION

Gene flow within and among populations is a critical parameter of evolutionary processes, such as population differentiation. Pollen flow has been considered the most important component of gene flow in plants that are wind pollinated and produce large and immobile seeds.

Currently, human land use for agriculture and development has transformed large natural ecosystems into fragmented landscapes, significantly modifying gene flow patterns and genetic diversity.

OBJECTIVES

To estimate nuclear genetic diversity in *Quercus castanea* populations in fragmented landscape.

To evaluate gene flow levels from the heterogeneity of pollen pools accepted by individual seed parents.

METHODS

This study was performed in the catchment basin of Cuitzeo lake, Mexico (~4000 km²)

Currently, this region is characterized by a high degree of forest fragmentation occurring within the last years. The basin has more than 1200 oak forest fragments.

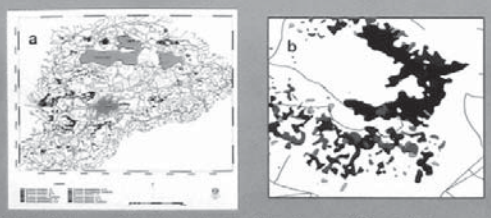

Fig 1. a) Map of Cuitzeo basin showing oak forest fragments, and b) enlargement of a small region of the basin.

We collected foliar tissue from
4 populations in different fragments
16 isolated trees throughout he basin
And acorns from each tree

Genetic parameters were evaluated using seven nuclear microsatellites (Aldrich *et al.*, 2002).

RESULTS

Great genetic diversity in all populations in both cohorts.

Gene flow diminish in progenies, principally in isolated progenies, which are strongly structured.

Heterogeneity of pollen pool was lower in isolated trees.

Table 1. Genetic diversity in adults and progenies of *Quercus castanea* populations and isolated trees

	Adults							Progenies						
Pob	n	N_a	N_e	A_p	H_o	H_e	F	n	N_a	N_e	A_p	H_o	H_e	F
JMB	16	9.429 (0.99)	5.558 (0.89)	0.714 (0.28)	0.777 (0.06)	0.765 (0.06)	-0.022 (0.05)	156	12.86 (1.37)	6.368 (1.04)	0.286 (0.28)	0.737 (0.07)	0.792 (0.06)	0.075 (0.05)
JMP	16	9.857 (1.28)	6.168 (0.68)	1.429 (0.36)	0.813 (0.04)	0.822 (0.02)	0.001 (0.07)	156	14 (1.57)	7.025 (0.94)	1.429 (0.36)	0.734 (0.04)	0.839 (0.02)	0.125 (0.04)
Corr	16	8.429 (0.84)	5.094 (0.63)	0.429 (0.30)	0.741 (0.07)	0.812 (0.02)	0.087 (0.09)	153	14.29 (1.56)	6.837 (0.94)	0.429 (0.20)	0.683 (0.05)	0.836 (0.02)	0.183 (0.06)
Ume	16	9.714 (1.32)	6.448 (1.04)	1.857 (0.59)	0.75 (0.08)	0.801 (0.04)	0.062 (0.09)	153	16.43 (1.91)	7.711 (1.33)	2.429 (0.42)	0.769 (0.06)	0.829 (0.04)	0.076 (0.04)
Average	16	9.357 (0.54)	5.967 (0.39)	1.107 (0.33)	0.77 (0.03)	0.801 (0.02)	0.032 (0.03)	154.5	14.29 (0.80)	6.952 (0.51)	1.143 (0.57)	0.731 (0.03)	0.824 (0.02)	0.115 (0.02)
Isolated trees														
Average	16	9.857 (0.73)	6.616 (0.98)	2.28 (0.18)	0.795 (0.04)	0.815 (0.04)	0.024 (0.03)	9.62	4.554 (0.15)	2.711 (0.09)	0.116 (0.03)	0.688 (0.02)	0.571 (0.01)	-0.221 (0.04)

n= mean sample size, N_a= mean number of allele, N_e= mean effective number of allele, A_p= mean number of private alleles, H_e= expected heterozygosity, H_o= observed heterozygosity, F= Fixation index.

Table 2. *F*statistics for *Quercus castanea* populations and isolated trees. * *P*< 0.05.

	F_{is}	F_{it}	F_{st}
Adults	0.110*	0.127*	0.018
Progenies	0.104*	0.138*	0.038*
Isolated adults	-0.019		
Isolated progenies	-0.120	0.157*	0.247*

Table 3. Gametic heterogeneity among the pollen pools

	Φ_{PT}	N_{ep}	$\hat{\delta}$	A_{ep}
JMB	0.233 *	2.142	6.67 m	0.03 ha
JMP	0.212 *	2.358	7.32 m	0.04 ha
Corr	0.215 *	2.326	10.78 m	0.09 ha
Ume	0.232 *	2.155	7.19 m	0.04 ha
Isolated trees	0.351*	1.424		

CONCLUSION

- Both sets of individuals (adults and progenies) posses high genetic diversity
- Progenies from isolated trees showed loss of alleles
- Inbreeding is acting on populations and isolated trees in different ways.
- Isolated adults are strongly structured.
- Isolated trees have less gametic heterogeneity of pollen pools

Gene Flow through Pollen in a Fragmented Mexican Landscape

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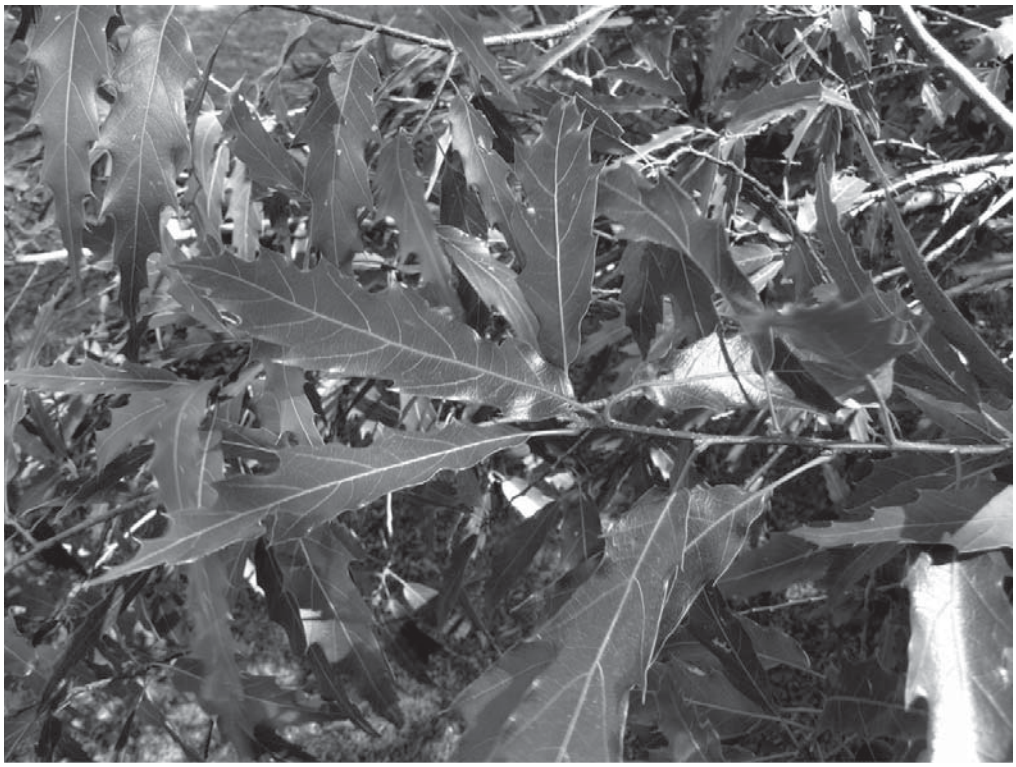
Gene flow is an important factor in the evolution of natural populations, and consequently is a critical parameter to shape genetic structure. Pollen flow has been considered as the major component of gene flow, especially in wind pollinated plants; therefore, it is a very important factor in maintaining genetic connectivity among populations. This pollen flow is not independent of environmental context and is very important to evaluate how processes like habitat fragmentation could affect these patterns.

Within the last four decades, *Quercus* forests of the Cuitzeo Basin in Mexico have been dramatically reduced to a large number of small patches of variable size. The goals of this research were to evaluate the genetic diversity and contemporary gene flow in a fragmented landscape. We sampled 16 maternal trees and collected seeds from every one, in four different isolated stands. We germinated the seeds and screened polymorphism at seven microsatellite loci. We found very high genetic diversity levels in adults *Ho*=0.77, *He*=0.8, and progenies *Ho*= 0.73, *He*=0.82, overall in different fragments. Only progenies populations were genetically structured. We found significant pollen structure across maternal trees with two-gene analysis. All populations were highly outcrossed, but biparental inbreeding is present.

We may conclude that the effect of forest fragmentation was moderated because both sets of individuals (maternal trees and progenies) maintain high genetic diversity levels. Nevertheless, genetic connectivity is lost in progeny populations.



Quercus acutifolia photo©Guy Sternberg

Quercus laeta photo©Guy Sternberg

Quercus mexicana photo©Guy Sternberg

Quercus polymorpha
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Reforesting or Restoring? The Case of the Oaks

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During recent years there has been a trend of "reforestation" in places close to urban areas, but it is known that many individuals that are planted will not survive the following year; the key to success in this is in using species native to the area. The "reforestation campaigns" were started 16 years ago in Africam Safari, and these campaigns have borne fruit beginning five years ago. The first planted trees were endemic species from Valsequillo Valley, which began to be disrupted some time ago.

There are three abundant species in this area, *Quercus mexicana*, *Quercus acutifolia* and *Quercus laeta*, which can survive in degraded soils due to their drought resistance. Experiments with oaks from other states have been carried out successfully due to the speed of germination, emergence of plumules and growth rate. The species that have most rapid growth are *Quercus polymorpha, Quercus germana,* and *Quercus eugeniifolia*. In addition, *Quercus greggii* and *Quercus microphylla* also have a rapid rate of maturation and resistance to water stress, and form large shrubs. Thus, the species of this genus are vital for reforestation, which provides medium- and long-term soil formation, water storage, and habitat for wildlife. We are therefore encouraging a "restoration" of our habitats, and not just reforestation.

The Utility of Arboreta and other Common Gardens of Oaks for Studying Ecology and Evolution

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Arboreta balance diverse uses - from picnickers to gardeners to scientists. Each use has its individual requirements for the management of an arboretum, but all share in their desire to explore the majesty and diversity of trees. While the needs of recreational arboretum-users are fairly straight-forward, ecologists or evolutionary biologists that visit arboreta look for fairly specific (and perhaps seemingly convoluted!) management practices that would maximize the utility of the arboretum as a resource for studying the ecology, physiology, and evolution of those trees. In this article, I would like to highlight some of the aspects of oak arboreta that make them most useful for scientists. At a time when there is particular interest in increasing oak collections at arboreta across North America through such concerted efforts as the North American Plant Collections Consortium (NAPCC) (Griswold 2009) and individuals with a particular interest in oaks, a list of arboretum attributes that make them ideal for researchers seems useful.

For the past three years, I have been exploring the evolutionary relationships between oaks and the ability of insects to colonize those diverse oak taxa. Much of my work has taken place in the UC Davis arboretum's Shields Oaks Grove, which was established by John Tucker (a renowned oak taxonomist), and represents one of the most useful scientific oak collections in the United States. As an evolutionary biologist and astute observer of oak natural history, Dr. Tucker had certainly taken many factors into account when planting the Oaks Grove that are now realized in making those trees especially useful for scientific studies. My intention with this article is to showcase some of these factors, not to suggest that arboreta that are differently organized are doing something wrong; arboreta have many uses, and some of those attributes that make them more useful for scientists may make them less desirable for other users.

Documentation: All studies of oak ecology or physiology rely upon correct identification and documentation of the tree not only to species, but also to the exact locality where it was collected. Equally important are records of taxonomy and provenance for trees that originated from cultivation, from other arboreta, or as progeny of other trees within the arboretum. The worth of tree collections becomes greater with additional resources such as deposition of representative specimens in herbaria (as would be useful for comparison to other oak specimens by taxonomists).

Taxonomic Completeness: For many questions about the evolution of oaks, it is beneficial to have a fairly complete sample of species from a given taxonomic section of *Quercus* or from a given geographic region. It would be very easy

for evolutionary biologists to make erroneous conclusions about the factors that contribute to the evolution of certain traits if they are only looking at a small portion of the diversity of species within the group that they care about. Oak collections that are most useful include not only a large sampling of taxa, but also contain multiple exemplars of individuals throughout the range of each species. Our concept of a species relies upon comparisons (either genetic or morphological) of individuals that occur naturally in multiple geographic regions of that species. If a taxonomist were to compare only one exemplar of each species, it would be easy to suspect that oak species were really more different from each other than may be true in natural populations, as this comparison ignores variation within those species. Accomplishing a robust sampling of oak species is balanced by obvious costs of maintaining trees from diverse taxa. It is impossible to cultivate most species of oaks at any given arboretum based on the local climate and soil. Moreover, simply having the space to maintain a complete sampling of any large group of oaks would be a challenge for any arboretum.

Aspects of a "Common Garden": Common garden experiments have been useful tools used by ecologists for over a century. When we look at the variation between individuals, populations, or species in their native habitat, we confound the effects of the different environments and the effects of inherent, genetic differences between those groups. A simple example might be comparing the leaf size of two oak species, one which grows in a xeric, sunny habitat and another in a mesic, shaded environment. We might see that the xeric, full-sun oak has smaller leaves than that species that grows in a wetter, shadier environment, but we also know that trees can alter their leaf size to adapt to different shade conditions. By simply growing plants in a common environment, we can more easily attribute differences in plant physiologies, morphologies, or ecologies, to genetic differences between individuals. Foresters (such as at the USDA Hardwood Tree Improvement and Regeneration Center) have planted true common gardens of oaks and other tree species with the goal determining the genetic basis of various tree traits. Arboreta provide a somewhat impromptu common garden of multiple oak species, and biologists do use them as such. There are potential pitfalls to this though. In a true common garden, plants are randomized throughout the garden such that there is no particular order to the trees (i.e. in an oak common garden there would be no "red oaks" section, "Eurasian natives" section, or unique stand of *Q. robur*). Again, designing an arboretum to fit strictly to the idea of a common garden would be useful to scientists that wanted to compare oak species, but it would also likely detract from the recreational uses of that arboretum.

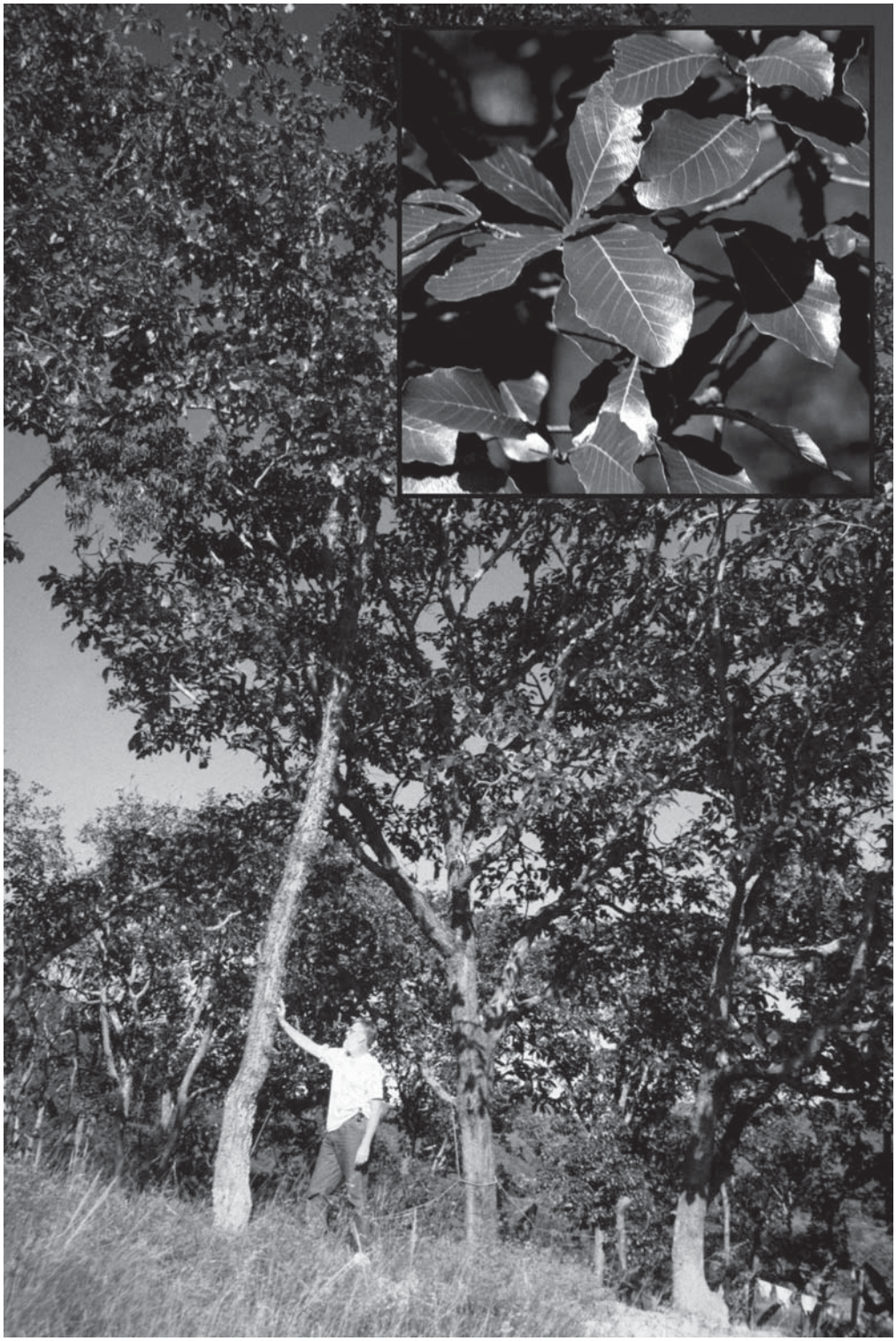
Allowing ecology to happen: Despite being managed environments, there are many interesting ecological interactions going on in arboreta. Insects feed on the trees, mycorrhizae colonize roots, and squirrels eat the acorns. My personal research has explored many of these interactions within various arboreta in order to understand how native animals utilize different non-native plants. As many species of oaks have been planted world-wide, especially in arboreta, they provide an ideal setting to understand these novel interactions (Pearse and Hipp 2009). How do insects in California deal with the chemical defenses of oaks that evolved in Mexico? How do birds that eat small acorns on oaks in their native range learn to deal with monstrous *Q. macrocarpa* or *Q. castaneifolia* acorns? In order

to be able to observe these interactions, it is necessary for the non-native tree to be in semi-natural setting. If we were to remove all of the acorn-eating birds or regularly apply pesticides to kill insects, it would be impossible to observe these interactions. Maintaining some degree of natural habitat within an arboretum can be useful in understanding the ecology of different oaks. Again, there are obvious trade-offs to doing this. If an insect outbreak occurs that could jeopardize the oak collection, it would quickly become desirable to mitigate the loss of the trees at the expense of the local insects.

Arboreta have the capacity to fulfill many purposes. Even different research biologists asking different questions about oaks will be interested in different aspects of arboreta. As a researcher that often uses arboreta as a scientific resource, I felt it may be helpful for arboretum directors and stewards to have a short list of attributes of arboreta that make them more or less useful as a scientific resource, such that they can balance those attributes with other uses such as recreation.

Griswold, E. 2009. Conseving Oaks in North American Plant Collections: A Collaborative Approach. International Oaks 20:35-42.

Pearse, I. S. and A. L. Hipp. 2009. Phylogenetic and trait similarity to a native species predict herbivory on non-native oaks. Proceedings of the National Academy of Sciences of the United States of America in press.



Quercus magnoliifolia photo©Guy Sternberg

Phenology and Gene Expression in *Quercus magnoliifolia* and *Q. resinosa* in an Altitudinal Gradient on the Volcano of Tequila, Jalisco, Mexico and Its Relation to Climate Change

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Growth and development of plants typically occur in the context of a stationary life. Therefore plants have evolved mechanisms to survive adverse conditions for growth. Tree species have adapted to local climate by evolving certain phenological characteristics. Phenology is important in the context of climate change and also determines the ranges of species. To predict likely responses of trees to global climate change we studied the phenology of *Q. magnoliifolia* and *Q. resinosa* in an altitudinal gradient (1450-2110 m) on the volcano of Tequila, Jalisco, Mexico using a scale of leaf development with values from 0 (dormant buds) to 5 (developed leaves). Environmental characteristics were recorded *in situ*. We found differences in the pattern and duration of leaf development. Phenological differences were associated with temperature, precipitation, and relative humidity. We also determined interspecific phenological differences and variation in phenology between the two years studied. The differential expression of seven candidate genes relevant in the signaling pathways for development in oaks was compared for the five stages of leaf development. These results, combined with others obtained by our working group, can help predict likely responses of trees to global climate change.

Quercus resinosa photo©Guy Sternberg

Quercus magnoliifolia photo©Guy Sternberg

Quercus resinosa photo©Guy Sternberg

Leaf Fluctuating Asymmetry Increases with Hybridization and Introgression between *Quercus magnoliifolia* and *Quercus resinosa* (Fagaceae) through an Altitudinal Gradient in Mexico

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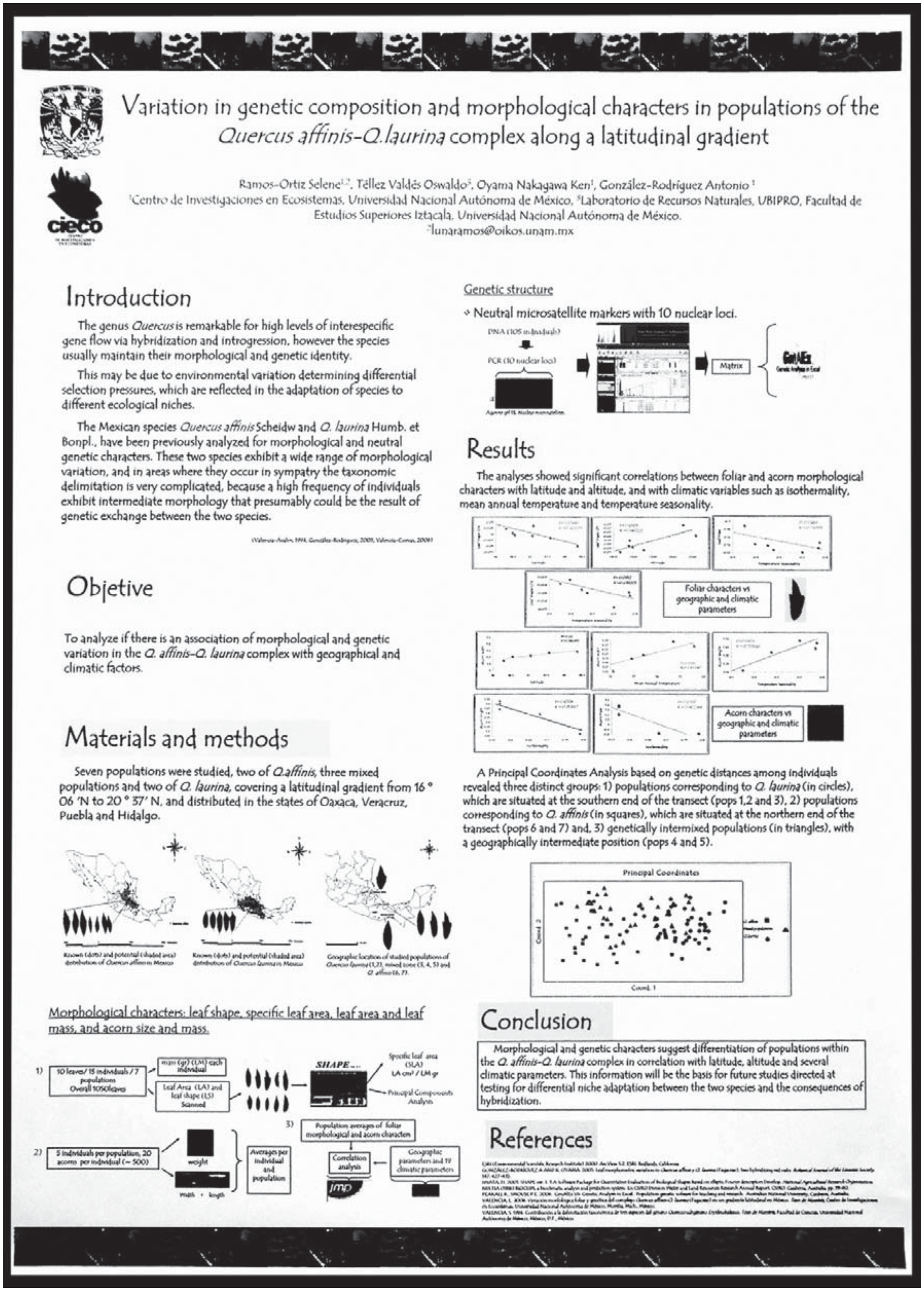
We examined the hypotheses that hybridization increases the level of developmental instability between *Q. magnoliifolia* and *Q. resinosa* at the Tequila volcano with morphological evidence and microsatellite marker data followed by Bayesian clustering analyses using the Structure program. Optimal thresholds for genetic assignment of pure, hybrid and backcrossed individuals were assessed using simulations. We found high leaf morphological differentiation between *Q. magnoliifolia* and *Q. resinosa* and a continuum of variation in leaf morphology in the individuals of the Tequila. Leaf-shape fluctuating asymmetry (FA) was higher in the hybrids and backcrosses than in pure species. The threshold *q*-value of < 0.90 for *Q. magnoliifolia* and $q > 0.10$ for *Q. resinosa* allows separating pure species from F1 hybrids (*q*- >0.41 to <0.59) and backcrosses of *Q. magnoliifolia* ($q > 0.90$ to 0.60) and backcrosses of *Q. resinosa* (<0.10 to 0.40). Simulation results showed that the genetic classes of pure and backcrossed individuals detected with Structure were reconstructed with good efficiency and accuracy, with some problems identifying hybrid F1 individuals correctly. Our genetic and morphological results showed that *Q. magnoliifolia* and *Q. resinosa* are two different lineages that overlapped on the Tequila volcano forming a hybrid zone with secondary contact, and the higher levels of FA found in hybrids and backcrossed individuals, compared to pure species, suggest that hybridization process involved the disruption of co-adapted gene complexes characteristic of each parental species.



Variation in genetic composition and morphological characters in populations of the *Quercus affinis-Q.laurina* complex along a latitudinal gradient

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Introduction

The genus *Quercus* is remarkable for high levels of interespecific gene flow via hybridization and introgression, however the species usually maintain their morphological and genetic identity.

This may be due to environmental variation determining differential selection pressures, which are reflected in the adaptation of species to different ecological niches.

The Mexican species *Quercus affinis* Scheidw and *Q. laurina* Humb. et Bonpl., have been previously analyzed for morphological and neutral genetic characters. These two species exhibit a wide range of morphological variation, and in areas where they occur in sympatry the taxonomic delimitation is very complicated, because a high frequency of individuals exhibit intermediate morphology that presumably could be the result of genetic exchange between the two species.

Objective

To analyze if there is an association of morphological and genetic variation in the *Q. affinis-Q. laurina* complex with geographical and climatic factors.

Materials and methods

Seven populations were studied, two of *Q.affinis*, three mixed populations and two of *Q. laurina*, covering a latitudinal gradient from 16 ° 06 'N to 20 ° 37' N, and distributed in the states of Oaxaca, Veracruz, Puebla and Hidalgo.

Morphological characters: leaf shape, specific leaf area, leaf area and leaf mass, and acorn size and mass.

Genetic structure

- Neutral microsatellite markers with 10 nuclear loci.

Results

The analyses showed significant correlations between foliar and acorn morphological characters with latitude and altitude, and with climatic variables such as isothermality, mean annual temperature and temperature seasonality.

A Principal Coordinates Analysis based on genetic distances among individuals revealed three distinct groups: 1) populations corresponding to *Q. laurina* (in circles), which are situated at the southern end of the transect (pops 1,2 and 3), 2) populations corresponding to *Q. affinis* (in squares), which are situated at the northern end of the transect (pops 6 and 7) and, 3) genetically intermixed populations (in triangles), with a geographically intermediate position (pops 4 and 5).

Conclusion

Morphological and genetic characters suggest differentiation of populations within the *Q. affinis-Q. laurina* complex in correlation with latitude, altitude and several climatic parameters. This information will be the basis for future studies directed at testing for differential niche adaptation between the two species and the consequences of hybridization.

References

Variation in Genetic Composition and Morphological Characters in Populations of the *Quercus affinis-Q. laurina* Complex along a Latitudinal Gradient

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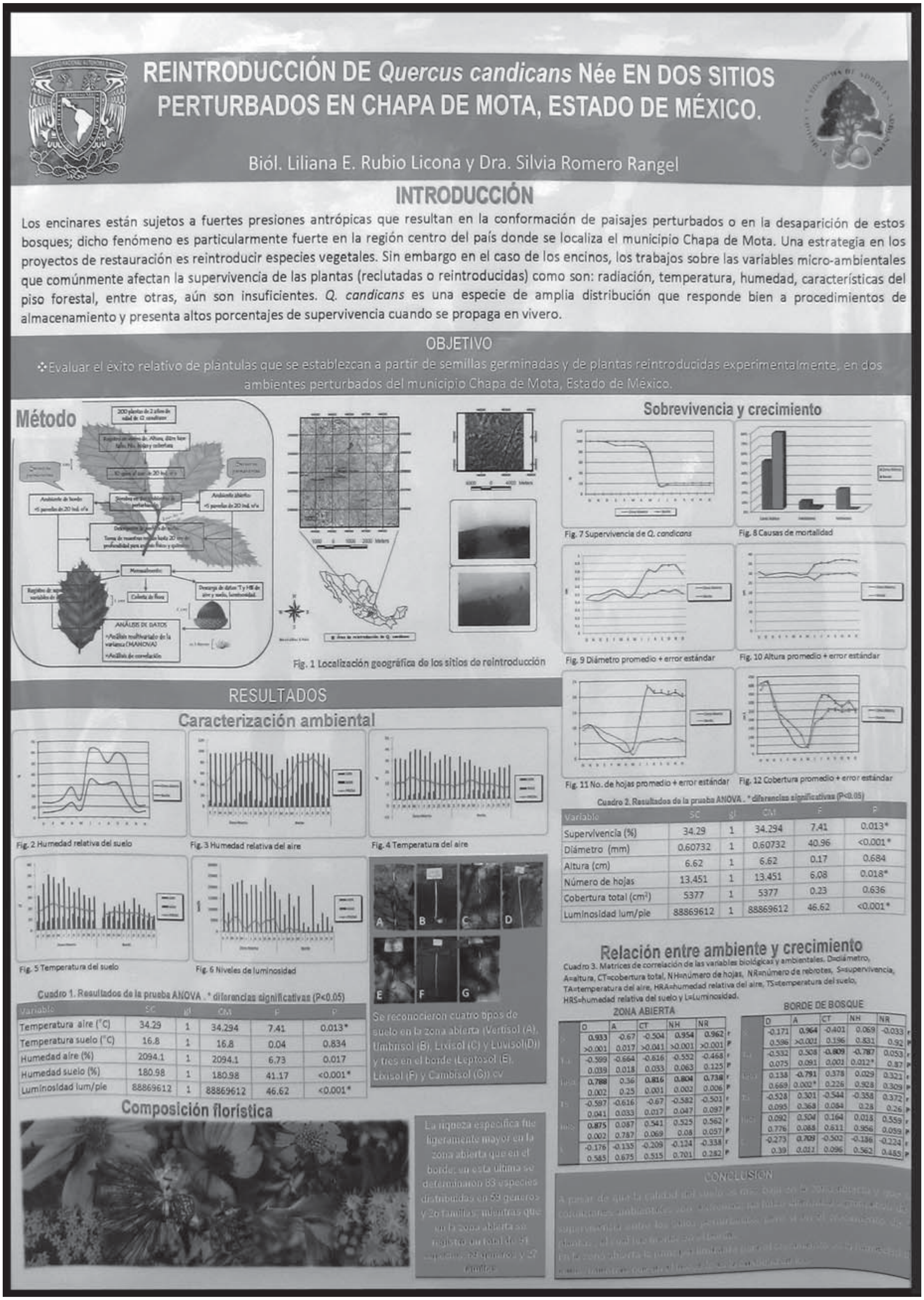
The genus *Quercus* is remarkable for high levels of interspecific gene flow via hybridization and introgression. However, the species usually maintain their morphological and genetic identity. This may be due to environmental variation determining differential selection pressures, which are reflected in the adaptation of species to different ecological niches. To understand the variation in morphological and genetic characters in a complex of Mexican red oaks formed by *Quercus affinis* and *Q. laurina*, foliar morphological characters (leaf shape, specific leaf area, leaf area, and mass) and seeds (mass and size) were correlated with distribution and climatic parameters. The genetic structure was determined using neutral microsatellite markers, with 10 nuclear and seven chloroplast loci. The morphological analysis showed a significant correlation between mass and size of seeds and foliar morphological characters like leaf shape and mass with latitude and altitude in addition to environmental variables such as isothermality, mean annual temperature, temperature seasonality, and temperature annual range. The results provide a basis for further studies on the ecophysiological and genetic variation among these two species.

Quercus affinis photo©Guy Sternberg

Quercus laurina photo©Guy Sternberg


REINTRODUCCIÓN DE Quercus candicans Née EN DOS SITIOS PERTURBADOS EN CHAPA DE MOTA, ESTADO DE MÉXICO.
Biól. Liliana E. Rubio Licona y Dra. Silvia Romero Rangel
INTRODUCCIÓN
Los encinares están sujetos a fuertes presiones antrópicas que resultan en la conformación de paisajes perturbados o en la desaparición de estos bosques; dicho fenómeno es particularmente fuerte en la región centro del país donde se localiza el municipio Chapa de Mota. Una estrategia en los proyectos de restauración es reintroducir especies vegetales. Sin embargo en el caso de los encinos, los trabajos sobre las variables micro-ambientales que comúnmente afectan la supervivencia de las plantas (reclutadas o reintroducidas) como son: radiación, temperatura, humedad, características del piso forestal, entre otras, aún son insuficientes. Q. candicans es una especie de amplia distribución que responde bien a procedimientos de almacenamiento y presenta altos porcentajes de supervivencia cuando se propaga en vivero.
OBJETIVO
Evaluar el éxito relativo de plantulas que se establezcan a partir de semillas germinadas y de plantas reintroducidas experimentalmente, en dos ambientes perturbados del municipio Chapa de Mota, Estado de México.
Método
Fig. 1 Localización geográfica de los sitios de reintroducción
Sobrevivencia y crecimiento
Fig. 7 Supervivencia de Q. candicans
Fig. 8 Causas de mortalidad
Fig. 9 Diámetro promedio + error estándar
Fig. 10 Altura promedio + error estándar
Fig. 11 No. de hojas promedio + error estándar
Fig. 12 Cobertura promedio + error estándar
Cuadro 2. Resultados de la prueba ANOVA . * diferencias significativas (P<0.05)
Variable | SC | gl | CM | F | P
Supervivencia (%) | 34.29 | 1 | 34.294 | 7.41 | 0.013*
Diámetro (mm) | 0.60732 | 1 | 0.60732 | 40.96 | <0.001*
Altura (cm) | 6.62 | 1 | 6.62 | 0.17 | 0.684
Número de hojas | 13.451 | 1 | 13.451 | 6.08 | 0.018*
Cobertura total (cm²) | 5377 | 1 | 5377 | 0.23 | 0.636
Luminosidad lum/pie | 88869612 | 1 | 88869612 | 46.62 | <0.001*
RESULTADOS
Caracterización ambiental
Fig. 2 Humedad relativa del suelo
Fig. 3 Humedad relativa del aire
Fig. 4 Temperatura del aire
Fig. 5 Temperatura del suelo
Fig. 6 Niveles de luminosidad
Cuadro 1. Resultados de la prueba ANOVA . * diferencias significativas (P<0.05)
Variable | SC | gl | CM | F | P
Temperatura aire (°C) | 34.29 | 1 | 34.294 | 7.41 | 0.013*
Temperatura suelo (°C) | 16.8 | 1 | 16.8 | 0.04 | 0.834
Humedad aire (%) | 2094.1 | 1 | 2094.1 | 6.73 | 0.017
Humedad suelo (%) | 180.98 | 1 | 180.98 | 41.17 | <0.001*
Luminosidad lum/pie | 88869612 | 1 | 88869612 | 46.62 | <0.001*
A B C D E F G
Se reconocieron cuatro tipos de suelo en la zona abierta (Vertisol (A), Umbrisol (B), Lixisol (C) y Luvisol(D)) y tres en el borde (Leptosol (E), Lixisol (F) y Cambisol (G)) cv
Composición florística
La riqueza específica fue ligeramente mayor en la zona abierta que en el borde; en esta última se determinaron 83 especies distribuidas en 59 géneros y 26 familias, mientras que en la zona abierta se
Relación entre ambiente y crecimiento
Cuadro 3. Matrices de correlación de las variables biológicas y ambientales. D=diámetro, A=altura, CT=cobertura total, NH=número de hojas, NR=número de rebrotes, S=supervivencia, TA=temperatura del aire, HRA=humedad relativa del aire, TS=temperatura del suelo, HRS=humedad relativa del suelo y L=Luminosidad.
ZONA ABIERTA
BORDE DE BOSQUE
CONCLUSIÓN

Relation Between Perturbation Degree and Success in Reintroduction of *Quercus candicans* Née (*Fagaceae*)

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Our study was held in Chapa de Mota municipality in the State of Mexico. Our objective was to evaluate seedling performance in germinated seeds and reintroduced plants in two disturbed environments. Light, temperature (°T), and air/soil relative humidity (H%) were evaluated. Edafic characteristics and floristic composition also were evaluated. The growth and survival of plants of *Quercus candicans* were related to the described environmental conditions. No significant differences were found in the survival ($p<0.05$), that was less in open areas (16%) than on the edges of woodland. Young seedlings showed differences in diameter, height, and buds; the contrasting microenvironmental conditions were L and T of air and soil. The correlation of growth variables with environmental ones was distinct in the two environments. Species and soil characteristics parallel disturbance characteristics; the latter can define which variables will affect the establishment of *Quercus* seedlings. In the same way it could indicate which improvements could be done to the techniques used with the purpose of increasing survival in the plantations, or what strategies to use according to site characteristics. This could optimize resources in restoration projects in *Quercus* forests, the species diversity of which is very important in Mexico.

ASPECTOS ECOLÓGICOS DE *QUERCUS FRUTEX* TREL. (FAGACEAE) EN EL NORTE DEL ESTADO DE MÉXICO

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Los encinos pueden ser árboles o arbustos, un ejemplo de éstos últimos es la especie *Quercus frutex*, la que se comporta como arbusto rizomatoso que forma manchones densos en matorral xerófilo y en zonas abiertas de bosque de encino. La especie *Quercus frutex* es poco conocida ecológicamente, pero puede ser un candidato para propagarse en vivero con fines de restauración, recuperación de suelos erosionados y en el diseño de áreas verdes.

OBJETIVOS

- Caracterizar las comunidades de *Quercus frutex*.
- Estimar la producción de frutos y describir el comportamiento germinativo.
- Evaluar el crecimiento de plantas en vivero y describir la morfología de plantas de diferentes edades.

RESULTADOS

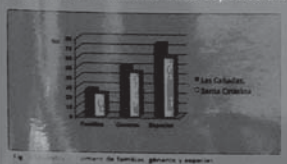
Caracterización de la comunidad

En Las Cañadas la altura promedio de *Q. frutex* fue de 1.4 m, cuyos tallos tuvieron en promedio 3.8 cm de diámetro; mientras que en Santa Catarina, la altura fue de 0.98 m y el diámetro de 1.9 cm.

Individuos de *Q. frutex* florecen y fructifican a los 6 años de edad.

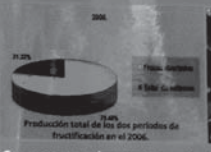
Se observaron dos periodos de floración en un año.

Dentro de los manchones del encinar arbustivo se encuentra un número importante de herbáceas y arbustivas, no faltando otras especies arboreas.

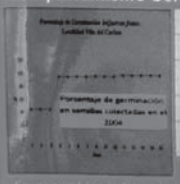


Las familias mejor representadas son Asteraceae, Fabaceae y Lamiaceae.

Durante los dos periodos de fructificación, en 38 individuos de 9 años de edad se contaron 1144 frutos inmaduros, de los cuales más de la mitad fue abortado.



Comportamiento Germinativo

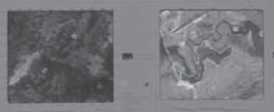


Índices de Germinación	"Santa Catarina"
Capacidad Germinativa (%)	98.8
Tiempo medio de Germinación (TMG) días	1.044
Desviación del TMG días (DTMG)	0.481
Valor germinativo de Maguire (I. Maguire)	57.0804

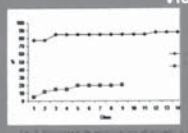
Valores obtenidos para los índices de germinación

En general los índices de germinación muestran que la calidad de germinación es buena, lo que hace a *Q. frutex* una especie candidata a propagación en vivero.

AREA DE ESTUDIO



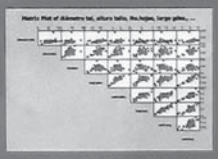
Viabilidad



Índices de Germinación	Frutos a un mes	Frutos a 3meses
Capacidad Germinativa (%)	87.5	21
(TMG) días	1.442	0.76
(DTMG)	0.56	0.25
(I. Maguire)	27.55	6.513

El porcentaje de germinación disminuye a los dos meses de almacenamiento, obteniéndose solo el 21%.

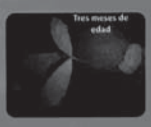
Evaluación del crecimiento en vivero .



El tallo no muestra un crecimiento notable en su diámetro, por lo que seguramente, los nutrientes se utilizan en la elongación del tallo y en la producción de hojas y ramas, mostrando un crecimiento proporcional.

Morfología de plantas de diferentes edades.

Las plantas de *Q. frutex* de tres meses muestran características muy similares a los ejemplares adultos. En la descripción de plantas de diferentes edades se observó que las variaciones en la morfología solo se dan en la forma de lamina, base, margen y tamaño de las hojas.



MÉTODO

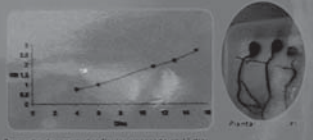
TRABAJO DE CAMPO: Colecta de flora dentro de los manchones arbustivos y recolección de frutos.

TRABAJO DE LABORATORIO:

1. Determinación del material colectado.
2. Desinfección y escarificación de frutos, se establecieron 5 lotes de 50 semillas c/u.
3. Registro diario del número de semillas germinadas.
4. Registro semanal de: sobrevivencia, altura del tallo, diámetro basal, no. hojas y cobertura de las plántulas.
5. Almacenamiento en refrigeración de frutos para evaluar su viabilidad.
6. Descripción morfológica de plantas de 6 y 12 meses de edad.

Evaluación de la longitud de la raiz

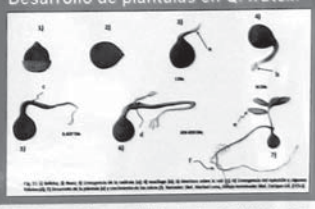
La gran cantidad de reservas alimenticias almacenadas favorecen extensivamente el desarrollo de la raiz antes que el vástago.



Promedio de longitud radicular alcanzada en 15 días

Las plantas emergidas de semillas colectadas desarrollaron raices con una longitud promedio de 2.5 cm a la edad de 15 días, iniciándose la emergencia de raices secundarias.

Desarrollo de plántulas en *Q. frutex*.



Finalmente la posibilidad de restaurar los terrenos degradados utilizando especies nativas en tiempos relativamente cortos requiere de conocimientos biológicos, ecológicos y de manejo de las especies. Por lo cual el presente trabajo trata de mostrar los elementos básicos que se deben conocer de una especie y que ayudan a seleccionar de forma conveniente las especies adecuadas para el desarrollo de una vegetación protectora que permita conservar e incrementar la fertilidad del suelo.

Ecological Aspects of *Quercus frutex* Trel. (Fagaceae) in Three Localities in the State of Mexico

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This work contributes to the ecological knowledge of the communities of *Quercus frutex* through an evaluation of production and weight of fruits, germination behavior, viability, growth in the nursery and in the field, and morphological and phenological description. Fruit collection and phenological registration were developed in Tepotzotlan and Villa del Carbon. Fruits were stratified for establishment and germination index was measured.

A correlation between diameter, stem height, leaf number and coverage, and fruit weight was analyzed, and phenology and morphology of young seedlings and fruit production also were analyzed. Fruit production totalled 1144 fruits of which 78.5% were aborted and 21.5% ripened. June and August were the months with most fruit production and the highest degree of maturity.

The germination capacity was 98.8% and the germination value was 57.0804. Fruits stored for one month showed 87.5% germination and an additional 21% at three months. The stems did not have a noticeable growth in diameter. The morphological variations occur in the lamina, base, margin, and leaf sizes. Two periods of flowering and fruiting were observed.

ASPECTOS ECOLÓGICOS DE *Quercus obtusata* Humb. & Bonpl. y *Quercus castanea Née* EN EL ESTADO DE MÉXICO

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INTRODUCCIÓN

En el Estado de México hay 23 especies del género *Quercus* (Romero et al., 2000), entre las cuales figuran *Quercus obtusata* y *Quercus castanea* que co-habitan en bosques de encino y mixtos de pino-encino. A pesar de la importancia económica y ecológica de estas especies se desconocen aspectos básicos de su biología como el comportamiento germinativo y la sobrevivencia de sus plántulas. Además hay pocos datos sobre las especies que conviven naturalmente con dichas especies de encino.

OBJETIVOS

- Caracterizar florística y estructuralmente dos comunidades de bosque en el Estado de México.
- Caracterizar el comportamiento germinativo y evaluar la viabilidad de semillas de *Q. obtusta* y *Q. castanea*.
- Describir el crecimiento en vivero de estas dos especies, así como la morfología de sus plántulas.

MÉTODO

TRABAJO DE CAMPO:

1. En cada localidad: establecimiento al azar de 5 cuadros de 200 m2.
2. En cada cuadro: registro de DAP, altura y cobertura de árboles; así como colecta de árboles, arbustos y herbáceas.
3. Recolección de frutos de *Q. obtusata* y *Q. castanea*.

TRABAJO DE LABORATORIO:

1. Determinación taxonómica del material colectado.
2. Desinfección (NaOCl al 15%) y escarificación mecánica.
3. De c/especie se establecieron 5 lotes de 50 semillas c/u.
4. Registro diario del No. semillas germinadas.
5. Siembra en suelo de las semillas germinadas.
6. Registro semanal de sobrevivencia, altura del tallo, diámetro basal, No. Hojas y cobertura de las plántulas.
7. Almacenamiento de frutos en refrigeración (5-7 °C), c/ 3 meses se extrajo una muestra de 50 semillas para evaluar la viabilidad.
8. Descripción morfológica de plantas de 6 y 12 meses de edad.

RESULTADOS

Caracterización estructural y riqueza florística de las comunidades

Cuadro 1. Atributos del estrato arbóreo en la comunidad de bosque en Puentecillas.

Especie	No Ind.	Densidad (%)	Frecuencia (%)	Área basal (m2)	AB (%)	Cobertura (%)	VIR (D%+F%+AB%)
Q. obtusata	8	8.333	19.2	4208.968	10.114	6.720	37.679
Q. crassipes	8	8.333	15.4	8013.052	19.256	37.511	42.974
Q. crasifolia	5	5.208	7.7	6690.358	16.077	5.275	28.979
Q. candicans	3	3.125	7.7	7834.156	18.826	22.591	29.644
Q. dysophylla	17	17.708	15.2	4109.185	9.874	14.460	46.814
P. leiophylla	50	52.083	15.4	9631.755	23.146	12.763	90.614
C. lusitanica	1	1.042	3.8	7.068	0.016	0.046	4.905
A. jorullensis	2	2.083	3.8	1103.487	2.651	0.601	8.581
A. tesellata	1	1.042	3.8	7.068	0.016	0.002	4.905
P. serotina	1	1.042	3.8	7.068	0.016	0.032	4.905
TOTAL:	96	100.000	100.000	41612.165	100.000	100.000	300.000

Cuadro 2. Atributos del estrato arbóreo en la comunidad de bosque en Loma de Cuevas.

Especie	No Ind.	Densidad (%)	Frecuencia (%)	Área basal (m2)	AB (%)	Cobertura (%)	VIR (D%+F%+AB%)
Q. castanea	28	36.363	41.666	36606.205	49.551	40.018	127.581
Q. obtusata	45	58.441	41.666	37217.342	50.378	59.963	150.486
P. serotina	4	5.194	16.666	51.836	0.070	0.018	21.931
TOTAL:	77	100.000	100.000	73875.383	100.000	100.000	300.000

La riqueza florística del bosque en Puentecillas, Nicolás Romero : estuvo compuesta por 52 especies, 40 géneros y 28 familias; las mas representativas del estrato arbustivo fueron: ***Senecio roldana*** y ***Monina ciliolata***. La del bosque de encino en Loma de Cuevas, Villa del Carbón, está constituida por 67 especies, 55 géneros y 31 familias; en el estrato arbustivo ***Eupatorium petiolare*** y ***Salvia mexicana*** fueron las especies mejor representadas.

Comportamiento germinativo y viabilidad de *Q. obtusata* y *Q. castanea*

	Q. obtusata	*Q. castanea*
Frutos / Kg	354	738
Peso promedio de los frutos	3.99 gr	1.68 gr
Peso promedio de semillas	1.19 gr	0.789 gr
ÍNDICES DE GERMINACIÓN (Camacho y Morales, 1992)		
	Q. obtusata	*Q. castanea*
Capacidad germinativa (%)	92.80	98.80
Tiempo Medio de Germinación (días)	3.64	3.17
Desviación del TMG (días)	3.72	2.86
Índice de Maguire	23.87	26.04

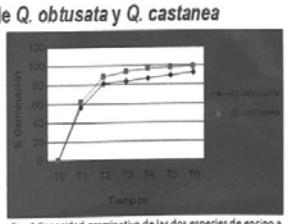

Fig. 1 Capacidad germinativa de las dos especies de encino a diferentes tiempos. (T0= día establecimiento, T1= día 3, T2=día 5, T3= día 7, T4= día 9, T5= día 11 y T6= día 13.

Fig. 2 Fases del desarrollo de plántulas de *Q. obtusata*

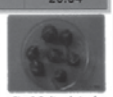

Fig. 3 Poliembrionia en *Q. obtusata*

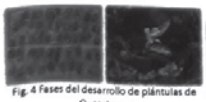

Fig. 4 Fases del desarrollo de plántulas de *Q. castanea*

Después de tres meses de almacenamiento las semillas de *Q. obtusata* perdieron su viabilidad (0% de germinación).

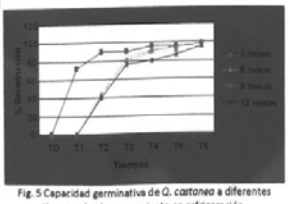

Fig. 5 Capacidad germinativa de *Q. castanea* a diferentes tiempos de almacenamiento en refrigeración.

Sobrevivencia y crecimiento de las especies de encino

En la fase de vivero se establecieron 232 plántulas de *Q. obtusata* y 247 de *Q. castanea*. Del total sobrevivió el 13.79% de *Q. obtusata* y 64.4% de *Q. castanea*.

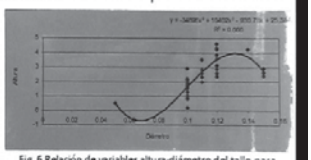

Fig. 6 Relación de variables altura-diámetro del tallo para *Q. obtusata*

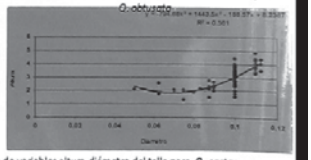

Fig. 7 Relación de variables altura-diámetro del tallo para *Q. castanea*

Morfología de plantas

Las diferencias morfológicas entre las plantas de diferentes edades de *Q. obtusata* estuvieron en la **forma, ápice, base y color de las hojas**; los individuos de seis meses no presentaron **tricomas glandulares** que es un caracter diagnostico que permiten reconocer a *Q. obtusata*. En las plantas de *Q. castanea* se encontraron diferencias en la **forma, ápice y base de las hojas** así como en el número de dientes por lado de las hojas.

Fig. 8 Plantas de 6 (B) y 12 (A) meses de edad de *Quercus obtusata*

Fig. 9 Plantas de 6 (B) y 12 (A) meses de edad de *Quercus castanea*

A Contribution to the Ecological Study of *Quercus obtusata* Bonpl. and *Quercus castanea* Née in Two Localities in the State of Mexico

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This is a contribution to the ecological knowledge of *Quercus obtusata* and *Quercus castanea* through study of their habitat, germination behavior, viability after storage, survival, and morphology. To study structure, five squares of 200m^2 in two localities were established. Canopy, height, and dbh were measured and specimens were collected. Fruits were collected and half of them were stored. Five batches for germination of 50 seeds were prepared. The growth was monitored in the laboratory and nursery. The viability of stratified seeds was determined and descriptions were made of young plants.

Both localities share 13 species, 19 genera and 16 families, Villa del Carbón being the zone with most floristic diversity. In Nicolás Romero *Pinus leiophylla* had the highest importance value, followed by *Q. dysophylla, Q. crassipes and Q. obtusata*. In Villa del Carbón, *Q. obtusata* had the highest value in importance, frequency, and coverage, followed by *Q. castanea* and *Prunus serotina*.

Germination was initiated in both species, reaching 92.8% for *Q. obtusata* and 98.8% for *Q. castanea*. Survival was 100% for *Q. obtusata* and 64.4% for *Q. castanea*. Viability was 100% for seeds of *Q. obtusata* and 64.4% for *Q. castanea*. The viability of *Q. obtusata* seeds was zero after 30 days of storage while *Q. castanea* was viable after 12 months. Morphological differences were found in

Quercus obtusata photo©Guy Sternberg

Quercus schottkyana (Xi Shan, Kunming) photo©Guy Sternberg

Acorn Production of *Quercus schottkyana*: an Endemic Evergreen Oak Species (subgenus *Cyclobalanopsis*) of Southwestern China

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Quercus schottkyana, belonging to oak subgenus *Cyclobalanopsis,* is one of the dominant trees in southwest China. It produces acorns annually. The acorns are important in the ecological system for the potential recruitment for the population as well as for food resources for insects and rodents. However, acorn production of this species is not well documented. In this study, we collected acorns of this species for three consecutive years (2006y-2008) at a site of c. 3850m altitude in Kunming, China. Weekly collections of acorns were used for determining the dry mass, moisture content, weevil (*Curculio* sp.) infestation rates, and germination. Results show the year 2006 to have been a mast year followed by two lean years. The peak time of weevil infestation was noticeable in the end of September and the beginning of October. Acorns dispersed after the beginning of October showed less infestation, greater weight, and better viability and might have the most important role for maintaining the oak population.

The Reponse of *Quercus* Section *Heterobalanus* (Golden Oaks) to the Himalayan Uplift

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Quercus section *Heterobalanus* is a natural group of oaks concentrated in SW China and the Himalaya, with 9 to 11 species. They are called golden oaks because of the back of leaves of most of them are covered by dense yellow hairs. One of the most outstanding features of the modern flora of the eastern Himalaya and Hengduan mountains is the preponderance of sclerophyllous oak forests.

These oaks are the main element in Himalayan ecosystem and play an important ecological role in terms of sheer abundance of standing biomass. In order to study the development, differentiation and distribution of *Quercus* section *Heterobalanus* in response to the uplift of the Himalaya, the hypothesis has been proposed that Quercus Section Heterobalanus originated in subtropical broad-leaf evergreen forests. After the uplift of the Hengduan mountains, whereby the climate became cold and dry, the environment ceased to favor most broad-leafed evergreen trees. However, oaks of section Heterobalanus, having obvious xerophytic characters such as dense hairs, thick cuticles, lignified epidermal cell walls and cuticles, and low stomatal density were preadapted to the environmental change and therefore became dominant in this area. This hypothesis has been documented by evidence from modern distribution, fossil history, genetic diversity and photosynthetic performance.

The Conservation and Population Increase of the Endangered Species, *Quercus sichourensis*

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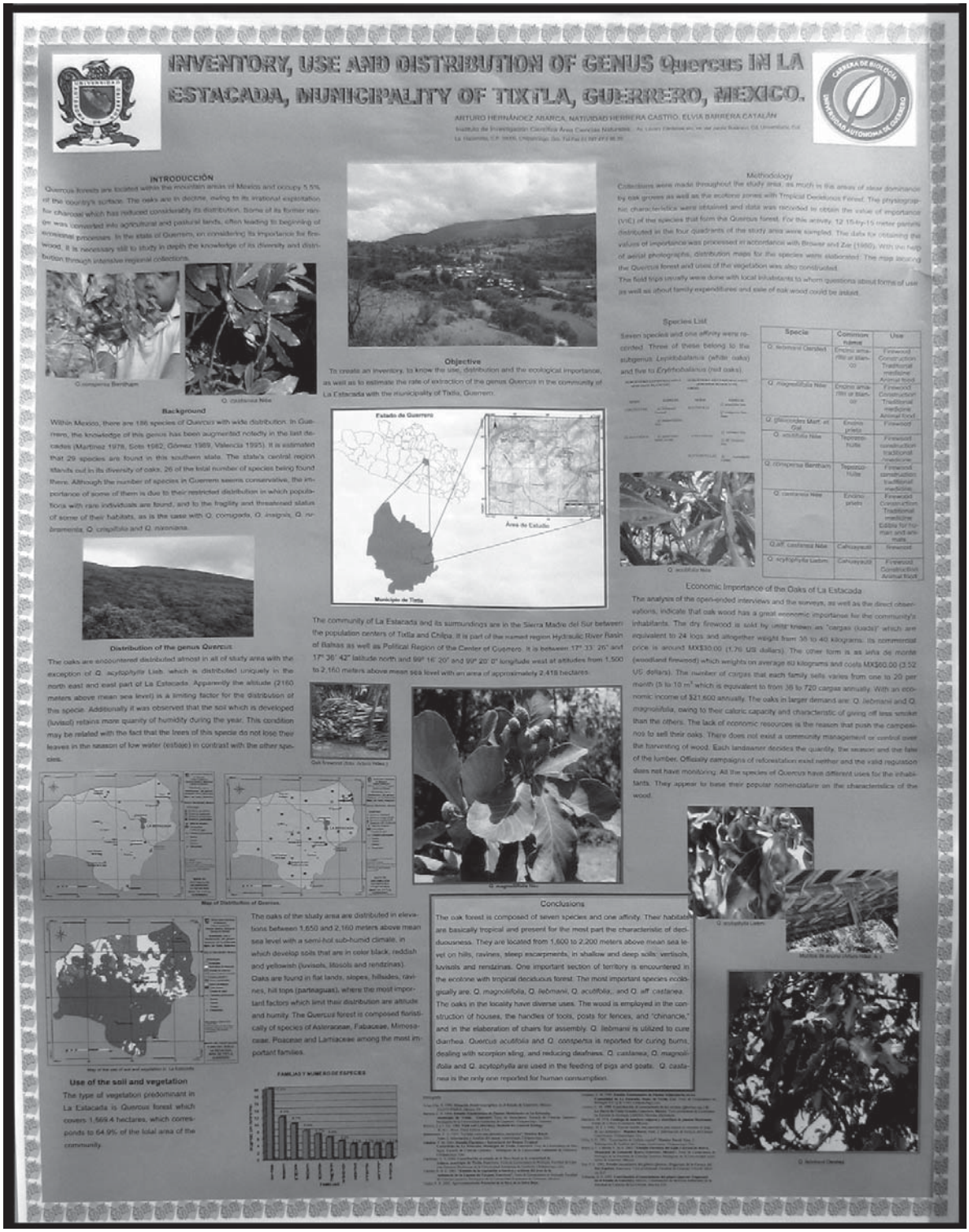
Quercus sichourensis (*Quercus*, *Fagaceae*) is an endangered species with only 5 adult individuals in Funing in Yunnan and Ceheng in Guizhou. It is also a key species in the broad leafed evergreen forest in limestone areas in SE Yunnan. The fruit with cupule has a diameter of 37.95±0.69 mm, presenting a normal distribution; the fruit weighed 25.93±1.18g; and the seed weighed 13.46±0.81g. The fruit had a moisture content of 46.7±0.3% at the time of natural dispersal. The pericarp of the fruit was permeable. Although the cupule can resist dessication, the fruits of *Quercus sichourensis* lost moisture rapidly. Fruits had moisture content less than 20% after 7 days' drying. Desiccation could obviously decrease their germination. The optimal temperatures for germinating *Q. sichourensis* fruits were 25°C and 30°C. Of the germination, 88-89.5% of the seedlings survived in the nursery planting. The dominant species of subgenus *Cyclobalanopsis* growing in the habitats of *Q. sichourensis* were also investigated. Fruits of these dominant species mature in the rainy season. The fruits of rare species *Q. sichourensis, Q. austroglauca, Q. camusiae,* and *Q. lobbii* mature at the end of the rainy season. This implies that the maturity of the fruits of subgenus *Cyclobalanopsis* are affected by the amount of precipitation. We currently have 300 seedlings growing in the nursery. To increase the number of individuals in the wild, and also to bolster the population of *Quercus sichourensis*, 50 seedlings have been replanted into their ancestral habitat.

Note from the editor:

Conservation efforts financed by the National Natural Science Fondation of China to help save *Quercus sichourensis* – considered to be critically endangered since the publication of the *Red List of Oaks* (Oldfield and Eastwood, Fauna and Flora International, Cambridge, UK, 2008) – received additional support in 2008 in the form of an International Oak Society grant of $1,000 plus $3,300 raised through private donations. Three IOS members (Diana Gardener, OR; Caroline Brown, CA; and Béatrice Chassé, FRANCE) plus one non-member (Alison Ramsdale, UK) are the contributors to this very successsful fund-raising campagne.


INVENTORY, USE AND DISTRIBUTION OF GENUS Quercus IN LA ESTACADA, MUNICIPALITY OF TIXTLA, GUERRERO, MEXICO.
ARTURO HERNÁNDEZ ABARCA, NATIVIDAD HERRERA CASTRO, ELVIA BARRERA CATALÁN
INTRODUCCIÓN
Quercus forests are located within the mountain areas of Mexico and occupy 5.5% of the country's surface. The oaks are in decline, owing to its irrational exploitation of the country's surface. The oaks are in decline, owing to its irrational exploitation for charcoal which has reduced considerably its distribution. Some of its former range was converted into agricultural and pastural lands, often leading to beginning of erosional processes. In the state of Guerrero, on considering its importance for firewood, it is necessary still to study in depth the knowledge of its diversity and distribution through intensive regional collections.
Q. conspersa Benth.
Q. castanea Née
Background
Within Mexico, there are 186 species of Quercus with wide distribution. In Guerrero, the knowledge of this genus has been augmented notedly in the last decades (Martínez 1978, Soto 1982, Gómez 1989, Valencia 1995). It is estimated that 29 species are found in this southern state. The state's central region stands out in its diversity of oaks, 26 of the total number of species being found there. Although the number of species in Guerrero seems conservative, the importance of some of them is due to their restricted distribution in which populations with rare individuals are found, and to the fragility and threatened status of some of their habitats, as is the case with Q. conspersa, Q. insignis, Q. rubramenta, Q. crispifolia and Q. nixoniana.
Distribution of the genus Quercus
The oaks are encountered distributed almost in all of study area with the exception of Q. acytophyllr Lieb. which is distributed uniquely in the north east and east part of La Estacada. Apparently the altitude (2160 meters above mean sea level) is a limiting factor for the distribution of this specie. Additionally it was observed that the soil which is developed (luvisol) retains more quanity of humidity during the year. This condition may be related with the fact that the trees of this specie do not lose their leaves in the season of low water (estiaje) in contrast with the other species.
Objective
To create an inventory, to know the use, distribution and the ecological importance, as well as to estimate the rate of extraction of the genus Quercus in the community of La Estacada with the municipality of Tixtla, Guerrero.
Estado de Guerrero
Área de Estudio
Municipio de Tixtla
The community of La Estacada and its surroundings are in the Sierra Madre del Sur between the population centers of Tixtla and Chilpa. It is part of the named region Hydraulic River Basin of Balsas as well as Political Region of the Center of Guerrero. It is between 17° 33' 26" and 17° 36' 42" latitude north and 99° 16' 20" and 99° 20' 0" longitude west at altitudes from 1,500 to 2,160 meters above mean sea level with an area of approximately 2,418 hectares.
Oak firewood (foto: Arturo Hdez.)
Map of Distribution of Quercus.
The oaks of the study area are distributed in elevations between 1,650 and 2,160 meters above mean sea level with a semi-hot sub-humid climate, in which develop soils that are in color black, reddish and yellowish (luvisols, litosols and rendzinas). Oaks are found in flat lands, slopes, hillsides, ravines, hill tops (parteaguas), where the most important factors which limit their distribution are altitude and humity. The Quercus forest is composed floristically of species of Asteraceae, Fabaceae, Mimosaceae, Poaceae and Lamiaceae among the most important families.
Use of the soil and vegetation
The type of vegetation predominant in La Estacada is Quercus forest which covers 1,569.4 hectares, which corresponds to 64.9% of the total area of the community.
FAMILIAS Y NÚMERO DE ESPECIES
Methodology
Collections were made throughout the study area as much in the areas of clear dominance by oak groves as well as the ecotone zones with Tropical Deciduous Forest. The physiographic characteristics were obtained and data was recorded to obtain the value of importance (VIE) of the species that form the Quercus forest. For this activity, 12 15-by-15 meter parcels distributed in the four quadrants of the study area were sampled. The data for obtaining the values of importance was processed in accordance with Brower and Zar (1980). With the help of aerial photographs, distribution maps for the species were elaborated. The map locating the Quercus forest and uses of the vegetation was also constructed.
The field trips usually were done with local inhabitants to whom questions about forms of use as well as about family expenditures and sale of oak wood could be asked.
Species List
Seven species and one affinity were recorded. Three of these belong to the subgenus Leptobalanus (white oaks) and five to Erythrobalanus (red oaks).
Q. acutifolia Née
Economic Importance of the Oaks of La Estacada
The analysis of the open-ended interviews and the surveys, as well as the direct observations, indicate that oak wood has a great economic importance for the community's inhabitants. The dry firewood is sold by units known as "cargas (loads)" which are equivalent to 24 logs and altogether weight from 35 to 40 kilograms. Its commercial price is around MX$30.00 (1.76 US dollars). The other form is as leña de monte (woodland firewood) which weights on average 60 kilograms and costs MX$60.00 (3.52 US dollars). The number of cargas that each family sells varies from one to 20 per month (5 to 10 m³ which is equivalent to from 35 to 720 cargas annually. With an economic income of $21,600 annually. The oaks in larger demand are: Q. liebmani and Q. magnolifolia, owing to their caloric capacity and characteristic of giving off less smoke than the others. The lack of economic resources is the reason that push the campesinos to sell their oaks. There does not exist a community management or control over the harvesting of wood. Each landowner decides the quantity, the season and the fate of the lumber. Officially campaigns of reforestation exist neither and the valid regulation does not have monitoring. All the species of Quercus have different uses for the inhabitants. They appear to base their popular nomenclature on the characteristics of the wood.
Q. magnolifolia Née
Q. acutifolia Liebm.
Conclusions
The oak forest is composed of seven species and one affinity. Their habitats are basically tropical and present for the most part the characteristic of deciduousness. They are located from 1,600 to 2,200 meters above mean sea level on hills, ravines, steep escarpments, in shallow and deep soils: vertisols, luvisols and rendzinas. One important section of territory is encountered in the ecotone with tropical deciduous forest. The most important species ecologically are, Q. magnolifolia, Q. liebmani, Q. acutifolia, and Q. aff. castanea. The oaks in the locality have diverse uses. The wood is employed in the construction of houses, the handles of tools, posts for fences, and "chinancle," and in the elaboration of chairs for assembly. Q. liebmani is utilized to cure diarrhea. Quercus acutifolia and Q. conspersa is reported for curing burns, dealing with scorpion sting, and reducing deafness. Q. castanea, Q. magnolifolia and Q. acytophylla are used in the feeding of pigs and goats. Q. castanea is the only one reported for human consumption.
Q. liebmani Oerstedt

Inventory, Use and Distribution of the Genus *Quercus* in La Estacada, Municipio Tixtla, Guerrero

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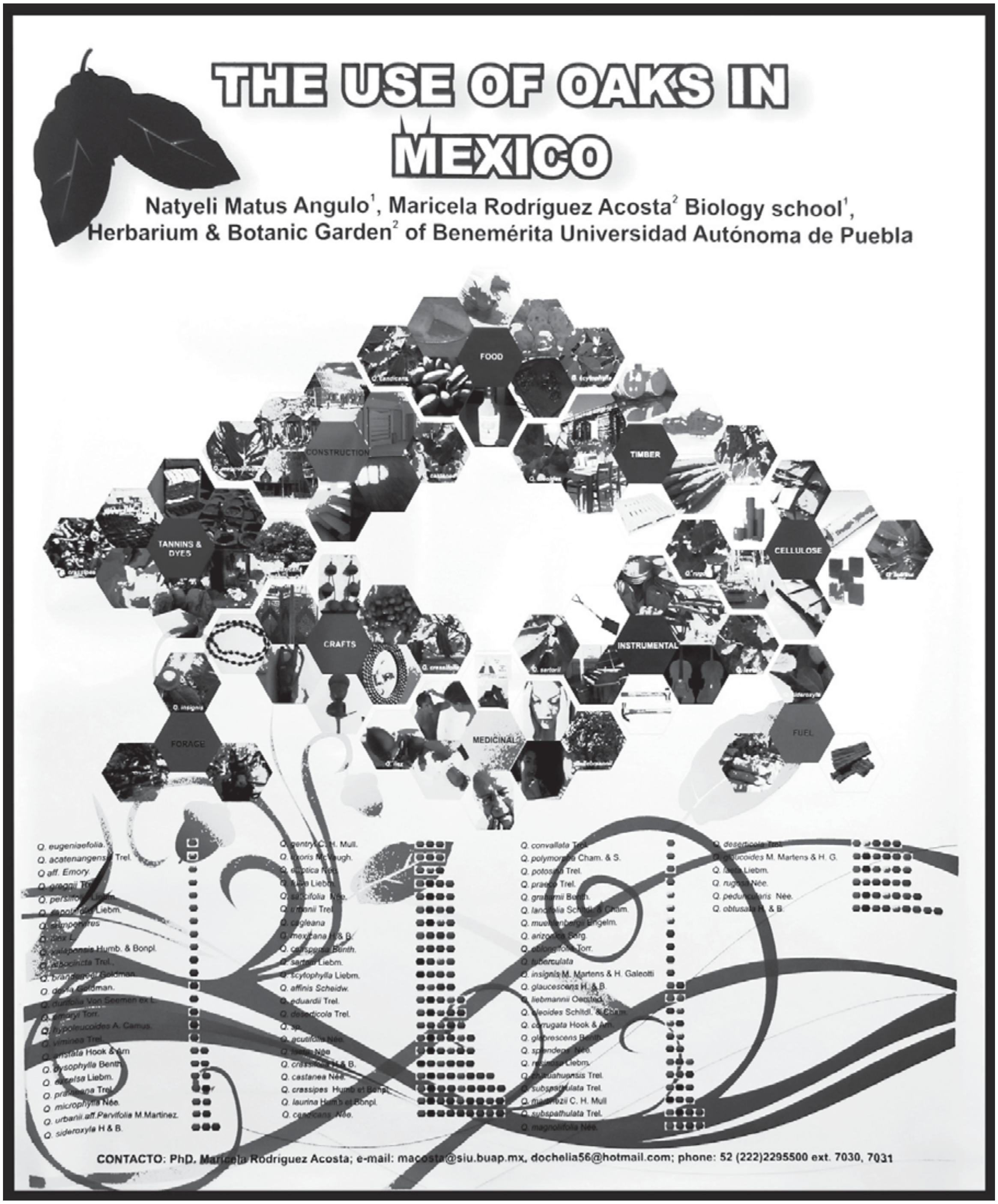
Mexico is one of the countries with the greatest diversity of oaks in the world and the state of Guerrero contributes significantly to this diversity. This paper provides information on the diversity and distribution of the genus *Quercus* in the community of La Estacada of the municipality of Tixtla in the state of Guerrero, Mexico. Botanic collections, analyses of trait distributions, field trips with local guides and ethnobotanical surveys were used to detail the ecological, economic and cultural aspects of oaks in the study area.

A floristic list of the species of the genus *Quercus* present in the study area, tables of statistical/ecological data and maps of vegetation, soil use as well as species distributions are included. Seven species and one affinity are reported, representing 28.6% of the species within the state and 66.7% within the municipality of Tixtla. The species with the most important ecological values are *Q. magnoliifolia* and *Q. liebmannii*. All species of *Quercus* have some use for the population. The most common is as a fuel with great commercial importance at the local and regional level, a use that contributes toward family income. Medicinal and food uses are reported for other species.

Quercus liebmannii photo©Guy Sternberg


THE USE OF OAKS IN MEXICO
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The Use of Oaks in Mexico

***Natyeli Matus Angulo and **Maricela Rodríguez-Acosta**
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The diverse Mexican oak forests are exploited at a local level, but not on an industrial scale (Rzedowski, 1978). This low exploitation is mainly because of the difficulty in working the hard wood and lack of technological studies of potentially commercial species in the country.

Oak wood is primarily used for pulp (54%), scantling (30%), fuel (7%), and charcoal (6%) (de la Paz Pérez *et all.,,* 2000).

On a national level, oak wood occupies the second place in exploitation after pines, with the main uses for pulp, railway sleepers, panelling, posts, and fuel (Bárcenas 1985).

In comparison, in the USA and Europe, oak wood has been considered as one of the woods with the best characteristics for the construction of ships and outdoor structures, as well as barrels and quality furniture manufacture (Bárcenas, 1985).

Variación Morfológica del Encino *Quercus rugosa* Née (FAGACEAE)

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INTRODUCCIÓN

El género *Quercus* es considerado como un grupo taxonómicamente complicado, debido a su gran variabilidad morfológica, a la aparente facilidad de hibridación y a que sus estructuras reproductivas no se han estudiado lo suficiente. El estudio del género *Quercus* requiere de una búsqueda importante de caracteres diagnósticos que contribuyan a esclarecer los límites taxonómicos de los taxa, por lo que no sólo es importante estudiar las variaciones de la arquitectura foliar, sino también las características que varían en la morfología de las semillas y en el crecimiento de plantas jóvenes.

OBJETIVOS

Describir la arquitectura foliar de individuos adultos procedentes de diferentes estados de México y EUA y de plantas jóvenes obtenidas en vivero.
- Describir el comportamiento germinativo de semillas con distinta morfología
- Describir el crecimiento y la morfología de plantas de *Q. rugosa* en condiciones de laboratorio y vivero

METODOLOGÍA

Descripción la arquitectura foliar de 58 muestras de individuos adultos y jóvenes (15 días a 24 meses) de acuerdo a Hickey (1974, 1999). Se estudiaron 91 caracteres a través del análisis de conglomerados y componentes principales (NTSYS 2.0) (Rohlf, 1997).
- Comportamiento germinativo de acuerdo a Camacho (1992) de semillas con distinto tamaño, color y tiempo de estratificación
- Monitoreo del crecimiento durante seis meses
- Descripciones morfológicas de plantas de 1,2,3 y 6 meses de edad

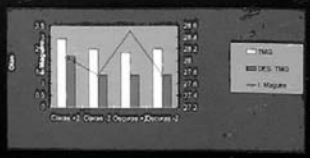
Tratamientos para comportamiento germinativo

Comp. Prin.			Carácter	Valor
I	11.7869	11.7865	Ancho de la hoja (cm.)	0.743
			Ápice acuminado	0.674
			Largo de la hoja (cm.)	0.644
II	9.1591	20.9457	Venación Pinnada Craspedódroma Simple	0.754
			Venación Pinnada Craspedódroma Semicraspedódroma	0.754
			Venas secundarias< de divergencia Agudo Angosto	0.561
III	8.117	29.0627	Modelo Reticulado Reticulado al azar	0.767
			Modelo Reticulado Reticulado ortogonal	0.767
			1° vena tamaño fuerte	0.571

COMPORTAMIENTO GERMINATIVO

Los porcentajes de germinación para las semillas sin estratificar y las estratificadas por tres meses y un año alcanzaron el 100% de germinación

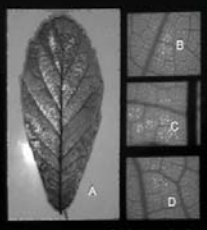
	DTM		
	TMG	G	I. Maguire
Claras +2 1R	2.93	2.2	28.06
Claras -2 1R	2.5	1.4	27.76
Oscuras +2 1R	2.36	1.4	28.51
Oscuras -2 1R	2.5	1.4	27.76



No se registraron diferencias significativas entre los grupos de semillas. Con la estratificación las semillas requieren de menos tiempo para germinar, reduciendo el tiempo prácticamente a la mitad. En las semillas estratificadas por tres meses la uniformidad decrece, pero la calidad germinativa es superior. Las semillas estratificadas por un año disminuyeron su uniformidad germinativa y su calidad de germinación .

RESULTADOS

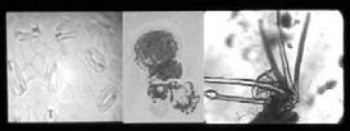
ARQUITECURA FOLIAR

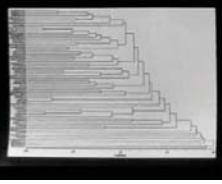


A. Hoja completa, B ápice de la hoja, C. Parte media de la hoja, D. base de la hoja

Venación pinnada semicraspedódroma; vena media de tamaño masivo moderado, fuerte, moderado o débil ; venas secundarias con ángulo de divergencia agudo-angosto y agudo-moderado; venas intersecundarias simples; venas terciarias con ángulo de origen agudo-recto o recorrido derecho; venas cuaternarias de tamaño moderado y trayectoria reticulado al azar y reticulado ortogonal; vénulas ramificadas una vez; areolas bien desarrolladas con disposición al azar de forma cuadrangular y tamaño pequeño.

Los estomas corresponden al tipo anomocítico y los tricomas son de tipo fasciculado y glandular.

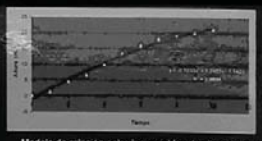




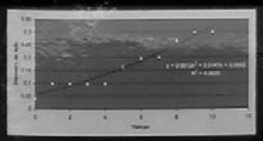
El análisis de conglomerados, muestra que no se forman grupos definidos de OTU's, lo que indica gran similitud entre los ejemplares usados en este estudio.

Quercus rugosa puede considerarse como una especie taxonómicamente definida .

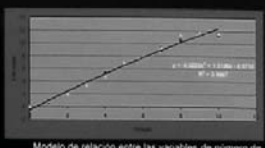
CRECIMIENTO



Modelo de relación entre las variables de altura total y tiempo



Modelo de relación entre las variables de diametro del tallo y el tiempo



Modelo de relación entre las variables de número de hojas y el tiempo

Durante el crecimiento de las plantas se observa que la altura total, el diámetro y el número de hojas de los cuatro grupos de plantas es muy semejante por lo que se utilizó un modelo polinomial del tercer orden, que como se puede observar posee puntos que se traslapan.

MORFOLOGÍA DE PLANTAS JÓVENES

Planta de 6 meses

Planta de 15 cm de altura, tallo de 2 mm de diámetro; raíz axonomorfa, de 7.2 cm de largo por 3.9 cm de diámetro; hojas con pecíolos de 0.1-0.5 mm de largo por 0.6-1.5 mm de diámetro glabrescentes; láminas coriáceas, ligeramente cóncavas por el envés, rugosa por el haz, elípticas u orbiculares, lámina 2.3-5.9 cm de largo 1-2.5 cm de diámetro; ápice mucronado; base aguda-redondeada; margen cartilaginoso dentado simple, con 3-8 dientes mucronados; venas secundarias de 6-9 a cada lado de la vena media o vena primaria ascendentes y ligeramente curvas, haz glabro, excepto en la vena primana, venas secundarias y venillas impresas dando una apariencia rugosa envés con tricomas fasciculados y abundantes tricomas glandulares vermiformes que permiten observar la epidermis blanco-papiloso.

Study of Morphological Variation in *Quercus rugosa* Née (*Fagaceae*)

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Study of the genus *Quercus* requires careful search for diagnostic characters that help to make clear the taxonomic limits of the taxa; the objectives in this work were to describe the foliar architecture of 58 adult and juvenile individuals of *Quercus rugosa* Née.

Fruits were disinfected and stored. The germination of scarified seed with different colors and weight was described. The amount of growth in the laboratory and in the nursery were recorded. Analysis of similarity of foliar architecture did not show different groups, which indicates that the specimens used in this study were very similar. Germination in *Quercus rugosa* in all cases was 100%. The calculated index showed that stratification improved seed germination in three months, but there was more uniformity in the seeds that were not stratified. The Maguire index was higher for the seeds stratified for three months than for the ones stratified for one year.

Quercus rugosa photo©Guy Sternberg

During development of the plants it was observed that the total height, the height of the first pair of leaves, diameter, and leaf number of the four groups was very similar. *Quercus rugosa* has a wide distribution in Mexico and occupies diverse habitats but it maintains itself as a morphologically uniform group.