Biology 496 – Senior Seminar

Hybridization as a mechanism of gene flow and speciation in plants (A case study of *Quercus* in the Four Corners region)

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Most common oak of mid-elevations in SW US – Morphologically very variable

Q. gambelii - Durango


Recently described segregate – characterized by more "silky" leaves and larger fruit

In canyon lands of SE Utah

Q. gambelii var. bonina


Q. gambelii – Abajo Mts. UT


Small scrub oak native to the Navajo Basin of AZ and UT – from the N edge of Black Mesa in AZ to Arches N.P.

Various hypotheses for the origin of this species

Q. havardii var. *tuckerii (Q. welshii)*

Only inhabits sandy soil where it forms large clonal clumps and stabilizes the soil

Q. havardii var. *tuckerii (Q. welshii)*

Q. havardii var. *tuckerii (Q. welshii)*

A desert scrub oak more common further SW

Differentiated from the others due to its maintenance of leaves for two growing seasons (partially evergreen – a common trait of many dryland oaks)

Q. turbinella

Hybrid: Abajo Mts. – parentage primarily *Q. gambelii* – other - ?

Hybrids

Known *Q. gambelii* x *Q. turbinella* hybrid

Canyon where hybridization occurs – SE UT

Hybridization is very common in oaks and is apparently a very important means of speciation in the group.

There are very low reproductive barriers in these wind pollinated trees.

Repeated hybridization events over evolutionary time and establishment of these intermediate offspring in intermediate habitats can result in new species

This mode of speciation gave rise to a unique definition of the species – Ecological species.

Hybridization in *Quercus*

Our goal is to study the oaks of the Four Corners region to evaluate the level of hybridization and gene sharing among the species.

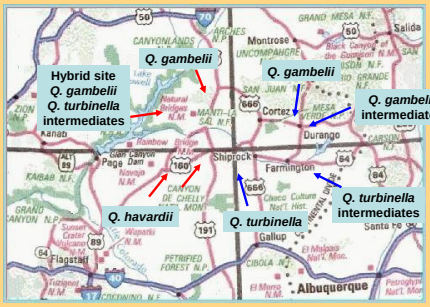
We can also test the two differing hypotheses for the origin of *Q. welshii*

1) a stabilized hybrid of *Q. turbinella* and *Q. gambelii*
2) a relict occurrence of *Q. havardii* which has since hybridized with other species.

We can use various tools:

1) GIS mapping of distribution of parental and hybrid forms to compare occurrence against environmental variables (elevation, precipitation, soil type)
2) Leaf morphometric variation to identify phenotypic evidence of hybridization
3) DNA fingerprinting for evaluation of genotypic evidence of hybridization

Seminar Goals



Locations of sampled species/populations

Pure species populations = 20 individuals sampled within population

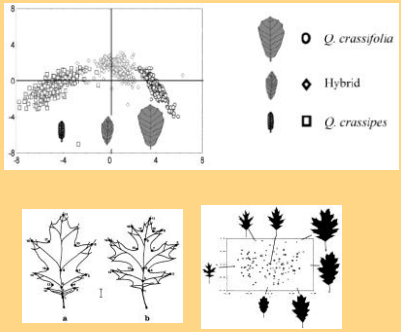
2 leaves taken from each individual for morphometric analysis

Leaf taken from each individual and frozen for DNA extraction and analysis

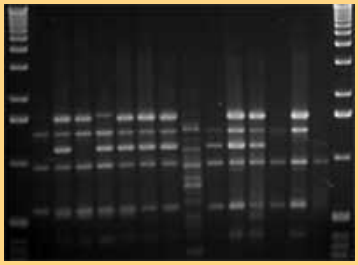
Active hybrid zone populations = 10 individuals from each species

Rest the same

Collection methodology



Morphometrics



ISSR Gel – type of DNA fingerprinting