Genetic diversity of silver fir (*Abies alba*) and European beech (*Fagus sylvatica*) populations from the south-eastern limits of their natural distribution.

Eleftheria Dalmaris [1], Nikolaos Tourvas [2] and Filippos A. Aravanopoulos [2,3]*

[1]Laboratory of Forest Genetics and Tree Breeding, School of Forestry and Natural Environment, Aristotle University of Thessaloniki, P.O. Box 238, 54124 Thessaloniki, Greece (edalmaris@gmail.com)

[2]Laboratory of Forest Genetics, Faculty of Agriculture, Forestry and Natural Environment, Aristotle University of Thessaloniki, Greece (tourvasn@auth.gr)

[3]Hellenic Agricultural Academy, Athens, Greece

*aravanop@for.auth.gr

Introduction

Abies alba Mill (silver fir) and *Fagus sylvatica* L. (European beech) are two fundamental European forest tree species that are expected to face survival issues in parts of their distribution range due to the upcoming change in the climate and particularly in Greece, which is their southern-eastern limit. Populations that are at the limits of their distribution (marginal/ peripheral populations) can be a valuable gene pool that is well adapted to the expected extreme conditions, and therefore exploring their genetic parameters is of high interest.

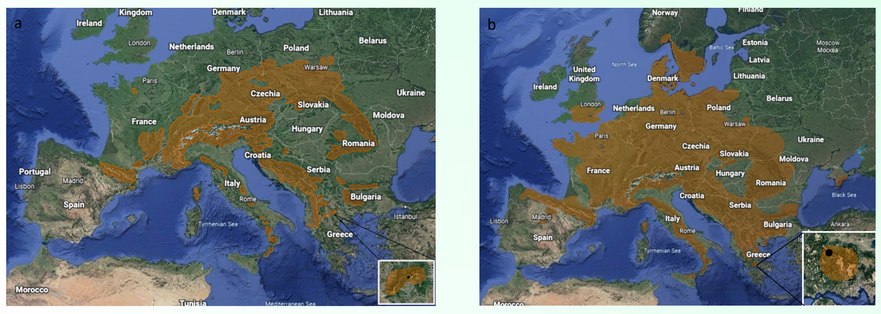

Figure 1: Distribution maps of a) *Abies alba* and b) *Fagus sylvatica*. Points on each insert of the maps indicates selected Greek populations.

Aims and Scope

- Determine the genetic variation (Ho: Observed heterozygosity; He: expected heterozygosity; AR: Allelic Richness) of marginal silver fir and European beech populations in Mt. Pinovo and Mt. Oxia, respectively.
- Compare the results with existing literature regarding populations of the main range (core distribution range) and of the SW (Spain and /or France) and S (Italy) part of their distribution.

Materials and Methods

SSR genotyping was conducted on plant material that was collected from the most south-eastern population of each species (30 trees per population):

(1) ***Abies alba*** (Mt Pinovo; 41° 07.209΄N, 22° 04.346΄E; altitude: 1266m asl; 12 SSRs [1-3], Figure 1a) and

(2) ***Fagus sylvatica*** (Mt Oxia; 38° 46.601΄N, 21° 58.618΄E; altitude 1686m asl; 15 SSRs [4], Figure 1b).

The material was stored at – 80°C until processed for DNA extraction using the Macherey-Nagel kit. PCR products were run on a ABI Prism 3730xl (Applied Biosystems) sequencer. Results were analysed by using the GeneMapper Software v4.1 (Life Technologies). Observed and Expected heterozygosity were calculated using GeneAlex ver. 6.5 and HP-Rare for allelic richness.

Results on a per species basis were compared to those of populations from the main distribution range with studies that included common SSRs. Analysis of Variance (ANOVA) was performed for each of the species using the R 3.5.0 package in order to detect if differences exist amongst the Greek marginal populations and populations from the main range of their distribution or from the southwest (Spain and/or France) or the south (Italy) region of their distribution.

Abies alba

✓Silver fir Ho at Mt Pinovo averaged 0.452, He 0.530 and AR 6.29

✓The statistical analysis showed no significant differences of Ho, He (Figure 2a) and AR (Figure 2b) amongst (i) Mt Pinovo (SE margin) (ii) Spain (SW part of the distribution) (iii) Italy (S part of the distribution) and (iv) core area of the distribution of *A. alba*.

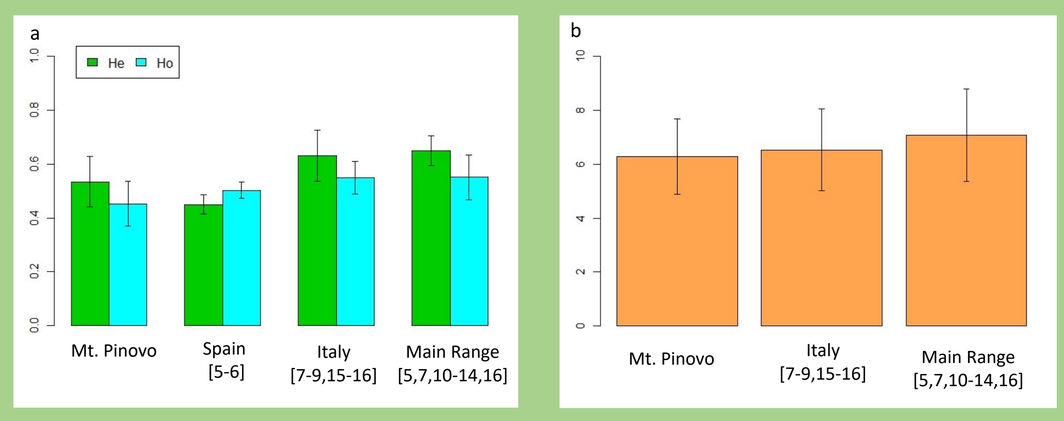

Figure 2: a) Observed (Ho) and Expected Heterozygosity (He) and b) Allelic Richness (AR) averages of rear edge Greek population and comparison with populations from Spain, Italy and the main range of *Abies alba*. In brackets are the literature that was used for each of the comparison areas. No AR was listed for Spain.

Fagus sylvatica

✓European beach Ho averaged 0.732, He 0.753 and AR 6.63.

✓The statistical analysis showed no significant differences of Ho, He (Figure 3a) and AR (Figure 3b) amongst (i) Mt Oxia (SE margin) (ii) Spain and France (SW part of the distribution) and (iii) core area of the distribution of *F. sylvatica*.

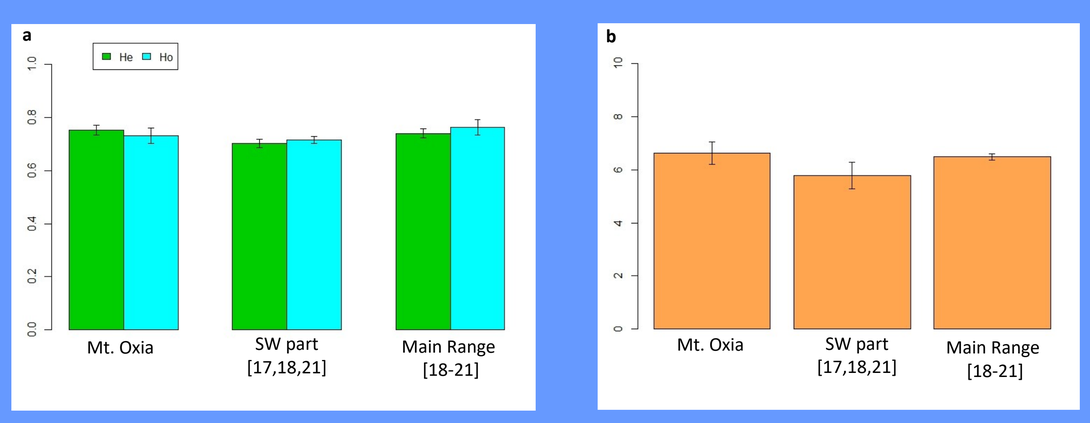

Figure 3: a) Observed (Ho) and Expected Heterozygosity (He) and b) Allelic Richness (AR) averages of rear edge Greek population and comparison with populations from the SW part and the main range of *Fagus sylvatica* distribution. In brackets are the literature that was used for each of the comparison areas.

Conclusions

The genetic variation (Ho, He and AR) of the Greek marginal populations, when compared with populations from the southwest or the south parts of their distribution or with their main range, showed no statistical differences. According to most species distribution models both *Abies alba* and *Fagus sylvatica* are expected to face survival issues in parts of their distribution range due to the upcoming change of the climate, and especially in Greece. With the Greek populations being well adapted to xerothermic condition, this can constitute a valuable genetic pool for European populations that may face survival issues. Therefore, the conservation of their genetic re-sources is of high priority .

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