Status of the Experimental Network of Mediterranean Forest Genetic Resources

FAO - *Silva Mediterranea* WG - Forest Genetic Resources in the Mediterranean Region
and
IUFRO Unit 20213 - Breeding and Genetic Resources of Mediterranean Conifers

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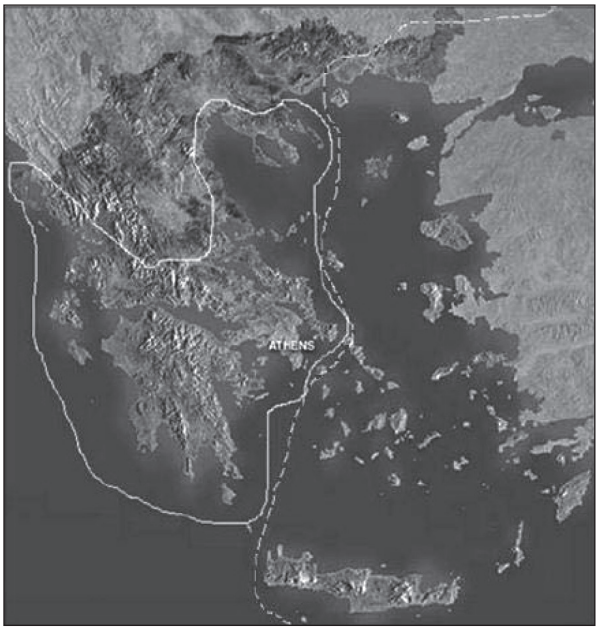
RESULTS OF *PINUS HALEPENSIS* AND *P. BRUTIA* TRIALS IN GREECE

Paraskevi G. Alizoti[1§], Kostas Ioannidis[2]

Abstract - Low elevation Mediterranean pines of the group *halepensis* are valuable and prominent forest tree species with wide distributions across the Mediterranean basin. The natural distributions of the two species in Greece are well defined and distinct. They hybridize naturally though in the Chalkidiki peninsula, where *Pinus halepensis* Mill. meets the easternmost limit of its distribution in the Mediterranean basin. A network of experimental trials has been established in Greece for *P. halepensis*, as well as for *P. brutia,* to explore the levels of the existing variation for adaptive traits. Both *P. halepensis* and *P. brutia* provenances exhibited significant genetic variation for all the adaptive traits studied, while their performance across sites indicated the high potential for effective across sites selection. Also, *P. brutia* provenances of Greek origin outgrew the provenances originating from Turkey and Cyprus, when tested in two different sites. The outstanding performance of *P. brutia* x *P. halepensis* hybrids is worth mentioning, as when tested together with their parental species in harsh environmental conditions they significantly outperformed the only parent that was able to survive *(P. brutia*). The results indicate the existence of ample genetic variation among and within the natural populations of both species for adaptive traits, the potential for selection and breeding and the need for conservation of their unique genetic resources in the face of climate change.

Key words: adaptive traits, genetic variation, provenances, hybrids, selection, breeding.

Low elevation Mediterranean pines of the group *halepensis* are valuable and prominent forest tree species with wide distributions across the Mediterranean basin. The ability of the species to grow in the adverse climatic conditions of the Mediterranean region combined with their fast growth in favorable sites and their ability to endure forest fires through specific mechanisms, render them irreplaceable for the Mediterranean ecosystems especially in the face of climate change. The two species (*Pinus halepensis*, *Pinus brutia* Ten.) grow naturally in the mainland and on the islands of Greece. The limit of *P. halepensis* natural distribution to the East of the Mediterranean region, is found in northern Greece, namely in Chalkidiki peninsula. The species grows naturally on the mainland of Greece, the islands of the Ionian Sea, the Sporades islands of the Aegean Sea and on the Euboia Island (Map 1). On the other hand the limits of natural distribution of *P.*



Map 1. Natural distribution range of *P. halepensis* (solid line) and *P. brutia* (broken line) in Greece.

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brutia to the west are also found in Greece as the species grows naturally only in Thrace and the Thasos island and on the islands of the eastern Aegean Sea (e.g. Lemnos, Lesvos, Samos, Chios, Rhodes) and the Crete island (Map 1).

Due to the importance of the two species a network of provenance trials was established in Greece, and a great part was due to the collaboration with FAO. In the Table 1 below the trials established in Greece concerning the two species are located (according to the data send by Varelidis, K. to FAO).

It was found that provenances differ significantly for survival and growth traits. In Figure 1, the differences among *P. halepensis* provenances and their comparison (at the P = 0.05 level) are shown (Alizoti and Panetsos, 2005).

In Figure 2 the mean height differences among

Species	Location	Est. yr	Material
Pinus halepensis/P. brutia/P. eldarica	NW Peloponnesos	Between 1976 and 1978	37 PRO
Pinus halepensis	Thiva	1971	10 PRO
Pinus halepensis	Lamia	1971	10 FAM
Pinus halepensis	Chalkidiki	1971	100 FAM
Pinus halepensis	Triadi	1989	20 FAM
P. brutia	NW Peloponnesos	1972	15 FAM, PRO
P. brutia	Thessaloniki	Between 1970 and 1972	
P. brutia	Thessaloniki		
P. brutia	Lamia	1974	10 PRO
P. brutia	Amphilochia	1971	7 PRO
P. brutia	Chalkidiki	1971	7 PRO
Hybrids	Taxiarchis	1969	4 plantations, 44 FAM
Hybrids	Triadi	1989	21 FAM
Hybrids	Thessaloniki area	1998	50 FAM
Hybrids	Chalkiidiki	1999	40 FAM
Hybrids	Chalkiidiki	1998	10 FAM

Table 1. Trials of species of the group *halepensis* and of hybrids established in Greece (data provided by K. Varelides).

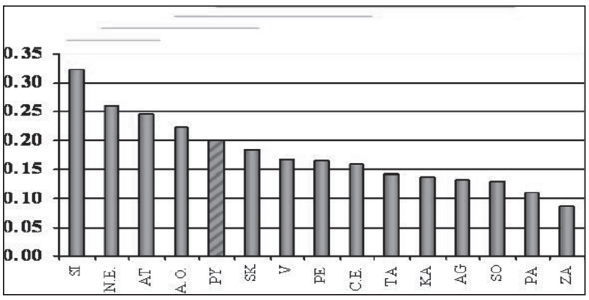

Figure 1. Mean volume performance of *P. halepensis* provenances (Elia provenance trial; Alizoti and Panetsos, 2005).

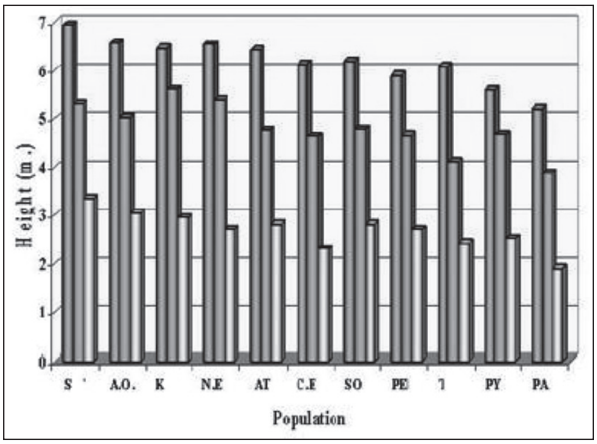

Figure 2. Mean height performance of *P. halepensis* Greek provenances in three different sites (Alizoti, 2000).

P. halepensis Greek provenances in three experimental trials is shown. The provenances exhibit pronounced differences within each site. The mean population performance varied among sites, as sites where characterized by different environmental index (Alizoti, 2000).

In Figure 3 the mean height performance of *P. brutia* provenances at ten years of age, tested in two sites (Borsi and Prokopi) appears. It was found that the two Greek provenances included were performing better than the rest provenances originating from Turkey and Cyprus (Matziris and Cooling, 1982).

In Figure 4, the mean height performance of five *P. brutia* provenances of Greek origin tested in four sites is shown. Significant differences among provenances were noticed at all sites. Sites also differed for their environmental index, while provenances differed for their stability across sites, proving that selection among and within populations for height growth and stability of performance can be efficient (Alizoti, 2000).

The performance and survival of hybrids, parents and their BCs at two extreme environments is shown in Figure 5. It was shown that the *P. brutia* x *P. halepensis* hybrids can withstand the hardest

environmental conditions and outperform the only parent that was able to survive (*P. brutia*) in the harsh environmental conditions of Oxya site, while *P. halepensis* was eliminated (Panetsos *et al.,* 1998). Also, the *P. brutia* x F1 backcross exhibited good performance and survival in the Oxya trial, while the P. *halepensis* x F1 backcross was also eliminated, which shows the effect of *P. halepensis* on the surviving ability of the crosses. From the results above it is shown that the need to monitor and re-evaluate all trials established years ago is urgent, due to the importance of the genetic material and the useful information that their analysis may yield in terms of selecting proper genetic material for future use in the face of climate change.

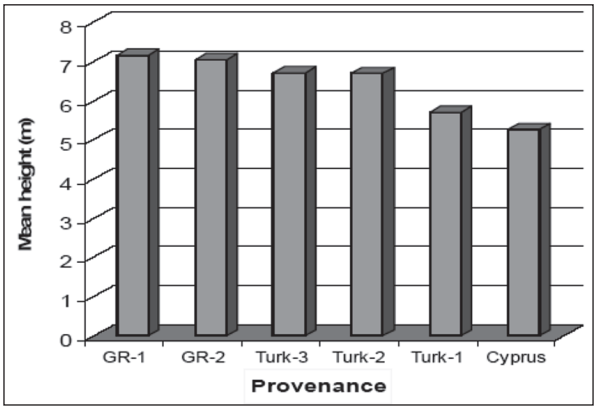

Figure 3. Mean height performance of *P. brutia* provenances tested at two sites (Matziris and Cooling, 1982).

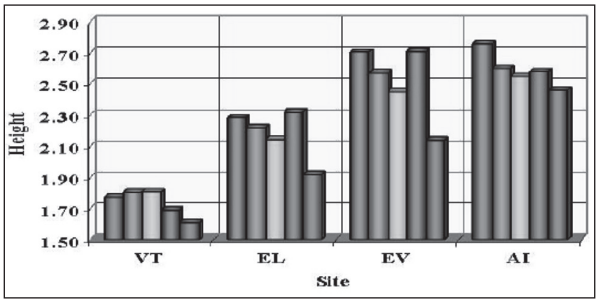

Figure 4. Mean height performance of *P. brutia* provenances of Greek origin in four different sites (Alizoti, 2000).

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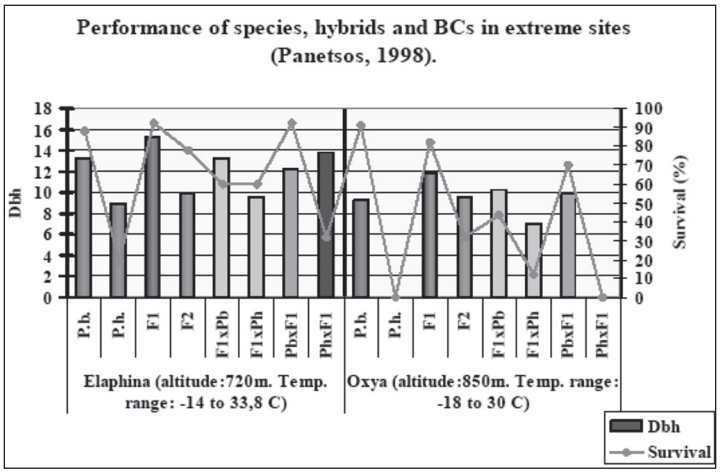

Figure 5. Performance of species, hybrids and BCs in extreme sites (Panetsos *et al.*, 1998).