

ALEPPO PINE (*PINUS HALEPENSIS* MILL.) IN UMBRIA (ITALY) AND ITS RELATION TO NATIVE ISRAELI POPULATIONS¹

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ABSTRACT

The Aleppo pine (*Pinus halepensis* Mill.) forests in Umbria, Italy, differ significantly from all the other Italian Aleppo pine forests in their phytosociology, resin monoterpene composition, allele frequencies, and ecophysiological properties such as higher frost resistance, higher resistance to low water potentials, and a different seedling growth mode.

The occurrence in Italy of an Aleppo pine population that has similarities with native Israeli populations is discussed.

Native Aleppo pine (*Pinus halepensis* Mill.) forests in Italy grow mainly in the regions of Puglia and Liguria along the shores of the Adriatic and Mediterranean seas, and in its central region in Umbria (Magini, 1954; Critchfield and Little, 1966). These forests can be divided into humid (Liguria and Umbria), sub-humid (Gargano in Puglia) and semi-arid (Taranto province in Puglia) forests (Nahal, 1962). The Aleppo pine forests differ significantly in phytosociology: forests in Gargano include *Quercus ilex*, the forests in Taranto province include *Q. calliprinos*, and the pine forest in Umbria includes *Q. ilex*, *Q. pubescens*, *Ulmus campestris*, and *Carpinus betulus*.

In Umbria, Aleppo pine stands cover about 27,500 ha, of which about 2,500 ha are pure stands from natural regeneration (Brunori et al., 1990) and about 25,000 ha are mixed stands with broadleaf. These forests have an unusual location (far from the sea in central Italy, located between 300 and 1000 m a.s.l. — see Fig. 1). Aleppo pine forests in Val Serra (one of the Umbrian valleys in which Aleppo pine occurs) have an unusual floristic composition. Two sub-associations with different pedoclimaxes have been identified: (i) *Quercetum ilicis pinetosum halepensis* which is located in areas with hard limestone bedrock, and (ii) *Quercetum pubescentis pinetosum halepensis* which is located on sites with sandstone or marl bedrock. On these sites the vegetation is composed of *Pinus*

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Ecophysiological and silvicultural studies on Italian provenances of Aleppo pine have pointed to differences between the population growing in Umbria on the hills near Otricoli in the Terni district (numbered A_{26} in the FAO-IUFRO 4-bis project) and the other three Italian provenances located at Imperia (A_{25}) on the coast of Liguria (northwest Italy), Vico del Gargano (A_{27}), and Patemisco (A_{28}) in Puglia (southeast Italy). Eccher (1966) described the A_{26} population as the most interesting one in Italy from the silvicultural point of view. In comparison with other populations, this population (A_{26}) has a regular development, good shape, and a cylindrical stem. Baradat et al. (1990) noticed that the Aleppo pine trees of the A_{26} provenance have an unusual monoterpene spectrum in comparison with the other three provenances. Calamassi (1986), Calamassi et al., (1984, 1989), and Falusi et al. (1983) have shown that seeds and seedlings of the A_{26} population differ significantly from the other Aleppo pine populations in their ecophysiological properties such as higher frost resistance, higher resistance to low water potentials, a lower number of stomata per linear centimeter, and a different seedling growth mode. In addition, they found that the growth mode of the A_{26} population was similar to that of the Israeli population A_6 (named Shaharia).

Results of electrophoretic analysis of diversity (Schiller et al., 1985) have shown that the Aleppo pine population in Umbria (A_{26}) differs significantly from the other Italian provenances by having distinct marker alleles in intermediate-to-high frequencies for two loci, Aap_1 and Cat_2 . The same marker alleles exist in the East Mediterranean group and are the basis for the subdivision of *P. halepensis* into the East and the West Mediterranean groups. Schiller et al. (1985) speculated that "the similarities between populations from Israel and central Italy were brought about by independent events like convergent evolution and natural selection, although the possibility of seed transfer by man in the distant past may not be excluded beforehand".

The occurrence in Italy, within the West Mediterranean group, of an Aleppo pine population that has similarities with native Israeli populations (East Mediterranean group) is explained by several Italian scientists by the existence, in geological times, of a "bridge" between the Near East and Italy (through Greece) when the Adriatic Sea was almost dry. However, Morandini (personal communication) is of the opinion that the A_{26} population developed in an area very different in its ecological conditions from those of the other populations. Pignatti (1982) considers this population of Central Italy to be the result of ancient afforestation.

The possible introduction in the past of seeds and/or seedlings from the East Mediterranean populations into Umbria is supported by paleobotanical evidence. Paleo-pollen analysis confirmed the existence of Aleppo pine in the Middle East in ancient times (Rossignol, 1963; Horowitz, 1971; Darmon, 1984; Leroi-Gourhan, 1984; Baruch, 1986), but not in Umbria. Furthermore, analysis of allele frequencies of Aleppo pine forests in Greece and Turkey, as presented by Schiller et al. (1985), would seem to rule out the possibility of this population being a remnant of an ancient East Mediterranean distribution.

Therefore, the questions are: who carried seed or seedlings of Aleppo pine from the Near East specifically into Umbria, when did it happen, and why? An historical analysis based on evidence found in the Umbrian region (Brunori et al., 1990) led to four

hypotheses as to the possible origin of the introduction:

- a. The settlement in Umbria of Roman army veterans, some of whom may have participated in the conquest of Syria and Palestine by Pompeii between the second and first centuries B.C.
- b. The presence in Umbria of a group of Syrian monks, sent by the popes to spread Christianity after the devastation caused by the Barbarian invasions of Visigoths and Ostrogoths (fourth to sixth centuries A.D.) (Penco, 1962).
- c. The Franciscans and the Templar Crusaders who were present in both the Holy Land and in the region of Umbria, where they owned vast rural areas from the twelfth century onwards.
- d. Transfer of seeds by merchants and dealers who traveled the "spice routes" between Italy and the East; one of which crossed Umbria in the eleventh century and later.

Support for each of the four hypotheses by historical documentation is very scarce; still, the hypothesis which is best supported by documentary evidence relates to the introduction of seeds or seedlings by a group of monks from Syria. During the Roman Empire, Syria included Lebanon and the upper part of Israel and Jordan. These monks began to arrive in Italy in the fourth century A.D. because they faced persecution in their homeland by the Bishop of Antioch and the Emperor Anastasio Dikoro. They were hermits with a lifestyle that was in contradiction with the concepts of the growing Church (Penco, 1962). At about 350 A.D., monks who escaped persecution in Rome founded many places in the hilly region of Umbria surrounded by swamps, 120 km from Rome, along the Via Flaminia, the only line of communication at that time. These monks served as an example to the local population both in pastoral and agricultural techniques, and in intellectual and religious life (Menghini, 1989). They were well trained in phytotherapy, which is why they were considered "Doctors and Saints". Many popular legends and small churches in Umbria commemorate their presence in this area. From a ninth century legend found in the Archive of Spoleto and from the book of Jacobilli (1647), it is possible to infer that two Syrian monks, Mauro and his son Felice, both from Caesarea in Syria, were asked to fight a dragon that killed the local population and caused much damage to the land. They succeeded in their mission by using "wood of pine that grew and blossomed" and an iron instrument "to cut the stones". This scene is represented in a bas-relief located in the entrance of the Church "San Felice in Val di Narco", which is in the village of Santa Anatolia, Terni district in Umbria. There is historical evidence that confirms part of the legend: it is still possible to see a channel near Spoleto, some distance from the abovementioned church, built in the sixth century, and reclamation work in the Spoleto area done by two men named Spes and Domizio is documented (Schmiedt, 1962). Spes was a name common among the Syrian monks and not used by the local inhabitants; the most famous Spes established a "Laura" (a monastery of an Eastern church) in Preci, near Terni, in 471 A.D. It is possible that these monks carried seeds of different plants known to them in their home country for therapeutic purposes, and they used Aleppo pine as a resin producer. The pioneer characteristic of this species and the easy spread and growth after fire could explain the diffusion of the species into the area (Schiller, 1979).

Thus, the enigma of the genetic similarity between *Pinus halepensis* in Umbria and in the Near East populations may be explained by historical evidence.

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