Provenance trials of stone pine (Pinus pinea L.) in the Aegean region: tenth year evaluation

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Provenance trials of stone pine (*Pinus pinea* L.) in the Aegean region: Tenth year evaluation

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Abstract. The purpose of the project here analysed was the establishment of provenance trials in natural environment of stone pines in order to determine adaptation ability and growth performance as well as to conserve gene materials of various origins in ex-situ environments. This project has been simultaneously implemented in France, Italy, Spain, Tunisia, Morocco and Turkey under the coordination of FAO-INRA. A total of 26 origins have been used in the trial with three replications in Kozak and Yigintas plots of the Aegean Region of Turkey. Spacing for the saplings was 6 × 6 m at both of the plots. Because no significant differences were found at the statistical analysis of 5th year data, here the collected data after 10 years were analyzed and evaluated. According to the variance analysis, significant differences were found between the provenances in terms of mean height (p value 0.1 %), mean diameter (0.5 %) and mean number of conelets (0.1 %). However, there were not any significant differences among the crown diameters and the survival ratios. There were significant differences between the trial plots. The reasons of the differences between two trial plots might be the distance to the sea, bedrock type and soil depth. For more precise evaluation of the provenance trials, the tree age should be minimum 20 years, therefore we should wait for results from next decade.

Keywords. Aegean Region – *Pinus pinea* – origin.

***Essais de provenance du pin pignon (**Pinus pinea *L.) dans la région égéenne : évaluation au bout de dix ans*

***Résumé.** Le but du projet était d'analyser la mise en place d'essais de provenance dans un environnement naturel de pins pignons afin de déterminer la capacité d'adaptation et de croissance et de préserver un matériel génétique d'origine diverse dans des environnements* ex situ*. Ce projet a été mis en œuvre simultanément en France, en Italie, en Espagne, en Tunisie, au Maroc et en Turquie sous la coordination de la FAO-INRA. Un total de 26 origines ont été utilisées dans le processus avec trois répétitions dans les parcelles de Kozak et Yigintas de la région égéenne de la Turquie. L'espacement des plants était de 6 × 6 m dans les deux parcelles. Vu qu'aucune différence significative n'avait été trouée pour l'analyse statistique des données de 5ème année, nous présentons les données recueillies après 10 ans, qui ont été analysées et évaluées. Selon l'analyse de variance, des différences significatives ont été trouvées entre les provenances en termes de hauteur moyenne (valeur p 0,1%), de diamètre moyen (0,5%) et de nombre moyen de jeunes cônes (0,1%). Cependant, il n'y avait pas de différences significatives entre les diamètres de la couronne et les ratios de survie. Il y avait des différences significatives entre les parcelles d'essais. Les raisons des différences entre les deux parcelles d'essai pourraient être la distance à la mer, le type de roche et la profondeur du sol.*

***Mots-clés.** Région égéenne –* Pinus pinea *– origine.*

I – Introduction

The interest of stone pine is due to its seeds rather than its wood. Approximately 1,200 tons of nuts per year are produced in Turkey, and average 1,000 tons of this production are provided by Aegean region. Bilgin and Ay (1997) determined the mean nut yield in between 68-118 kg/ha in this region, versus some 200 kg/ha in Spain.

According to Urgenc (1982), provenance trials are important in order to identify the most suitable origins for the certain regions. Therefore, the determination of the adaptation and the

seed ability of different stone pine origins tested in various ecological regions in Turkey is going to facilitate the management of economic resources realistically.

Even though there are other origin trial studies conducted on stone pine species in Turkey, the current study is the only one that includes also stone pine provenances from the other countries. As a result of the study, it is aimed to determine the adaptation abilities and the growth performances of the origins, to ex-situ conserve the gene resources of the origins and to identify the cone yields of the origins.

II – Material

A total of 26 origins, 11 native Turkish (Fig. 1) and and 15 from other countries (Table 1), have been used in the trial with three replications in Kozak (Izmir, Bergama) and Yigintas (Aydın, Koçarlı) plots of the Aegean Region of Turkey. Latitude of Kozak is 39º 16' 21'' N, longitude is 27º 09' 32'' E. Koçarlı latitude is 37º 39' 44'' N, longitude is 27º 40' 22' E'. Spacing for the saplings was 6 × 6 m in both plots.

In each trial, tree height and stem diameter at breast height were measured at five and ten years, and the cone number per tree was registered.
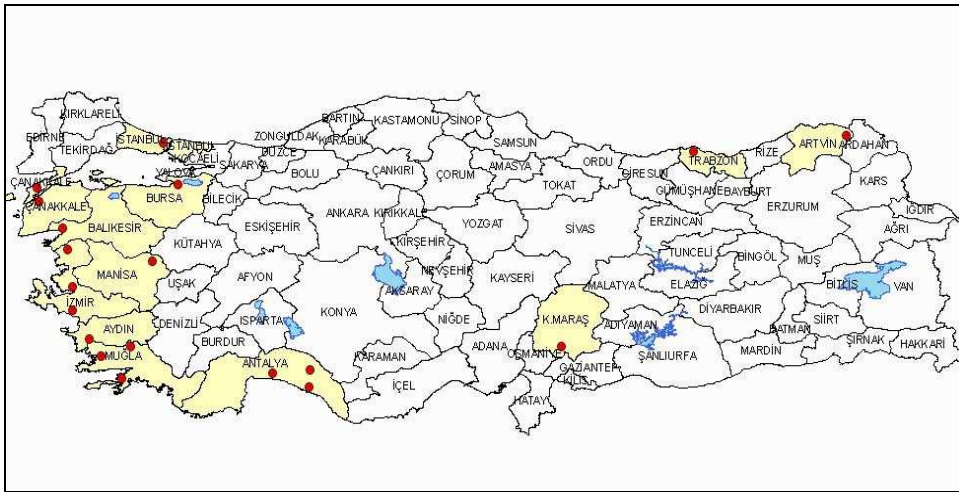

Fig. 1. Distribution areas of stone pine in Turkey.

III – Results

According to the data analysis at 10 years (Box *et al.*, 1997), in Kozak, the provenances that have the maximum mean height were Eceabat /TR (h_{mean}=414 cm), Cataluña/SP (h_{mean}=378 cm) and Elmacık/TR (h_{mean}=376 cm) (Fig. 2). The mean height and also mean diameter of Serik/TR (h_{mean}=275 cm, d_{mean}=5.7 cm) was the minimum at this plot. The provenances with the maximum mean diameter were Cataluña/SP (d_{mean}=15.1 cm), Villeneuvette (Hérault) (d_{mean}=12.8 cm and Saintes-Maries /FR (d_{mean}=12.6 cm) (Fig.3). St. Raphael/FR (nc_{mean}=6.5) and Artvin/TR (nc_{mean}=6.1) provenances has showed the best performance in terms of mean number of conelets, while the mean number of the conelets of Yatağan/TR provenance was the minimum (nc_{mean}=2.9) (Fig. 4).

Table 1. Provenances used in the trials

Number	Provenance	Country	Altitude (m)	Rainfall (mm)
1	Brignoles-Le Val	France	310	813
2	Saintes-Maries	France	2	543
3	Bkassine	Lebanon	800	-
4	St Aygulf	France	10	943
5	Fenignlia	Italy	25	680
6	Andalucia occidental	Spain	50	631
7	Chalkidiki Agios Nikolaos	Greece	50-400	439
8	Beit Mounzer	Lebanon	1300-1400	-
9	St. Raphael	France	80	943
10	Cordillera central	Spain	900	1,007
11	Muğla Yatağan-Katrancı	Turkey	685	752
12	Çanakkale Eceabat	Turkey	20	629
13	Denizli	Turkey	650	
14	Antalya Kumluca	Turkey	5	986
15	Qsaibe	Lebanon	600-700	-
16	Meseta Castellana	Spain	875	452
17	Cataluna	Spain	150	710
18	Kornael	Lebanon	1200-1400	-
19	Villeneuvette (Hérault)	France	130-220	775
20	Bergama Kozak	Turkey	460	668
21	Antalya Serik Belek	Turkey	5	1,030
22	Edremit Atkayası	Turkey	415	733
23	Yalova Dumanlıdağ	Turkey	500	725
24	Aydın Koçarlı	Turkey	450	-
25	Artvin	Turkey	250	1,009
26	K.Maraş Elmacık	Turkey	750	1,151
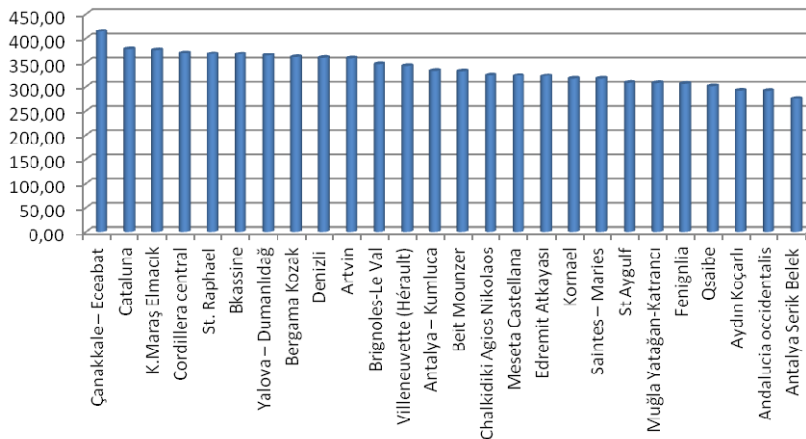
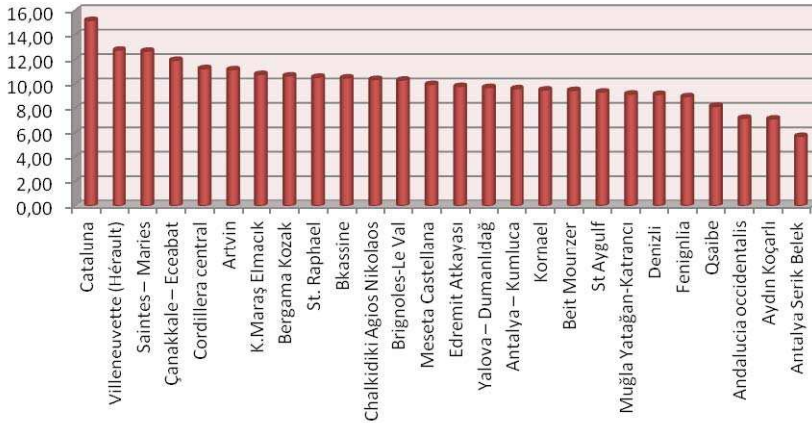Fig. 2. Average tree height of provenances at Kozak (cm).

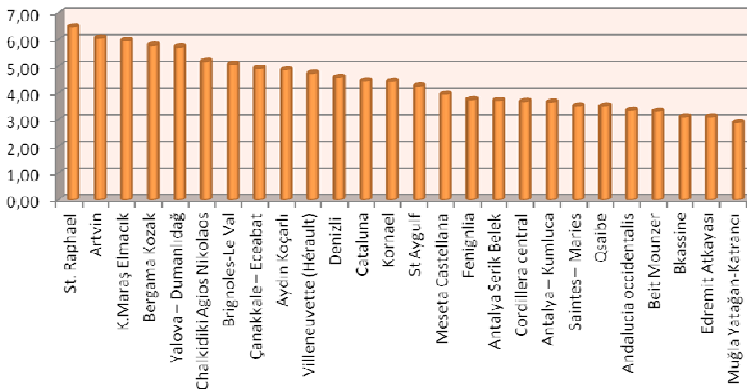**Fig. 3. Average stem diameter of provenances at Kozak (cm).**

Fig. 4. Average conelet number of provenances at Kozak.

On the other hand, according to the data analysis at 10 years in Koçarlı, the provenances that have the maximum mean height were Yatağan/TR (h_{mean}=357 cm, d_{mean}=11.5 cm), Brignoles/FR (h_{mean}=342 cm, d_{mean}=8.6 cm) and St Aygulf/FR (h_{mean}=312 cm, d_{mean}=8.5 cm). These provenances showed also the maximum mean diameter. The mean height of Chalkidiki/GR (h_{mean}=198 cm) was the minimum while the mean diameter of Kumluca/TR (d_{mean}=3.1 cm) was the minimum at this plot. Yatağan/TR (nc_{mean}= 5.4) and Saintes Maries/FR (nc_{mean}= 4.5) showed highest number of conelets, while still no tree of Cataluna/SP produced any conelets at all (Figs 5, 6 and 7).

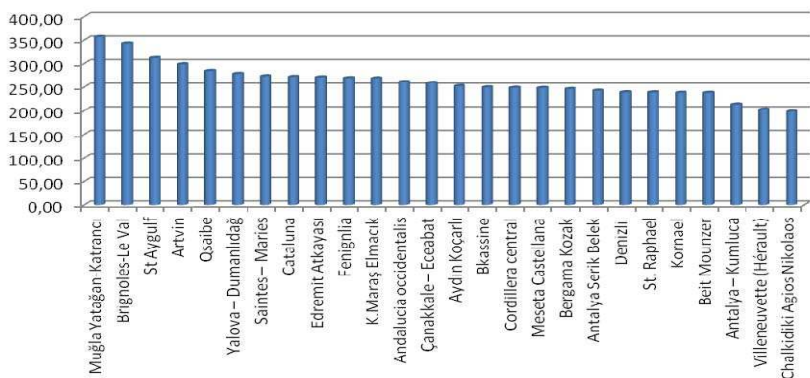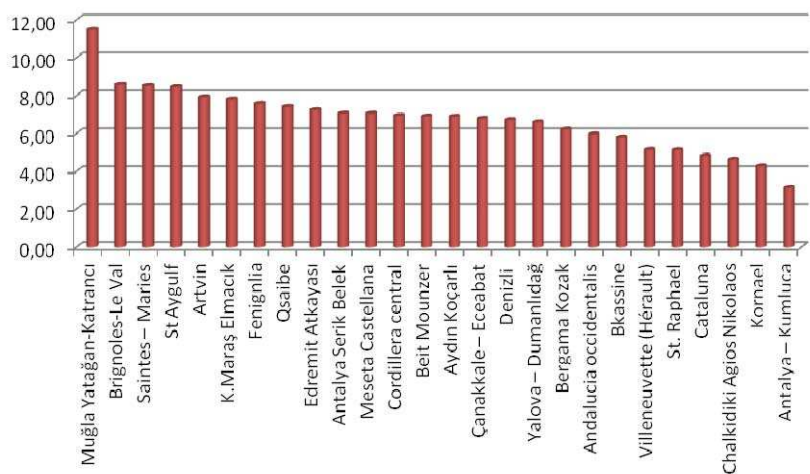**Fig. 5. Average tree height of provenances at Koçarlı (cm).**

Fig. 6. Average stem diameter of provenances at Koçarlı (cm).
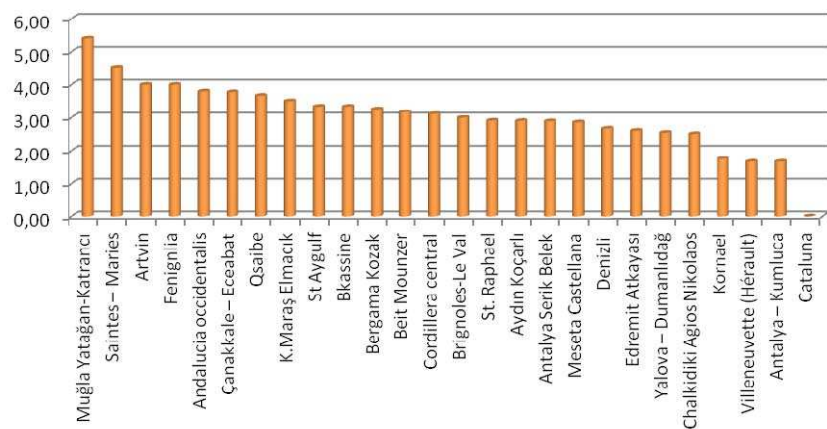

Fig. 7. Average conelet number of provenances at Koçarlı.

IV – Discussion

The main purpose of afforestation with stone pine in Turkey is the pine nut production. For this reason, it is important to determine the origins possessing high pine nut yield. Therefore, not only height and crown diameter but also the number of mature cones and seed numbers in those cones, seed weights and sizes, seed quality etc. parameters should be monitored in the future. Additionally, because crown diameter is important in increasing in cone yield, there is a need for thinning after the 10th year, in order to provide an adequate growth space. In this study, Turkish origins are seen to be more successful than foreign origins, but for more precise evaluation of the provenance trials, the tree age should be minimum 20 (at least the half of the rotation period). Therefore we should wait for results from next decade.

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Ürgenç S., 1982. Orman Ağaçları Islahı, İstanbul Üniversitesi, Orman Fakültesi, Yayın No: 293, İstanbul.