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Fourth year results in variations of manna ash (*Fraxinus ornus* L.) families

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ABSTRACT

Variations among Manna ash (*Fraxinus ornus* L.) families including narrow-sense heritability, and correlations were investigated based on seedling height and root collar diameter in a progeny trial at fourth year. Averages of the height and diameter were 143 cm and 19 mm, respectively. Seedling heights were ranged from 117 to 163 cm at families, and from 53 to 221 cm at individual seedlings. They were between 16 and 25 mm, and between 10 and 23 mm for root collar diameter, respectively. Significant differences (*pd"0.05*) were found among families for root collar diameter, while seedling height was similar for seedling height in the families according to results of analysis of variance. The heritability in narrow-sense (h_i^2) reflects the share of the variation that depends on the genotypes was very low for the characters. It was 0.004 for the height and 0.065 for the diameter. Significant phenotypic and genotypic correlations (*pd" 0.05*, r=0.687 and 0.720) were found between seedling height and root collar diameter based on results of correlation.

KEYWORDS

Breeding;
Fraxinus ornus;
Heritability;
Plantation;
Progeny;
Seedling.

INTRODUCTION

Turkey has three natural ash species (*Fraxinus excelsior*, *F. ornus* and *F. angustifolia*) at 11700 hectares. The Manna ash (*Fraxinus ornus*) is one of the most important forest tree species because of commercial wood and potential advantages for plantation of extreme regions such as arid areas, while the species has the most limited distribution in Turkish and European ashes. Besides, wood of the species is an important material for such as furniture, ornamental, charcoal and music industries. Besides, oil is extracted from its bark used in medicinal purposes[1]. In addition to the species is very resistance to aridity, forest fire[2], and climate change[3]. It is clear that these advantages of the species are getting importance for increasing of limited distribution by plantation forestry especially based on global warming and aridity. Source of vegetative and generative propagation materials have important roles in biological and commercial success of plantation such as re-plantation, quality and quality of forest products. While different methods are used in determination of these sources, progeny test is one of the most common methods used in determination of better sources and to estimation of genetic parameters

and variation. Heritability, defined the proportion of observed differences on a trait among individuals of population that is due to genetic differences, is one of the most important genetic parameters used in plant genetics for different purposes[4,5].

The purposes of this study were to compare of families for seedling height and root collar diameter, to estimate of variation among genotypes and within genotype, to estimate correlations between the characters based on fourth year field results of progeny test to contribute breeding and plantation forestry of the species.

MATERIALS AND METHODS

Data collection

The height and root collar diameter data were collected in three year field growth of seedlings of 28 open-pollinated families (called also as genotype in the paper) planted at an experimental area (latitude 37°452 N, longitude 30°352 E, altitude 1050 m) as three replicates and ten seedlings each replicate at 2x2 m spacing in 2009 Figure 1. Seedling height (SH) and root collar diameter (RCD) data were measured in all survival seedlings at the end of fourth growth period.

Data analysis

The statistical analysis was carried out by SPSS statistical package[6] according to following model of ANOVA was used for the analysis:

$$\mathbf{Y_{i j_k} = \mu + F_i + B(F)_{j(i)} + e_{ijk}}$$

where Y_{ijk} is the observation from the kth seedling of the jth genotype in the ith block, μ is overall mean, $B(F)_{j(i)}$ is effect of the jth genotype in the ith block, and e_{ijk} is random error.

Individual heritability (h^2; narrow-sense heritability) was estimated as:

$$\mathbf{h_i^2 = \sigma^2_A / \sigma^2_u}$$

where σ^2_A is the additive genetic variance, σ^2_u is the phenotypic variance for the characters.

Correlations among characters were also calculated at the levels of individual seedlings and genotype means.

RESULTS AND DISCUSSION

Seedling morphology and variation

Averages and ranges of seedling height and root-collar diameter were presented in TABLE 1 and showed in Figure 1. Averages of seedling height and root-collar diameter were 143.1 cm and 18.9 mm, respectively TABLE 1. It could be said that averages of seedling height and root collar diameter increased about twenty times in both characters from 1+0 seedlings to end of fourth year field performance of the same genotypes[7]. Beside, growth performances for the characters were generally higher than that of other forest tree species[8,9,10].

While averages of seedling height were similar in families Figure 2, significant differences (*pd"0.05*) were found among families for root collar diameter according to results of analysis of variance. However, there were large differences within family for the height and diameter. The difference was about five times in individual seedlings for the height (53 cm – 259 cm) and four times for the diam-

Figure 1 : A view from the experiment.

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TABLE 1 : Averages and ranges of the characters

Family	Seedling height (cm)		Root collar-diamater (mm)	
No	average	range	average	range
1	153.7	84 - 239	20.6	12 - 34
2	144.4	81 - 188	20.0	11 - 25
3	147.1	66 - 237	19.0	11 - 27
4	119.7	84 - 195	14.0	10 - 19
5	162.5	121 - 217	20.0	13 - 31
6	138.9	68 - 212	17.0	11 - 28
7	128.1	60 - 197	18.0	10 - 31
8	153.9	72 - 237	21.0	11 - 38
9	142.9	86 - 185	19.2	15 - 30
10	121.3	55 - 232	16.2	12 - 23
11	132.1	58 - 185	17.8	13 - 25
12	133.0	67 - 224	16.9	12 - 25
13	135.5	102- 174	17.1	10 - 24
14	150.3	110 - 248	21.3	15 - 29
15	149.1	82 - 237	18.6	11 - 28
16	144.8	53 - 231	20.3	10 - 29
17	135.6	70 - 200	20.2	11 - 34
18	156.9	113 - 259	18.2	12 - 24
19	137.4	72 - 240	15.9	10 - 27
20	117.1	55 - 204	16.1	11 - 31
21	141.6	60 - 210	18.3	12 - 30
22	137.6	84 - 186	20.4	13 - 30
23	154.4	94 - 225	20.4	12 - 32
24	148.1	80 - 246	19.9	10 - 30
25	154.3	97 - 183	18.2	14 - 25
26	160.2	109 - 236	25.1	15 - 34
27	141.7	56 - 222	17.1	10 - 23
28	147.5	116 - 196	18.6	12 - 23
General	143.1	53 - 259	18.9	10 - 38

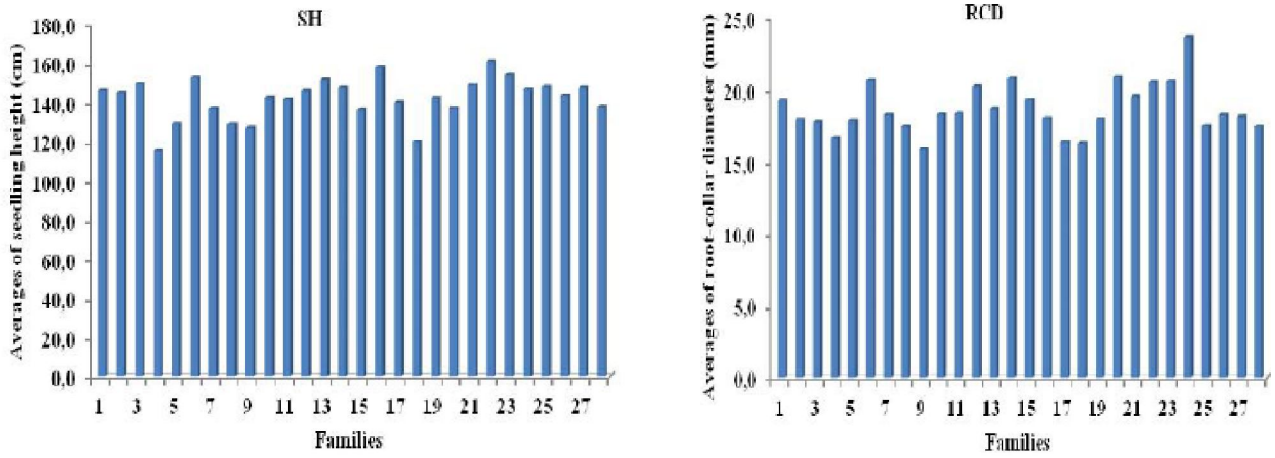

Figure 2 : Averages of seedling height and root-collar diameter in the families

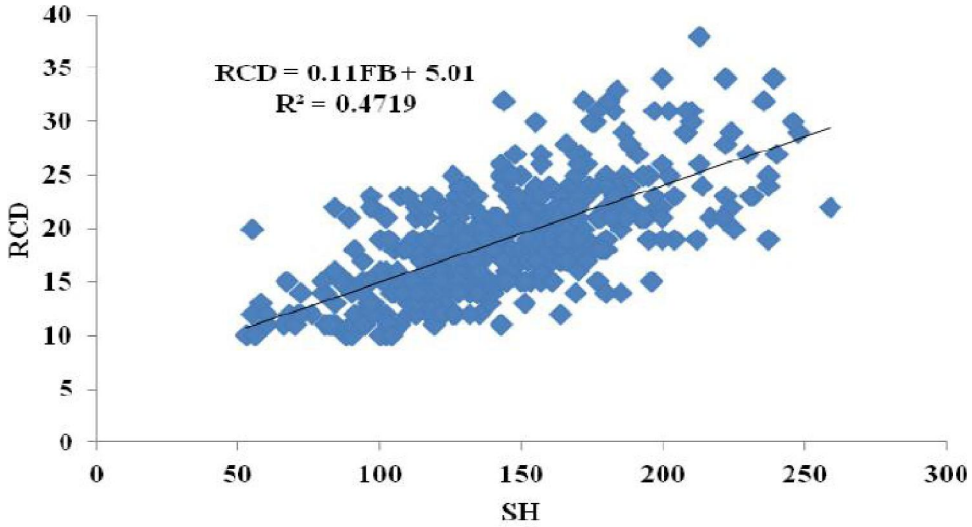

Figure 3 : Relation between seedling height (H) and root-collar diameter (RCD)

eter (10 mm – 38 mm) TABLE 1. These differences were well in accordance with the results of early studies in the species[7,11].

The phenotypic and genotypic correlations between seedling height and root collar diameter were positive and significant (*pd" 0.05*, R^2=0.687 and 0.720). The relation between seedling height and root-collar diameter was also showed in Figure 3. Similar correlations were also reported between characters in the species[7].

Heritability

The heritability in narrow-sense reflects the share of the variation that depends on the genotypes was very low for all the characters. It was 0.004 for the height and 0.065 for the diameter. Low heritability was also reported between characters in the species[7,12]. The environment seems to be more important for growth performance of genotypes than their genetic constitution in the species.

CONCLUSIONS

Manna ash is very resistance to extreme areas (i.e., aridity), and suitable for private forestry in the future. It is getting importance of present and future studies on the species. However, the studied genotypes were sampled in limited area of the species. New studies should be conducted by large genotypes and seed sources. Therefore, it was needed to collect more data on future years from the experiment to draw accurate conclusions. Results of the present study should be supported by molecular genetics.

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