

# Seed Characteristics in Orchard and Stand Populations of Anatolian Black Pine

Durmus Cetinkaya

Aladag Vocational School of Cukurova University, Adana-Turkey

## ABSTRACT

Seed size characteristics (length, width and weight) and germination percentage in a seed orchard and a seed stand populations of Anatolian black pine [*Pinus nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe] were studied to compare seed sources and to contribute seed improvement of the species. Length, width and weight of the combined populations were 2.35 mm, 6.34 mm and 0.021 g, respectively. Length and width of stand seed were higher than that of orchard seeds. However, it was opposite for seed weight (0.023 g and 0.019 g). Orchard seeds had higher germination percentage (73%) than stand seeds (35 %). Statistically significant differences ( $p < 0.05$ ) were found for seed size characteristics between populations based on results of analysis of variance. Positive and significant ( $p < 0.05$ ) relations ( $r = 0.21$ ) were found among seed size characteristics in both populations.

**Keywords:** Germination, Length, Size, Weight, Width

## I. INTRODUCTION

Improved seeds genetically have been produced from seed orchards, seed stands and seed plantation in Turkish Forestry. Turkey has 73 seed stands at 9376 ha, and 57 seed orchards at 476 ha to produce quality seeds in Anatolian black pine [*Pinus nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe] (www. Ortohum.gov.tr, 2017). The species is one of the most important forest tree species of “National Tree Breeding and Seed Production Programme” (Koski and Antola, 1993) and Turkish forestry because of its commercial wood production of Turkey by 4.7 million natural distributions of which 45% to be unproductive (Anonymous, 2015). It is also used widely in forest establishment in conversion of unproductive forest (9.6 million ha and 43% of Turkish forest area) to productive forest of Turkey. It is known that seed quality included has important role in conversion of unproductive forest to productive forest, and success

of forest establishment (Cetinkaya and Cercioğlu, 2017a), and to produce quality seedlings. It is known that there can be many artificial (i.e., nursery practice) and natural (i.e., seed source) factors can be effective in these quality (Yazici, 2010; Yazici and Bilir, 2017). However, there are limited studies on seed characteristics from different seed sources of the species (i.e., Cetinkaya and Cercioğlu, 2017ab). Seed characteristics of new populations were suggested for accurate conclusion in the early studies (Cetinkaya and Cercioğlu, 2017ab).

In the present study, it is aimed to compare seed size characteristics and germination percentage of seed orchard and seed stand seeds to contribute genetic and breeding populations in seed production of the species.

## II. METHODS AND MATERIAL

Mixed seed samples were collected from seed orchard (latitude 39° 35' 20" N, longitude 30°22'57" E, altitude

900 m) and seed stand (latitude 38° 41'48" N, longitude 30° 07'14"E, altitude 1510 m) populations of the species at end of 2017.

Seed size characteristics including length (SL, mm), width (SWi, mm) and weight (SWe, g), and germination percentage (GP %) of 21 days was measured on 100 seed samples selected random from each population by ISTA-rules (ISTA, 1999):

Populations were compared for the seed size characteristics germination characters by the following linear ANOVA model:

$$Y_{ij} = \mu + P_j + e_{ij}$$

Where  $Y_{ij}$  is the observation from the  $j^{th}$  size characteristic of the  $i^{th}$  population,  $\mu$  is overall mean,

**Table 1.** Average and ranges of for seed size characteristics for the population.

	Seed orchard			Seed stand			Total		
	SL(mm)	SWi(mm)	SWe(g)	SL(mm)	SWi(mm)	SWe(g)	SL(mm)	SWi(mm)	SWe(g)
<b>Average</b>	6.15	2.31	0.023	6.53	2.40	0.019	6.34	2.35	0.021
<b>Minimum</b>	4.32	1.61	0.015	4.85	1.67	0.012	4.32	1.61	0.012
<b>Maximum</b>	8.00	3.04	0.042	8.64	2.99	0.040	8.64	3.04	0.042

Length and width of stand seed were higher than that of orchard seeds. However, it was opposite for seed weight (0.023 g and 0.019 g) (Table 1). Cetinkaya and Cercioğlu (2017b) reported that seed width, seed length and seed weight were higher in seed orchard population than that of stand populations of Anatolian black pine. These results showed there could be many environmental and genetical factors on seed size such as year, population, genetic of seed collected tree.

Orchard seeds had higher germination percentage (73%) than stand seeds (35%) in the present study. Opposite result was reported in different seed sources of the species by Cetinkaya and Cercioğlu (2017b). Control seeds showed the highest germination performance, while it was the lowest in seeds of -6.0 bars in a study of the species (Cetinkaya and Cercioğlu, 2017a). Average of germination percentage was 61.55% varied between 49.50% and 85.37% in the seed production populations of Anatolian black pine (Cetinkaya and Cercioğlu, 2017b). The results showed

$P_j$  is the random effect of the  $i^{th}$  population, and  $e_{ij}$  is random error.

### III. RESULTS AND DISCUSSION

#### Seed size and germination

Length, width and weight of the seeds were 2.35 mm, 6.34 mm and 0.021 g, in combined populations respectively (Table 1). Averages of seed width and seed length were found 6.77 mm and 3.75 mm in ten seed stand and seed orchard population of the species, while they ranged from 6.50 mm to 7.38 mm for seed width, and ranged from 3.55 to 4.03 for seed length in the populations (Cetinkaya and Cercioğlu, 2017b).

that seed size characteristics and germination could change for population and year.

Length, width and weight of the seeds were 2.35 mm, 6.34 mm and 0.021 g, in combined populations respectively (Table 1). Averages of seed width and seed length were found 6.77 mm and 3.75 mm in ten seed stand and seed orchard population of the species, while they ranged from 6.50 mm to 7.38 mm for seed width, and ranged from 3.55 to 4.03 for seed length in the populations (Cetinkaya and Cercioğlu, 2017b).

Length and width of stand seed were higher than that of orchard seeds. However, it was opposite for seed weight (0.023 g and 0.019 g) (Table 1). Cetinkaya and Cercioğlu (2017b) reported that seed width, seed length and seed weight were higher in seed orchard population than that of stand populations of Anatolian black pine. These results showed there could be many

environmental and genetical factors on seed size such as year, population, genetic of seed collected tree.

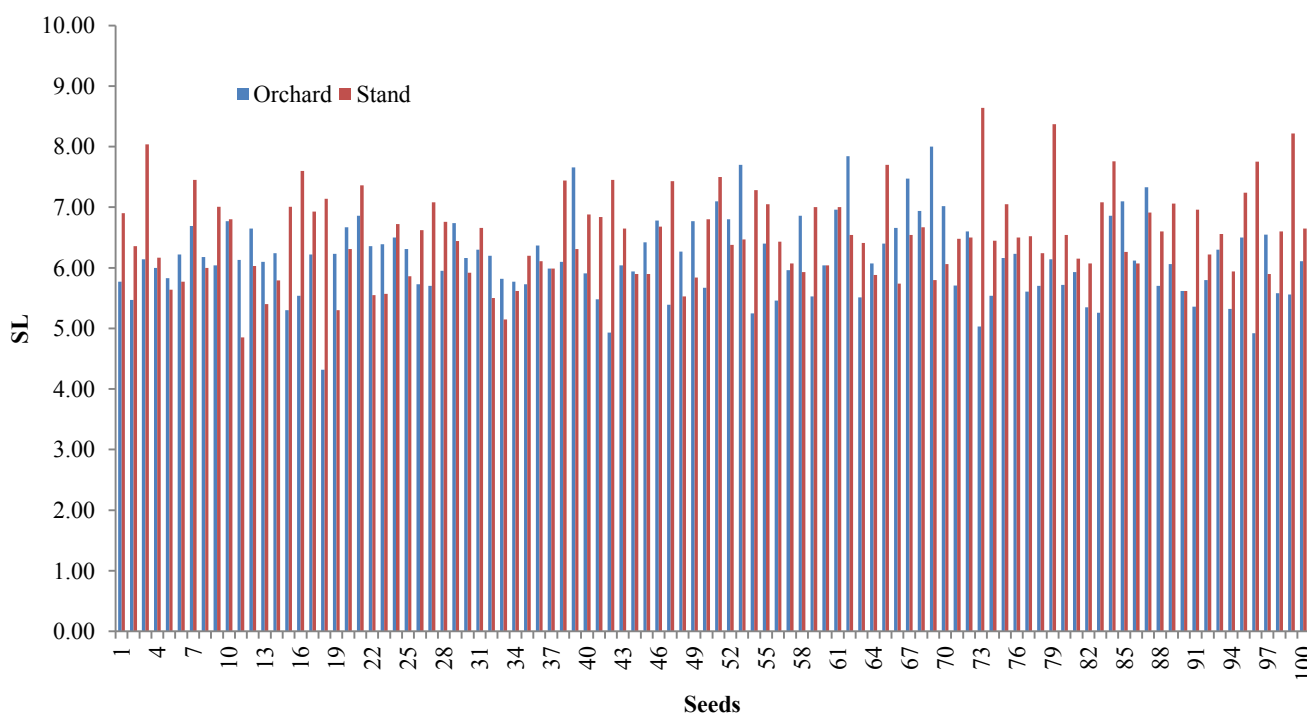
**Variation**

Large differences were found within population and between populations for seed sizes. For instance, seed length (SL) was between 4.32 mm and 8.00 mm in orchard seeds, while it was ranged from 4.32 mm and 8.64 mm in orchard seeds (Table 1, Figure 1). Statistically significant differences ( $0.05 > p$ ) were

found for seed size characteristics between populations based on results of analysis of variance (Table 2). Large differences among populations and within population were also reported for seed characteristics of ten populations of the species by Cetinkaya and Cercioglu (2017b). The results emphasized importance of individual selection in collection of seed crop.

**Table 2.** Results analysis of variance for the seed size characteristics.

Characteristics	Source of variation	Sum of squares	Degrees of freedom	Mean of squares	F value	P
SL	Between groups	7.285	1	7.285	15.373	.000
	Within group	93.824	198	.474		
	Total	101.109	199			
SWi	Between groups	.471	1	.471	8.184	.004
	Within group	11.405	198	.058		
	Total	11.877	199			
SWe	Between groups	.001	1	.001	13.179	.000
	Within group	.012	198	.000		
	Total	.013	199			



**Figure 1.** Variation for the seed length in the populations.

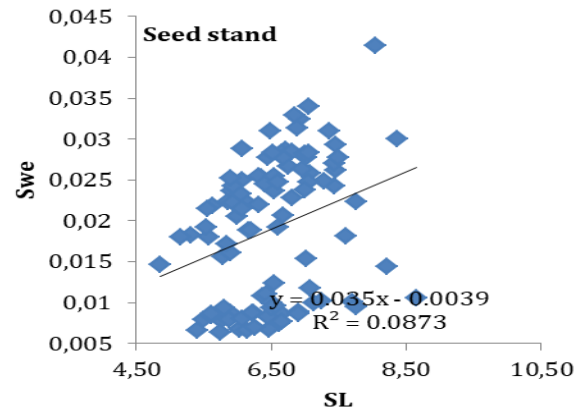
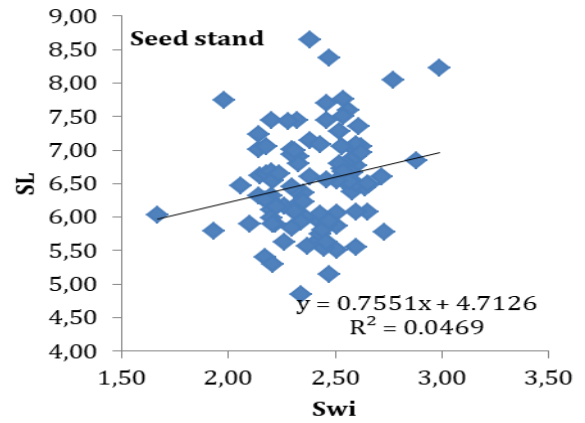
**Correlation**

Positive and significant ( $0.05 > p$ ) relations ( $r > 0.21$ ) were found among seed size characteristics in both populations (Table 3, Figure 2). Statistically significant and positive correlations were also reported among seed width, seed length and seed weight, while they had no significant ( $0.05 < p$ ) effect on germination percentage by Cetinkaya and Cercioglu (2017b). The results could be used future studies on the species.

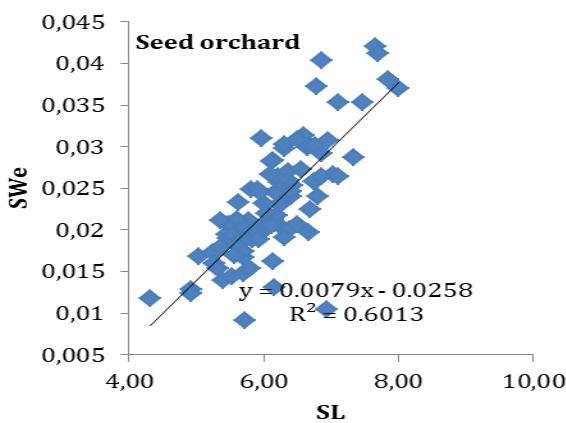
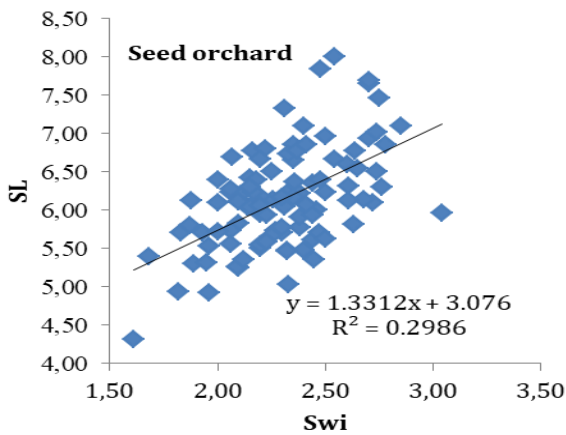
**Table 3.** Relations between cone production and growth characteristics.

$r^*$		SWi	SWe
Orchard	SL	.546	.775
Stand		.217	.295
Total		.422	.394
Orchard	SWi	-	.727
Stand		-	.297
Total		-	.424

\*; correlation is statistically significant ( $p < 0.05$ ).



**Figure 2.** Relationship between seed characteristics in populations.



**IV. REFERENCES**

1. Anonymous (2015), Forest inventory of Turkey. General Directorate of Forestry of Ankara, Turkey.
2. D Cetinkaya, M. Cercioglu (2017a), "Germination Characters under Water stress in Anatolian Black Pine Populations", International Journal for Research in Applied Science & Engineering Technology, 5, 100-104.
3. D Cetinkaya, M. Cercioglu (2017b), "Variation in Seed Characteristic among Anatolian Black Pine Populations", International Journal for Research in Applied Science & Engineering Technology, 5, 690-693.
4. ISTA (1999), International Rules for Seed Testing. Seed Science and Technology, 27, Supplement, Zurich, Switzerland.

5. N, Yazici, (2010), Determination of water consumption of some coniferous seedlings and its relation with meteorological parameters, Graduate School of Natural and Applied Science, Suleyman Demirel University, PhD. Thesis, Isparta, Turkey.
6. N, Yazici, N. Bilir N (2017), "Aspectual Fertility Variation and Its Effect on Gene Diversity of Seeds in Natural Stands of Taurus cedar (*Cedrus libani* A. Rich.)", *IJ. Genomics*, 12960624, 1-5.
7. V Koski, J. Antola (1993), National Tree Breeding and Seed Production Programme for Turkey 1994-2003. The Research Directorate of Forest Tree Seeds and Tree Breeding, 52 pp., Ankara
8. [www. Ortohum.gov.tr](http://www.ortohum.gov.tr) (2017), Website of The Research Directorate of Forest Tree Seeds and Tree Breeding, Ankara, Turkey.