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CHARACTERIZATION OF SOME TURKISH SESAME POPULATIONS AND CULTIVARS FOR AGRONOMICAL AND SOME QUALITY TRAITS

Cemal KURT, Halis ARIOGLU

Cukurova University, Faculty of Agriculture, Adana, Turkey

Corresponding author email: ckurt@cu.edu.tr

Abstract

Sesame (Sesamum indicum L., Pedaliaceae) is one of the oldest and important oil seed crops known by mankind. Sesame was grown during the ancient Harappan, Mesopotamian, and Anatolian areas for its edible seed and its oil but now it is grown in more than 60 countries. Landraces of sesame represent a valuable genetic resources for breeding and genetics studies. The aim of this study was to determine agronomical and quality traits of some sesame genotypes (17 landraces and 7 commercial cultivars). The field experiment was arranged in randomized complete block design with three replications at the research farm of Department of Field Crops, Faculty of Agriculture University of Cukurova in 2010 and 2011. The results of the study showed that the differences between the landraces and cultivars were statistically significant for lowest branch height, lowest capsules height, number of capsules, number of branch, 1000 seeds weight, seed yield, oil content and protein content. According to a two-year average, the highest seed yield was obtained from Adana-Saricam population (1952 kg/ha), while the lowest seed yield was obtained from Mugla-Ortaca population (615 kg/ha). The highest oil content was obtained from Kahramanmaras population (53.28%), while the lowest value was obtained from Adana-Yumurtalik3 population (49.3%).

Key words*: Turkish sesame, genetic diversity, morphology.*

INTRODUCTION

Sesame (*Sesamum indicum* L. - *Pedaliaceae*) is one of the oldest and important oil seed crops known to mankind. Sesame seeds are used on bread, cakes and especially simit in Turkey. The seed can also be made into a paste called tahini which is rich in protein and a very good energy source and confection called halvah. Sesame seed contains 50-60% oil and 25% protein with antioxidants lignans such as sesamolin, sesamin and has been used as active ingredients in antiseptics, bactericides, viricides, disinfectants, moth repellants, anti-tubercular agents (Bedigian et al., 1985) and considerable source of calcium, tryptophan, methionine and many minerals (Johnson et al., 1979). Sesame was grown during the ancient Harappan, Mesopotamian and Anatolian areas for its edible seed and its oil (Bedigian et al. 1985; Bedigian 2004) but now it is grown in more than 60 countries. There are great number sesame landraces which are adapted to various ecological conditions throughout the Turkey (Demir, 1962).

Despite sesame has been grown in various ecological regions of Turkey during hundreds years, sesame yield and production is very low. The low production is due to a number of reasons such as low inputs and poor management occurrence of biotic and abiotic stresses and more importantly, a lack of improved varieties for use by the farmers in Turkey (Baydar, 2005). This situation can be changed by selecting varieties of good quality and high adaptive potential to the different climatic conditions (Nyongesa et al., 2013). Sesame landraces are an important source of genetic diversity for breeders. Information on genetic diversity and relationship among landraces is important for plant breeders to select the adequate genetic material to be used (Ganesh and Thangavelu, 1995). Genetic diversity in crop species can be determined using morphological (phenotypic), biochemical, and molecular (DNA) markers. Studies on sesame genetic diversity and divergence have been mainly based on agro-morphological traits.

The purpose of this study was to evaluate morphology of sesame varieties from different region of Turkey regarding morphological and some quality characters such as oil and protein content, and 1000 seeds weight.

MATERIALS AND METHODS

The study was carried out using 17 sesame landraces population which were collected from different region in Turkey and 7 commercials in Adana region in 2010 and 2011 to compare and determine the plant height, capsule number per plant, first capsule height, branch number per plant, 1000-seeds weight, protein content, oil content and seed yield of cultivated sesame genotypes (Table 1).

Table 1. The list of some Turkish sesame population and cultivars

Genotype Name	Genotype Name
Kahramanmaras	Adana-Saricam
Antalya-Kumluca	Adana-Yumurtalik1
Aydın-Cine	Adana
Adana-Kozan	Adana-Yumurtalik3
Balikesir-Koseler	Adana-Yumurtalik7
Diyarbakir-Silvan	Baydar-2001 ©
Osmaniye	Muganli-57©
Manisa-Salihli	Kepsut-99©
Mugla-Ortaca	Osmanlı-99©
Şanlıurfa-Bozova-Cukurkoy 2	Orhangazi-99©
Diyarbakir-Bismil-Bakacak2	Tan-99©
Manisa-Alasehir-Ulubentdere	Cumhuriyet-99©

©: Cultivar

The experiment was conducted at Adana province of Turkey (35°18′ E latitude, 37°01′ N longitude, and 23 m above sea level) in 2010 and 2011. The accessions were grown in four row plots of 5 m row length with a row spacing of 70 cm and intra-row spacing of 15 cm. Thinning was carried out after 25 days of sowing to secure one plant at 15 cm. Sprinkler irrigation was established immediately after sowing and thereafter used when necessary based on soil and plant conditions. Nitrogen, phosphorus and potassium were applied at a rate of 60 kg per hectare at sowing as a complete fertilizer. Weeding were carried out by hand weeding and no herbicides were applied during the growing seasons. All the plants were harvested in the last week of September, 2010 and 2011.

The data obtained were statistically analyzed by the computing MSTAT-C package program in accord with the Randomized Complete Block Design. The means of the treatment were compared by using the LSD as described by Steel and Torrie (1997).

RESULTS AND DISCUSSIONS

Plant Height, First Capsule Height and Number of Capsule

The results about the plant height, first capsule height and number of capsules were shown in Table 2.

There was a no statistically significant difference in plant height between sesame genotypes in a two-year average. The genotypes showed variation in plant height between 156-177.2 cm in a two-year average. The half of the genotypes shorter than average plant height value.

It can be seen in Table 2, the significant differences were observed for first capsule between sesame populations and cultivars. The highest first capsule height was recorded for Mugla-Ortaca population (62.25 cm) while the lowest first capsule height was recorded for Antalya-Kumluca (45.97 cm) (Table 2). Similar results were reported by Curat (2010) and Ulukutuk (2011).

The average performance of the accessions over the two years shown in Table 2 indicated significant differences among the accessions in number of capsule. The result shows that the highest number of capsule was obtained from Adana population (169.4 capsule/plant), while the lowest value was obtained from Adana-Yumurtalik7 population (119.3 capsule/plant). The average number of capsule was 142.4 capsule/plant and of ten genotypes higher average.

Number of branch, 1000-seeds weight, oil and protein content

All accessions and cultivars were branching with an average of 4.4 primary branches per plant. The highest branches number was obtained from Orhangazi-99 Turkish sesame cultivar (5.4 branch/per plant), while the lowest value was obtained from Aydin-Cine population (3.4 branch/per plant). Indeed, number of branches showed a positive correlation ($r = 0.392^{**}$) to number of capsules, but no significant correlation to seed yield.

The average for 1000-seeds weight, oil content and protein content, among the genotypes were 3.42, 51.46 and 21.68, respectively (Table 3).

Table 2. Plant height, first capsule height and number of capsule of some Turkish sesame populations and cultivars

Genotypes	Plant Height (cm)	First Capsule Height (cm)	Number of Capsule (no. plant^{-1})
Kahramanmaras	167.3	51.08 abcd	161.8 abc
Antalya-Kumluca	157.6	45.97 d	140.8 abcdef
Aydin-Cine	157.7	51.33 abcd	121.3 ef
Adana-Kozan	165.6	53.78 abcd	127.1 def
Balikesir-Koseler	164.9	55.85 abcd	129.9 def
Diyarbakir-Silvan	161.1	58.18 abcd	140.0 abcdef
Osmaniye	166.9	55.60 abcd	137.1 bcdef
Manisa-Salihli	167.3	48.53 cd	138.4 abcdef
Mugla-Ortaca	178.4	62.25 a	121.9 def
Sanliurfa-Bozova-Cukurkoy 2	158.1	53.58 abcd	161.7 abc
Diyarbakir-Bismil-Bakacak2	176.2	57.57 abcd	149.1 abcdef
Manisa-Alasehir-Ulubentdere	170.5	58.37 abcd	138.4 abcdef
Adana-Saricam	173.0	53.88 abcd	132.5 bcdef
Adana-Yumurtalik1	158.2	49.88 abcd	151.4 abcde
Adana	161.8	51.33 abcd	169.4 a
Adana-Yumurtalik3	172.1	62.08 ab	130.4 cdef
Adana-Yumurtalik7	161.5	48.72 bcd	119.3 f
Baydar-2001	166.6	47.18 d	147.7 abcdef
Muganli-57	175.7	54.22 abcd	153.6 abcd
Kepsut-99	176.5	59.42 abcd	148.9 abcdef
Osmanli-99	171.6	50.62 abcd	127.1 def
Orhangazi-99	156.0	61.45 abc	145.0 abcdef
Tan-99	167.5	58.08 abcd	136.7 bcdef
Cumhuriyet-99	177.2	62.15 ab	163.9 ab
Average	**167.1**	**54.6**	**142.4**
LSD (% 5)	**N.S.**	**10.92**	**26.04**

Table 3. Number of branch, 1000-seed weight, oil content and protein content of some Turkish sesame populations and cultivars

Genotypes	Number of Branch	1000 Seeds Weight	Oil Content	Protein Content
Kahramanmaras	5.2 ab	3.273 hıj	53.28 a	21.75 cdefg
Antalya-Kumluca	4.1 efghı	3.513 defg	50.90 cdefgh	21.10 fghıj
Aydin-Cine	3.4 ı	3.522 cdefg	50.68 cdefgh	21.55 defghı
Adana-Kozan	5.2 abcd	3.632 abcd	50.60 cdefgh	21.17 fghıj
Balikesir-Koseler	4.7 abcdefg	3.355 ghı	52.20 abcde	21.27 fghıj
Diyarbakir-Silvan	4.7 abcdefgh	3.145 j	52.12 abcde	22.45 bc
Osmaniye	4.9 abcde	3.418 efgh	49.77 fgh	22.05 cde
Manisa-Salihli	4.2 defghı	3.738 a	51.73 abcdef	21.75 cdefg
Mugla-Ortaca	4.8 abcdef	3.312 hıj	50.90 cdefgh	23.13 a
Sanliurfa-Bozova-Cukurkoy 2	4.9 abcde	3.700 ab	51.77 abcdef	21.77 cdef
Diyarbakir-Bismil-Bakacak2	4.2 cdefghı	3.415 efgh	52.15 abcde	21.02 hıj
Manisa-Alasehir-Ulubentdere	4.5 abcdefgh	3.250 hıj	51.43 abcdefg	20.70 j
Adana-Saricam	4.0 efghı	3.680 abc	51.82 abcdef	21.55 defghı
Adana-Yumurtalik1	4.5 abcdefgh	3.478 defg	50.42 defgh	22.23 cd
Adana	4.0 efghı	3.420 efgh	50.13 efgh	20.92 ıj
Adana-Yumurtalik3	3.7 hı	3.172 j	49.10 h	21.75 cdefg
Adana-Yumurtalik7	3.9 fghı	3.505 defg	53.18 ab	21.75 defg
Baydar-2001	4.2 defghı	3.297 hıj	52.40 abcde	21.45 efghı
Muganli-57	4.0 efghı	3.225 ıj	51.88 abcdef	21.67 defgh
Kepsut-99	3.7 ghı	3.547 bcdef	51.82 abcdef	22.17 cde
Osmanli-99	3.8 ghı	3.270 hıj	52.23 abcde	20.88 ıj
Orhangazi-99	5.4 a	3.377 fghı	52.55 abcd	22.17 cde
Tan-99	4.3 bcdefghı	3.565 bcde	52.78 abc	21.03 ghıj
Cumhuriyet-99	5.1 abc	3.218 ıj	49.30 gh	23.02 ab
Average	**4.4**	**3.42**	**51.46**	**21.68**
LSD (% 5)	**0.8173**	**0.1450**	**1.809**	**0.6057**

The range for 1000-seeds weight was 3.145 g (Diyarbakir-Silvan population) and 3.738 g (Manisa-Salihli population), oil content varied from 49.1% (Adana-Yumurtalik 3 population) and 53.28% (Kahramanmaras population), and protein content was 20.7% (Manisa-Alasehir-Ulubentdere population) and 23.13% (Mugla-Ortaca) in a two-year average. These traits showed genetic variation and accessions with such a large level of genetic diversity often used for the determination of best genotypes for diverse ecological conditions. Earlier reports by other researchers also indicated significant variation among sesame genotypes in 1000-seed weight, oil and protein content (Solanki et al., 2001; Adebisi et al., 2005; Baydar, 2005; Parameshwarappa and Salimath, 2009; Furat and Uzun, 2010; Pham et al., 2010; Yol and Uzun, 2012).

Seed yield

There was a great deal of seed yield variation observed among all the sesame germplasm.

The differences between the genotypes were statistically significant for the seed yield in both years and in a two-year average.

The seed yield values varied between 538.3-1990 kg/ha in 2010, 692.7-1959 kg/ha in 2011 and 615.5-1952 kg/ha in a two-year average. This variation can be contributed to the cultivation conditions and strongly supported the idea that local sesame germplasm still commonly sustained by the farmers due to the absence of improved breeding cultivars for diverse environmental conditions (Furat and Uzun, 2010).

Table 4. Seed yield (kg/ha) of some Turkish sesame populations and cultivars in 2010, 2011 and in a two-year average

Genotypes	2010	2011	Average
Kahramanmaras	1793 abc	1786 abcd	1789 ab
Antalya-Kumluca	1663 abc	1464 bcdef	1564 bcd
Aydin-Cine	1291 c	1314 ef	1302 d
Adana-Kozan	1361 bc	1245 f	1303 d
Balikesir-Koseler	1346 bc	1614 abcdef	1480 bcd
Diyarbakir-Silvan	1314 c	1300 ef	1307 d
Osmaniye	1392 abc	1255 f	1323 d
Manisa-Salihli	1490 abc	1686 abcdef	1588 abcd
Mugla-Ortaca	538.3 d	692.7 g	615.5 e
Sanliurfa-Bozova-Cukurkoy 2	1842 abc	1759 abcde	1801 ab
Diyarbakir-Bismil-Bakacak2	1581 abc	1700 abcdef	1641 abcd
Manisa-Alasehir-Ulubentdere	1554 abc	1441 bcdef	1497 bcd
Adana-Saricam	1945 ab	1959 a	1952 a
Adana-Yumurtalik1	1695 abc	1410 cdef	1552 bcd
Adana	1876 abc	1612 abcdef	1744 abc
Adana-Yumurtalik3	1428 abc	1348 cdef	1388 cd
Adana-Yumurtalik7	1372 bc	1326 def	1349 d
Baydar-2001	1572 abc	1426 bcdef	1499 bcd
Muganli-57	1990 a	1607 abcdef	1799 ab
Kepsut-99	1541 abc	1788 abc	1664 abcd
Osmanli-99	1622 abc	1617 abcdef	1620 abcd
Orhangazi-99	1498 abc	1505 abcdef	1501 bcd
Tan-99	1493 abc	1645 abcdef	1569 bcd
Cumhuriyet-99	1815 abc	1881 ab	1848 ab
Average	**1542**	**155.2**	**1529**
LSD (% 5)	**50.30**	**38.16**	**31.15**

CONCLUSIONS

Our results indicated that there is significant variability among the genotypes in the yield and yield component parameters measured. It also revealed that some genotypes are showed better yield performance under Mediterranean condition. Adana-Saricam (1952 kg/ha) and Sanliurfa-Bozova-Cukurkoy 2 (1801 kg/ha) populations with Cumhuriyet-99 (1848 kg/ha) and Muganli-57 (1799 kg/ha) which showed outstanding performances in seed yield in both years are therefore recommended for cultivation in the Adana.

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