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Pomological Traits of Apricots (*Prunus armeniaca* L.) Selected from Bitlis Seedling Population

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Abstract

The native apricot (*Prunus armeniaca* L.) germplasm of Bitlis province and its districts situated in the East Anatolia of Turkey was examined during 2000 and 2001. From the native genotypes twenty-eight genotypes were selected for breeding efforts, and their fruit and flowering traits were recorded with compared to those of standard cultivars 'Hacihaliloglu', 'Kabaasi' and 'Hasanbey'. Selected genotypes had fruit weight between 29.1 g and 60.3 g, soluble solids between 8.2% and 21.6% and acidity between 0.54 % and 1.77 %. Three standard cultivars had fruit weight between 30.7 g and 43.1 g, soluble solids between 20.2% and 22.4% and acidity between 0.21 % and 0.62 %. The fruit weight was over 45 g in five selections (BTL-20, BTL-45, BTL-49, BTL-50 and BTL-51) that had higher fruit weight than standard cultivars. The content of soluble solids was higher than 20% in two selections (BTL-49 and BTL-51). Standard cultivars usually had higher soluble solids and lower acidity than selected genotypes. The majority of genotypes had acidity lower than 1%. The fruit size ranged from small (fruit weight between 29.1-37.6 g) to medium (fruit weight between 45.1-60.3 g). The first bloom in late April and full bloom in early May occurred. In March of both years, extreme temperature fluctuations caused damage to flower buds and subsequent yield reductions. The harvest season usually was mid-August. The results indicated valuable native apricot germplasm of the district.

Introduction

Turkey is one of the centers of origin of apricot in the Near East of Central Asia (7). Seed propagation for centuries has lead to rich genetic resources of apricot. Local apricots in Turkey have been included in the Irano-Caucasian group (21). Mehlenbacher et al. (21) reported that inadequate information is available on apricot genetic variability and the information on Irano-Caucasion apricots. Developing well adapted cultivars to local conditions is high priority of apricot breeding programs (7, 21). It has been pointed out that Turkey is rich in native apricot genetic resources (17).

In the areas where late spring freeze injury occurs like Turkey, apricot production fluctuates considerably from year to year. Turkey is the leader country in the world's dried apricot trade, and meets 20 % of the world production. Annual production

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reached 538,000 (1998) tons (3). The major cultivar for dried apricots is 'Haci haliloglu'. This accounts for 73% of the current apricot (4). The cultivar 'Kabaasi' has later blooming than 'Hacihaliloglu' with good fruit traits and is being widely planted. In addition to these two cultivars, the cultivars 'Hasanbey', 'Soganci', 'Alyanak', 'Tokaloglu', 'Salak', 'Sekerpare' are also widely cultivated. The current production from native apricot trees accounts for approximately 45% of all apricot production.

Audergon (5) indicated that most apricot varieties cultivated today have resulted from random selections. The main apricot breeding efforts include objectives such as high quality fruit traits for dried and table production, late blooming habit, expansion of production areas and extension of ripening season, well adapted cultivars and selections to local conditions (5,7,11,18,21).

Material and Method

The research was performed on native seedling population of apricot (*Prunus armeniaca* L.) in Bitlis and its districts situated in the East Anatolia Region of Turkey during 2000 and 2001. The native population consisted of over 3000 seedling trees was studied with respect to fruit characteristics and blooming dates for two years. Pomological and phenological traits of selected genotypes were identified with compared to the standard cultivars 'Hacihaliloglu', 'Kabaasi' and 'Hasanbey'.

At each harvest season, trees that produce very small-sized fruits were discarded. Fruit samples were collected from trees bearing medium-sized and large fruits. Analyses of pomological traits were done using fifteen fruits randomly chosen from each selection (3,12). Because each selection is represented by a single genotype, replicates were years.

Based on fruit traits, the twenty-eight genotypes were identified for future breeding efforts. Fruit traits such as fruit dimensions (mm), fruit weight (g), soluble solid content (%), titratable acidity (%), pH, stone weight (g), seed weight (g), seed separation, skin color, flesh color, fruit taste, seed taste and flesh firmness were described. In addition, their blooming times were also determined (18).

Results and Discussion

In selected genotypes, bud break time varied from 3 April to 9 April, and first bloom occurred between 23 April and 29 April and full bloom between 2 May and 6 May. The range of harvest time was 12-18 August. The time of bud break, first bloom, full bloom and harvest of some genotypes was closer to those of standard cultivars (Table 1).

As regards fruit dimensions, selected genotypes had a range of 33.3-46.2 mm for fruit width, 35.8-59.9 mm for fruit length and 30.1-42.2 mm for fruit height. Genotypes usually produced small to medium-sized fruits. The fruit weight ranged from 29.1 g to 60.3 g (BTL-49). BTL-49 was followed by BTL-20 (59.8 g), BTL-50 (47.2 g), BTL-45 (45.2 g) and BTL-51 (45.1 g). The fruit weight was over 45 g in five selections (BTL-20, BTL-45, BTL-49, BTL-50 and BTL-51) that had higher fruit weight than standard cultivars. In addition, the fruit weight was higher than 35 g in ten genotypes (Table 2).

In addition, stone width was between 14.9 mm (BTL-19) and 23.6 mm (BTL-51). The stone length ranged from 20.7 mm (BTL-19) to 29.6 mm (BTL-41). The stone weight varied between 1.31 (BTL-9) and 3.42 (BTL-49) and the kernel weight between 0.53 (BTL-20) and 1.19 (BTL-41) (Table 2).

BTL-51 had the highest soluble solid content (21.6%), this was followed by BTL-49 (21.3%), BTL-50 (18.9%) and BTL-41 (18.8%). Except for these four selections, other selections contained soluble solids between 8.2% (BTL-7) and 16.5% (BTL-33 and BTL-53). Standard cultivars usually had higher soluble solids than selected genotypes (Table 2).

The lowest acidity was determined in BTL-7 (0.54%), this was followed by BTL-28 (0.58%), BTL-49 and BTL-50 (0.65%) and BTL-51 (0.68%). The major-

ity of genotypes had acidity lower than 1%. Standard cultivars usually had lower acidity than selected genotypes. Mehlenbacher et al. (21) mentioned that the Irano-Caucasian apricot cultivars contain lower acidity than European and Japanese cultivars. In addition, the range of pH was from 3.66 to 5.97 (Table 2).

The seed separation was free in the majority of genotypes and in three standard cultivars. Skin colors were yellow, light orange, dark orange and light yellow with red blush. Genotypés had orange, light orange or yellow colored fruit flesh. The fruit firmness sensorially was middle or good. Most genotypes had sweet fruit. Kernel flavor was bitter and sweet (Table 2).

On the other hand, attractive, well-colored and medium-sized fruits are desired for apricot cultivar breeding (7, 21). Some genotypes of this study had attractive, good-colored and medium-sized fruits. Layne (20) described 'Harval' apricot that has firm-fleshed and attractive colored fruits with 42.2 g fruit weight and 17.8 % soluble solids content. Also, Goffreda et al. (15) identified significant characteristics of 'NJA54' apricot that has attractive bright red blush and high quality fruits with 42 g fruit weight and 18 % soluble solids content.

Native apricot populations of various parts of Turkey have been examined (1, 2, 6, 8, 9, 10, 12, 13, 14, 18, 19, 22, 23, 24), and many local cultivars with desirable fruit characteristics have been released (4). Some selected genotypes from the current study had similar fruit traits to those of earlier reports. Akça (1), Ayanoglu and Kaska (6), Balta and Celik (9), Balta et. al. (10), Bolat and Güleryuz (12), Bostan et. al. (13) Cangi and Tekintas (14), Gülcan et al. (16), Güleryuz (18), Karadeniz and Islam (19), Önal (22), and Sen et. al. (24) reported promising native apricot genotypes that have small to medium-sized fruits, soluble solids over 20% and fruits with lower acidity. Güleryuz (18) reported native genotypes that are not influenced by late spring frosts from Erzincan plain.

Temperature fluctuations in late winter and early spring have been reported to lead to flower bud damages and yield reductions in apricots (4, 7, 17, 21). In 2000 and 2001, minimum temperatures during the flowering period (April and May) did not cause damage to blossoms or reduce furit set. The lowest daily minimum temperature was -2°C in April 2000 (11 April), and -1°C in April 2001 (14 April). Temperatures below 0°C were recorded for five days in April 2000, but only for one day in

Table 1. Bud break, first bloom, full bloom and harvest times of selected genotypes and three standard cultivars.

Bitlis Genotypes and Cultivars	Bud Break (April)	First Bloom (April)	Full Bloom (May)	Harvest (August)
BTL-4	6	27	4	17
BTL-5	5	23	2	15
BTL-7	7	24	6	16
BTL-8	6	23	3	17
BTL-9	9	26	5	14
BTL-18	8	27	5	17
BTL-19	3	23	3	16
BTL-20	9	29	4	16
BTL-21	7	23	4	17
BTL-22	8	26	5	14
BTL-23	6	25	3	17
BTL-25	3	24	5	17
BTL-27	4	23	3	17
BTL-28	3	26	4	12
BTL-31	7	26	6	13
BTL-32	8	27	4	12
BTL-33	6	24	6	18
BTL-38	7	26	5	13
BTL-41	3	26	4	15
BTL-43	8	26	4	16
BTL-44	9	27	6	14
BTL-45	9	29	5	14
BTL-49	4	27	4	14
BTL-50	3	24	6	13
BTL-51	9	26	4	14
BTL-52	7	25	5	15
BTL-53	6	26	2	14
BTL-54	8	27	3	16
Hacihaliloglu	8	27	4	15
Kabassi	10	29	6	18
Hasanbey	7	26	5	12

Table 2. Fruit traits of three apricot cultivars and apricot genotypes selected from Bitlis seedling population (2000-2001).

Bitlis Genortypes & cultivars	Fruit width (cm)	Fruit length (cm)	Fruit height (cm)	Fruit weight (g)	Stone width (mm)	Stone length (mm)	Stone weight (g)	Kernel weight (g)	Soluble solids (%)	Acidity (%)	pH	Seed separation	Skin color	Flesh color	Fruit firmness	Fruit taste	Kernel flavor
BTL-4	39.9	42.0	36.8	35.0	16.2	24.3	2.10	0.70	8.8	1.05	3.67	F[Z]	Y[Y]	Y	G[X]	LS[W]	B[V]
BTL-5	38.7	39.5	35.4	30.1	15.6	23.2	1.92	0.63	11.0	1.77	3.66	F	Y	Y	M	S	B
BTL-7	34.8	35.8	34.0	29.4	16.0	21.5	1.87	0.63	8.2	0.54	4.30	F	Y	Y	M	LS	S
BTL-8	37.5	39.8	33.4	29.1	18.1	25.4	3.19	0.68	11.0	1.11	4.36	SJ	Y	Y	G	S	B
BTL-9	35.5	38.1	33.9	29.8	17.9	24.7	1.31	0.58	9.8	0.92	4.00	F	Y	LO	G	LS	B
BTL-18	37.3	37.3	35.3	32.8	16.8	21.5	2.15	0.64	11.0	0.79	4.14	F	Y	Y	G	S	S
BTL-19	37.5	36.7	36.1	31.8	14.9	20.7	2.06	0.67	9.0	0.71	4.05	F	Y	Y	G	LS	S
BTL-20	46.2	59.9	42.2	59.8	18.4	25.0	2.21	0.53	15.0	0.84	4.80	F	Y	O	G	S	S
BTL-21	38.5	38.0	36.3	35.4	17.3	25.8	2.04	0.79	14.0	1.40	4.05	SJ	Y	O	M	S	B
BTL-22	40.3	40.1	35.1	36.9	18.3	25.3	2.58	0.89	15.5	1.16	4.28	SJ	LYB	Y	M	LS	S
BTL-23	37.7	42.4	33.7	33.2	16.9	27.3	2.05	0.72	15.2	0.93	5.16	F	DO	O	G	S	S
BTL-25	36.3	37.6	33.1	30.6	17.4	22.3	2.00	0.82	14.6	0.76	5.90	F	LYB	O	G	S	S
BTL-27	39.5	38.9	34.5	32.4	20.2	23.9	2.49	0.70	13.0	1.06	4.90	F	Y	O	M	S	S
BTL-28	33.5	37.0	27.2	30.0	20.1	25.5	2.58	0.78	14.9	0.58	4.91	F	Y	LO	B	S	S
BTL-31	37.7	36.2	35.1	28.0	16.5	21.1	1.99	0.85	15.2	1.02	6.01	F	LYB	Y	M	LS	B
BTL-32	37.7	43.0	34.5	35.5	17.1	27.6	2.03	0.75	14.7	1.42	5.97	F	Y	Y	B	S	B
BTL-33	38.7	38.5	37.2	31.6	18.1	24.1	2.80	1.10	16.5	1.01	4.97	F	Y	O	B	S	B
BTL-38	40.2	41.6	37.6	31.6	17.7	25.1	2.64	0.96	16.0	0.99	5.08	F	LYB	Y	M	S	S
BTL-41	40.4	44.8	37.8	37.6	18.2	29.6	2.92	1.19	18.8	1.20	4.90	F	Y	Y	M	S	S
BTL-43	41.8	45.2	34.1	32.7	20.6	28.0	2.90	1.17	15.2	0.97	4.50	F	LO	O	M	S	B
BTL-44	36.6	39.6	36.3	29.1	16.6	22.9	2.09	0.88	15.4	0.95	5.10	F	Y	O	M	S	B
BTL-45	42.7	47.2	41.6	45.2	20.4	24.2	2.49	0.71	11.9	0.85	4.78	F	LYB	O	B	S	S
BTL-49	45.2	56.0	40.2	60.3	23.1	28.1	3.42	0.90	21.3	0.65	4.90	F	LO	O	G	S	S
BTL-50	42.4	42.0	38.4	47.2	22.1	27.1	2.70	0.88	18.9	0.65	4.80	F	Y	Y	G	S	S
BTL-51	42.1	48.2	37.2	45.1	23.6	26.4	2.78	0.78	21.6	0.68	5.90	F	LO	O	G	S	B
BTL-52	33.3	46.1	34.4	32.7	23.1	28.1	2.18	0.80	16.2	0.82	5.10	F	Y	LO	G	S	S
BTL-53	42.4	44.3	31.1	29.2	22.0	27.2	2.61	0.77	16.5	0.88	4.40	F	Y	LO	G	S	S
BTL-54	40.1	41.3	30.1	29.1	21.1	24.2	2.84	0.69	16.1	0.79	5.20	SJ	Y	LO	G	S	S
Hacihaliloglu	36.3	41.1	35.5	30.7	17.8	23.2	2.25	0.54	22.4	0.29	4.92	F	O	Y	G	S	S
Kabaasi	42.5	44.8	39.8	42.6	19.5	25.6	2.32	0.59	21.6	0.62	4.86	F	O	Y	G	S	S
Hasanbey	40.6	45.2	37.2	43.1	20.1	25.9	2.43	0.63	20.2	0.21	5.14	F	O	Y	G	S	S

[Z]Seed separation: F: Free, SJ: Semi-jointed

[Y]Color: Y: Yellow, LYB: Light yellow with red blush, DO: Dark orange, LO: Light orange, O: Orange

[X]Fruit firmness: G: Good, M: Middle, B: Bad

[W]Fruit taste: LS: Less sweet, S: Sweet

[V]Kernel flavor: B: Bitter, S: Sweet

April 2001. In both years, temperatures in May did not fall below 0°C. In March 2000, minimum temperature ranged from 0°C (22 March) to -17°C (15 March) with 29 days where temperatures were below 0°C. Minimum temperature in March 2001 varied from -3.6°C (11 March) to 9°C (29 March) with 14 days lower that 0°C. In both 2000 and 2001, some flower buds were adversely affected by temperature fluctuations in March rather than by late spring freezes. The response of genotypes to temperature fluctuations in the spring will need further evaluations. For Erzincan Province, Güleryuz (6) reported apricot of native genotypes that are resistant to spring freezes.

Local cultivar breeding of apricot and expansion of production areas are important (7, 16, 21). Many genotypes from this study might have valuable fruit traits that require further evaluation in replicated studies.

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