



Promising apricot genetic resources from the Lake Van Region

F. Balta^{1,*}, T. Kaya¹, T. Yarılgaç¹, A. Kazankaya¹, M.F. Balta¹ and M.A. Koyuncu²

¹Faculty of Agriculture, Department of Horticulture, Yüzüncü Yıl University, 65080 Van, Turkey; ²Faculty of Agriculture, Department of Horticulture, Süleyman Demirel University, Isparta, Turkey; *Author for correspondence

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Abstract

This study was conducted in order to select valuable genetic resources (*Prunus armeniaca* L.) of apricot in Gevaş situated on Lake Van Region (East Anatolia) of Turkey during 1998 and 1999. All population consisted of native apricot genotypes were examined with respect to fruit and tree characteristics for two years, and twenty-eight genotypes were selected for future breeding efforts. Their flowering habit and desirable fruit characteristics were determined in comparison with 'Hacıhaliloğlu'. All selected apricots grown at 1700 m in the region were not affected by late spring frosts. In the majority of genotypes, bud break, first flowering, full flowering and end of flowering occurred a few days earlier than the cultivar 'Hacıhaliloğlu' in both years, whereas, harvest was later than that. Some selections produced larger fruits than 'Hacıhaliloğlu'. All genotypes showed a range of 25–48 g for fruit weight, 11–21% for soluble solids and 0.19–2.90% for acidity. Soluble solids content was more than 20% in three selections (G12, G29 and G33), and the acidity was lower than 1% in five genotypes (G2, G12, G27, G29 and G33). Selections with attractive fruit colors had small to medium-sized fruits. Many genotypes were evaluated as promising for further breeding efforts.

Abbreviations: B – Bitter, DO – Dark orange, F – Free, G – Good, HH – The cultivar 'Hacıhaliloğlu', LO – Light orange, LY – Light yellow, LYB – Light yellow with red blush, M – Middle, O – Orange, OB – Orange with red blush, S – Sweet, SJ – Semi-jointed, VG – Very Good, Y – Yellow, YB – Yellow with red blush

Introduction

With rich genetic resources of apricot, Turkey is among native spreading areas of apricot in the Near East of Central Asia (Bailey and Hough 1975). Turkey's local apricot selections are included in the Irano-Caucasian group (Mehlenbacher et al. 1990). Cultivated for centuries, apricot is an important crop for Turkey, the leading exporter country of dried apricot around the world. According to 1998's records, Turkey meets 20 % of world apricot production of 2 670 000 tons. Turkey's apricot production annually varies from 281 000 tons (1995) to 538 000 (1998) tons and fluctuates by years (Anonymous, 1998). Annual production is highly affected by late spring frosts. Except for the Black Sea Region, ap-

ricots are grown almost in all parts. The commercial growing for dried production is mainly concentrated on Malatya Province of the East Anatolia Region. In this province, the leader of Turkey's apricot production, approximate 90 percent of the crop is dried for export. Despite many well adapted apricot cultivars (Yalçinkaya et al. 1995), the main cultivar is 'Hacıhaliloğlu' which occupies 73% apricot culture areas of the Malatya (Asma 2000). In addition, in recent years in the Mediterranean and Aegean Coastal Regions, apricot culture increasingly gains importance using low chilling domestic and foreign cultivars and develops for table production with precocity cultivars and early ripening selections (Kaşka et al. 1995; Paydaş and Kaşka 1995; Ayanoğlu and Kaşka 1995).

There exist a limited information on Irano-Caucasian apricots including Turkey (Mehlenbacher et al. 1990). In apricot culture areas of Turkey, there is a large number of native genotypes from seedling trees other than standard cultivars. These trees occurred from continuous seed propagation since long years, still meet an important part of present apricot production. Therefore, the maintenance of apricot genetic resources that are being increasingly lost and their identification in terms of genetic variability are very important for future breeding efforts. Information on genetic variability in apricot is also limited (Mehlenbacher et al. 1990). Until 1970's years, while the number of native apricot trees of Turkey constitutes 60% of all apricot trees, this percentage today decreased up to 25% (Asma 2000). Gülcan (1988), Akça and Sen (1993) have indicated that Turkey has rich genetic resources in native apricot genotypes, and that these resources should examine for breeding efforts. So far, many researchers studied native apricot populations from different areas, and reported some promising genotypes that have good fruit characteristics and late flowering habit (Akça and Sen 1993; Güteryüz 1995; Bostan et al. 1995; Ayanoglu and Kaşka 1995; Bolat and Güteryüz 1995; Şen et al. 1995; Akça and Aşkın 1995; Akça and Asma 1997).

Most of cultivated apricot varieties today have come from random selections (Audergon 1995). In addition, objectives such as good fruit properties for dried and table production, late flowering habit, expanding production areas and extending the ripening season, local adaptations and the use of locally adapted selections have been considered among the main breeding efforts for apricots (Bailey and Hough 1975; Mehlenbacher et al. 1990; Gülcan et al. 1995). In addition, one of the most important objective for breeding efforts in Turkey is selection of apricots that are not affected by late spring frosts.

With its microclimatic structure, Lake Van Region situated on the Eastern Anatolia, also has rich genetic resources in native apricots. In the region, apricots are grown at about 1700 m attitudes, and not usually affected by late spring frosts. Of apricot trees lack of modern technical and cultural practices, almost all are not grafted. From Adilcevaz plain (Bitlis province) located in this region, promising apricots have been selected (Şen et al. 1995) and many of them have been released as cultivars (Akça and Asma 1997; Asma 2000). On the other hand, a large number of native apricot trees exist also in the district Gevaş (Van province) of the Region. This study has aimed at

selecting native apricots from Gevaş district and their identification with respect to fruit and tree characteristics for future breeding efforts.

Material and method

The study was conducted on native apricot (*Prunus armeniaca* L.) population of Gevaş, a district of Lake Van Region during 1998 and 1999. The whole population consisted of approximate 1500 native trees was individually studied at flowering and harvest seasons for two years. The first year all trees were individually examined in flowering period, and a large number of trees were marked. At harvest season, trees which produce very small fruits were discarded, and fruit samples from trees bearing better fruits were collected. Representing each tree, ten fruits were randomly chosen, and they were evaluated with respect to fruit characteristics (Güteryüz 1995; Bostan et al. 1995). The second year phenological, morphological and pomological properties of the same trees were determined. Within existing population, twenty-eight genotypes were identified for future breeding efforts. Of these, fruit properties 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, fruit aroma, seed taste, flesh firmness and tree characteristics such as flowering date, harvest date, tree height, tree width and trunk circumference were described (Güteryüz 1995).

Results and discussion

The selected genotypes showed a range of 3–10 April in 1998 and 1–7 April in 1999 for bud break time. The first flowering time varied from 12 April to 22 April in 1998 and from 7 April to 20 April in 1999. The full flowering was between 20 April and 30 April in 1998 and between 14 April and 25 April in 1999. Their flowering ended between 1 May and 10 May in 1998, and between 25 April and 5 May in 1999. In addition, harvest time continued from 23 July to 16 August in 1998, and from 16 July to 10 August in 1999. The bud break, first flowering, full flowering, end of flowering and harvest date of the second year were earlier than those of the first year. In the majority of genotypes, bud break, first flowering, full flowering and end of flowering occurred a few days earlier than

the cultivar 'Hacıhaliloğlu' in both years, whereas, their harvest was later. On the other hand, genotypes had a range of 3.5–11 m for tree height, 3.5–8 m for tree width and 40–126 cm for trunk circumference (Table 1). These ranges were due to differences of tree ages.

With regard to fruit dimensions, genotypes had a range of 3.5–4.6 cm for fruit diameter, 3.5–4.7 cm for fruit length and 3.3–4.1 cm for fruit suture. The fruit weight ranged from 24.2 g to 48.3 g. G5 had the highest fruit weight (48.3 g), this was followed by G6 (38.1 g), G21 (36.0 g), G1 (35.1 g), G17 (34.8 g), G18 and G20 (34.1 g), G4 (33.9 g) and G8 and G12 (33.5 g), respectively. The sixteen selections produced fruits over 30 g. Some selections had larger fruits than 'Hacıhaliloğlu'. The soluble solids varied from 11.9% to 21.1%. Although soluble solid content

was lower in the majority of genotypes, it was more than 20% in three selections (G12, G29 and G33) as in 'Hacıhaliloğlu'. The acidity was between 0.19% and 2.90%, and lower than 1% in five genotypes (G2, G12, G27, G29 and G33). The range of pH was between 3.4 and 5.1. In addition, stone weight ranged from 1.6 g to 3.6 g, and kernel weight was between 0.5 g and 0.9 g. All genotypes except G6, G17 and 'Hacıhaliloğlu' had bitter kernels. Fruit taste, fruit aroma and flesh firmness sensorially varied from middle to very good. Seed separation was free in all genotypes but their three. On the other hand, selections had flesh colors of orange, light orange, dark orange, yellow, light yellow. Their some produced fruits with red blush on light yellow (Table 2).

In Turkey, many researchers examined native apricot populations from different areas and reported

Table 1. Tree characteristics of native apricot genotypes from Lake Van Region (1998-1999).

Genotypes	Bud Break		First Flowering		Full Flowering		End of flowering		Harvest		Tree Height (m)	Tree Width (m)	Trunk Circumference (cm)
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999			
	(April)	(April)	(April)	(April)	(April)	(April)	(May)						
G-1	5	1	15	12	23	20	3	1 May	6 Aug	30 Jul	3.5	3.5	40
G-2	7	5	22	20	30	25	10	5 May	25 Jul	16 Jul	4	4	60
G-3	5	1	15	12	25	20	3	27 Apr	6 Aug	30 Jul	7	6	69
G-4	6	2	16	13	23	21	1	30 Apr	6 Aug	29 Jul	7	4	74
G-5	5	1	15	12	24	19	2	1 May	6 Aug	30 Jul	11	8	110
G-6	4	1	14	11	24	18	2	26 Apr	6 Aug	30 Jul	5	7	78
G-7	7	3	17	14	25	20	5	2 May	6 Aug	28 Jul	7	5	88
G-8	10	5	20	17	28	23	10	5 May	6 Aug	29 Jul	10	6	109
G-9	5	3	17	14	25	22	5	1 May	6 Aug	29 Jul	9	7	82
G-10	5	3	16	14	26	23	4	2 May	6 Aug	30 Jul	5	5	72
G-11	3	1	14	10	24	20	1	28 Apr	6 Aug	30 Jul	10	6	97
G-12	5	3	15	12	25	20	2	27 Apr	23 Jul	15 Jul	8	5	80
G-13	10	1	15	7	22	15	1	25 Apr	6 Aug	31 Jul	8	7	126
G-15	10	7	20	15	27	23	5	1 May	25 Jul	17 Jul	7	4	120
G-16	5	2	16	12	25	19	2	27 Apr	6 Aug	29 Jul	7	5	70
G-17	3	1	13	8	23	17	1	27 Apr	6 Aug	30 Jul	6	5.5	45
G-18	5	1	15	12	23	20	2	30 Apr	25 Jul	18 Jul	7	4.5	103
G-19	5	1	15	10	24	18	1	27 Apr	6 Aug	30 Jul	6	5	97
G-20	4	1	14	10	24	20	4	30 Apr	6 Aug	30 Jul	4	5	42
G-21	6	2	16	12	25	20	2	28 Apr	25 Jul	15 Jul	6	6	75
G-24	10	2	17	12	26	20	6	30 Apr	25 Jul	18 Jul	7	4.5	126
G-25	5	2	15	10	25	18	5	27 Apr	6 Aug	31 Jul	4	4	55
G-27	8	1	14	7	23	15	1	25 Apr	25 Jul	19 Jul	7	5	120
G-28	9	2	16	8	26	17	5	27 Apr	6 Aug	29 Jul	9	5	90
G-29	9	1	17	7	25	14	4	25 Apr	25 Jul	16 Jul	5	3.5	110
G-30	8	2	17	7	24	14	5	25 Apr	25 Jul	16 Jul	7.5	4	67
G-33	5	1	14	10	24	20	3	27 Apr	25 Jul	17 Jul	7	5	120
G-34	5	1	12	9	20	19	1	28 Apr	16 Aug	10 Aug	5	4	75
HH*	10	8	20	17	28	26	5	1 May	25 Jul	17 Jul	5	5	90

*HH: The cultivar 'Hacıhaliloğlu'.

Table 2. Fruit characteristics of native apricot genotypes selected from Lake Van Region (1998–1999).

Genotypes	Fruit Width (cm)	Fruit Length (cm)	Fruit High (cm)	Fruit Weight (g)	Soluble Solids (%)	Stone Weight (g)	Kernel Weight (g)	Acidity (%)	pH	Fruit Taste	Kernel Flavor	Fruit Aroma	Fruit Firmness	Flesh Color	Skin Color	Seed Separation	Usage
G-1	4.2 ± 0.02	4.0 ± 0.06	3.7 ± 0.02	35.1 ± 1.62	13.5 ± 0.11	2.4 ± 0.02	0.8 ± 0.02	1.80	3.7	M	B	M	M	O	O	F	Fresh
G-2	4.0 ± 0.04	3.9 ± 0.05	3.4 ± 0.03	26.8 ± 1.38	14.2 ± 0.34	2.4 ± 0.01	0.8 ± 0.01	0.88	4.0	G	B	G	M	O	LYB	F	Fresh
G-3	4.0 ± 0.02	4.1 ± 0.02	3.6 ± 0.05	30.3 ± 1.27	15.4 ± 0.20	2.2 ± 0.01	0.5 ± 0.01	1.48	3.9	G	B	G	M	LY	LYB	F	Fresh
G-4	4.0 ± 0.03	4.2 ± 0.04	3.7 ± 0.03	33.9 ± 1.67	14.5 ± 0.51	2.1 ± 0.02	0.7 ± 0.02	1.09	3.9	G	B	M	G	Y	Y	F	Fresh
G-5	4.6 ± 0.03	4.7 ± 0.06	4.1 ± 0.03	48.3 ± 1.25	16.5 ± 0.25	3.6 ± 0.03	1.4 ± 0.02	2.20	3.4	G	B	G	G	LO	O	F	Fresh
G-6	3.9 ± 0.05	4.4 ± 0.08	3.6 ± 0.03	38.1 ± 1.93	14.7 ± 0.29	3.0 ± 0.01	1.0 ± 0.03	1.49	3.7	G	S	G	G	DO	LYB	F	Fresh
G-7	3.6 ± 0.05	3.9 ± 0.04	3.4 ± 0.02	33.5 ± 1.14	14.2 ± 0.23	2.1 ± 0.01	0.6 ± 0.01	1.65	3.6	M	B	G	M	O	O	F	Fresh
G-8	3.7 ± 0.07	3.9 ± 0.06	3.2 ± 0.04	25.2 ± 1.69	12.8 ± 0.19	1.6 ± 0.02	0.6 ± 0.02	2.34	3.4	M	B	M	G	O	O	F	Fresh
G-9	4.1 ± 0.05	4.2 ± 0.03	3.7 ± 0.07	33.6 ± 1.44	16.4 ± 0.33	2.4 ± 0.02	0.6 ± 0.02	1.33	3.5	G	B	G	G	O	LYB	F	Fresh
G-10	3.7 ± 0.03	3.8 ± 0.04	3.4 ± 0.05	26.0 ± 1.88	13.4 ± 0.31	1.6 ± 0.03	0.5 ± 0.02	1.80	3.5	M	B	M	M	O	O	F	Fresh
G-11	3.8 ± 0.04	4.0 ± 0.03	3.3 ± 0.04	25.2 ± 1.39	13.7 ± 0.27	2.0 ± 0.01	0.7 ± 0.01	2.90	3.4	G	B	G	M	LY	Y	SJ	Fresh
G-12	4.0 ± 0.03	4.1 ± 0.02	3.7 ± 0.03	33.5 ± 1.21	20.3 ± 0.17	2.2 ± 0.02	0.7 ± 0.02	0.25	5.3	VG	B	G	G	LY	LYB	F	Dried
G-13	3.8 ± 0.02	3.9 ± 0.03	3.2 ± 0.03	24.9 ± 1.08	18.6 ± 0.46	2.0 ± 0.01	0.5 ± 0.02	1.11	4.0	VG	B	G	G	LY	LO	F	Fresh
G-15	3.8 ± 0.06	4.2 ± 0.05	3.5 ± 0.02	28.3 ± 1.92	17.9 ± 0.38	1.7 ± 0.03	0.6 ± 0.03	1.10	4.0	G	B	G	M	LO	OB	F	Fresh
G-16	3.8 ± 0.04	4.1 ± 0.04	3.3 ± 0.05	26.1 ± 1.51	15.6 ± 0.19	2.3 ± 0.01	0.6 ± 0.01	1.62	3.7	M	B	G	G	LO	LYB	F	Fresh
G-17	3.8 ± 0.02	4.1 ± 0.03	3.6 ± 0.02	34.8 ± 1.73	16.1 ± 0.27	2.8 ± 0.01	0.6 ± 0.03	1.27	4.0	G	S	VG	G	O	O	F	Fresh
G-18	4.0 ± 0.03	4.2 ± 0.04	3.7 ± 0.04	34.1 ± 2.06	13.7 ± 0.56	2.1 ± 0.02	0.7 ± 0.02	1.45	4.0	G	B	G	G	Y	OB	F	Fresh
G-19	3.9 ± 0.03	4.1 ± 0.02	3.6 ± 0.02	30.0 ± 1.10	15.7 ± 0.22	2.7 ± 0.02	0.8 ± 0.03	1.29	3.8	G	B	G	G	O	LO	F	Fresh
G-20	4.0 ± 0.06	4.0 ± 0.05	3.9 ± 0.06	34.1 ± 1.58	11.9 ± 0.15	2.4 ± 0.02	0.7 ± 0.02	1.08	3.8	G	B	M	G	LY	LY	SJ	Fresh
G-21	4.3 ± 0.06	4.1 ± 0.07	3.8 ± 0.04	36.0 ± 1.60	15.3 ± 0.33	2.6 ± 0.03	0.9 ± 0.01	1.38	3.7	G	B	M	G	O	LO	F	Fresh
G-24	3.9 ± 0.04	4.1 ± 0.05	3.4 ± 0.02	28.7 ± 1.17	13.5 ± 0.37	1.8 ± 0.01	0.7 ± 0.01	1.29	3.6	M	B	M	M	O	LO	F	Fresh
G-25	3.8 ± 0.03	3.5 ± 0.02	3.7 ± 0.02	25.4 ± 1.35	16.2 ± 0.10	2.5 ± 0.03	0.7 ± 0.03	1.56	3.7	M	B	M	M	O	Y	SJ	Fresh
G-27	3.9 ± 0.05	3.9 ± 0.06	3.7 ± 0.05	32.1 ± 1.99	18.8 ± 0.32	2.0 ± 0.02	0.7 ± 0.02	0.24	4.8	VG	B	G	G	O	YB	F	Fresh
G-28	3.7 ± 0.04	3.8 ± 0.03	3.4 ± 0.02	27.3 ± 1.62	14.9 ± 0.61	2.1 ± 0.01	0.6 ± 0.01	1.47	3.7	M	B	M	G	LO	LO	F	Fresh
G-29	3.5 ± 0.03	3.8 ± 0.02	3.3 ± 0.02	30.0 ± 1.46	21.2 ± 0.29	1.9 ± 0.01	0.7 ± 0.02	0.21	5.1	VG	B	G	M	O	YB	F	Dried
G-30	3.8 ± 0.04	3.7 ± 0.06	3.6 ± 0.02	29.8 ± 1.87	14.8 ± 0.50	2.1 ± 0.02	0.8 ± 0.02	1.48	3.7	G	B	G	M	O	LO	F	Fresh
G-33	3.9 ± 0.04	4.0 ± 0.05	3.4 ± 0.03	26.8 ± 1.05	20.1 ± 0.26	2.1 ± 0.02	0.7 ± 0.01	0.19	5.1	M	B	G	G	LO	LYB	F	Dried
G-34	4.1 ± 0.05	4.0 ± 0.06	3.7 ± 0.05	30.3 ± 1.63	15.6 ± 0.21	2.3 ± 0.01	0.8 ± 0.03	1.04	3.8	M	B	G	G	Y	LY	F	Fresh
HH*	4.0 ± 0.02	3.9 ± 0.03	3.8 ± 0.03	30.1 ± 1.64	20.0 ± 0.09	2.2 ± 0.02	0.6 ± s0.01	0.18	4.8	G	S	G	G	Y	YB	F	Dried

*HH: The cultivar 'Hachhaliloğlu', O: Orange, LO: Light orange, DO: Dark orange, Y: Yellow, LY: Light yellow, LYB: Light yellow with red blush, YB: Orange with red blush, YB: Yellow with red blush. VG: Very Good, G: Good, M: Middle, F: Free, SJ: Semi-joined, S: Sweet, B: Bitter.

promising genotypes that have good fruit characteristics and resistance to late spring frosts (Akça and Sen 1993; Güleriyüz 1995; Bostan et al. 1995; Ayanoğlu and Kaşka 1995; Bolat and Güleriyüz 1995; Şen et al. 1995; Akça and Aşkın 1995; Ayanoğlu and Kaşka 1995; Akça and Asma 1997), and some genotypes have been released as cultivar (Asma 2000). In addition, native apricot populations of areas of both Lake Van Region and other areas also wait for searching for breeding efforts.

The crop load in apricots may be highly affected by insufficient cultural practices, and especially late spring frosts. Therefore, fruit weights may vary from year to year depending on tree crop heavy Genotypes from this study have produced fruits of which weights varied from 25 g to 48 g under cultivation practices lack of modern technical and cultural practices. So, it may be expected the selections to produce larger fruits with better cultural practices. Accordingly, promising apricots will need replicated trials for further examinations with their clones representing each genotype.

Genotypes were resistance to late spring frosts for two years. Late spring frost damages were not seen during flowering periods of two years. The lowest daily minimum temperature was -2.6°C in April (2 April) of 1998 and -1.8°C in April (4 April) of 1999. The number of day under 0°C in April months of two years was two in 1998 and three in 1999. That has been considered as an advantage for local cultivar breeding in the region. In apricot breeding, the importance of local cultivars is recognized. On the other hand, expanding production areas and extending the ripening season, and the use of locally adapted selections are among apricot breeding programs (Bailey and Hough 1975; Mehlenbacher et al. 1990; Gülcan et al. 1995). Many promising ones from this research will gain importance with respect to local cultivar breeding efforts. So, some genotypes should be investigated with replicated trials.

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