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Promising Pear Genotypes from North Anatolia, Turkey: Preliminary Observations

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Abstract

Anatolia is one of the primary gene centers of origin of pear. The main aim of this study was to describe pomological and phenological characteristics of wild selections of pear genotypes from North Anatolia which has a rich local pear population. Pomological characteristics such as fruit weight, flesh firmness, fruit shape, skin ground color, soluble solids concentration, titratable acid concentration, and eating quality, and phenological traits such as first flowering, full flowering, days from full flowering to maturity, and harvest date were examined. The potential of the pear genotypes that were studied was determined by a "weighted ranked method" based on fruit weight, eating quality, appearance, russet intensity, alternate bearing and earliness. Overall, 14 pear genotypes were selected as promising genotypes from the 98 pear genotypes that were initially included in the study. The genotypes 'Dalkıran', 'Yaz Ziraati' and 'Kara Armut-II' had the highest scores. In the 14 genotypes examined, fruit weight varied from 50.7 to 533.8 g and from 45.9 to 479.9 g in 2008 and 2009, respectively and, correspondingly, harvest dates ranged from 5 July to 6 November and 16 July to 30 October, days from full flowering to maturity varied from 103 to 212 days and from 89 to 206 days, flesh firmness varied from 4.1 to 8.8 kg and 4.4 to 11.5 kg, soluble solids concentration ranged from 8.8 to 19.0% and 11.0 to 16.2%, and titratable acid concentration ranged from 0.13 to 0.62 and 0.21 to 1.02. Further assessment of these promising genotypes will be carried out under standardized, controlled cropping conditions.

Pear (*Pyrus* spp.) has been one of the most important fruits cultivated in Europe and Asia over thousands of years. The genus *Pyrus* contains at least 22 widely recognized primary species, all indigenous to Europe, Asia, and the mountainous areas of North America (Bell and Hough, 1986; Bell et al., 1996; Itai, 2007; Ozcagiran et al., 2004). The most important *Pyrus* species include *Pyrus communis* L. and *Pyrus pyrifolia* Nak. The European pear, *P. communis* L., is distributed across southeastern Europe, Turkey and Eurasia (Bell et al., 1996) with Turkey being one of the primary gene centers of origin of the pear (Vavilov et al., 1951) where it is indigenous to the natural flora (Davis, 1972; Ercisli, 2004; Westwood, 1978). Moreover, Turkey is one of the major pear producing countries in Europe being ranking third after Italy and Spain. World pear production was about 22 million tonnes in 2012 with Turkey producing 384,244 tonnes (FAO, 2012).

Turkey has over 500 local pear cultivars which have a large diversity of characteristics such as fruit size, fruit shape, fruit skin color, fruit texture and fire blight resistance (Ercisli, 2004). Many quality pear genotypes that have originated from Anatolia are grown throughout Turkey but only a few standard pear cultivars have originated in Turkey, including 'Deveci', 'Ankara' and 'Akça'. Although local pear genotypes are generally grown only in the gardens of people's homes, they are an important component of Turkey's total pear production. The characteristics of local pear genotypes from different parts of Turkey have been determined in a number of studies. Some local cultivars have been selected as promising commercial cultivars due to their resistance to insects and diseases (including fireblight, *Erwinia amylovora* (Burrill) Winslow et al) (Citir and Mirik, 1999;

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Guleryuz and Ercisli 1997; Hepaksoy et al., 1999; Unal et al., 1997), earliness (Buyukyilmaz and Bulagay, 1983; Buyukyilmaz et al., 1994), and good fruit quality (Akcay et al., 2009; Bostan, 2009; Ozrenk et al., 2010). The commercial development of these local genotypes has, however, been very limited.

High fruit quality, resistance to diseases and insects, precocity, and compatibility with different rootstocks are major priorities in the development of new pear cultivars (Hancock and Lobos, 2008; Itai, 2007). Local varieties and genotypes that include these characteristics are, therefore, valuable in breeding and improvement programs. The Black Sea Region (including North Anatolia), in northern Turkey, which has about 21.0% of the pear production within Turkey, has rich local and native pear gene resources.

The purpose of this study was to describe pomological and phenological characteristics of a wide range of pear genotypes growing in the wild and to select pear genotypes with superior fruit quality from North Anatolia that might be used in pear improvement programs.

Materials and Methods

Research area and sampling: The study was carried out in the region near to Sinop, located in North Anatolia in the Western Black Sea Region, in 2008 and 2009. The research area was located between 41° 12' and 42° 06' north latitude and 34° 14' and 35° 26' east longitude. The altitude of the experimental area that was surveyed ranged from 32 to 1123 m. The average annual rainfall ranges from 679 to 1077 mm and the climate of the area is characterized by a cool summer season and a mild winter season. The mean maximum temperature is 26.4°C, the mean minimum is 4.6°C, and the mean annual temperature is 14.1°C. Soil textures within the district include clay-loam, sandy-loam, loam, sandy-clay loam and clay types. The pH ranges from 5.7 to 7.8 and the soil organic matter is generally high, ranging from 0.63 to 10.45%. The climate data from the local meteorological station in Sinop are presented in Fig 1 as being indicative of the conditions prevailing across the surveyed area.

Trees of each genotype in the surveyed area were allowed to grow naturally without any intervention with cultural practices such as pruning, fruit thinning, fertilization, or irrigation. Trees of the selected genotypes, located in farmer orchards or in mixed plantations, ranged from approximately 10 to 100 years old and were all originally grafted onto seedling rootstocks. The coordinates (alti-

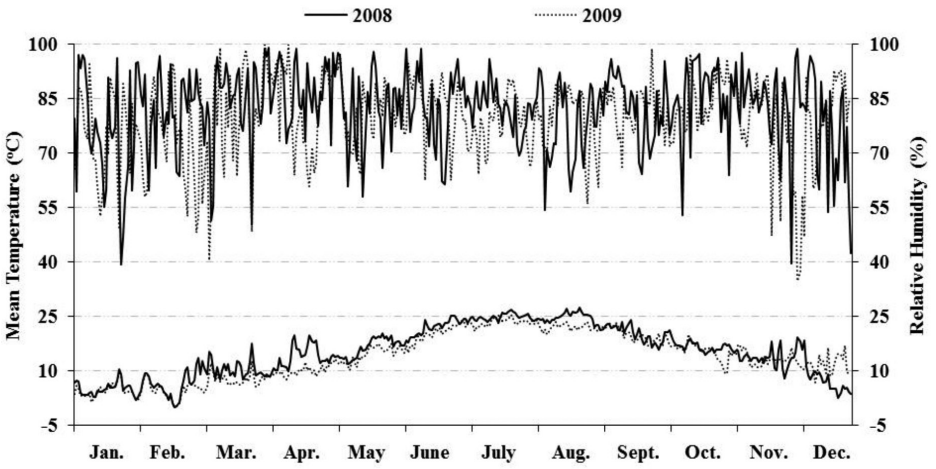

Fig. 1. Mean temperature and relative humidity at Sinop in the surveyed area in 2008 and 2009.

tude, latitude and longitude) of the location of the selected pear genotypes were recorded using a global positioning system (Magellan Sportrak Color, San Damis, CA) and the altitude of the each collection site is presented in Table 5. Each tree was considered as a genotype. Initially, 98 different pear genotypes were selected by considering those having large fruit weight, weak alternate bearing (based on local knowledge), good fruit appearance and high tree health. In 2008, these 98 pear genotypes were assessed and, using the "weighted ranked method" based on fruit weight, eating quality, fruit appearance, alternate bearing habit, russet intensity and earliness, 40 pear genotypes were selected as being superior. In 2009, further evaluation identified 14 pear genotypes that were selected as being promising commercial pear cultivars.

Sensory Data: Samples of 10 fruit from each tree (genotype) were used for sensory analyses. Qualitative fruit characteristics, such as the eating quality, appearance and russet intensity, were rated by a taste group, comprising five panelists of experienced horticulturists, on a 1–5 scale. Eating quality (IBPGR, 1983) and appearance were scored as "extremely fine", "fine", "intermediate", "poor", or "extremely poor". Russet intensity was scored as "absent or very little", "little", "moderate", "very extensive", or "completely covered".

Fruit characteristics of each of the pear genotypes, such as fruit weight, fruit shape and skin ground color, were determined from 30 fruit that were sampled randomly from the sun-exposed outside parts of each genotype canopy. Fruit shape was classified as "round", "elongate", or "elliptic" (Buyukyilmaz and Bulagay, 1983). Skin ground color was classified as "green", "green-yellow", "yellow" or "red" (IBPGR, 1983).

Fruit weight was determined using a digital balance (+/- 0.01 g) and classified as being "very large", "large", "medium", "small" or "very small" (UPOV, 2000).

Flesh firmness (kg) was tested on opposite sides of each fruit using an Effegi penetrometer (Model 4301, Instron, Canton, MA) with a 7.8 mm plunger after removal of the peel (Dumanoglu et al., 2006). Soluble solids concentration was measured using a Carl-Zeiss Abbe refractometer. For titratable acidity, a 5 mL sample of juice was diluted with 45 mL of distilled water and then titrated with 0.1 N NaOH and expressed as malic acid equivalents (Demirsoy and Demirsoy, 2003).

Phenological observations: The dates of first flowering and full flowering, time (days) from full bloom to maturity, and harvest date of the selected promising pear genotypes were recorded as outlined by Buyukyilmaz and Bulagay (1983), with harvest maturity being determined according to a combination of local grower's long term experience, flesh firmness, skin color and flavor.

Data Analysis: Pear genotypes were rated from high to low for each of six fruit characteristics using a "weighted ranked method" (Ayfer and Celik, 1979; Buyukyilmaz and Bulagay, 1983; Celikel et al., 2008; Michelson et al., 1958). The relative value and class values of each of these characteristics are shown in Table 1. To obtain the total weighted ranked method scores, the relative scores were multiplied by each characteristic's score and summed up for each pear genotype. The selected pear genotypes were assessed in accordance with IBPGR (1983) and UPOV (2000) criteria.

Results and Discussion

Initially, 98 pear genotypes were evaluated from the Sinop province in 2008. According to the scores obtained using the weighted ranked method (based on fruit weight, eating quality, appearance, russet intensity, alternate bearing, and earliness), 40 of these genotypes were selected as being superior (Table 2). The genotype 'Dalkıran' had the highest score followed by 'Tefenc' and 'Kara Armut-II' (Fig. 2). Fruit weight of these superior pear genotypes ranged from 50.7 to 533.8 g. 'Dalkıran' (533.8 g) (Fig. 2) had a higher fruit weight than the other pear genotypes,

Table 1. Scoring method for the range of fruit characteristics included in this study and their relative values.

Characteristic	Relative value (%)	Classes and scores of characteristics		
		Classes		Scores
Fruit weight	30	≥ 128.2	Very small	1
		128.3 - 229.6	Small	3
		229.7 - 331.0	Medium	5
		331.1 - 432.4	Large	7
		≤432.5	Very large	9
Eating quality	15	≥ 4.2	Extremely fine	9
		3.3 - 4.1	Fine	7
		2.4 - 3.2	Intermediate	5
		1.5 - 2.3	Poor	3
		≤1.4	Extremely poor	1
Appearance	15	≥ 4.2	Extremely fine	9
		3.3 - 4.1	Fine	7
		2.4 - 3.2	Intermediate	5
		1.5 - 2.3	Poor	3
		≤1.4	Extremely poor	1
Russet intensity	10	Absent or very little		9
		Little		7
		Moderate		5
		Very		3
		Complete covered		1
Alternate bearing	10	No		9
		Relatively yes		5
		Yes		1
Earliness	20	June	Very early	9
		July	Early	5
		August	Intermediate	4
		September	Late	3
		October- November	Very late	1
TOTAL	100			

Fig. 2. The most promising pear genotypes, 'Dalkıran' and 'Kara Armut-II' (checked bar is 15 cm long).

Table 2. Selection criteria scores and total weighted scores (2008 assessments) for 40 pear genotypes from the North Anatolia region.

Genotypes	Fruit weight		E.Q.[1]	A.	Rs.	A.B.	E.	Total weighted score, (rank)	
	(g)	Score	Score	Score	Score	Score	Score		
Ankara	118.0±3.9[2]	1	9	7	9	9	4	530	(9)
As	226.5±7.5	3	7	7	7	9	4	540	(8)
Bakal	57.9±1.6	1	7	7	7	9	9	580	(5)
Bal	102.5±3.3	1	7	7	9	9	5	520	(10)
Bardak-I	128.2±5.4	1	9	9	9	9	5	580	(5)
Bardak II	131.7±5.0	3	7	7	9	9	4	560	(6)
Beyaz Kış	359.7±9.4	7	7	7	5	9	1	580	(5)
Burunsuz	104.9±4.3	1	7	9	9	9	3	510	(11)
Dalkıran	533.8±9.3	9	7	7	5	9	1	640	(1)
Erikli	82.8±3.4	1	9	7	9	9	5	550	(7)
Esek	200.9±7.5	3	9	7	9	9	4	590	(4)
Fırıncık	51.8±2.2	1	7	7	9	9	4	500	(12)
Gelin	90.3±2.0	1	9	9	9	9	5	580	(5)
Güp Düsen	102.5±4.9	1	9	9	9	9	5	580	(5)
Harman	98.9±6.8	1	9	7	9	9	3	510	(11)
Istanbul	50.7±1.7	1	9	9	9	9	5	580	(5)
Kadınparmak	51.7±1.4	1	7	7	9	9	5	520	(10)
Kantar	327.8±5.2	5	7	7	5	9	1	520	(10)
Kara Armut-I	104.0±5.5	1	7	7	9	9	4	500	(12)
Kara Armut-II	138.0±6.7	3	9	9	9	9	4	620	(2)
Karga	86.0±3.1	1	7	7	9	9	5	520	(10)
Karpuz	245.7±9.6	5	7	5	9	9	5	610	(3)
Keten	67.5±2.9	1	7	7	7	9	5	520	(10)
Kedibaş	180.4±8.6	3	5	5	9	9	5	520	(10)
Kıs	191.1±7.0	3	7	7	9	9	1	500	(12)
Kısa Bacak	69.3±2.4	1	7	7	9	9	5	520	(10)
Kıs Ziraati	270.7±7.8	5	7	7	7	9	3	580	(5)
Kokulu	110.4±5.8	1	7	7	7	9	5	500	(12)
Kuşak	118.0±4.1	1	9	7	9	9	5	550	(7)

Pazar	115.3±5.6	1	7	7	9	9	4	500	(12)
Rıza	138.7±4.7	3	7	7	9	9	3	540	(8)
Sarıkum	65.1±1.8	1	9	9	9	9	5	580	(5)
Seker	67.5±2.2	1	7	7	9	9	5	540	(8)
Sulu	154.8±5.0	3	7	7	7	9	5	560	(6)
Susak	65.1±2.1	1	9	7	9	9	5	550	(7)
Sülükgöl	59.6±2.9	1	7	7	9	9	5	520	(10)
Tefenc	259.4±9.9	5	9	9	9	9	1	620	(2)
Tuzcu	145.6±4.8	3	7	7	9	9	4	560	(6)
Yaz Ziraati	123.4±9.3	1	7	7	9	9	5	520	(10)
Yumru	100.4±4.1	1	7	7	9	9	5	520	(10)

[1]E.Q: Eating Quality, A: Appearance, Rs: Russet intensity, A.B.: Alternate Bearing, E: Earliness
[2]Standard error from 10 samples

noting that yield had not been standardized across genotypes (Table 2).

In 2009, 14 pear genotypes were selected as having the most commercial promise from the 40 genotypes selected in 2008. Among these 14 promising genotypes, 'Dalkıran', 'Yaz Ziraati' and 'Kara Armut-II' had the highest scores (Table 3) and fruit weight varied from 45.9 to 479.9 g. 'Dalkıran' had the highest fruit weight and highest fruit weight score in both years (Tables 2 and 3). Although fruit weight of pear can be influenced by a number of factors, including climate, soil conditions, species, variety, crop load and rootstock, generally fruit weight in the pear ranges from 80-400 g (Bell et al., 1996; Elkins and Dejong, 2002; Hancock and Lobos, 2008; Layne and Quamme, 1975; Ozcagiran et al., 2004). In previous studies, fruit weight of different pear cultivars and genotypes was shown to vary from 36.2 to 420.0 g in different regions of Turkey (Akcay et al., 2009; Bostan, 2009; Buyukyilmaz et al., 1994; Yarilgac and Yildiz, 2001) with the fruit weights of 'Williams Bon Chretien', 'Passe Crassane' and 'Kieffer' being determined as 207.3 g and 332.0 g and 410.7 g, respectively (Akcay et al., 2009).

Flesh firmness of the 14 promising pear genotypes ranged from 4.1 to 8.8 kg in 2008 and from 4.4 to 11.5 kg in 2009. In 2008, 'Dalkıran', 'Kıs Ziraati' and 'Esek' had the highest fruit firmness and 'Karpuz', 'Karga' and Bardak-I' had the lowest, while in 2009, 'Esek', 'Dalkıran' and 'Sarıkum' had the highest firmness and 'Bardak-I', 'Kara Armut-II' and 'Karpuz' had the lowest (Table 4). In similar studies, flesh firmness in pears was determined as being between 1.1 and 11.3 kg (Akcay et al., 2009; Bostan, 2009; Guleryuz and Ercisli, 1997).

The soluble solids concentration of the promising pear genotypes ranged from 8.8 to 19.0% in 2008 and from 11.0 to 18.0% in 2009. High soluble solids concentrations were observed from 'Kara Armutt-II' in both years of the study while 'Yaz Ziraati' and 'Bardak-I' consistently had the lowest soluble solids concentrations (Table 4). Previous studies have shown that the soluble solids concentration of pears can vary from 5.5 to 17.8% (Kıprjanovski and Ristevski, 2009; Ozrenk et al., 2010; Ozturk et al., 2009; Tanrıöven and Eksi, 2005).

The titratable acid concentration of the selected promising pear genotypes varied from

Table 3. Selection criteria scores and total weighted scores (2009 assessments) for 14 pear genotypes from the North Anatolia region.

Genotypes	Fruit weight		E.Q.[1]	A.	Rs.	A.B.	E.	Total weighted score, (rank)
	(g)	Score	Score	Score	Score	Score	Score	
Bardak-I	170.3±5.5[2]	3	7	7	9	9	5	580 (5)
Dalkıran	479.9±9.9	9	5	7	7	9	1	630 (1)
Esek	200.8±7.6	3	7	7	9	9	4	560 (7)
Güp Düşen	72.4±1.8	1	9	9	9	9	5	580 (5)
Istanbul	45.9±1.9	1	9	9	9	9	5	580 (5)
Kara Armut-II	129.2±5.1	3	9	9	9	9	3	600 (3)
Karga	92.7±6.4	1	9	9	9	9	5	580 (5)
Karpuz	100.7±3.8	1	9	9	9	9	5	580 (5)
Kıs	339.1±9.6	7	5	7	7	9	1	570 (6)
Kıs Ziraati	275.2±9.9	5	9	7	7	9	1	570 (6)
Rıza	134.0±3.4	3	7	9	9	9	3	570 (6)
Sarıkum	90.7±3.5	1	9	9	9	9	5	580 (5)
Tefenc	245.9±9.8	5	7	9	9	9	1	590 (4)
Yaz Ziraati	192.5±6.6	3	9	9	9	9	4	620 (2)

[1]E.Q.: Eating Quality, A: Appearance, Rs: Russet intensity, A.B.: Alternate Bearing, E: Earliness
[2]Standard error from 10 samples

year to year and ranged from 0.13 to 0.62% in 2008 and from 0.21 to 1.02% in 2009. The highest titratable acid concentration occurred with 'Kıs' in both years while the lowest concentration was with 'Karga' and 'Karpuz' in 2008 and 2009, respectively (Table 4). Previous reports have indicated that the titratable acid concentration in pears varied from 0.06 to 2.45% (Bostan, 2009; Galvis-Sanchez et al., 2003; Guleryuz and Ercisli, 1997; Kıprjanovski and Ristevski, 2009; Ozrenk et al., 2010).

Eating quality at harvest of all of the selected genotypes was high, ranging from intermediate to extremely fine, based on local recommendations for determining harvest maturity. The fruit shapes of the promising 14 pear genotypes included round, elongate and elliptic types. Layne and Quamme (1975) noted that although many of the common standard pear cultivars are pyriform, fruit shape can vary from oblate to round to pyriform and to conical.

The skin color of the selected genotypes

Table 4. Flesh firmness, soluble solids concentration, titratable acidity, fruit shape and skin ground color of 14 promising pear genotypes in 2008 and 2009.

Genotype	Flesh firmness (kg)		Soluble solids concentration (%)		Titratable acidity (%)		Fruit shape	Skin color
	2008	2009	2008	2009	2008	2009		
Bardak-I	4.5±0.4	4.4±0.3	9.2±0.5	11.0±0.4	0.42±0.2	0.40±0.1	Elongate	Green-Yellow
Dalkıran	8.8±0.3	10.5±0.7	14.2±0.3	12.4±0.4	0.40±0.1	0.38±0.1	Elongate	Green-Yellow
Esek	8.6±0.7	11.5±0.5	11.6±0.3	12.0±0.5	0.39±0.3	0.60±0.2	Elongate	Green-Yellow
Güp Düsen	7.1±0.4	7.9±0.3	12.8±0.4	13.1±0.3	0.35±0.1	0.32±0.1	Elliptic	Green
Istanbul	5.3±0.3	7.5±0.3	13.0±0.3	12.9±0.4	0.34±0.1	0.24±0.1	Elongate	Yellow
Kara Armut-II	5.6±0.4	4.6±0.1	19.0±0.7	16.2±0.5	0.27±0.1	0.24±0.1	Elliptic	Green-Yellow
Karga	4.5±0.2	5.7±0.3	11.4±0.5	17.1±0.4	0.13±0.1	0.32±0.1	Elliptic	Green-Yellow
Karpuz	4.1±0.3	5.1±0.4	13.2±0.6	11.0±0.3	0.21±0.1	0.21±0.1	Round	Green-Yellow
Kıs	5.6±0.3	5.9±0.2	13.6±0.2	15.8±0.6	0.62±0.2	1.02±0.4	Round	Green-Yellow
Kıs Ziraati	8.7±0.3	8.1±0.1	14.0±0.5	15.0±0.6	0.30±0.1	0.40±0.1	Elongate	Green-Yellow
Rıza	5.2±0.2	6.7±0.2	13.0±0.4	13.6±0.4	0.36±0.1	0.46±0.1	Round	Yellow
Sarıkum	6.1±0.3	10.1±0.4	14.0±0.4	14.2±0.5	0.25±0.1	0.36±0.1	Elongate	Yellow
Tefenc	7.4±0.4	7.3±0.2	13.0±0.6	14.3±0.4	0.31±0.2	0.43±0.2	Elongate	Green-Yellow
Yaz Ziraati	8.4±0.2	7.5±0.4	8.8±0.4	11.2±0.3	0.46±0.2	0.50±0.2	Elongate	Green-Yellow

included green, yellow and green-yellow types. Skin color in pears is generally yellow, green and greenish-yellow, but there are a few cultivars with red skin color (Ercisli, 2004; Itai, 2009; Layne and Quamme, 1975). Bell et al. (1996) considered that the skin color should be golden yellow and bright, with or without a red blush, although green or greenish-yellow types are also acceptable.

In pear, flowering time is an important characteristic due to the need to synchronize bloom with pollinating varieties and the need to avoid damage due to late spring frosts (Kıprjanovski and Ristevski, 2009). The earliest flowering genotypes were 'Karga' (16 March) in 2008 and 'Yaz Ziraati' and 'Kıs Ziraati' (20 March), in 2009. In both years, the latest flowering pear genotype was 'Dalkıran' (26 March and 15 April in 2008 and 2009, respectively) (Table 5). In 2008, 'Karga' was the earliest full flowering pear genotype (20 March), while 'Karga', 'Yaz Ziraati', and 'Kıs Ziraati' were the earliest in 2009. The latest full flowering pear genotype was 'Dalkıran' in both 2008 and 2009 (10 and 25 April, respectively). Due to the fact that temperatures and relative humidity were slightly higher in 2008 than in 2009 during the flowering period (Fig. 1), first flowering and full flowering dates were later in 2009. Environmental conditions, such as temperature and relative humidity, affect phenological development and pomological characteristics in many plants. Flowering times can change depending upon cultivar, environmental conditions, altitude and latitude (Ozcagiran et al, 2004; Westwood, 1978).

The number of days from full flowering to maturity of the 14

promising pear genotypes varied from 103 to 212 days in 2008 and from 89 to 206 days in 2009. However, it is known that, in pear, the number of days from full flowering to maturity changes according to cultivar, region and year (Ozcagiran et al., 2004). Harvest of the promising pear cultivars was between 5 July and 6 November in 2008, and 16 July and 30 October in 2009. The earliest harvest date was with 'Istanbul' in both 2008 and 2009 (5 and 16 July, respectively). In 2008, 'Dalkıran' was the latest pear genotype (6 November) while 'Kıs' and 'Dalkıran' were the latest in 2009 (30 October) (Table 5). Since temperatures were slightly lower in 2009 than in 2008 during the harvest season (Fig. 1), harvest date was delayed following later first flowering and full flowering dates in 2009. In previous similar studies, harvest dates were determined as being between 9

Table 5. First flowering, full flowering, days from full flowering to maturity and harvest date in selected promising pear genotypes in 2008 and 2009.

Genotype	Altitude (m)	Phenological characteristics							
		First flowering date		Full flowering date		Days from full flowering to maturity		Harvest date	
		2008	2009	2008	2009	2008	2009	2008	2009
Bardak-I	288	20 Mar.	28 Mar.	25 Mar.	5 Apr.	120	115	23 July	29 July
Dalkıran	134	26 Mar.	15 Apr.	10 Apr.	25 Apr.	211	188	06 Nov.	30 Oct.
Esek	249	20 Mar.	26 Mar.	27 Mar.	4 Apr.	139	138	13 Aug.	20 Aug.
Güp Düsen	149	21 Mar.	10 Apr.	25 Mar.	19 Apr.	121	101	23 July	29 July
Istanbul	189	24 Mar.	9 Apr.	26 Mar.	18 Apr.	103	89	05 July	16 July
Kara Armut-II	750	25 Mar.	11 Apr.	28 Mar.	20 Apr.	151	143	26 Aug.	10 Sept.
Karga	249	16 Mar.	25 Mar.	20 Mar.	30 Mar.	117	121	15 July	29 July
Karpuz	266	25 Mar.	9 Apr.	02 Apr.	20 Apr.	104	94	15 July	23 July
Kıs	288	21 Mar.	29 Mar.	26 Mar.	6 Apr.	211	206	22 Oct.	30 Oct.
Kıs Ziraati	221	20 Mar.	20 Mar.	27 Mar.	30 Mar.	176	192	18 Sept.	8 Oct.
Rıza	249	23 Mar.	27 Mar.	27 Mar.	3 Apr.	160	160	02 Sept.	10 Sept.
Sarıkum	89	25 Mar.	22 Mar.	06 Apr.	6 Apr.	109	114	23 July	29 July
Tefenc	229	20 Mar.	22 Mar.	25 Mar.	17 Apr.	212	181	22 Oct.	15 Oct.
Yaz Ziraati	216	20 Mar.	20 Mar.	27 Mar.	30 Mar.	118	129	23 July	6 Aug.

July and 13 November in the Eastern Black Sea region (Karadeniz and Sen, 1990), between 25 June and 29 October in the Marmara region (Buyukyilmaz et al., 1994), and between 24 July and 21 October in Southeast Anatolia (Kaplan, 1997).

The commercially promising pear genotypes were collected from 89 to 750 m elevation (Table 5). As shown in Table 5, many of these pear genotypes (10) were collected from approximately 250 m and three of them were collected from about 125 m, with one of them ('Kara Armut II') being collected from 750 m elevation.

Conclusions

In this study, the best pear genotypes in terms of quality and productivity in the province of Sinop, situated in the Black Sea Region, which has a rich diversity of pear germplasm were determined. Several of these pear genotypes, such as 'Dalkıran', 'Kara Armut-II', 'Yaz Ziraati' and 'Tefenc', are of sufficient potential that they should be evaluated further for their commercial potential. These pear genotypes had a range of harvest dates, phenological characteristics (timing of flowering and fruit set), tree vigor (tree size), fruit sizes and productivity, indicating their considerable potential value for inclusion in pear cultivar breeding programs. Because the climatic characteristics would have varied due to the wide geographical distribution of the surveyed area, the phenological and pomological traits would have been affected and these genotypes should, therefore, be evaluated under similar environmental conditions. Consequently, the selected superior pear genotypes have been grafted on Quince BA 29 clonal rootstock for further evaluation under a common climate while using standardized cultural conditions. This genetic resource will be maintained for the development of new pear cultivars in the future.

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