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Full Length Research Paper

Determination of promising native Feijoa (*Feijoa sellowiana* Berg.) genotypes from Sakarya Region in Turkey

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This study was conducted to determine Feijoa genotypes grown within seedling population in Sakarya region. In the study, approximately 300 Feijoa plants were surveyed. In these plants, 28 genotypes were labelled and evaluated. Phenological and pomological researches on these genotypes were made for two years. As a result of this study, 16 Feijoa genotypes were selected according to the weighted ranked method in this population. It was determined that fruit weight, fruit length, fruit width and shape index of the selected Feijoa genotypes changed from 21.66 to 40.00 g, 27.74 to 59.95 mm, 23.42 to 39.43 mm and 0.51 to 0.90, respectively. It was deternined that pH and total soluble solids in pulp of Feijoa genotypes varied from 2.84 to 4.55 and 10.00 to 16.00%, respectively. Flowering in the genotypes began in the last week of May and ended in the first week of July. Harvest time of the genotypes began in the second week of October and ended in the last week of November. In addition, it was determined that table properties of both selected and non selected Feijoa genotypes were lower than those of standard Feijoa varieties. However, because of the taste, aroma and yield properties of the selected Feijoa genotypes, studies should be continually done in the next stages of these genotypes.

Key words: Feijoa, acca, selection, pomology, phenology.

INTRODUCTION

As a result of the various ecological conditions, Turkey is the motherland of many fruit species. In addition, many fruit species which have different motherlands and which are important with respect to human nutrition and health, have adapted successfully to the ecological conditions and are cultivated economically in Turkey. Among these species, kiwi, avocado and pecan walnut are the most important (Agaoglu et al., 1995; Samanci, 1995; Ozdemir and Topuz, 1997; Ozdemir et al., 2004). Feijoa is one of the fruit species that attract attention with respect to both its herbal feature and fruit quality (Karadeniz, 2004; Ruberto and Tringali, 2004). Feijoa plant is from the family Myrtaceae and is known with different names such as *Feijoa sellowiana* and *Acca sellowiana* (Aisey et al., 2007; Anonymous, 2010a; Anonymous, 2010b; Anonymous, 2010c). Feijoa is a native plant of South America, and has grown both naturally and commercially in countries like Brazil, Argentina, Chile, Colombia, Uruguay and New Zealand (Morthon, 1987; Gilman and Watson, 1993; Gutierrez et al., 2008; Cangahuala et al., 2009). This species can be an evergreen bush and shrub or medium-size depending on pruning. Feijoa was brought to Europe in the end of the 19th century and then started to be cultivated in Turkey by Atatürk Horticulture Research Institute in 1989. Afterwards, adaptation orchards for *Feijoa* species were established in Sakarya, Antalya, Mersin and İzmir Provinces; although these adaptation studies are still progressing (Kahraman et al., 2007; Samanci, 1995).

The ecological needs of Feijoa plant are similar to that

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Table 1. Selection criteria used in weighted ranked method.

Selection criteria	Scores	Categories	Values
Yield of tree	30	(Low-Medium-High)	(3-5-7)
Fruit weight	20	(Low-Medium-High)	(3-5-7)
Fruit largeness	20	(Low-Medium-High)	(3-5-7)
Fruit flavor	10	(Low-Medium-High)	(3-5-7)
Fruit sourness	10	(Low-Medium-High)	(3-5-7)
Aroma	10	(Low-Medium-High)	(3-5-7)
Total	100	---	---

Table 2. Some fruit characteristics, averages and variation ranges of the Feijoa genotypes (average values in 2009 to 2010).

Characteriistics	Average	Variation range
Fruit weight (g)	22.89	10.00 - 40.00
Fruit length (mm)	41.88	27.74 - 59.95
Fruit width (mm)	30.54	23.42 - 39.43
Shape index	0.74	0.51- 0.90
Acidity (pH)	3.85	2.69 - 4.78
Total soluble solid content (%)	12.08	8.00 - 16.00

of olive tree; therefore, it can grow easily in the areas where olive trees are cultivated. Feijoa is attractive with its fruits, leaves and flowers. This plant contains biochemical substances; thus, it is popular in obtaining industrial food productions. In addition, the plant has been used in medical and pharmacological areas (Binder and Flath, 1989; Dicesare et al., 1995; Basile et al., 1997; Heinrich et al., 1998; Beyhan et al., 2010). This plant can be used for herbal treatment and in the drug industry, due to the presence of some substances, like antioxidants, antimicrobials, antidiabetics, anticough, antiinflamatory and antiallergic, in its fruit and leaves. The leaves of the Feijoa plant can be used as tea and for treatment of severe cough, digestion, dysentery, ulcer, diabetic and respiratory disorders. In addition, the Feijoa plant can be used as jam, canned food, ice cream, drink and flavouring industries (Morthon, 1987; Vuotto et al., 2000; Teixeira et al., 2003; Ojewole, 2006).

Productions in this fruit species were carried out under the leadership of Yalova Ataturk Horticulture Research Institute in Turkey. The private fruit sapling producers have propagated a generation to this plant recently. Therefore, genetic declinations have occured in this plant. As a result of this variety situation, standardization in Feijoa causes the occurrence of different plants from each other in modern orchards and they do not supply product standardization. In Feijoa plant, it is absolutely necessary to provide variety standardization for a commercial cultivation. Therefore, suitable varieties are selected for different purposes. Then, the selected varieties are vegetatively reproduced to increase their popularities (Beyhan, 2010). This study was conducted with the aim to determine their pomological and phenological properties by selection of promising genotypes among approximately 300 Feijoa genotypes grown within seedling trees which have different properties from each other in Sakarya region.

MATERIALS AND METHODS

This study was carried out in adaptation orchard established with approximately 300 Feijoa genotypes grown within seedling population in Akyazi District of Sakarya Province in years 2009 and 2010. Altitude, average annual rainfall, relative humidity and temperature of Akyazi District are 35 to 40 m, 1016 mm, 73.9% and 14.4°C, respectively. Coordinates of the orchard ranged from 296884 to 4507845 (Anonymous, 2009). This study began with the determination of Feijoa genotypes considering fruit features in the harvest period of 2009. Samples were taken from these genotypes in harvest period and these samples were pomologically evaluated. Phenological observations in these genotypes were determined in the spring of 2010. Fruit samples were taken from these genotypes again in the harvest period of 2010 and evaluated as two-year average data.

Primarily, fruit weight (g), fruit lenght (mm), fruit width (mm), shape index, pH of mature pulp and total soluble solids of the Feijoa genotypes were determined (Kacar, 1984). In determination of fruit weights and dimensions of these genotypes, 0.01 g sensitive digital scales and digital calipers were used respectively. Shape index was derived from the formula of fruit weight/fruit length (Kahraman et al., 2007). As fruit shapes and peel roughness states were visually determined, fruit flavor, aroma and sourness were evaluated sensually. However, the beginning and ending dates of flowering and harvest were phenologically determined, and the Feijoa genotypes were selected according to the weighted ranked method used by UPOV as shown in Table 1 (Beyhan, 2010).

RESULTS

This study was carried out in years 2009 to 2010. In the first year, 28 Feijoa genotypes were selected according to fruit and plant characteristics. In addition, pomological traits were determined by taking their fruit samples for two years. According to the weighted ranged method, the data regarding some fruit properties obtained from 26 Feijoa genotypes were given in Table 2. As can be seen from Table 2, the average fruit weight, fruit length, fruit width, shape index, pH of pulp and total soluble solids of 26 examined genotypes were determined to be 22.89 g, 41.88, 30.54 mm, 0.74, 3.85 and 12.08%, respectively. It was determined that variation ranges of fruit weight, fruit length, fruit width, shape index, pH of pulp and total soluble solids varied from 10.00 to 40.00 g, 27.74 to

Table 3. Average values and variation ranges of the selected genotypes according to weighted ranked method.

Characteristics	Average	Variation range
Fruit weight (g)	28.22	21.66 - 40.00
Fruit length (mm)	45.53	27.74 -59.95
Fruit width (mm)	32.79	23.42-39.43
Shape index	0.73	0.51 - 0.90
Acidity (pH)	3.84	2.84 - 4.55
Total soluble solid content (%)	12.57	10.00 - 16.00

59.95 mm, 23.42 to 39.43 mm, 0.51 to 0.90, 2.69 to 4.78 and 8.00 to 16.00%, respectively. Thus, the next selection studies will be appropriately carried out on these genotypes. The average values and variation ranges of the selected genotypes are given collectively in Table 3.

As can be seen in Table 3, average fruit weight, fruit length, fruit width, shape index, pH of pulp and total soluble solid content of the selected genotypes were found as 28.22 g, 45.53, 32.79 mm, 0.73, 3.84 and 12.57%, respectively. In addition, it was determined that variation ranges in fruit weight, fruit length, fruit width, shape index, pH of pulp and total soluble solid contents of the selected genotypes varied from 21.66 to 40.00 g, 27.74 to 59.95 mm, 23.42 to 39.43 mm, 0.51 to 0.90, 2.84 to 4.55 and 10.00 to 16.00%, respectively. Major pomological characteristics of the selected genotypes are given in detail in Tables 4 and 5. As can be seen in Table 5, flowering of selected genotypes began in the third week of May and lasted until the end of June. In addition, no significant differences were observed between the beginning and ending dates of flowering of these genotypes, but there were significant differences between harvest dates of these genotypes. It was observed that the harvest dates of two genotypes (Mestan 11 and 13), 3 genotypes (Mestan 5, 22 and 27) and other genotypes were early, late and mid ripening, respectively.

Fruit weight, length and width values of the selected genotypes were lower than both the given values of descriptors and some studies carried out in Turkey and abroad. Indeed, in a study conducted in Yalova, fruit weight, length and width of the selected genotypes varied from 23.28 to 69.29 g, 40.91 to 66.27 mm and 30.97 to 47.81 mm, repectively. In addition, shape index ranged from 0.60 to 0.90 (Kahraman et al., 2007). It was reported that the values of standard Feijoa varieties grown abroad were higher than those of this research. For example, fruit weights of Mammoth and Trumph varieties changed from 80.0 to 90.0 and 80.0 to 100.0 g, respectively. The values of other standard Feijoa varieties were close to those of the two varieties. In addition to fruit weight, values of fruit length were also higher than those obtained (Samanci, 1995; Kahraman et al., 2007; Anonymous, 2010a, b, c; Vuotto et al., 2000).

DISCUSSION

The major cause of lowness in fruit weights and the dimensions of the selected genotypes is their inherited properties. However, the values in Feijoa which is a tropical fruit species are higher than those of its motherland. Therefore, our results may seem normal. In a sense, ecological conditions of the region can significantly affect fruit dimensions. Beginning from September, the number of rainy and cloudy days increase in Sakarya region where we carried out our research. Accordingly the temperatures also start to fall in this region. However, increases in sizes and dimensions of Feijoa fruits began in these periods exactly. Thus, adverse ecological conditions in these periods prevented adequate development of fruits (Ozdemir and Topuz, 1997; Ozdemir et.al., 2004; Erdal, 2005; Biricik and Basoglu, 2006; Ekholm et.al., 2007; Gutierrez et.al., 2008; Kazankaya et.al., 2008; Eksi and Ozhamamcı, 2009). There is a wide variation in shape index of the selected genotypes. According to the values obtained, 4 of the selected genotypes are ‘globose’, 5 of them are long ‘cylindrical’ and 7 of them are ‘heart’ shaped. It can be said that shape characteristics are also genotype characteristics. Other studies made in Turkey and the descriptor’s data are also compatible with the results of our study (Samanci, 1995; Kahraman et.al., 2007; Anonymous 2010a,b,c).

It was determined that total soluble content and pulp pH of the selected genotypes varied from 10.00 to 16.00% and 2.84 to 5.00, respectively. These values are the main quality criteria which affect the taste and flavor of pulp and the table property. Acidity degrees of the selected genotypes were high because their pH was low. In addition, total soluble solid content of the selected genotypes was low as well. In a study conducted in Yalova, it was determined that the pH values of the selected genotypes were 5 and above, while their total soluble solid contents varied between 12.00 and 17.00%, respectively.

Moreover, values of the studies conducted abroad and the descriptors’ data are higher than those of our research (Samanci, 1995; Kahraman et.al., 2007; Anonymous, 2010a,b and c). It can be said that the major cause of high acidity and low total soluble solid content is their ecological conditions. As seen with other characteristics, sugar accumulation and pH change in Feijoa fruit occur in September and October. During this period, sunshine duration and intensity in Sakarya region was low. In other words, the number of cloudy and rainy days in this province was very much. Therefore, the fruit’s sugar accumulation decreased.

Besides, groundwater level of the research orchard in this region was high (Ozdemir and Topuz, 1997; Ozdemir et.al., 2004; Erdal, 2005; Biricik and Basoglu, 2006; Ekholm et.al., 2007; Gutierrez et.al., 2008; Kazankaya et.al., 2008; Eksi and Ozhamamci, 2009).

Table 4. Some important pomological characteristics of the selected genotypes.

Type No	Fruit weight (g)	Fruit length (mm)	Fruit width (mm)	Shape index (w/l)	Acidity (pH)	Total soluble solids (%)	Peel roughness	Fruit Shape
Mestan - 3	27.98	27.74	23.42	0.84	3.59	10.00	Smooth	Globular
Mestan- 5	29.23	49.27	35.12	0.71	3.73	10.00	Rough	Heart
Mestan- 9	27.78	42.50	34.67	0.81	4.40	11.20	Smooth	Heart
Mestan- 11	24.67	42.83	33.01	0.77	4.27	14.30	Medium	Heart
Mestan- 13	23.33	47.69	29.02	0.61	5.00	14.00	Medium	Cylindric
Mestan- 14	23.33	49.01	28.14	0.57	4.55	12.50	Rough	Cylindric
Mestan- 15	37.14	48.68	35.98	0.74	4.13	11.60	Medium	Globular
Mestan- 16	25.00	42.21	32.14	0.76	3.54	10.20	Smooth	Heart
Mestan- 18	25.46	39.71	34.53	0.87	3.76	12.40	Medium	Heart
Mestan- 21	32.86	41.55	37.39	0.90	4.15	13.90	Medium	Heart
Mestan -22	23.85	43.21	31.71	0.73	3.40	12.00	Medium	Globular
Mestan- 24	33.64	46.03	37.54	0.81	3.52	12.00	Medium	Heart
Mestan- 25	23.00	42.48	29.91	0.70	3.50	16.00	Medium	Cylindric
Mestan- 26	40.00	46.61	39.43	0.85	2.84	14.00	Rough	Globular
Mestan- 27	21.66	58.96	32.14	0.55	3.50	13.00	Smooth	Cylindric
Mestan- 28	32.66	59.95	30.63	0.51	3.45	14.00	Medium	Cylindric

Table 5. Some important sensual and phenological characteristics of the selected genotypes in 2010.

Type No	Fruit flavor	Aroma	Fruit sourness	First flowering	Least flowering	First harvest	Ripening period
Mestan- 3	Sweet	Exist	Medium	20 May	25 June	01.Nov.	Mid
Mestan- 5	Mid	Absent	High	25 May	25 June	20.Nov.	Late
Mestan- 9	Sweet	Exist	Medium	25 May	27 June	30.Oct.	Mid
Mestan-11	Sweet	Exist	Low	17 May	20 June	20.Oct.	Early
Mestan-13	Sweet	Exist	Low	17 May	20 June	15.Oct.	Early
Mestan-14	Sweet	Exist	Low	25 May	25 June	01.Nov.	Mid
Mestan-15	Mid	Absent	Medium	30 May	27 June	01.Nov.	Mid
Mestan-16	Sweet	Exist	Medium	25 May	27 June	01.Nov.	Mid
Mestan-18	Sweet	Exist	Medium	25 May	27 June	15.Nov.	Mid
Mestan-21	Sweet	Exist	Medium	25 May	30 June	01.Nov.	Mid
Mestan-22	Sweet	Exist	High	17 May	25 June	15.Nov.	Late
Mestan-24	Mid	Absent	High	20 May	25 June	01.Nov.	Mid
Mestan-25	Sweet	Exist	Low	20 May	25 June	01.Nov.	Mid
Mestan-26	Mid	Absent	High	25 May	27 June	01.Nov.	Mid
Mestan-27	Sweet	Exist	Low	20 May	25 June	15.Nov.	Late
Mestan-28	Sweet	Exist	High	20 May	25 June	01.Nov.	Mid

Conclusion

This study was carried out with the aim of selecting and revealing the pomological and phenological characteristics of promising Feijoa genotypes. Among these genotypes, 16 were selected to continue the next selection studies. There was a wide variation in the fruit characteristics of the examined genotypes. Thus, we can say that this variation of genetic declination is quite high in Feijoa plants.

REFERENCES

Agaoglu YS, Celik H, Celik M, Fidan Y, Gulsen Y, Gunay A, Hallaron N, Koksal Aİ, Yanmaz R (1995). General Horticultural Science, Ankara University, Faculty of Agriculture, Education and Research Foundation Publishings. Ankara,Turkey. p. 4.

Anonymous (2010). Dates of Turkey Union Meteorology DMK.Turkey

Anonymous (2010a). hhtp: //www.mytropical.com/popup/ Feijoa.html.

Anonymous (2010b). hhtp: //www.crfg.org/ pubs/ft/Feijoa.html.

Anonymous (2010c). http://www.en.wikipedia.org/wiki/Acca_sellowiana.

Asiey R, Pal RK, Sagar VR, Pate VB (2007). İmpact of Tree Age and Canopy Position on Fruit Quality of Guava, I.Internatıonal Guava

Symp. Acta Horticulturea, 735: 259-262.
Basile A, Wuotto ML, Violonte U, Sorbo S, Martone G, Cobianchi RC (1997). Antibacterial Activity in *Actinidia chinensis*, *Feijoa sellowiana* and *Aberia caffra*. İnt. J. Antimicrob. Agents 8:199-203.
Beyhan O (2010). A Study On Selection Of Promising Native Cherry Laurel (*Prunus laurocerasus* L.) Genotypes From Sakarya, Turkey. The Journal Of Animal And Plant Science,Vol. 20, No.4,233-235,ISSN:1018-7081.
Beyhan O, Elmastas M, Gedikli F (2010). Total Phenolic Compounds and Antioxidant Capacity of Leaf, Dry Fruit and Fresh Fruit of Feijoa (*Acca sellowiana*, Myrtaceae) J. Med. Plants Res., 4(11): 1065-1072.
Binder RG, Flath RA (1989). Volatile Components of Pineapple guava. J. Agic. Food Chem., 37: 734-736.
Biricik GF, Basoglu F (2006). Determination of Mineral Contents in Some Olives (Samanli, Domat, Manzanilla, Ascolana) Varieties. Gida, 31(2): 67-75.
Bozkurt MA, Yarılgac T, Cimrin KM (2001). Determination of Nutrition Status in Various Fruit trees. Yuzuncu Yıl Univ. J. Agic. Sci., 11(1): 39-45.
Cangahuala GC, Villarino A, Seixas D, Dumas EG, Guerra MP (2009). Differential Proteomic Analysis of Developmental Stages of Acca sellowiana Somatic Embriyos. Acta Physiol. Plant, 31: 501-514.
Dicesare LF, Nanı R, Dangelo V (1995). Composition on Distrubition of Volatile Compounds in Feijoa Fruit Gown in İtaly. Industrıe Alimentari, 34: 337, 498-503.
Ekholm P, Reinivvo H, Mattila P, Pakkalo H, Koponen J, Happonen J,Hellström J, Ovaskainen ML (2007). Changes in the Mineral and Trace Eelement Contents of Cereals, Fruits and Vegetables in Finland. J. Food Compos. Anal., 20: 487-495.
Eksi A, Ozhamamci I (2009). Chemical Composition and Guide Values of Pomeganate Juice, Gida 34(5): 265-270.
Erdal I (2005). Leaf Nutritient Consentrations of Apple Orchards in Isparta Province, J. Ag Sci., 11(4): 411-416.
Gilman EF, Watson DG (1993). *Feijoa sellowiana*, Guava, Institue of Food and Agicultural Sciences University of Florida. Environmental Hortıculture Department, Fact Sheet ST-249, Florida.
Gutierrez RMP, Mitchell S, Solis RV (2008). *Pisidium guajava*: A Review of Its Traditional Uses, Phytochemistry and Pharmacology, J. Ethno Pharmacol., 117: 1-27.
Heinrich M, Ankli A, Frei B, Weimann C, Sticher O (1998). Medicinalplants in Mexico: Healers Consensus and Cultural Importance. Soc. Sci. Med., 47: 1859–1871.
Kahraman KA, Atak A, Kil L (2007). Determining of Phenologic and Pomologic Characteristics of Some Wild Feijoa Genotypes (*Feijoa sellowiana* Berg.) in Turkey.V.Natıonal Hortıculturea Congees. 4-7 September Erzurum, Turkey. Pp. 380-386.
Kazankaya A, Balta F, Ozturk N, Sonmez F (2008). Mineral Composition of Pistacia (*Pistacia vera* L.) from Siirt Turkey, Asian J. Chem., 20(3): 2337-2343.
Morthon J (1987). Feijoa (*Feijoa sellowiana* Berg.) Fruits of Warm Climates Wikipedia Com, file://localhost/C:/Documents and settings/Administrator/Desktop/Feijoa.mht.
Ojewole JA (2006). Antiinflamatory and Analgesic Effects of *Psidium guajava* Linn. (Myrtaceae) Leaf Aqueous Extract in Rats and Mice. Methods and Findings in Experimental and Clinical Pharmacology, 28: 441–446.
Ozdemir F, Topuz A (1997). Some Physical and Chemical Properties of Loquat Fruit, Gida 22(5): 389-393.
Ozdemir F, Topuz A, Demirkol A, Golukcu M (2004). Changes in Composition of some Avokado (*Persa americana* Mill.) Cultivars during Harvesting Time and Postharvest Ripening Period. Gıda 29(2): 177-183.
Ruberto G, Tringali C (2004). Secondary Metabolites From The Leaves of Feijoa (*Feijoa sellowiana* Berg.) Phytochemistry 65: 2947-2951.
Samanci H (1995). A New Type of Fruit, Feijoa (*Feijoa sellowiana* Berg.) Marmara'da Tarim, 63: 14-15.
Teixeira RS, Camparoto ML, Mantovani MS, Vicentini VEP (2003). Asessment of Two Medicinal Plants, *Psidium guajava* L. and *Achillea millefolium* L., in vitro and in vivo Assays. Genet. Mol. Biol., 26:234–239.
Vuotto ML, Basile A, Moscatiello V, Desole P, Cobianchi RC, Laghi E, Ielpo MTL (2000). Antimicrobial and Antioxidant Activities of *Feijoa sellowiana* Fruit. Int. J. Antimicrob. Agents, 13: 197-201.