Turkish Journal of Agricultural and Natural Sciences
Special Issue: 2, 2014

TÜRK
TARIM ve DOĞA BİLİMLERİ
DERGİSİ

TURKISH
JOURNAL of AGRICULTURAL
and NATURAL SCIENCES

www.turkjans.com

Some Pomological Properties of Promising Persimmon Genotypes from Ardeşen and Pazar Province (Rize), Turkey

[a] Emre VARDAL, [b] Tarık YARILGAÇ*
[a] Ministry of Food Agriculture and Livestock, Rize, Turkey
[b] Department of Horticulture, Faculty of Agriculture, University of Ordu, Ordu, Turkey
*Corresponding author: t.yarilgac@odu.edu.tr

Abstract

Turkey has a great potential with regard to fruit species and varieties. Eastern Black Sea Region is located within natural growing sites of such a rich diversity. The present research was conducted to determine pomological properties of some persimmon genotypes selected from Eastern Black Sea Region (Ardeşen and Pazar Provinces) with a rich local persimmon population. Fruit weight, fruit size (length, width and thickness), fruit shape index, flesh and skin color, astringency, fibrousness, soluble solids content, titratable acidity and pH values were investigated as the pomological properties. Fruit weights of selected genotypes varied between 165.5 – 303.3 g in 2007 and between 254.9 – 308.2 g in 2008. Fruit shape of almost all of the selected genotypes was round but fruit flesh was not astringent. Skin color was generally orange. SSC values of the genotypes varied between 14.90 – 21.40% in 2007 and between 15.80 – 24.10% in 2008.

Keywords: Color, fibrousness, fruit weight, shape index, soluble solids content

Ardeşen ve Pazar İlçelerinden (Rize) Seçilmiş Trabzonhurması Genotiplerinin Bazı Pomolojik Özellikleri

Özet

Türkiye, meyve tür ve çeşitliliği bakımından büyük bir potansiyele sahiptir. Doğu Karadeniz Bölgesi bu çeşitliliğin gözlemlendiği doğal yetişme alanlarını içine almaktadır. Bu çalışma, zengin yerel trabzonhurması popülasyonuna sahip Doğu Karadeniz Bölgesi'nden (Ardeşen ve Pazar) seçilmiş bazı trabzonhurması genotiplerinin pomolojik özelliklerini belirlemek amacıyla yürütülmüştür. Çalışmada, meyve ağırlığı, meyve boyutsal özellikleri (boy, en, kalınlık), meyve şekil indeksi, meyve şekli, et ve kabuk rengi, burukluk, liflilik, suda çözünebilir kuru madde (SÇKM), titre edilebilir asitlik ve pH gibi bazı pomolojik özellikler incelenmiştir. Seçilmiş genotiplerde meyve ağırlığı 2007 yılında 165.5 ile 303.3 g, 2008 de ise 254.9 ile 308.2 g aralığında değişmiştir. Seçilmiş genotiplerin hemen hemen tümünün meyve şekli yuvarlak bulunurken, meyve etlerinin buruk olmadığı tespit edilmiştir. Genotiplerin, meyve kabuk ve et renginin turuncu olduğu gözlemlenmiştir. Seçilmiş genotiplerin 2007 yılında SÇKM değeri % 14.90 ile % 21.40, 2008 yılında ise % 15.80ile % 24.10 aralığında değişmiştir.

Anahtar Kelimeler: Liflilik, meyve ağırlığı, renk, suda çözünebilir kuru madde, şekil indeksi

Introduction

Persimmon cultivation is increasing in Turkey as it was worldwide together with increasing consumptive demands because of rich vitamin (vitamin A), carbohydrate, mineral and antioxidant contents of the fruits. Persimmon fruits play significant roles especially in treatment of cardiovascular and digestive system diseases, in enriching immune system and in elimination of anemia (Şeker and Toplu, 2003; Karadeniz, 2004).

Persimmon is cultivated primarily in China, Far East and Mediterranean countries, Black Sea basin and America (Onur, 1990). While 2.3 million tons produced worldwide from about 300 000 ha land area in the year 2000, the production was realized as 4.5 million tons from around 814 000 ha in the year 2012 (FAO, 2014). In Turkey, 33 232 tons production was realized from about 2264 ha land area in the year 2013 (TUİK, 2014).

The species *Diospyros kaki* is commercially the most valuable species of persimmon. It was initially widespread from Russia to Black Sea Region of Turkey. Therefore, persimmon is also known with the local name of 'Trabzonhurması' (Tuzcu and Yıldırım, 2000). It is also called as 'Hurma', 'Cennet meyvesi', 'Japon elması' and 'Amme' in different

regions of Turkey. Persimmon is particularly cultivated in Mediterranean and Black Sea Regions and other hot-mild climate regions of Turkey (Onur, 1990). It is most of the time naturally grown and grown from the seeds. Therefore, there are several persimmon genotypes available in cultivated regions. Cultivators have preserved the promising genotypes and widespread them through various means (Sütyemez and Ergenoğlu, 2000). The genotypes grown from the seeds should be used selection researches and the ones with superior characteristics should be determined through breeding and fruit development programs. Thus, several selection researches were carried out both in Turkey and in the world (Sütyemez and Ergenoğlu, 2000; Yıldız, 2005; Yamada et al., 2006).

The purpose of this study was to describe pomological characteristics of persimmon genotypes growing in the wild of Pazar and Ardeşen districts of Rize province (Turkey).

Materials and Methods

Research area and sampling

The present study was carried out in Eastern Black Sea Region in the years 2007 and 2008. The research site covers two towns (Pazar and Ardeşen) of Rize Province and located between 41°.04' and 41°.10' north latitude and 40°.52' and 40°.58' east longitude for Pazar, between 41°.05' and 41°.10' north latitude and 40°.57' and 41°.13' east longitude for Ardeşen. The altitude of research area that surveyed ranged from 5 to 500 m. The average annual rainfall ranges from 2000 to 2300 mm and the climate of research area is characterized by a cool summers and mild winters. The mean temperature and relative humidity are 14-15 °C and 77%, respectively. Soil textures within the district include sandy-loam, loam and sandy-clay loam. The pH ranges from 5.5 to 7.7 and the soil organic matter is generally high.

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, training and irrigation. Trees of the selected genotypes located in farmer orchards or in mixed plantations. They were between the ages 5 - 25 years and were all originally grafted onto seedling rootstocks. Each tree was considered as a genotype. Initially, 85 different persimmon genotypes were selected by considering their fruit weight, fruit sizes, soluble solids content, titratable acidity, astringency and fibrousness. In 2007, these 85 genotypes were assessed and by using the "weight ranked method" based on fruit weight, fruit sizes, soluble solids content (SSC), titratable acidity, astringency and fibrousness, 67 persimmon genotypes were selected as being superior. In 2008, further evaluations identified 6 persimmon genotypes that were selected as being promising commercial persimmon cultivars.

Fruit quality evaluation

Fruit characteristics of each of the persimmon genotypes, such as fruit weight, fruit sizes (length, width and thickness), fruit shape, flesh and skin color, astringency, fibrousness, SSC, titratable acidity and pH, were determined from 10 fruits that were sampled randomly from the sun-exposed outside parts of each genotype canopy.

Fruit weights were determined by using a digital balance (±0.01 g) (Radvag PS 4500/C/1, Poland). The fruit length, width, and thickness were measured with 0.01 mm sensitive digital calipers (Model No; CD-6CSX, Mitutoyo, Japan). Fruit shape was classified as 'short conic', 'conic', 'long conic', 'long', 'round', 'oblate' or 'angled'. By using fruit width and length, shape index was calculated with the following equation: shape index=fruit width/fruit length. Skin color was classified as 'yellow-orange', 'orange' or 'red-orange'. In 2008, skin and flesh color of persimmons was also measured by a colorimeter (Minolta, CR-400, Japan) as L*, a* and b*. The hue angle (h^o) expresses the color nuance and values are defined as follows: red-purple: 0°; yellow: 90°; bluish green: 180°; blue: 270°. The chroma (C^*) is a measure of chromaticity, which defines the purity or saturation of the color. The chroma value was calculated with the formula $C^*=(a^{*2}+b^{*2})^{1/2}$, and the hue angle with $h°= \tan^{-1} b^*/a^*$.The flesh color was classified as 'yellow', 'yellow-orange', 'orange', 'red-orange', 'brown-orange' or 'brown'. Astringency was scored as 'absent', 'low' or 'high'. Fibrousness was scored as 'absent', 'middle' or 'high'. SSC was measured using a digital refractometer (PAL-1, McCormick Fruit Tech., Yakima, Wash) as percentages. The pH value was measured with pH meter (HI9321; Hanna instruments, Padova, Italy). Titratable acidity was determined by titrating to a pH of 8.1 with 0.1 N sodium hydroxide (NaOH) and expressed as g malic acid 100 mL^{-1}.

Data analysis

Persimmon genotypes were rated from high to low for each of five fruit characteristics using a 'weight ranked method'.

Results and Discussion

Initially, 85 persimmon genotypes were evaluated. Based on the scores obtained through weight-ranked method, 6 of these genotypes were selected as superior. In the year 2008, fruit weights of selected genotypes varied between 234.1 - 308.2 g, [53 AR 12 (308.2 g)]. The genotypes with higher fruit weights also had higher fruit lengths, widths

and thicknesses. In the year 2008, the highest fruit length, width and thickness values (74.10, 88.66 and 82.52 mm, respectively) were observed in 53 AR 12 genotype. With regard to shape index, the highest value was observed in genotype 53 PA 27 (1.24) in 2007 and in genotype 53 PA 40 (1.30) in 2008 (Table 1). In previous international and local studies, fruit weights were reported as between 72.0-200.9 g by Yamada et al. (1994); between 106.6-222.1 g by Onur (1995); between 68.7-287.0 g by Onur and Onur (1997); between 189.5-310.9 g by Özkaraman and Özcan (1998); between 45.5-267.7 g by Akça et al. (1999); between 195.01-359.57 g by Sütyemez and Ergenoğlu (2000); between 109.0-293.0 g by Akbulut et al. (2004) and between 61.1-293.3 g by Kaplankıran et al. (2004).

Table 1. The fruit weight, fruit length, fruit width, fruit thickness and shape index of promising persimmon genotypes in 2007 and 2008.

Genotypes	Fruit weight (g)		Fruit length (mm)		Fruit width (mm)		Fruit thickness (mm)		Shape index	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
53 PA 25	303.3	234.1	79.57	64.08	84.32	79.59	73.00	76.03	1.06	1.24
53 PA 27	262.9	280.8	66.65	70.69	82.57	86.35	77.26	81.02	1.24	1.22
53 PA 40	207.9	256.0	75.04	64.44	73.18	83.60	67.27	79.22	0.98	1.30
53 PA 79	243.6	259.5	71.83	69.93	78.85	83.17	67.50	78.54	1.10	1.19
53 PA 84	168.9	254.9	64.93	65.49	68.13	82.63	60.22	74.80	1.05	1.26
53 AR 12	165.51	308.2	63.32	74.10	68.16	88.66	61.36	82.52	1.08	1.20

Fruit lengths and widths were reported respectively as between 41.4-82.9 and 52.8-88.4 mm by Onur and Onur (1997); between 59.25-71.14 and 72.28-83.68 mm by Özkaraman and Özcan (1998); between 38.55-67.65 and 42.08-78.15 mm by Akça et al. (1999); between 63.5-82.3 and 69.2-87.1 mm by Sütyemez and Ergenoğlu (2000). Kaplankıran et al. (2004) in a study carried out under Hatay ecological conditions reported the shape index of persimmons as between 0.39-1.45; Çelik and Erçişli (2007) carried out a study on Hachiya cultivar and reported the shape index as 1.09. With regard to fruit weights and other dimensional characteristics, other researchers also reported the similar values. However, fruit weight and other dimensional characteristics of the genotype 53 AR 12 selected in this study were higher than the previously reported values.

Fruit shape of selected persimmon genotypes was round. With regard to skin color of the selected persimmon genotypes, they mostly had orange color, but the genotype 53 AR 12 had a skin color of yellow-orange, 53 PA 25 had yellow-red-orange skin color. Flesh color of the selected genotypes varied among yellow-brown-orange. Fruit flesh of selected genotypes was not astringent (low for 53 PA 25), fibrousness of the genotypes was low or medium but fibrousness of the genotype 53 PA 25 was high (Table 2). Sütyemez and Ergenoğlu (2000) carried out a research under ecological conditions of Kahramanmaraş and reported the general shape of the genotypes as conical, skin and flesh color as orange and fibrousness as medium. While astringency is a significant factor negatively effecting the consumption of persimmon, higher fibrousness positively affects the consumption (Zavrtanık et al., 1999).

Of the skins of selected genotypes, L* values varied between 36.79 - 56.79, a* values varied between 16.79 - 38.26, b* values varied between 20.37 - 51.17, C* values varied between 26.40 - 61.44 and hue angles varied between 50.51 - 57.96. With regard to fruit flesh, L* values varied between 31.84 - 51.08, a* values between 10.28 -15.48, b* values between 25.60 - 43.04, C* values between 27.59 - 45.74 and hue angles between 60.78 - 73.79 (Table 3). Öz (2002) reported L*, a* and b* values of fruit skin respectively as 67.91, 18.73 and 63.60. Çelik and Erçişli (2007) carried out a study on cultivar Hachiya and reported the L*, a* and b* values of fruit skin respectively as between 58.13-68.15, 24.10-36.98 and 51.94-70.88 and L*, a* and b* values of fruit flesh respectively as between 61.18-69.25, 7.64-14.38 and 49.64-61.94. Current findings were relatively lower than the values reported by previous researchers.

Table 2. Fruit shape, skin and flesh color, astringency and fibrousness of promising persimmon genotypes in 2007 and 2008.

Genotypes	Fruit shape		Skin color		Flesh color		Astringency		Fibrousness	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
53 PA 25	Round	Round	Yellow-Orange	Red-Orange	Brown-Orange	Brown-Orange	Low	Low	Middle	High
53 PA 27	Round	Round	Yellow-Orange	Orange	Yellow	Yellow-Orange	Low	Absent	Low	Middle
53 PA 40	Round	Round	Orange	Orange	Brown-Orange	Yellow-Orange	Absent	Absent	Low	Absent
53 PA 79	Round	Round	Orange	Orange	Brown	Brown-Orange	Absent	Absent	Middle	Middle
53 PA 84	Round	Oblate	Orange	Orange	Brown-Orange	Yellow-Orange	Absent	Absent	Low	Low
53 AR 12	Round	Round	Yellow-Orange	Yellow-Orange	Yellow	Yellow-Orange	Absent	Absent	Middle	Low

Table 3. Color characteristics (L*, a*, b*, C* and hue angle) of promising persimmon genotypes in 2008.

Genotypes	Skin color					Flesh color				
	L*	a*	b*	C*	Hue °	L*	a*	b*	C*	Hue °
53 PA 25	36.79	16.79	20.37	26.40	50.51	32.56	10.28	25.60	27.59	68.11
53 PA 27	50.94	33.02	46.57	57.09	54.66	44.07	13.00	40.69	42.72	72.29
53 PA 40	56.79	29.21	46.68	55.06	57.96	31.84	10.91	26.30	28.47	67.46
53 PA 79	55.72	34.02	51.17	61.44	56.38	51.08	15.48	43.04	45.74	70.22
53 PA 84	50.76	27.56	41.61	49.91	56.48	36.84	16.65	29.77	34.11	60.78
53 AR 12	54.64	38.26	53.67	65.91	54.52	45.80	11.06	38.04	39.61	73.79

Table 4. Soluble solids content, titratable acidity and pH of promising persimmon genotypes in 2007 and 2008.

Genotypes	Soluble solids content (%)		Titratable acidity (g malic acid 100 mL^{-1})		pH	
	2007	2008	2007	2008	2007	2008
53 PA 25	21.40	22.10	0.158	0.144	6.27	5.90
53 PA 27	17.50	21.00	0.104	0.147	6.08	5.95
53 PA 40	16.10	24.10	0.141	0.147	6.03	6.25
53 PA 79	16.00	21.20	0.057	0.101	6.26	6.44
53 PA 84	15.20	22.00	0.074	0.131	6.34	6.24
53 AR 12	14.90	15.80	0.074	0.127	6.34	6.24

In the year 2007, SSC contents of selected genotypes varied between 14.90 - 21.40%, titratable acidity between 0.074 - 0.158 g malic acid and pH values between 6.03 - 6.34; in the year 2008, SSC varied between 15.80 - 24.10%, titratable acidity between 0.101 - 0.147 g malic acid and pH values between 5.90 - 6.44 (Table 4). SSC contents under different ecological conditions were reported as between 16.4-20.7% by Aksu (1994); between 13.0-21.0% by Onur and Onur (1997); between 14.8-18.8% by Özkaraman and Özcan (1998); between 17.0-21.5% by Onur (1995); between 17.0-25.0% by Akça et al. (1999) and between 19.0-25.7% by Sütyemez and Ergenoğlu (2000). Titratable acidity was reported as between 0.119-0.201 by

Özkaraman and Özcan (1998); between 1.34-1.76 malic acid by Sütyemez and Ergenoğlu (2000); between 0.07-0.31 g/100 ml usare by Akbulut et al. (2004); as 0.167 by Karadeniz and Cangi (2004). pH values were reported as between 6.11-6.52 by Sütyemez and Ergenoğlu (2000); as 5.45 by Karadeniz and Cangi (2004); as 5.40 by Çelik and Ercişli (2007). Current findings are parallel to above provided findings.

Conclusion

As a result, selected persimmon genotypes had preferable fruit weight, size and homogeneous color. The astringency, limiting the consumption and eating quality, was significantly low and fibrousness was at medium level. They also have SSC values close to the values specified for the culture cultivars. Further studies should be carried out in detail to serve the selected genotypes to country agriculture.

References

Akbulut, M., Kaplan, N., Macit, İ., Koç, A., 2004. Karadeniz Bölgesi trabzonhurması (*Diospyros kaki* L.) seleksiyonu. 1. Trabzonhurması Yetiştirme ve Pazarlama Sempozyumu. Ondokuz Mayıs Üniversitesi Ünye İktisadi ve İdari Bilimler Fakültesi Yayınları 2: 32-40.

Akça, Y., Özkan, Y., Kaya, E., Gümüş, A., Keskin, S., 1999. Tokat ve yöresinde trabzonhurması (*Diospyros kaki* L.) seleksiyon çalışmaları. "Türkiye 3. Ulusal Bahçe Bitkileri Kongresi 14-17 Eylül 1999, Ankara, s: 792-793.

Aksu, M.İ., Nas, S., Gökalp, H.Y., 1994. Artvin-Yusufeli vadisinde yetiştirilen trabzonhurması meyvelerinin bazı fiziksel ve kimyasal özellikleri. *Gıda* 19(6): 367-371.

Çelik, A., Ercişli, S., 2007. Persimmon cv. Hachiya (*Diospyros kaki* Thunb.) fruit: Some physical, chemical and nutritional properties. *Int J Food Sci Nut* 59(7-8): 599-606.

FAO, 2014. http://faostat.fao.org (Access to web: 25 June 2014)

Kaplankıran, M., Yıldız, E., Toplu, C., 2004. Hatay ili trabzonhurması seleksiyonunda ilk bulgular. 1. Trabzonhurması Yetiştirme ve Pazarlama Sempozyumu. Ondokuz Mayıs Üniversitesi Ünye İktisadi ve İdari Bilimler Fakültesi Yayınları 2: 103-110.

Karadeniz, T., 2004. Şifalı Meyveler. Burcan ofset matbaacılık sanayi, Ordu, s. 208.

Karadeniz, T., Cangi, R., 2004. Trabzonhurması (*Diospyros kaki* L.) Moralı çeşidinde fenolojik ve pomolojik özelliklerin belirlenmesi. *Anadolu Tarım Bilimleri Dergisi* 19(1): 8-11.

Onur, C., 1990. Trabzonhurması özel sayısı. *Derim* 7 (1).

Onur, S., 1995. Trabzonhurması çeşitlerinin adaptasyonu. *Derim* 12 (1): 8-18.

Onur, C., Onur, S., 1997. Karadeniz Bölgesi trabzonhurması (*Diospyros kaki* L.) seleksiyonu. *Derim* 14(4): 146-156.

Öz, A.T., 2002. İki farklı sıcaklığın trabzonhurmasında L-askorbik asit (C vitamini) içeriği, muhafaza ömrü ve meyve kalite kriterleri üzerine etkileri. *Bahçe* 31(1-2): 51-57.

Özkaraman, F., Özcan, M., 1998. Ordu'nun Ünye ilçesinde trabzonhurmasının (*Diospyros kaki* L.) seleksiyon yoluyla ıslahı üzerinde bir araştırma. *Anadolu Tarım Bilimleri Dergisi* 13(2): 51-65.

Sütyemez, M., Ergenoğlu, F., 2000. Kahramanmaraş bölgesinde trabzonhurması (*Diospyros kaki* L.) seleksiyonu. Fen ve Mühendislik Dergisi 3(1): 51-57.

Şeker, M., Toplu, C., 2003. Trabzonhurması yetiştiriciliği. *Türktarım Dergisi* 149: 35-37.

TUİK, 2014. www.tuik.gov.tr (Erişim 25 Haziran 2014)

Tuzcu, Ö., Yıldırım, B., Trabzonhurması (*Diospyros kaki* L.) ve yetiştiriciliği. Türkiye Bilimsel ve Teknik Araştırmalar Kurumu, Türkiye Tarımsal Araştırma Projesi Yayınları, Adana.

Yamada, M., Sato, A., Yamane, H., Yoshinaga, K., Hirakawa, N., Iwanami, H., Ozawa, T., Kakutani, M., Mitani, N., Yoshioka, M., Nakajima, I., 2006. New Japanese persimmon cultivar 'Kanshu'. *Bulletin of the National Institute of Fruit Tree Science* 5: 95-106.

Yıldız, E., 2005. Hatay ili tarbzonhurmalarının seleksiyon yoluyla ıslahı. Mustafa Kemal Üniversitesi, Fen Bilimleri Enstitüsü Yüksek Lisans Tezi, 302 sayfa, Hatay.

Zavrtanık, M., Hribar, J., Vidrih, R., Effect of short anoxia exposure on metabolic changes of persimmon fruits (Diospyros kaki L.). *Acta Horticulturae* 485: 405-411.