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Research Article

The Determination of Promising Genotypes in Native Walnut *(Juglans regia L.)* Populations of Hani (Diyarbakır) District

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Abstract

This study was carried out to determine the promising walnut genotypes, to two years (2017-2018) in the Hani district of Diyarbakır province. In this study, 19 genotypes were selected as promising from about 4000 seeds origin walnut trees. In these selected genotypes, the fruit weights were between 10.03-15.46 g, kernel weights were between 5.00-6.77 g, kernel rates from 41.18% to 53.65%, shell thicknesses were between 1.47-2.03 mm. In selected genotypes shell color as 'light' for 13 genotypes, as 'dark' for 6 genotypes; inner shell color as 'light' for 6 genotypes, as 'yellow' for 9 genotypes and as 'dark' for 4 genotypes. Blooming habits of promising genotypes were protandrous in 14 genotypes, protogynous in 1 genotype and homogamous in 1 genotype. The lateral fruitfulness ratio was found to be between 0.00% to -100.00 %.

Keywords: Walnut, genotype, selection, Diyarbakır, Hani.

Diyarbakır'ın Hani İlçesi Doğal Ceviz Popülasyonu İçerisinde Ümitvar Ceviz *(Juglans regia L.)* Genotiplerinin Belirlenmesi

Özet

Diyarbakır'ın Hani ilçesinde 2 yıl (2017-2018) süreyle yürütülen bu çalışmada üstün özellik gösteren ceviz genotiplerinin belirlenmesi amaçlanmıştır. Çalışmada yaklaşık 4000 adet tohumdan yetişmiş ceviz genotipi içerisinden 19 genotip ümitvar olarak seçilmiştir. Seçilen genotiplerde, kabuklu meyve ağırlığı 10.03-15.46 g, iç ağırlığı 5.00-6.77 g, iç oranı %41.18-%53.65 ve kabuk kalınlığının ise 1.47-2.03 mm arasında olduğu belirlenmiştir. Seçilen genotiplerin, kabuk rengi 13'ünde 'açık', 6'sında 'esmer, iç rengi ise 6'sında 'açık', 9'unda 'sarı' ve 4'ünde 'esmer'olarak değerlendirilmiştir. Ümitvar genotiplerin 14'ünün protandry, 1'inin protogeny ve 4'ünün homogamy çiçeklenme karakteri gösterdiği tespit edilmiştir. Yan dallarda meyve tutma oranının %0.00 ile %100 arasında olduğu görülmüştür.

Anahtar kelimeler: Ceviz, genotip, seleksiyon , Diyarbakır, Hani.

Introduction

Although there are 18 different walnut species in the world, it is *Juglans regia* L. which is widely cultivated economically. Turkey is one of the world's oldest country which walnut cultivation (Şen, 1986; Akça, 2001).

Turkey produces annually 210.000 tons walnut and ranking 4th place after China (1.925.403 tons), USA (571.526 tons) and Iran (349.192 tons) (FAO, 2019). Turkey has 11.250.526 bearing walnut trees which a large part has grown from seed (TUİK, 2019). Our country is in a very rich state in terms of walnut gene resources. Even though our country has very rich walnut gene resources, it is not among the leading countries in the word walnut production. This is due to the fact that still obtained from seed-origin trees the majority of walnut produced in our country. Nowadays, although shows a rapid increase in the number of orchards established with standard cultivars, it is not enough and there are productivity problems. Selection of genotypes showing superior characteristics in terms of yield and quality with selection studies in different regions, receiving of cultivar certificate of

these genotypes, and increasing the number of orchards established with standard cultivars will make significant contributions to walnut production and export (Yıldırım et al., 2005, Demir et al., 2019).

In this study, which is a follow-up of the selection studies conducted in our country was carried out to the aim of selection of the promising walnut genotypes in Hani district of Diyarbakir and their villages, to prevent them from disappearing and to detect their pomological properties

Materials and Methods

Material

This study was carried out to determine promising walnut genotypes in the center and villages Hani district of Diyarbakır during the years 2017-2018 in Turkey. Fruit samples were picked from 120 genotypes determined by pre-selection from approximately 4000 walnut populations and examined in terms of fruit characteristics according to walnut selection criteria. In 120 walnut genotypes in 2017, 44 genotypes which had more than 10.00 g of the fruit weight, more than 5.00 g of the kernel weight were selected for second years.

Method

For pomological properties such as the fruit weight (g), kernel weight (g), fruit width (mm), fruit length (mm), fruit height (mm), kernel ratio (%), shell thickness (mm), shell color, shell roughness, cracking status, kernel fullness, kernel color, fruit shape, and fruit size were investigated 20 fruit from each genotype. As the phenological observation, first leaf initiation date, flowering/blooming conditions or habit (homogamous, protandrous, protogynous), fruit yield in lateral branches and harvested time were observed.

It was used a weighted-ranked method for comparison of the selected walnut genotypes and evaluation, used by Şen, 1980 and Yarılgaç, 1997 (Table 1). 19 genotypes which had high scores according to the weighted-ranked method were selected as promising

Results and Discussion

The fruit weight, kernel weight, kernel ratio, shell thickness, kernel shrinkage, kernel /rate, shell roughness, shelled and kernel fruit color are among the most important walnut breeding criteria's in walnut selection studies (Ölez, 1971; Şen, 1980; Paunovic, 1990; Yarılgaç 1997; Akça, 2009; Sutyemez, 2016).

Table 1. Criteria's based on weighted ranking method, relative scores and value scores of these criteria

Criteria	Relative score (%)	Value scores	
Shelled fruit weight	25	Very heavy	:10
		Heavy	:8
		Medium	:6
		Light	:4
		Very light	:2
Kernel Ratio	20	Very High	:10
		High	:8
		Medium	:6
		Low	:4
		Very low	:2
Shell Color	15	Light	:10
		Medium	:6
		Dark	:2
Fruit Size	10	Very big	:10
		Large	:8
		Medium	:6
		Small	:4
		Very small	:2
Full Kernel Ratio	5	%100	:10
		%80-90	:6
		%70≥	:2
Strong Kernel Ratio	5	%100	:10
		%80-90	:6
		%70≥	:2
Shell Roughness	5	Straight	:10
		Medium	:6
		Rough	:2
Shell Thickness	5	Very thin	:10
		Thin	:8
		Medium Thick	:6
		Thick	:4
		Very Thick	:2
Shell Cracking Status	5	Easy	:10
		Medium	:6
		Hard	:2
Kernel Fullness	5	Good	:10
		Medium	:6
		Bad	:2
TOTAL	100		

In this study, according to the results of the weighted-ranked method, 19 walnut genotypes (Hani 4, Hani 7, Hani 14, Hani 19, Hani 20, Hani 32, Hani 43, Hani 58, Hani 59, Hani 64, Hani 68, Hani 70, Hani 84, Hani 85, Hani 87, Hani 89, Hani 95, Hani 105, Hani 119) were selected as promising. Fruit characteristics of 19 genotypes selected as promising are given in Table 2 and Table 3.

Table 2. Some pomological properties of the walnut genotypes selected from Hani district

Genotype No	Fruit weight (g)	Kernel weight (g)	Fruit width (mm)	Fruit length (mm)	Fruit height (mm)	Kernel Ratio (%)	Shell thickness (mm)
Hani 4	12.15	5.64	29.17	36.42	33.48	46.36	1.82
Hani 7	10.77	5.19	29.40	34.56	30.33	48.24	1.78
Hani 14	10.03	5.00	27.38	31.52	29.48	50.24	1.88
Hani 19	10.15	5.45	29.73	36.94	30.48	53.65	1.47
Hani 20	10.42	5.15	28.16	31.20	29.15	49.51	1.83
Hani 32	10.36	5.06	30.98	34.48	29.49	48.78	1.77
Hani 43	14.60	6.22	31.20	37.36	33.17	42.59	1.99
Hani 58	14.17	6.77	35.04	50.12	35.88	47.85	1.58
Hani 59	15.46	6.70	33.45	45.41	34.55	43.30	1.71
Hani 64	11.54	5.23	32.54	41.64	32.18	45.34	1.71
Hani 68	10.36	5.25	31.98	37.93	31.99	52.65	1.54
Hani 70	13.28	6.11	31.96	37.71	32.85	45.98	1.89
Hani 84	11.75	5.70	31.62	35.52	33.03	49.07	1.63
Hani 85	11.28	5.90	31.66	36.59	31.56	52.29	2.03
Hani 87	11.36	5.82	30.33	40.90	32.31	51.20	1.53
Hani 89	12.95	6.64	31.20	36.92	34.40	51.28	1.69
Hani 95	13.94	5.80	32.30	38.55	31.50	41.18	2.00
Hani 105	10.52	5.08	27.53	38.63	29.58	48.78	1.96
Hani 116	11.91	5.63	43.03	34.93	32.96	46.84	1.74

According to 2-year averages, shelled fruit width was found to be lowest at 27.38 mm (Hani 14) and highest at 43.03 mm (Hani 116). Shelled fruit length was found to be lowest at 31.20 mm (Hani 20) and highest at 50.12 mm. Shelled fruit height was found to be lowest at 29.15 mm (Hani 20) and highest at 35.88 mm (Hani 58). Fruit weight was found to be lowest at 10.03 g in Hani 14 and highest at 15.46 g in Hani 59. Promising genotypes averagely changed between kernel weight of 5.00-6.77g, kernel ratio of 41.18-53.65% and shell thickness of 1.47-2.03 mm.

Karadag (2007), in a study that performed on some promising selected walnut genotypes, reported the average fruit weight as 10.35 g, kernel weight as 5.17 g, kernel ratio as 51.27%, shelled fruit width as 30.21 mm, shelled fruit length as 35.00 mm, shelled fruit height as 31.45 mm and shell thickness as 1.4 mm. In some other studies, Osmanoğlu and Şimşek (2010), found fruit weight to be between 10.28-14.55 g, kernel weight 5.55-7.22 g, kernel ratio 43.58-63.10% in walnut genotypes of Mazidağ (Mardin) region; Paris (2015), in promising walnut genotypes selected in Kayseri province detected fruit weight to be between 7.58-13.11 g, kernel weight 3.83-5.40 g, kernel ratio 41.21-55.91%, shell thickness 1.12-1.83 mm; Demir and et al. (2019), in Afşin (Kahramanmaraş) region selection, the fruit weight of the selected genotypes found to be between 10.11-21.53 g, kernel weight 4.62-8.38 kernel ratio 27.95-52.90%. The results in this research were mostly similar to those of previous literature in terms of shelled and kernel weight, kernel ratio and fruit sizes (width, length, height).

The lightness of the kernel fruit color is important for the quality of the kernel walnut. Light kernel color depends on genetic factors, but the relative humidity of the air ratio increases, the darkening of walnuts increases, decreases as the moisture decreases (Şen, 2011). In selected genotypes, the kernel color was evaluated as light in 6 genotypes, yellow in 9 genotypes and dark in 4 genotypes. Also, in 19 genotypes, the color of the shell was light in 13 genotypes and dark in 6 genotypes. In promising genotypes, fruit shape was found as round in 14 genotypes and oval in 5 genotypes. All genotypes were classified in ''extra class ''in terms of fruit size. Cracking status was evaluated as easy in 17 genotypes and medium in 2 genotypes. Kernel fullness of genotypes was detected as good in 17 genotypes, medium in 2 genotypes (Table 3) In study conduct by Muradoglu (2005), observed that kernel color yellow in 25 genotypes and dark in 25 genotypes. In another study, Kösekul (2017), reported that the color of fruit peel light yellow at 48.88% and dark-skinned at 51.11%

Table 3. Some fruit properties selected from Hani district

Genotype No	Shell Color	Shell roughness	Cracking Status	Kernel Fullness	Kernel Color	Fruit Shape	Fruit Size
Hani 4	Light	Intermediate	Easy	Good	Yellow	Round	Extra
Hani 7	Light	Rough	Easy	Good	Light	Round	Extra
Hani 14	Dark	Smooth	Medium	Good	Light	Round	Extra
Hani 19	Dark	Smooth	Easy	Good	Yellow	Round	Extra
Hani 20	Light	Smooth	Easy	Good	Light	Round	Ekstra
Hani 32	Light	Rough	Easy	Good	Light	Round	Extra
Hani 43	Light	Intermediate	Medium	Good	Light	Round	Extra
Hani 58	Dark	Intermediate	Easy	Medium	Dark	Oval	Extra
Hani 59	Dark	Rough	Easy	Good	Yellow	Oval	Extra
Hani 64	Light	Intermediate	Easy	Good	Dark	Oval	Extra
Hani 68	Dark	Intermediate	Easy	Good	Yellow	Round	Extra
Hani 70	Light	Rough	Easy	Good	Dark	Round	Ekstra
Hani 84	Light	Rough	Easy	Good	Light	Round	Extra
Hani 85	Light	Rough	Easy	Good	Dark	Round	Ekstra
Hani 87	Light	Intermediate	Easy	Good	Yellow	Oval	Extra
Hani 89	Dark	Rough	Easy	Good	Yellow	Round	Extra
Hani 95	Light	Rough	Easy	Good	Yellow	Round	Extra
Hani 105	Light	Rough	Easy	Medium	Yellow	Oval	Extra
Hani 116	Light	Smooth	Easy	Good	Yellow	Round	Extra

Table 4. Phenological characteristics and harvest dates of promising genotypes

Genotype No	First leaf initiation date	Male flowering date	Female flowering date	Dicogamy flowering state	Fruit yield in lateral branches (%)	Harvest time
Hani 4	18-20 April	26-28 April	1-3 May	Protandrous	50	21-22 September
Hani 7	17-19 April	23-25 April	1-2 May	Protandrous	60	23-25 September
Hani 14	16-18 April	24-26 April	3-5 May	Protandrous	70	23-25 September
Hani 19	25-27 April	5-7 May	8-10 May	Protandrous	20	28-29 September
Hani 20	18-20 April	24-26 April	27-29 April	Protandrous	0	23-25 September
Hani 32	27-29 April	5-7 May	6-8 May	Protandrous	50	28-29 September
Hani 43	16-18 April	25-27 April	4-6 May	Protandrous	40	21-22 September
Hani 58	26-28 April	1-3 May	1-3 May	Homogamous	40	28-29 September
Hani 59	21-23 April	28-30 April	1-2 May	Protandrous	30	21-22 September
Hani 64	24-26 April	7-9 May	3-5 May	Protogynous	40	28-29 September
Hani 68	23-25 April	1-3 May	1-3 May	Homogamous	50	21-22 September
Hani 70	21-23 April	28-30 April	1-3 May	Protandrous	30	21-22 September
Hani 84	20-22 April	28-30 April	1-3 May	Protandrous	60	23-24 September
Hani 85	21-23 April	28-30 April	1-2 May	Protandrous	70	23-24 September
Hani 87	21-23 April	1-3 May	1-3 May	Homogamous	40	23-24 September
Hani 89	21-23 April	1-2 May	3-5 May	Protandrous	50	23-24 September
Hani 95	24-26 April	1-2 May	1-2 May	Homogamous	100	28-29 September
Hani 105	22-24 April	1-2 May	3-4 May	Protandrous	60	23-24 September
Hani 116	16-18 April	23-25 April	27-29 April	Protandrous	60	19-20 September

Phenological properties of promising genotypes were given in Table 5. According to Table 5, it was recorded that first leaf initiation date, male flowering date, female flowering date, dichogamy flowering state, lateral fruitfulness (%) and harvest time of promising genotypes changed between 16-29 April, 23 April and 9 May, 27 April and 10 May, 0-100% and 21-29 September, respectively (Table 4). Şimşek and Osmanoğlu (2010) determined that the flowering state of genotypes was found to be 50.00% protandrous, 33.33% protogynous and 16.16% homogamous. Gülsoy et al. (2016), reported that in selected genotypes, protandrous, protogynous and homogamous were 11, 9 and 1 respectively in terms of flowering state Yıldız (2016), informed that percentages of fruit yield in lateral branches of selected genotypes were observed between 30 % and 80 %. In walnut varieties and genotypes, it is reported that flowering dates, the tendency of dichogamy, lateral fruitfulness depend on climate conditions, altitude, planting direction, plant age, and the genetic structure (Şen, 1980; Akça, 2009; Balık ve Beyhan 2011; Sütyemez et al., 2018).

Conclusion

As a result, very valuable walnut genotypes were identified in the natural walnut population in the Hani district of Diyarbakır, where no previous studies were conducted on walnut selection. In the study, especially Hani 59, Hani 43 and Hani 58 with high shelled fruit weight (over 14 g), and Hani 58, Hani 59 and Hani 89 with high kernel weight (over 6.5 g) attracted attention. It is also thought that these promising genotypes can be cultivar candidates. Besides, these genotypes should be done of the adaptations in the same ecological conditions with domestic and foreign standard walnut varieties. Afterward, the prominent genotypes can be produced as economical and grafted onto suitable rootstocks. In this way, it is thought to contribute to both regional producers and walnut production in our country.

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References

Akça, Y. 2001. Türkiye ceviz yetiştiriciliğine genel bakiş, Türkiye I. Ulusal Ceviz Sempozyumu, s: 298–307, 5–8 Eylül, Tokat.

Akça, Y. 2009. Ceviz Yetiştiriciliği. Anı Matbaası. Ankara, 83-89s.

Balık, H.İ., Beyhan, N. 2011. Meyve türlerinde dikogami. Türkiye VI. Ulusal Bahçe Bitkileri Kongresi. 964-968.

Demir, M.İ., Sütyemez, M., Özcan, A., Bükücü, Ş.B. 2019. Kahramanmaraş Afşin ilçesi ceviz (*Juglans regia* L.) popülasyonu içerisinde ümitvar genotiplerin belirlenmesi *KSÜ Tarım ve Doğa Dergisi* 22 (Ek Sayı 1):91-97.

FAO, 2019. http://www.fao.org/faostat/en/#data /QC; Production quantity of walnuts (Access Date: 20.09.2019).

Gülsoy, E., Kaya, T., Şimşek, M., Pehluvan, M. 2016. Iğdır yöresi cevizlerinin *(Juglans regia L.)* seleksiyonu. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*. 6(1): 25-30.

Karadağ, H. 2007, Amasya İli Merkez İlçe Cevizlerinin (Juglans regia L.) Seleksiyon Yolu İle Islahı, Yüksek Lisans Tezi, Gaziosmanpaşa Üniversitesi Fen Bilimleri Enstitüsü Bahçe Bitkileri Anabilim dalı, Tokat, 101 s.

Koyuncu, F., Yıldırım, F.A., Koyuncu, M.A., Tosun, F. 2005. Isparta yöresindeki üç farkli ceviz popülasyonunun fenolojik özelliklerinin islah açisindan incelenmesi, *Bahçe, Yalova Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü Dergisi, II. Ulusal Ceviz Sempozyumu Özel Sayısı* 123-132, Yalova.

Kösekul, M. 2017, Besni ve Gölbaşı (Adıyaman) İlçelerindeki Ceviz *(Juglans regia L.)* Genotiplerinin Seleksiyonu, Yüksek Lisans Tezi, Sütçü İmam Üniversitesi Fen Bilimleri Enstitüsü, Fen Bilimleri Üniversitesi, Kahramanmaraş, 120 s.

Muradoğlu, F. 2005. Hakkari Merkez İlçe ve Ahlat (Bitlis) Yöresinde Tohumdan Yetişmiş Ceviz *(Juglans regia L.)* Populasyonunda Genetik Değişkenlik ve Ümitvar Genotiplerilerin Seleksiyonu (doktora tezi, basılmamış). Y.Y.Ü Fen Bilimleri Enstitüsü, Van,172 s.

Ölez, H. 1971. Marmara Bölgesi Cevizlerinin Seleksiyon Yoluyla Islahı Üzerine Araştırmalar, (Basılmamış Doktora Tezi), Yalova.

Paris, K. 2013, Kayseri İlinde Ceviz *(Juglans regia L.)* Seleksiyonu, Yüksek Lisans Tezi, Erciyes Üniversitesi Fen Bilimleri Üniversitesi Enstitüsü, Kayseri, 150s.

Paunovic, S.A. 1990. The walnut cultivars selected from indigenous population of *Juglans regia L*. In Sr Serbia, Sfr Yugoslavia. Acta Hort. 284: 135-142.

Sutyemez, M. 2016. New Walnut Cultivars: Maras 18, Sutyemez 1, and Kaman 1. *HortScience*,51(10), 1301-1303.

Sütyemez, M., Özcan A, Bükücü Ş.B. 2018. Walnut Cultivars Through Cross-Breeding: 'DİRİLİŞ' and '15 TEMMUZ'. *The American Pomological Society*. 72(3):173-180.

Şen, S.M. 1980. Kuzeydoğu Anadolu ve Doğu Karadeniz Bölgesi Cevizlerinin Seleksiyon Yoluyla Islahı Üzerinde Araştırmalar, Atatürk Üniv. Ziraat Fak. Bahçe Bitkileri Bölümü Doktora Tezi, Erzurum.

Şen, S.M. 1986. Ceviz Yetiştiriciliği, Eser Matbaası 232 s. Samsun.

Şen, S.M. 2011. Ceviz Yetiştiriciliği ve Besin Değeri Folklorü (4. Baskı). ÜÇM Yayıncılık. Ankara.

Şimşek, M., Osmanoğlu, A. 2010. Mazıdağı (Mardin) yöresindeki doğal cevizlerin *(Juglans regia L.)* seleksiyonu araştirmasi, *Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi*, 20(2), 131-137.

TUİK, 2019. https: //biruni.tuik.gov.tr/ medas/?kn= 92&locale=tr. Türkiye Ceviz Üretimi İstatislikleri (Erişim Tarihi: 20.09.2019).

Yarılgaç, T. 1997. Gevaş Yöresi Cevizlerinin *(Juglans regia L.)* Seleksiyon Yoluyla Islahı Üzerinde Araştırmalar. Doktora tezi (basılmamış). Y.Y.Ü. Fen Bil. Enst., Van,152 s.

Yıldız, A. 2016. Mucur Doğal Ceviz Popülasyonunun *(J. regia)* Seleksiyon Yolu İle Islahı. Yüksek Lisans Tezi, Bozok Üniversitesi Fen Bilimleri Üniversitesi Enstitüsü, Yozgat,114 s.