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***Araştırma Makalesi***
*(Research Article)*

Kerem MERTOĞLU[1a*]

Yasemin EVRENOSOĞLU[1b]

F. Mücahit YEŞİLBAŞ[1c]

Emre AKKURT[1d]

A. Kürşat ÖLMEZ[1e]

[1]Eskişehir Osmangazi Üniversitesi, Ziraat Fakültesi Bahçe Bitkileri Bölümü, Eskişehir

[a]**ORCID:** 0000-0002-0490-9073

[b]**ORCID:** 0000-0002-0212-8492

[c]**ORCID:** 0000-0003-1484-9390

[d]**ORCID:** 0000-0002-4451-3946

[e]**ORCID:** 0000-0003-2875-7331

***sorumlu yazar:** kmertoglu@ogu.edu.tr

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Antioxidant activity, Breeding, Pyrus communis L., Selection, Vitamin C, Weighted ranking method

**Anahtar Sözcükler:**

Antioksidan aktivite, Islah, Pyrus communis L., Seleksiyon, Vitamin C, Tartılı derecelendirme

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# Evaluation of Fall Pear Variety Candidates Obtained by Hybridization in Terms of Fire Blight Disease Resistance, Pomological and Commercial Values

Melezleme yoluyla elde edilen güzlük armut çeşit adaylarının ateş yanıklığı hastalığına dayanıklılık, pomolojik ve ticari değerler yönünden değerlendirilmesi

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## ABSTRACT

**Objective:** In this research, evaluations of F1 fall pear hybrids, that obtained from different cross combinations, were made to contribute to our country's agriculture and gene pool.

**Material and Methods:** 11 hybrids investigated in this research were obtained from the cross combinations that 'Magness', 'Kiefer', 'Williams' and 'Santa Maria' cultivars were maternal and, 'Güz', 'Santa Maria' and 'Kiefer' cultivars were used as pollinator parents. Susceptibilities of those hybrids to fire blight disease, pomological and biochemical characteristics were determinated. Besides, sensory parameters were added to the data attained by the measurements, and promising hybrids were detected through the modified weighted ranking method.

**Results:** Fruit width, fruit length, shape index, fruit weight, fruit firmness, soluble solid content, pH, titratable acidity, vitamin C and antioxidant activity characteristics were varied between 53.22 - 84.25 mm, 52.91 - 105.01 mm, 0.95 - 1.62, 86.51 - 317.70 g, 3.32 - 8.41 kg/cm2, %8.77 - 16.53, 3.52 - 4.73, %0.14 - 0.59, 0.53 - 3.17 mg.L-1 and %26.43 - %75.09, respectively. Eight hybrids were evaluated as promising fall cultivars through the modified weighted ranking method.

**Conclusions:** Due to the lack of a definite solution against fire blight, the chemicals used are harmful to human health and organic cultivation is becoming more widespread, the pears with high fruit quality parameters and disease resistant hybrids will come to the fore in the near future, it is thought that the hybrids (2-12-43, 2-15-93, 2-12-47, 1-17-20, 3-36-87, 2-33-32, 2-15-33 and 1-16-130) transferred to the forward observation plot will contribute to pear cultivation by registering in the following period.

## ÖZ

**Amaç:** Bu çalışmada, farklı melezleme kombinasyonları sonucu elde edilen güzlük F1 armut melezlerinin, ülke tarımına ve genetik havuza katkı sağlaması amaçları doğrultusunda, değerlendirmeleri yapılmıştır.

**Materyal ve Metot:** Çalışmada incelenen 11 genotip; 'Magness', 'Kiefer', 'Williams' ve 'Santa Maria' çeşitlerinin ana ebeveyn, 'Güz', 'Santa Maria' ve 'Kiefer' çeşitlerinin tozlayıcı olduğu melezleme kombinasyonları veya serbest tozlamalar sonucu elde edilmiştir. Melez bireylerin, armudun en yıkıcı hastalığı olan ateş yanıklığı hastalığına karşı hassasiyetleri, pomolojik ve biyokimyasal özellikleri tespit edilmiştir. Ayrıca ölçümlerle elde edilen verilere, meyvelerin ticari değerini belirlemeye yönelik duyusal parametrelerde eklenerek, tartılı derecelendirme sonucu ümitvar melez bireyler tespit edilmiştir.

**Bulgular:** Meyve eni, 53,22 - 84,25 mm, meyve boyu 52,91 - 105,01 mm, şekil indeksi 0,95 - 1,62, meyve ağırlığı 86,51 - 317,70 g, meyve eti sertliği 3,32 - 8,41 kg/cm2, suda çözünebilir kuru madde miktarı %8,77 - 16,53, pH 3,52 - 4,73, titre edilebilir asit miktarı %0,14 - 0,59, Vitamin C 0,53 - 3,17 mg.L-1 ve antioksidan aktivite %26,43 - %75,09 aralıklarında değişim göstermiştir. Tartılı derecelendirme sonucunda, 8 melezin, güzlük armut olarak tescil edilebilme potansiyelinde olduğu görülmüştür.

**Sonuç:** Ateş yanıklığına karşı henüz kesin bir çözümün bulunamamış olması, kullanılan kimyasalların insan sağlığına zararlı olmaları ve organik yetiştiriciliğin giderek yaygınlaşması sebebiyle, meyve kalite parametreleri yüksek ve hastalığa dayanıklı genotiplerin , ön plana çıkacağı yakın dönemde, ileri gözlem parseline aktarılan genotiplerin (2-12-43, 2-15-93, 2-12-47, 1-17-20, 3-36-87, 2-33-32, 2-15-33 and 1- 16-130), ilerleyen dönemde tescil edilmesiyle, armut yetiştiriciliğine, katkı sağlayacağı düşünülmektedir.

## INTRODUCTION

Pear is the most produced fruit after apple among the temperate fruit species in the world. Only 10% of world pear production is subjected to international trade (FAO, 2017). Increasing the trade share is possible by providing standard and quality fruit production. In this context, it is very important to develop genotypes that meet both consumer and breeder requests (Byrne, 2012).

The appeal of freshly consumed fruits is important in diverting consumer demands (Reid and Buisson, 2001). Visually, a typical pear shape in fruits, pink-red cheek on the yellow-green background color and the presence of some rust are wanted by consumers because of the organic perception (Gamble et al., 2006; Steyn et al., 2010). During tasting, firm, juicy, buttery and aromatic properties are sought (Pinto et al., 2007; Predieri et al., 2014). Due to the decrease in the number of individuals in families and short shelf-life of fruits, large pears are not preferred. Producers tend to produce yielding, disease and pest-resistant pears which are preferred by consumers and marketed at high prices with a long shelf-life (Soare et al., 2019).

Considering the changing market demands with variable ecological factors, it is possible to make farming economical and sustainable only by using wild species and local genotypes effectively (Polat and Bağbozan, 2017; Çubukçu and Bostan, 2019). In breeding studies, variation in gene sources is very important in determining the genotypes to be developed. With the global climate change, ecosystem balance has deteriorated as a result of the destruction of natural resources by humans. Therefore, it has been observed that species and variety losses are increasing nowadays (Çepel, 2003). As a result of breeding studies, the new genotypes may contain the genes that provide resistance to biotic and abiotic stress conditions as much as possible, with a broad genetic base (Sekhwal et al., 2015). At this point, before the breeding studies, it is the most important criterion that the use of genetic pool as rich as possible to be able to choose the variety that will serve the desired characteristics (Dumanoglu et al., 2018; Evrenosoğlu et al., 2019). In the last periods of the production season, when the winter fruits are not yet in the market, the lack of product as variety and quantity in the market increases the importance of fall cultivar breeding. With a more balanced sugar-acid ratio, mid and late-season varieties are highly consumed. In addition, they are also very suitable for storage by having less intercellular space and pectinase enzyme activity (Koutouvela et al., 2007; Bostan and Çelikel-Çubukçu, 2018).

In this study, fall pear hybrids obtained as a result of different hybridization combinations were evaluated to contribute to World's agriculture and genetic pool. The susceptibility levels of hybrid individuals to fire blight disease was determined in the previous studies (Evrenosoglu et al., 2010; Evrenosoglu et al., 2011). In addition to this feature, harvest time, pomological and biochemical properties of hybrids were identified. Also, sensory parameters were added to reveal the commercial value of fruits, and promising hybrids were identified as a result of weighted ranking method.

## MATERIAL and METHODS

### Plant material

The study was carried out in 2018 on the F1 hybrid pear parcel in Eskişehir Osmangazi University, Faculty of Agriculture. Eleven hybrids, that obtained using 'Magness', 'Kiefer', 'Williams' and 'Santa Maria' varieties as female parents, 'Güz', 'Santa Maria' and 'Kiefer' varieties as pollinators, by hybridization or open pollination, examined in this study. Hybrids are obtained within the projects of TOVAG 106O719 and 110O938 (Evrenosoglu et al., 2010). The fall varieties 'Conference' and 'Kaiser Alexandre' were used as reference varieties for a better evaluation of the results.

Fire blight disease susceptibility of the hybrid plants was determined by the artificial inoculation method by injection according to Thompson et al. (1962). Hybrids were classified as A (The least susceptibility) to E (The most susceptibility) through the inoculations (Evrenosoglu et al., 2010; Evrenosoglu et al., 2011).

### Harvest Date

Harvest time of the varieties and hybrid individuals was determined based on coloration, taste and the status of abscission layer (Karaçalı, 2012; Mertoğlu and Evrenosoğlu, 2017).

### Pomological Characteristics

The fruits harvested from hybrids were immediately transferred to the laboratory. Fruit weight was determined using an electronic scale susceptible to 0.001 g (Sartorius - CPA 16001S) and digital calipers were used to measure fruit width and fruit length at 0.01 mm precision. The shape index of the fruits was obtained by proportioning the fruit length to the fruit width. Fruit flesh firmness was determined using a digital hand penetrometer (PCE-FM200) while the color values of the over color were determined using a colorimeter (NR20XE) (Karaçalı, 2012).

### Chemical Characteristics

Total soluble solids (TSS) were measured by a digital refractometer (Atago PR-32, Japan) and the results were given in percentile values (Karaçalı, 2012). The volumetric titration method was conducted to determine vitamin C content. According to this method, starch was used as an indicator and titrated with potassium iodide. Calculations were carried out according to Spinola et al. (2013), the results are given as mg.100 mL-1. For the determination of titratable acidity, the fruit juices were titrated with 0.1 N sodium hydroxyl solution using phenolphthalein as indicator

and the results were expressed as malic acid % by calculating the formula showed by Karaçalı (2012). Antioxidant activity analyzes were performed using the DPPH method. Accordingly, all the fruit juices were mixed firstly, and sample concentration that provides 50% inhibition (IC50) was calculated by plotting the percent inhibition against the of the sample. Samples were taken from each sample in the amount of IC50 determined, and the ability to scavenge the DPPH radical was determined according to the method specified by Sanchez-Moreno et al. (1998) and the results were expressed in percentile values (%).

**Statistical Analysis**

Statistical analysis was done on fruit width, height, shape index, weight, firmness, L*. C*, hº, TSS, pH, TA, Vitamin C and DPPH values. The study was designed according to a randomized plot design and was carried out with three replications. Results are expressed as mean ± standard deviation. Statistically significant differences between hybrids and reference varieties were determined by the one-way ANOVA procedure in the Minitab-17 program package. The Tukey multiple comparison test was used to reveal differences (Zar, 2013).

**Identification of the promising hybrids**

The weighted ranking method was used to determine the superior hybrids. Sensory parameters (eating quality, appeal, fruit meat stone cell status and rustiness) were added to the numerical data obtained from the study and the selection criteria were established (Table 1). The international pear identification documents were used (UPOV, 2000) for the selection of the criteria used in the weighted ranking table and the determination of the reference values of the criteria.

**Table 1.** Parameters of hybrid pears based on modified weighted ranking method, relative scores, class values and scores of traits
***Çizelge 1.*** *Melez armut genotiplerin tartılı derecelendirme yöntemine esas alınan parametreleri, göreceli puanları, özelliklerin sınıf değerleri ve puanları*

| ParameterS | Relative Scores | Class Values and Scores of the Properties | |
|---|---|---|---|
| Eating Quality | 20 | Very Good | 10 |
| | | Good | 7 |
| | | Moderate | 4 |
| | | Poor | 1 |
| Attractiveness | 20 | Very Good | 10 |
| | | Good | 7 |
| | | Moderate | 4 |
| | | Poor | 1 |
| Resistance to Fire Blight | 15 | Very Low Susceptibility(<10) | 10 |
| | | Low Susceptibility(11-20) | 8 |
| | | Moderate Susceptibility(21-40) | 5 |
| | | High Susceptibility(41-60) | 3 |
| | | Very High Susceptibility(>60) | 1 |
| Fruit Size | 10 | Very Large Size (> 220g) | 10 |
| | | Large Size (175-220g) | 8 |
| | | Moderate Size (130-175g) | 5 |
| | | Small Size (75-140g) | 3 |
| | | Very Small Size (> 75g) | 1 |
| Length/Diameter | 10 | Very Long | 10 |
| | | Long | 8 |
| | | Moderate | 5 |
| | | Short | 3 |
| | | Ery Short | 1 |
| TSS | 10 | High (> 13.75%) | 10 |
| | | Moderate (10 - 13.75%) | 7 |
| | | Low (< 10%) | 3 |
| Stone Cell Status of Fruit Flesh | 5 | Low | 10 |
| | | Moderate | 5 |
| | | High | 1 |
| Fruit Flesh Firmness | 5 | Very Firm (>11 kg/cm$^2$) | 1 |
| | | Firm (>8-11 kg/cm$^2$) | 10 |
| | | Moderate (6-8 kg/cm$^2$) | 7 |
| | | Soft (>86 kg/cm$^2$) | 4 |
| Rustiness | 5 | Very Low | 10 |
| | | Low | 7 |
| | | Moderate | 4 |
| | | High | 1 |

**RESULTS and DISCUSSION**

The characterization of the pomological characteristics of the new genotypes developed for table consumption is extremely important in the selection of products intended for consumer needs (Sağır and Aygün, 2018). In this context, among the pomological characteristics listed in Table 2, fruit width, fruit length, shape index, fruit weight and fruit flesh firmness were varied between 53.22 mm (hybrid 2-12-47) - 84.25 mm (hybrid 2-15-93), 52.91 mm (hybrid 3-36-87) - 105.01 mm (hybrid 2-15-93), 0.95 (hybrid 3-36-87) - 1.62 (hybrid 1-17-20), 86.51 g (hybrid 3-36-87) - 317.70 g (hybrid 2-15-93) and 3.32 kg.cm-2 (hybrid 2-26-73) - 8.41 kg.cm-2 (hybrid 3-36-87), respectively. L*, C* and hº values representing the over color were found in the range of 51.18 (hybrid 2-15-93) - 76.16 (Conference), 31.53 (hybrid 2-12-36) - 49.61 (hybrid 2-26-73) and 35.84 (hybrid 2-33-32) -108.21 (hybrid 1-16-130), respectively.

**Table 2.** Distribution of pomological characteristics according to hybrids
***Çizelge 2.*** *İncelenen pomolojik özelliklerin melez genotiplere göre dağılımı*

| Hybrid | Width (mm) | Height (cm) | Shape index | Weight (g) | Firmness (kg. cm$^2$) | L* | C* | hº |
|---|---|---|---|---|---|---|---|---|
| 1-16-130 | 53.62c | 57.73ef | 1.08bc | 88.86d | 7.32ab | 73.08ab | 43.60a-c | **108.21a** |
| 1-17-20 | 53.31c | 86.23a-d | **1.62a** | 112.02b-d | 5.71b-e | 70.96ab | 46.38ab | 98.57ab |
| 2-15-42 | 64.92bc | 80.04a-e | 1.25a-c | 157.30b-d | 5.19b-e | 59.16bc | 41.31 a-c | 76.86bc |
| 2-12-47 | **53.22c** | 63.52c-f | 1.19bc | 92.73cd | 6.23a-d | 51.95c | 36.41bc | 54.08c-f |
| 2-15-33 | 64.13bc | 76.14b-f | 1.19bc | 145.21b-d | 7.84ab | 62.17a-c | 42.08 a-c | 42.75d-f |
| 2-33-32 | 65.99bc | 84.41a-d | 1.28a-c | 191.74b | 4.05c-e | 51.95c | 37.16 a-c | **35.84f** |
| 3-36-87 | 55.39bc | **52.91f** | **0.95c** | **86.51d** | **8.41a** | 52.15c | 36.63bc | 41.45ef |
| 2-12-43 | 61.26bc | 64.29c-f | 1.05bc | 120.23b-d | 3.71de | 62.85a-c | 46.42ab | 77.6bc |
| 2-15-93 | **84.25a** | **105.01a** | 1.24a-c | **317.70a** | 5.90a-e | **51.18c** | 37.09 a-c | 41.95ef |
| 2-12-36 | 59.71bc | 62.08d-f | 1.03c | 117.20b-d | 5.85a-e | 62.43a-c | **31.53c** | 72.09b-d |
| 2-26-73 | 58.08bc | 67.24b-f | 1.16bc | 121.41b-d | **3.32e** | 69.18ab | **49.61a** | 84.48ab |
| **Conference** | **61.60bc** | **88.41a-c** | **1.44ab** | **137.42b-d** | **5.67b-e** | **76.16a** | **43.44 a-c** | **95.69ab** |
| **K.Alexandre** | **69.78ab** | **91.91ab** | **1.32a-c** | **185.13bc** | **6.61a-c** | **67.75ab** | **42.78 a-c** | **70.87b-e** |
| **Mean** | **61.94** | **75.38** | **1.22** | **144.11** | **5.83** | **62.39** | **41.11** | **69.26** |

Examining the previous studies carried out with different purposes, depending on the pear varieties, fruit width, height, weight and firmness values were reported in the range of 31.44- 71.77 mm, 29.24- 87.29 mm, 20,07-199.00 g and 3.07-13.00 lb (Özrenk et al., 2010); 38.24-58.23 mm, 36.85-65.50 mm, 31.10-109.40 g and 2.07-6.30 kg/cm$^2$ (Duric et al., 2015); 37.0-82.6 mm, 32.2-132.8 mm, 30.8-476.4 g, and 6.9-36.18 lb (Öz and Aslantaş, 2015); 59.14-70.98 mm, 60.66-91.40 mm, 28.29-160.02, and 2.99-13.23 lb (Bayazit et al., 2016); 35.76-73.48 mm, 25.91-117.33 mm, 21.57-273.00 g, and 4.91-13.26 kg/cm$^2$ (Polat and Bağbozan, 2017); 35.02-87.33 mm, 30.55-141.27 mm, 22.04-334.00, and 9.92-12.65 kg/cm$^2$ (Polat and Öznur, 2017), respectively. Although the data obtained from the study were determined within the limits reported in the literature, these values were generally found at higher levels. Late varieties that have a long period from full bloom to harvest, have larger fruit sizes and higher weight than those of the early varieties. The slow course of developmental physiology allows a fewer inter-cellular space in late varieties and increases the flesh firmness (Bostan and Çelikel-Çubukçu, 2018). In the late varieties that complete their development in the warmer period, the shape index of the fruits is lower due to the higher exposure to auxin hormone which increases with high temperature and causes the formation of a round structure in fruits (Sherman and Beckman 2002). In this study, the average of shape index value obtained as 1.22 was found to be in parallel with the studies in which late genotypes were evaluated whereas lower than those reported in studies in which early genotypes were evaluated (Polat and Öznur, 2017; Polat and Bağbozan, 2017; Bayındır et al., 2019).

Chemical properties, which is one of the most important factors affecting the taste of plant products, are also important in terms of their qualitative and quantitative quality parameters (Hepaksoy et al., 2009). TSS, pH, titratable acidity, vitamin C and antioxidant activity values were varied from 8.77% (hybrid 3-36-87) to 16.53% (hybrid 2-26-73), 3.52 (hybrid 2-12-47) to 4.73 (hybrid 2-12-43), 0.14% (hybrid 2-12-43) to 0.59% (hybrid 2-12-47), 0.53 mg.L-1 (hybrid 2-15-42) - 3.17 mg.L- 1 (Conference) and 26.43% (hybrid 2-12-36) to 75.09% (Conference) (Table 3), respectively. In similar studies TSS, TA and pH values were reported as 11.0-17.1%, 0.22-0.37%, and 4.4-6.2% (Karadeniz and Corumlu, 2012); 10.6%-14.1%, 0.10%-0.94%, and 3.21-5.41% (Polat and Bağbozan, 2017); 10.0-21.0%, 0.20-1.33% and 4.07-5.56 (Kalkisim et al., 2018), respectively.

**Table 3.** Harvest dates, susceptibility to fire blight and phytochemical properties of hybrids
***Çizelge 3.*** *Melez bireylerin hasat tarihleri, ateş yanıklığına karşı hassasiyet durumları ve fitokimyasal özellikleri*

| Genotype | Date of Harvest | Susceptibility to fire blight (%) | TSS (%) | pH | **TA (%)** | Vitamin C ($mg.L^{-1}$) | DPPH (%) |
|---|---|---|---|---|---|---|---|
| 1-16-130 | 29.8 | 1.56 | 13.13bc | 3.69f-h | 0.33bc | 1.63b | 31.78e |
| 1-17-20 | 27.8 | 8.70 | 16.27a | 3.67gh | 0.31b-d | 1.66b | 31.39e |
| 2-15-42 | 28.8 | 16.18 | 13.67bc | 4.00de | 0.23e-g | **0.53c** | 42.80c-e |
| 2-12-47 | 28.8 | **0.00** | 14.13bc | **3.52h** | **0.59a** | 0.74c | 49.09b-d |
| 2-15-33 | 28.8 | 9.09 | 14.33b | 4.24cd | 0.19f-h | 0.75c | 28.19e |
| 2-33-32 | 26.8 | 61.43 | 12.43c | 3.93ef | 0.24d-g | 0.58c | 33.13de |
| 3-36-87 | 29.8 | 4.29 | **8.77d** | 3.65gh | 0.26c-f | 1.90b | 61.74ab |
| 2-12-43 | 28.8 | 2.75 | 14.06bc | **4.73a** | **0.14h** | 0.78c | 28.50e |
| 2-15-93 | 28.8 | 8.93 | 12.43c | 3.82e-g | 0.28c-e | 0.72c | 52.48bc |
| 2-12-36 | 28.8 | **78.36** | 13.53bc | 4.38bc | 0.19f-h | 2.01b | **26.43e** |
| 2-26-73 | 29.8 | 36.48 | **16.53a** | 3.80e-g | 0.38b | 1.84b | 55.21bc |
| **Conference** | **19.8** | **75.00** | **14.63b** | **4.56ab** | **0.17gh** | **3.17a** | **75.09a** |
| **K.Alexandre** | **20.8** | **50.00** | **13.83bc** | **4.54ab** | **0.24ef** | **3.05a** | **54.65bc** |
| **Mean** | | | **13.67** | **4.04** | **0.27** | **1.49** | **43.88** |

Due to the long developmental periods, in the late cultivars, TSS content is generally high and titratable acid content is low. Therefore, it has been reported that phenolic and organic acids and aroma compounds, which are acidic and exhibit antioxidant activity, are present at lower levels in varieties showing high pH (Mertoğlu and Evrenosoğlu, 2019). Vitamin C and antioxidant activity characteristics, which were determined as 1.49 mg.100ml-1 and 43.88%, were found to be lower than reported in the literature (Kevers et al., 2011; Öztürk et al., 2015; Erbil et al., 2018).

Although differences in all investigated characteristics were thought to be mainly due to the differences in genotypes examined, differences in climate and soil characteristics, geographical status of the cultivation area, harvesting type and time, storage or processing of the crop, method or periodical differences of the applied cultural processes lead to significant differences in the final shape and content of the products (Li et al., 2012; Tiwari and Cummins, 2013; Gündüz and Özbay, 2018; Atılgan et al., 2019).

Among the hybrids, 1-16-130, 1-17-20, 2-12-47, 2-15-33, 3-36-87, 2-12-43 and 2-15-93 showed very low susceptibility to fire blight, the most destructive disease for the pome fruit species, while the hybrid 2-15-42 showed low susceptibility, and the remaining hybrids showed high susceptibility (Table 3). It has been reported that cultivated pear varieties were highly susceptible to fire blight disease and suffer from great economic losses due to the disease (Hepaksoy et al., 1998; Ozrenk et al., 2012; Gaaliche et al., 2018). Therefore, breeding studies are carried out for the development of pear hybrids that are resistant to fire blight disease and have high fruit quality parameters (Evrenosoglu et al., 2010; Hunter, 2016; Evrenosoğlu and Mertoğlu, 2018).

To obtain the correct identification of the intended new candidate varieties that are planned to be offered

to world markets, varieties are needed to meet consumer demands in every sense. In the present study, sensory parameters were added in addition to the properties determined by numbers and all the hybrids were subjected to weighted ranking to determine superior hybrids. As a result of the method created by the parameters that highlight the commercial value of the hybrids, the total scores obtained ranged from 500 (hybrid 2-12-36) to 835 (hybrid 2-12-43) (Table 4). In the study carried out within the concept of the breeding program, the ones who scored higher than the reference varieties among the hybrids were considered as new variety candidates. In this context, eight hybrids (2-12-43, 2-15-93, 2-12-47, 1-17-20, 3-36-87, 2-33-32, 2-15-33 and 1- 16-130) were found to have potential to be registered as a fall pear cultivar.

**Table 4.** Scores of the hybrid pears according to weighted ranking method
***Çizelge 4.*** *Tartılı derecelendirme metoduna göre melez armut genotiplerinin aldıkları puanlar*

| Genotype (Maternal parent*Pollinator) | Resistance to Disease | Eating Quality | Appeal | Fruit Size | Length/Diameter | TSS | Fruit Flesh Stone Cell Status | Fruit Flesh Firmness | Rustiness | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 2-12-43 (Kiefer*Open Pollination) | 150 | 200 | 200 | 30 | 50 | 100 | 50 | 20 | 35 | **835** |
| 2-15-93 (Magness*Santa Maria) | 150 | 140 | 140 | 100 | 50 | 100 | 50 | 50 | 50 | **830** |
| 2-12-47 (Kiefer*Open Pollination) | 150 | 200 | 140 | 30 | 50 | 100 | 50 | 35 | 5 | **760** |
| 1-17-20 (Magness*Güz) | 150 | 140 | 80 | 30 | 80 | 100 | 50 | 50 | 35 | **715** |
| 3-36-87 (Williams*Kiefer) | 150 | 200 | 140 | 30 | 30 | 30 | 25 | 50 | 35 | **690** |
| 2-33-32 (Williams*Open Pollination) | 15 | 200 | 140 | 80 | 80 | 50 | 50 | 20 | 35 | **670** |
| 2-15-33 (Magness*Santa Maria) | 150 | 80 | 80 | 50 | 50 | 100 | 50 | 35 | 35 | **630** |
| 1-16-130 (Magness*Santa Maria) | 150 | 140 | 80 | 30 | 50 | 70 | 50 | 35 | 20 | **625** |
| **Kaiser Alexandre** | 45 | 140 | 80 | 80 | 80 | 100 | 25 | 35 | 5 | **590** |
| 2-26-73 (Santa Maria*Open Pollination) | 100 | 140 | 80 | 30 | 50 | 100 | 25 | 20 | 35 | **580** |
| 2-15-42 (Magness*Santa Maria) | 120 | 80 | 80 | 50 | 50 | 70 | 25 | 50 | 35 | **560** |
| **Conference** | 15 | 140 | 80 | 30 | 80 | 100 | 25 | 20 | 20 | **510** |
| 2-12-36 (Kiefer*Open Pollination) | 15 | 140 | 140 | 30 | 50 | 35 | 50 | 20 | 20 | **500** |

## CONCLUSION

With respect to the advantages of fall cultivars, it should not be ignored that superior fall hybrids that can be developed and grown with standard and high quality can meet both domestic and international demand.

As a result of the study, eight hybrids (2-12-43, 2-15-93, 2-12-47, 1-17-20, 3-36-87, 2-33-32, 2-15-33 and 1- 16-130) were found to have potential to be registered as a fal pear cultivar and seven of them shows very low susceptibility to fire blight disease that is difficult to control and has a very high destructive effects. The facts that no effective solution has been found against disease, the chemicals used are harmful to human health and the consumer tendency is gradually shifting to organic products make the use of resistant rootstocks and cultivars important in the control of the disease. The very low susceptibility of the hybrids identified as promising to the disease makes the study also important.

We believe that the hybrids transferred to the advanced observation parcel will contribute to pear cultivation as genetic and production material by registering in the following periods.

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