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Selection of Pear Gene Resources in Muş Region

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Abstract: This study was carried out in Muş province and its districts between 2020-2022. In the study, phenological, pomological and chemical properties of local pear cultivars grown in Muş ecological conditions were obtained. In the region where 42 different local pear varieties determined as a result of the studies were grown, the superior local varieties within the scope of the study were determined by using the "Weighed Rating" method. In order to compare these local varieties with each other, 24 local pear cultivars were selected with superior characteristics in terms of fruit weight, eating quality, external appearance, rustiness, water-soluble dry matter content and fruit flesh hardness as a result of the weighted grading made in 2020. These 24 selected varieties were compared according to the weighted grading results in 2021 and finally 13 local pear varieties were determined as promising. Among the promising local pear cultivars, Güz Armudu-1, Paşa Armudu-2 and Sulu Armut cultivars received the highest scores, respectively. It is aimed to increase the quality of the promising local pear varieties, thus to protect genetic resources and to reveal genotypes that may be candidates for registration.

Keywords: Muş, pear, phenology, pomology, variety

Muş Yöresi Armut Gen Kaynaklarının Seleksiyonu

Öz: Bu çalışma 2020-2022 yılları arasında Muş ili ve ilçelerinde yürütülmüştür. Araştırmada Muş ekolojik koşullarında yetiştirilen mahalli armut çeşitlerinin fenolojik, pomolojik ve kimyasal özellikleri incelenmiştir. Çalışmalar sonucunda belirlenen 42 farklı mahalli armut çeşidinin yetiştirildiği bölgede, çalışma kapsamındaki ümitvar mahalli çeşitler "Ağırlıklı Derecelendirme" yöntemi kullanılarak belirlenmiştir. Belirlenen çeşitlerin birbirleriyle karşılaştırılması amacıyla 2020 yılında yapılan tartılı derecelendirme sonucunda meyve ağırlığı, yeme kalitesi, dış görünüş, paslılık durumu, suda çözünebilir kuru madde miktarı ve meyve eti sertliği bakımından 24 mahalli armut çeşidi üstün özellikli seçilmiştir. Seçilen bu çeşitlerde 2021 yılında yapılan tartılı derecelendirme sonuçlarına göre 13 mahalli armut çeşidi ümitvar olarak belirlenmiştir. Ümitvar olan mahalli armut çeşitleri içerisinde en yüksek puanı sırasıyla Güz Armudu-1, Paşa Armudu-2 ve Sulu Armut çeşitleri almıştır. Ümitvar mahalli armut çeşitlerinin kalitesinin artırılması, böylece genetik kaynakların korunması ve tescile aday olabilecek genotiplerin ortaya çıkarılması amaçlanmıştır.

Anahtar Kelimeler: Muş, armut, fenoloji, pomoloji, çeşit.

1. Introduction

Pear is one of the important fruit species that is suitable for our country's ecology, has favorable environmental conditions and has high nutritional value. Different species are grown in our country due to ecological conditions and different climate types. Approximately 85 fruit species are grown throughout our country. This number is around 138 worldwide (Ercişli, 2004). In this sense, Turkey has a high diversity and population throughout the world where different fruit species grow.

It is known that countries such as Turkey, Italy, France and Belgium are important locations for pear cultivation. The pear was first brought to the Americas by British and French colonists in 1630. Significant advances were made in pear cultivation in those region, and many studies were conducted on Western and Eastern pears (Karadeniz & Çorumlu, 2012; Yarılgaç & Yıldız, 2001).

Pear (Pyrus communis) is a fruit that is widely produced and consumed around the world. Pear, whose homeland is shown as Anatolia, Central Asia and the Caucasus, has a significant genetic diversity still waiting to be discovered in our country. It is reported that Turkey has a richness of more than 600 varieties as standard, summer, winter or local (Özbek, 1978; Özçağıran et al., 2004).

Selection studies on pear cultivars focus on various characters. These characters may differ depending on the purpose of the study. Among these, features such as

regular and high yield, fruit quality factors, resistance to diseases and damages, resistance to cold, resistance to Erwinia amylovora disease, fruit size, pH, acidity and growth strength of the tree are important (Büyükyılmaz et al., 1992; Özbek, 1978).

Many researchers have selected the pear genotypes formed as a result of natural foreign pollination, developed them by selection method, and carried out improvement studies using breeding methods. At the same time, it is among the studies carried out to reveal the degree of kinship and genetic relationships between varieties (Fischer, 2009; Yamamoto & Chevreau, 2009).

Researchers in our country are aware of the rich genetic variation and carry out studies to evaluate this source. These studies focus on selecting and characterizing genotypes with superior characteristics. Selection studies are among important studies that require extreme care and attention. The main purpose of these studies is to protect and improve our genetic diversity (Öz & Aslantaş, 2015).

551.086 tons of pear production was realized in Turkey in 2022. The highest production amount was recorded in Bursa province with 225,798 tons. It is observed that Bursa is followed by Antalya province with 58.797 tons. After Antalya province, production was realized in Mersin with 13,379 tons. Especially in Bursa and Antalya provinces, a significant amount of pear production is made, and these two provinces are in the leading position in terms of pear production. In the province of Muş, 550 tons of pears were produced in 2022 (TSI, 2022).

During the research process, field and laboratory studies were carried out in the regions where pear cultivation is intense between the years 2020-2022. After these studies, the criteria used for the "Weighed Rating" method were determined and the genotypes were classified according to these criteria, and the total weighted rating scores were calculated.

After these studies, the criteria used for the "Weighed Rating" method were determined and the genotypes were classified according to these criteria and the total weighted rating scores were calculated. Based on these scoring results, promising native varieties for Muş province and its districts were determined.

The aim of the study; selection of pears grown in the region, taking important steps to protect pear genetic diversity and determining suitable candidate genotypes for registration.

2. Material and Methods

2.1. Material

This research was carried out in the province of Muş and its districts between 2020-2022. The material of the research was composed of native pear varieties grown in Muş province and districts. Leaf and fruit samples of each cultivar were randomly collected from different parts of the trees at the full maturity stage. For the evaluation of qualitative and quantitative characteristics, 20 ripe fruits and leaves per cultivar were selected.

Muş Province is located within the borders of the Eastern Anatolia Region. It lies between 39°29' and 38°29' north latitudes and 41°06' and 41°47' east longitudes. The total area of Muş province is 8196 km² and its altitude is 1350 m (Figure 1).

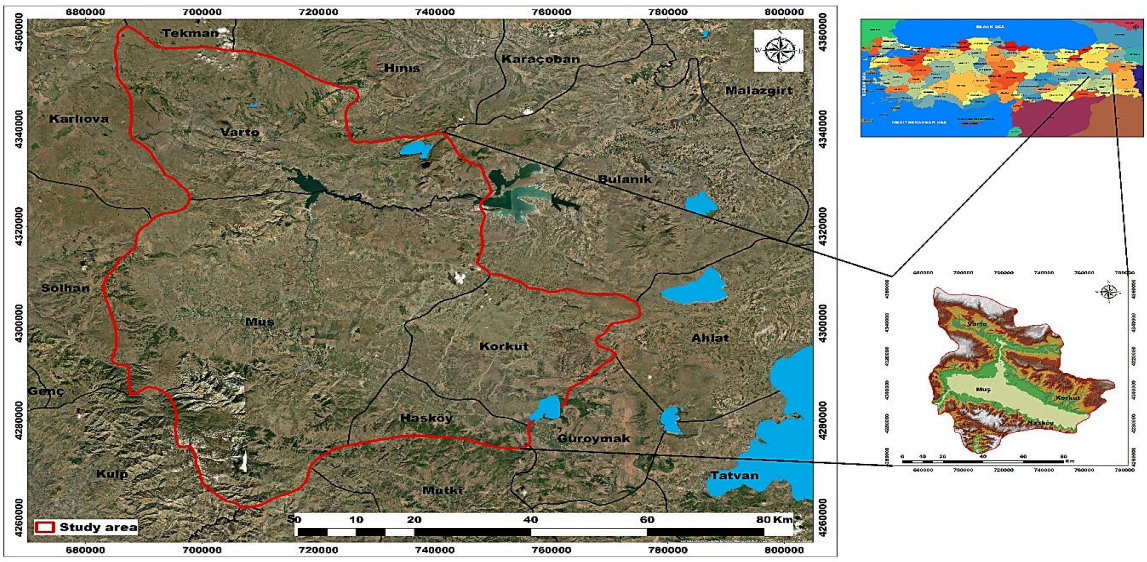

Figure 1. The map of Muş province where the research was conducted.
Şekil 1. *Araştırmanın yapıldığı Muş ilinin haritası.*

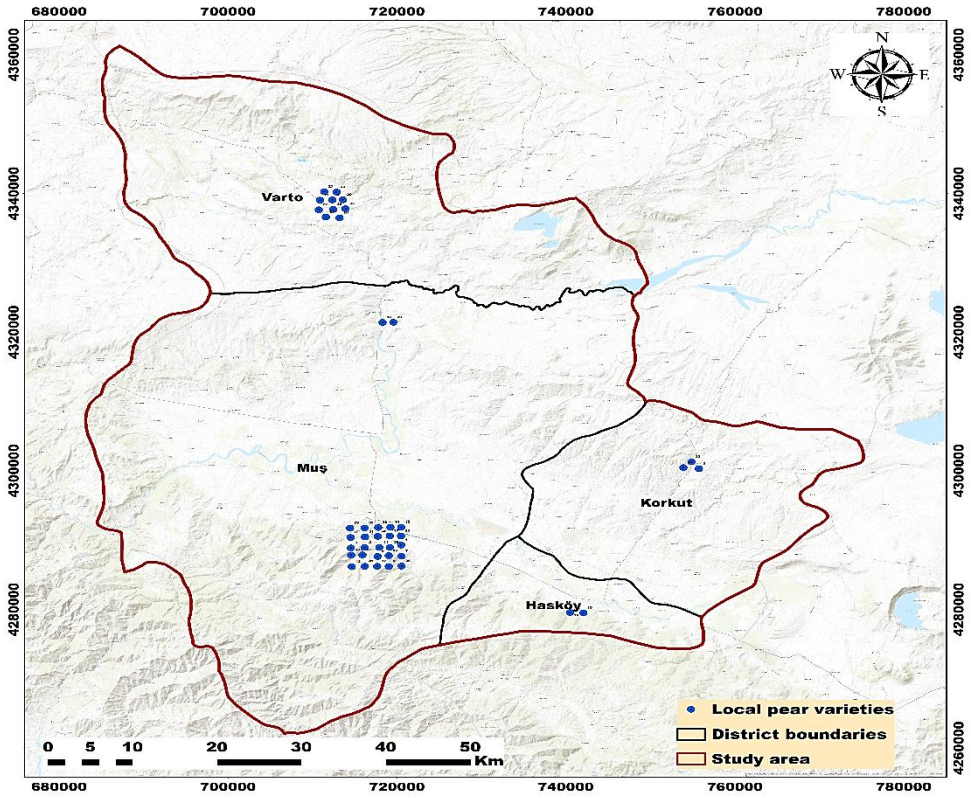

Figure 2. Coordinates of local pear varieties determined in Muş province in the research.
Şekil 2. *Araştırmada Muş ilinde belirlenen mahalli armut çeşitlerinin koordinatları.*

Table 1. General information of local pear varieties determined in Muş province
Çizelge 1. *Muş ilinde belirlenen mahalli armut çeşitlerine ilişkin genel bilgiler*

Local varieties sampled from different locations					
Sample No	**Varieties**	**Altitude**	**Sample No**	**Varieties**	**Altitude**
1	Abbasi	1417	22	Kültür-4	1546
2	Ampul	1478	23	Kültür-5	1546
3	Bal Armut	1487	24	Mayhoş	1526
4	Dağ Armudu	1546	25	Mecnunun Ar.	1511
5	Devecik	1525	26	Mihrani	1411
6	Elazığ	1510	27	Mor Armut-1	1547
7	Erkenci Karçin	1401	28	Mor Armut-2	1503
8	Geççi Karçin	1400	29	Pamukhala	1513
9	Güz Armudu-1	1412	30	Paşa Armudu-1	1277
10	Güz Armudu-2	1499	31	Paşa Armudu-2	1503
11	Güz Mihranisi	1510	32	Sert Armut	1524
12	Güzlük Armut	1497	33	Sulu Armut	1547
13	Haziran Gülü	1557	34	Şeker	1503
14	Hıyan	1505	35	Şuti	1412
15	Karakütük-1	1357	36	Van Armudu	1405
16	Karakütük-2	1351	37	Yaz Armudu-1	1412
17	Karanfil	1556	38	Yaz Armudu-2	1513
18	Kışlık	1282	39	Yazlık Armut	1489
19	Kültür-1	1546	40	Yerli Ankara	1513
20	Kültür-2	1547	41	Yeşil Mihrani	1557
21	Kültür-3	1546	42	Yuvarlak Karçin	1395

A harsh continental climate prevails in the province of Muş. The temperature ranges between -29°C and +37°C. The temperature is above +30°C on 120 days of the year and below 0°C on 120 days. It snows a lot in winter. Annual precipitation is between 350-1000 mm. Winters are very cold and long, summers are short, hot and dry (Anonymous, 2022).

In the province of Muş, producers grow different fruit trees around their houses and in their gardens in proportion to their possibilities. These fruit growing

activities do not have a commercial purpose in general, but production is carried out for family needs. In the province of Muş, cultivation activities in the form of a closed garden have been observed during our studies in recent years. Within the scope of the study, the areas where pear cultivation is carried out in Muş province were examined and 42 local pear varieties were detected. The local pear varieties identified in Muş provincial center, Hasköy, Korkut and Varto districts were marked for examination and processed on the map (Figure 2) by taking their coordinates. The names of the local varieties used in the study and the altitude values of the place where they are grown are shown in Table 1.

2.2. Method

Phenological, pomological and chemical analyzes of local pear cultivars grown in Muş province are based on the criteria specified in IBPGR (International Board for Plant Genetic Resources), UPOV (International Union for The Protection of New Varieties of Plants); fruit weight, fruit length (UPOV 37), fruit width (UPOV 38), fruit stem length (UPOV 50), fruit stem thickness (UPOV 51), fruit flesh firmness (UPOV 61), skin thickness, rusty condition, harvest date, from chemical properties; The amount of water-soluble dry matter, titratable acidity, fruit juice pH, sensory quality of eating and external quality parameters were examined within the framework of references (Büyükyılmaz & Bulagay, 1983; Büyükyılmaz et al., 1992; 1994; Kaya, 2008; Öztürk, 2010).

Of the 42 varieties examined in the study, those that were harvested before August 15 were recorded as "Summer", those that were harvested between August 15 and October 14 as "Autumn" and those that were harvested after October 14 were recorded as "Winter" pears, and these were subjected to weighted rating. The characteristics of a total of 42 genotypes as summer, fall and winter, selected according to the weighted grading made in 2020, were examined.

In the comparison of pear varieties determined in Muş province and districts with each other within the scope of the study, similar studies (Büyükyılmaz & Bulagay, 1983) and (Büyükyılmaz et al., 1992; 1994) used by (Michelson et al., 1958), the modified "Weighted Rating" method was used. According to the characteristics and the degree of importance based on the weighted rating, these characteristics (Büyükyılmaz & Bulagay, 1983; Büyükyılmaz et al., 1994; Çelikel-Çubukçu & Bostan, 2018; Öztürk, 2010), the relative scores and the class values are given in Table 3.

The sum of the weighted scores obtained by multiplying the class value score of each trait with the relative scores determined the total value score of the pear genotypes, which is the basis for the "Weighted Rating". Genotypes were divided into 3 groups as good, middle and bad according to their total value scores and groups were formed (Table 2).

Table 2. Total value score ranges "Weighted Rating"
Çizelge 2. *Toplam değer puanı aralıkları ''Tartılı Derecelendirme''*

Total Value Points		Group
2020	2021	
450 ≤	550 ≤	**Good**
351 – 449	450 – 549	**Medium**
350 ≥	400 ≥	**Bad**

As a result of the evaluation of the data of 2020, the varieties with the highest value score (with a score of 450 and above) in the good value group were selected in the selection of local pear varieties and they were re-examined in 2021. According to the grouping made in the total value score, local pear varieties that were in the good group (550 points and above) in 2021 were decided as promising.

3. Results

3.1. 2020 Studies

Fruit weights of local pear cultivars were found to be 17.76-284.81 g, fruit lengths of 24.92-103.87 mm, fruit widths of 30.47-94.85 mm, fruit stalk lengths of 16.83-62.16 mm, fruit stalk thicknesses of 2.07-5.03 mm, and skin thicknesses between 0.14-0.69 mm. Harvest dates for cultivars varied between July 25 and November 21. The harvest dates could not be determined since Elazığ, Yaz Armudu-2 and Yuvarlak Karçin cultivars show periodicity (Table 4).

The water-soluble dry matter contents of the local pear cultivars grown in Mus province where 9.4-20.5%, titratable acidity 0.13-0.83%, pH values 3.23-4.88, fruit firmness 1.82-11.30 kg $cm^{2\ -1}$. When the varieties were evaluated in terms of eating quality, it was determined that 4 of them had bad eating quality, 12 of them were medium, 9 of them were good and 14 of them were very good. When the cultivars were examined in terms of external quality, it was determined that 14 of them were medium, 14 of them were good, and 11 of them were very good. When the rustyness status of the pear varieties determined in Muş province was examined, it was determined that 3 of them were moderately rusty, 9 of them were slightly rusty, and 27 of them were rust-free or slightly rusty (Table 5).

Table 3. The characteristics based on the weighted rating, their relative scores, the class values and scores of the characteristics

Çizelge 3. *Tartılı derecelendirmeye dayalı özellikler, bunların göreceli puanları, sınıf değerleri ve özelliklerin puanları*

Criteria	Relative Points		Classes	Classes	Points
Fruit Weight (g)	**30**	**Summer**	60 ≥	Very small	1
			60.01 - 80	Small	3
			80.01 – 100.00	Medium	5
			100.01 – 120.00	Large	7
			120.01 ≤	Very large	9
		Autumn	60 ≥	Very small	1
			60.01 – 90.00	Small	3
			90.01 – 120.00	Medium	5
			120.01 – 150.00	Large	7
			150.01 ≤	Very large	9
		Winter	60.00 ≥	Very small	1
			60.01- 100.00	Small	3
			100.01 – 140.00	Medium	5
			140.01 – 180.00	Large	7
			180.01 ≤	Very large	9
Eating Quality	**20**		4.2 ≤	Very good	9
			3.3-4.1	Good	7
			2.4-3.2	Middle	5
			1.5-2.3	Bad	3
			1.4 ≥	Very bad	1
External Quality	**10**		4.2 ≤	Very good	9
			3.3-4.1	God	7
			2.4-3.2	Middle	5
			1.5-2.3	Bad	3
			1.4 ≥	Very bad	1
State of Rustiness	**5**			None or very low	9
				Low	7
				Medium	5
				High	3
				All surface covered	1
Water Soluable Dry Matter	**20**	**Summer**	12.74 ≥	Low	1
			12.75-15.01	Medium	3
			15.02 ≤	High	5
		Autumn	11.79 ≥	Low	1
			11.80-14.99	Medium	3
			15.00 ≤	High	5
		Winter	13.99 ≥	Low	1
			14.00-16.69	Medium	3
			16.70 ≤	High	5
Fruit Flesh Firmness (kg cm$^{2\ -1}$)	**15**	**Summer**	4.29 ≥	Soft	1
			4.30-6.31	Medium	3
			6.32 ≤	Hard	5
		Autumn	4.88 ≥	Soft	1
			4.89-6.96	Medium	3
			6.97 ≤	Hard	5
		Winter	5.76 ≥	Soft	1
			5.77-7.84	Medium	3
			7.85 ≤	Hard	5
TOTAL	**100**				

The total scores of the local pear cultivars grown in Muş as a result of the weighted grading are given in Table 6. Accordingly, Sulu Armut (750 points) got the highest score. This cultivar was followed by Paşa Armudu-2 with 720 points and Güz Armudu-1 with 700 points. The cultivar with the lowest score was Kültür-2 cultivar with 250 points. After the Kültür-2 variety, the Kültür-4 variety received the lowest score with 260 points, the Kültür-4 variety was followed by the Dağ Armudu variety with 290 points (Table 6).

Considering the scores obtained by the determined pear cultivars as a result of the "Weighted Rating" method, 21 pear cultivars in the good group with a score of 450 and above, and 3 pear cultivars (Elazığ, Yaz Armudu-2 and Yuvarlak Karçin) that could not be pomologically examined were selected to be examined

in 2021. Pear cultivars scored 30-270 points in terms of fruit size, 60-180 points in terms of eating quality, between 50-90 points in terms of external quality, 20-100 points in terms of water-soluble dry matter, and 15-75 points in terms of fruit flesh firmness (Table 6).

Table 4. 2020 fruit characteristics and harvest dates of local pear varieties
***Çizelge 4**. Mahalli armut çeşitlerinin 2020 yılı meyve özellikleri ve hasat tarihleri*

S.N.	Varieties	Fruit						
		Weight (g)	Width (mm)	Lenght (mm)	Stem Lenght (mm)	Stem thickness (mm)	Skin thickness (mm)	Harvest date
1	Abbasi	188.58	69.13	66.15	31.53	2.92	0.19	25-30 October
2	Ampul	184.35	60.55	74.81	28.14	3.44	0.51	24-30 August
3	Bal Armut	102.68	55.15	56.08	19.70	2.52	0.33	25-29 July
4	Dağ Armudu	21.47	31.15	25.21	16.83	4.72	0.69	01-14 November
5	Devecik	148.29	62.87	74.83	29.85	3.38	0.53	04-19 November
6	Elazığ	***	***	***	***	***	***	***
7	Erkenci Karçin	30.17	35.17	29.14	34.47	2.58	0.33	08-13 August
8	Geççi Karçin	40.86	38.43	30.74	40.17	2.61	0.41	010-9 Setember
9	Güz Armudu-1	140.39	61.74	80.93	62.16	3.19	0.14	20-27 September
10	Güz Armudu-2	116.81	57.65	77.20	56.11	3.38	0.24	23-29 September
11	Güz Mihranisi	97.52	55.93	57.89	38.88	4.27	0.47	01-09 October
12	Güzlük Armut	108.37	54.28	67.82	30.71	3.55	0.51	17-26 September
13	Haziran Gülü	133.24	63.02	64.77	36.48	3.14	0.37	27-31 July
14	Hıyan	56.47	43.75	52.20	29.92	3.53	0.62	01-08 September
15	Karakütük-1	87.76	53.82	54.04	39.37	3.84	0.48	16-26 October
16	Karakütük-2	60.42	42.14	55.49	33.71	2.93	0.37	10-21 November
17	Karanfil	26.88	30.47	29.13	29.58	2.67	0.53	10-18 September
18	Kışlık	135.92	68.66	57.95	26.67	4.06	0.56	20-31 October
19	Kültür-1	45.95	44.79	41.17	22.99	3.19	0.30	01-12 November
20	Kültür-2	25.7	33.29	30.13	39.38	2.25	0.32	17-30 October
21	Kültür-3	52.64	44.17	45.25	27.44	2.89	0.28	22-31 October
22	Kültür-4	56.91	48.38	45.92	32.20	2.39	0.53	16-28 October
23	Kültür-5	80.12	58.14	50.17	29.44	2.55	0.49	03-16 November
24	Mayhoş	152.28	60.45	73.26	37.71	3.54	0.37	20-27 August
25	Mecnunun Ar.	106.28	63.14	64.82	33.41	4.02	0.28	23-30 August
26	Mihrani	80.22	59.56	61.49	28.73	2.93	0.16	26-30 August
27	Mor Armut-1	140.36	53.47	72.41	40.13	4.88	0.24	07-13 October
28	Mor Armut-2	89.82	68.13	83.01	36.91	5.03	0.34	20-30 October
29	Pamukhala	68.11	52.81	59.10	23.12	3.87	0.17	01-08 September
30	Paşa Armudu-1	152.7	64.19	70.47	35.55	4.06	0.42	02-10 September
31	Paşa Armudu-2	284.81	94.85	103.87	58.17	4.45	0.22	23-29 September
32	Sert Armut	106.77	56.74	65.92	26.63	3.86	0.51	20-26 September
33	Sulu Armut	170.85	60.05	83.14	34.71	2.98	0.27	01-07 October
34	Şeker	17.76	31.03	24.92	27.52	2.07	0.47	18-30 October
35	Şuti	73.77	51.10	54.12	17.60	4.30	0.28	04-10 October
36	Van Armudu	115.45	55.79	70.31	50.05	4.11	0.44	01-12 November
37	Yaz Armudu-1	70.68	53.78	60.11	46.71	3.92	0.19	06-11 August
38	Yaz Armudu-2	***	***	***	***	***	***	***
39	Yazlık Armut	140.26	68.13	66.81	39.22	3.76	0.51	09-14 August
40	Yerli Ankara	100.88	62.86	54.37	25.93	4.16	0.38	01-08 October
41	Yeşil Mihrani	70.56	52.41	53.83	30.64	4.53	0.33	21-29 August
42	Yuvarlak Karçin	***	***	***	***	***	***	***

(S.N.=Serial Number)

Table 5. The year 2020 of local pear cultivars, chemical properties, fruit flesh firmness, eating quality, external quality and rustiness conditions

Çizelge 5. *Mahalli armut çeşitlerinin 2020 yılı, kimyasal özellikleri, meyve eti sertliği, yeme kalitesi, dış kalite ve paslılık durumları*

S. N.	Varieties	WSDM (%)	Acidity (%)	pH	Fruit flesh firmness (kg $cm^{2\ -1}$)	Eating quality	External quality	State of Rustiness
1	Abbasi	15.2	0.24	4.48	5.81	4.4	4.6	None or very low
2	Ampul	11.8	0.39	3.76	3.84	3.2	4.0	None or very low
3	Bal Armut	9.4	0.29	4.30	5.92	4.0	4.4	None or very low
4	Dağ Armudu	15.0	0.54	3.23	6.59	2.0	3.0	None or very low
5	Devecik	10.3	0.13	4.66	4.16	4.2	3.2	None or very low
6	Elazığ	***	***	***	***	***	***	***
7	Erkenci Karçin	12.8	0.14	4.51	3.88	4.4	4.0	None or very low
8	Geççi Karçin	15.8	0.38	4.12	2.86	3.8	3.4	Low
9	Güz Armudu-1	17.6	0.18	4.33	8.95	4.8	4.4	None or very low
10	Güz Armudu-2	15.1	0.26	3.94	4.63	4.2	4.2	None or very low
11	Güz Mihranisi	14.4	0.31	4.04	5.54	4.0	4.2	Low
12	Güzlük Armut	9.6	0.22	4.13	3.87	3.2	3.8	None or very low
13	Haziran Gülü	19.2	0.15	4.53	1.82	3.0	3.2	Medium
14	Hıyan	15.7	0.56	3.81	3.64	3.2	3.0	None or very low
15	Karakütük-1	18.9	0.32	3.93	3.08	2.2	2.8	Low
16	Karakütük-2	16.6	0.24	3.56	2.34	2.8	3.0	Low
17	Karanfil	12.6	0.25	4.16	5.03	4.2	4.0	None or very low
18	Kışlık	10.8	0.30	3.96	2.33	3.2	2.6	None or very low
19	Kültür-1	20.4	0.55	3.68	4.58	2.6	3.4	Low
20	Kültür-2	15.3	0.69	3.52	4.46	2.2	3.2	Low
21	Kültür-3	14.8	0.50	3.48	6.87	4.4	3.8	None or very low
22	Kültür-4	11.8	0.78	3.89	5.51	3.2	3.0	None or very low
23	Kültür-5	17.5	0.38	4.06	1.85	1.8	3.0	Medium
24	Mayhoş	11.1	0.41	3.70	2.44	3.8	2.8	None or very low
25	Mecnunun Arm.	18.0	0.16	4.34	5.77	4.0	3.6	None or very low
26	Mihrani	20.5	0.50	3.86	5.94	4.6	4.4	None or very low
27	Mor Armut-1	17.3	0.14	4.41	4.89	3.8	4.4	None or very low
28	Mor Armut-2	15.4	0.83	3.66	2.27	3.0	3.2	None or very low
29	Pamukhala	16.2	0.13	4.79	9.63	4.4	4.2	None or very low
30	Paşa Armudu-1	13.5	0.22	4.51	8.47	3.6	3.8	Low
31	Paşa Armudu-2	14.9	0.65	3.64	11.30	4.6	4.4	None or very low
32	Sert Armut	14.4	0.67	3.62	5.48	3.2	2.8	Medium
33	Sulu Armut	17.4	0.13	4.70	8.96	4.2	4.6	Low
34	Şeker	15.7	0.17	4.88	2.81	3.2	3.2	None or very low
35	Şuti	15.6	0.64	3.62	8.28	4.6	4.0	None or very low
36	Van Armudu	18.2	0.54	3.49	10.73	4.8	4.2	None or very low
37	Yaz Armudu-1	13.1	0.16	4.82	9.83	4.0	4.2	None or very low
38	Yaz Armudu-2	***	***	***	***	***	***	***
39	Yazlık Armut	16.4	0.24	3.60	2.09	4.2	3.4	None or very low
40	Yerli Ankara	14.2	0.31	3.41	2.46	3.8	3.2	Low
41	Yeşil Mihrani	10.2	0.40	3.55	6.11	3.2	4.0	None or very low
42	Yuvarlak Karçin	***	***	***	***	***	***	***

(S.N.=Serial Number, WSDM= Water-Soluable Dry Matter)

Table 6. Scores and total scores of local pear cultivars from weighted rating criteria in 2020
Çizelge 6.*.Mahalli armut çeşitlerinin 2020 yılı tartılı derecelendirmeden aldıkları puanlar ve toplam puanlar*

Serial Number	Varieties	Taken County	F.W.	E.Q.	E.Q.	S.R.	WSDM	F.F.F.	Total
1	Abbasi	Center	270	180	90	45	60	45	**690 (4)**
2	Ampul	Center	270	100	70	45	60	15	**560 (10)**
3	Bal Armut	Center	210	140	90	45	20	45	**550 (13)**
4	Dağ Armudu	Varto	30	60	50	45	60	45	290
5	Devecik	Korkut	210	180	50	45	20	15	**520 (18)**
6	Elazığ	Center	***	***	***	***	***	***	***
7	Erkenci Karçin	Center	30	180	70	45	60	15	400
8	Geççi Karçin	Center	30	140	70	35	100	15	390
9	Güz Armudu-1	Center	210	180	90	45	100	75	**700 (3)**
10	Güz Armudu-2	Center	150	180	90	45	60	15	**540 (16)**
11	Güz Mihranisi	Center	150	140	90	35	60	45	**520 (19)**
12	Güzlük Armut	Center	150	100	70	45	20	15	400
13	Haziran Gülü	Center	270	100	50	25	100	15	**560 (11)**
14	Hıyan	Center	30	100	50	45	100	15	340
15	Karakütük-1	Hasköy	90	60	50	35	100	15	350
16	Karakütük-2	Hasköy	90	100	50	35	60	15	350
17	Karanfil	Center	30	180	70	45	60	45	430
18	Kışlık	Center	150	100	50	45	20	15	380
19	Kültür-1	Varto	30	100	70	35	100	15	350
20	Kültür-2	Varto	30	60	50	35	60	15	250
21	Kültür-3	Varto	30	180	70	45	60	45	430
22	Kültür-4	Varto	30	100	50	45	20	15	260
23	Kültür-5	Varto	90	60	50	25	100	15	340
24	Mayhoş	Korkut	270	140	50	45	20	15	**540 (17)**
25	Mecnunun Armudu	Center	150	140	70	45	100	45	**550 (14)**
26	Mihrani	Center	90	180	90	45	100	45	**550 (15)**
27	Mor Armut-1	Varto	210	140	90	45	100	45	**630 (7)**
28	Mor Armut-2	Varto	90	100	50	45	60	15	360
29	Pamukhala	Center	90	180	90	45	100	75	**580 (9)**
30	Paşa Armudu-1	Center	270	140	70	35	60	75	**650 (5)**
31	Paşa Armudu-2	Center	270	180	90	45	60	75	**720 (2)**
32	Sert Armut	Korkut	150	100	50	25	60	45	430
33	Sulu Armut	Varto	270	180	90	35	100	75	**750 (1)**
34	Şeker	Center	30	100	50	45	60	15	300
35	Şuti	Center	90	180	70	45	100	75	**560 (12)**
36	Van Armudu	Center	150	180	90	45	100	75	**640 (6)**
37	Yaz Armudu-1	Center	90	140	90	45	60	75	**500 (20)**
38	Yaz Armudu-2	Center	***	***	***	***	***	***	***
39	Yazlık Armut	Center	210	180	70	45	100	15	**620 (8)**
40	Yerli Ankara	Center	150	140	50	35	60	15	**450 (21)**
41	Yeşil Mihrani	Center	90	100	70	45	20	45	370
42	Yuvarlak Karçin	Center	***	***	***	***	***	***	***

(**F.W:** Fruit Weight, **E.Q:** Eating Quality, **E.Q:** External Quality, **SR:** State of Rustiness, **F.F.F:** Fruit Fless Firmness, **WSDM:** Water-Soluable Dry Matter)

3.2. 2021 Studies

Fruit weight of the cultivars was 58.96-268.36 g, fruit length 32.77-99.83 mm, fruit width 31.11- 90.41 mm, fruit stalk length 22.39-59.46 mm, fruit stalk thickness 2.43-5.14 mm, fruit skin thickness 0.14-0.46 mm. The harvest dates of the varieties took place between July 15 and November 16 (Table 7).

In 2021, the amount of water-soluble dry matter (WSDM) of local pear varieties was found to be between 12.1-19.6%, titrable acidity values were found to be 0.14-0.61%, pH values were found to be 3.48-4.72, and fruit flesh hardness was found to be in the December 2.94-11.16 kg $cm^{2\ -1}$ range. When the varieties were evaluated in terms of eating quality, it was determined that 1 of them was bad, 4 of them medium, 10 of them good and 9 of them very good. When the cultivars were examined in terms of external quality, it was determined that 6 of them were medium, 9 of them were good, and 9 of them were very good. Looking at the rusty condition of the pear varieties determined in Muş province, it was determined that 10 of them were low rusty, and 14 of them were none or very low rusty (Table 8).

Table 7. Fruit characteristics and harvest dates of local pear varieties in 2021
***Çizelge** 7. Mahalli armut çeşitlerinin 2021 yılı meyve özellikleri ve hasat tarihleri*

Serial Number	Varieties	Fruit						
		Weight (g)	Width (mm)	Lenght (mm)	Stem Lenght (mm)	Stem thickness (mm)	Skin thickness (mm)	Harvest date
1	Abbasi	192.34	72.15	67.59	36.69	2.82	0.16	16-29 October
2	Ampul	170.19	56.43	69.16	30.93	3.67	0.46	12-19 August
3	Bal Armut	91.84	50.29	52.77	22.39	2.43	0.26	23-28 July
4	Devecik	146.29	60.39	73.55	27.00	3.08	0.45	01-16 November
5	Elazığ	58.96	46.57	49.91	28.08	2.84	0.33	05-11 September
6	Güz Armudu-1	146.53	63.26	78.86	58.87	3.11	0.16	15-20 September
7	Güz Armudu-2	113.75	57.81	76.88	59.46	3.10	0.19	19-25 September
8	Güz Mihranisi	96.01	57.98	59.62	35.75	3.99	0.43	20-26 September
9	Haziran Gülü	135.42	64.15	65.22	35.40	3.20	0.39	20-24 July
10	Mayhoş	126.95	52.63	64.82	34.66	3.58	0.29	11-16 August
11	Mecnunun Arm.	98.36	62.69	63.86	34.22	4.22	0.30	14-20 August
12	Mihrani	93.49	64.83	68.93	26.25	3.17	0.14	18-25 August
13	Mor Armut-1	135.84	51.67	69.92	42.96	5.14	0.27	1-8 October
14	Pamukhala	64.87	51.15	57.03	28.16	3.14	0.20	23-30 August
15	Paşa Armudu-1	160.60	66.67	71.61	33.03	3.83	0.38	20-28 August
16	Paşa Armudu-2	268.36	90.41	99.83	53.82	4.13	0.34	24-30 August
17	Sulu Armut	162.28	57.66	81.92	32.72	2.90	0.29	25-30 September
18	Şuti	70.99	49.35	52.43	24.75	4.15	0.28	22-29 September
19	Van Armudu	114.23	53.38	68.32	45.92	4.81	0.40	18-31 October
20	Yaz Armudu-1	80.78	50.85	58.50	46.38	3.42	0.23	01-05 August
21	Yaz Armudu-2	77.93	52.44	63.98	45.16	3.04	0.34	06-10 August
22	Yazlık Armut	118.14	65.41	61.98	44.28	3.95	0.44	03-06 August
23	Yerli Ankara	66.85	56.42	50.85	26.05	4.20	0.38	24-29 September
24	Yuvarlak Karçin	67.61	56.27	55.90	36.69	2.82	0.39	14-23 September

Table 8. The year 2021 of local pear cultivars, chemical properties, fruit firmness, eating quality, external quality and rustyness
***Çizelge 8.** Mahalli armut çeşitlerinin 2021 yılı, kimyasal özellikleri, meyve eti sertliği, yeme kalitesi, dış kalite ve paslılık durumları*

Serial Number	Varieties	WSDM (%)	Acidity (%)	pH	Fruit flesh firmness (kg $cm^{2\ -1}$)	Eating quality	External quality	State Of Rustiness
1	Abbasi	15,5	0.19	4.38	6.94	3.8	4.4	None or very low
2	Ampul	13,7	0.41	3.55	4.73	3.2	3.2	Low
3	Bal Armut	12,3	0.35	4.51	5.72	4.0	4.4	None or very low
4	Devecik	12,8	0.17	4.44	2.94	4.0	3.8	Low
5	Elazığ	15,4	0.25	4.41	6.53	4.2	4.4	Low
6	Güz Armudu-1	18,3	0.14	4.41	10.13	4.8	4.6	None or very low
7	Güz Armudu-2	15,1	0.27	3.95	4.13	4.2	4.2	None or very low
8	Güz Mihranisi	13,9	0.34	3.94	4.96	4.0	3.8	Low
9	Haziran Gülü	12,1	0.36	3.73	5.74	2.3	3.2	None or very low
10	Mayhoş	12,8	0.43	3.62	4.18	3.8	3.2	Low
11	Mecnunun Arm.	17,4	0.31	3.96	3.35	3.2	3.2	Low
12	Mihrani	17,8	0.40	3.49	6.33	4.6	4.4	None or very low
13	Mor Armut-1	18,2	0.20	4.23	5.33	4.0	4.4	None or very low
14	Pamukhala	17,0	0.19	4.51	9.57	4.4	3.8	None or very low
15	Paşa Armudu-1	14,1	0.20	4.69	9.12	3.2	4.0	Low
16	Paşa Armudu-2	13,5	0.61	3.48	9.95	4.4	4.0	None or very low
17	Sulu Armut	15,4	0.20	4.33	9.65	4.0	3.6	Low
18	Şuti	15,6	0.56	3.61	8.75	4.8	4.0	None or very low
19	Van Armudu	16,8	0.43	3.70	11.16	4.4	4.2	None or very low
20	Yaz Armudu-1	13,5	0.14	4.72	8.77	4.4	4.6	None or very low
21	Yaz Armudu-2	13,4	0.18	4.29	3.82	4.0	3.8	Low
22	Yazlık Armut	17,7	0.26	3.86	3.11	4.4	3.8	Low
23	Yerli Ankara	14,7	0.28	3.56	2.98	3.1	3.2	None or very low
24	Yuvarlak Karçin	19,6	0.42	3.54	4.67	3.8	4.2	None or very low

Table 9. Scores and total scores obtained from the weighted grading criteria of the local pear cultivars for 2021
Çizelge 9. *Mahalli armut çeşitlerinin 2021 yılı ağırlıklı deerecelendirme kriterlerinden alınan puanlar ve toplam puanlar*

Serial Number	Varieties	Taken County	F.W.	E.Q.	E.Q.	S.R.	WSDM	F.F.F.	Total
1	Abbasi	Center	270	140	90	45	60	45	**650 (4)**
2	Ampul	Center	270	100	50	35	60	15	530
3	Bal Armut	Center	150	140	90	45	20	45	490
4	Devecik	Korkut	210	140	70	35	20	15	490
5	Elazığ	Center	30	140	50	35	100	45	400
6	Güz Armudu-1	Center	210	180	90	45	100	75	**700 (1)**
7	Güz Armudu-2	Center	150	180	90	45	100	15	**580 (11)**
8	Güz Mihranisi	Center	150	140	70	35	60	45	500
9	Haziran Gülü	Varto	270	60	50	45	20	45	490
10	Mayhoş	Korkut	210	140	50	35	60	15	510
11	Mecnunun Armudu	Center	150	100	50	35	100	15	450
12	Mihrani	Center	150	180	90	45	100	45	**610 (8)**
13	Mor Armut-1	Varto	210	140	90	45	100	45	**630 (6)**
14	Pamukhala	Center	90	180	70	45	100	75	**560 (12)**
15	Paşa Armudu-1	Center	270	100	70	35	60	75	**610 (9)**
16	Paşa Armudu-2	Center	270	180	70	45	60	75	**700 (2)**
17	Sulu Armut	Varto	270	140	70	35	100	75	**690 (3)**
18	Şuti	Center	90	180	70	45	100	75	**560 (13)**
19	Van Armudu	Center	150	180	90	45	100	75	**640 (5)**
20	Yaz Armudu-1	Center	150	180	90	45	60	75	**600 (10)**
21	Yaz Armudu-2	Center	90	140	70	35	60	15	410
22	Yazlık Armut	Center	210	180	70	35	100	15	**660 (7)**
23	Yerli Ankara	Center	90	100	50	45	60	15	360
24	Yuvarlak Karçin	Center	90	140	90	45	100	15	480

(**F.W:** Fruit Weight, **E.Q:** Eating Quality, **E.Q:** External Quality, **SR:** State of Rustiness, **F.F.F:** Fruit Fless Firmness, **WSDM:** Water-Soluable Dry Matter)

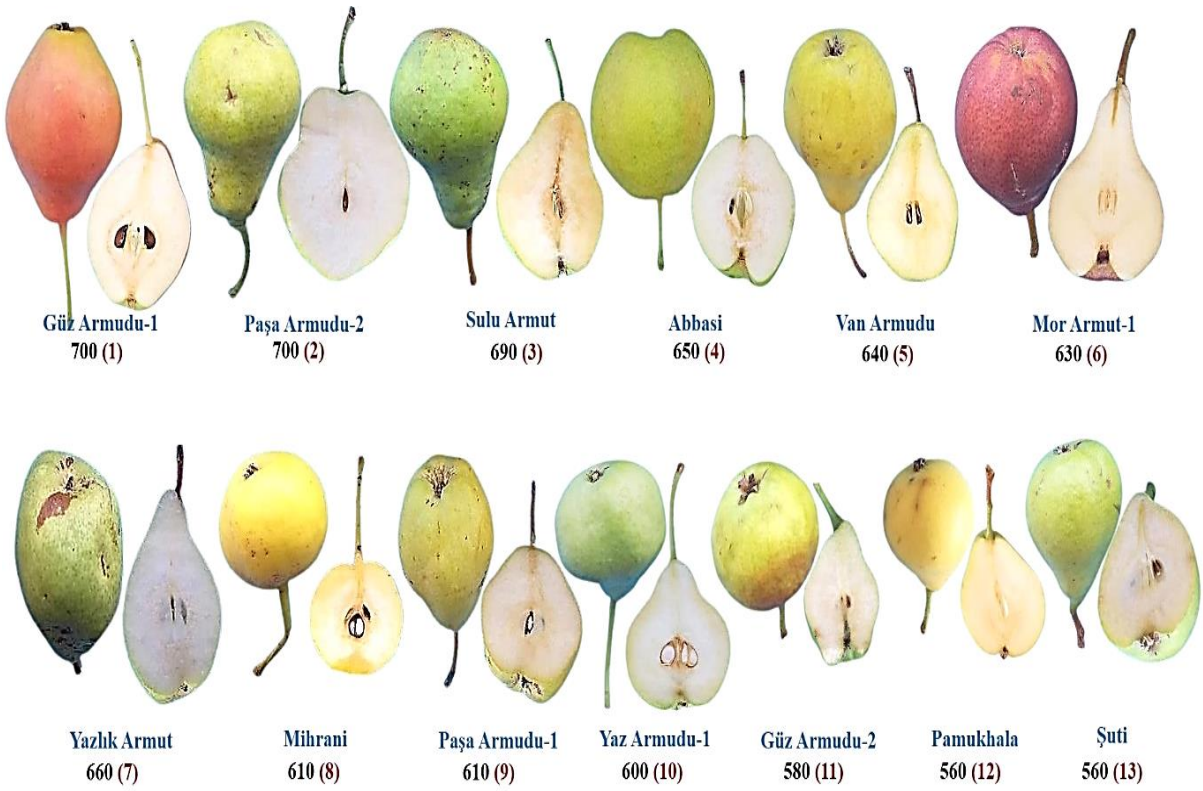

Figure 3. Cultivars determined as promising
Şekil 3*. Ümitvar olarak belirlenen çeşitler*

The cultivars scored 30-270 points in terms of fruit weight, 60-180 points in terms of eating quality, 50-90 points in terms of external quality, 35-45 points in terms of rustiness, 20-100 points in terms of water-soluble dry matter and 15-75 points in terms of fruit flesh firmness (Table 9).

Local pear varieties selected for the second year in Muş got scores between 360-700. According to this scoring, there are two varieties with the highest score. These are the Güz Armudu-1 and Paşa Armudu-2 varieties with 700 points. These varieties were followed by Juicy Pear with 690 points. In the scoring, the Yerli Ankara variety received the lowest score with 360 points. Considering the scores they got as a result of the "Weighed Rating" method from the selected pear varieties, 13 pear cultivars with a score of 550 and above were determined as promising (Table 9).

4. Discussion

Although our country is among the important pear producing countries, it is obvious that pear varieties are not yet at the desired level in terms of yield, quality and the low number of varieties that ripen at different times. One of the most important reasons for this is the lack of standard and quality varieties in line with the demands of the international market. In our country, in addition to the closed gardens created especially in recent years, production at a significant level is still provided by local varieties that people grow in collection gardens and in front of their own homes to meet local needs, and where maintenance and cultural processes are not carried out adequately. Local varieties have been evaluated as very valuable genetic resources by fruit breeders, but they are not widely accepted, especially in terms of national and international trade. Therefore, it is very important to determine the local varieties that can be standard varieties and to prevent the extinction of genetic resources.

Cultivation is a very important issue economically in our country. If economical cultivation is desired, the most important condition for this is to cultivate standard domestic and foreign varieties that meet the demands of the domestic and foreign markets. For this reason, it is very important to reveal productive and high-quality varieties suitable for the different ecologies of our country from our existing pear variety richness.

Bayındır et al. (2018) used the Weighed Grading method to determine promising varieties in local autumn varieties grown in Malatya province between 2014 and 2017, and the criteria used were fruit weight, TSS, eating quality, fruit flesh hardness and eating quality (sandiness).

Çelikel-Çubukçu and Bostan (2018) used the Weighed Grading method in their study to determine umivar varieties in summer, winter and autumn pear genotypes in Çaykara district of Trabzon province in 2012-2013. In the method, they used fruit weight, rustiness, eating quality and external quality criteria.

A study was carried out between 2009 and 2012 to determine the superior types of Çermail pear variety grown in the Erzincan plain. In the study, the Weighed Grading Method was used and yield, periodicity, fruit size, attractiveness, taste, fruit flesh hardness and TSS criteria were used as criteria (Gültekin, 2015).

In this study conducted in Muş province, the harvest dates of local pear cultivars in 2020 were between July 25-November 21, and in 2021 between July 20 and November 16. Harvest dates in 2020 in promising cultivars were between August 6 and November 12. In 2021, the harvest of promising varieties took place between August 1 and October 31 (Table 4 and Table 7).

Terkoğlu (2021), of his study on local pear varieties in Yüksekova district of Hakkari province in 2018-2019, found that the earliest local variety harvested in the first year was Hirmiyatirmehi between August 15 and September 4, and the earliest in both years of the research was Hirmizer, Hirmiyatirmehi and it has been reported that the latest Kurişi cultivar has reached the harvest maturity.

Fruit weights of local varieties determined in Muş province were measured between 21.47-284.81 g, fruit lengths of 24.92-103.87 mm and fruit widths between 30.47-94.85 mm in 2020. In 2021, fruit weights were 34.31-268.36 g, fruit lengths were 32.77-99.83 mm, and fruit widths were between 31.11-90.41 mm. In 13 cultivars identified as promising, fruit weights were 68.11-284.81 g, fruit lengths were 54.12-103.87 mm, and fruit widths were 51.10-94.85 mm in 2020 (Table 4 and Table 7).

In the similar study, fruit weights of promising summer, autumn and winter genotypes were determined between 81.30-221.35 in the study carried out in Çaykara district and 25 neighborhoods of Trabzon province (Çelikel et al., 2015). Yavuz and Pırlak (2018) reported that the fruit weights of 4 Asian pear cultivars (Hosiu, Kosiu, Hakko and Shinseiki) were determined as 122.00-206.00 g in a study conducted in the Ereğli district of Konya province to determine the phenological and pomological characteristics. In the research conducted in the ff district of Trabzon province to determine the pomological characteristics of local pear

varieties, the average fruit weight of 7 early and mid-season local pear varieties was determined to be 53.80-151.48 g (Cevahir & Bostan, 2017).

In 2020, fruit lengths were measured between 54.12-103.87 mm and fruit width between 51.10- 94.85 mm in promising cultivars. Paşa Armudu-2 is also the variety with the highest fruit size and fruit width (Table 4 and Table 7).

Acar (2007) determined the morphological and pomological characteristics of 18 local pear cultivars grown in and around Ünye. He determined fruit weights between 18.67-258.30 g, fruit length between 31.15-85.70 mm, and fruit width between 34.04 mm-81.96 mm. It is seen that the fruit weight values obtained from our study are compatible with the results of other researchers.

In local pear cultivars, fruit stalk lengths of 16.83-62.16 mm, fruit stalk thicknesses of 2.07-5.03 mm in 2020; In 2021, fruit stem lengths were measured between 22.39-59.46 mm, and fruit stem thicknesses were between 2.29-5.14 mm. In 13 varieties determined as promising, in 2020, fruit stalk lengths are between 17.60-62.16 mm, and fruit stalk thicknesses are between 2.52-4.88 mm; In 2021, fruit stem lengths were measured between 22.39-59.46 mm, and fruit stem thicknesses were between 2.43-5.14 mm (Table 4 and Table 7).

Oturmak et al. (2017) determined the fruit stem length between 19.87-50.10 mm and the fruit stem thickness between 2.45-7.98 mm in pear genotypes grown in Silvan, Kulp, Hazro districts and connected villages of Diyarbakır in 2016. The values determined in these studies and the values we determined in our study showed similarities in general.

It has been determined that 3 cultivars have little, and the remaining 10 cultivars have no or very little fruit skin rust in promising cultivars (Table 5 and Table 8).

Yılmaz (2020) examined the rustiness of the fruit skin of local varieties in his study in Fatsa district of Ordu province; He determined that 8 of them had 'low', 8 of them had 'none or low' rust, 10 of them had 'high' and 12 of them had 'medium' rust.

In fruit growing where thin skin is desired, skin thickness was found to be 0.14-0.44 mm in the first year and between 0.14-0.40 mm in the second year in promising cultivars (Table 4 and Table 7).

Yılmaz (2020) found the fruit skin thickness of local varieties to be between 0.38±0.12-0.98±1.34 mm in his study in Fatsa district of Ordu province. In studies, skin thickness data have shown similarities with our data.

Fruit flesh firmness in promising cultivars was 4.63-11.30 kg $cm^{2\ -1}$ in 2020; In 2021, it was found between 4.13-11.16 kg $cm^{2\ -1}$ (Table 5 and Table 8).

Terkoğlu (2021) determined the firmness of fruit flesh as 1.62±0.41 lb (Mellaki) and 11.51±0.10 lb (Şirya) in 2018; In 2019, it has determined that it varies between 1.63±0.42 lb (Mellaki) and 10.68±0.24 lb (Kurişi).

As can be seen, the fruit flesh firmness was found to be different from each other in studies conducted in different places, however, there was not much difference between the mentioned literature findings and the study findings.

In local pear cultivars in 2020, WSDM was found to be 9.4-20.5%, acidity 0.13-0.84%, and pH 3.23-4.88. In the promising cultivars, the WSDM was found to be between 13.1%-20.5%, acidity 0.13-0.65% and pH 3.49-4.82 in 2020. In local pear cultivars in 2021, WSDM was found between 12.1-19.6%, acidity between 0.14-0.61% and pH between 3.48-4.79%. In the promising cultivars, in 2021, WSDM was found to be 13.5-18.3%, acidity 0.14-061 and pH 3.48-4.72 (Table 5 and Table 8).

Polat and Bağbozan (2014), in a study they conducted on local pear cultivars, determined the amount of water-soluble dry matter of the fruits between 10.58-16.33%, the titratable acid content between 0.10-0.94%, and the pH of the juice between 3.21-5.41. Çelikel et al. (2015) stated that the water-soluble dry matter content of the genotypes determined as promising in Çaykara district varied between 9.7-16.6% and the titratable acid content ranged between 1.43%-16%. The findings of the chemical properties we obtained were shown to be between the same values with the literature findings.

It has been determined that 4 of the promising varieties have good eating quality and 9 of them have very good eating quality in 2020 and 2021. In promising varieties, it was determined that 2 of them had good external quality in 2020, 11 of them had very good external quality, and in 2021, 3 of them had good external quality and 10 of them had very good external quality (Table 5 and Table 8).

Büyükyılmaz et al. (1994) found that the quality of eating in promising pear varieties for the Marmara Region is very bad in Popska and Karagöynük varieties, bad in Doyenne d'Hiver varieties, medium in June Gold varieties, good in June Beauty, Devoe and Magness varieties, and very good in Williams Bovey, Klapov Lübimets varieties.

Büyükyılmaz et al. (1992) reported that Akça pears grown in the Eastern Marmara Region have a medium-good level of external quality.

The external quality (appearance) of pears is closely related to shape smoothness and attractiveness. The smoothness of the fruit shape in pears is closely related to the maintenance conditions. High soil and air humidity ensures the formation of large and properly shaped fruit (Özçağıran et al., 2004).

5. Conclusion and Recommendations

With this study carried out in 2020-2022, 13 of the 42 local pear cultivars grown in Muş province (Güz Armudu-1, Paşa Armudu-2, Sulu Armut, Abbasi, Van Armudu, Mor Armut-1, Mihrani, Paşa Armudu-1, Yazlık Armut, Yaz Armudu-1, Güz Armudu-2, Pamukhala and Şuti) were determined as promising.

It is thought that for the selected promising varieties it is possible to increase their superior characteristics even more when they are grown under controlled conditions or when necessary maintenance procedures are carried out. In this study, it will be possible to obtain more accurate results and to be compared with each other by cultivating all local varieties under equal conditions and at the same quality, and by performing cultural processes such as fertilization, spraying and irrigation of each local variety. Because it is a known fact that production practices such as care, irrigation, fertilization, fight against diseases and pests and pruning increase yield and fruit quality in fruit growing.

In this study, it is thought that there are local varieties with features and quality that can be standard varieties among the varieties determined as hopeful in Muş province. In this study we conducted in the province of Muş, it was observed that although the people of the region dealing with fruit growing had grown these local pear varieties for many years, there was no conscious production, that is, traditional agriculture was dominant.

With this study, fruit growing will be done more consciously in the region by determining the promising local pear varieties in Muş province. The people of the region will make a significant contribution to the economy of the region, especially the family, by cultivating these promising local pear varieties for many years.

While combating diseases, pests and weeds that cause very important losses in terms of quality and quantity in fruit growing, sustainability principles should be followed in agriculture, which is one of the most important principles of agriculture, and sensitive cultivation methods that give importance to human, environment and animal health should be applied. It is necessary to develop new agricultural policies that reduce or prohibit the use of pesticides in agricultural production. Especially in recent years, varieties resistant to diseases and pests obtained in the studies carried out within the scope of the methods used in the fight against plant diseases and pests, and the breeding of these varieties have started to attract a lot of attention.

It is an important fact that it is important to protect our superior local varieties, which are indispensable materials for breeding studies and, in addition to offering a different taste, are also an important genetic resource for the development of new types and varieties and they are of great importance for sustainability in agriculture.

In this study, it is among our aims to determine and reveal the richness of local pear varieties, which are known and loved by the local people and found in local markets, and to make the important and superior aspects of these varieties known, to spread more and better quality cultivation and to ensure the recognition of local varieties. In this context, varieties that can be standard varieties should be selected from the local varieties grown, necessary technical information should be given to the farmers who produce them, and new closed gardens should be established for higher quality fruit growing. Thus, it is thought that the local varieties with good characteristics that come to the forefront as a result of our research and adapt to the local ecology will be very effective in increasing the fruit production potential of the region.

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