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A research on the determination of the potential and fruit properties of fruit species growing naturally and processed in the food industry in Merzifon district*

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Abstract: This research was carried out in Merzifon District and villages of Amasya province between 2021-2022 years. In 2021, the natural rosehip, hawthorn, and cornelian cherry populations in these areas were identified. Detailed observations and analyses of 27 rosehip, 21 hawthorn, and 10 cornelian cherry genotypes, selected through pre-selection, were conducted in 2022. . In the study, average fruit weight for rosehip genotypes is 0.85-3.12 g, fruit length is 16.27-23.11 mm, fruit width is 9.56-16.37 mm, number of seeds is 15.33-40.60 pieces/fruit, water-soluble dry matter content is 9.2-22.8%, total solids content is 39.43-78.14%, pH 3.45-4.45 and titratable acidity 0.93-3.48%; Average fruit weight for hawthorn genotypes is 2.07-4.62 g, fruit length is 12.81-17.82 mm, fruit width is 14.96-20.55 mm, number of seeds is 2.17-4.87 pieces/fruit, water-soluble solid content is 13.2-32.4%, total dry matter content is 20.13-59.73%, pH 3.03-3.74 and titratable acidity 0.8-3.08%; For cornelian cherry genotypes, average fruit weight is 1.18-2.43 g, fruit length is 15.57-20.26 mm, fruit width is 10.40-13.83 mm, number of seeds is 1 piece/fruit, water-soluble solids content is 11-17%, total dry matter content is 9.92-78.93%, pH 2.72-3.51 and titratable acidity were found between 0.8- 2.41%.

Keywords: Cornelian cherry (*Cornus mas* L.), Hawthorn (*Crataegus* spp.), Merzifon, Rosehip (*Rosa canina* L.)

Merzifon ilçesinde doğal olarak yetişen ve gıda sanayisinde işlenen meyve türlerinin potansiyelinin ve meyve özelliklerinin belirlenmesi üzerine bir araştırma

Öz: Bu araştırma, 2021-2022 yılları arasında Amasya ili Merzifon ilçe ve köylerinde yürütülmüştür. 2021 yılında, bu alanlarda doğal olarak bulunan kuşburnu, alıç, kızılcık populasyonu belirlenmiştir. Bunlar arasından da ön seçimle belirlenen 27 kuşburnu, 21 alıç ve 10 kızılcık genotiplerinin detaylı gözlem ve analizi 2022 yılında yapılmıştır. Araştırma sonucunda; Kuşburnu genotipleri için ortalama meyve ağırlıkları 0.85-3.12 g, meyve boyları 16.27-23.11 mm, meyve enleri 9.56-16.37 mm, tohum sayıları 15.33-40.60 adet/meyve, suda çözünebilir kuru madde miktarı %9.2-22.8, toplam kuru madde miktarı %39.43-78.14, pH 3.45-4.45 ve titre edilebilir asitlik ise %0.93- 3.48; alıç genotipleri için ortalama meyve ağırlıkları 2.07-4.62 g, meyve boyları 12.81-17.82 mm, meyve enleri 14.96-20.55 mm, tohum sayıları 2.17-4.87 adet/meyve, suda çözünebilir kuru madde miktarı %13.2-32.4, toplam kuru madde miktarı %20.13-59.73, pH 3.03-3.74 ve titre edilebilir asitlik ise %0.8- 3.08; kızılcık genotipleri için ortalama meyve ağırlığı 1.18-2.43 g, meyve boyları 15.57-20.26 mm, meyve enleri 10.40-13.83 mm, tohum sayıları 1 adet/meyve, suda çözünebilir kuru madde miktarı %11-17, toplam kuru madde miktarı %9.92-78.93, pH 2.72-3.51 ve titre edilebilir asitlik ise %0.8- 2.41 arasında bulunmuştur.

Anahtar kelimeler: Kızılcık (*Cornus mas* L.), Alıç (*Crataegus* spp.), Merzifon, Kuşburnu (*Rosa canina* L.),.

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1. Introduction

Anatolia is one of the centers of many plant genetic resources and diversity (Artık and Ekşi, 1988). Most of these fruits are cultivated, while some are grown regionally and evaluated with traditional methods (Erdoğan et al., 2001). The relationship between healthy living and healthy nutrition is getting stronger every day. The biggest factor in this situation is that today's consumers are starting to prefer healthy, delicious and naturally grown foods. The nutritional value of these foods, their vitamin and mineral content, as well as their high antioxidant levels are important factors in the increase in the consumption of natural fruits and vegetables (Ercişli, 2004).

Ensuring the continuity of fruit growing in our country and transferring the existing diversity to the future will be possible by selecting and preserving suitable genotypes. For this reason, determining, preserving and evaluating the genotypes that are desired to be transferred to the future is very important. In addition, the fact that the number of types/genotypes and varieties of berry-like fruits such as mulberry and cornelian cherry grown in our country is very high locally and the increase in the production of these types in the production regions makes it necessary to transform the genotypes/types into standard varieties in terms of regions (Güleryüz, 1977).

Especially in developed countries, as well as in Turkey, interest in fruits with high antioxidant capacity and products obtained from these fruits, which are of great importance for human health, is increasing day by day (Scheerens, 2001). In our country, which is rich in terms of plant diversity, in addition to cultivated fruits, there are many wild fruit species, most of which are known by our producers but are not cultivated and grow naturally. Many of the wild fruits such as rosehip, hawthorn, blueberry and cornelian cherry, which are rare and very important for health, are consumed fresh, as well as processed into products such as jam and marmalade both at home and in the industrial area, and these products can find buyers at high prices in foreign markets (Kökosmanlı and Keleş, 2000).

The food industry processing fruits (jam, marmalade, vinegar, sherbet, etc.) in Merzifon district has reached a certain capacity. 9 facilities licensed by the Ministry of Agriculture and Forestry produce and offer these products for sale (Anonymous 2021a). These facilities currently process hawthorn, cornelian cherry and rosehip fruits. Almost all of the enterprises in the district have goals and work plans such as expanding their production areas, increasing their capacities and market shares, increasing their production patterns and producing branded products (geographical indications), and reaching the level of export. In addition, in interviews with enterprises producing in Merzifon, they state that they can produce at 30% of their production capacity and that one of the most important reasons for this is the lack of sufficient raw materials (Anonymous 2021b).

Merzifon district is located within the natural distribution area of fruits such as cornelian cherry, hawthorn and rosehip. These fruits are collected and processed intensively by the people in the district, as in the surrounding provinces and districts, and their products are consumed. The product demands of local food companies are met by the people living in forest villages, by collecting fruits that grow wild in nature.

One of the species processed in the food sector and contributing significantly to our economy is rosehip. Rosehip grows naturally in a very wide area from Europe to Africa, North America, the Middle East, Asia and Europe, and Russia (Çelik, 2007). It is stated that there are 27 rosehip species in our country (Ercişli and Güleryüz, 2005), and these species grow intensively especially in the Central and Western Black Sea regions such as Gümüşhane, Kastamonu, Çorum, Amasya, Tokat, and in Eastern Anatolia, in provinces with a harsh continental climate such as Erzincan and Erzurum, Bitlis, Van and Hakkari (Ercişli, 1996; Güneş, 1997; Güneş & Şen, 2001; Doğan & Kazankaya, 2006,).

Since ancient times, farmers have given different names to the hawthorn plant, such as bread or butter. Because farmers believed that the leaves, flowers and fruits of this plant relieved their hunger and fatigue. It has been believed throughout history that seeing a hawthorn tree brings luck and that the place where the tree is located will be filled with abundance and fertility. Research has shown that hawthorn was used in wedding decorations by the Greeks and Romans in ancient times to bring happiness and fertility. According to women, hawthorn ensures youth, and according to fishermen, it is believed that hawthorn, which is taken with them when hunting, brings good luck (Gürsoy, 2016).

Rosehip seed oil is very valuable. It contains very rich fatty acids. This oil contains abundant amounts of vitamins A, C, E, proanthocyanidins, galactolipids and

folate. These vitamins are very beneficial for the human body. They protect the human body against disease and delay aging.(Kayahan et al., 2022 ; Köksal and Tuğlu,2025).

When the phytochemical content of rosehip is examined, it is found that there are anthocyanins, phenolic acids (hydroxybenzoic and hydroxycinnamic acids), tannins (hydrolyzable tannins and ellagitannins), flavanols, flavonoids (dihydrochalcone), stilbenoids, carotenoids, chlorines, organic acids, sugars, fatty acids, galactolipid (monogalactosyldiacyl glycerol), tocopherols and vitamins (Basar and Demirtas, 2025)

The cornelian cherry plant, which is spread over a wide area in our country, generally grows naturally as a single or a few trees on the edges of gardens and fields or in forested areas. A type of hard-core fruit, cranberry is widely found in our country, especially in mountainous and forested areas, in valleys with suitable climates and in coastal areas (Kantemiz, 2022).

Cornelian cherry fruit can be consumed fresh or dried, as well as in many different ways such as jam, marmalade, fruit juice, compote, syrup, fruit yogurt, liqueur, wine. Recently, cornelian cherry has also been used as a flavoring agent in ice cream, cakes and pastries by many food manufacturers (Topdaş et al., 2017).

Cornelian cherry is a fruit species that is successfully grown especially in forest climates and, although its production is rarely seen in recorded records, makes significant contributions to the Turkish economy as a natural product (Mert and Müftüoğlu, 2024). Cornelian cherry fruit is notable for its high vitamin C and iridoid compounds. In addition to vitamin C, this fruit also contains other vitamins such as α-tocopherol, biotin, and riboflavin (Lidiková et al., 2024). Cornelian cherry is an important nutritional source due to the phenolic compounds and organic acids it contains. In studies conducted by Martinović and Cavoski (2020) and Uğur et al., (2024), it was reported that the amounts of phenolic acids in cornelian cherry fruit varied between 158-583.72 mg/100 g.

No data could be found on the current populations (such as the number of trees, total product potential and fruit characteristics) of these species, which are a very important raw material for the local food sector and grow in their natural habitat. Such a study was needed to determine the plant presence in the district where these naturally grown fruits are consumed with pleasure, to evaluate the results obtained, and to provide resources for studies to determine superior types that could be candidate varieties among these determined species.

2. Materials and Methods

2.1. Material

The material of this research conducted in 2021 and 2022 consisted of hawthorn (Crataegus sp.), rosehip (Rosa canina L.) and cornelian cherry (Cornus mas L.) genotypes naturally growing in the Merzifon district of Amasya province.

General characteristics of the district where the research was conducted

Merzifon District, which is affiliated to Amasya Province in the central part of the Black Sea Region and is the largest settlement after the city center, is surrounded by Suluova District in the east, Amasya and Çorum Province in the south, Gümüşhacıköy District in the west and Samsun Province in the north. Merzifon, which is affiliated to Amasya Province and the largest settlement after the central district, is located in the central part of the Black Sea Region and where the Northern Anatolian Mountains descend and give way to Central Anatolia in the south. Merzifon, which is the Amasya district in the inner part of the Central Black Sea Region, is affected by the climate of the Black Sea and Central Anatolia Regions. Summers are dry and rainless, winters and springs are rainy. The average annual precipitation is 350 kg/m^2.

In the years when the research was conducted, the maximum temperature was as 39.2 oC in July 2021 and 35.6 oC in September 2022; the minimum temperature was as -11.8 oC in January 2021 and -10.1 oC in the same month in 2022. The total annual precipitation was 75.2 kg in 2021 and 457.2 kg in 2022, with more precipitation recorded. The highest precipitation fell in June in each year (Anonymous, 2021-2022).

2.2. Method

Survey studies

This study is not a selection study. However, a selection study was conducted in 2021 to determine the populations of hawthorn, cornelian cherry and rosehip genotypes, which are raw materials for the local food sector, and to identify genotypes with superior characteristics within these species. Therefore,

interviews were conducted with the District Directorate of Agriculture and Forestry, village headmen and local people to determine the locations of the plants in the Merzifon district and its villages. As a result of these interviews, areas with high concentrations of plants of these species and their populations were identified.

Because it would be difficult to analyze all the species populations identified in the first year, genotypes for the species to be analyzed were determined in the second year. For this purpose, disease-free, healthy, productive, and large-fruited genotypes were identified during the fruit ripening period. The locations of these genotypes were also recorded using a GPS device. The analyses and measurements made on the fruits are given below (Eşitken, 1992; Karadeniz & Kalkışım, 1996; Kalyoncu, 1996; Karaçalı, 1999; Karaçalı, 2002).

Plant and pomological characteristics

Tree yield: Since it is very difficult to determine the yield of trees by weighing in the natural environment, the yields of the selected genotypes were determined by relative comparison with the yields of other genotypes in the same location (productive-medium productive-low productive) during the period when the fruits ripened.

Fruit weight (g); fruits were weighed with a scale sensitive to 0.01 g and their average weights were found. Fruit length (mm); fruits were measured with a caliper sensitive to 0.01 mm and average values were determined. Fruit width (mm); fruits were measured with a caliper sensitive to 0.01 mm and average values were determined. Number of seeds (piece/fruit); in fruits, the number of seeds in the fruit was determined and average values were determined. All measurements were made on 30 fruits.

Chemical properties

Total soluble solid (%): It was done with a hand refractometer (ATC BX32 brand). pH; it was measured by taking a certain amount of fruit juice and directly dipping the tip with a table type pH meter. Total acidity (%); it was calculated in terms of malic acid with the pH metric method (Ertan et al., 1982; Kurnaz, 1989). Total dry matter (%); fruit samples with certain initial weight from each genotype were dried in the oven at 65 degrees until the weight remained constant. Dried samples were calculated by proportioning them to the initial weight (Cemeroğlu, 1992).

3. Results and Discussion

A total of 1,300 rosehip, 700 hawthorn, and 500 cornelian cherry saplings were identified in the Merzifon district and its villages in 2021. Because the research is a master's thesis and must be completed within the deadline, the numbers determined for each species can be considered quite reasonable.

In the second year (2022), detailed observations and analyses were made on 27 rosehip, 21 hawthorn, and 10 cornelian cherry genotypes with good characteristics (disease-free, healthy, productive, and large-fruited genotypes during the ripening period of their fruits) from this determined population, in total 58 genotypes. Rosehip fruit samples were collected from areas with altitudes of 740 m-1641 m, hawthorn fruit samples from 956 m-1811 m, and cornelian cherry samples from 895 m-1050 m. GPS records of the analyzed genotypes were also identified. However, to protect genetic resources, this information was not provided in this study.

The plant and pomological trait findings such as fruit width (mm), fruit length (mm), fruit stem length (cm), fruit weight (g), fruit outer hairiness, seed number (number/fruit), seedlessness status and tree yield (relative) in rosehip, hawthorn and cornelian cherry genotypes determined in 2022 are given in Tables 1-3. The results of TSS (%), pH, total acidity (%) and total dry matter (%) in rosehip, hawthorn and cornelian cherry genotypes determined in 2022 are given in Tables 4-6. In our research findings, in 27 rosehip genotypes selected in 2022 and for which we made detailed observations and analyzes, the average fruit weight varied between 1.13 g (05MRZTD02) and 3.12 g (05MRZTD05) (Table 1). In similar studies on fruit weight, fruit weights were found to be between 0.41 g and 4.09 g (Kara & Gerçekcioğlu, 1992; Türkben et al., 1999; Kazankaya et al., 2002; Türkoğlu & Muradoğlu, 2003; Yörük, 2006; Ekincialp, 2007; Sağır, 2010; Encu, 2015).

Our fruit weight findings are similar to the findings of Ekincialp (2007), lower than the findings of Yörük (2006) and higher than the findings of Türkoğlu and Muradoğlu (2003). It is also similar to the results of other studies. Fruit weight is primarily a variety/genotype characteristic and is also seriously affected by ecological factors (heat, cold, nutritional status, rainfall, etc.). In fact, Kaygısız and Aybak (2000) stated that the growth and development of both trees

and fruits depend on sufficient light, sufficient water, and sufficient ambient temperature. Since rosehip is a technological product, a low number of seeds is desired. In our study, the average number of seeds in 27 rosehip genotypes was found to be between 15.33 (05MRZDH09) - 40.60 (05MRZTD08) (Table 1). In many studies conducted with rosehip, these values were generally found to be between 10-45 seeds/fruit (Kara and Gerçekcioğlu, 1992; Türkben et al., 1999; Türkoğlu and Muradoğlu, 2003; Kazankaya et al., 2002).

Table 1. Some vegetative and pomological characteristics examined in rosehip genotypes determined for analysis in 2022

Rosehip	Fruit width (mm)	Fruit length (mm)	Fruit stem length (cm)	Fruit weight (g)	Number of seeds(pieces/ fruit)	Fruit outer hairiness	Seedless state	Plant yield (Relative)
05MRZTD01	11.57	18.96	1.14	1.23	21.07	No	No	Medium productive
05MRZTD02	14.88	18.40	1.11	1.72	28.27	No	No	Productive
05MRZTD03	11.76	19.19	1.31	1.47	24.67	No	No	Productive
05MRZTD05	15.75	23.00	1.55	3.12	37.20	No	No	Productive
05MRZTD06	12.82	19.14	1.35	1.97	28.97	No	No	Productive
05MRZTD07	13.99	20.24	1.02	1.90	34.73	No	No	Productive
05MRZTD08	16.37	21.28	1.97	3.10	40.60	No	No	Productive
05MRZKD01	13.73	17.73	1.09	1.95	26.53	No	No	Productive
05MRZKD02	9.56	19.47	1.15	1.13	21.57	No	No	Medium productive
05MRZKD03	13.36	20.86	1.38	2.22	36.83	No	No	Productive
05MRZKD04	12.79	19.12	1.74	1.82	29.33	No	No	Productive
05MRZKD05	11.74	18.66	1.42	1.48	30.93	No	No	Medium productive
05MRZBL01	13.93	22.31	1.84	2.38	39.33	little	No	Productive
05MRZBL02	13.84	21.75	1.80	2.32	35.30	little	No	Productive
05MRZBL03	14.09	20.50	1.67	2.23	33.63	little	No	Productive
05MRZBL04	12.46	23.11	1.69	2.22	24.13	little	No	Productive
05MRZBL05	11.34	22.07	1.59	1.63	27.40	little	No	Medium productive
05MRZDH01	11.07	18.15	1.40	1.18	21.30	No	No	Medium productive
05MRZDH02	10.96	18.96	1.42	1.22	20.53	No	No	Medium productive
05MRZDH03	12.73	19.05	1.79	1.92	29.73	No	No	Medium productive
05MRZDH04	13.57	19.87	2.06	2.07	36.10	No	No	Productive
05MRZDH05	13.87	20.61	1.43	1.90	24.93	No	No	Productive
05MRZDH06	13.17	19.35	1.67	1.79	25.03	No	No	Productive
05MRZDH07	13.37	18.93	1.54	1.87	25.07	No	No	Productive
05MRZDH08	14.27	21.73	1.98	2.33	26.50	No	No	Productive
05MRZDH09	10.95	19.07	2.04	1.40	15.33	No	No	Productive

Our results are similar to the findings of Kazankaya et al. (2002), lower than the findings of Türkoğlu and Muradoğlu (2003), and higher than the findings of Türkben et al. (1999). It is also similar to the results of other studies. It is thought that the differences in the number of seeds primarily arise from the species and genotype, but ecological factors may also affect the number. Indeed, one of the two registered varieties in our country, the 'Yıldız' rosehip variety, belongs to the Rosa canina species, and the average number of seeds is 28.99 pieces/fruit; the 'Gerçekcioğlu' variety belongs to the Rosa montana chaix subsp. woronowii (Lonacz.) Ö.Nillson species, and the average number of seeds is 2.93 pieces/fruit (Anonim, 2012; Anonymous, 2015).

The average TSS values in 27 rosehip genotypes examined varied between 7.2% (05MRZKD05) and 22.8% (05MRZDH09) (Table 4). In many studies conducted with rosehip, these values were generally found to be between 8.8-33.91% (Kara and Gerçekcioğlu, 1992; Türkben et al., 1999; Yörük, 2006; Ekincialp, 2007; Türkoğlu and Muradoğlu, 2003; Sağır, 2010; Kazankaya et al., 2002; Encu, 2015). Our TSS findings were similar to the findings of Yörük (2006), lower than the findings of Ekincialp (2007), and higher than the findings of Türkoğlu and Türkoğlu and Muradoğlu (2003). It also showed similarity with the results of other studies. It is thought that the difference in TSS values is affected by the altitude of the region, day-night temperature difference, and precipitation factors, as well as genetic factors. In fact, Bostan and Günay (2014) stated that the TSS value may vary according to altitude.

The pH and acidity levels of fruits are affected by similar factors. In our study, the average pH in rosehip genotypes was found to be 3.45 (05MRZDH02) - 4.45 (05MRZTD02); total acidity was found to be between 0.93% (05MRZTD06) - 3.48% (05MRZBL02) (Table 4). Our pH findings are similar to the findings of Yörük (2006), lower than the findings of Kazankaya et al. (2002), and higher than the findings of Encu (2015). It is also similar to the results of other studies.

Our findings regarding total acidity are similar to those of Encu (2015), lower than those of Yörük (2006), and higher than those of Kara and Gerçekcioğlu (1992). They are also similar to other study results. It is thought that the differences in total acidity are affected by the climate conditions and altitude prevailing in the region. In fact, Kurucu and Keskioğlu (1990) stated that the amount of acid contained in rosehip fruit may vary depending on the type of plant, the altitude where it grows, climate and soil conditions, the degree of ripeness of the fruit, and the time of collection.

In our research, the average fruit weight of the 21 hawthorn genotypes examined varied between 2.07 g (05MRZKD002) and 4.62 g (05MRZKD005) (Table 2). In similar studies on fruit weight, fruit weights were determined between 0.65 and 6.30 (Gazioğlu, 2000; Balta et al., 2006; Akça, 2020; Gürlen et al., 2020; Yanar et al., 2011). Our fruit weight findings were similar to the findings of Yanar et al. (2011), lower than the findings of Akça (2020), and higher than the findings of Gazioğlu (2000). It was also similar to the results of other studies. Fruit weight is primarily a variety/genotype characteristic and is also seriously affected by ecological factors (heat, cold, nutritional status, precipitation, etc.). In fact, Doğan et al. (2020) stated that the plant-water relationship is one of the factors affecting fruit weight, product quality, adaptation abilities and physiological activities.

Our hawthorn fruit width (diameter) findings varied between 14.96 mm (05MRZKD002) - 20.55 mm (05MRZAK005) (Table 2). In similar studies, fruit width (diameter) findings were found to be between 6.6-56 mm-28.10 mm (Gazioğlu, 2000; Balta et al., 2006; Yanar et al., 2011; Gürlen et al., 2020). Our fruit width findings were similar to the findings of Yanar et al. (2011), lower than the findings of Balta et al. (2006), and higher than the findings of Gazioğlu (2000). It was also similar to the results of other studies. It is thought that the differences in fruit size are affected by the ecological conditions of the region, altitude, slope, soil structure, wildlife, the prevailing climate conditions of the region and the altitude, as well as the genotype. Indeed, Karlıdağ (1998) stated that fruits grown especially in high altitude areas are smaller but have higher tissue hardness.

In our study, the average seed number in hawthorn genotypes varied between 2.17 (05MRZTD003) and 4.87 (05MRZKD004) (Table 2). Different results were obtained in studies conducted on seed number. Balta et al. (2006) determined 2-5 seeds in 42 hawthorn genotypes in their study conducted on hawthorn genotypes growing in Darende district of Malatya. Our findings on seed number were found to be similar to the findings of Balta et al. (2006). It was also similar to the results of other studies. It is thought that the differences in seed number are due to genotype and ecological factors. In the 21 hawthorn genotypes examined, the

average TSS varied between 13.2% (05MRZKD006) and 32.4% (05MRZKD005) (Table 5). In studies on TSS, this value has been in the range of 6.40% - 24.83% (Gazioğlu, 2000; Balta et al., 2006; Akça, 2020; Gürlen et al., 2020; Yanar et al., 2011). Our TSS findings were similar to the findings of Akça (2020) and higher than the findings of Yanar et al. (2011). It was also similar to the results of other studies.

Table 2. Some vegetative and pomological characteristics examined in hawthorn genotypes determined for analysis in 2022

Hawthorn	Fruit width (mm)	Fruit length (mm)	Fruit stem length (cm)	Fruit weight (g)	Number of seeds (pieces/ fruit)	Fruit outer hairiness	seedless state	Plant yield (Relative)
05MRZAK001	16.85	13.92	1.46	2.48	2.33	No	No	Productive
05MRZAK002	16.66	13.06	1.36	2.55	4.23	No	No	Productive
05MRZAK003	16.04	13.02	1.27	2.48	3.43	No	No	Productive
05MRZAK004	17.22	14.51	1.63	2.12	3.30	No	No	Productive
05MRZAK005	20.55	17.28	0.56	3.95	4.73	No	No	Productive
05MRZAK006	19.09	16.30	0.87	3.43	4.77	No	No	Productive
05MRZAK007	20.63	17.82	0.92	3.85	4.73	No	No	Productive
05MRZAK008	19.86	17.25	0.86	3.97	4.80	No	No	Productive
05MRZAK009	16.95	14.03	0.87	2.18	3.27	No	No	Productive
05MRZAK010	19.82	13.75	0.90	2.08	3.23	No	No	Productive
05MRZKD001	18.43	17.41	1.40	3.67	4.37	No	No	Productive
05MRZKD002	14.96	13.93	1.35	2.07	4.13	No	No	Productive
05MRZKD003	18.48	14.53	1.14	3.10	4.70	No	No	Productive
05MRZKD004	15.31	15.57	1.04	2.25	4.87	No	No	Productive
05MRZKD005	20.13	16.35	1.10	4.62	4.70	No	No	Productive
05MRZKD006	17.22	14.90	1.19	2.85	4.73	No	No	Productive
05MRZTD001	15.54	12.81	1.47	2.08	4.37	No	No	Productive
05MRZTD002	15.87	13.15	1.45	2.10	2.57	No	No	Medium productive
05MRZTD003	15.65	13.23	1.12	2.17	2.17	No	No	Medium productive
05MRZTD004	19.99	16.14	1.09	3.70	4.57	No	No	Medium productive
05MRZTD005	18.90	15.44	1.01	3.25	4.57	No	No	Medium productive

Table 3. Some vegetative and pomological characteristics examined in 10 cornelian cherry genotypes selected for analysis in 2022

Cornelian cherry	Fruit width (mm)	Fruit length (mm)	Fruit stem length (cm)	Fruit weight (g)	Number of seeds (pieces/ fruit)	Fruit outer hairiness	seedless state	Plant yield (Relative)
05MRZAK0001	13.71	18.86	1.36	1.95	1	No	No	Productive
05MRZAK0002	12.74	19.03	1.32	1.92	1	No	No	Productive
05MRZAK0003	11.32	17.83	1.22	1.60	1	No	No	Productive
05MRZAK0004	12.69	17.70	1.35	1.80	1	No	No	Productive
05MRZAK0005	12.98	18.92	1.34	1.92	1	No	No	Productive
05MRZAK0006	12.26	16.70	1.24	1.58	1	No	No	Productive
05MRZAK0007	10.40	15.57	1.04	1.18	1	No	No	Productive
05MRZAK0008	13.83	20.26	1.09	2.43	1	No	No	Productive
05MRZAK0009	11.93	18.46	1.16	1.65	1	No	No	Productive
05MRZAK0010	13.24	18.84	1.55	2.32	1	No	No	Productive

Table 4. Some chemical properties of rosehip genotypes selected in 2022

Rosehip	TSS (%)	pH	Total acidity (%)	Total dry matter (%)
05MRZDH01	12.80	3.60	2.90	59.32
05MRZDH02	12.40	3.45	3.14	59.83
05MRZDH03	16.80	3.67	2.26	59.92
05MRZDH04	17.60	3.79	3.08	59.95
05MRZDH05	14.00	3.84	3.20	59.93
05MRZDH06	13.20	3.94	2.01	41.73
05MRZDH07	12.80	3.90	2.27	41.96
05MRZDH08	16.40	3.81	2.54	68.25
05MRZDH09	22.80	3.47	2.90	59.91
05MRZTD01	12.00	4.03	2.34	59.81
05MRZTD02	10.00	4.45	1.67	42.84
05MRZTD03	12.40	3.96	1.80	59.94
05MRZTD04	9.20	3.94	1.20	58.75
05MRZTD05	21.60	4.03	2.14	71.17
05MRZTD06	11.20	4.21	0.93	39.43
05MRZTD07	10.40	4.13	2.01	69.73
05MRZTD08	20.80	3.77	2.27	57.91
05MRZBL01	20.80	3.95	3.21	58.62
05MRZBL02	13.20	3.47	3.48	59.15
05MRZBL03	17.60	4.23	2.41	77.64
05MRZBL04	16.40	3.73	2.47	59.89
05MRZBL05	14.80	3.78	2.07	39.74
05MRZKD01	9.20	4.12	1.74	39.92
05MRZKD02	13.60	3.74	2.01	78.14
05MRZKD03	14.40	4.18	1.87	59.43
05MRZKD04	13.20	3.87	2.41	59.15
05MRZKD05	7.20	4.30	2.01	58.97

Table 5. Some chemical properties of hawthorn genotypes selected in 2022

Hawthorn	TSS (%)	pH	Total acidity (%)	Total dry matter (%)
05MRZAK001	16.8	3.74	1.07	38.78
05MRZAK002	17.2	3.52	1.60	39.15
05MRZAK003	13.6	3.49	1.34	39.43
05MRZAK004	16.4	3.64	1.66	39.71
05MRZAK005	21.2	3.07	1.60	37.55
05MRZAK006	13.6	3.04	2.27	38.68
05MRZAK007	16.8	3.06	1.74	37.93
05MRZAK008	20.4	3.03	1.87	38.65
05MRZAK009	16.8	3.56	1.54	38.93
05MRZAK010	14	3.40	1.67	20.13
05MRZKD001	31.2	3.30	0.93	39.72
05MRZKD002	14.8	3.29	0.80	38.45
05MRZKD003	18.4	3.43	1.20	59.48
05MRZKD004	14	3.29	1.00	37.96
05MRZKD005	32.4	3.19	1.34	38.47
05MRZKD006	13.2	3.53	2.54	59.17
05MRZTD001	16.4	3.53	3.08	19.98
05MRZTD002	18	3.70	1.07	38.95
05MRZTD003	17.6	3.74	1.74	39.63
05MRZTD004	24.8	3.13	1.47	38.46
05MRZTD005	21.2	3.20	2.01	59.73

It is thought that the results in our study are affected by criteria such as the altitude of the region, day-night temperature difference, and precipitation factor. In fact, Nas and Duman (2017) stated that the TSS values are significantly changed by the soil structure and the effect of precipitation close to the harvest period. Uzun (2000) stated that the balance between light and temperature, especially in cultivation, has a very important effect on the control of net assimilation increase and dry matter production. In our study, the average pH in hawthorn genotypes varied between 3.03 (05MRZAK008) - 3.74 (05MRZAK001) and total acidity varied between 0.8% (05MRZKD002) - 3.08% (05MRZTD001) (Table 5). Our pH findings were similar to the findings of Balta et al. (2006), lower than the findings of Gürlen et al. (2020), and higher than the findings of Yanar et al. (2011). It was also similar to the results of other studies. It is thought that the pH value is affected by climate factors and altitude. According to Yıldız (2013) and Demirsoy (2016), they stated that increasing light intensity increases the fruit pH value.

Our findings regarding total acidity were similar to those of Gürlen et al. (2020) and higher than those of Gazioğlu (2000). They were also similar to other study results. It is thought that the change in total acidity is affected by the climate conditions and altitude prevailing in the region. Indeed, Shaw (1988) reported that the acid content of ripe fruit is largely affected by genetic factors, while Sistrunk and Morris (1995) reported that the acid content of ripe fruit can also be affected by environmental conditions such as nutrition or light. The average fruit weight of the 10 examined cornelian cherry genotypes varied between 1.18 g (05MRZAK0007) - 2.43 g (05MRZAK0008) (Table 3). In other studies on cranberry fruit weight, fruit weights were found to be between 0.39 g - 7.36 g (Türkoğlu et al., 1999; Selçuk, 2010; Karadeniz, 2019; Kalyoncu, 1996; Yalçınkaya et al., 2007; Bayoğlu, 2021; Tural and Koca, 2008; Okatan, 2016; Yıldırım et al., 2017; Karadeniz, 1995; Genç, 2015). Our fruit weight findings are similar to the findings of Karadeniz (1995), Türkoğlu et al. (1999) was found to be low, but higher than the findings of Tural and Koca (2008). It also showed similarity with the results of other studies. Fruit weight is primarily a genotype characteristic and is also seriously affected by ecological factors (heat, cold, nutritional status, rainfall, etc.). In fact, Özçağlar (1988) stated that temperature, rainfall patterns and evaporation affect the weight, species diversity, ripening periods and distribution of agricultural products.

In our cornelian cherry findings, our fruit width (diameter) values varyed between 10.40 mm (05MRZAK007) and 13.83 mm (05MRZAK008) (Table 3). In other studies, these values were found to be between 8.41 mm and 20.63 mm (Türkoğlu et al., 1999; Karadeniz, 2019; Yalçınkaya et al., 2007; Bayoğlu, 2021; Tural and Koca, 2008; Okatan, 2016; Yıldırım et al., 2017; Karadeniz, 1995; Genç, 2015). Our fruit width findings were similar to the findings of Tural and Koca (2008) but were lower than the findings of Bayoğlu (2021) and higher than the findings of Okatan (2016). It was also similar to the results of other studies. It is thought that the differences in fruit sizes are affected by the ecological conditions of the region where the land is located, altitude, slope, soil structure, wildlife, climate conditions prevailing in the region and altitude, as well as the genotype. In fact, Cangi and Karadeniz (1999) determined that fruits of species and varieties that need high temperature sums to ripen their fruits became smaller with increasing altitude, and they stated that similar results were obtained in studies conducted on fruits in different places.

In our study, the average TSS in the cornelian cherry genotypes examined varied between 11% (05MRZAK07) - 17% (05MRZAK08) (Table 6). In other studies on TSS, this value was found to be between 8.0% and 25.26% (Karadeniz, 2019; Kalyoncu, 1996; Yalçınkaya et al., 2007; Bayoğlu, 2021; Tural and Koca, 2008; Okatan, 2016; Yıldırım et al., 2017; Karadeniz, 1995; Genç, 2015). Our TSS findings were similar to the findings of Yalçınkaya et al. (2007), lower than the findings of Bayoğlu (2021) and higher than the findings of Karadeniz (2019). It also showed similarity with the results of other studies. It is thought that the results in our study are affected by criteria such as the altitude of the region, the temperature difference between day and night, and the precipitation factor. In fact, in the study conducted by Paydaş and Kaşka (1993), it was stated that as the altitude above sea level increases, the sugar/acid ratio increases due to acid disintegration and the fruits become sweeter.

In our study, the average pH in cornelian cherry genotypes varied between 2.72 (05MRZAK0004)–3.51 (05MRZAK0006) and total acidity varied between 0.8% (05MRZAK0005)–2.41% (05MRZAK0003) (Table 6). Our pH findings were similar to the findings of Okatan (2016), lower than the findings of Genç (2015), and

higher than the findings of Bayoğlu (2021). They are also similar to the results of other studies. It is thought that the pH value is affected by climate factors and altitude. Çelik (1996) stated that changes in pH vary according to the location of the fruit, altitude direction, climate factors, temperature changes, precipitation type and amount, humidity and sunshine duration, and the genetic structure of the varieties. Our findings regarding total acidity were similar to those of Karadeniz (2019), lower than those of Bayoğlu (2021) and higher than those of Okatan (2016). It was also similar to other study results. It is thought that the differences in total acidity are due to the prevailing climate conditions and altitude of the region. According to Eşitken (2006), the altitude of the place where plants are grown above sea level can affect their vitamin content and plants grown at higher altitudes generally contain more acid than those grown at lower altitudes.

Table 6. Some chemical properties of cornelian cherry genotypes selected in 2022

Cornelian cherry	TSS (%)	pH	Total acidity (%)	Total dry matter (%)
05MRZAK0001	12.5	2.80	1.51	38.64
05MRZAK0002	15.0	3.12	2.07	19.73
05MRZAK0003	16.0	3.21	2.41	19.61
05MRZAK0004	13.0	2.72	1.84	9.92
05MRZAK0005	15.0	3.03	0.80	78.43
05MRZAK0006	15.0	3.51	1.07	19.43
05MRZAK0007	11.0	2.83	1.27	19.13
05MRZAK0008	17.0	3.01	1.40	18.69
05MRZAK0009	16.0	3.15	2.14	78.93
05MRZAK0010	15.0	3.25	1.00	78.44

4. Conclusion

Both the development of new varieties to increase agricultural production and the transfer of natural (wild) plant species in the form of raw materials to future generations without erosion will be possible by preserving and protecting the existing plant diversity. Although this study was conducted in a narrow area, a significant amount of plant assets were determined. The characteristics of genotypes that stand out with their more distinct characteristics among these species and that can be a source for future research were also determined. These resources should be transferred to genetic resource parcels without being destroyed, and they should be introduced to agriculture by carrying out variety registration studies.

Even if the raw material needs of the 9 companies with an annual capacity of 3,265 tons that process these products in our district where the research was conducted are met, they will make serious contributions to the local economy and the country's economy in the future. According to the final report of the General Directorate of Combating Desertification and Erosion under the Ministry of Environment, Urbanization and Climate Change of the Republic of Turkey, hawthorn populations are endangered and must be protected due to land clearing, particularly in rural areas. It also emphasizes the importance of hawthorn in resilience to arid and semiarid conditions due to recent global climate change (Anonim, 2022).

In the local food sector, all kinds of hawthorn, rosehip and cornelian cherry fruits collected from the local nature are processed, regardless of the quality of any fruit. At least with this study, especially for the food sector, the '05MRZDH09' rosehip genotype for rosehip, '05MRZKD005' and '05MRZTD003' genotypes for hawthorn and '05MRZAK008' genotype for cornelian cherry can be protected, and even if registered varieties are not produced, the multiplication of these genotypes can be pursued, and raw material can be supplied by establishing closed gardens.

Conflict of interest

The authors declare no conflicts of interest.

Authorship contribution statement

R.G: Planning, data processing, article writing, editing.

L.Ş: Field work, data collection and thesis writing.

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