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Research Article/Araştırma Makalesi

Determination of Genetic Variation of Ayhan Eggplant (*Solanum melongena* L.) Genotypes using Some Plant and Fruit Characteristics

Ayhan Patlıcanı (Solanum melongena L.) Genotiplerinin Bazı Bitki ve Meyve Özellikleri Kullanılarak Genetik Varyasyonunun Belirlenmesi

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ABSTRACT

The different climatic conditions of Turkey contribute to the diversity of genetic resources. It is very important to detect, describe, protect and evulate this genetic diversity. One of these genetic resources is the Ayhan eggplant, which is grown locally in and around Ayhan village of Avanos district of Nevşehir province. The most commonly used method for detecting and identifying genetic resources is morphological characterization using some plant and fruit features. For morphological characterization, observations and measurements of 41 fruit and vegetative characters of 29 genotypes of Ayhan eggplant were used and genetic similarity/differences were determined among eggplant genotypes. A dendogram was created using the 41 features examined for morphological characterization, and while the genetic similarity was determined as 0.91-1.00, two main groups were obtained in the dendogram. These two main groups are divided into two separate subgroups. While there are control genotypes in the first group, there are genotypes of Ayhan eggplant in the other group. The results of present study show that, Ayhan eggplant population has important genetic variation. These eggplant population can be used for eggplant breeding programs.

Key Words: Eggplant, genetics diversity, plant, fruit characteristics

ÖZ

Türkiye'nin farklı iklim koşulları genetik kaynakların çeşitliliğine katkıda bulunmaktadır. Bu genetik çeşitliliğin tespiti, tanımlanması, korunması ve değerlendirilmesi oldukça önemlidir. Bu genetik kaynaklardan biri de Nevşehir ili Avanos ilçesine bağlı Ayhan köyü ve çevresinde yerel olarak yetiştirilen Ayhan patlıcanıdır. Genetik kaynakların tespiti ve tanımlanmasında en yaygın kullanılan yöntemlerden birtanesi de, bazı bitki ve meyve özelliklerini kullanarak morfolojik karakterizasyondur. Morfolojik karakterizasyon için Ayhan patlıcanının 29 genotipine ait 41 meyve ve bitkisel karakterin gözlem ve ölçümleri kullanılmış ve patlıcan genotipleri arasında genetik benzerlik/farklılıklar belirlenmiştir. Morfolojik karakterizasyon için incelenen 41 özellik kullanılarak bir dendogram oluşturulmuş ve genetik benzerlik 0,91-1,00 olarak belirlenirken, dendogramda iki ana grup elde edilmiştir. Bu iki ana grup iki ayrı alt gruba ayrılmaktadır. Birinci alt grupta kontrol genotipleri bulunurken, ikinci grupta ise Ayhan patlıcanı genotipleri bulunmaktadır. Bu çalışmanın sonuçları Ayhan patlıcan populasyonunun önemli genetik varyasyona sahip olduğunu göstermektedir. Bu patlıcan popülasyonu patlıcan ıslah programları için kullanılabilir niteliktedir.

Anahtar Kelimeler: Patlıcan, Genetik çeşitlilik, Bitki, meyve özellikleri

Introduction

Turkey has many regions with different characteristics in terms of climate and soil. Since it is on one of the first regions where agriculture was practiced, it has become a center of diversity and a micro gene center of most cultivated plant species. In this way, an intense plant endemism emerged. Plant genetic resources are in danger of extinction due to various reasons. Preserving the diversity of plant genetic resources of cultivated species is very important for the sustainability of plant production (Tan and İnal, 2003). Plant diversity is decreasing due to reasons such as increased land work, the spread of improved varieties instead of local varieties, natural disasters, urbanization, differentiation of agricultural systems and control methods, and consumption by collecting from nature. For this reason, many countries have initiated studies on the detection, protection and preserve of plant resources (Tan, 1992).

Plant genetic resources carry genetic codes that enable and maintain the adaptation of the plant to the environmental and climate factors in the region where it is grown for a long time. Plant genetic resources will provide significant adapting to different conditions caused by environmental factors and climate changes, creating resistance to current diseases and pests, and meeting new needs in the future. There are different studies conducted in many countries regarding plant genetic researches, and these studies are continuing rapidly today (Zhukovsky, 1951). Genetic resources are defined as basic living resources consisting of wild and modern varieties for the purpose of increasing the performance of plants and developing new varieties (Şakiroğlu, 2010).

Since Turkey is in a geographically and climatically favorable location with various ecological regions, it is very rich in terms of animal and plant diversity. Ecological diversity has led to the formation of three plant geography regions. 75% of the 11,600 plant species seen in Europe are represented by over 9,500 taxa in Turkey. Turkey's flora includes important local cultivated plants as well as many wild relatives of these species (Harlan, 1951; Harlan, 1995).

Turkey is the micro gene center of many vegetables. Many types of vegetables originate from Anatolia. As a result of the adaptation process to eco-geographic regions and farmer choices, local vegetable varieties vary greatly between regions. Especially in the vegetable species grown in Turkey's micro areas or small producers, traditional agricultural methods used and natural hybridizations resulting from the combination of some species play a major role in the emergence of different forms (Tan, 2010). Local genetic resources form the basis of phenotypic variation, which is one of the most important factors in variety breeding studies (Bliss, 1981; Balkaya et al., 2010).

So far, genetic resources collection studies have been carried out mostly in pepper, melon, tomato, broad bean and watermelon species in Turkey. Seeds of vegetable genetic resources originating from Turkey are collected and preserved in many important seed gene banks abroad. There are a total of 14,348 vegetable genetic resources originating from Turkey in 18 vegetable species in the world seed gene banks (Balkaya et al., 2017). As of the 1990s, instead of local varieties; Hybrid varieties have become popular due to advantages such as yield, quality, standardization and resistance to stress conditions. Most of the vegetables grown under greenhouses are hybrid tomatoes, peppers, cucumbers, eggplants and zucchinis(Balkaya et al., 2015).

Eggplant (*Solanum melongena* L.) is a member of the Solanaceae family and is a tropical plant. While eggplant grows as an annual in hot climates, it is a perennial plant in tropical climates. The origine of eggplant is India and some wild species are found in Africa. In Turkey, eggplant is grown under cover and in open fields conditions. Eggplant species have high sugar, high anthocyanin, phenol, free reducing sugar, amide proteins, dry matter and glycoalkaloid content. High glycoalkaloid content creates a bitter taste (Ali et al., 2011). Although it is very important in terms of vitamin

and mineral content, its fruit is a powerful antioxidant. It is very rich in minerals, vitamins and some polyphenols (Sudheesh et al., 1999; Nisha et al., 2009). Therefore, it is a vegetable with economic value(Topçu et al., 2016).

As a result of variety breeding programs carried out using local genetic resources in the last fifty years, 75 open-pollinated vegetable varieties in 15 vegetable species have been registered. Eggplant varieties including Topan 374 (2), Kemer 27 (2), Balıkesir -76 (1), Pala-49 (1), Halep-18 (2), Aydın Siyahı -55 (2)(Balkaya et al., 2017).

One of the most important of these genetic resources is the eggplant genotype called "Ayhan eggplant", which is grown in Nevşehir and its surroundings. Ayhan eggplant has round-shaped fruits that are lilac-tinged, purple and white in color. Although it is used for roasting, it is consumed in different ways, such as dried, fresh and pickled, especially by the people in the region. However, since production is continued by producers obtaining their own seeds, productivity gradually decreases, while susceptibility to diseases and the introduction of new diseases and pests into production areas have started to restrict production. At the same time, non-uniform fruit size and color are frequently encountered in markets. If the productivity and quality of this variety are not increased, there is a possibility that the variety specific to the region will be completely removed from production over time. In this case, determining the genetic diversity in the region is very important. Based on this, this study aimed to develop a standard variety with the selection breeding method and to determine the variation within the Ayhan eggplant population by using morphological characterizations to be used in possible breeding studies.

Materials And Methods

Plant materials

In present study, 29 Ayhan eggplant genotypes and also, one Yamula eggplant, Adana Topak eggplant and Kemer eggplant genotype were used as the control group (Table 1). Ayhan eggplant materials, including 29 genotypes, were collected from the Ayhan Village region of Avanos district of Nevşehir province (Figure 1.) Genotypes were collected from 29 different producer eggplant fields, showing variation in morphological characteristics.

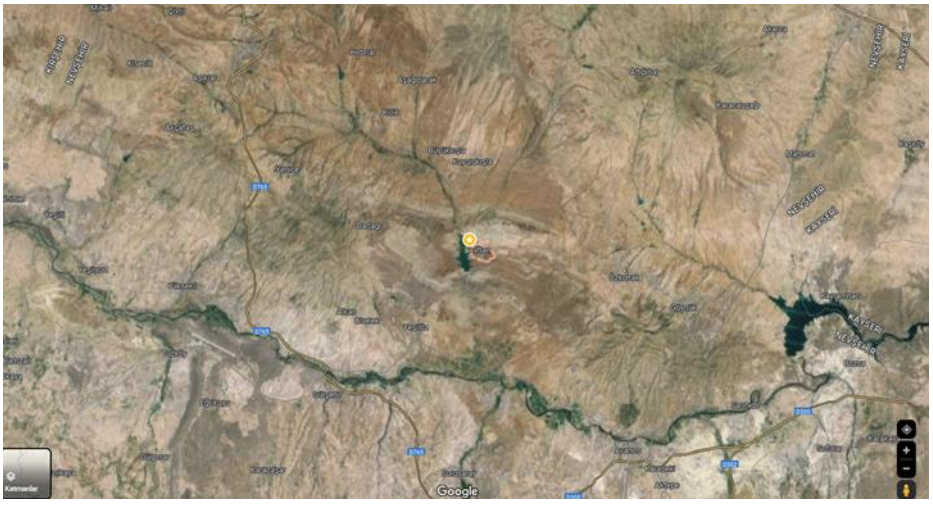

Figure 1. The region where the eggplant genotypes used in the study were collected.

Table 1. Eggplant genotypes used in the study

Number	Genotype Code	Variety
1	AYH-1	Ayhan Eggplant
2	AYH-2	Ayhan Eggplant
3	AYH-3	Ayhan Eggplant
4	AYH-4	Ayhan Eggplant
5	AYH-5	Ayhan Eggplant
6	AYH-6	Ayhan Eggplant
7	AYH-7	Ayhan Eggplant
8	AYH-8	Ayhan Eggplant
9	AYH-9	Ayhan Eggplant
10	AYH-10	Ayhan Eggplant
11	AYH-11	Ayhan Eggplant
12	AYH-12	Ayhan Eggplant
13	AYH-13	Ayhan Eggplant
14	AYH-14	Ayhan Eggplant
15	AYH-15	Ayhan Eggplant
16	AYH-16	Ayhan Eggplant
17	AYH-17	Ayhan Eggplant
18	AYH-18	Ayhan Eggplant
19	AYH-19	Ayhan Eggplant
20	AYH-20	Ayhan Eggplant
21	AYH-21	Ayhan Eggplant
22	AYH-22	Ayhan Eggplant
23	AYH-23	Ayhan Eggplant
24	AYH-24	Ayhan Eggplant
25	AYH-25	Ayhan Eggplant
26	AYH-26	Ayhan Eggplant
27	AYH-27	Ayhan Eggplant
28	AYH-28	Ayhan Eggplant
29	AYH-29	Ayhan Eggplant
30	KNT-1	Yamula Eggplant
31	KNT-2	Adana Topak Eggplant
32	KNT-3	Kemer Eggplant

The genotypes used in the study were inbred for 2 years and seeds were obtained by selection to represent the population. Seedlings of the genotypes were germinated in a 3:1 peat:perlite media and transfered to the Research and Training area of Erciyes University Department of Horticulture at the 3-4 true leaf stage. The experiment was set up according to the random plot design, with 3 replications of each genotype and 5 plants in each replication. The planting spacing was determined as 40 cm above the row and 70 cm between the rows. Soil analysis was done before planting and fertilization was done according to the prepared program. Other cultural treatments such as irrigation and disease and pest management were carried out. A total of 15 plants from each genotype were used for plant measurements. For fruit measurements, 3 fruits were taken from each plant. The average of the measurements taken was used in the characterization.

Morphological Characterization

For morphological characterization, 14 plant characteristics and 27 fruit characteristics determined by the rules of UPOV (International Union for the Protection of New Plant Varieties) (2002) were examined. The examined features are shown in Table 2.

Table 2. Vegetative and fruit characteristics used in morphological characterization

Plant characteristics		
Number	**Characteristics**	**Descriptions**
1	Plant : Attitude	Erect, semi-erect, recumbent (3,5,7)
2	Plant: Height	Short, middle, long (3,5,7)
3	Plant : Length of stem (from cotyledon to node of first flower	Short, middle, long (3,5,7)
4	Stem : Anthocyonin coloration	Absent, present (1,9)
5	Stem : Intensity of anthocyonin coloration	Slight, Middle, strong (3,5,7)
6	Stem : Hairness	Slight, Middle, much (3,5,7)
7	Branch :Length of internodes	Short, middle, long (3,5,7)
8	Leaf : Size	Small, middle, big (3,5,7)
9	Leaf : Margin	Whole, Serrated, Wavy (3,5,7)
10	Leaf : Degree of sinuation of margin	Slight, Middle, strong (3,5,7)
11	Leaf :Blistering	Absent, present (1,9)
12	Leaf :Spininess	Absent, Slight, Medium, Strong, Very Strong (1,3,5,7,9) 9
13	Leaf :Color	Green, Bluish Green, Violet Green(3,5,7)
14	Flower : Purple color	Light, Medium, Dark(3,5,7)
Fruit characteristics		
Number	**Characteristics**	**Descriptions**
1	Fruit : Length	Measured data
2	Fruit : Diameter	Measured data
3	Fruit : Ratio length /diameter	Measured data
4	Fruit : General shape	Pear, Solid, Sphere, Cylindrical (1,3,5,7,9)
5	Fruit : Size of pistil scar	Small, Medium, Large (3,5,7)
6	Fruit: Shape of apex	Notched, Round, Pointed(3,5,7)
7	Fruit : Depth of indentation	Superficial, Medium, Deep (3,5,7)
8	Fruit : Curvatıre (only for cylindirical types	Ansent, Slight, Medium, Much, Very Much (1,3,5,7,9)
9	Fruit : Color of skin at commercial harvesting	White, Yellow, Green, Lilac, Purple (1,3,5,7,9)
10	Fruit :Intensity of color of skin	Light, Medium, Dark (3,5,7)
11	Fruit : Glossiness at harvest maturity	Slight, Medium, High (3,5,7)
12	Fruit : Status of stripes	Absent, present (1,9)
13	Fruit : Intensity of stripes	Low, Medium, High (3,5,7)
14	Fruit : Ribs	Absent, present (1,9)
15	Fruit : Prominence of ribs	Slight, Medium, Large (3,5,7)
16	Fruit : Size of calyx	Small, Medium, Large (3,5,7)
17	Fruit : Anthocyanin coloration below calyx	Slight, Medium, High (3,5,7)
18	Fruit : Anthocyanin coloration of calyx	Very Little, Little, Medium, Much, Very Much (1,3,5,7,9)
19	Fruit : Anthocyanin coloration below calyx	Absent, present (1,9)
20	Fruit : Intensity ofa Anthocyanin coloration below calyx	Slight, Medium, High (3,5,7)
21	Fruit : Spinyness calyx	Very Little, Little, Medium, Much, Very Much (1,3,5,7,9)
22	Fruit : Color of flesh	Whitish, Greenish (1,9)
23	Fruit :Color of skin (at physiological ripeness)	Yellow, Soil Color, Brown (3,5,7)
24	Fruit : Time of beginning of flowering	Early, Medium, Late (3,5,7)
25	Fruit : Time of physiological ripeness	Early, Medium, Late (3,5,7)
26	Fruit : Weight	Measured data
27	Fruit : Firmness	Measured data

Data analysis The features examined during morphological

characterization were evaluated as described above and analyzed in the computer package program NTSYS (Numerical Taxonomy Multivariate Analysis System, NTSYS-pc version 2.11, Exeter Software, Setauket, N.Y., USA, Rohlf, 2000). Similarity indices were calculated according to the Dice (1945) method, and the dendrogram was created according to the UPGMA (Unweighted Pair-Group Method With Arithmetic Average) method.

Results And Discussıon

Vegetative characteristics

In the study, a total of 14 vegetative traits in 32 genotypes were examined (Table 3) According to plant characteristics findings; Looking at the plant posture, it was seen that 25 genotypes grew upright, 5 genotypes grew semi-erectly, and 2 genotypes grew horizontally. In terms of plant height, it was determined that 12 genotypes were tall, 12 genotypes were medium height, and 8 genotypes were short. In terms of plant stem length, it was determined that 1 genotype was long-stemmed, 1 genotype was medium-stemmed, and 30 genotypes were short-stemmed. The anthocyanin content of plants is an important factor. In terms of anthocyanin coloration in the stem, coloration was observed in 17 genotypes, while no anthocyanin coloration was observed in the stem in 15 genotypes. It was observed that anthocyanin coloration was slight in 12 of the 17 genotypes, moderate in 5 genotypes, and strong in 1 genotype. While the hairiness on the stem was slight in 29 genotypes, moderate hairiness was observed in 3 genotypes. It was determined that internode length was long in 2 genotypes, medium in 10 genotypes, and short in 20 genotypes. In plants, leaf size and leaf color are important for the photosynthesis efficiency of the plant. In terms of leaf size, 5 genotypes had large leaves, 10 genotypes have medium-sized leaves and 17 genotypes have small leaves. The leaf edge shape was toothed in 1 genotype, has the entire structure in 1 genotype, and was wavy in the remaining 30 genotypes. Among the genotypes with a wavy leaf edge structure, the wavy degree is middle in AYH-2, AYH-4, AYH-5 and AYH-31 genotypes, AYH-30 had a strong degree in one genotype and a slight degree in the remaining 27 genotypes. Leaf spininess was not observed in any genotype. Leaf blistering was only AYH-3. and AYH-4. was observed in genotypes. In terms of leaf color, only the AYH-30 genotype had a bluish green color, while all the remaining genotypes have a green color. In plants, flower color is a factor that attracts pollinator insects and ensures pollination. As for flower color, 4 genotypes were determined as dark purple, 6 genotypes as medium purple and 22 genotypes as light purple (Table 3).

Fruit characteristics

27 fruit characteristics were observed on the genotypes (Table 4 and Table 5). According to the fruit characteristics results; all fruit characteristics are directly proportional to the prominence of the variety and the demand of the fruits by the consumer. The fruit length of the genotypes used in the study was measured between 82 mm and 196 mm and the fruit diameter was measured between 36 mm and 62 mm. Fruit length/fruit diameter ratios were determined as the lowest 1.72 mm and the highest 3.92 mm. Such as fruit shape, curvature, skin color, fruit brightness, etc. fruit characteristics are phenotypic advantages that are very important. In terms of fruit shape, AYH-3, AYH-13, AYH-19 and AYH-32 genotypes were spherical, while all genotypes had a cylindrical structure. Female flower marks in eggplant fruits are the traces left behind from the structures that remain on the fruit after pollination and fruit set formation, but fall off from the tip of the fruit after the fruit matures. Fruit pistil scar size was large in 7 genotypes, medium in 10 genotypes and small in 15 genotypes. The fruit tip shape is round in 9 genotypes and all genotypes have a pointed structure. Fruit tip paddy depth was not found in any genotype. In terms of curvature in the fruit, AYH-2, AYH-8 and AYH-17 genotypes were slightly curved, AYH-4, AYH-24, AYH-27 and AYH-32 genotypes were moderately curved, and no curvature was found in the remaining genotypes.

There is no uniform fruit color in the genotypes used in the present study. It was observed that the commercial shell color of the genotypes was white in 5 phenotypes, purple in 15 genotypes and lilac in 12 genotypes. In terms of fruit skin color density, apart from the white genotypes, it was determined that it was slight in 5 genotypes, medium in color in 13 genotypes, and dark in 9 genotypes. In terms of stripes on the fruits of the genotypes, stripes were found in 22 of them, and no stripes were observed in the other 10 genotypes. It was determined that the stripes were dense in 9 of the striped genotypes, moderate in 5 genotypes, and sparse in 8 genotypes. It was observed that the brightness of the fruit at harvest was high in AYH-31 and AYH-32 genotypes, and moderate in the other 30 genotypes.

Fruit vascularity was seen in 16 genotypes but not in 16 genotypes. In genotypes with vascularity, the protrusion of the vessels was large in 1 genotype, medium in 4 genotypes, and mild in 11 genotypes. The size of the fruit flower envelope was determined as large in 9 genotypes, medium in 16 phenotypes and small in 7 genotypes. Anthocyanin, which has many benefits for human health, is abundant in eggplant fruits. Anthocyanin coloration below calyx on the fruit was found in 11 genotypes but not in 21 genotypes. The intensity of anthocyanin coloration under the flower calyx was high in 2 genotypes, moderate in 7 genotypes, and slight in 2 genotypes. Anthocyanin coloration of the fruit flower calyx was moderate in 1 genotype, slight in 13 genotypes, and was not observed in the remaining genotypes. In the genotypes in which anthocyanin coloration of the fruit flower envelope was observed, the coloration intensity was moderate in 1 genotype and low in 13 genotypes. The prickliness of the fruit flower envelope was seen at a medium level in 1 genotype, at a low level in 6 genotypes, and the remaining genotypes do not have thorniness. Two different colors were observed in the fruit in terms of flesh color. The AYH-32 genotype had greenish flesh color, while all other genotypes have whitish flesh color. At physiological maturity, the skin color of the fruit was yellow in AYH-30 and AYH-31 genotypes, while it was soil colored in other genotypes(Figure 2). Flowering onset time and fruit physiological maturity time are early in AYH-30 and AYH-32 genotypes, and intermediate in all remaining genotypes. Fruit weight of the genotypes varied between 47.7 g and 214.7 g, and fruit flesh hardness varied between 1.3 kg/cm2 and 4.1 kg/cm2 (Table 4). There is wide phenotypic variation among Ayhan eggplant fruits, as in vegetative characteristics.

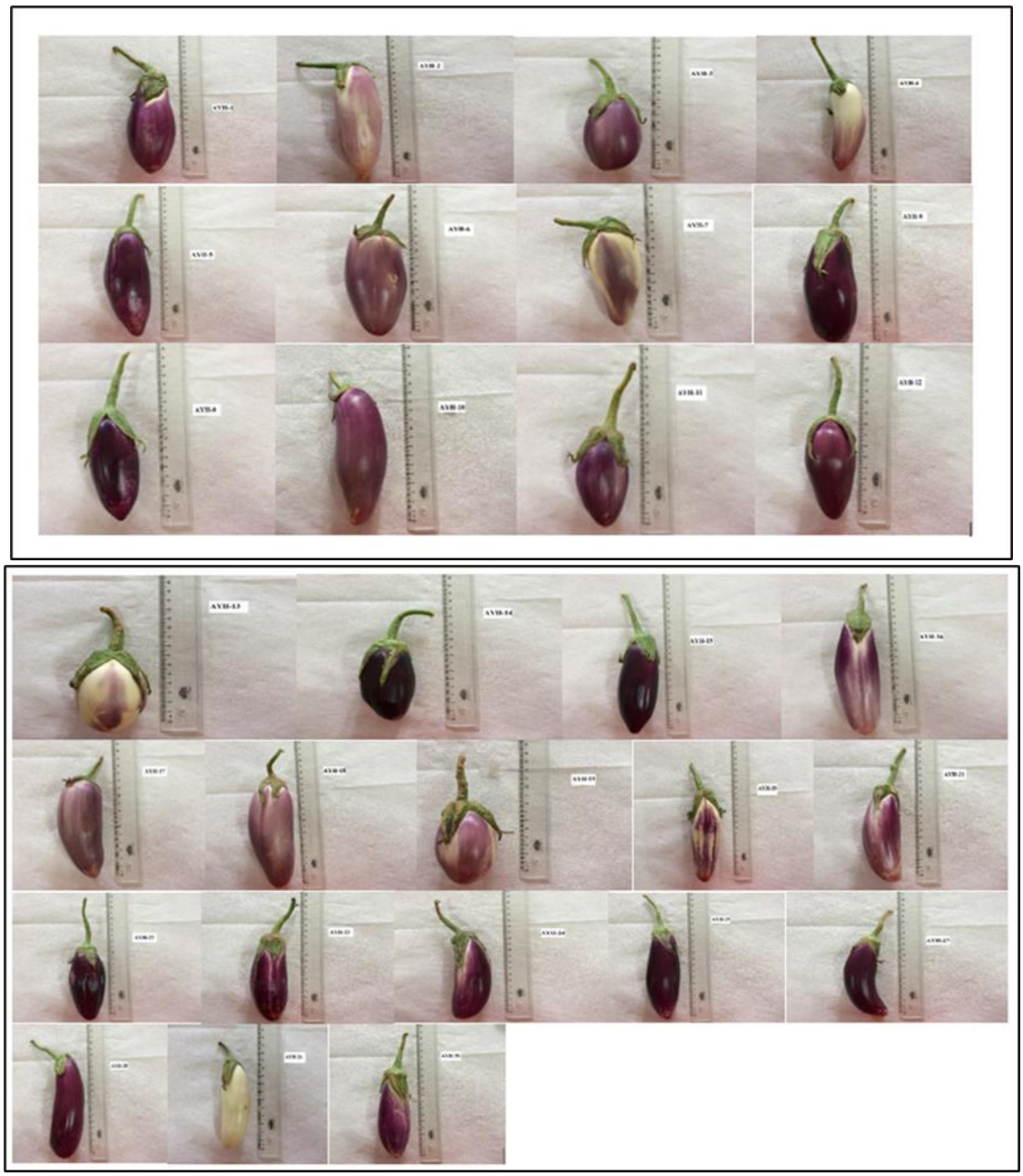

Figure 2. Fruit photos of Ayhan eggplant genotypes

A dendogram was created using the 41 features examined for morphological characterization, and while the genetic similarity was determined as 0.91-1.00, two main groups were obtained in the dendogram. These two main groups are divided into two separate subgroups. While there are control genotypes in the first subgroup, there are genotypes of Ayhan eggplant in the other subgroups (Figure 3).

Especially since the vegetable genotypes grown locally in Turkey are produced with seeds obtained from the producers' production area, there is genetic segregation, and the genotypes have population characteristics. Therefore, it is possible to obtain differences within the same population. As a matter of fact, in a study conducted by Uysal (2023), morphological characterization was made using 16 vegetative traits and 14 fruit traits in 28 Yamula eggplant genotypes, 1 Manisa eggplant genotype as a control group, and 3 Kemer eggplant genotypes. According to the results, the genetic similarity between eggplant genotypes was determined to be between 0.27-0.84. Two main groups were obtained in the dendrogram. These two groups are divided into two separate subgroups. The first group consisted of genotypes belonging to control groups, while the second group consisted of genotypes belonging to Yamula eggplant. In another study conducted by Topçu et al. (2016), 100 eggplant lines used in breeding programs were characterized morphologically and molecularly. For morphological characterization,

observations and measurements of 32 morphological features were made using the criteria specified by UPOV, and as a result, it was determined that the genotypes were divided into 17 groups.

On the other hand, Çakır (2018) aimed to characterize local eggplant populations originating from Turkey according to their morphological characteristics and to determine the level of genetic variation in the current population. At the beginning of the study, a gene pool consisting of eighty eggplant genotypes was created. The present collection has been reported to show significant phenotypic diversity in fruit characteristics. Principal Component Analysis explained 71.38% of the total variation based on the first four principal component axes. This result showed that there was a high degree of variation among eggplant genotypes.

In the dendrogram, the geotypes in the 1st main group had lilac fruit color and round fruit structure, while the other groups included genotypes with calyx thorniness and oval fruit structure. Fruit shape and color were effective in the genetic separation of eggplant genotypes (Figure 3).

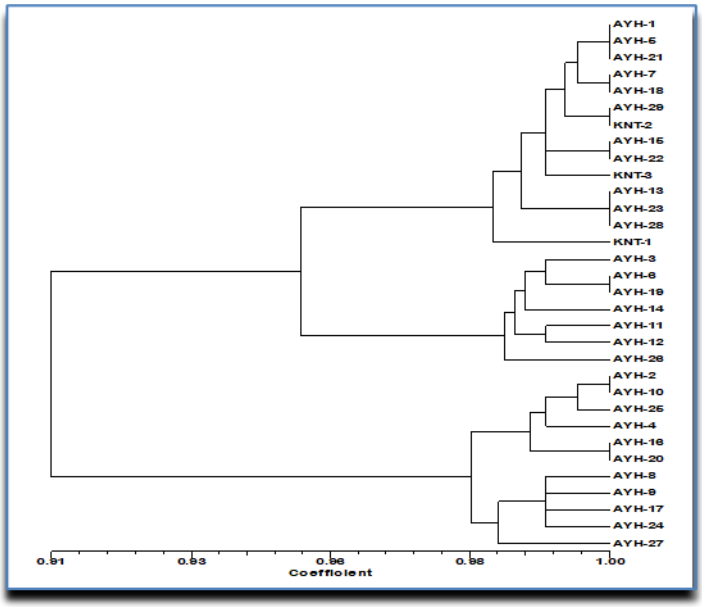

Figure 3. Dendrogram created as a result of morphological characterization data analysis

Conclusion

It is possible to determine similar variation in other eggplant varieties produced in Turkey. However, although this genetic difference is important in terms of breeding, it creates negativities in terms of production in terms of yield, resistance/sensitivity to diseases and pests, and some fruit quality criteria. Therefore, the solution to this problem is to determine the variation within the populations that constitute local genetic resources and to use the obtained variation in developing efficient and high-quality varieties, on the other hand, genotypes bearing all the characteristics of the local variety are determined through selection taking into account variation and are evaluated as standard varieties after yield trials. In this study, the genotypes of the eggplant variety called Ayhan eggplant, determined from the areas where eggplant is produced in Ayhan Village of Avanos district of Nevşehir province, were evaluated taking into account morphological features and variation was determined using eggplant genotypes commonly grown in Turkey. The variation obtained can be used in the development of new hybrid eggplant varieties, or it is possible to develop a new standard variety and bring it into production through selection using the genotypes in question. According to the results of present study, an important variation was observed among Ayhan eggplant genotypes, and Ayhan eggplant genotypes could be used as a good source for future breeding studies.

Conflict of Interests: The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results. The authors declare no conflict of interest.

Authors' Contribution: The authors declare that they contributed equally to the article.

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Table 3. Vegetative characteristics of some Ayhan eggplant and control genotypes.

Genotpe	Plant Attitude	Plant Height	Length of stem	Stem Anthocyonin coloration	Intensity of anthocyonin coloration	Stem Hairness	Length of internodes	Leaf Size	Leaf Margin	Degree of sinuation of margin	Leaf Blistering	Leaf Spininess	Leaf Color	Flower Purple color
AYH-1	Erect	Long	Short	Present	Medium	Slight	Short	Big	Whole	Slight	Absent	Absent	Green	Medium
AYH-2	Erect	Short	Short	Absent	Absent	Slight	Medium	Big	Wavy	Medium	Absent	Absent	Green	Light
AYH-3	Semi Erect	Short	Short	Absent	Absent	Slight	Short	Medium	Wavy	Slight	Absent	Present	Green	Medium
AYH-4	Horizantal	Short	Short	Absent	Absent	Slight	Medium	Big	Wavy	Medium	Absent	Present	Green	Dark
AYH-5	Semi Erect	Long	Short	Absent	Absent	Slight	Medium	Medium	Wavy	Medium	Absent	Absent	Green	Dark
AYH-6	Erect	Long	Short	Present	Medium	Slight	Short	Medium	Wavy	Slight	Absent	Absent	Green	Dark
AYH-7	Erect	Medium	Short	Present	Slight	Slight	Medium	Small	Wavy	Slight	Absent	Absent	Green	Medium
AYH-8	Erect	Short	Short	Present	Slight	Slight	Medium	Medium	Wavy	Slight	Absent	Absent	Green	Dark
AYH-9	Semi Erect	Medium	Short	Present	Slight	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-10	Erect	Medium	Short	Absent	Absent	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-11	Erect	Long	Short	Absent	Absent	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Medium
AYH-12	Erect	Long	Short	Present	Slight	Slight	Medium	Medium	Wavy	Slight	Absent	Absent	Green	Medium
AYH-13	Erect	Medium	Short	Present	Medium	Slight	Medium	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-14	Erect	Short	Short	Present	Slight	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-15	Erect	Short	Short	Present	Slight	Slight	Short	Big	Wavy	Slight	Absent	Absent	Green	Light
AYH-16	Erect	Medium	Short	Present	Slight	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-17	Semi Erect	Medium	Short	Present	Slight	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-18	Erect	Medium	Short	Absent	Absent	Slight	Medium	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-19	Erect	Long	Short	Present	Slight	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-20	Erect	Long	Short	Present	Medium	Slight	Short	Medium	Wavy	Slight	Absent	Absent	Green	Light
AYH-21	Semi Erect	Long	Short	Absent	Absent	Slight	Medium	Medium	Wavy	Slight	Absent	Absent	Green	Light
AYH-22	Erect	Long	Short	Present	Slight	Slight	Short	Medium	Wavy	Slight	Absent	Absent	Green	Medium
AYH-23	Erect	Medium	Short	Absent	Absent	Slight	Short	Big	Wavy	Slight	Absent	Absent	Green	Light
AYH-24	Erect	Short	Short	Present	Slight	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-25	Erect	Medium	Short	Absent	Absent	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-26	Erect	Long	Short	Absent	Absent	Slight	Medium	Big	Wavy	Slight	Absent	Absent	Green	Light
AYH-27	Erect	Long	Short	Absent	Absent	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light
AYH-28	Erect	Medium	Short	Absent	Absent	Slight	Short	Small	Wavy	Slight	Absent	Absent	Green	Light

AYH-29	Erect	Medium	Short	Absent	Absent	Slight	Long	Small	Wavy	Slight	Absent	Absent	Green	Light
KNT-1	Horizantal	Short	Short	Present	Strong	Medium	Short	Small	Wavy	Strong	Absent	Absent	Bluish Green	Light
KNT-2	Erect	Medium	Medium	Absent	Absent	Medium	Short	Medium	Wavy	Medium	Absent	Absent	Green	Slight
KNT-3	Erect	Long	Long	Present	Slight	Medium	Long	Medium	Serrated	Medium	Absent	Absent	Green	Slight

Table 4. Fruit characteristics of some Ayhan eggplant and control genotypes.

Genotype	Status of stripes	Intensity of stripes	Size of calyx		Anthocyanin coloration below calyx	Anthocyanin coloration below calyx	Anthocyanin coloration of calyx	Spinyness calyx	Color of flesh	Fruit Color of skin (at physiological ripeness)	Time of beginning of flowering	Time of physiological ripeness	Fruit firmness(kg/cm2)	Fruit weight(g)
AYH-1	Present	Slight	Medium	Absent	Absent	Slight	Low	Absent	Whitish	Soil	Medium	Medium	2.9	182.3
AYH-2	Present	Slight	Small	Absent	Absent	Absent	Absent	Medium	Whitish	Soil	Medium	Medium	2.2	176.7
AYH-3	Absent	Absent	Big	Absent	Absent	Absent	Absent	Low	Whitish	Soil	Medium	Medium	1.9	89.7
AYH-4	Absent	Absent	Medium	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.6	93.2
AYH-5	Present	Medium	Medium	Absent	Absent	Slight	Low	Low	Whitish	Soil	Medium	Medium	2.1	148.2
AYH-6	Absent	Absent	Small	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.1	146.3
AYH-7	Absent	Absent	Small	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.1	84.6
AYH-8	Present	Slight	Big	Present	Medium	Absent	Absent	Low	Whitish	Soil	Medium	Medium	1.8	162.9
AYH-9	Present	Slight	Big	Present	Medium	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.3	82.5
AYH-10	Absent	Absent	Small	Present	Slight	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.2	124.9
AYH-11	Present	Slight	Medium	Absent	Absent	Slight	Low	Absent	Whitish	Soil	Medium	Medium	2.3	54.5
AYH-12	Absent	Absent	Medium	Present	High	Slight	Low	Absent	Whitish	Soil	Medium	Medium	2.1	61.3
AYH-13	Absent	Absent	Big	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.4	65.7
AYH-14	Present	Slight	Big	Present	High	Slight	Low	Low	Whitish	Soil	Medium	Medium	2.7	73.8
AYH-15	Present	Slight	Medium	Present	Medium	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.5	122.6
AYH-16	Present	Slight	Medium	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.4	143.6
AYH-17	Absent	Absent	Small	Present	Slight	Slight	Low	Absent	Whitish	Soil	Medium	Medium	2.9	107.7
AYH-18	Absent	Absent	Small	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.8	214.7
AYH-19	Absent	Absent	Big	Absent	Absent	Slight	Low	Absent	Whitish	Soil	Medium	Medium	1.8	100.4
AYH-20	Absent	Absent	Medium	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.3	121.4
AYH-21	Present	Slight	Medium	Absent	Absent	Slight	Low	Absent	Whitish	Soil	Medium	Medium	2.5	97.8
AYH-22	Present	Big	Medium	Present	Medium	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.2	73.8
AYH-23	Absent	Absent	Big	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.7	118
AYH-24	Present	Medium	Big	Absent	Absent	Medium	Medium	Absent	Whitish	Soil	Medium	Medium	2.6	80

AYH-25	Present	Medium	Medium	Present	Medium	Slight	Low	Absent	Whitish	Soil	Medium	Medium	2.5	103.6
AYH-26	Present	Medium	Medium	Absent	Absent	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	2.4	47.7
AYH-27	Present	Slight	Medium	Present	Medium	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	1.7	78
AYH-28	Present	Slight	Medium	Present	Medium	Absent	Absent	Absent	Whitish	Soil	Medium	Medium	1.3	152
AYH-29	Absent	Absent	Medium	Absent	Absent	Slight	Low	Low	Whitish	Soil	Medium	Medium	2.9	84
KNT-1	Absent	Absent	Big	Absent	Absent	Slight	Low	Low	Whitish	Yellow	Early	Early	4.1	128.2
KNT-2	Absent	Absent	Medium	Absent	Absent	Slight	Low	Medium	Whitish	Yellow	Medium	Medium	3.6	155.6
KNT-3	Absent	Absent	Small	Absent	Absent	Slight	Low	Absent	Greenish	Soil	Early	Early	2.9	164.8

Table 5. Fruit characteristics of some Ayhan eggplant and control genotypes.

Genotip	Fruit : Length	Fruit : Diameter (mm)	Fruit : Length / Diameter	Fruit General shape	Size of pistil scar	Shape of apex	Depth of indentation	Curvatıre	Color of skin at commercial harvesting	Intensity of color of skin	Status of stripes	Intensity of stripes	Glossiness at harvest maturity
AYH-1	164	62	2.64	Cylindrical	Medium	Pointed	Absent	Absent	Lilac	Dark	Present	Sparse	Medium
AYH-2	168	52	3.23	Cylindrical	Small	Pointed	Absent	Slight	White	Dark	Present	Intense	Medium
AYH-3	93	54	1.72	Sphere	Medium	Pointed	Absent	Absent	Lilac	Medium	Present	Medium	Medium
AYH-4	133	43	3.09	Cylindrical	Small	Pointed	Absent	Medium	White	Medium	Present	Intense	Medium
AYH-5	148	56	2.64	Cylindrical	Big	Pointed	Absent	Absent	Purple	Medium	Absent	Intense	Medium
AYH-6	115	61	1.88	Cylindrical	Small	Round	Absent	Absent	Lilac	Medium	Present	Medium	Medium
AYH-7	114	46	2.47	Cylindrical	Small	Pointed	Absent	Absent	White	Medium	Present	Intense	Medium
AYH-8	143	59	2.42	Cylindrical	Big	Pointed	Absent	Slight	Purple	Medium	Absent	Intense	Medium
AYH-9	103	47	2.19	Cylindrical	Small	Pointed	Absent	Absent	Purple	Medium	Present	Sparse	Medium
AYH-10	174	52	3.34	Cylindrical	Small	Round	Absent	Absent	Lilac	Medium	Present	Intense	Medium
AYH-11	90	47	1.91	Cylindrical	Medium	Pointed	Absent	Absent	Lilac	Dark	Present	Sparse	Medium
AYH-12	82	45	1.82	Cylindrical	Medium	Pointed	Absent	Absent	Lilac	Dark	Present	Sparse	Medium
AYH-13	139	49	2.83	Sphere	Medium	Round	Absent	Absent	White	Dark	Present	Intense	Medium
AYH-14	89	51	1.74	Cylindrical	Medium	Pointed	Absent	Absent	Purple	Dark	Absent	Intense	Medium
AYH-15	143	53	2.69	Cylindrical	Big	Pointed	Absent	Absent	Purple	Dark	Absent	Intense	Medium
AYH-16	159	52	3.05	Cylindrical	Medium	Round	Absent	Absent	Lilac	Dark	Present	Intense	Medium
AYH-17	115	51	2.25	Cylindrical	Medium	Pointed	Absent	Slight	Lilac	Slight	Present	Intense	Medium
AYH-18	162	59	2.74	Cylindrical	Small	Round	Absent	Absent	Lilac	Slight	Present	Intense	Medium
AYH-19	110	56	1.96	Sphere	Medium	Round	Absent	Absent	Lilac	Slight	Present	Sparse	Medium

AYH-20	143	47	3.04	Cylindrical	Small	Round	Round	Absent	Purple	Medium	Present	Intense	Medium
AYH-21	122	48	2.54	Cylindrical	Big	Pointed	Absent	Absent	Purple	Slight	Present	Sparse	Medium
AYH-22	113	44	2.56	Cylindrical	Big	Pointed	Absent	Absent	Purple	Dark	Absent	Sparse	Medium
AYH-23	133	47	2.82	Cylindrical	Small	Pointed	Absent	Absent	Purple	Medium	Present	Sparse	Medium
AYH-24	130	40	3.25	Cylindrical	Big	Pointed	Absent	Medium	Purple	Medium	Present	Medium	Medium
AYH-25	136	43	3.16	Cylindrical	Small	Pointed	Absent	Absent	Purple	Dark	Present	Sparse	Medium
AYH-26	102	36	2.83	Cylindrical	Small	Pointed	Absent	Absent	White	Dark	Absent	Medium	Medium
AYH-27	133	39	3.41	Cylindrical	Big	Pointed	Absent	Medium	Purple	Medium	Absent	Medium	Medium
AYH-28	156	53	2.95	Cylindrical	Medium	Round	Absent	Absent	Purple	Medium	Present	Medium	Medium
AYH-29	120	47	2.55	Cylindrical	Small	Pointed	Absent	Absent	Lilac	Medium	Present	Medium	Medium
KNT-1	116	48	2.42	Cylindrical	Small	Pointed	Absent	High	Lilac	Slight	Absent	Medium	Medium
KNT-2	137	54	2.53	Sphere	Small	Round	Absent	Absent	Purple	Medium	Absent	Medium	High
KNT-3	196	50	3.92	Cylindrical	Small	Pointed	Absent	Medium	Purple	Dark	Absent	Medium	High