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Ampelographic characterization of some grape genetic resources in the Aegean region of Türkiye

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Abstract

Viticulture has an ancient history worldwide, and thousands of grape cultivars are grown in different countries. Some of these grape cultivars are the same cultivar, but they are grown with different names, and similarly, other varieties are grown with the same name. To prevent this confusion, grape varieties or genotypes must be defined differently. The most widely used definition in the world is ampelographic, and different grapes are preserved by being identified in this way. In this study, 29 of the local grape cultivars or genotypes collected from different vineyard areas of our country, especially in the Aegean Region, and taken under protection were defined regarding 53 different ampelographic characters. As a result of the definitions, it was identified that all of the cultivars/genotypes were seeded and belonged to the *Vitis vinifera* L. species. According to the similarity dendrogram data from the definitions, the similarity rate between the defined cultivars/genotypes changed between 0.53 and 0.89. The highest similarity rate (0.89) was obtained from the Ak Üzüm and Nuri Bey genotypes with light-coloured berries. It is seen that all cultivars and genotypes are different from each other according to the 53 criteria evaluated. According to the results of the 53 different characters evaluated, it was determined that the varieties/genotypes were the same in terms of the 50th (seed formation) and 48th (intensity of the flesh colouration with anthocyanin) characters. But, there were differences in terms of other characters. According to the results obtained from the study, it was revealed that cultivars/genotypes differed at varying rates, and cultivars /genotypes whose definitions were made were protected for future studies regarding their identified characteristics.

Keywords: *Vitis vinifera*, Dendrogram, Similarity, Cultivars, Genotypes, Identification

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INTRODUCTION

Viticulture has an ancient history worldwide, and thousands of grape cultivars are grown in different countries. Among the grapevine species cultivated thousands of years ago and spread over a wide area worldwide, the species with the most significant number of cultivars is *Vitis vinifera* L. (De Lorenzis, 2024; Baltazar et al., 2025). However, in recent years, some interspecific hybrid cultivars developed in breeding studies have increased production areas (Atak, 2024). These cultivars are grown intensively, especially in the European continent and Türkiye (İşçi and Altındişli, 2024). In Anatolia, which is among the genetic resources of the grapevine, many grape cultivars have been produced for different purposes since ancient times (Winkler, et al., 1974; Taskesenlioglu et al., 2022; Kaya et al., 2023).

As in many countries, there is a very rich variety of grapes in Türkiye and different widely accepted identification techniques are used to identify these cultivars. Researchers have been using ampelographic methods for many years to identify grape cultivars or genotypes, and in recent years, molecular methods have also begun to be used for identification purposes (Vivien and Pretorius, 2000; Atak et al., 2012). In addition, chromatographic

and spectrophotometric methods are also used for identification purposes, where grape berries are identified in terms of their different contents (Rapp, 1988; Temerdashev et al., 2024).

Grapevine cultivar identification is essential for ensuring product authenticity, managing quality control, and maintaining regulatory compliance. In some cases, grape leaves used for consumption can be more valuable than the fruit itself (Moncayo et al., 2016; Koklu et al., 2022; Carneiro et al., 2024).

Some researchers compared and identified grape cultivars and genotypes by examining and scoring different parts of the grapevine plant, such as fresh shoots, lignified shoots, leaves, flowers, berries and seeds (Sargolzaei et al., 2021; Bodor-Pesti et al., 2023; Hbyaj et al., 2024).

In Türkiye, grape cultivars are registered according to approximately 50 ampelographic identification criteria for registration of grape cultivars for two years. They are registered if a difference is detected in at least one criterion. Therefore, the selected cultivars and genotypes must be identified based on different characteristics during registration in breeding and clonal selection studies (Atak et al., 2013; Kara et al., 2023).

In addition, cultivars or genotypes that are the same despite being grown under different names and cultivars and genotypes that are grown under the same name in different places but have mutated due to climate, soil and other factors and have now become different need to be defined (Dettweiller et al., 2000; Labra et al., 2004; Yılmaz et al., 2020). According to the findings obtained from the definitions, it will be determined whether these cultivars or genotypes are the same or different, and cultivar confusion will be prevented.

In this study, some grape cultivars/genotypes collected from different parts of Türkiye and preserved as grapevine genetic resources were identified by determining their important ampelographic characteristics to be used with their defined characteristics in future breeding studies.

MATERIALS AND METHODS

Plant Material

Grape varieties and genotypes grown in the Aegean Region but whose numbers have been decreasing over time were collected to prevent their extinction and their important characteristics were identified within the scope of this study. The material for this study consisted of 29 cultivars/genotypes from the Aegean Region Genetic Resources Parcel within the Manisa Viticulture Research Institute, located within the central borders of Manisa province. The cultivars/genotypes were grafted onto 1103 P and planted at a 3 m x 1.5 m distance. They were planted in 6-8 vines each. They are 12-14 years old and short-pruned in the double-arm cordon training system. A training system was created with concrete poles and a low-trunk 6-wire V system. The soil structure of the experimental area is clayey-loamy, the organic matter content is approximately 1% and the soil pH is 7.9. Photographs of the cultivars and genotypes used in the study (except for two genotypes) are given in Figure 1. Temperature data (lowest, highest, average) for the experimental area in 2024 are given in Figure 2.

Method

Ampelographic characterization

In this study, 53 characters selected from the OIV descriptive list (2nd edition) for grape varieties and *Vitis* species, published by the International Organization for Grape and Wine (OIV, 2009), were used for identification. The criteria in this list were used in the ampelographic identifications of 29 varieties/genotypes. According to the recommendation of the descriptive list published by OIV for grape varieties and genotypes, criteria with high discrimination properties were selected for identification. The names and explanations of the OIV characters used in the study are given in Table 1. Shoot tips were examined when they reached approximately 25 cm in length, and the first four young leaves were evaluated within the scope of this study. The definitions of mature leaves were made in the period between the fruit set and the verasion and in the leaves in the clusters located in the middle part of the shoots. The clusters were measured when they reached harvest maturity. For berry characteristics, examinations were made when the maturity index of samples from the middle of the cluster reached at least 25.

Ampelographic clustering

According to international descriptors, the mean values of the definition data obtained in different years (2022-2024) were transformed into numerical scales. In cases where two-year differences were observed, definitions were made by looking at the values in the third year. These data obtained within the scope of the study were analysed with the help of a distance matrix with the NTSYSpc 2.0 program (Rohlf, 2000). The data in the clustering dendrogram were calculated based on the Unweighted Pair Group of the Arithmetic Mean (UPGMA). Genetic similarity status was determined according to the degree to which each of the cultivars and genotypes had a common scale with each other.

Figure 1. Photos of the genotypes

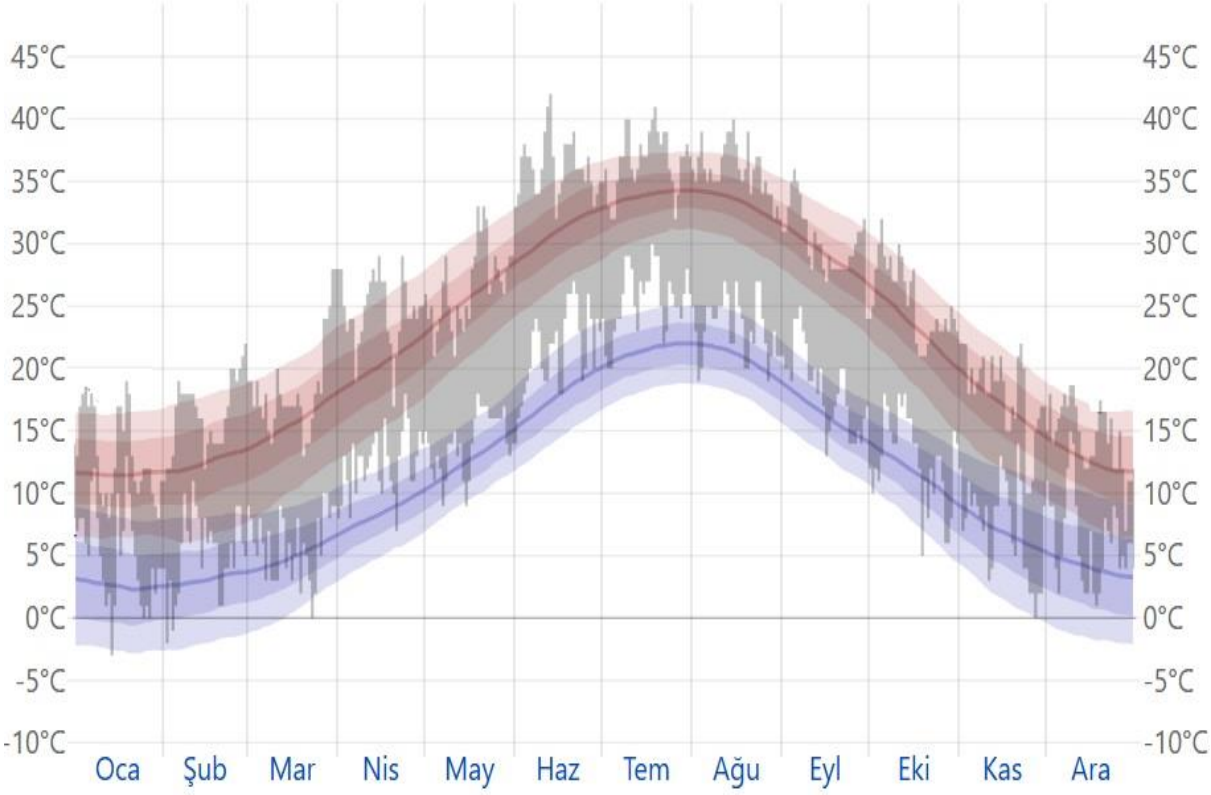

Figure 2. Temperature data (lowest, highest, average) for the experimental area in 2024

Table 1. OIV codes and descriptions are used to identify grape genotypes.

Vegetation Stage	Code Order	OIV Code	Characteristics	Notes and Explanations
Phenology	1	301	Time of bud burst	1=very early
				3=early
				5=medium
				7=late
				9=very late
	2	302	Time of full bloom	1=very early
				3=early
				5=medium
				7=late
				9=very late
	3	303	Time of beginning of berry ripening (veraison)	1=very early
				3=early
				5=medium
				7=late
				9=very late
	4	304	Time of physiological stage of full maturity of the berry	1=very early
				3=early
				5=medium
				7=late
				9=very late
Young Shoot, Shoot, and Young Leaf	5	3	Young Shoot: intensity of anthocyanin coloration on prostrate hairs of tip	1=absent or very weak
				3=weak
				5=medium
				7=strong
				9=very strong
	6	4	Young Shoot: density of prostrate hairs on tip	1=none or very sparse
				3=sparse
				5=medium
				7=dense
				9=very dense
	7	6	Shoot: attitude (before tying)	1=erect
				3=semi erect
				5=horizontal
				7=semi droping
				9=droping
	8	7	Shoot: colour of dorsal side of internodes	1=gren
				2=green with red stripes
				3=red
	9	8	Shoot: color of ventral side of internodes	1=gren
				2=green with red stripes
				3=red
	10	16	Shoot: number of consecutive tendrils	1=discontinuous(2 or less)
				2=subcontinuous or continues (3 or more)
	11	51	Young leaf: color of the upper side of blade (4 th leaf)	1=green
				2=yellow
				3=bronze
				4=copper reddish
	12	53	Young leaf: density of prostrate hairs between main veins on lower side of blade (4th leaf)	1=none or very sparse
				3=weak
				5=medium
				7=strong
				9=very dense
Flower	13	151	Flower: sexual organs	1=male
				2=male to hermaphrodite
				3=hermaphrodite
				4=female with upright stamina
				5=female

Mature Leaf (Ampelography).	14	68	Mature leaf: number of lobes	1=entire
				2=three
				3=five
				4=seven
				5=more than seven
	15	70	Mature leaf: area of anthocyanin coloration of main veins on upper side of blade	1=absent
				2=petiol point red
				3=red until the first bifurcation
				4=red until the 2nd bifurcation
				5=red beyond the 2nd bifurcation
	16	76	Mature leaf: shape of teeth	1=both sides concave
				2=both sides rectilinear
				3=mixture between notes 2 and 4
				4=both sides convex
				5=one side concave one side convex
	17	79	Mature leaf: degree of opening / overlapping of petiole sinus	1=very wide open
				2=open
				3=slightly open
				4=slightly overlapping
				5=overlapping
				6=strongly overlapping
	18	80	Mature leaf: shape of base of petiole sinus	1=U shaped
				2={ shaped
				3=V shaped
	19	081-1	Mature leaf: teeth in the petiole sinus	1=none
				2=occurrence of 1 or 2 teeth in the petiole sinus
	20	081-2	Mature leaf: petiole sinus base limited by veins	1=none
				2=occurrence on one side of petiole sinus
				3=occurrence on both sides of petiole sinus
	21	083-1	Mature leaf: shape of base of upper lateral sinuses	1=U shaped
				2={ shaped
				3=V shaped
	22	083-2	Mature leaf: teeth in the upper lateral sinuses	1=none
				2=frequently occurring
	23	84	Mature leaf: density of prostrate hairs between the main veins on lower side of blade	1=none or very weak
				3=weak
				5=medium
				7=dense
				9=very dense
	24	85	Mature leaf: density of erect hairs between the main veins on lower side of blade	1=none or very low
				3=low
				5=medium
				7=high
				9=very high
	25	86	Mature leaf: density of prostrate hairs on main veins on lower side of blade	1=none or very low
				3=low
				5=medium
				7=high
				9=very high
	26	87	Mature leaf: density of erect hairs on main veins on lower side of blade	1=none or very weak
				3=weak
				5=medium
				7=dense
				9=very dense
	27	601	Mature leaf: length of vein N1	1=very short (up to about 75 mm)
				3=short (about 105 mm)
				5=medium (about 135 mm)
				7=long (about 165 mm)
				9=very long (about 195 mm and more)
	28	602	Mature leaf: length of vein N2	1=very short (up to about 65 mm)
				3=short (about 85 mm)
				5=medium (about 105 mm)
				7=long (about 125 mm)
				9=very long (about 145 mm and more)

	29	603	Mature leaf: length of vein N3	1=very short (up to about 35 mm)
				3=short (about 55 mm)
				5=medium (about 75 mm)
				7=long (about 95 mm)
				9=very long (about 95 mm)
	30	604	Mature leaf: length of vein N4	1=very short (up to about 15 mm)
				3=short (about 25 mm)
				5=medium (about 35 mm)
				7=long (about 45 mm)
				9=very long (about 55 mm and more)
	31	605	Mature leaf: length petiole sinus to upper lateral leaf sinus	1=very short (up to about 30 mm)
				3=short (about 50 mm)
				5=medium (about 70 mm)
				7=long (about 90 mm)
				9=very long (about 110 mm and more)
	32	606	Mature leaf: length petiole sinus to lower lateral leaf sinus	1=very short (up to about 30 mm)
				3=short (about 45 mm)
				5=medium (about 60 mm)
				7=long (about 75 mm)
				9=very long (about 90mm and more)
	33	611	Mature leaf: length of vein N5	1=very short (up to about 15 mm)
				3=short (about 25 mm)
				5=medium (about 35 mm)
				7=long (about 45 mm)
				9=very long (about 55 mm and more)
	34	612	Mature leaf: length of tooth N2	1=very short (up to about 6 mm)
				3=short (about 10 mm)
				5=medium (about 14 mm)
				7=long (about 18 mm)
				9=very long (about 22 mm and more)
	35	613	Mature leaf: width of tooth N2	1=very narrow (up to about 6 mm)
				3=narrow (about 10 mm)
				5=medium (about 14 mm)
				7=wide (about 18 mm)
				9=very wide (about 22 mm and more)
	36	614	Mature leaf: length of tooth N4	1=very short (up to about 6 mm)
				3=short (about 10 mm)
				5=medium (about 14 mm)
				7=long (about 18 mm)
				9=very long (about 22 mm and more)
	37	615	Mature leaf: width of tooth N4	1=very narrow (up to about 6 mm)
				3=narrow (about 10 mm)
				5=medium (about 14 mm)
				7=wide (about 18 mm)
				9=very wide (about 22 mm and more)
	38	618	Mature leaf: opening/overlapping of petiole sinus	1=wide open (up to about -35 mm)
				3=open (about -15 mm)
				5=closed (about -5 mm)
				7=overlapping (about 25 mm)
				9=very overlapping (about 45 mm and more)
Bunch	39	202	Bunch: length (peduncle excluded)	1=very short (up to about 80 mm)
				3=short (about 120 mm)
				5=medium (about 160 mm)
				7=long (about 200 mm)
				9=very long (about 240 mm and more)
	40	203	Bunch: width	1=very narrow (up to about 40 mm)
				3=narrow (about 80 mm)
				5=medium (about 120 mm)
				7=wide (about 160 mm)
				9=very wide (about 200 mm and more)
	41	204	Bunch: density	1=very loose, 3=loose, 5=medium, 7=dense 9=very dense
	42	208	Bunch: shape	1=long cylindrical bread cylindrical
				2=narrow conical broad conical

				3=funnel shaped
	43	502	Bunch: weight of a single bunch	1=very low (about 200 mm and more)
				3=low (about 300 g)
				5=medium (about 500 g)
				7=high (about 700 g)
				9=very high (about 900 g and more)
Berry	44	220	Berry: length	1=very short (up to about 8 mm)
				3=short (about 13 mm)
				5=medium (about 18 mm)
				7=long (about 23 mm)
				9=very long (about 28 mm and more)
	45	221	Berry: width	1=very small (up to about 8 mm)
				3=small (about 13 mm)
				5=medium (about 18 mm)
				7=large (about 23 mm)
				9=very large (about 28 mm and more)
	46	223	Berry: shape	1=flat
				2=roundish
				3=elliptic
				4=ovate
				5=obtuse ovate
				6=obovate
				7=cylindric
				8=arched
	47	225	Berry: color of skin	1=green yellow
				2=rose
				3=red
				4=grey
				5=dark red violet
				6=blue black
	48	231	Berry: intensity of the anthocyanin coloration of flesh	1=none or very weak, 3=weak, 5=medium 7=strong, 9=very strong
	49	236	Berry: particularity of flavour	1=none, 2=muscat, 3=foxy, 4=herbaceous, 5=others
	50	241	Berry: formation of seeds	1=none, 2=rudimentary, 3=complete
	51	242	Berry: length of seeds	1=very short (≤ 3,8 mm)
				3=short (5 mm)
				5=medium (6,2 mm)
				7=long (7,4 mm)
				9=very long (≥ 8,6 mm)
	52	243	Berry: weight of seeds	1=very low (up to about 10 mg)
				3=low (about 25 mg)
				5=medium (about 40 mg)
				7=high (about 55 mg)
				9=very high (about 65 mg and more)
	53	503	Berry: single berry weight	1=very low (up to about 1 g)
				3=low (about 3 g)
				5=medium (about 5 g)
				7=high (about 7 g)
				9=very high (about 9 g and more)

RESULTS AND DISCUSSION

While the ampelographic identification results obtained with this study are given in Table 2, the genetic similarity dendrogram formed according to these results is given in Figure 3. According to the data obtained from the definitions and scores, the cultivars and genotypes show similarities with each other at rates varying between 0.53 and 0.89. It is seen that all cultivars and genotypes are different from each other according to the 53 criteria evaluated.

The results obtained from 53 different characters evaluated showed that all cultivars and genotypes had a seeded structure in terms of the 50th criterion, which is the seed condition. Similarly, it was determined that all were colourless regarding the 48th criterion, the anthocyanin colouration intensity in the flesh of the berry. In addition, it was defined as a result of the definitions that the number of consecutive tendrils was discontinuous (2+0+2) since all cultivars and genotypes were *V. vinifera* cultivars. It was determined that only two of the cultivars

and genotypes had a muscat aroma in terms of the 49th criterion, which is the particularity of flavour. In contrast, all the others did not have a unique taste. It was determined that only two genotypes were different from the others in terms of the "petiole sinus base limited by veins" examined in the mature leaves in terms of the 20th criterion. It was understood as a result of the definition studies that the cultivars and genotypes showed quite different characteristics from each other in terms of all the other criteria.

According to the dendrogram, the cultivars and genotypes are divided into two main branches. While it is seen that the Siyah Yuvarlak genotype differs considerably from the other genotypes in the first main branch, in the second main branch, the Bağdat Siyahı and Bülbül genotypes differ greatly from the other cultivars/genotypes and are located in a separate branch.

The highest similarity rate (0.89) was obtained from the Ak Üzüm and Nuri Bey genotypes with light-coloured berries. Despite having different berry colours, the Ak Dimrit and Ufak Dimrit genotypes showed a high similarity rate of 0.85. Similarly, Balçova Karası and Beyaz Kokulu genotypes, despite their different berry colour, showed similar characteristics in many other respects and had a high similarity rate in the dendrogram. A similarity of over 0.80 was also found between the Yuvarlak Kara and Ufak Kara genotypes and Sivri Kara and Al İdris genotypes.

Although ampelographic (morphological) identification studies with different numbers of characters are used to distinguish or identify many grape varieties, genotypes or hybrids from each other, they sometimes may not give the desired results. Ampelographic characters are related to many conditions, but they are especially closely related to ecological factors and different growth stages of the grapevine. Therefore, they can sometimes be insufficient in distinguishing genotypes. Nevertheless, ampelographic characters are often needed in determining close agronomic mutations (Ortiz et al., 2004).

Some values related to the berry characteristics of the cultivars or genotypes used in the particular study can greatly affect the similarity ratio. Sabir et al. (2009) obtained a match among seedless hybrids and hybrids with seeds in the UPGMA dendrogram based on ampelographic data. They characterized 41 ampelographic descriptors. It was also concluded that the relationship between genotypes was highly related to the origin of the places where they were grown. In this study, high similarities were obtained between some cultivars and genotypes collected from close geographical regions. Researchers have also attempted to identify differences using molecular markers for identification. The dendrogram constructed by the two approaches was the varieties are highly similar, especially in terms of where they are clustered and the differentiation of the groups to which they belong. Another similar study was conducted by Atak et al. (2012) with hybrid grape genotypes. The researchers compared the hybrid genotypes by making both ampelographic and molecular definitions. They emphasized that, especially in ampelographic definitions, seedless ones showed more similarities to each other and could differ significantly from seeded ones.

Davies and Savolainen (2006) also reported that biodiversity is phenotypic and genetic variation, and the numbers of morphological changes along the branches of the phylogenetic tree were significantly correlated with the number of reconstructed changes in genetic characters.

Chadha and Randhawa (1974) reported that leaf morphological investigations are essential. They emphasized that grapevine leaf characteristics without the observation of other organs would be sufficient for the classification of grapevine cultivars. During the past decades, several refinements and specifications related to sampling, methodology, and data evaluation have been reported, which makes measurements faster and more accurate with higher discriminative power. (Preiner et al., 2014; Bodor-Pesti et al., 2023).

Recently, morphometric variability between and within species, cultivars, clones, and clone candidates was explored, and traits with discriminative power were highlighted. These traits are not necessarily the same in all investigations. The reasons for this are the different sample sets and those external factors that influence the morphometric traits. Related studies show that biotic and abiotic factors and vineyard management practices modify the ampelometric characteristics (Silvestroni et al., 1990; Bodor et al., 2013). Also, the climatic condition is significant, as year-to-year studies can show big differences (Chitwood et al., 2021). Observation of similar differences in our study shows that conducting identification studies in different years will yield more realistic results.

The differences between varieties and genotypes can be clearly revealed with identification studies, and synonyms or homonyms can be determined. After identification studies conducted by Maletic et al. (2015) with Croatian genetic resources, many synonyms and homonyms were detected, and unique genotypes were selected. Stavrakaki and Binari (2017) conducted a similar study with varieties from Greece. The researchers determined the synonyms, homonyms and variations of the varieties they identified as a result of their studies. Similarly, in our study, the differences between all varieties/genotypes were revealed after identification.

Ateş et al. (2011) also observed great differences among the varieties examined regarding ampelographic characters in their study of ten grape varieties regarding 52 ampelographic characters. They especially reported that certain characteristics played a particular role in the constitution of the ampelographic dendrogram. In our study, it was determined that while few ampelographic data (especially 48th and 50th definition criteria) showed common characteristics among varieties and genotypes, most of them showed great differences.

As a result, according to the findings obtained from our study, 29 varieties or genotypes differed from each other in terms of selected ampelographic criteria at varying rates. Thus, important ampelographic descriptions of these grapes collected from the Aegean Region, many of which are in danger of extinction, have been made and safely preserved in the genetic resource parcel for use in subsequent scientific studies.

Table 2. OIV notes of genotypes are defined within the scope of the study.

Order No	OIV Code	Siyah Yuvarlak	Ak Dimrit	Yuvarlak Kara	Hacı Balbal	Bostancı	Ufak Dimrit	Erkenci Dimrit (Demirhan)	Kayırcık	Kürt üzümü	Pembe Gemre Type
1	**301**	7	1	1	1	3	1	1	3	7	1
2	**302**	5	3	3	5	5	3	3	5	7	5
3	**303**	5	5	3	5	5	3	5	5	5	3
4	**304**	7	3	5	7	7	3	5	7	7	7
5	**3**	1	3	3	3	1	3	1	1	1	1
6	**4**	7	9	1	9	3	9	7	3	1	1
7	**6**	1	3	1	1	3	3	1	3	1	1
8	**7**	2	2	2	3	1	1	2	2	2	3
9	**8**	1	2	2	3	2	2	2	2	1	3
10	**16**	1	1	1	1	1	1	1	1	1	1
11	**51**	3	3	3	3	3	4	3	2	1	3
12	**53**	7	9	1	9	1	9	9	1	1	3
13	**151**	3	3	3	3	3	3	3	3	3	3
14	**68**	3	4	4	3	3	3	3	3	3	3
15	**70**	2	3	3	3	2	2	3	2	1	3
16	**76**	3	2	3	2	2	2	5	3	3	2
17	**79**	2	3	3	3	5	4	2	2	3	2
18	**80**	1	1	3	1	1	1	3	1	3	1
19	**081-1**	1	1	2	1	1	1	1	1	1	1
20	**081-2**	1	1	1	1	1	1	1	1	1	1
21	**083-1**	1	3	2	2	3	2	1	2	2	1
22	**083-2**	1	1	1	1	1	1	2	1	1	1
23	**84**	5	7	1	7	1	7	7	1	1	1
24	**85**	1	1	1	3	1	3	3	1	1	1
25	**86**	5	5	1	3	1	5	3	1	1	3
26	**87**	1	1	1	1	1	1	1	1	1	1
27	**601**	5	5	7	3	5	5	5	3	5	7
28	**602**	5	5	7	5	7	7	7	7	5	7
29	**603**	7	7	7	5	7	7	5	5	5	7
30	**604**	9	9	9	7	9	9	7	7	9	9
31	**605**	5	3	5	3	5	5	5	5	5	3
32	**606**	7	5	7	3	5	5	5	5	5	3
33	**611**	5	5	5	5	5	5	3	3	3	3
34	**612**	3	3	5	3	7	3	5	5	3	5
35	**613**	3	3	5	3	7	3	5	5	3	5
36	**614**	3	3	3	3	5	3	5	3	5	3
37	**615**	5	5	5	5	7	5	5	5	3	5
38	**618**	3	3	5	7	7	7	3	3	1	3
39	**202**	7	7	7	5	7	5	7	7	7	3
40	**203**	3	3	7	3	3	5	5	5	3	5
41	**204**	5	5	5	5	7	7	7	7	5	5
42	**208**	2	2	1	2	1	2	2	2	2	1
43	**502**	5	3	5	5	3	3	5	7	5	3
44	**220**	5	5	7	7	3	3	3	9	5	3
45	**221**	5	5	5	5	5	5	5	5	5	5
46	**223**	4	3	1	3	2	2	2	3	2	4
47	**225**	2	1	5	2	1	5	5	1	1	1
48	**231**	1	1	1	1	1	1	1	1	1	1
49	**236**	1	1	1	1	1	2	2	1	1	1
50	**241**	3	3	3	3	3	3	3	3	3	3
51	**242**	5	5	7	7	7	5	5	7	7	5
52	**243**	5	5	9	5	5	5	5	5	7	5
53	**503**	3	5	5	7	5	3	3	7	5	3

Table 2. Continue

Order No	OIV Code	Ufak Kara	Gelin Üzümü-1	Hacıoğlu Siyahı	Beyaz Çavuş	Sivri Kara	Siyah Asma	Ak Üzüm	Balçova Karası	Beyaz Gut	Bağdat Siyahı
1	**301**	3	3	7	1	1	3	7	3	1	7
2	**302**	7	3	7	3	5	5	3	3	3	5
3	**303**	5	3	5	5	5	5	5	3	5	5
4	**304**	7	5	3	7	5	5	9	5	5	7
5	**3**	1	1	1	3	1	1	1	1	3	1
6	**4**	3	7	1	9	1	9	1	3	7	3
7	**6**	1	1	1	1	3	3	3	3	3	3
8	**7**	3	1	1	2	1	1	1	1	1	1
9	**8**	2	2	2	1	2	2	2	2	2	2
10	**16**	1	1	1	1	1	1	1	1	1	1
11	**51**	3	3	3	3	1	1	1	3	4	3
12	**53**	1	5	1	7	1	3	1	1	7	1
13	**151**	3	3	3	3	3	3	3	3	3	3
14	**68**	3	2	3	3	3	3	3	2	3	3
15	**70**	2	1	2	1	2	2	1	2	2	2
16	**76**	4	2	2	2	4	4	4	2	2	2
17	**79**	2	2	1	2	3	4	5	2	4	3
18	**80**	2	2	2	1	2	1	1	2	2	1
19	**081-1**	2	1	2	1	1	1	1	1	1	1
20	**081-2**	1	1	2	1	1	1	1	1	1	1
21	**083-1**	1	3	3	1	3	1	3	2	1	3
22	**083-2**	1	1	1	1	1	1	1	1	1	1
23	**84**	1	5	1	5	3	5	3	3	5	1
24	**85**	1	1	1	5	1	1	1	1	3	3
25	**86**	3	5	3	3	3	5	1	5	7	1
26	**87**	1	1	1	3	1	3	1	1	3	3
27	**601**	5	5	5	5	5	5	7	5	5	3
28	**602**	5	7	7	9	5	5	7	7	5	5
29	**603**	7	7	7	7	5	5	7	5	5	5
30	**604**	9	7	9	9	9	7	9	9	7	7
31	**605**	5	5	5	3	3	3	7	5	3	3
32	**606**	7	5	5	3	5	3	7	7	1	3
33	**611**	5	3	3	3	3	3	5	3	3	3
34	**612**	3	5	5	5	3	3	5	3	5	3
35	**613**	3	5	5	5	3	3	5	3	5	3
36	**614**	3	3	5	3	1	3	3	3	3	1
37	**615**	5	3	3	3	5	5	7	3	5	3
38	**618**	3	3	9	5	5	7	7	3	7	3
39	**202**	5	5	9	5	5	7	7	7	7	7
40	**203**	5	7	5	3	3	5	5	5	3	3
41	**204**	5	7	5	5	5	7	5	5	3	5
42	**208**	2	2	2	2	2	2	2	2	2	2
43	**502**	5	5	5	3	3	5	3	3	3	3
44	**220**	7	5	7	7	3	7	7	5	5	7
45	**221**	5	5	5	7	5	7	5	5	5	7
46	**223**	4	2	2	1	1	2	2	2	2	1
47	**225**	5	2	2	1	5	6	1	5	1	6
48	**231**	1	1	1	1	1	1	1	1	1	1
49	**236**	1	1	1	1	1	1	1	1	1	1
50	**241**	3	3	3	3	3	3	3	3	3	3
51	**242**	7	7	7	5	7	7	7	7	5	5
52	**243**	9	5	5	5	5	5	9	5	7	5
53	**503**	7	5	5	7	3	5	5	3	3	7

Table 2. Continue

Order No	OIV Code	Al İdris	Kara Parmak	Beyaz Kokulu	Nuri Bey	Hurma	Kara Dimrit	Siyah Pekmezlik (Demirhan)	Gelin Üzümü-3	Bülbül
1	**301**	3	3	3	7	7	3	3	1	7
2	**302**	5	3	5	5	7	3	3	3	3
3	**303**	5	5	5	5	5	5	5	5	5
4	**304**	5	5	9	7	7	5	7	3	5
5	**3**	1	1	1	1	1	1	1	1	1
6	**4**	1	1	1	1	1	7	7	3	3
7	**6**	3	3	3	3	3	3	3	3	3
8	**7**	1	1	1	1	1	1	1	1	1
9	**8**	2	2	2	2	2	2	2	2	2
10	**16**	1	1	1	1	1	1	1	1	1
11	**51**	2	2	3	3	3	3	3	3	1
12	**53**	1	1	1	1	1	3	7	3	3
13	**151**	3	3	3	3	3	3	3	3	3
14	**68**	2	3	1	2	3	4	4	3	3
15	**70**	2	4	1	1	5	3	1	2	2
16	**76**	5	4	2	4	4	3	5	3	2
17	**79**	4	2	2	4	2	2	2	2	2
18	**80**	1	1	1	1	2	1	1	2	3
19	**081-1**	1	1	1	1	1	1	2	1	1
20	**081-2**	1	3	1	1	1	1	1	1	1
21	**083-1**	1	3	3	3	1	3	1	3	3
22	**083-2**	1	1	1	1	1	1	2	1	1
23	**84**	1	1	3	5	5	7	7	3	1
24	**85**	3	1	1	1	1	3	5	1	1
25	**86**	3	5	5	5	5	7	7	3	1
26	**87**	1	1	3	3	1	3	5	1	1
27	**601**	5	5	5	5	5	5	3	3	3
28	**602**	5	5	5	7	5	7	5	5	3
29	**603**	5	5	5	5	7	7	5	5	5
30	**604**	9	7	9	9	9	9	7	7	5
31	**605**	5	5	7	5	3	3	3	5	3
32	**606**	7	5	7	5	3	3	1	5	3
33	**611**	5	3	3	3	3	5	3	1	3
34	**612**	3	3	3	5	5	3	5	3	5
35	**613**	3	3	3	5	5	3	5	3	5
36	**614**	3	1	1	3	5	3	3	3	3
37	**615**	5	5	3	5	5	3	3	3	3
38	**618**	9	3	3	7	7	3	3	3	3
39	**202**	5	7	7	7	7	7	5	7	7
40	**203**	3	5	7	7	5	7	5	7	7
41	**204**	5	7	5	5	7	7	9	5	5
42	**208**	2	2	2	2	2	1	2	2	2
43	**502**	3	3	3	3	5	7	5	7	3
44	**220**	5	7	7	7	9	5	7	5	7
45	**221**	5	5	7	7	5	5	5	5	7
46	**223**	2	3	2	2	5	1	2	6	2
47	**225**	3	3	1	2	2	5	3	1	1
48	**231**	1	1	1	1	1	1	1	1	1
49	**236**	1	1	1	1	1	1	1	1	1
50	**241**	3	3	3	3	3	3	3	3	3
51	**242**	5	7	7	7	5	5	7	7	7
52	**243**	5	5	5	7	5	5	5	5	9
53	**503**	3	5	3	5	7	3	5	5	7

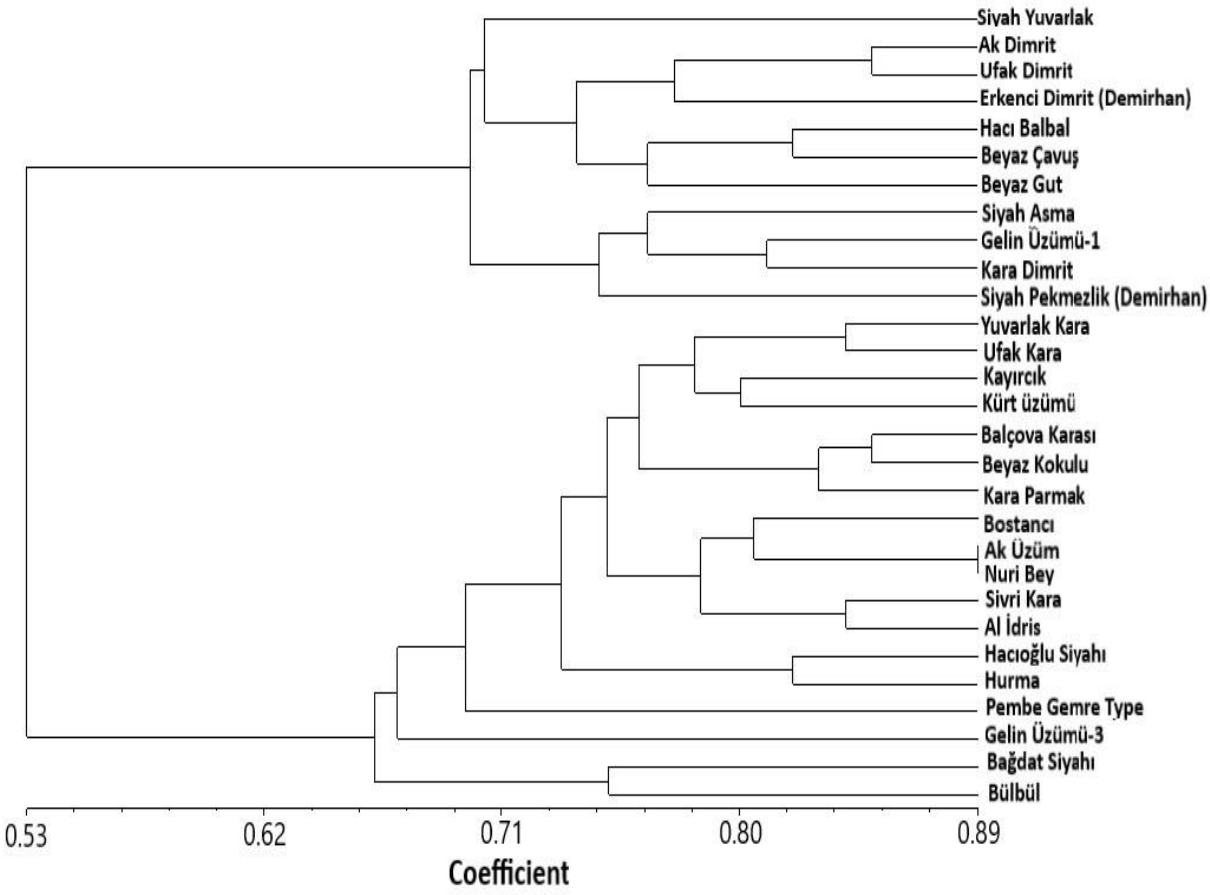

Figure 3. Dendrogram based on ampelographic descriptors showing the relationship among cultivars/genotypes studied (Dissimilarity Coefficient Euclidean Distances Squared, UPGMA)

CONCLUSION

This study revealed the ampelographic identification and differences of 29 grape varieties or genotypes collected from the Aegean region. Our study has revealed those that are highly similar to each other and those that are highly different from each other. With the adverse effects of climate change, changing consumer demands and increasing production costs, grape genetic resources are under serious threat in many countries. Unfortunately, many grape varieties grown locally have begun to disappear. These genetic resources must be identified and preserved in the coming years due to their resistance to different biotic and abiotic stress conditions and potential to be suitable for changing consumer demands. In an environment where even wild vines are gaining excellent value today, it is inevitable that our genetic resources, local grapes, will be needed in the coming years. It is essential to identify all genetic resources in different parts of our country in other ways, such as in this study, to determine the different ones and to protect them for the next generations.

Compliance with Ethical Standards

Peer-review

Externally peer-reviewed.

Declaration of Interests

The authors state there is no competing interest.

Author contribution

The contribution of the authors to the present study is equal.

Data availability

Data will be made available on request.

Consent to participate

The authors consent to participate.

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