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AMPELOGRAPHIC CHARACTERIZATION OF SOME GRAPE CULTIVARS (*VITIS VINIFERA* L.) GROWN IN SOUTH-WESTERN REGION OF TURKEY

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Abstract

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Ten grapevine cultivars (*Vitis vinifera* L.) were characterized according to the international grape descriptor lists. The morphology of various vine organs of some autochthonous and hybrid cultivars was described at several phenological stages, and pomologycal characteristics were determined during growth cycle. With respect to the ampelographic characters, great differences were observed among the studied cultivars. The relationships between the cultivars were further assessed via UPGMA dendrogram analysis. Certain characteristics were anticipated to play particular role in the constitution of the ampelographic dendrogram. Particular data observed in this study on some autochthonous grapevine cultivars would help to prevent disappearing local cultivars and to preserve germplasm collection.

Key words: Vitis vinifera, ampelography, UPGMA, cluster analysis

Introduction

The neighbouring regions of the Caucasian area including Turkey have a long history of viticulture and possess a great diversity of grape cultivars and types. The remains of grape seeds and some of the earliest wine artefacts found in Turkey suggest that the country is the cradle of viticulture and winemaking (Oraman and Agaoglu, 1969; Winkler et al., 1974). Therefore, Turkey is home to many hundreds of indigenous grape varieties many of which have invaluable genetic potential, supposedly emerged as a result of natural hybridization, mutation, and selections over years (Aradhya et al., 2003).

Invasion of gall-forming insect phylloxera (*Daktulosphaira vitifoliae* Fitch) throughout the viticulture areas around the world resulted in devastation in grape and wine production, especially during the nineteenth century. After this calamity, viticulture experts of the OIV and IBPGR (currently IPGRI) declared the urgency of the establishment of the germplasm collections because of the losses of wild forms and/or autochthonous va-

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rieties of *Vitis*. They further indicated the necessity of international co-operation in the characterisation and evaluation of such invaluable genetic sources to avoid genetic erosion (Winkler et al., 1974; Weaver, 1976; Dettweiler, 1990). Ampelography is a scientific methodology accepted for the characterization of grapevine genotypes, based on the description of different morphological, phenological and pomological characters. This method has been standardized and extended by many scientist for more logical and accurate identification of *Vitis* materials (Galet, 1985; Alleweldt and Dettweiler, 1986; Dettweiler, 1991). Following the recommendations of the experts, characterisation and conservation of the worldwide *Vitis* materials has been started by different researchers (Alleweldt and Dettweiler, 1986; Agaoglu et al., 1989; Soylemezoglu et al., 2001; Santiago et al., 2007). As a consequences of such efforts, the resulting *Vitis* International Variety Catalogue (VIVC) is accessible via internet since 1996. This catalogue provides an inventory of the grapevine genetic resources with passport, primary and secondary descriptors, bibliography and photos.

The preservation of genetic resources is justified by the requirement of protecting varieties in danger of extinction, genes with a present or future agronomic interest, and variability in cultural aptitudes and organoleptic complexity (Blanco et al., 2007). Currently, the National Germplasm Repository Vineyard in Turkey accommodates more than 1200 accessions collected from different regions of the country. Nevertheless, for various reasons, many autochthonous cultivars in Turkey started to diminish, almost reaching to the point of extinction recently. Also, some local cultivars such as 'Sacalan', 'Siksari', 'Silken sari' and 'Şika' might be on the verge of disappearing because these cultivars have been generally neglected in scientific studies. Therefore, genetic characterization of such grapevine cultivars is a task for the future improvements in grape breeding and genetic researches. Such studies would be an invaluable source in breeding program in choosing proper parent to generate large numbers of progeny generated from hybridization program. This study was conducted to characterize some Turkish autochthonous cultivars and hybrids throughout the ampelographic methods. Relationship among the cultivars was further evaluated via UPGMA dendrogram analysis.

Materials and Methods

Ten grapevine cultivars (*Vitis vinifera* L.) were analyzed to determine their ampelographic relationships (Table 1). The representative vines of cultivars (6 autochthonous and 4 hybrid cultivars) were grown at Manisa Viticulture Research and Implementation Area (Manisa/Turkey). Twelve vines per cultivar were selected for study. The vines were 14 years old and cultivated under the same growing conditions using rootstock 5 BB with the spaces 3 x 1.75 m. Majority of the varieties included here were not defined (to our knowledge) with international descriptor lists. For more logical comparison of the studied materials, 'Uslu' and 'Ata sarısı' were considered as reference cultivars, as they were recently characterized in detail using ampelographic and molecular markers (Sabir, 2008).

Original IBPGR publications Grape Descritors (Anonymous, 1983) and its revision Descriptors for Grapevine (*Vitis* spp.) (Anonymous, 1997) were used for ampelographic characterization of cultivars. Highly discriminating characters were selected according to recommendation of IBGRI list. The ampelographic observations were carried out during vegetation cycle. With respect to descriptor lists, ten average shoots per variety were chosen for analysis. The characters of representing vines were investigated/measured following the specifications of vine growth stages indicated by OIV. According to the definition norms, the shoot tips were investigated when they were from 10 to 30 cm; the definitions regarding young leaves were recorded on the first four distal leaves; the mature leaf descriptions were carried out between berry set

Table 1
The cultivars and their basic characteristics

Cultivar	Abrev.	Genetic background	Main use	Geographic origin
‘Silken sarı’	SISA	Autochthonous	Table, juice, wine	Tavas/Denizli
‘Hacefe’	HACI	Autochthonous	Table	Karahalli/Usak, Manisa
‘Sacalan’	SACA	Autochthonous	Juice, wine	Atca /Aydin
‘Siksarı’	SIKS	Autochthonous	Juice, wine	Ula/Mugla
‘Pembe salman’	PESA	Autochthonous	Table	Atca /Aydin
‘Sika’	SIKA	Autochthonous	-	Menemen/Izmir
‘Uslu’	USLU	‘Honusu’ x ‘Siyah gemre’	Table	Yalova
‘Yalova incisi’	YAIN	‘Honusu’ x ‘Siyah gemre’	Table	Yalova
‘Ata sarisi’	ATSA	‘Cavus’ x ‘Cardinal’	Table	Yalova
‘Yalova cekirdeksizi’	YACE	‘Beyrut hurmasi’ x ‘Perlette’	Table	Yalova

and veraison (onset of maturity) on leaves above the cluster within the medium third of shoot; the clusters were measured when matured; the berry characteristics were investigated at ripening ones located in the middle of the clusters and woody shoots were analyzed after fall of the leaves.

The observed OIV characters were presented in two sections (morphological and agronomic characters) in order to describe certain distinguished features of cultivars. Mean values of the ampelographic definitions were transformed to numerical scales according to the international descriptors (Anonymous 1983; Anonymous, 1997). The row data were subjected to NTSYSpc 2.02k software using distance matrix calculated with the correlation distance coefficient. The clustering dendrogram to diagnose discrimination between genotypes was drawn with Unweighted Pair Group of Arithmetic average (UPGMA) using SAHN module (Rohlf, 2000) (Table 2).

Results and Discussion

Certain morphological characters of the cultivars

With respect to the ampelographic characters, great differences were observed among the studied cultivars, expect for certain features which verifies the 10 cultivars as the members of *V. vinifera*, such as form of tip (code 001), number of consecutive tendrils (016) (Table 3).

Among comprehensive descriptions observed in this study, certain characteristics were anticipated to have particular significance to identify grapevine cultivars. Such characters also play essential role in the constitution of the ampelographic dendrogram for more visible evaluation of phylogenetic relationship among the cultivars. For example; density of prostrate hairs on tips of young shoots (004) varied extensively among the analyzed cultivars. Prostrate hair was absent in ‘Ata sarisi’ young shoot tips, while the others had different types from sparse to very dense hairs. On the other hand, ‘Yalova incisi’ was apparent with its colourless young shoot tips. Cultivars also differed in terms of shoot attitude (006), varying from horizontal to erect habit. Colours of the dorsal side of indernodes (007) among the cultivars were mostly green and red striped. Anthocyanin accumulation of buds (015) on shoot was either absent (‘Sacalan’, ‘Şika’, ‘Yalova incisi’ and ‘Ata sarisi’) or weak (such as ‘Silken sari’, ‘Haciefe’).

Table 2
Descriptor list investigated in the study (Anonymous, 1983; 1997)

No	Code OIV	Vine part	Description of character
1	1	Young shoot	Form of tip
2	2	Young shoot	Distribution of anthocyanin coloration of tip
3	4	Young shoot	Density of prostrate hairs on tip
4	6	Shoot	Attitude (habit)
5	7	Shoot	Colour of dorsal side of internode
6	8	Shoot	Colour of ventral side of internode
7	9	Shoot	Colour of dorsal side of node
8	10	Shoot	Colour of ventral side of node
9	15	Shoot	Anthocyanin of buds
10	16	Shoot	Number of consecutive tendrils
11	51	Young leaf	Colour of young leaf upper surface
12	53	Young leaf	Density of prostrate hairs between veins
13	66	Mature leaf	Length of blade
14	67	Mature leaf	Shape of blade
15	68	Mature leaf	Number of lobes
16	69	Mature leaf	Colour of mature leaf upper surface
17	70	Mature leaf	Anthocyanin colouration of main veins on upper side of blade
18	76	Mature leaf	Shape of teeth
19	77	Mature leaf	Length of teeth
20	78	Mature leaf	Ratio of length/width of teeth
21	79	Mature leaf	General shape of petiole sinus
22	80	Mature leaf	Shape of base of petiole sinus
23	81	Mature leaf	Tooth at petiole sinus
24	82	Mature leaf	Shape of upper lateral sinus
25	83	Mature leaf	Shape of upper leaf sinuses
26	84	Mature leaf	Density of prostrate hairs between veins
27	85	Mature leaf	Density of erect hairs between veins
28	90	Petiole	Density of prostrate hairs on petiole
29	91	Petiole	Density of erect hairs on petiole
30	92	Petiole	Length
31	151	Inflorescence	Sex of flower
32	154	Bunch	Length
33	202	Bunch	Size
34	204	Bunch	Density
35	205	Bunch	Berry number
36	206	Bunch	Length of peduncle
37	221	Berry	Size
38	222	Berry	Uniformity of size

continued

Table 2 (continued)

39	223	Berry	Shape
40	225	Berry	Skin colour
41	230	Berry	Colour of flesh
42	238	Berry	Pedicel length
43	241	Berry	Presence of seeds
44	242	Berry	Seed length
45	243	Berry	Seed weight
46	301	Evaluation	Time of bud burst
47	303	Evaluation	Time of *véraison* (beginning of maturity)
48	304	Evaluation	Time of ripening
49	502	Evaluation	Single bunch weight
50	503	Berry	Single berry weight
51	505	Berry (Must)	Sugar content (%)
52	506	Berry (Must)	Total acid content

Table 3
Ampelographic characters of grapevine cultivars (corresponding to morphological characters of various vine parts)

OIV Code	SISA	HACI	SACA	SIKS	PESA	SIKA	USLU	YAIN	ATSA	YACE
001	Fully open	Fully open	Fully open	Fully open	Fully open	Fully open	Fully open	Fully open	Fully open	Fully open
002	Complete	Complete	Partial	Partial	Partial	Partial	Complete	Absent	Partial	Partial
004	Dense	Very dense	Very dense	Very dense	Dense	Sparse	Sparse	Sparse	Absent	Sparse
006	Erect	Horizontal	Erect	Semi-erect	Horizontal	Semi-erect	Semi-erect	Semi-erect	Erect	Horizontal
007	GreRedSt	GreRedSt	GreRedSt	GreRedSt	GreRedSt	CompGre	GreRedSt	CompGre	GreRedSt	CompGre
008	GreRedSt	GreRedSt	GreRedSt	GreRedSt	GreRedSt	CompGre	GreRedSt	CompGre	CompGre	GreRedSt
009	GreRedSt	GreRedSt	GreRedSt	GreRedSt	GreRedSt	CompGre	GreRedSt	CompGre	GreRedSt	GreRedSt
010	CompGre	CompRed	CompGre	GreRedSt	CompGre	CompGre	GreRedSt	CompGre	CompGre	CompGre
015	Weak	Weak	Absent	Weak	Weak	Absent	Weak	Absent	Absent	Weak
016	Up to 2	Up to 2	Up to 2	Up to 2	Up to 2	Up to 2	Up to 2	Up to 2	Up to 2	Up to 2
051	Copper	GreBroSp	GreBroSp	GreBroSp	GreBroSp	GreBroSp	GreBroSp	Green	GreBroSp	Green
053	Sparse	Very dense	Very dense	Very dense	Absent	Absent	Absent	Absent	Absent	Absent
067	Penta-gonal	Penta-gonal	Penta-gonal	Penta-gonal	Penta-gonal	Penta-gonal	Penta-gonal	Penta-gonal	Penta-gonal	Penta-gonal
068	Five	Five	Five	Five	Three	Five	Five	Five	Five	Five
069	Green	Green	Green	Light green	Green	Green	Dark green	Green	Green	Green
070	Weak	Medium	Weak	Medium	Weak	Weak	Weak	Weak	Weak	Absent
076	BotSiCnv	BotSiCnv	BotSiCnv	BotSiCnv	BotSiCnv	BotSiCnv	BotSiCnv	BotSiCnv	BotSiCnv	BotSiCnv

continued

Table 3 (continued)

079	Closed	LoSliOv	Half open	LoSliOv	Slightly open	Half open	Half open	Half open	Half open	Half open
080	V shaped	V shaped	V shaped	V shaped	V shaped	V shaped	U shaped	V shaped	V shaped	V shaped
081	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
082	LoStOv	Open	Closed	Closed	Open	Closed	LoStOv	LoStOv	LoStOv	LoStOv
083	V shaped	V shaped	V shaped	V shaped	V shaped	V shaped	V shaped	V shaped	V shaped	V shaped
084	Absent	Very dense	Medium	Dense	Absent	Absent	Absent	Absent	Absent	Absent
085	Absent	Dense	Sparse	Medium	Absent	Absent	Absent	Absent	Absent	Absent
090	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
091	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
151	MFFD	MFFD	MFFD	MFFD	MFFD	MFFD	MFFD	MFFD	MFFD	MFFD
204	Medium	Dense	Sparse	Dense	Medium	Dense	Medium	Medium	Medium	Medium
222	Hetero	Homo	Homo	Hetero	Homo	Hetero	Hetero	Hetero	Hetero	Hetero
223	Oblate	Round	Oblate	Round	Round	Elliptic	ObOvate	ObOvate	NarEliptic	Ovate
225	GreYel	Red	GreYel	GreYel	Rose	GreYel	Rose	GreYel	GreYel	GreYel
230	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless
241	Seeded	Seeded	Seeded	Seeded	Seeded	Seeded	Seeded	Seeded	Seeded	Rudi

GreRedSt: Green and red striped, **CompGre:** Completely green, **GreBroSp:** Green with bronze spots, **BotSiCnv:** Both sides convex, **LoSliOv:** Lobes slightly overlapping, **LoStOv**: Lobes strongly overlapping, **MFFD:** Male and female fully developed, **GreYel:** Green-yellow, **Rudi:** Rudimenter, **Hetero:** Heterogeneous, **Homo:** Homogeneous

Wide variation was also detected for observations relevant to young leaves. For instance, 'Silken sari' had strongly pigmented young leaves which were distinguished with copper colour. Such colour on young leaves has been rarely detected among Turkish grapevine cultivars (Ecevit and Kelen, 1999; Sabir et al., 2009).

Definitions relevant to mature leaves have been generally approved as powerful way of identifying grapevine genotypes (Kara, 1990; Ortiz et al., 2004; Santiago et al., 2007). Mature leaf characters chosen in this study provided discriminative data, although certain parameters were the same among the studied cultivars (such as shape of blade, general shape of petiole sinus, shape of teeth, anthocyanin colouration of main veins on upper side of blade). With respect to colour of mature leaf upper surface (069), 'Uslu' diverged from others with its dark green mature leaves, while 'Siksari' had light green mature leaves. Most varieties were investigated as carrying leaves with five lobes, while 'Pembe Salman' had leaves with three lobes. In a similar study, Ecevit and Kelen (1999) also reported the leaves with five lobes as a major type among some Turkish grapes. Anthocyanin colourations of main veins on upper side of blades (070) were generally weak among the cultivars. Similar situation was also detected for anthocyanin accumulation of buds (015). General shapes of petiole sinus (079) were half-open for five cultivars, while the others had different types.

Entire of the cultivars had flowers (151) with male and female parts fully developed (perfect flowers). 'Yalova cekirdeksizi' had rudimental seeds while the others had healthy seeds. Uniform berry development, an important quality factor desired for table grapes, determined in three cultivars ('Haciefe', 'Sacalan' and 'Pembe salman'). Remarkable differences were detected by means of berry shape (223) across the genotypes examined. Seedless cultivar 'Yalova cekirdeksizi' had ovate berries, while many shapes of berries were observed across the cultivars.

Previously, Rubio and Yusto (2001) and Santiago et al. (2007) also reported wide differences among grape cultivars with respect to berry shape. This fact could possible be relevant to the high level of intervarietal heterogeneity of *Vitis* genome which result in wide biodiversity in such characters.

Certain agronomic characters of the cultivars

A wide range of variability was determined among the studied cultivars relevant to measurements on mature leaves, bunches, berries, seeds, and must (juice). The lengths of mature leaf blades (066) among the cultivars were in range of 11.9 cm ('Şika') and 15.0 cm ('Yalova çekirdeksizi'). 'Silken sari' leaves was distinguished with its long leaf teeth (code 077) with the mean value of 16.0 mm. Petioles of 'Uslu', 'Yalova cekirdeksiz' and 'Yalova incisi' cultivars were noticeably longer than others. On the other hand, the highest number of berry for single bunch was counted in 'Siksari'. Bunch, berry and must characteristics have particular importance in quality assessment of table grapes (Winkler et al., 1974; Celik et al., 1998).

Table 4

Means and standard deviations for agronomic variables (corresponding to clusters, berries, seeds)

OIV Code	SISA	HACI	SACA	SIKS	PESA	SIKA	USLU	YAIN	ATSA	YACE
066	13.5±1.48	13.7±0.97	13.06±1.06	12.7±3.06	13.5±1.14	11.9±0.7	14.6±1.2	13.5±1.5	12.8±1.7	15±1.38
077	16.0±0.38	14.1±0.23	13.3±0.2	10.9±0.23	12.05±0.24	12.3±0.25	14.7±0.4	13.7±0.3	14.5±0.3	12.8±0.2
078	0.84	0.92	0.82	0.78	0.63	0.68	0.90	0.80	0.90	0.60
092	10.2±1.98	11.0±1.17	9.7±1.56	9.89±1.73	9.14±1.95	9.73±0.85	13.6±1.36	12.5±2.1	11.0±1.6	13.1±1.9
154	23.7±3.65	19.3±3.14	21.7±2.76	14.3 ±2.05	21.9 ±1.26	18.8 ±3.95	25.8±3.9	27.8±2.1	27.6±0.4	21.0±3.6
202	20.5±0.9	18.4±1.5	18.7±1.14	12.5±2.19	19.4±1.12	13.25±2.16	21.5±2.7	26.1±2.8	25.8±2.4	20.5±2.1
205	168.1±60.59	226.2±51.7	169.8±48.9	275±12.60	109.7±13.1	125±25.5	104.7±24.2	107±6.7	178±0.3	102±1.8
206	2.54±1.62	2.85±0.87	2.36±0.30	2.02±0.12	2.63±0.11	2.48±0.74	3.62±1.37	2.38±0.1	3.7±1.3	5.3±2.2
221	18.4±0.11	16.3±0.09	15.6±0.09	12.8±0.15	20.3±0.70	25.3±0.18	19.1±1.8	23.7±0.2	28.2±0.2	20.1±0.1
203	20.5±0.9	18.4±1.5	18.7±1.14	12.5±2.19	19.4±1.12	13.25±2.16	21.5±2.7	26.1±2.8	25.8±2.4	20.5±2.1
205	168.1±60.59	226.2±51.7	169.8±48.9	275±12.60	109.7±13.1	125±25.5	104.7±24.2	107±6.7	178±0.3	102±1.8
206	2.54±1.62	2.85±0.87	2.36±0.30	2.02±0.12	2.63±0.11	2.48±0.74	3.62±1.37	2.38±0.1	3.7±1.3	5.3±2.2
238	9.0±0.1	8.4±0.11	8.9±0.08	7.8±0.21	9.0±0.07	9.0±0.10	8.3±3.7	9.3±1.4	11.2±0.4	8.4±0.1
242	6.3±0.31	6.4±0.03	6.2±0.05	6.0±0.14	6.9±0.18	7.3±0.04	6.7±0.03	4.9±0.4	7.2±0.8	-
243	35.0±2.45	31.0±1.85	35.9±3.25	48.0±2.25	41.9±1.14	50.5±1.65	23.3±2.30	32.0±2.1	45±2.1	-
502	510±34	372±23	318±12.4	357±23.5	341.6±14.3	434.8±12.5	266.4±14.6	461.0±23.1	544.8±26.5	291.6±12.2
503	3.92±0.4	3.02±0.2	2.67±0.05	1.80±0.15	5.47±1.12	5.37±1.34	4.45±1.10	4.92±0.08	7.82±0.09	3.30±0.02
505	17.2±1.30	18.5±1.10	19.5±1.10	14.4±0.09	18.8±0.05	17.7±1.10	15.0±0.09	17.7±0.08	18.4±1.10	19.7±0.98
506	5.90±0.25	5.30±0.17	7.70±0.08	4.20±0.09	3.80±0.10	5.37±0.14	5.80±0.90	4.50±1.10	3.98±0.05	6.70±0.07

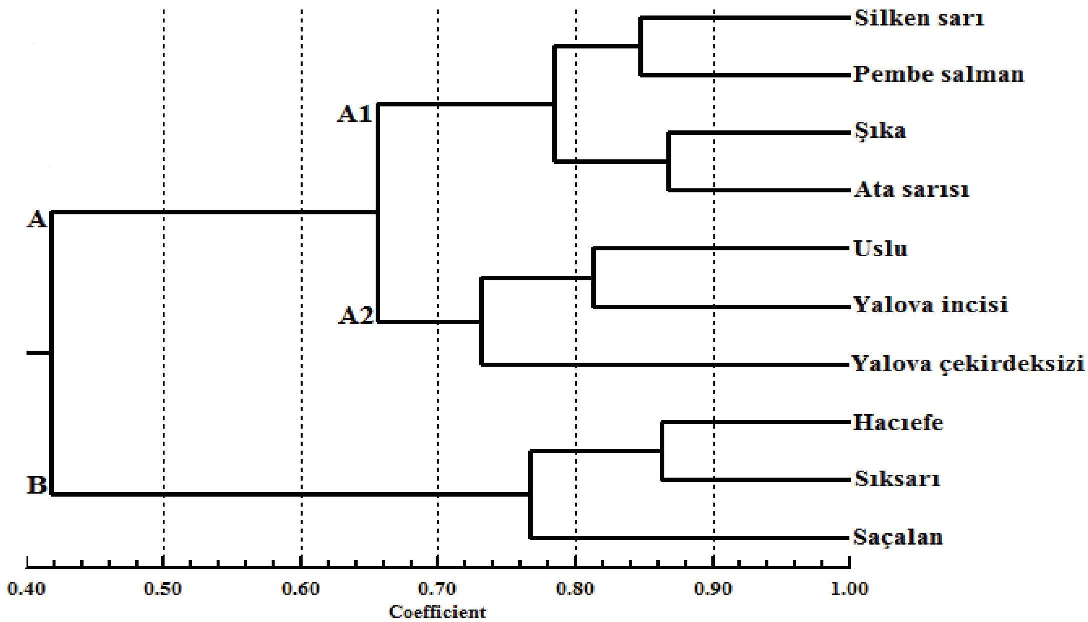

Fig. 1. Dendrogram representing ampelographic relationships among cultivars elaborated by using the UPGMA clustering method using SAHN module and correlation distance coefficient

With respect to bunch, berry and seed weights (codes 502, 503 and 243, respectively), cultivars exhibited a wide variability. 'Ata sarisi' was outstanding with its significantly bigger bunches and berries. Such characteristics of this cultivar were also reported before in different geographical regions of Turkey (Uslu and Samanci, 1998; Sabir, 2008). At commercial maturity, the highest sugar content was determined in 'Yalova çekirdeksizi' (19.7 ºBrix) cultivar, while 'Sıksarı' had the least value (14.4 ºBrix) (Table 4).

Cluster analysis of the cultivars

For further assessment of ampelographic differences among the cultivars, the UPGMA clustering dendrogram was constructed on the basis of ampelographic scoring (0-9), adapted according to the international definition norms (Figure 1). The dendrogram formed by the NTSYS analysis of the characteristics presents two main clusters at a similarity level of 0.42. This is a remarkably lower value when discrimination at cultivar level was considered. Such a separation at low similarity level verifies the highly heterozygous nature of the *Vitis* genome (Lodhi et al., 1995; Adam-Blondon et al., 2005; Doligez et al., 2006). It also proves the discriminative potentials of the descriptor parameters employed in this study. The first group (A) is composed of 7 cultivars, 6 of which constituted pairwises between 0.80 and 0.88 similarity levels. Apart from 'Ata sarısı' which was derived from 'Çavuş' x 'Cardinal' crossing, the remaining three hybrid cultivars grouped together in an associate sub cluster (A2). In this branch, 'Uslu' ('Hönüsü' x 'Siyah Gemre') and 'Yalova İncisi' ('Hönüsü' x 'Siyah Gemre') set up a pairwise combination at a relatively higher similarity point (around 0.81). This proximity would solely be related with their parental status, as indicated in a previous study in which parental-based position was detected similarly using molecular markers (Sabir et al., 2008). The present case is also well-suited to findings obtained by Sefc et al. (1997) who explained the molecular-based close connection between 'Cab-

Table 5
Modal values of ampelographic descriptors (corresponding to morphological, cluster, berry and must characters) used for cluster analysis

No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Code OIV	001	002	004	006	007	008	009	010	015	016	051	053	066	067	068	069	070	076	077	078	079	080	081	082	083	084
SISA	7	5	5	1	2	2	2	1	3	5	6	3	1	3	3	5	3	3	5	5	5	3	0	5	3	0
HACI	9	5	5	5	2	2	2	3	3	5	2	9	1	1	3	5	5	3	5	5	6	3	0	5	3	9
SACA	9	3	5	1	2	2	2	1	0	5	2	9	1	2	3	5	3	3	3	5	3	3	0	5	3	5
SIKS	9	3	5	3	2	2	2	2	3	5	2	9	1	2	3	3	5	3	3	5	6	3	0	5	3	7
PESA	7	3	5	5	2	2	2	1	3	5	2	0	1	1	2	5	3	3	3	3	4	3	0	5	3	0
SIKA	3	3	5	3	1	1	1	1	0	3	2	0	1	2	3	5	3	3	3	3	3	3	0	5	3	0
USLU	3	5	5	3	2	2	2	2	3	3	2	0	1	4	3	7	3	3	3	5	3	5	0	5	3	0
YAIN	3	0	5	3	1	1	1	1	0	5	1	0	1	4	3	5	3	3	3	5	3	3	0	5	3	0
ATSA	0	3	5	1	2	1	2	1	0	5	2	0	1	4	3	5	3	3	5	5	3	3	0	5	3	0
YACE	3	3	5	5	1	2	2	1	3	5	1	0	1	3	3	5	0	3	5	3	3	3	0	5	3	0
No	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**
Code OIV	**085**	**090**	**091**	**092**	**151**	**154**	**202**	**204**	**205**	**206**	**221**	**222**	**223**	**225**	**230**	**238**	**241**	**242**	**243**	**301**	**303**	**304**	**502**	**503**	**505**	**506**
SISA	0	0	0	5	3	7	5	5	7	1	5	0	5	5	0	3	1	5	5	1	5	3	5	5	5	7
HACI	7	0	0	5	3	5	5	7	9	1	3	1	4	5	0	3	1	5	3	3	5	3	5	5	5	5
SACA	3	0	0	5	3	7	5	3	7	1	5	1	5	3	0	3	1	5	5	1	7	5	5	5	5	5
SIKS	5	0	0	3	3	3	3	7	9	1	3	0	4	7	0	3	1	5	7	1	5	3	5	3	3	9
PESA	0	0	0	5	3	7	5	5	5	1	5	1	4	3	0	3	1	5	5	2	5	3	5	5	5	9
SIKA	0	0	0	3	3	5	3	7	5	1	7	0	3	5	0	3	1	7	7	1	7	3	5	5	5	7
USLU	0	0	0	5	3	7	5	5	3	3	5	0	7	3	0	3	1	5	3	2	1	3	3	5	3	1
YAIN	0	0	0	7	3	7	7	5	3	1	7	0	7	1	0	3	1	3	3	1	3	3	5	5	5	3
ATSA	0	0	0	7	3	7	7	5	3	3	7	0	3	5	0	5	1	7	7	1	7	3	5	7	5	9
YACE	0	0	0	5	3	5	5	5	3	3	7	0	6	5	0	3	0	99*	99*	1	5	3	3	5	5	5

***:** Values relevant to seed length and weight were assigned as 99 because 'Yalova çekirdeksizi' is a seedless cultivar.

ernet Sauvignon' and 'Cabernet Franc' as linked with morphological characteristics. On the other hand, 'Ata sarisi' matched with 'Şika' in the first sub-cluster (A1), expectedly resulting from their certain distinguished morphological features, at a high similarity point. Furthermore, 'Şika' and 'Ata sarisi' were the most closely related cultivars among the studied cultivars, forming a pair wise at 0.87 levels. Another match was constituted between 'Silken sari' and 'Pembe salman' cultivars. The second group (B) includes 3 cultivars. In this group, a closely related pair wise combination occurred between 'Haciefe' and 'Siksari' at around 0.86 similarity point, while 'Sacalan' diverged with a private branch at 0.77 similarity level, encircling this pair. Dendrogram analysis indicates that ampelographic descriptors separated the cultivars from each other uniquely. Distributions of cultivars throughout the dendrogram were also logical when genetic background of cultivars were considered. Therefore, the methodology used in this study would be suitable when identification of individuals at cultivar level were needed. This is in agreement with previous reports in which suitability of certain ampelographic characters were indicated (Martinez and Perez, 2000; Asensio et al., 2002; Blanco et al., 2007; Sabir, 2008) (Table 5).

Conclusion

According to the ampelographic characters investigated in this study, great differences were observed among the cultivars. Certain characteristics, as emphasized above, were anticipated to play specific role in the constitution of the ampelographic dendrogram. For example, characters such as density of prostrate hairs on tips of young shoots, anthocyanin colouration of young shoot tips, colours of the dorsal side of indernodes, shoot attitude, colour of upper surface of young leaves, general shape of petiole sinus, shape of teeth, anthocyanin colouration of main veins on upper side of blade greatly varied among the cultivars. The present study provided particular knowledge on some autochthonous grapevine cultivars, most of which are today on the verge of extinction. This study would therefore help to prevent disappearing local cultivars and to preserve such germplasm collection for the future studies. The results also would shed light into the contradictory opinions of researchers on evaluation of such grapevine cultivars.

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