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# Ampelographic characterization of white grapevine cultivars (*Vitis vinifera* L.) grown in Palestine

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**Abstract:** In Palestine, grape culture consists of ecotypes and cultivars (also called local varieties), for which a large number of homonymous and synonymous designations exist as well as misnaming of cultivars. The present study is the first report using detailed ampelographic characterizations (39 informative traits) to assess genetic diversity and detect similarities among sixteen accessions collected from putative diverse grape genotypes

In general, 30 descriptors presented highly and satisfactory divergent genotypes, whereas the remaining traits showed no or very little ampelographic variation. Based on the similarity matrix and the resulting dendrogram of these ampelographic data, distinguishable genotypes as well as some cases of synonymies and homonymies clearly exist. A synonymy case seemed to be in four genotypes including Jandali-Mfarad, Jandali-Mrazraz, Jandali, and Hamadani-Mattar, which indeed showed genetic distances of less than 0.5, suggesting their relatedness, and the possibility that they are the same genotype, but with different names. In addition, homonym cases also occur in the following pairs of "Marawi's, Hamadani's, and Zaini's genotypes, in which each pair seems to be two distinctive genotypes.

Finally, among the 16 examined genotypes, the Zaini-Baladi genotype tended to show the highest genetic distance values from the others and thus could be potentially incorporated into any further local or regional breeding programs as well as germplasm conservation.

**Keywords:** ampelographic, genotypes, Palestine, similarities, variations

## Introduction

Grapevine (*Vitis vinifera* L.) is one of the oldest fruit trees cultivated all over the world. According to the International Organization of Vine and Wine, grapes are grown in more than 80 countries using acreage in excess of 8 million hectares (OIV, 2009), and this area is increasing dramatically by about 2-3% per year.

In Palestine, grapevine is one of the main cultivated fruit crops covering an area of about 7,600 ha (PCBS, 2011). Due to the unique geographical and ecological environment for growing high-quality fruits, grape growing and production are still limited to the southern part of West-Bank, especially Hebron and Bethlehem areas (Basheer-Salimia and Hamdan, 2010).

Grape culture consists of ecotypes and cultivars, also called local varieties (landraces), for which a large number of homonymous and synonymous designations, as well as the occurrence of

misnaming, may exist. In addition, names of these cultivars have been traditionally given on the basis of several traits such as fruit skin color, local geographical origin, names of the vineyard owner, and cluster shape. Moreover, Palestinian grapes are seriously threatened by severe genetic erosion due to biotic and abiotic stresses. Therefore, characterization and discrimination between these cultivars/varieties is an essential stage in the certification program and guaranteeing the trueness-to-type of the propagation materials, improvement and conservation of germplasm and monitoring of the genetic quality (Rout and Mohapatra, 2006).

Varietal discrimination and recognition could be achieved either by morphological and/or molecular markers (Saddoud et al., 2008). Despite the importance, accuracy, and efficiency of the molecular markers (Zulini et al., 2005), methods based on morphological traits continue to be the first

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step for the description and classification of any germplasm as well as useful tools for screening the accessions of any collection (Cantini et al., 1999). Several reports demonstrated the usefulness of these traits in documenting variability in grape genotypes (De-Tuda and Sancha, 1999; Ocete et al., 2008; Cunha et al., 2009).

The main goal of the present study is to characterize and quantify the genetic variability among accessions of white-table grapes grown in Palestine using ampelographic methods.

## Material and methods

### Study area

This study was carried out during the growing season of 2012. A total of sixteen white grapevine genotypes, with a preference of long-lived individuals (> 30 years old) were surveyed throughout the southern region of West-Bank, Palestine (Table 1). The climate of the region is a typical Mediterranean climate, with mild temperatures (18-25°C), rainy weather (580-800 mm/year) in autumn and winter, and hot, dry summers. Generally, all grapevines are cultivated under rain-fed conditions.

### Plant materials and descriptors

From each assumed genotype (biotype), random samples of 20 adult leaves and 10 mature grape clusters were collected from three adult plants per assumed genotype. Sixteen leaf morphological and 23 grape cluster descriptors or traits (Tables 1, 2, respectively) were determined according to the grape descriptors (IPGRI, UPOV, OIV, 1997) with some minor modifications that showed high discrimination values.

### Data analysis

Each descriptor (quantitative and qualitative) was scored as 1 for presence and 0 for absence. Accordingly, the relatedness among genotypes was estimated based on Jaccard's similarity coefficient using the multilocus fingerprinting data sets containing missing data (FAMD) software version 1.108 beta. Consequently, cluster analysis was made using the un-weighted pair-group method with arithmetic averages (UPGMA) (Schluter and Harris, 2006) and the Tree view software (Win32, version 1.6.6).

## Results

### Plant and leaf descriptors

Sixteen examined traits are shown in Tables 1. Bud break of four genotypes was observed on March 20; four genotypes on April 1st, with the remainder occurring on May 1st. Among all genotypes tested, anthocyanin coloration of main veins on upper side of blade ranged from absent to weak, blade shape was either wedge-shaped or circular, number of lobes was always more than seven, size of blade fluctuated from very small (Malikat-Libnan) to very large (Zaini-Baladi), leaf area was small, medium, or large (except for Marawi-Taeel and Zaini-Baladi which presented large and very large leaf areas respectively), density of hairs between veins extended from absent to very dense, length of petiole compared to middle vein was slightly or much shorter with the exception of Baluti-Abiad genotype which revealed equal length, shape of the upper lateral sinus presented either slightly or strongly overlapping lobes. Depth of upper lateral sinus was very shallow (Malikat-Libnan), shallow (Jandali-Mfarad), very deep (Salti-Khdari) however, the remainder genotypes were either medium or deep.

Dabuki genotype exhibited slightly open shape of petiole sinus, Jandali-Mfarad and Jandali-Mrazraz revealed strongly overlapping lobes, whereas the remainder genotypes were half open. The general shape of petiole sinus as well as sinus limited by veins variables were constantly absent, shape of teeth was mixture of both sides straightened both side convex, length of teeth was very small (Malikat-Libnan) small (Dabuki and Bairuti); however the remainder genotypes presented medium to large length of teeth. Finally, the ratio of length to width of teeth were very small (3 genotypes), small (5 genotypes), medium (6 genotypes), large (Marawi-Taweel) and very large (Hamadani-Muttar).

### Fruit descriptors

Twenty three fruit (bunch, berry and panel) traits are presented in Table 2

### Bunch descriptors

For all examined genotypes, bunch size ranged from small to large with the exception of Hamadani-Muttar and Dabuki-Kurawi genotypes which presented very small bunch sizes and lengths. A similar trend goes also with bunch length parameter. The length of the

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**Table 1. Leaf descriptors / white grapevine cultivars**

1	Genotype Name	Malikat-Libnan	Dabuki	Jandali	Miskat-El-Eskandaria	Zaini	Bairuti	Salti-Khdari	Hamadani-Mattar
<b>B</b>	<b>Leaf Descriptors</b>								
1	Bud break	20-Mar	20-Mar	01-May	01-May	20-Mar	01-Apr	01-Apr	01-Apr
2	Anthocyanin colouration of main veins on upper side of blade	Absent	Weak	Absent	Weak	Very weak	Very weak	Weak	Absent
3	Shape of blade	Wedge-shaped	Wedge-shaped	Circular	Wedge-shaped	Circular	Wedge-shaped	Circular	Wedge-shaped
4	Number of lobes	More than seven	More than seven	More than seven	More than seven	More than seven	More than seven	More than seven	More than seven
5	Size of blade (cm <sup>2</sup> )	Very Small	Medium	Medium	Small	Large	Small	Large	Small
6	Leaf Area	Small	Small	Medium	Small	Medium	Small	Medium	Medium
7	Density of hairs between veins	Absent	Dense	Dense	Absent	Dense	Absent	Sparse	Very dense
8	Length of petiole compared to middle vein	Much shorter	Much shorter	Slightly shorter	Much shorter	Much shorter	Much longer	Much shorter	Much shorter
9	Shape of upper lateral sinus	Lobes slightly overlapping	Lobes strongly overlapping	Lobes slightly overlapping	Lobes strongly overlapping	Lobes slightly overlapping	Lobes strongly overlapping	Lobes slightly overlapping, Lobes strongly overlapping	Lobes slightly overlapping
10	Depth of upper lateral sinus	Very shallow	Deep	Medium	Medium	Medium	Medium	Very deep	Medium
11	General shape of petiole sinus	Half open	Slightly open	Lobes half overlapping	Half open	Lobes half overlapping	Half open	Lobes slightly overlapping, Lobes half overlapping	Half open
12	Petiole sinus limited by veins	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
13	Tooth at petiole sinus	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
14	Shape of teeth	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex
15	length of teeth	Very Small	Small	Medium	Medium	Medium	Small	Medium	Large
16	Ratio length/width of teeth	Small	Medium	Very Small	Medium	Small	Medium	Small	Very Large

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Table 1 continued

2	Genotype Name	Marawi-Haba-Tawela	Zaini-Baladi	Jandali-Mfarad	Jandali-Mrazraz	Marawi-Taweel	Baluti-Abiad	Dabuki-Kurawi	Hamadani-Kadeem
B	Leaf Descriptors								
1	Bud break	01-May	01-May	01-May	01-May	01-May	01-May	20-Mar	01-Apr
2	Anthocyanin colouration of main veins on upper side of blade	Absent	Weak	Absent	Absent	Weak	Weak	Medium	Absent
3	Shape of blade	Wedge-shaped	Wedge-shaped	Circular	Circular	Wedge-shaped	Wedge-shaped,Circular	Wedge-shaped	Wedge-shaped
4	Number of lobes	More than seven	More than seven	More than seven	More than seven	More than seven	More than seven	More than seven	More than seven
5	Size of blade (cm <sup>2</sup> )	Large	Very Large	Large	Large	Large	Large	Medium	Medium
6	Leaf Area	Medium	Very Large	Medium	Medium	Large	Medium	Medium	Medium
7	Density of hairs between veins	Very sparse	Sparse	Medium	Medium	Very sparse	Medium	Medium	Very dense
8	Length of petiole compared to middle vein	Much shorter	Much shorter	Much shorter	Slightly shorter	Slightly shorter	Equal	Slightly shorter	Slightly shorter
9	Shape of upper lateral sinus	Lobes strongly overlapping	Lobes slightly overlapping	Lobes slightly overlapping	Lobes slightly overlapping	Lobes strongly overlapping	Lobes slightly overlapping	Lobes slightly overlapping, Lobes strongly overlapping	Lobes slightly overlapping, Lobes strongly overlapping
10	Depth of upper lateral sinus	Medium	Deep	Shallow	Medium	Medium	Medium	Medium	Deep
11	General shape of petiole sinus	Half open	Half open	Lobes strongly overlapping	Lobes strongly overlapping	Half open	Half open, Lobes slightly overlapping	Half open	Half open
12	Petiole sinus limited by veins	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
13	Tooth at petiole sinus	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
14	Shape of teeth	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex	Mixture of both sides straight and both sides convex
15	length of teeth	Large	Large	Medium	Medium	Medium	Medium	Medium	Large
16	Ratio length/width of teeth	Medium	Small	Very Small	Very Small	Large	Medium	Small	Medium

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Table 2. Fruit descriptors / white grapevine cultivars

1	Genotype Name	Malikat-Libnan	Dabuki	Jandali	Miskat-El-Eskandaria	Zaini	Bairuti	Salti-Khdari	Hamadani-Mattar
<b>A</b>	<b>Fruit Descriptors</b>								
<b>A-1</b>	<b>Bunch Descriptors</b>								
1	Size (cm <sup>2</sup> )	Small	Medium	Small	Small	Large	Medium	Medium	Very small
2	Length (cm)	Short	Very long	Intermediate	Short	Long	Intermediate	Intermediate	Very short
3	Length of Peduncle (cm)	Short	Medium	Medium	Medium	Long	Medium	Medium	Short
4	Density	Very loose	Very loose	Very loose	Very loose	Very loose	Very loose	Very loose	Dense
5	Single Bunch Weight (g)	Low	Medium	Medium	Medium	High	High	High	Medium
<b>A-2</b>	<b>Berry Descriptors</b>								
6	Time of Berry Ripening	Medium (15/9-15/10)	Early (15/8-15/9)	Early (15/8-15/9)	Medium (15/9-15/10)	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)
7	Skin Color	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow
8	Size (mm <sup>2</sup> )	Small	Medium	Small	Very large	Large	Large	Large	Small
9	Shape	Elliptic	Obtuse-ovate	Round	Round	Oblong	Narrow elliptic	Obtuse-ovate	Round
10	Pedicle Length (mm)	Intermediate	Intermediate	Short	Short	Intermediate	Intermediate	Intermediate	Short
11	Firmness of Flesh	Medium	Soft	Medium	Firm	Soft	Firm	Medium	Soft
12	Single Berry Weight (g)	Medium	Medium	Medium	High	High	High	High	Medium
13	Ease of Detachment from Pedicle	Slightly Easy	Very Easy	Slightly Easy	Difficult	Slightly Easy	Slightly Easy	Very Easy	Slightly Easy
14	Anthocyanin Coloration of Flesh	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured
15	Presence of Seeds	Well developed	Well developed	Well developed	Well developed	Well developed	Well developed	Well developed	Well developed
16	Seed Length (mm)	Short	Medium	Medium	Short	Medium	Long	Medium	Medium
17	100-Seed Weight (g)	Low	Low	Very low	Medium	Low	Very high	Low	Low
18	Juiciness	Very Juicy	Very Juicy	Very Juicy	Slightly Juicy	Very Juicy	Slightly Juicy	Very Juicy	Very Juicy
19	Must Yield (mL)	High	High	Very high	High	Very high	Medium	High	High
20	Sugar Content of Must %	Low	High	High	High	Medium	Medium	Low	High
<b>A-3</b>	<b>Panel Test</b>								
21	Firmness	Soft	Soft	Medium	Firm	Soft	Very Firm	Soft	Medium

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Table 2 continued

22	Crashness	Very Small	Small	Medium	High	Small	Very High	Small	Medium
23	Sweetness	Medium	Very High	Very High	High	Medium	High	Low	Very High
<b>2</b>	<b>Genotype Name</b>	<b>Marawi-Haba-Tawela</b>	<b>Zaini-Baladi</b>	<b>Jandali-Mfarad</b>	<b>Jandali-Mrazraz</b>	<b>Marawi-Taweel</b>	<b>Baluti-Abiad</b>	<b>Dabuki-Kurawi</b>	<b>Hamadani-Kadeem</b>
<b>A</b>	<b>Fruit Descriptors</b>								
<b>A-1</b>	<b>Bunch Descriptors</b>								
1	Size (cm <sup>2</sup> )	Small	Large	Small	Small	Small	Medium	Small	Large
2	Length (cm)	Short	Long	Short	Short	Short	Intermediate	Very short	Long
3	Length of Peduncle (cm)	Long	Long	Short	Short	Long	Medium	Medium	Short
4	Density	Very loose	Very loose	Very loose	Very loose	Very loose	Very loose	Very loose	Very loose
5	Single Bunch Weight (g)	Medium	Very high	Medium	Medium	Medium	Medium	Medium	High
<b>A-2</b>	<b>Berry Descriptors</b>								
6	Time of Berry Ripening	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)	Early (15/8-15/9)
7	Skin Color	Green-Yellow	Green	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow	Green-Yellow
8	Size (mm <sup>2</sup> )	Small	Large	Small	Small	Small	Medium	Small	Small
9	Shape	Elliptic	Oblong-Narrow elliptic	Narrow elliptic-Obtuse-ovate	Elliptic	Narrow elliptic-Elliptic	Round	Obtuse-ovate	Obtuse-ovate
10	Pedicle Length (mm)	Long	Intermediate	Intermediate	Short	Intermediate	Intermediate	Intermediate	Intermediate
11	Firmness of Flesh	Medium	Soft	Medium	Soft	Medium	Soft	Firm	Medium
12	Single Berry Weight (g)	Medium	High	Medium	Medium	High	High	Medium	Medium
13	Ease of Detachment from Pedicle	Very easy	Very easy	Very easy	Slightly Easy	Slightly Easy	Very Easy	Slightly Easy	Very Easy
14	Anthocyanin Coloration of Flesh	Very slightly Coloured	Slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured	Very slightly Coloured
15	Presence of Seeds	Well developed	Well developed	Well developed	Well developed	Well developed	Well developed	Well developed	Well developed
16	Seed Length (mm)	Long	Medium	Medium	Medium	Long	Medium	Medium	Medium
17	100-Seed Weight (g)	Medium	Low	Medium	Low	High	High	Low	Medium
18	Juiciness	Very Juicy	Very Juicy	Very Juicy	Very Juicy	Very Juicy	Very Juicy	Slightly Juicy	Very Juicy
19	Must Yield (mL)	High	High	High	High	High	High	High	High
20	Sugar Content of Must %	Medium	Medium	High	High	Low	Medium	High	Medium
<b>A-3</b>	<b>Panel Test</b>								
21	Firmness	Soft	Soft	Medium	Medium	Medium	Very soft	Very Firm	Medium
22	Crashness	Very Small	Very Small	Medium	Small	Medium	Very Small	Very High	Medium
23	Sweetness	High	Very High	High	High	Medium	High	Very High	High

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peduncle was short to long, bunch density was always very loose, single bunch weight was low (Malikat-Libnan) to very high (Zaini-Baladi); however the remaining genotypes were medium and or high.

## Berry descriptors

All studied genotypes were categorized as early ripened (matured) ones; skin color was always green-yellow except for Zaini-Baladi genotype with green color.

Berry shape, peduncle length, firmness of flesh, and single berry weight presented a wide range of variation. Ease of detachment of berries from peduncle was either very or slightly easy with the exception of Miskat-El-Eskandaria genotype (difficult), anthocyanin coloration of flesh was always very slightly colored, and presence of seeds was constantly well developed.

The majority of the genotypes revealed medium seed length; however two and three genotypes presented short and long seed length respectively. Descriptors of 100-seeds weight, juiciness, must yield, and sugar content of must showed a wide range of deviation.

## Panel test

In terms of firmness parameter, Baluti-Abiad was very soft; Miskat-El-Eskandaria was firm; Bairuti and Dabuki-Kurawi were very firm, however the remaining genotypes presented soft and medium firmness. All evaluated genotypes presented very small, small, and medium berry crunchiness except for Miskat-El-Eskandaria (high) as well as Bairuti and Dabuki-Kurawi (very high). A wide range of variation revealed for sweetness trait starting from very small to very high sweetness.

## Dendrogram of relatedness among grape genotypes

The similarity indexes (Table 3) were used to build a dendrogram by means of UPGMA analysis in order to determine the cluster of the genotypes (Fig 1). As shown in the dendrogram, grapevine genotypes were classified into two clusters. The first (minor) cluster (I) was composed of only two genotypes namely Bairuti and Miskat-El-Eskandaria, and the second (major) cluster (II) consisted of 14 genotypes, which divided into three sub-clusters (IIa, IIb, and IIc).

Sub-cluster (IIa) composed of "Salti-Khdari and Zaini-Addi" related to Baluti-Abiad as well as "Zaini-Baladi and Dabuki" genotypes.

Sub-cluster (IIb) consisted of "Hamadani-Kadeem and Dabuki-Kurawi" as well as "Jandali-Mrazraz and Jandali-Mfarad" linked to Jandali, in which the three genotypes were correlated to Hamadani-Muttar.

Sub-cluster (IIc) included Marawi-Haba-Tawela and Malikat-Libnan associated to Marawi-Addi genotype. Genetic distances ranged from 0.395 to 0.833 with a mean of 0.614 (Table 3). The most closely related genotypes were "Jandali-Mrazraz and Jan-dali-Mfarad" followed respectively by "Jan-dali-Mrazraz and Jandali" and "Jandali and Hama-dani-Muttar". On the contrary, the most distant genotypes were "Zaini-Baladi and Jandali" followed respectively by "Zaini-Baladi and Miskat-El-Eskandaria" and "Miskat-El-Eskandaria and Zaini-Addi".

## Discussion

Despite the small and narrow area of Palestine, its location between three continents (Asia, Europe and Africa) has possessed a wide range of agro-ecological concerns and hosts a large variety of plants. This situation in addition to the long history of grapevine cultivation in Palestine which exceeds 4000 years (Basheer-Salimia and Hamdan, 2009), the intense movement of material between countries and the possibility of vegetative propagation has led to the diffusion of many biotypes and cultivars and accordingly resulted in a great genetic variability in germplasm that often allowed misidentification and cases of homonymy and synonymy (Vignini et al., 2002).

Towards this end, identifying different ampelographic markers (morphological traits of leaves, bunch, berries, etc), is an essential step and important tool for characterization of grape germplasm (Cantini et al., 1999; Leao et al., 2011), for the purposes of protecting, conserving, maintaining, and conducting any future breeding program.

The present study is the first report using detailed ampelographic characterizations (39 informative traits) to assess genetic diversity and detect similarities among sixteen Palestinian table grapes collected from putative diverse genotypes. In general, 30 descriptors presented highly and satisfactory divergent genotypes, and accordingly could be potentially incorporated to both local and regional breeding



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Table 3. Jaccard's distance index generated for the 16 Palestinian grape genotypes based on 39 ampelographic descriptors.

	Malikat-Libnan	Dabuki	Jandali	Miskat-El-Eskandaria	Zaini-Addi	Bairuti	Salti-Khdari	Hamadani-Mattar	Marawi-Haba-Tawela	Zaini-Baladi	Jandali-Mfarad	Jan-dali-Mrazraz	Mara-wi-Addi	Baluti-Abiad	Dabuki-Kurawi
Dabuki	0.722														
Jandali	0.717	0.722													
Miskat-El-Eskandaria	0.692	0.745	0.786												
Zaini-Addi	0.722	0.654	0.620	0.810											
Bairuti	0.745	0.727	0.789	0.647	0.727										
Salti-Khdari	0.732	0.588	0.685	0.776	0.560	0.737									
Hamadani-Mattar	0.640	0.698	0.489	0.692	0.698	0.745	0.709								
Marawi-Haba-Tawela	0.553	0.647	0.741	0.692	0.698	0.647	0.635	0.640							
Zaini-Baladi	0.704	0.608	0.833	0.814	0.660	0.754	0.596	0.704	0.654						
Jandali-Mfarad	0.698	0.679	0.500	0.768	0.679	0.750	0.588	0.592	0.620	0.776					
Jandali-Mrazraz	0.612	0.745	0.419	0.786	0.592	0.745	0.608	0.553	0.612	0.793	0.395				
Marawi-Addi	0.673	0.750	0.673	0.647	0.704	0.627	0.691	0.647	0.563	0.776	0.627	0.620			
Baluti-Abiad	0.750	0.660	0.704	0.679	0.608	0.660	0.596	0.704	0.571	0.642	0.580	0.600	0.608		
Dabuki-Kurawi	0.673	0.627	0.592	0.698	0.679	0.654	0.691	0.592	0.698	0.732	0.627	0.532	0.627	0.635	
Hamadani-Kadeem	0.704	0.551	0.627	0.750	0.709	0.660	0.623	0.571	0.542	0.615	0.521	0.600	0.580	0.588	0.521

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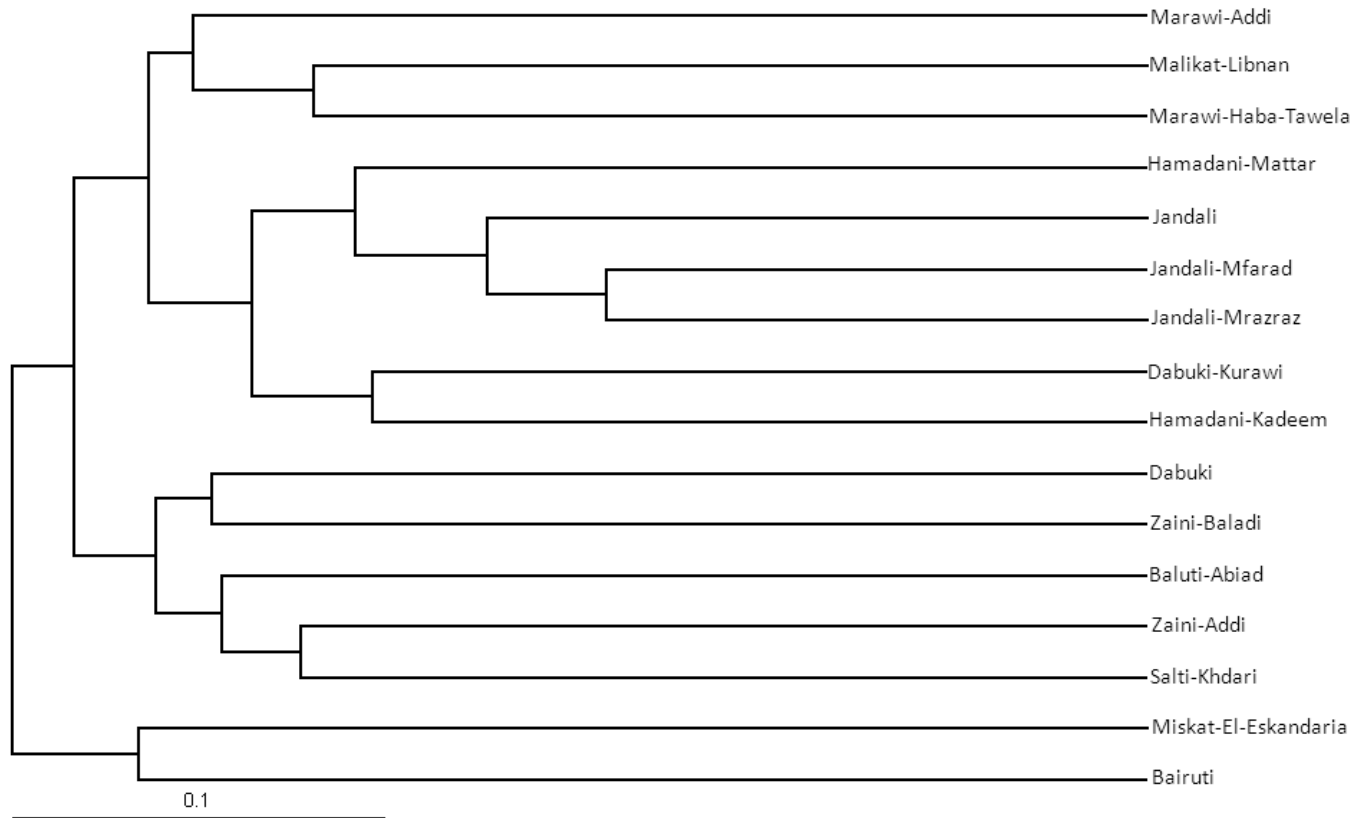


Figure 1. Dendrogram of 16 Palestinian white grape genotypes constructed by UPGMA based on some ampelographic descriptor

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programs (Bandelj et al., 2002; Borges et al., 2010), whereas the remainder traits showed no or very little ampelographic variation.

Based on the similarity matrix and thereby the constructed dendrogram of these ampelographic data, distinguishable genotypes as well as some cases of synonymies and homonymies clearly exists (Fig. 1). Several studies showed the existence of confusion in grapevine nomenclature, in addition numerous putative synonyms and homonyms cases were also reported in many Mediterranean countries such as Italy (Alba et al., 2011), Spain (Asensio et al., 2002), Tunisia (Zoghalmi et al., 2009); Egypt (Hassan et al., 2011) and Turkey (Cangi et al., 2006).

Here, a synonymy case seemed to be in four genotypes (Jandali-Mfarad, Jandali-Mrazraz, Jandali, and HamadaniMattar), which showed genetic distances of less than 0.5 suggesting their close relatedness, and possibly might be the same genotype, but with different names. In addition, homonym cases also occur in the following pairs of "Marawi's, Hamada-ni's, and Zaini's genotypes, in which each pair seems to be two distinctive genotypes (Table 3, Fig. 1).

The occurrence of these cases, which is indeed frequent among genotypes of the same cultivar, might relate to the environmental influences on the expression of several phenotypic traits (Ghaffari and Ferchichi, 2011), as a mechanism of adaptation to local environmental conditions (Martinez de Toda, 1991; Ocete et al., 1999).

In addition, grapevine cultivars are often spread via vegetative propagation and this usually leads to the diffusion of numerous genetically identical copies of a specific plants. During this process, somatic mutation could occur and this results in a plant characterized by unique genomic traits that could lead to a unique phenotype (Alba et al., 2011).

Finally, among the 16 examined genotypes, the Zaini-Baladi genotype tends to show the highest genetic distance values from the others thus could be potentially promised and incorporated into any further breeding programs and germplasm conservation. In fact, this genotype is the most widely grown in Palestine. It possesses drought resistance and is successfully cultivated under different soil types and therefore we anticipate high adaptability to a wide range of environmental conditions. Furthermore, it receives its name based on the appealing shape of the clusters, as "Zain" in the Arabic language reflects beauty and sweetness, and "Baladi" means locally.

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