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Use the qualitative parameters from grapes and grapes berries to identify the native *vitis vinifera* in Morocco

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Abstract**—** *We have used qualitative parameters to characterize and identify the native cultivars vitis vinifera in Northwestern of Morocco. Thirty nine accessions of locale grapevine were selected for this study and for each tree fifteen grape and fifteen grape berries were describe using ampelographic descriptors OIV. The table of ampelographic modalities shows a variation within the parameters studied between the different tree and inside the tree of the same variety. This variation gives us a preliminary idea of the diversity of the tree from local accessions of grapevine how deserves to be preserved and protected. Our results showed a significant variation of the shape of berries not only between the varieties but also inside the same variety.*

Keywords**— qualitative parameters; vitis vinifera, local accessions, Morocco.**

I. INTRODUCTION

Grapevine (*Vitis vinifera L.*) is one of the oldest and most important perennial crops in the world. [1] estimated the existence of about 14,000 cultivars, with numerous synonyms and occasional use of the same or similar names for genetically different cultivars. The Mediterranean region overlaps with the area of distribution of *Vitis vinifera subsp. sylvestris*, the species from which the cultivated grapevine was domesticated [2]. The history of grapevine cultivation parallels the history of civilization along the Mediterranean basin. From the earliest events of grape and wine production, dating back to before 6000 BC in the Transcaucasian region [3] to the present, there has been an important trade of grapevines and their products, mainly wine and raisins, promoted by different cultures like the Phoenicians, Greeks, Romans, and Muslims. Furthermore, as observed all along the Mediterranean basin, human activities are rapidly eroding the number and size of existent local grapevine populations. A morphological characterization of these grapevine resources can help identify the genotypes that should be preserved and partially prevent or delay this genetic erosion.

Traditional ampelography (from the Greek ampelos-grapevine and graphos-description), analysing and comparing morphological characters to identify cultivars, is not sufficiently reliable and consistent due to environmental factors, individual plant biology, and plant growth stage [4]; [5], [6]; [7]. More recently, microsatellite markers have extensively been used for varietal characterization [8]; [9]; [7]; [10]; [11] and for rootstock identification [12]. Pedigree [13]; [5] and parantage analysis [14]; [15] has also been reported. Since SSRs have been revealed fully informative and solid markers, they have definitely been involved in mapping studies [16]; [17]; [18]; [19]. Moreover, these markers have been used for identification of chimaeras of grapes [20]; [21]; [22]; [9]. A novel SSR application has finally concerned the authentication of varietal wines [23].

Viticulture in Morocco was likely introduced by the Phoenicians, who brought with them their taste for wine [24]. Much later, with the expansion of the Muslim culture, wine production was forbidden and grapevines were grown to produce table grapes and raisins. Currently, grapevines are grown throughout Morocco mainly for fruit production. Many grapevine cultivars, recognized as local cultivars, are still cultivated. However, their substitution by newly bred cultivars is causing a rapid reduction in the number of local genotypes. Up-to-now in Morocco, varietal identifications have been carried out with ampelographic studies [24], [25], [26], [27]. The goal of this work was to use the qualitative parameters to identify and to characterize the Moroccan native *vitis vinifera* cultivars prospected from the north west of morocco.

II. MATERIAL AND METHODS

The study was conducted on a set of clusters and varieties of prospective varieties in northwestern of Morocco. A total of 39 vines were selected for this study and for each tree 15 grapes and 15 berries were selected for the study.

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The choice of vines was made according to their age in the orchards. A set of qualitative parameters has been used for the description and characterization of local grape fruits according to the OIV codes [28], [29]. Sampling was done at the time of fruiting. In each site studied and with the help of farmers, we collected samples of named and recognized fruits.

Principal Component Analysis (A.C.P) was done using SPSS Version 10 software. For the purposes of statistical analysis we have coded the different states of each parameter. Table 1 illustrates this coding of the parameters with their meanings.

Table 1: The coding table for qualitative parameters of bunches and berries

	Parameter	Value	Signification
Grape	Easy detachment of the pedicel	1	Very loose
		2	Loose
		3	Medium
		4	compact
		5	Very compact
Berrie grape	Easy detachment of the pedicel	1	Very easy
		2	Easy enough
		3	Difficult
	Shape	1	Rounded
		2	Flattened at the ends
		3	Elliptical
		4	egg-shaped
		5	Troncovoïde
		6	Obovoid
	Succulence of the pulp	1	Very little juicy
		2	A little juicy
		3	Juicy
	Intensity of pigmentation of the pulp	1	Very slightly colored
		2	Slightly colored
		3	Colorful
		4	Highly colored
		5	Very strongly colored
	Color of the epidermis	1	Green yellow
		2	Pink
		3	Red
		4	Red purple
		5	Dark blue

III. RESULTS AND DISCUSSION

The qualitative parameters of the cluster and the berries

The qualitative (semi-quantitative) results obtained are shown in Table 2. The table of ampelographic modalities shows a variation within the parameters studied between the different tree and inside the tree of the same variety. This variation gives us a preliminary idea of the diversity of the tree under study. For example, the tree of the Taferyalt variety expresses a rounded-to-flattened shape at Taferyalt kahla2, Taferylat Kahla3, Taferylat Kahla4, Taferylat Kahla5, Taferyalt Kahla7 and Taferyalt Khala8. On the other hand, the Taferylat Kahla1 tree has an ovoid shape. Thus, the tree Taferylat Bayda1, Mouska Hamra1 and Mouska Hamara2 show an elliptical shape. The tree of the variety Bezoul El awda shows the most distinctive form (troncovoid) among the studied tree. Similarly, the Maticha variety has mounted berries that resemble tomatoes with a difference in compactness that varies from compact in Maticha mjemaa and loose in Maticha mferqa (Table.2).

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Table 2: List of quality parameters of grapes and berries

Variety	Compactness	facility of detachment of the pedicel	Shape	Succulence of pulp	Intensity of the pigmentation of pulp	Color of the skin	Firmness of pulp
feryal Khal1	3	2	4	3	2	4	3
feryal khal2	2	2	1	3	2	4	3
Taferyalt kahla3	2	3	2	3	4	5	3
Taferyalt Kahla4	2	2	1	3	4	4	3
Taferyalt Kahla5	3	2	2	3	2	4	2
Taferyalt Kahla6	4	2	5	3	2	4	3
Taferyalt kahla7	3	3	2	3	3	2	3
Taferyalt kahla8	4	2	2	3	4	2	3
Aferyal Byad1	3	3	3	3	2	1	3
Aferyal Byad2	3	2	2	3	3	1	3
Taferyalt Byad3	2	2	1	3	2	2	3
taferyalt Byad4	3	2	1	3	2	2	3
DiBI 1	2	3	2	3	3	2	3
Dibi 2	2	2	2	3	2	2	3
Echabel(Dibi)	1	2	1	3	2	2	3
Dibani 1	2	3	1	3	2	1	3
Dibani 2	2	2	1	3	2	1	3
Maticha Mferqa	2	2	2	2	2	4	2
Maticha Mjemaa	4	2	2	3	3	1	3
Mouska	4	3	1	3	2	1	3
Mouska Bayda	3	3	5	3	2	2	2
Mouska hamra1	1	2	3	2	3	2	2
Mouska hamra2	2	2	3	2	2	1	2
Ineb Nhal	4	2	1	3	3	5	3
Fekas khal	4	2	1	3	3	4	3
Fekas Byad	5	3	6	3	2	2	3
Fekas	3	2	2	2	4	5	3
Ineb Byad1	3	2	1	3	3	1	3
Ineb Byad2	2	2	2	3	2	1	3
Bezoul awda1	1	2	4	2	2	1	2
Bezoul awda2	4	2	3	3	3	2	3
Boukhanzir1	5	2	1	3	3	3	2

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Boukanzir2	2	2	2	3	4	2	3
Boukhanzir3	4	3	1	3	3	1	3
Sbiyae Bnat	4	1	1	3	2	1	3
Rjiyil Dib 1	3	2	5	3	3	4	3
Rjiyil Dib2	3	1	4	2	3	4	3
Zbarjel	4	2	1	1	4	4	1
Sanso	4	2	2	3	2	4	2

Principal component analyses of the semi-quantitative parameters of the bunches and berries

We used after coding (transformation of the qualitative variables into semi-quantitative variables) the means of the parameters qualitative of bunches and berries to carry out an analysis in principal component. Table 3 shows the percentages of the variance associated with each axis.

Table 3: Variance associated with PCA axes with semi-quantitative berries variables

Explained original variance			
Component	Total	% of the variance	% cumulated
1	1.93	27.64	27.64
2	1.36	19.44	47.14
3	1.16	16.60	63.74
4	.926	13.23	76.98
5	.815	11.64	88.62
6	.582	8.31	96.93
7	.214	3.06	100.00

We carried out the analysis in component of principal starting from the semi characters quantitative of the grapes and of berries of the various trees. The results are shown in figures 1 and 2.

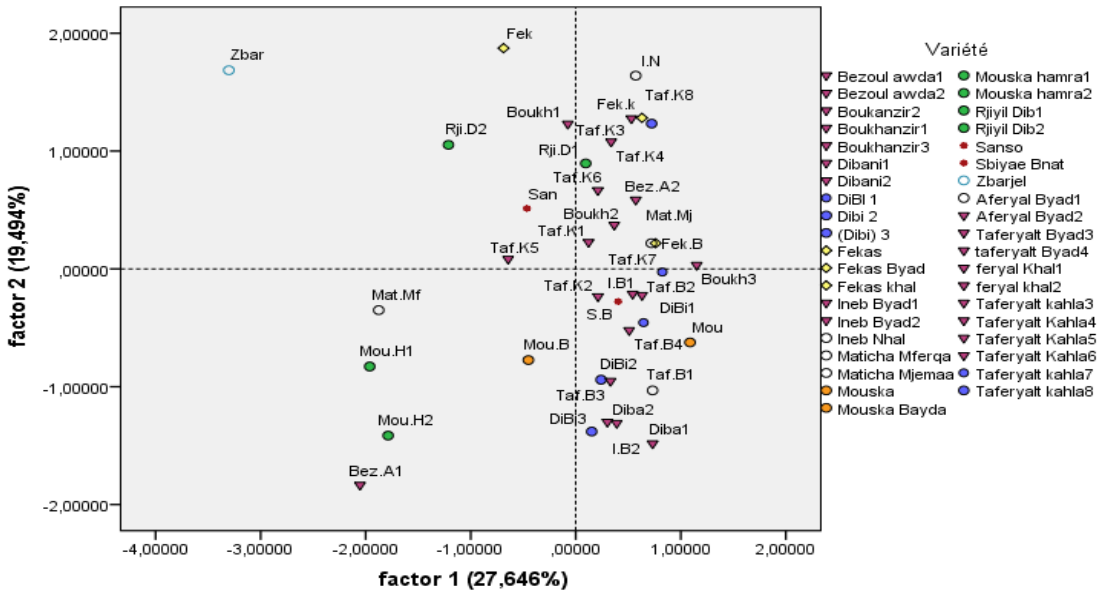

Fig. 1: Projection on the plan (1, 2) of the ACP of the semi-quantitative parameters

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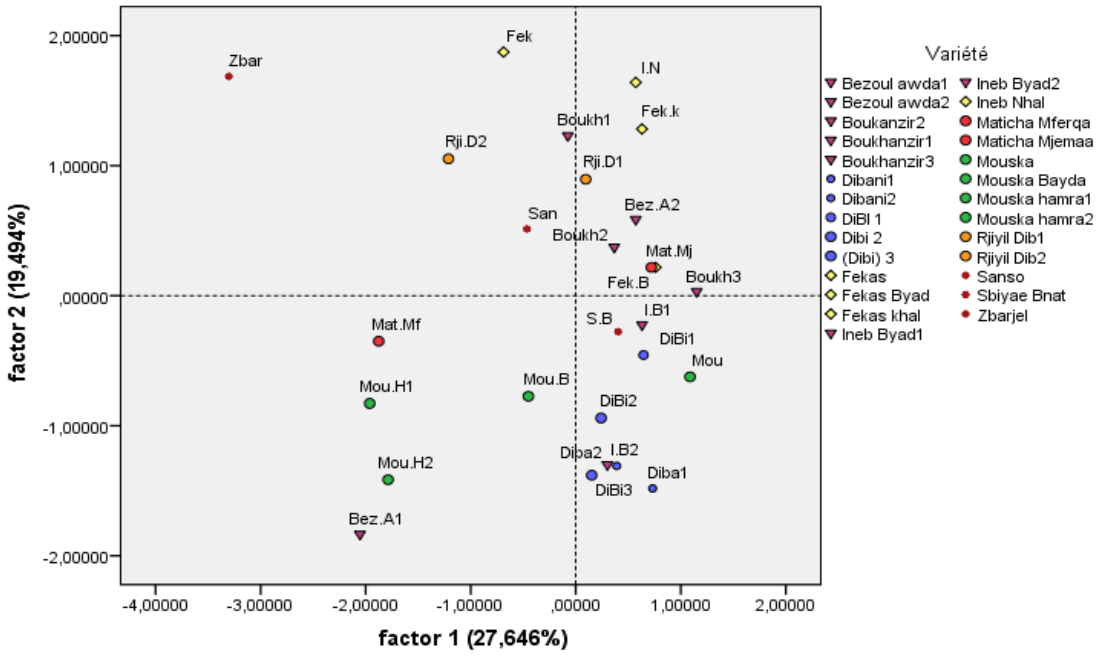

Fig. 1 Projection on the plan (1, 2) of the ACP of the semi-quantitative parameters (without Taferyalt)

According to the results obtained we notice the absence of a clear structure. On the other hand formation of a homogeneous group on the positive side of axis 1 and insulation of a few tree (Maticha mferqa, Mouska hamra1, Mouska hamra2, Mouska bayda, Bezoul aouda1, Zbarjel, Sanso, Boukhanzir1, Taferylat kahla5 and Fekass) at the negative side. One notices also the regrouping of the tree of each variety. As an example, tree of the variety Dibi, Mouska, Dibani and Boukhazir.

Indeed, our results showed a significant variation of the shape of berries not only between the varieties but also inside the same variety. It is the case of the tree of the Taferyalt variety whose shape of berries varies round form (feryal Kahl2 and TaferyaltKahla4) with flattened at the ends (Taferyalt Kahla5, Taferyalt Kahla7 and Taferyalt Kahla8) with elliptic berries(Taferyalt Byad1) or ovoid (Feryal Khal 1) and troncovoïde (Taferyalt Kahla6). The sugar content (Brix), is variable within the feet of the same variety but, we notice sometimes similar values at tree of various varieties such as for example at Taferyalt Kahla7, Maticha mjemaa, Bezoul El awda1, Boukhanzir3 and Sanso.

IV. CONCLUSION

The study of the morphology of plants, mainly leaves, buds, and the grape morphology (also called ampelography) was until recently the only means of identifying vine cultivars. This method is still used for identification particularly during in situ plant collection. In ours study the utilization of the qualitative parameters help us to more identify and characterize the local variety of grapevine in morocco. Indeed, a significant variation of the shape of berries not only between the varieties but also inside the same variety was observed. This study must be completed in the future by use the molecular markers for the best identification.

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