

Discrimination the accessions of grapevine cultivars Taferyalt with phyllometric parameters

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Abstract— The northwestern region of Morocco is rich in native vine cultivars where the problem of synonymy and homonymy is very common and causes the spread of varieties or the color of the fruits. The name of the grape cultivar Taferyalt has become inseparable from the name of the northwestern region where the cultivar is met under different names. In front of this situation, we tried to classify the accessions which have the same ampelographic character but with the different names (synonyms) or which showed several names which are given to the same variety (homonyms). The results of the phyllometric analyzes confirmed that these accessions are different.

Keywords— Taferylat cultivar, Phyllometric parameters, Morocco, synonymy, homonymy.

I. INTRODUCTION

Vitis vinifera L., the commonly cultivated grapevine, is one of the most widely grown fruit plants in the world [1]. It has subspecies with West Asiatic and European origins, and ranges from Central Asia to the Mediterranean Basin [2]. The cultivated grape *V. vinifera* subsp. *sativa* has played an important economic and cultural role throughout human history in different parts of the world. Researchers from East and West European countries initiated efforts to collect and preserve germplasm from a wide range of countries, including regions where autochthonous germplasm had not been investigated by genetic and ampelographic methods [3, 4]. Traditionally, morphological and agronomical characteristics have been the main criteria for differentiating grapevine cultivars, but it is well known that many of those characters are strongly influenced by environmental conditions. In grape, synonymies are very common [5, 6, 7, 8, 9] and convergences of names for distinct cultivars (homonyms) also occur because of some peculiar features of the varieties or because they grow in different regions [10]. That is a major problem in the management of grapevine germplasm collections [11, 12].

Ampelometric methods can also be a useful tool in cultivar identification, as they are less expensive, do not require special equipment and can give relevant results if managed properly and the resulting data are analyzed appropriately. Leaf descriptors have generally been used as effective tools for characterization of grapevine cultivars [13], [14], [15], [16], [17], [18], [19], [20]. Study of plant morphology, mainly leaves, buds, and cluster morphology (also called ampelography) until it is the last means of

detecting vine cultivars [21]. This method is still used for identification [22], [23], [24] particularly during the collection of data plants in situ. Many ampelographic studies have been made of grapevine cultivars from all over the world, but only a few have described those of Algeria and Morocco [25], [26], [27], [28]. Recently, many of the Maghrebi cultivars have now been profiled by nuclear and chloroplast microsatellite analysis [29], [30], [31], [32], [33].

In Morocco, the grapevine is one of the oldest crops, it is known from the past important wine growing areas despite this decline, and viticulture occupies an important place in the Moroccan socio-economic fabric. Actually in Morocco the most modern area of grapevine sector was constituted only by foreign introduced grapevine but these plant need adaptation cultural, simultaneously this exist the old local type of grapevines but the most of them not express all their potential of production and offer consequently a weak yield because the plantation of theses local grapevine was without grafting. In spite of this situation, the old grapes of grapevine remain much appreciated by the Moroccan consumer and during our prospection [30], the farmers claimed to make it begin research of improvement and valorization on its old grapevines. In this study we try to identify the native cultivar Taferyalt by used the phyllometric parameters.

II. MATERIAL AND METHODS

Twelve trees of Taferyalt accessions were selected in these study and thirty leaves of each tree was used. Several studies show that this is a sufficiently large and representative number of samples [34], [35], [36], [37],

[38], [39]. The leaves selected were between the 7th and 12th nodes, counted from the base of the primary branch following the recommendations of the [40]. The leaves were dried in herbarium. Indeed, the measurements were made on the sheets scanned using Super Ampelo software [41]. This software measures different quantitative characteristics of the sheet and also calculates different

parameters such as distances, angles, ratios, and descriptors of the OIV (International Office of Vine and Wine) (Fig 1). The software provides a total of 125 numeric values for each sheet. But only 86 characters were used, eliminating redundancy between characters. Principal Component Analysis (A.C.P) was done using SPSS Version 10 software.

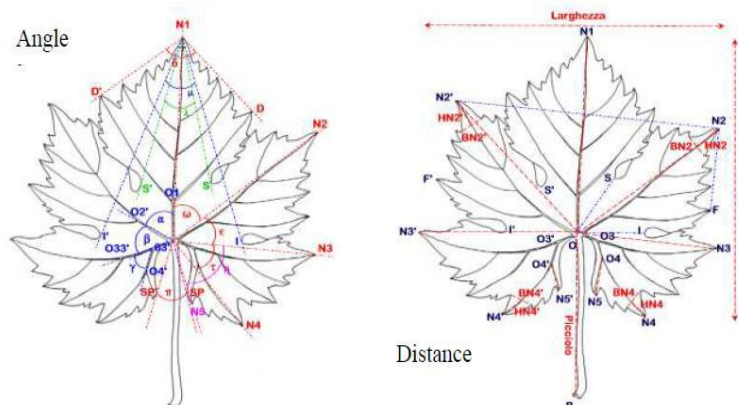


Fig.1. Point of the sheet requested by the information system to calculate the parameters (software Super Ampelo)

III. RESULT AND DISCUSSION

The leaves of the vine represent five main veins. The relative dimensions of the nerves are certain elementary relations: wedge-shaped, cordate, pentagonal, circular and reniform. But the enormous variability of characters such as lobes, teeth, petiolar sinus, hairiness, pigmentation, are the rights of choice for the differentiation of varieties [42]. So, the shape of the leaf varies according to the varieties, it can also vary even on each foot. Indeed, it is not uncommon to see on one foot, leaves almost whole to another so cut up. The shape of the leaf is determined by the length of the nerves (N1, N2, N3, N4 and N5), as well as the angles between the veins (α , β , ε , δ , λ , μ). The size of the leaf is determined from its length (LU) and its width (LA). We distinguish a petiolar sinus (OP), an upper and lower lateral sinus, separating the lobes (Fig.1).

Average distances

We calculated the average for the leaf parameters of the different trees from the automatic measurements performed by the SuperAmpelo software (Table 1). Originally, the software measures 86 parameters for each

leaf. This total number seems to be high compared to previous studies on grapevine cultivars as [43] (43 descriptors); [44] (50 descriptors); [45] (61 descriptors) and [46] (71 descriptors). We performed an analysis of variance to find the most discriminating parameters, we have shown that only 20 most discriminating parameters for distances and angles whereas only 16 parameters are the most discriminating for angles (Table 1, 2 and 3).

From Table 1 it can be seen that the tree Taferyalt khal 2 presents the means of the distances of the different points of the highest leaves compared to other trees of the Taferyalt variety. In general, and from the results of Table 1 we can say that the different tree of the variety Taferyalt does not represent the same average values of the different points of the leaves.

Table 1: Averages of the most discriminating parameters among the distances

Tree	OP	OS	OS1	OI	OI1	HN2	HN21	HN4	HN41	BN2	BN21	BN4	BN41	OO31	OO3	SPSP1	N4N41	FN21	O4N5	O41N51
Aferyal khal																				
1	18.39	12.38	11.13	12.4	11.07	1.92	1.79	2.04	1.75	3	2.55	2.96	2.77	2.71	4.57	24.11	17.85	12.93	4.76	2.61
Feryal khal																				
2	14.17	14.61	13.86	13.84	12.93	3.48	2.38	3.16	2.69	3.88	3.31	3.95	3.35	4.25	5.82	28.95	26.19	15.83	5.69	4.10
Taferyalt	16.14	11.75	11.18	11.57	10.48	2.03	1.86	2.12	1.85	2.91	2.39	2.69	2.28	2.46	4.22	23.59	15.61	12.05	4.36	2.47

Khal3																				
Taferyalt																				
Khal4	16.92	11.8	10.87	11.68	10.91	1.79	1.65	1.93	1.63	2.86	2.5	2.78	2.39	2.52	4.35	23.62	17.11	11.69	4.29	2.14
Taferyalt																				
Kahla5	14.61	10.08	9.261	10.31	8.93	1.87	1.65	1.91	1.56	2.73	2.38	2.86	2.24	2.09	4.16	19.9	10.62	10.16	4.28	1.83
Taferyalt																				
Kahla	24.06	13.29	12.46	12.38	12.48	2.11	2.27	2.57	2.54	2.81	2.69	2.91	3.11	2.65	6.1	26.25	19.49	14.64	7.18	2.03
Taferyalt																				
Kahla7	23.73	11.3	10.4	11.06	9.754	2.03	2	2	1.95	2.78	2.68	2.79	3.12	2.59	5.54	24.33	16.13	13.5	5.73	2.10
Taferyalt																				
Kahla8	25.51	13.31	12.05	13.49	12.09	2.11	1.84	2.19	1.81	3.13	2.83	2.97	2.59	1.88	5.96	25.12	15.5	12.21	5.59	1.94
Aferyal																				
Byad1	18.39	12.38	11.13	12.4	11.07	1.92	1.79	2.04	1.75	3	2.55	2.96	2.77	2.71	4.57	24.11	17.85	12.93	4.76	2.61
Aferyal																				
Byad2	14.07	12.88	12.38	12.87	12.33	2.64	2.13	2.76	1.98	2.76	3.39	2.88	3.31	2.77	7.13	25.82	16.47	15.44	7.52	2.83
Taferyalt																				
Byad3	17.94	11.81	11.39	12.25	11.95	2.61	2.27	2.98	2.26	3.08	2.59	3.54	2.75	3.67	4.82	25.44	19.9	13.38	4.79	3.42
Taferyalt																				
Byad4	17.47	12.97	13.16	12.62	11.99	2.78	2.18	2.62	2.13	3.33	2.82	3.09	2.71	3.55	4.74	25.34	21.31	14.23	4.87	3.59

Average angles

The average values of the angles of the points of the different trees are very variable from one tree to another (Table 2). Note that the tree Aferyal bayad 2 shows the average values of the different points of very large angles compared to the average values of the angles of other trees.

Table 2: Averages of the most discriminating parameters among the angles

Tree	AL (α)	AL1 (α')	BE (β)	BE1 (β')	GA (γ)	GA1 (γ')	ET (ϵ)	ET1 (ϵ')	TA	TA1	PI (π)	DE (δ)	LAM (λ)	MU (μ)	ALBE ($\alpha+\beta$) (μ)	ALBE1 ($\alpha'+\beta'$)	ALBEGA ($\alpha+\beta+\gamma$)	ALBEGA1 ($\alpha'+\beta'+\gamma'$)	ANGA (η)	ANGA1 (η')
Aferyal																				
khal 1	50.76	55.59	48.73	11.07	50.78	50.54	47.2	48.45	42.6	42	59.14	113.8	45.45	49.15	99.48	66.67	150.3	117.2	59.07	58.54
Feryal khal 2	51.55	54.38	45.32	10.81	51.89	55.79	44.3	49.3	41.6	41.9	69.12	103	41.3	48.42	96.85	65.2	148.8	121	59.17	60.07
Taferyalt																				
Khal3	54.71	51.68	48.81	9.7	51.93	49.4	52.1	45.91	43.1	41.9	60.54	107.4	42.68	48.46	103.5	61.36	155.5	110.8	57.72	56.79
Taferyalt																				
Khal4	47.88	47.06	45.43	8.64	49.24	48.83	51.7	44.6	40.5	41.6	73.22	108.3	40.13	49.19	93.33	55.7	142.5	104.5	55.78	55.35
Taferyalt																				
Kahla5	54.29	56.68	50.5	11.48	56.4	59.06	52.9	50.81	48.1	50.1	36.23	108.2	44.83	46.65	104.8	68.16	161.2	127.2	65.91	68.56
Taferyalt																				
Kahla	51.56	55.93	43.51	11.56	54.16	52.95	44.2	45.59	45.4	46.9	35.75	98.71	42.43	50.06	95.05	67.49	149.2	120.4	73.73	69.64
Taferyalt																				
Kahla7	51.48	51.27	46.45	10.92	53.27	54.29	47.8	50.22	46.8	48.1	41.94	105.2	36.03	43.32	97.93	62.19	151.2	116.5	68.15	68.48
Taferyalt																				
Kahla8	49.8	47.54	43.74	10.02	48.94	45.22	45.6	50.16	49.6	48	37.46	89.75	44.36	48.41	93.55	57.56	142.5	102.8	70.08	73.51
Aferyal																				
Byad1	50.76	55.59	48.73	11.07	50.78	50.54	47.2	48.45	42.6	42	59.14	113.8	45.45	49.15	99.48	66.67	150.3	117.2	59.07	58.54
Aferyal																				
Byad2	56.33	75.96	58.85	17.74	57.84	56.44	51.1	53.83	48	49.2	17.58	109.9	45.81	47.57	115.2	93.69	173	150.1	74.87	73.89
Taferyalt																				
Byad3	52.01	57.72	43.95	8.07	53.35	52.57	50.5	48.56	40.4	39.3	76.13	103.6	37.15	46.89	95.96	65.79	149.3	118.4	53.05	53.2
Taferyalt																				
Byad4	56.35	54.11	44.62	7.53	51.75	53.06	49.5	45.08	39.8	39.8	74.15	105.9	44.55	51.01	100.9	61.65	152.7	114.7	54.38	56.54

Average ratios

Table 3 shows the reports of different measurements made by the SuperAmpelo software. We note that the different ratios are variable between the trees of the variety Taferyalt.

Table 3: Averages of the most discriminating parameters among the ratios

Tree	RS	RS1	HD	LULA	RI	HBD	HBD1	HD1	RP	RI1	ALBEOSOI	ALBEOSOI1	HBN2	HBN41	HBN21	HBN4
Aferyal khal 1	0,52	0,51	1,23	0,91	0,62	0,66	1,32	2,50	0,73	0,61	0,08	0,05	0,67	0,64	0,71	0,70
Feryal khal 2	0,50	0,46	1,57	0,88	0,62	0,63	1,42	3,18	0,45	0,56	0,06	0,05	0,90	0,8	0,73	0,82
Taferyalt																
Khal3	0,49	0,50	1,27	0,95	0,65	0,71	1,54	2,43	0,63	0,64	0,09	0,05	0,71	0,86	0,76	0,81
Taferyalt																
Khal4	0,50	0,50	1,15	0,93	0,63	0,63	1,31	2,35	0,65	0,64	0,08	0,05	0,63	0,70	0,66	0,73

Taferyalt																
Kahla5	0,50	0,52	1,08	0,95	0,66	0,62	1,28	2,18	0,68	0,64	0,1	0,07	0,68	0,71	0,71	0,68
Taferyalt																
Kahla	0,50	0,48	1,4	0,97	0,62	0,72	1,44	2,52	0,85	0,65	0,07	0,05	0,75	0,82	0,87	0,88
Taferyalt																
Kahla7	0,46	0,45	1,31	0,94	0,58	0,69	1,38	2,58	0,9	0,55	0,08	0,05	0,74	0,63	0,76	0,72
Taferyalt																
Kahla8	0,52	0,55	1,46	0,97	0,64	0,73	1,53	2,92	0,92	0,66	0,07	0,04	0,69	0,71	0,67	0,74
Aferyal Byad1	0,52	0,51	1,23	0,91	0,62	0,66	1,32	2,50	0,73	0,61	0,08	0,05	0,67	0,64	0,71	0,70
Aferyal Byad2	0,50	0,50	1,64	0,94	0,62	0,74	1,54	3,34	0,5	0,61	0,09	0,07	0,96	0,6	0,62	0,98
Taferyalt																
Byad3	0,46	0,48	1,39	0,95	0,61	0,61	1,30	2,89	0,63	0,61	0,08	0,05	0,85	0,80	0,86	0,82
Taferyalt																
Byad4	0,51	0,51	1,35	0,93	0,67	0,63	1,31	2,78	0,63	0,63	0,07	0,05	0,82	0,78	0,78	0,83

Principal component analysis

Using different leaf phyllometric measurements, we performed a principal component analysis of the different trees of the Taferyalt variety to see if the trees cluster together. The result is shown in Figure 2. From the figure we see that the trees of the taferylat variety form a group together except one tree Taferyalt Beyad 2 which is very far from other trees. Also the tree Taferyalt khal 1 and tree Taferyalt Byad 1 are superimposed. According to the result of the principal component analysis it can be said that it is a single vine variety Taferylat presented by several accessions, except the tree Taferyalt Beyad 2.

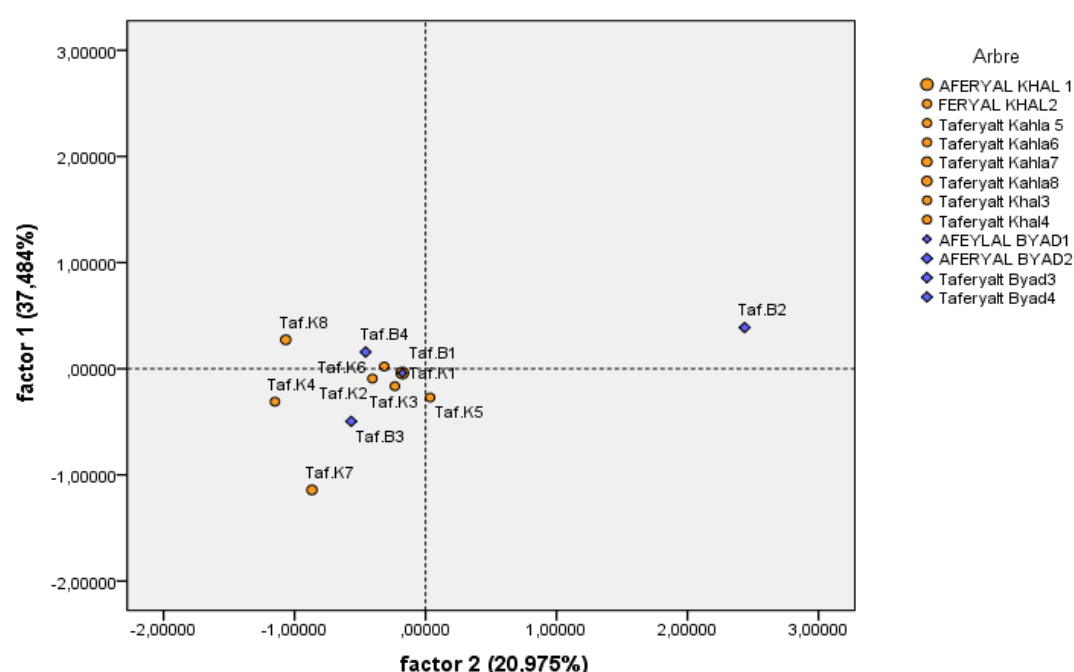


Fig. 2: Representation of the 12 trees of the "variety" Taferyalt

This result can be explained by the fact that there are problems of nomenclature due mainly to synonymy (several names are given to the same variety) and homonymy (the same name is given to several varieties). This problem is very common among local varieties. Synonymies are particularly related to the dissemination of varieties, which have been widely circulated and which have often been named differently in the different growing areas. As for the homonymy very common in the culture of the Moroccan vine, it is particularly determined by the color of the fruit as for the varieties "EL Biod and EL

Kahal". The names El Biod and El Kehal are given to varieties for which the morphological characters are different but whose fruits have a white or black color, hence the Arabic name of EL Biod (White) or EL Kehal (Black). In other study, [47] presumed the variety 'Kéknyelu' for the same as the Italian 'Picoletto bianco' (= 'Picolit'). [48] commented that Italian ampelographers approve of the similarity of the two cultivars. He suggests importing 'Picolit' to Hungary to clarify this issue. Nowadays molecular markers are useful tools detect homonymies and synonymies [49].

IV. CONCLUSION

In this study, the different parameters phyllometric was used to identify the accessions of one of the must answered cultivars in the north western of morocco, the result indicate the clear difference between the two studied accessions. On the basis of these results it can be established, that as we supposed the studied cultivars are different.

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