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Characterization and Morphological Typology Of Fig Variety (*Ficus carica*) In The Tlemcen Region

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Abstract

The purpose of this study is to describe morpho-biometric and identify fig varieties in Tlemcen region, based on 33 morphological markers (24 qualitative and 9 quantitative traits). The samples collected are processed by the ImageJ software for taking measurements. The statistical analysis was carried out using the SAS version 9 software. The results of the descriptive analysis of morphological traits studied allowed us to describe each variety and estimated the variability associated with each character of the different varieties sampled. The results of the principal Component Analysis (PCA) allowed the distinction of nine groups. Comparison of the data collected for each two-to-two variety and the estimate of the square distance between them showed that there is a highly significant difference between all local varieties. Then the comparison between local varieties and imports allowed the population to be separated into 16 distinct groups. Statistical analysis identified skin color as the primary discriminating factor between local varieties followed by fruit length, apical branching and leaf count per shoot. Statistical analysis of qualitative and quantitative morphological data from the 33 characters in study is to be effective for the distinction of new local varieties. That said, morpho-biometric description and local variety identification must be verified by the molecular tool to embark on an effective program of management and genetic improvement of this important biological resource.

Keywords: Fig (*Ficus carica*), local varieties, morpho-biometric identification, Tlemcen, Algeria.

Introduction

The fig (*Ficus carica L.*) belongs to the Moraceae family. As one of the first domesticated crops, it is mainly planted in Mediterranean countries (Kislev et al, 2006) cited by Jing, 2020. This fruit tree is widespread in the countries of the Mediterranean basin since it is well adapted to different soils and climate (Mars, M., 2003) quoted by Ciarmiello et al. 2015. The center of origin of the fig has not been clearly established. However, a recent molecular analysis suggests that the center of origin is present-day Turkey (Karandeniz, 2009). The genus Ficus is distributed mainly in warm and temperate climates and consists of approximately 881 species (Kumar et al., 2011). Man's interest in fig trees has led to its dispersal in several parts of the world (Mauri, 1939). Fig fruits and derived products are used as an advantageous rich source of bioactive compounds of high economic value because of its use in cosmetic, pharmaceutical and agriculture industries (Amessis-Ouchemoukha, Et al, 2016). According to Barolo MI 2014, the fig is becoming increasingly popular for its edible value and medicinal properties. According to data from FAOSTAT (2018), world production of figs is about 1,135,316 tons of which Algeria ranks fourth in the world with 118,949 tons in 2018. The fig tree is one of Algeria's three main fruit productions. The vast majority of plantations are in Kabylie (Chouaki, et al. 2006). There are two forms, one wild: the caprifig, and the other cultivated.

The latter occupies an area of 39,356 Ha (FAOSTAT 2018). According to Chouaki, et al. 2006, local fig cultivars are preserved on family farms in mountain areas. However, among the main factors of genetic erosion are the abandonment of orchards urbanization, fires, aging of trees and the scarcity, even the absence of new plantations especially since the eighties. Added to this are the environmental, technical, economic and organizational constraints facing fig cultivation.

When harvesting figs, there is an apparent difference in fruit quality. Indeed, the ripening period of the fruit is staggered over time and gives rise to differences in fruit size, shape and color. Smaili and Kessai 2016) reported, that lower quality figs are used mainly as livestock feed. There is a growing industry to diversify the uses and enhance values of fig fruit (jam, coffee, paste, ingredients, etc.). The genetic improvement is becoming an important area of research to have better crops, and prior collection of information with regard to its genetic diversity necessary. The conservation of local resources also requires rational management, and such management requires prior knowledge of genetic diversity. The evaluation of the fig germplasm could be optimized using genetic markers; of morphological, biochemical (isozymes, proteins) and/or molecular types.

According to Bachi, 2012, the same genotype may encompass several phenotypes. This disparity may, result in synonymy problems. There are also fig appellations that differ from one locality to another within the same region, referring to the same cultivar. On the other hand, the homonymy may be the result of the presence of morphological similarities between individuals belonging to different genotypes, subject to the same environmental conditions. These similarities are the result of adaptive convergence in a given environment. Some fig cultivars have similar appellations.

Morphological characterization is still essential in any program of conservation and use of genetic resources (GIRALDO et al. 2008) and can largely address the problems of synonym and homonymy. Our work was focused on a morphometric description and identification of local fig varieties existing in the Tlemcen region, north-west Algeria. The purpose of morphological characterization is to characterize and compare the vegetative, and reproductive organ of different varieties studied, using the quantitative and qualitative morphological markers reported in IPGRI and CIHEAM 2003).

Material and methods

Selecting plant Material

The prospections were carried out, on a region of 500 km2 in the region of Tlemcen, which is located at the level of Western Orania of Algeria. Fifty on-site trips took place in different agro-ecological regions: coastal, steppe and mountain. (Figure 1)

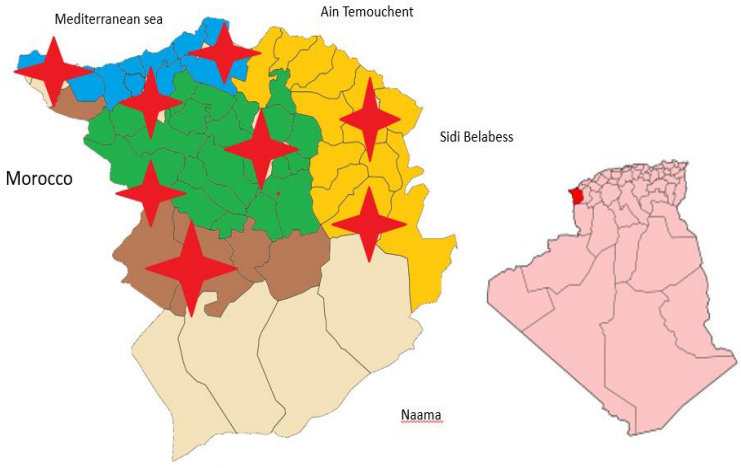

Figure 1: Geographical localization of the study zones (sampling places in red)

The collection of plant material was carried out in the regions aroused, for morphological characterization on the basis of IPGRI and CIHEAM (2003), discriptors and, according to the varietal catalogue of Gonz-Lez-Rodr-Guez and Grajal-Mart-N (2011). Thirty-three morphological markers (qualitative and quantitative) related to the tree, fruit and leaves were selected for this study. These morphological markers have been used by several previous authors (Cabritaa Et Al., 2000, Khadari Et Al., 2001; Papadopoulou Et Al., 2002; Giraldo Et Al., 2005; Guasmi Et Al., 2006; Ikegami Et Al., 2008; Achtak, Et Al., 2009; Akbulut Et Al., 2009; Baraket Et Al., 2010; Chatti Et Al., 2010; Giraldo Et Al., 2010; Saddoud Et Al., 2011; Gaaliche Et Al., 2012; Perez-Jimez Et Al., 2012; Garcia Ruiz Et Al 2013; Ciarmiello F. 2015; And Ben Abdelkrim 2015 (Table 1).

The study was conducted on adult individuals who have approximately the same age and sampled randomly. Attempts were made to eliminate the effect of exposure by taking samples from all cardinal points: north, south, east and west, as well as inside the tree, during the summer period (June, July, August and September) of 2017.

In total, thirty-nine fig tree belonging to nine common cultivars (uniferous and biferous) were sampled; with repeats for each cultivar for morpho-biometric characterization.

The local cultivars studied are BAKOR, KAHLA, HAMRA, BEYDA, CHETOUI, ASSAL, BOUAFASSE, ONKE HEMMAM, HAFER ELJEMAL. Some so-called introduced varieties, according to the fig-farmer of the region Zeriki (imp06DJ), Spanish Chetoui (imp04DJ, IMP XY SS and imp XX SS), SpanishBayda (imp02BS), Khadra Baraniya (imp YZTHR) and Chetoui Spanish Brunette (impYZ). were included in this study for comparison to local cultivars (table 1)

Table 1: Name of the varieties studied, and geographical origin of the collected samples.

Variety name	Origin ofSampless
BAKOR	Chouli - Nedroma
KAHLA	Chouli
HAMRA	Chouli- Benissnous
BEYDA	Maghnia - Chouli
CHETOUI	Chouli- Djebala- Maghnia
ASSAL	Djebala
BOUAFAS	Maghnia Nedroma
ONKE HEMMAM	Maghnia Nedroma
HAFER ELJEMAL	Benisswe
ZERIKI (IMP 06DJ)	Nedroma
SPANISH CHETOUI (IMP04DJ, IMP XY SS AND IMP XX SS)	Maghnia
BAYDA ESPAGNOL (IMP 02BS)	Benisswe
KHADRA BARANIYA(FYZ THR IMP)	Nedroma
SPANISH BRUNETTE (IMP YYSS)	Maghnia

In order to accomplish this study, measurements were made for morphometric characterization on three levels: tree, leaf and fruit. **(Table 1, Table 2).** In total, morphological characterization was carried out on 39 trees, 645 leaves and 898 fruits. Samples taken were photographed to identify and measure the different dimensions and surface using imageJ software (National Institutes of Health 1987). The fruit weight was measured using an electric balance with an accuracy of 1 g.

Statistical analyses

Data from the samples collected were used for statistical analyses using SAS version 9 software. The meaning was chosen for a value of p - 0.05. In order to properly describe the different morphometric parameters of the sampled fig trees, the arithmetic average (M) and the standard deviation the minimum (Min) and maximum (Max) values, were calculated. using the MEANS procedure. The principal component analysis (PCA) of the values of the measurements of morphometric traits studied, was carried out using the CANDISC procedure, in order to separate the populations of fig trees statistically. In addition to detect the similarities and morphological

differences between these varieties were compared by pairs. Procedure STEPDISC was used to look for factors that discriminate the different fig varieties.

Table 2: Qualitative characters and abbreviations

Character	*Abbreviation*
Tree	
Shape of the tree	FORMPL
Tree vigour	Hpl
Apical Branch	BRAPPL
Ramification level	NVRMPL
Color of branches	CLBRPL
Number of leaves per shoot	NFTRPL
Leaf	
Leaf Shape	FORMF
Number of lobes	NLOBF
shape of lobe	FLOBF
Shape of Leaf base	FBASF
Dentition of the edges of the Leaf	DTLMRGE
Leaf nervation	VntF
Color leaves	Clf
Petiole color	CLPTLF
Fruit	
Ostiole color	CLOST
Shape of peduncle	FRMTGFR
Easy of peeling	FACEPFR
Fruit Skin cracks	CRPOFR
Firmness of the fruit skin	FRMPOFR
Skin color	CLPOFR
Number of lenticels	LNTFR
Color of lenticel	CLNTFR
Fruit flavor	SCRFR
Shape of the fruit	FORMFR

Table 3: Quantitative characters and abbreviations

Character	*Abbreviation*
Leaves	
Length of Leaf	LONGF
Length of petiole	PTLF
Leaf width	LARGF
Fruit	
Length of fruit	LGFR
Fruit width	LRFR
Fruit pulpit surface	SURFCHRF
Surface cavity of the fruit	ONCVFR
Ostiole surface of fruit	OSFR
Weight of the fruit	POIFR

Results and Discussion

Descriptive analysis

The study of 33 morphological traits (24 qualitative and nine quantitative) allowed us to describe all studied cultivars and varieties, and the estimate of variability associated with each character, for the different varieties sampled.

for the nine quantitative measures arithmetic average, standard deviation minimum and maximum values were calculated, for each studied variety (Table 4**).** The twenty-four qualitative characters studied are presented with the percentage of representation per variety (Table **5).** The variability between populations was significant despite the common geographical origin of the cultivars studying.

Similar previous descriptive studies were carried out using qualitative and quantitative morphological

markers, on Tunisian varieties (Gaaliche et al 2012, Ben Abdelkrim 2015) and Moroccan varieties (Oukabli 2005). The results of the work on Tunisian varieties for quantitative traits were superior to ours. On the other hand, a significant similarity existed between our results and those of Moroccans which may be due to the environmental effect and geographical proximity.

On the other hand, in terms of the results of qualitative pomological traits, the description of Mexicanes varieties (Garcia Ruiz et al., 2013) was similar to some of our varieties studied (Onk Hemam Tetela, Bouafasse Neza/Salvateirra, Chetoui Spanish brunette, Tecàmac, Zeriki Zacapaia). This result may be due to the great influence of Spanish varieties on our genetic resource and of course indirectly that of Mexico.

Principal Component Analysis (PCA)

The principal component analysis (PCA) of the values of morphometric measurements is presented in **figure 2.** This PCA separated the populations of local fig trees studied into nine distinct groups. The graphic interpretation of the PCA results is carried out primarily on the basis of Plan 1-2 because it provides the maximum amount of information with 60.93 contribution to the total variation (37.6 contribution for axis 1 and 23.33 for axis 2).

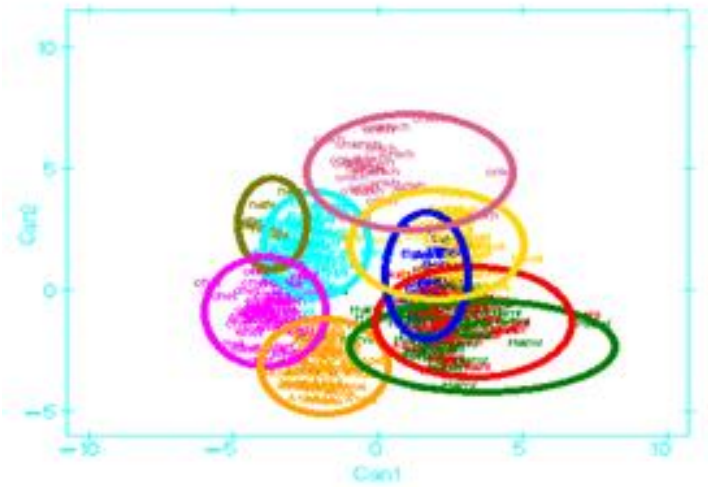

Figure 2: Projection of the average points of local fig varieties on the first factor of a principal component analysis. (*Pink Circle: Onk Hemam; Yellow Circle: Bouafasse; Dark Blue Circle: Bakor; Red Circle: Kahla; Green Circle: Hamra; Orange Circle: Assal; Violet Circle: Chetoui; Clear Blue Circle: Bayda; Brown Circle: Hafer Ejemal)*

Table 5 represents probabilities, statistical F values and square distances between the varieties studied (two-to-two comparison)

The difference is very highly significant between all local varieties (two-to-two comparison). The value of the highest square distance is observed between the two varieties Bakor and Hafer ejemal, with D^2 equal to 130.30. These results indicate that Bakor and Hafer ejemal are considered to be the two most morphologically and probably genetically distant local varieties since the environment in which these two varieties evolve belongs to the same bioclimatic stage Nedroma for the Bakor variety and Benissnous for the Hafer ejemal variety. Square distance values (D^2) less than 50 indicate that overlaps exist between varieties. The value of the lowest square distance is noted between the two varieties Kahla and Hamra, with D^2 equal to 7.11. These results indicate that Kahla and Hamra are considered to be the two most morphologically similar local varieties and probably also genetically for the same reason mentioned above for the Bakor and Hafer ejemal varieties. These results are of paramount importance in a management and/or breeding program because it will give us a fairly

precise idea of which variety to guide the crosses and what varieties can be mixed in the event of a decision to reduce the number of varieties for better management.

To see if variety importation is warranted, a principal component analysis (PCA) of the values of the morpho-metric character measurements presented in **Figure 3** was used in conjunction with measurements obtained from imported varieties. This PCA separated the populations of fig trees studied, local and imported into 16 distinct groups. The graphic interpretation of the PCA results is carried out primarily on the basis of Plan 1-2 because it provides the maximum amount of information with 46.54 contribution to the total variation (24.31 % contribution for axis 1 and 22.22 % for axis 2).

Table 6 represents square distances (D^2) between local and imported varieties (two-to-two comparison). The difference is very highly significant between all varieties, local and imported, ($P<.0.0001$).

The most morphologically distant imported variety of local varieties is Khadra Baraniya (imported 01 FYZ THR). This variety is unlike any local variety. For the rest of the imported varieties, we found overlaps between the populations of these and the populations of the local varieties, which means that overall, these imports, should not take place (globally), except for the Khadra Baraniya variety. The value of the lowest square distance was observed between the imported varieties; Bayda espaniol (imported 02 BS)" and the local beyda variety (D^2- 11.73). These results indicate that the imported bayda espaniol variety can be replaced by the local Beyda variety (D^2- 11.73) at farmers' loan. It is also probably that it is the same variety but with two different names**.**

Table 5: Square distances between local varieties, f values and probability values

Squared distance to variety									
Variétés	Assal	Bakor	Beyda	Hamra	Bouafasse	Chetoui	Hafer Eljemel	Kahla	Onke Hemmam
Assal	0	61.710130	39.679620	34.590430	51.555910	24.554770	69.165080	40.390890	85.068670
Bakor			72.470630	45.011530	42.510260	2.723440	130.306850	45.381270	77.935930
Beyda				41.760900	44.573210	23.014100	34.269340	38.558090	40.245210
Hamra					30.763390	42.830270	88.995680	7.113570	60.137790
Bouafasse						60.539160	73.396870	25.586680	40.833810
Chetoui							38.123680	47.605080	58.868210
Hafer Eljemel								81.691300	56.660600
Kahla									60.832420
Onke Hemmam									
F Statistics, NDF=33, DDF=420 for squared distance to variety									
Variétés	Assal	Bakor	Beyda	Hamra	Bouafasse	Chetoui	Hafer Eljemel	Kahla	Onke Hemmam
Assal	0	39.348550	34.679860	24.750720	38.456220	21.076710	13.569870	38.059970	45.193940
Bakor			51.871450	27.271390	26.675790	51.287020	24.356840	34.531630	36.499620
Beyda				34.052230	38.114220	23.156660	6.957140	43.320370	23.519700
Hamra					21.621000	34.340370	17.183400	6.221130	30.612090
Bouafasse						50.859820	14.329020	23.548810	21.405890
Chetoui							7.707000	52.260540	33.989020
Hafer Eljemel								16.868430	10.005090
Kahla									37.361720
Onke Hemmam									
Prob > Mahalanobis distance for squared distance to variety									
Variétés	Assal	Bakor	Beyda	Hamra	Bouafasse	Chetoui	Hafer Eljemel	Kahla	Onke Hemmam
Assal	1.000	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Bakor		1.000	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Beyda			1.000	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Hamra				1.000	<.0001	<.0001	<.0001	<.0001	<.0001
Bouafasse					1.000	<.0001	<.0001	<.0001	<.0001
Chetoui						1.000	<.0001	<.0001	<.0001
Hafer Eljemel							1.000	<.0001	<.0001
Kahla								1.000	<.0001
Onke Hemmam									1.000

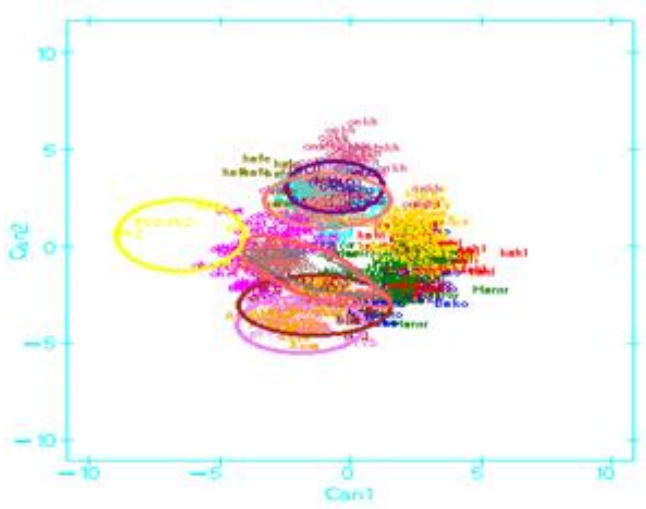

Figure 3: Projection of the average points of local and imported fig varieties on the first factor of a main component analysis. (Light *pink circle: imported 02 BS; dark pink circle: imported XYSS; Yellow circle: imported FYZ THR; grey circle: imported XXSS; brown circle: imported 06 DJ; purple circle: imported YYSS; dark purple circle: imported 04 DJ*

Factors determining the identification of local varieties.

In order to identify the factors that discriminate each local varieties of fig, we used the STEPDISC procedure in the publisher of SAS version 9. The results obtained show that the factors determining the identity of different local varieties, in descending order, are as follows: the skin color of the fruit, with R 2.00-0.79; followed by the length of the fruit (R^2-0.56). The third factor is the type of apical connection, with R^2-0.53. Last, we found the number of sheets per shoot with R^2-0.50**, (Table 7).**

These results confirmed our remarks in the field, where figs most often used fruit-binding characteristics to distinguish varieties from fig trees, and the density of the tree is also used to identify cultivars; this confirms that these factors have been well selected and can be used officially for varietal identification.

Grouping of homogeneous varieties

The four factors that discriminate different varieties allowed us to group them according to each factor:

Consistent varieties by skin color of fruit

The grouping of homogeneous varieties according to the skin color of the fruit is achieved by the use of a generalized linear model, with the comparison of the two-to-two averages by the use of the DUNCAN WALLER test. The grouping showed that the four local varieties Hamra, Bakor, Bouafasse and Kahla have a similar fruit skin color. The second group is represented by Onk hemam. In the third group, Assal variety. The fourth group includes three varieties, namely Chetoui, Beyda and Hafer ejemal.

Consistent varieties by fruit length

The results of the groupings obtained indicate that local varieties are classified into five distinct groups. This classification is based on the length of the fruit. The first group includes two varieties, Onk hemam and Bakor. The second group is represented by Bouafasse. The third group shows that the three varieties Chetoui, Hafer ejemal and Beyda are similar. The fourth group includes two varieties, Assal and Kahla. Finally, in the fifth group consists of only Hamra variety.

Table 6. Square distances (D^2) between local and imported varieties (two-to-two comparison).

	Squared Distance to variete															
	Bayda espaniol	04DJ	6 DJ	Assal	Bakor	Beyda	Khadra Baraniya	Hamra	IMPXY	XXSS	bouafasse	chetoui	hafer ejemal	kahla	onk hemam	pYYSS
Bayda espaniol	0	47.75720	51.52692	53.70118	67.71483	11.73879	169.82944	39.27181	47.07840	52.12569	51.17916	41.28021	60.32147	44.22096	55.39040	69.32144
04DJ		0	65.42505	58.37397	67.99160	24.16744	205.89897	43.70296	57.77365	53.23485	47.30526	31.73492	42.52723	42.22835	47.26164	106.46497
6 DJ			0	21.35208	43.00386	46.28156	136.45796	28.08102	21.23314	27.42534	40.46473	36.28452	77.73807	41.02550	69.28882	17.96246
Assal				0	55.76004	42.89859	179.03553	31.99217	37.51763	39.85532	52.03862	26.74021	70.65223	40.05450	91.25689	38.29215
Bakor					0	57.60695	219.19601	41.22188	46.56953	40.26095	40.13935	58.35744	108.89392	41.86404	73.84198	66.49553
Beyda						0	164.56669	32.20941	38.88606	40.55787	37.96662	25.51231	35.39174	30.13213	37.90503	71.34414
Khadra Baraniya							0	193.87281	126.03507	128.89451	170.33734	155.65893	148.28373	201.86846	171.94632	133.32046
Hamra								0	33.39130	46.71022	31.18172	35.17080	74.00608	7.49003	60.86276	52.14246
IMPXY									0	11.64465	48.62388	26.32073	62.61147	39.85417	63.84082	33.81720
XXSS										0	46.11656	28.55792	55.02333	52.95020	58.18344	35.96988
bouafasse											0	56.31827	61.48752	25.77302	40.84064	56.91889
chetoui												0	39.10740	42.06232	59.77305	51.38427
hafer ejemal													0	68.79790	49.43974	88.44325
kahla														0	60.77901	65.93422
onk hemam															0	92.78973
pYYSS																0

Table 7: Results of the STEPDISC procedure used to identify the determining factors

Character	R partial square	Value F	Pr > F	LANBDA DE wILK	Pr < Lanbda	Squared canonical correlation	Pr > ASCC
CLPOFR	0.7990	224.56	<.0001	0.20102773	<.0001	0.09987153	<.0001
LGFR	0.5634	72.75	<.0001	0.08776886	<.0001	0.17028004	<.0001
BRAPPL	0.5316	63.84	<.0001	0.04110916	<.0001	0.23651597	<.0001
NFTRPL	0.5030	56.80	<.0001	0.02043124	<.0001	0.29376730	<.0001
LONGF	0.3650	32.19	<.0001	0.01297326	<.0001	0.32157535	<.0001
HPL	0.2870	22.50	<.0001	0.00924946	<.0001	0.35307361	<.0001
CLOST	0.2433	17.92	<.0001	0.00699918	<.0001	0.37304554	<.0001
PTLF	0.2291	16.53	<.0001	0.00539586	<.0001	0.39667222	<.0001
FACEPFR	0.2197	15.63	<.0001	0.00421025	<.0001	0.41658349	<.0001
FORMF	0.1800	12.15	<.0001	0.00345249	<.0001	0.43063494	<.0001
LNTFR	0.1734	11.59	<.0001	0.00285388	<.0001	0.44716634	<.0001
POIFR	0.1654	10.93	<.0001	0.00238180	<.0001	0.45975362	<.0001
FORMFR	0.1775	11.87	<.0001	0.00195892	<.0001	0.47283543	<.0001
LARGF	0.1369	8.71	<.0001	0.00169068	<.0001	0.47927057	<.0001
PTLF	0.1366	8.66	<.0001	0.00145977	<.0001	0.48853424	<.0001
FORMPL	0.1344	8.48	<.0001	0.00126352	<.0001	0.49804623	<.0001
SURFCHRF	0.1179	7.28	<.0001	0.00111457	<.0001	0.50431469	<.0001
NVRMPL	0.1153	7.09	<.0001	0.00098603	<.0001	0.50939889	<.0001
FBASF	0.1091	6.64	<.0001	0.00087847	<.0001	0.51627023	<.0001
FLOBF	0.0976	5.86	<.0001	0.00079271	<.0001	0.52132520	<.0001
DTLMRGE	0.0922	5.49	<.0001	0.00071959	<.0001	0.52524070	<.0001
NLOBF	0.0868	5.12	<.0001	0.00065717	<.0001	0.52942272	<.0001
CRPOFR	0.845	4.96	<.0001	0.00060163	<.0001	0.53409347	<.0001
CLF	0.766	4.45	<.0001	0.00055556	<.0001	0.53771885	<.0001
VNTF	0.0611	3.48	0.0007	0.00052159	<.0001	0.54126440	<.0001
CLPTLF	0.0490	2.75	0.0058	0.00049606	<.0001	0.54365146	<.0001
SURCVFR	0.0461	2.57	0.0095	0.00047320	<.0001	0.54544684	<.0001
FRMPOFR	0.0427	2.37	0.0168	0.00045301	<.0001	0.54925801	<.0001
SCRFR	0.0371	2.04	0.0402	0.00043619	<.0001	0.55105289	<.0001
CLBRPL	0.0320	1.75	0.0860	0.00042224	<.0001	0.55329294	<.0001

Homogeneous varieties by apical connections

The results of the grouping obtained indicate that the local varieties are classified into three distinct groups. This classification is based on the apical branches of the tree. The first group includes five varieties, Onk hemam, Kahla, Beyda, Bouafasse, and Hafer ejemal. The second group is represented by Hamra. The last group shows that the three varieties Bakor, Chetoui, and Assal are similar.

Homogeneous varieties by number of leaves per shoot

The results of the grouping obtained indicate that the local varieties are classified into five distinct groups. This classification is based on the number of leaves per shoot. The first group is represented by the Assal variety. The second group contains the Bouafasse variety. The third group brings together the two varieties: Kahla and Hamra. The fourth group brings together the varieties: Bayda, Bakor, Hafer Ejemal, and Onk Hemam. Finally, in the last group, we have the Chetoui variety.

Conclusion

Our study aims to characterize and compare different varieties of fig trees existing in the Tlemcen region (local and imported varieties). We based our morphological description of the tree on the

vegetative and reproductive parts of the fig tree. These morphological parameters that we have used are described in the international descriptor of the IPGRI (International Plant Genetic Resources Institute) and CIHEAM (International Center for Mediterranean Agricultural Studies). The use of the results of statistical analyses of the morphological, qualitative, and quantitative data in this study showed that there are significant phenotypic differences between the varieties studied. The results of the principal component analysis (PCA) separated the populations of fig trees studied into 9 distinct groups for local varieties. This reflects the wide variety that exists for this resource at the prospecting region level. The two-to-two comparison between these local varieties, as well as the estimate of square distances between these varieties, showed that there is a very highly significant difference between all local varieties ($P<0.001$). The value of the highest D2 distance is noted between the two varieties Bakor and Hafer ejemal, indicating that these two varieties are the two most morphologically distant local varieties (D^2-130.30). The lowest value (between Kahla and Hamra) indicates that the two Kahla and Hamra varieties are the two most morphologically identical local varieties (D2-7.11). This remoteness and morphological approximation between the study varieties may also have been due to a genetic phenomenon. Comparison of local and imported variety populations separated populations into 16 distinct groups. The results of the distance allowed us to infer that the imported variety Khadra Baraniya (01 FYZ) does not resemble any population of local varieties. On the other hand, the imported variety Spanish Bayda morphologically resembles the local variety Beyda (D^2-11.73). This fact shows that the different imported varieties apart from the Khadra Baraniya variety not due to be introduced because it does not bring a plus to the existing potentials and may be on the contrary the origin of the introduction to the level of our genetic potential of allelic variant sensitive to local agroecological conditions. Factors discriminate local varieties, in descending order, are as follows: The skin color of the fruit, followed by the length of fruit, then apical branching and finally the number of leaves per shoot. The rest of the variables do not differentiate between varieties. This result clearly shows that the identification of cultivars by farmers according to their traditional knowledge is consistent with the results of this study and therefore very effective. As a result, homogeneous varieties were grouped according to each factor. This study has therefore provided an important tool for varietal identification for the scientific community. In this study, the approach used for statistical analysis of morphological, qualitative, and quantitative characterization data facilitated the distinction of nine varieties into well-individualized groups, based on all the most discriminating traits identified on the 33 morphological traits (24 qualitative and 9 quantitative) selected. This morpho-biometric description and identification of existing fig varieties in the Tlemcen region, can be considered as a complementary approach and a starting point for other characterization methods. Nevertheless, molecular characterization is necessary for the identification of fig varieties to be more accurate as well as to demonstrate the genetic richness of fig cultivars in the region. However, during our field survey and exploration we detected several threats of this biodiversity that are mainly socio-commercial; on the one hand we have the problem of homonymy and synonym, the aging of trees and the neglect of orchards. On the other hand, the lack of marketing strategy and the enhancement of varieties in the region which also bring farmers to variety imports that was in most cases not justified according to our study. This conclusion sounds the death knell for important measures to be taken in terms of the management of this resource which must continue more regions in Algeria with more varieties, but above all implement by a molecular study.

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Appendix 1

Table 1: Percentage of qualitative character distribution at the variety studied level.

Variety	Variable	Min	Max	Average	Standard deviation
Bakor	Weight of the fruit	42g	82g	60.2g	10.6g
	Fruit length	5.05 cm	7.96 cm	6.6 cm	0.7 cm
	Fruit width	2.84 cm	5.29 cm	4.16 cm	0.56 cm
	Ostiole surface	0.15 cm^2	1.41 cm^2	0.49 cm^2	0.25 cm^2
	Fruit pulpit surface	5.29 cm^2	26.45 cm^2	14.75 cm^2	5.45 cm^2
	Cavity surface	0 cm^2	2.49 cm^2	0.68 cm^2	0.6 cm^2
	Leaf length	11.88 cm	23.36 cm	15.87 cm	3.08 cm
	Leaf width	10.27 cm	23.09 cm	15.12 cm	3.28 cm
	Petiole	4.65 cm	13.07 cm	8.03 cm	2.06 cm
Kahla	Weight of the fruit	11g	46g	25.47 cm^2	5.27g
	Length	2.79 cm	5.81cm	4.27 cm^2	0.66 cm
	Fruit width	2.77 cm	4.9 cm	3.84 cm^2	0.44 cm
	Ostiole surface	0.1 cm^2	1.28cm^2	0.94 cm^2	6.77 cm^2
	Fruit pulpit surface	2.15 cm^2	19.37 cm^2	9.33 cm^2	3.92 cm^2
	Cavity surface	0 cm^2	1.22 cm^2	0.34 cm^2	0.27 cm^2
	Leaf length	10.11 cm	26.36 cm	16.36 cm	3.15 cm
	Leaf width	9.39 cm	22.85 cm	14.38 cm	2.74 cm
	Petiole	5.15 cm	12.15 cm	7.46 cm	1.97 cm
Hamra	Weight of the fruit	12g	39g	22.13g	5.01g
	Length	2.72cm	5.59cm	3.90 cm	0.49cm
	Fruit width	2.75cm	4.43cm	3.67 cm	0.31cm
	Ostiole surface	0.09 cm^2	1.90 cm^2	0.46 cm^2	0.38 cm^2
	Fruit pulpit surface	4.86 cm^2	20.36 cm^2	10.63 cm^2	4.13 cm^2
	Cavity surface	0 cm^2	2.80 cm^2	0.41 cm^2	0.4 cm^2
	Leaf length	11.18 cm	29.09 cm	16.84 cm	4.15 cm
	Leaf width	9.39 cm	25.35 cm	13.10 cm	3.74 cm
	Petiole	3.35 cm	11.39 cm	7.76 cm	2.38 cm
Beyda	Weight of the fruit	10g	74g	32.71g	10.78g
	Length	2.55 c	8.16 cm	50.3 cm	0.86 cm
	Fruit width	2.36 cm	5.85 cm	4.25 cm	0.62 cm
	Ostiole surface	0.03 cm^2	2.84	0.42 cm^2	0.33 cm^2
	Fruit pulpit surface	3.39 cm^2	19.35 cm^2	9.10 cm^2	3.44 cm^2
	Cavity surface	0 cm^2	0.99 cm^2	0.21 cm^2	0.23 cm^2
	Leaf length	12.36 cm	28.29 cm	17.59 cm	3.55 cm
	Leaf width	6.97 cm	22.95 cm	15.10 cm	3.37 cm
	Petiole	1.00 cm	22.27 cm	2.21 cm	2.54 cm
Charles	Weight of the fruit	15g	77g	36.50g	13.11g
	Length	3.19cm	7.52 cm	5.30 cm	0.98cm
	Fruit width	3.17cm	6.45cm	4.59 cm	0.69cm
	Ostiole surface	0.07 cm^2	4.44 cm^2	0.68 cm^2	0.56 cm^2
	Fruit pulpit surface	0.42 cm^2	30.38 cm^2	11.92 cm^2	7.15 cm^2
	Cavity surface	0 cm^2	2.07 cm^2	0.8 cm^2	0.39 cm^2
	Leaf length	10.60 cm	20.31 cm	14.52 cm	2.02 cm
	Leaf width	9.45 cm	19.38 cm	12.69 cm	2.44 cm
	Petiole	4.19 cm	9.66 cm	6.55 cm	1.37 cm
Assal	Weight of the fruit	14g	42g	25.42g	6.17g
	Length	3.22cm	5.67 cm	4.41 cm	0.49 cm
	Fruit width	2.86 cm	5.24 cm	3.85 cm	0.42 cm
	Ostiole surface	0.11 cm^2	1.12 cm^2	0.43 cm^2	0.17 cm^2
	Fruit pulpit surface	4.37 cm^2	14.56 cm^2	7.91 cm^2	1.77 cm^2
	Cavity surface	0 cm^2	0.97 cm^2	0.31 cm^2	0.21 cm^2
	Leaf length	10.93 cm	17.92 cm	14.13 cm	1.70 cm
	Leaf width	9.28 cm	16.21 cm	12.57 cm	2.08 cm
	Petiole	4.02 cm	8.37 cm	5.86 cm	1.16 cm
Bouafasse	Weight of the fruit	20g	88g	46.09g	15.70g
	Length	4.06 cm	7.06 cm	5.76 cm	0.91 cm
	Fruit width	3.11 cm	7.03 cm	4.77 cm	0.77 cm
	Ostiole surface	0.04 cm^2	1.41 cm^2	0.35 cm^2	0.30 cm^2
	Fruit pulpit surface	2.99 cm^2	25.13 cm^2	13.61 cm^2	5.84 cm^2
	Cavity surface	0 cm^2	1.54 cm^2	0.37 cm^2	0.40 cm^2
	Leaf length	15.39 cm	28.17 cm	21.67 cm	2.53 cm
	Leaf width	14.12 cm	26.41 cm	20.98 cm	2.11 cm
	Petiole	4.41 cm	10.51 cm	7.97 cm	1.12 cm

Onk hemam	Weight of the fruit	21g	74g	42.57g	13.14g
	Length	4.07 cm	8.87 cm	6.32 cm	0.95 cm
	Fruit width	3.35 cm	6.38 cm	4.75 cm	0.67 cm
	Ostiole surface	0.13 cm^2	1.10 cm^2	0.46 cm^2	0.20 cm^2
	Fruit pulpit surface	3.23 cm^2	12.88cm^2	3.38 cm^2	2.28 cm^2
	Cavity surface	0 cm^2	0.41 cm^2	0.03 cm^2	0.08 cm^2
	Leaf length	17.13 cm	36.81 cm	23.80 cm	4.19 cm
	Leaf width	13.12 cm	25.53 cm	19.06 cm	2.69 cm
	Petiole	7.18 cm	13.32 cm	10.84 cm	1.59 cm
Hafer Ejemal	Weight of the fruit	35g	63g	53.12g	9.09g
	Length	3.73cm	6.31 cm	5.29 cm	0.87 cm
	Fruit width	4.75 cm	6.82 cm	5.91 cm	0.68 cm
	Ostiole surface	0.35 cm^2	0.79 cm^2	0.53 cm^2	0.17 cm^2
	Fruit pulpit surface	9.61 cm^2	17.85cm^2	13.44 cm^2	2.94cm^2
	Cavity surface	0.12 cm^2	1.09 cm^2	0.54 cm^2	0.29 cm^2
	Leaf length	20.08 cm	26.03 cm	22.28 cm	1.89 cm
	Leaf width	17.98 cm	22.80 cm	19.8 cm	1.70 cm
	Petiole	5.99 cm	10.55 cm	8.62 cm	1.56 cm
Imported 01 (Khadra baraniya)	Weight of the fruit	39g	59g	46.66g	7.84g
	Length	7.01 cm	9.87 cm	8.79 cm	1.18 cm
	Fruit width	4.7 cm	8.96 cm	7.22 cm	1.56 cm
	Ostiole surface	1.08 cm^2	2.56 cm^2	1.47 cm^2	0.55 cm^2
	Fruit pulpit surface	16.17 cm^2	36.65 cm^2	26 cm^2	8.27 cm^2
	Cavity surface	0.89 cm^2	1.43 cm^2	0.93 cm^2	0.36 cm^2
	leaf length	24.43 cm	30.38 cm	26.27 cm	1.29 cm
	leaf width	7.34 cm	34.65 cm	27.7 cm	6.46 cm
	Petiole	13.6 cm	23.79 cm	15.57 cm	2.02 cm
Imported 02 (bayda espangiol)	Weight of the fruit	19g	62g	41.29g	11.08g
	Length	3.87 cm	6.1 cm	5.16 cm	0.53 cm
	Fruit width	3.2 cm	5.78 cm	4.54 cm	0.62 cm
	Ostiole surface	0.28 cm^2	0.94 cm^2	0.62 cm^2	0.19 cm^2
	Fruit pulpit surface	8.32 cm^2	24.45cm^2	15.68 cm^2	3.67 cm^2
	Cavity surface	0 cm^2	3.07 cm^2	0.49 cm^2	0.73 cm^2
	Leaf length	17.18 cm	19.98 cm	18.25 cm	0.91 cm
	Leaf width	11.81 cm	17.41 cm	14.14 cm	1.63 cm
	Petiole	7.06 cm	12.24 cm	9.84 cm	1.30 cm
Imported 03 (chetoui espaniol brunette)	Weight of the fruit	23g	69g	40.32g	9.68g
	Length	3.95 cm	6.69 cm	5.35 cm	0.73 cm
	Fruit width	3.85 cm	5.91 cm	4.87 cm	0.47 cm
	Ostiole surface	0.27 cm^2	1.56 cm^2	0.61 cm^2	0.27 cm^2
	Fruit pulpit surface	7.95 cm^2	20.35 cm^2	13.83 cm^2	2.88 cm^2
	Cavity surface	0 cm^2	1.81 cm^2	0.46 cm^2	0.42 cm^2
	Leaf length	15.16 cm	7.32 cm	16.52 cm	1.23 cm
	leaf width	14.32 cm	19.02 cm	16.36 cm	1.59 cm
	Petiole	5.92 cm	9.03 cm	6.95 cm	0.99 cm
Imported 04 (chetoui espaniol)	Weight of the fruit	25g	97g	39.11g	11.87g
	Length	4.19 cm	6.08 cm	5.21 cm	0.58 cm
	Fruit width	3.75 cm	5.99 cm	4.79 cm	0.53 cm
	Ostiole surface	0.27 cm^2	0.85 cm^2	0.55 cm^2	0.15 cm^2
	Fruit pulpit surface	7.46 cm^2	18.52cm^2	12.21 cm^2	2.86 cm^2
	Cavity surface	0 cm^2	0.77 cm^2	$cm^2$0.23	0.21 cm^2
	Leaf length	15.1 cm	20.39 cm	17.35 cm	1.38 cm
	leaf width	15.21 cm	20.90 cm	17.77 cm	1.48 cm
	Petiole	7.02 cm	12.38 cm	9.45 cm	2.08 cm
Imported 05 (Zeriki)	Weight of the fruit	18g	54g	27.67g	7.88g
	Length	4.32 cm	6.62 cm	5.15 cm	0.55 cm
	Fruit width	3.2 cm	4.98 cm	3.88 cm	0.44 cm
	Ostiole surface	0.16 cm^2	0.83 cm^2	0.33 cm^2	0.14 cm^2
	Fruit pulpit surface	6.32 cm^2	14.79 cm^2	8.53 cm^2	1.94 cm^2
	Cavity surface	0 cm^2	2.43 cm^2	0.31 cm^2	0.43 cm^2
	leaf length	16.52 cm	19.89 cm	17.98 cm	0.86 cm
	leaf width	15.36 cm	7.27 cm	17.28 cm	0.95 cm
	Petiole	7.96 cm	13.68 cm	9.71 cm	1.95 cm

Appendix 2

Table 2: Percentage of qualitative character distribution at the variety studied

Variety	Character	Variable	%
Bakor	Shape of the Tree	Erect	50
		Semi-erect	34
		Open	18
	Tree Vigour	Intermediate	80
		High	20
	Apicale Branch	Absent	80
		Present	20
	Ramification Level	Separate	80
		Intermediate	20
	Color of Branches	Brown	80
		Black Brown	20
	Number of Leaves per shoot	4-8	100
	Skin Color	Black	94
		Black Spotted Brown	4
		Black Spotted In Green	2
	Shape of the fruit	Bell	88
		Oval	12
	Ostiole Color	Pink	46
		Yellow	26
		Red	10
		Transparent	8
		Rose White	8
	Shape of Peduncle	Differently Expanded (A-E)	50
		Long And Thin	28
		Short And Thick	22
	Easy peeling	Hard	38
		Medium	38
		Easy	24
	Fruit Skin Cracks	Absent	94
		Rare Cracks	6
	Firmness of the Fruit Skin	Sweet	45
		Medium Firmness	30
		Farm	18
		Rubber	8
	Lenticel	Many	62
		Medium	34
		Rare	4
	Color Lenticels	Pink	62
		White	38
	Fruit Flavour	Aromatic	60
		Little	30
		Strong	6
		Neutral	4
	Leaf Shape	B	35
		Has	33
		C	8
		D	8
		E	8
		F	8
	Number of Lobes	5 Lobes	60
		3 Lobes	40
	Shape of Lobe	Spatulated	78
		Lanceolate	10
		Linear	8
		Lyré	5
	Shape of Leaf base	Auriculated	88
		Corded	8
		Haste	5
	Dentition of the edges of the Leaf	Crenellated	68
		Absent	25
		Toothed	8

	Leaf Nervation	Effective	55
		Inapparente	35
		Slightly Apparent	10
	Leaves Color	Dark Green	70
		Green	30
	Petiole Color	Green	68
		Brown	17
		Pink	10
		Yellowish Green	5
Kahla 	Shape of the Tree	Open	18
		Semi-Spreads	50
		Spread	34
	Tree Vigour	Intermediate	60
		Raise	40
	Apicale Branch	This	100
	Ramification Level	Intermediate	80
		Dense	20
	Color of Branches	Grey	60
		Grey Black	20
		Brown- Black	20
	Number of Leaves Per shoot	9-12	60
		4-8	40
	Skin Color	Black	84
		Purple	4
		Green	3
		Mauve, Green Spots	3
		Brown and Red	6
	Shape of the Fruit	Rounded	65
		Oval	22
		Bell	13
	Ostioles Color	Red	33
		Pink	32
		Black	20
		Black, Red	9
		Transparent	3
		Red Rose	3
	Shape of Peduncule	Differently Expanded	56
		Short and Thick	39
		Long and Thin	5
	Easy of Peeling	Hard	39
		Easy	35
		Medium	26
	Fruit Skin cracks	Cracks Minutes	62
		Rare Cracks	31
		Absent	7
	Firmness of the fruit skin	Medium Firmness	43
		Rubber	24
		Farm	19
		Sweet	14
	Number of Lenticel	Many	67
		Medium	30
		Rare	4
	Color of Lenticel	Pink	72
		White	28
	Fruit Flavor	Aromatic	55
		Little	33
		Strong	7
		Neutral	5
	Leaf Shape	B	27
		C	13
		D	32
		E	21
		F	3
	Number of Lobes	5 Lobes	49
		3 Lobes	44
		4 Lobes	7
	shape of Lobe	Spatulated	56
		Linear	20

		Lanceolate	16
		Lyré	6
	Shape of Leaf Base	Corded	40
		Auriculated	39
		Truncated	19
		Rounded	2
	Dentition of the edges of the Leaf	Finely Crenellated	47
		Toothed	30
		Absent	24
	Leaf nervation	Slightly Apparent	65
		Inapparente	24
		Effective	11
	Color Leaf	Dark Green	51
		Green	40
		Light Green	9
	Petiole Color	Brown	39
		Yellowish Green	29
		Green	22
		Pink	11
Hamra	Shape of the Tree	Spread	60
		Open	40
	Tree Vigour	Intermediate	60
		Raise	40
	Apicale Branch	This	100
	Ramification Level	Intermediate	100
	Color of Branches	Grey	80
		Grey Black	20
	Number of Leaves Per shoot	4-8	60
		9-12	40
	Skin Color	Brown	56
		Purple	28
		Green or Mauve	16
	Shape of the fruit	Rounded	73
		Bell	24
		Oval	3
	Ostioles Color	Pink	51
		Transparent	32
		Red	7
		Yellow	6
		Yellow Rose	4
	Shape of Peduncule	Short and Thick	55
		Differently Expanded	32
		Long and Thin	13
	Easy of Peeling	Hard	50
		Medium	34
		Easy	16
	Fruit Skin cracks	Cracks Minutes	48
		Absent	27
		Rare	26
	Skin color	Medium Firmness	42
		Rubber	30
		Sweet	17
		Farm	11
	Number of Lenticel	Medium	46
		Many	44
		Rare	10
	Color of Lenticel	Pink	79
		White	21
	Fruit Flavor	Aromatic	48
		Little	43
		Neutral	10
	Leaf Shape	B	8
		C	4
		D	6
		E	64
		F	11
		G	8
	Number of Lobes	3 Lobes	74

			4 Lobes	13
			5 Lobes	13
		shape of Lobe	Spatulated	47
			Lanceolate	28
			Linear	25
		Shape of Leaf Base	Truncated	55
			Corded	19
			Auriculated	17
			Stalled	9
		Dentition of the edges of the Leaf	Absent	51
			Toothed	34
			Finely Crenellated	15
		Leaf nervation	Effective	70
			Slightly Apparent	21
			Inapparente	10
		Leaf Color	Green	57
			Dark Green	43
		Petiole color	Yellowish Green	30
			Green	24
			Brown	22
			Green-Marron	13
			Pink	7
			Rose-Marron	4
Beyda		Shape of the Tree	Semi-Spreads	80
			Open	20
		Tree vigour	Intermediate	60
			Lows	40
		Apicale Branch	This	100
		Ramification Level	Dense	60
			Intermediate	40
		Color of Branches	Grey	80
			Grey-Black	20
		Number of Leaves Per shoot	4-8	100
		Skin Color	Greenish Clear	73
			Green	25
			Mauve Or Brown	1
		Shape of the fruit	Rounded	46
			Bell	45
			Oval	9
		Ostioles Color	Pink	40
			Yellow	31
			Transparent	24
			Black	5
		Shape of peduncle	Enlarged	58
			Short And Thick	32
			Long And Thin	10
		Easy of Peeling	Easy	46
			Medium	42
			Hard	12
		Fruit skin Cracks	Absent	75
			Cracks Minutes	18
			Rare	7
		Firmness of the fruit Skin	Medium	41
			Farm	10
			Sweet	17
			Rubber	2
		Number of Lenticel	Many	73
			Medium	24
			Rare	3
		Color of Lenticel	Pink	90
			White	10
		Fruit Flavor	Aromatic	48
			Little	35
			Strong	11
			Neutral	5
		Leaf Shape	B	31
			C	1
			D	21

		E	28
		G	14
	Number of Lobes	3 Lobes	56
		5 Lobes	42
		1 Lobe	3
	Shape of Lobe	Spatulated	64
		Linear	19
		Lanceolate	16
	Shape of leaf Base	Truncated	49
		Corded	32
		Auriculated	17
		Stalled	3
	Dentition of the edges of the Leaf	Toothed	73
		Finely Crenellated	22
		Absent	5
	Leaf nervation	Effective	71
		Slightly Apparent	6
		Inapparente	12
	Color Leaf	Green	52
		Dark Greens	44
		Light Green	4
	Petiole color	Green	48
		Yellowish Green	32
		Brown	12
		Green-Marron	8
Chetoui	Shape of Tree	Erect	60
		Open	20
		Semi-Spreads	20
	Tree vigour	Raise	80
		Intermediate	20
	Apicale Branch	Absent	80
		This	20
	Ramification Level	Separate	40
		Intermediate	40
		Dense	20
	Color of Branches	Grey	100
	Number of Leaves Per shoot	4-8	60
		4	40
	Skin Color	Green	98
		Brown, Green	2
	Shape of the fruit	Bell	58
		Rounded	27
		Oval	14
	Ostioles Color	Pink	61
		Transparent	20
		Yellow	16
		Pink	2
	Shape of pedencule	Differently Expanded	58
		Short and Thick	38
		Long and Thin	4
	Easy Peeling	Easy	61
		Medium	32
		Hard	7
	Fruit skin cracks	Absent	50
		Little	38
		Rare	10
		Cracks Minutes	2
	Firmness of the fruit Skin	Farm	45
		Medium	43
		Sweet	11
	Number of Lenticel	Many	81
		Medium	17
		Rare	2
	Color Lenticel	Pink	82
		White	18
	Fruit Flavor	Aromatic	70
		Little	17
		Strong	13

	Leaf Shape	B	18
		C	18
		D	1
		E	25
		G	38
	Number of lobes	3 Lobes	71
		5 Lobes	25
		4 Lobes	4
	Shape of Lobe	Spatulated	68
		Lanceolate	18
		Linear	14
	Shape of Leaf Base	Truncated	66
		Rounded	21
		Corded	8
		Stalled	5
	Dentition of the edges of the Leaf	Absent	55
		Finely Crenellated	27
		Toothed	18
	Leaf Nervation	Effective	51
		Slightly Apparent	44
	Color Leaf	Inapparente	5
		Dark Green	57
		Green	42
		Light Green	1
	Petiole Color	Yellowish Green	36
		Green	34
		Brown	12
		Pink	10
Assal	Shap of Tree	Open	60
		Semi-De erect	20
		Semi-Spreads	20
	Tree Vigour	Intermediate	80
		Raise	20
	Apicale Branch	Absent	80
		This	20
	Ramification Level	Dense	60
		Intermediate	40
	Color of Branches	Grey	80
		Black Grey	20
	Number of Leaves Per shoot	9-12	60
		12	40
	Skin Color	Green	43
		Green Spotted Mauve	29
		Green Spotted Brown	21
		White, Green	7
	Shape of the Fruit	Bell	44
		Rounded	40
		Oval	16
	Color Ostioles	Pink	49
		Transparent	25
		Yellow	17
	Shape of Pedencule	Enlarged	61
		Short and Thick	32
		Long and Thin	7
	Easy of Peeling	Easy	46
		Medium	29
		Hard	21
	Fruit Skin Craks	Absent	43
		Crack	29
		Cracks Minutes	20
		Rare	9
	Firmness of the Fruit Skin	Medium	38
		Farm	33
		Sweet	28
	Number of Lenticel	Many	75
		Medium	25
	Color Lenticel	Pink	74
		White	26

	Fruit Flavor	Aromatic	60
		Little	29
		Strong	10
	Leaf Shape	B	9
		C	2
		D	24
		E	30
		F	7
		A	28
	Number of Lobes	3 Lobes	65
		5 Lobes	30
		4 Lobes	6
	Shape of Leaf	Launched	59
		Spatulated	24
		Linear	17
	Shape of Leaf Base	Truncated	57
		Corded	26
		Auriculated	11
		Rounded	6
	Dentition of the edges of the Leaf	Absent	63
		Toothed	24
		Finely Crenellated	13
	Nervation	Inapparente	66
		Slightly Apparent	25
		Effective	8
	Leaf Color	Dark Green	89
		Green	11
	Petiole Color	Yellowish Green	63
		Brown	17
		Green	9
		Green-Marron	7
		Pink	4
Bouafasse 	Shap of Tree	Open	80
		Semi-De erect	10
		Semi-Spreads	10
	Tree Vigour	High	80
		Intermediate	20
	Apicale Branch	Present	100
	Ramification Level	Dense	60
		Intermediate	40
	Color of Branches	Grey	60
		Grey brown	20
		Grey green	20
	Number of Leaves Per shoot	4-8	60
		9-12	20
		>12	20
	Skin Color	Black	100
	Shape of the Fruit	Bell	91
		Oval	9
	Color Ostioles	Red	46
		Black	32
		Transparent	8
		Pink	8
		Yellow	5
	Shape of Pedencule	Enlarged	74
		Short and Thick	26
	Easy of Peeling	Medium	45
		Easy	29
		Hard	26
	Fruit Skin Craks	Absent	65
		Cracks Minutes	19
		Rare	16
	Firmness of the Fruit Skin	Medium	52
		Sweet	39
		Farm	10
	Number of Lenticel	Many	87
		Medium	13
	Color Lenticel	Pink	81

		White	19
	Fruit Flavor	Aromatic	68
		Little	19
		Strong	13
	Leaf Shape	H	16
		D	15
		E	47
		G	23
	Number of Lobes	3 Lobes	82
		1 Lobes	15
		5 Lobes	2
	Shape of Leaf	Launched	79
		Spatulated	21
		Auriculated	52
	Shape of Leaf Base	Truncated	31
		Corded	13
		Hasty	5
	Dentition of the edges of the Leaf	Finely crenellated	47
		Toothed	44
		Absent	13
	Nervation	Apparent	50
		Slightly Apparent	47
		Inapparente	3
	Leaf Color	Dark Green	52
		Green	48
	Petiole Color	Yellowish Green	58
		Brown	39
		Green	2
		Green-Marron	2
Onk Hemam	Shap of Tree	Semi-De erect	100
	Tree Vigour	High	80
		Intermediate	20
	Apicale Branch	Present	100
	Ramification Level	Dense	60
		Intermediate	40
	Color of Branches	Grey	100
	Number of Leaves Per shoot	4-8	100
	Skin Color	Brown mauve	52
		mauve, green	18
		Mauve	14
		Brown, green	6
		mauve black	4
		Black-green- mauve	6
	Shape of the Fruit	Elongate	67
		Bell	28
		rounded	5
	Color Ostioles	White	36
		Transparent	36
		Pink	22
		Yellow	7
	Shape of Pedencule	Thick	74
		Enlarged	15
		Thin	11
	Easy of Peeling	Easy	41
		Medium	34
		Hard	25
	Fruit Skin Craks	Absent	62
		Cracks Minutes	33
		Longitudinales Rare	5
	Firmness of the Fruit Skin	Medium	36
		Farm	33
		Sweet	31
	Number of Lenticel	Rare	49
		Medium	50
		Many	3
	Color Lenticel	Pink	66
		White	34
	Fruit Flavor	Aromatic	57

		Little	38
		neutral	3
		Strong	2
	Leaf Shape	H	11
		E	39
		G	50
	Number of Lobes	3 Lobes	78
		1 Lobes	9
		7 Lobes	9
		2 lobes	3
	Shape of Leaf	Linear	69
		Launched	22
		Spatulated	9
	Shape of Leaf Base	Truncated	69
		Corded	22
		Rounded	9
	Dentition of the edges of the Leaf	Toothed	50
		Finely crenellated	31
		Absent	19
	Nervation	Apparent	44
		Slightly Apparent	56
	Leaf Color	Dark Green	56
		Green	41
		Yellowish Green	3
	Petiole Color	Green	25
		Yellowish Green	25
		Brown	16
		Green-Marron	16
		Pink	9
		Green, pink	6
		Pink, brown	3
Hafer Ejemal	Shape of the Tree	Spread	100
	Tree Vigour	Raise	100
	Apicale Branch	This	100
	Ramification Level	Dense	100
	Color of Branches	Brown	100
	Number of Leaves Per shoot	4-8	100
	Skin Color	Green	100
	Shape of Fruit	Bell	75
		Rounded	25
	Color Ostioles	Yellow	63
		Red	25
		Transparent	12
	Shape of Pedencule	Enlarged	75
		Short and Thick	25
	Easy of Peeling	Easy	63
		Medium	38
	Fruit Skin Craks	Absent	50
		Cracks Minutes	25
		Rare	25
	Firmness of the Fruit Skin	Medium	63
		Farm	38
	Lenticel	Many	75
		Rare	13
		Medium	12
	Color Lenticel	Pink	50
		White	50
	Fruit Flavor	Strong	50
		Aromatic	25
		Little	25
	Leaf Shape	B	42
		E	58
	Number of Lobes	3 Lobes	67
		5 Lobes	33
	Central Lobe Shape	Spatulated	83
		Launched	17
	shape of Leaf Base	Truncated	83
		Cordate	17

	Dentitions	Finely Crenellated	62
		Absent	23
		Toothed	15
	Nervation	Effective	58
		Slightly Apparent	42
	Leaf Color	Green	75
		Dark Green	17
		Yellowish Green	8
	Petiole Color	Yellowish Green	58
		Green	17
		Brown	17
		Pink	8
Imported 01 (Khadra baraniya)	Shape of the Tree	Open	100
	Tree Vigour	Intermediate	100
	Apicale Branch	Absent	100
	Ramification Level	Intermediate	60
		Dense	40
	Color of Branches	Grey	100
	Number of Leaves Per shoot	4-8	80
		9-12	20
	Skin Color	Green	67
		green, brown	17
		purple worm	17
	Shape of Fruit	Bell	83
		Rounded	17
	Color Ostioles	Pink	85
		Red	15
	Shape of Pedencule	Enlarged	66
		short and thick	44
	Easy of Peeling	Medium	67
		Easy	17
		Hard	17
	Fruit Skin Craks	Rare	80
		Absent	6
	Firmness of the Fruit Skin	Medium	45
		Sweet	33
		Farm	22
	Lenticel	Many	100
	Lenticel Color	Pink	35
		White	65
	Fruit Flavor	Little	67
		Aromatic	17
		Neutral	17
	Leaf Shape	D	36
		B	32
		E	23
		C	9
	Number of Lobes	5 lobes	70
		3 lobes	15
		4 lobes	10
		6 lobes	5
	Central Lobe Shape	Spatulated	86
		Linear	14
	Shape of Leaf Base	Truncated	40
		auriculé	36
		roped	24
	Dentitions	finely crenellated	60
		Toothed	40
	Nervation	Slightly apparent	82
		Effective	19
	Leaf Color	yellowish green	54
		Green	46
	Petiole Color	yellowish green	38
		Brown	15
		Pink	5
Imported 02 (Bayda espangiol)	Shape of the Tree	Semi-discarded	80
		Open	20
	Tree Vigour	Lows	60

	Intermediate	40
Apicale Branch	This	100
Ramification Level	Intermediate	100
Color of Branches	Grey black	100
Number of Leaves Per shoot	4-8	80
Skin Color	Green	78
	green mauve	22
Form	Rounded	59
	Bell	41
Color Ostioles	Yellow	45
	Pink	35
	Transparent	20
Shape of Pedencule	Enlarged	52
	Short and thick	47
Easy of Peeling	Medium	35
	Easy	35
	Hard	29
Fruit Skin Craks	Absence	65
	minutes of cracks	20
Firmness of the Fruit Skin	Sweet	47
	Farm	29
	Medium	24
Lenticel	Many	88
	Medium	6
	Rare	6
Lenticel Color	Pink	94
	White	6
Fruit Flavor	Neutral	59
	Little	41
Leaf Shape	C	40
	E	40
	H	20
Number of Lobes	1 lobe	45
	5 lobes	27
	3 lobes	27
Central Lobe Shape	Spatulated	66
	Lanceolate	26
	Linear	7
Shape of Leaf Base	Truncated	100
Dentitions	Absence	47
	finely crenellated	33
	Toothed	20
Nervation	Effective	78
	Inapparent	17
	Slightly apparent	6
Leaf Color	dark green	48
	yellowish green	29
	Green	24
Petiole Color	Green	56
	Yellowish green	38
	Brown, green	6

Shape of the Tree	Semi-discarded	100
Tree Vigour	Lows	60
	Intermediate	40
Apicale Branch	Absent	100
Ramification Level	Intermediate	100
Color of Branches	Grey	100
Number of Leaves Per shoot	9-12	100
Skin Color	Brown, green	38
	Purple	24
	Black	24
	Mauve, green	9
	Green, black	5
Shape of Fruit	Round	53
	Bell	44
	Oval	3
Color Ostioles	Pink	88
	Black	12

(chetoui espaniol brunette)	Shape of Pedencule	Courtyard and thick	71
		Long and thin	15
		Enlarged	15
	Easy of Peeling	Easy	44
		Medium	35
		Hard	21
	Fruit Skin Craks	Absence	53
		Rare	38
		minutes of cracks	9
	Firmnesse of the Fruit Skin	Medium	44
		Farm	32
		Sweet	21
		Rubber	3
	Lenticel	Many	79
		Medium	18
		Rare	3
	Lenticel Color	Pink	97
		White	3
	Fruit Flavor	Aromatic	57
		Strong flavour	19
		Little flavour	16
		Neutral	8
	Shape of Leaf	E	64
		C	21
		F	7
		A	7
	Number of Lobes	3 lobes	93
		5 lobes	7
	Central Lobe Shape	Spatulated	86
		Linear	7
		Lanceolate	7
	Shape of Leaf Base	Truncated	85
		Auriculated	7
		roped	7
	Dentitions	finely crenellated	36
		Toothed	36
		Absence	29
	Nervation	Slightly apparent	71
		Inapparente	29
	Leaf Color	Green	57
		dark green	43
	Petiole Color	Green	54
		yellowish green	15
		Brown, green	15
		Brown	15
Imported 04 (chetoui espaniol)	Shape of the Tree	Open	100
	Tree Vigour	Intermediate	80
		Raise	20
	Apicale Branch	Absent	60
		This	4
	Ramification Level	Separate	100
		Intermediate	20
	Color of Branches	Grey	80
		Grey black	20
	Number of Leaves Per Shoot	4-8	100
	Skin Color	Green	56
		Brown	22
		Green, brown	17
		Mauve, brown	6
	Shape of Fruit	Rounded	44
		Bell	44
		Oval	11
	Color Ostioles	Pink	79
		Yellow	17

		Transparent	6
	Shape of Pedencule	Short and thick	44
		Enlarged	39
		Long and thin	17
	Easy of Peeling	Easy	67
		Medium	28
		Hard	6
	Fruit Skin Craks	Absence	50
		minutes of cracks	33
		Rare	17
	Firmnesse of Fruit Skin	Farm	61
		Medium	33
		Sweet	6
	Lenticel	Many	61
		Medium	38
	Lenticel Color	Pink	94
		White	6
	Fruit Flavor	Aromatic	44
		Little flavor	39
		Strong flavor	17
	Shape of Leaf	C	31
		F	25
		B	19
		D	13
		A	13
	Number of Lobes	3 lobes	69
		5 lobes	31
	Central Lobe Shape	Spatulated	75
		Linear	19
		Lanceolate	6
	Shape of Leaf Base	Auriculated	69
		Haste	19
		Corded	13
	Dentitions	Absence	38
		finely crenellated	31
		Toothed	31
	Nervation	Slightly apparent	44
		Inapparente	38
		Effective	19
	Leaf Color	dark green	56
		Green	44
	Petiole Color	Green	69
		yellowish green	31
Imported 05 (Zeriki)	Shape of the Tree	Open	100
	Tree Vigour	Intermediate	100
	Apicale Branch	Absent	100
	Ramification Level	Intermediate	100
	Color of Branches	Grey	80
			20
	Number of Leaves Per Shoot	9-12	100
	Skin Color	Green mauve	50
		Black-mauve-green	29
		Green	15
	Shape of Fruit	Bell	73
		Rounded	27
	Color Ostioles	Transparent	41
		Pink	32
		Yellow	12
		Black	9
		Red	6
	Shape of Pedencule	Enlarged	44
		Short and thick	29
		Long and thin	26
	Easy of Peeling	Easy	50
		Medium	38
		Hard	12
	Fruit Skin Craks	Absence	91
		minutes of cracks	9

	Firmnesse of the Fruit Skin	Medium	53
		Farm	24
		Sweet	18
		Rubber	6
	Lenticel	Many	50
		Medium	44
		Rare	6
	Lenticel Color	Pink	65
		White	35
	Fruit Flavor	Aromatic	50
		Little flavor	44
		Neutral	6
	Shape of Leaf	D	50
		C	20
		E	20
		B	10
	Number of Lobes	3 lobes	50
		5 lobes	44
		4 lobes	6
	Central Lobe Shape	Spatulated	72
		Linear	22
		Lanceolate	6
	Shape of Leaf Base	Truncated	61
		Corded	39
	Dentition	finely crenellated	44
		Absence	39
		Toothed	17
	Nervation	Slightly apparent	67
		Effective	33
	Leaf Color	Green	56
		dark green	44
	Petiole Color	Green	50
		Yellowish green	28
		Green pink	11
		Green-Marron	6
		Brown yellow	5