



Prospecting and assessment of the local varieties of the fig (*Ficus carica L*) tree in Beni Ahmed area of Morocco

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ABSTRACT

The fig tree cultivation in Morocco is very old; this culture is very promising and still regaining interest. In objective to identify and characterize the riches of fig tree abroad prospection of fig tree plants was carried out in northwest Morocco during the period from 2015 to 2016. It included zones located in Beni ahmed as well as in the provinces of chefchaouen. A total of 203 accessions were sampled, studied and identified by used the biometric analyses include in European program GEN LMBO 029. As a result of the study a total of 20 different fig varieties were identified. Several synonymies and homonymies were detected. Comparison of the ecotype shows the high significatif difference. Conservation of the local cultivars is highly recommended.

Keywords: *fig tree, genetic resources, biometric analysis, beni ahmed, Morocco.*

INTRODUCTION

The fig tree (*Ficus carica L.*) is a diploid species ($2n = 26$) of the family Moraceae, well adapted to the bioclimatic conditions of the country of the Mediterranean basin. It is the only species of this family cultivated for its edible fruits [1], [2]. According to FAO statistics (2014), the majority of fig areas are in the Mediterranean Basin and Middle East. The largest fig tree area is in Morocco with 54,771 ha followed by Turkey with 49,464 ha, Algeria with 44,395 ha and Egypt with 28,501 ha [3].

In Morocco, the fig tree is a tree of great importance for the Moroccan population and which fulfills several functions: social, economic and environment [4]. Among the fruit crops, the fig tree occupies the fourth place after the olive, the rosacea with pips and rosacea with kernel (mainly almond). However, in the Northern region (Rif), the fig tree is one of the main agricultural resources and occupies the second place after the almond tree from the point of view of fruit plantations. The fig tree is considered in Morocco as a fruit species of secondary importance [5], [6]. However, at the regional scale and from the point of view of agro-diversity, its varietal diversity and its omnipresence designate it as one of the characteristic elements of the agro-ecosystems of the Rif Mountains [2], [7].

The regions in which the fig tree assumes economic importance are Taounate (22230 ha), Chefchaouen (7050 ha), Al Hoceima (5000 ha), Ouazzane (3150 ha), Tetouan (2000 ha) [8]. In Morocco, the

production of fresh figs in 2018 growing season for fresh consumption was approximately 57000 tons with a total area of 46000 hectares (ha) of fig plantations in Morocco [8]. Particularly, in rural area, fig production assumes economic importance mainly in Beni ahmed area. Surveys done in different regions of Morocco contributed to identify and describe numerous cultivars [9]; [10]; [11]; [12].

The first work concerning the pomological description of fig varieties has been done by Tayou in 1985 but from limited surveys to the Chefchaouen region. The evaluation of the morphological and pomological diversity of the fig tree in northern Morocco [13] showed that fig cultivars are highly diverse and provide a large collection of genotypes. However, because of many possible cases of synonymy and homonymy, the pomological characterization is insufficient for the establishment of reference genotypes of figs in Morocco.

This paper presents and identifies diversity of fig ecotype, comparing 20 cultivars from Beni Ahmed region. The aim of the work was to characterize the fruit of fig tree in limited zone of northwestern of morocco by the bimetric approach.

MATERIAL AND METHODS

Prospection and sampling have been carried out at different localities in Ben Ahmad region in Northwestern of morocco (fig. 1). In total 203 accessions were gathered. In many cases, either isolated plants or plants located at old fig plant ations areas were sampled (Table 1).

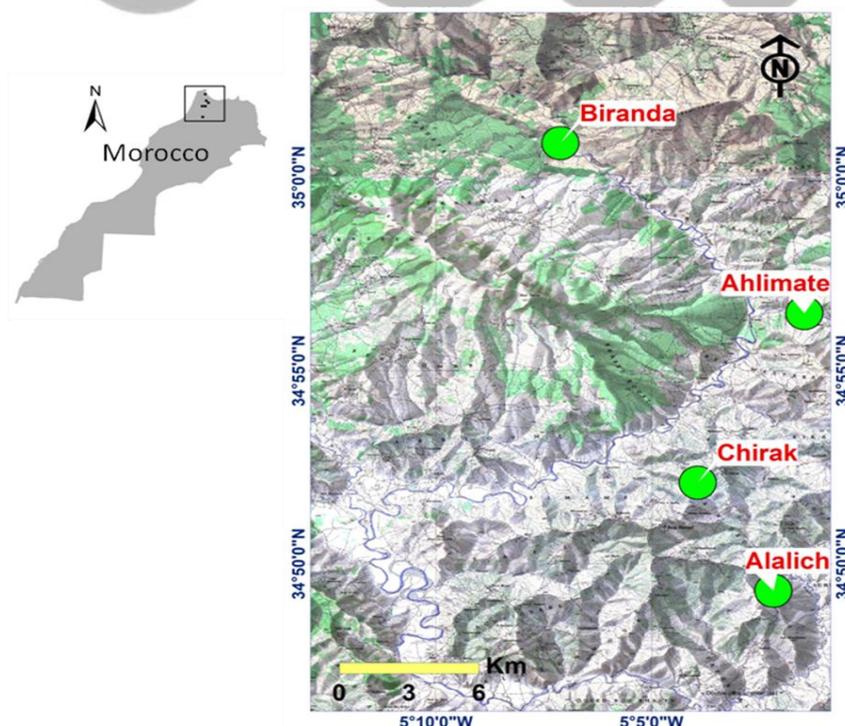


Fig. 1. Collection sites.

Table 1: Key data for location of prospecting sites

Number of ecotype	Douar	Caïdat	Locatlity	Altitude	Geographic coordinate
50	Alalich	Beni ahmed	Beni ahmed	337m	34°N -49,3' 0,5°W - 2,181
52	Ahlimate	Beni ahmed	Beni ahmed	383m	34°N - 56,489' 0,5°W - 1,460'
51	Chirak	Beni Ahmed	Beni Ahmed	537m	34°N - 52,098' 0,5°W - 03,933'
50	Biranda	Beni Ahmed	Beni Ahmed	437m	35°N - 0,885' 0,5°W - 7,115'

Plant material

Fig fruits from twenty cultivars (Al fasi, Lhmar, rhouddane, Lmessari, Qouiziya, Maqoutiya, Lqouti, Assal, Al hamra, Harchi, Lmdar, Aounq hmam, Rzilane, Lassoune, sebti, Tebantou, Zerqui, Tebal, Lbayad, Gouzi) were harvested from the five respective areas during cropping seasons 2015 and 2016. Cultivars were selected for their large distribution and their commercial value in the five regions. Samples of 203 homogenous fruits (three replicates of 50 fruits each) were chosen for each ecotype. Fruits were selected ripe and free from diseases.

Pomological characters

Biometric Approach

To examine the characteristics of the fruit for each ecotype, it was considered useful to approach a biometric study of the fruit based on the evaluation of the weight, caliber, dimensions and ostiole of the fruit. For each ecotype, a sample of twenty four fruits was randomly collected from different branches of the tree. Fruit weight was measured using a laboratory precision balance. Dimensions of the fruits such length, width, height and ostiole width were measured using a caliper (Fig. 2). The descriptors used were adapted list drawn up by European program GEN LMBO 029 [14].

General appearance of the fruit:

The general appearance of the fruit corresponds to its external form. In this aspect, we were interested in the shape and size of the fruit.

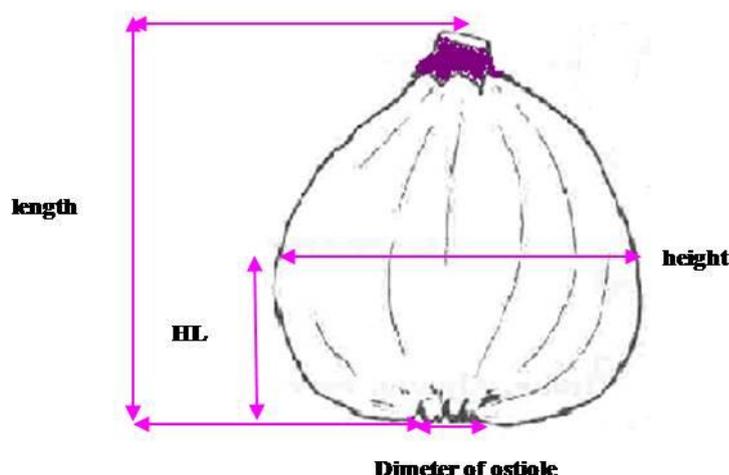


Fig 2: Representative diagram of measurements made on fig fruit

Fruit Shape

The fruits are of variable shape within the same tree and during the same season [15]. To avoid this hazard, we often rely on the presence or absence of neck. Other authors rely on three dimensions of the fruit to differentiate the varieties: the length C, the diameter D, and the distance A separating the base from the center of the circle of diameter D. The study of the shape of the fruit is important because it is related to the treatment that is applied to it. This is how the flattened shape with a short neck is ideal for canning. Other forms require certain precautions during transport; and others may facilitate the marketing of fresh fruits.

Statistical analysis

Comparison between the ecotype was made by statistical analysis of collected data. Statistical analyzes are performed with SPSS software version 21.

RESULT AND DISCUSSION

Many of the sampled accessions were collected either as unidentified or with local names. As result of the biometric approach the prospected plant material was characterized. 203 accessions were identified in Beni Ahmed region.

The average weight of the varieties studied varied from 13.70 g to 77.22 g (Table 2). The Sebti variety shows the highest weight while the Gouzi variety shows the lowest weight. The analysis of variance showed five homogeneous groups from the weight fruit. The variety Gouzi and Maqoutiya are

significantly not different for the parameter weight of fruit. The varieties Lmdar, Harchi, Lassoune, Rzilane, are significantly not different. The varieties Assal, Anounq hmam, Rhouddane, and Lqouti are significantly not different, also the variety Lmessarin Tebantou, Tebal, Al hamra, Zerqui, Lhmar, Lbayad, Quiziya and Al fasi are significantly not different. Only the variety Sebti how show the highest weight formed one group (Table 2).

The average length of the fruit varied between 2.91 cm and 5.04 cm (Table 2), the variety Zerqui showed the height value of the length of the fruit whereas the variety Lassoune showed the lowest value of the length of the fruit. We distinguished 11 groups significantly different from the Length of fruit (Table 2). The variety Aounq hmam, Lqouti, Al fasi and Al Hamra are not significantly different. Ferzaouia, Baghi assal are not significantly. The variety Harchi, Rzilane, Tebal, Tebantou, Rhouddane and Zerqui each one formed one group significantly different to the other group (Table 2).

The width of the fruit varied between 2.98 cm and 5.66 cm (Table 2), the Gouzi variety shows the weaker value of width fruit while the variety Sebti shows the greatest value of the width of the fruit (Fgi.5). The analyse of variance show seven groups significantly different from the width of fruit. the variety Lmessari, Assal, Lqouti, Zerqui, AL hamra, Lbayad, Al fasi, Tebal and Lhmar are significantly not different. The variety Rhouddane, Tebantou, Qouiziya and Sebti are singificalnty different from other variety for the parameter Width of fruit (Table 2).

The value of HL varied between 1.53 cm and 2.84 cm (Table 2), the variety Sebti shows the greatest value while the variety Gouzi shows the lowest value of HL. The variety Gouzi, Lmdar, Lassoune, Maqoutiya, Harchi and Rzilane are not significantly different. However, the variety Lbayad, Tebantou, Zerqui, Al hamra, qouiziya and Sebti are signifcalnty different from other groups (Table 2).

The diameter of the ostiole varied between 0.30 cm and 1.00 cm (Table 2) the variety Anounq hmam shows the smallest value of the diameter of the ostiole whereas the variety Sebti shows the greatest value of the diameter of the ostiole. The analysis of variance shows that the variety Harchi, Lassoune, Tebantou, Al fasi, Rzilane and Lmessari are not significantly different. The variety Assal, Lmdar, Lbayad, Qouiziya, Al hamra, Lhmar and Sebti was significantly different from other groups from diameter of ostiole (Table 2).

The length/ Width ratio of the fruit varies between 0.81 and 1.23 (Table 2), the greatest value of the length / width ratio of the fruit was observed in the Zerqui variety, while the lowest value was observed in the variety Sebti. The analysis of variance shows 12 groups significantly different. The variety Assal, Lmdar, Ak fasi, Rzilane, Al hamra, Lhmar, and Lqouti are significantly not different from the ratio

Length/width. The variety Tebal, Assal, Lmdar, Qouiziya, Tebantou, Maqoutiya, Rhouddane and Zerqui are significantly different from the parameter Length/width ratio (Table 2).

The length / HL of the fruit varied between 1.63 and 2.28 (Table 2), it is found that the variety Lassoune showed the lowest value of the ratio length / HL while the variety Rhouddane showed the most great value. Table 2 shows the varieties Rzilane, Lmdar, Lqouti, Harchi, Assal, Al fasi, Qouiziya, Aounq hamam and Lbayad are not significantly different (Table 2).

In these results, we find that the variety Sebti (Fig 3) showed the greatest value of the weight of the fruit, the width of the fruit and diameter of ostiole. And the Zerqui variety (Fig 4) showed the greatest value of the Length and Length/Width when the variety Rhouddane (Fig 5) show the high value of ration Length /HL. .

Table 2: Biometric characteristics of fig cultivars harvested from the region

	Weight (g)	Length (cm)	Width (cm)	HI (cm)	Diameter of ostiole (cm)	Length/Width	Length / HL
Al fasi	38,01 <i>cd</i>	3,89 <i>defg</i>	4,31 <i>def</i>	2,14 <i>efgh</i>	0,43 <i>abcd</i>	0,91 <i>abcde</i>	1,88 <i>abc</i>
Lhmar	36,55 <i>cd</i>	4,07 <i>efgh</i>	4,34 <i>def</i>	2,04 <i>cdefg</i>	0,83 <i>gh</i>	0,93 <i>abcde</i>	2,0 <i>bcdef</i>
Rhouddane	29,40 <i>bcd</i>	4,44 <i>gh</i>	3,73 <i>bcd</i>	1,96 <i>bcdef</i>	0,35 <i>abc</i>	1,18 <i>gh</i>	2,28 <i>e</i>
Lmessari	30,68 <i>cd</i>	4,08 <i>efgh</i>	3,98 <i>def</i>	1,91 <i>bcdef</i>	0,46 <i>abcd</i>	1,02 <i>cdef</i>	2,13 <i>cde</i>
Qouiziya	37,96 <i>cd</i>	4,61 <i>hi</i>	4,48 <i>f</i>	2,43 <i>h</i>	0,69 <i>efg</i>	1,02 <i>def</i>	1,91 <i>abc</i>
Maqoutiya	16,15 <i>a</i>	3,62 <i>cdef</i>	3,25 <i>a</i>	1,81 <i>a</i>	0,33 <i>a</i>	1,11 <i>fgh</i>	1,93 <i>abcd</i>
Lqouti	30,19 <i>bcd</i>	3,86 <i>defg</i>	4,07 <i>def</i>	2,07 <i>cdefg</i>	0,51 <i>abcde</i>	0,95 <i>abcde</i>	1,82 <i>abc</i>
Assal	28,20 <i>bcd</i>	3,65 <i>cdef</i>	4,05 <i>def</i>	1,99 <i>bcdef</i>	0,53 <i>bcde</i>	0,86 <i>abc</i>	1,85 <i>abc</i>
Al hamra	34,43 <i>cd</i>	3,91 <i>defg</i>	4,19 <i>def</i>	2,32 <i>gh</i>	0,74 <i>fg</i>	0,92 <i>abcde</i>	1,68 <i>ab</i>
Harchi	18,16 <i>ab</i>	3,36 <i>abcd</i>	3,28 <i>a</i>	1,82 <i>a</i>	0,36 <i>abcd</i>	1,02 <i>cdef</i>	1,84 <i>abc</i>
Lmdar	18,13 <i>ab</i>	3,07 <i>a</i>	3,37 <i>a</i>	1,71 <i>a</i>	0,56 <i>cdef</i>	0,90 <i>abcd</i>	1,79 <i>abc</i>
Aounq hmam	29,03 <i>bcd</i>	3,85 <i>defg</i>	3,85 <i>cde</i>	2,06 <i>cdefg</i>	0,30 <i>a</i>	1,01 <i>bcdef</i>	1,92 <i>abc</i>
Rzilane	24,18 <i>ab</i>	3,50 <i>bcde</i>	3,81 <i>cde</i>	1,82 <i>a</i>	0,43 <i>abcd</i>	0,91 <i>abcde</i>	1,78 <i>abc</i>
Lassoune	18,24 <i>ab</i>	2,91 <i>a</i>	3,40 <i>a</i>	1,78 <i>a</i>	0,37 <i>abcd</i>	0,85 <i>a</i>	1,63 <i>a</i>
Sebti	77,22 <i>e</i>	4,65 <i>hi</i>	5,66 <i>g</i>	2,84 <i>i</i>	1,00 <i>h</i>	0,81 <i>a</i>	1,63 <i>a</i>
Tebantou	31,29 <i>cd</i>	4,17 <i>fgh</i>	3,93 <i>de</i>	2,14 <i>defgh</i>	0,42 <i>abcd</i>	1,06 <i>efg</i>	1,95 <i>abcde</i>
Zerqui	35,00 <i>cd</i>	5,04 <i>i</i>	4,13 <i>def</i>	2,22 <i>fgh</i>	0,48 <i>abcde</i>	1,23 <i>h</i>	2,27 <i>de</i>
Tebal	33,20 <i>cd</i>	3,71 <i>def</i>	4,32 <i>def</i>	2,15 <i>efgh</i>	0,49 <i>abcde</i>	0,85 <i>ab</i>	1,72 <i>ab</i>
Lbayad	36,76 <i>cd</i>	3,60 <i>cdef</i>	4,26 <i>def</i>	1,88 <i>bcde</i>	0,58 <i>def</i>	0,84 <i>a</i>	1,92 <i>abc</i>
Gouzi	13,70 <i>a</i>	3,01 <i>a</i>	2,98 <i>a</i>	1,53 <i>a</i>	0,34 <i>abc</i>	1,0 <i>bcdef</i>	1,97 <i>abcde</i>
<i>Pa = 0.05</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>

Significant differences within the same column and means followed by the same letter do not differ at $P\alpha \leq 0.05$ according to Duncan test.



Fig 3. Variety Sebti from Beni ahmed Region



Fig 4: Variety Zerqui from Beni Ahmed region



Fig 5: variety Rhouddane from Beni ahmed region

CONCLUSIONS

The results of this study give us knowledge of diversity and pomological characteristics of the fig tree in Beni Ahmed region of Morocco. The plant material used corresponds to very old varieties or local denominations. Although the Prospection had been made on a limited area, it had shown the existence of a great varietal diversity in this region. Indeed, 20 “local varieties” were listed in this study and showed high biometric characteristics. The maintenance of this material for future use or reintroduction is of high interest. The minor varieties detected in the present study should be preserved in germplasm banks in order to prevent their extinction and maintain the biodiversity of the region.

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