CONTRIBUTION TO THE MORPHOMETRIC AND SYSTEMATIC STUDY OF *PISTACIA TEREBINTHUS* L. IN THE REGION OF TLEMCEN (CASE OF BENI SNOUS - EXTREME NORTHWEST ALGERIA)

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Abstract. *The Pistacia terebinthus* L., *is a species belonging to the family Anacardiaceae; a deciduous plant growing in the matorrals, common throughout the Mediterranean basin. The region of Tlemcen, an integral part of Mediterranean ecosystems, is characterized by several climatic and anthropic constraints that can influence the morphology of plant species. Following these constraints and recordings of some phenotypic variations in the station of Beni Snous, it seemed to us that there could be a new species or variety. The sampling adopted is of subjective type by taking into account the floristic homogeneity and the ecological homogeneity of the station. The choice of the station of Beni Snous was justified by the presence of good subjects of Pistacia terebinthus* L. *he most representative of the study area. In order to meet our objective, the morphometric analysis was performed on the leaves of 16 individuals, that is to say a total of 1126 leaves and 7837 leaflets measured. The statistical analysis of linear correlation, showed us the types of relationships that exist between the measured parameters. According to our results the length of the leaflets is between 3.3 cm and 4.93 cm and the width between 1.38 cm and 2.43 cm; and the number of leaflets in a leaf is on average between 5 and 11 leaflets. In conclusion, according to the analysis and the synthesis of our results of measurements on the one hand, and the comparison with the bibliography on the other hand, we confirmed that it is the same species.*

Keywords: *Pistacia terebinthus* L., *Beni Snous, Tlemcen, Morphometry, linear correlation, leaves, leaflets*

INTRODUCTION

It is known that the Pistachio terebinth or (*Pistacia terebinthus* L.), is a deciduous species growing in matorrals of the Mediterranean basin, belonging to the family *Anacardiaceae*.

The *Anacardiaceae*, a moderately large family that includes 875 species and 70 genera (SIMPSON 2006).

The pistachio tree is a characteristic species of the Mediterranean region, this woody and indigenous, xerothermophilous species of the *Anacardiaceae* family is a tree par excellence of arid, semi-arid and Saharan areas BOUDY (1952).

Most of its distribution area is in North Africa (Morocco, Algeria, Tunisia), but it is also found in the Canary Islands, Libya (Cyrenaica), Cyprus and the Near East (QUEZEL AND MÉDAIL, 2003). It is the most ubiquitous tree in North Africa and the Near East (MONJAUZE, 1980).

The Terebinth is native to eastern Mediterranean countries, where it is generally found at rocky sites with open vegetation; it avoids the driest and coldest locations (MONTSERRAT-MARTI' AND MONTSERRAT-MARTI' 1988; CASTRO-DI'EZ *et al*., 1998). It is common in a scattered state on hills, limestone rocks, in the processions of holm oak and pubescent oak. LEMOINE (2005), usually grows on calcareous and stony soils TASSIN, (2012). Rocks, scrub, especially in the mountains (QUEZEL AND SANTA,1962).

Taxonomically. According to the monographic study of ZOHARY, (1954) the *Pistacia terebinthus* L. or therabinth is part of the 11 species of the genus *Pistacia* namely: *P. atlantica* Desf. *P.lentiscus* L., *Pistacia vera* or, *P. afghanistania, P. chinensis, P. khinjuk, P. mexicana, P. palestina, P.wienmannifolia, P.intergerrima.*

In Algeria, the genus *Pistacia* is represented by four species: *Pistacia lentiscus, Pistacia terebinthus, Pistacia vera* and *Pistacia atlantica* (QUEZEL AND SANTA ,1962).

AL-SAGHIR AND PORTER (2012) described thirteen species in the genus *Pistacia* which are divided into two monophyletic sections: *Pistacia* section: *P. atlantica, P. chinensis, P. eurycarpa, P. falcata, P. integerrima, P. khinjuk, P. mutica, P. palaestina, P. terebinthus and P. vera*. -Section *Lentiscus*: *P. aethiopica, P. lentiscus, P. mexicana, P. texana and P. weinmannifolia, P. vera.*

The accepted classification is reported by JUDD *et al.,* (2002), LIEUTAGHI, (2004) AND YAAQOBI *et al.,* (2009).

Kingdom: *Plantae*
Class: *Magnoliopsida*
Order: *Sapindales*
Family: *Anacardiaceae*
Genus: *Pistacia*
Species: *Pistacia terebinthus* L.

According to Antoine RISSO, (1844) the *Pistacia terebinthus* L. is characterized by a bushy stem, elongated branches, spaced; slender, deciduous leaves, with 5-7 oval-oblong leaflets, rounded at their base, mucronate, carried on a more developed common petiole; small flowers, in loosely panicled clusters; very small, bluish-green berry.

It is a shrub or small tree branched from the base. Leaves with non-winged rachis and obovate leaflets apiculate at the top 4-6 X 2-3,5 cm. Plant with a very foul odor (QUEZEL AND SANTA,1962).

The terebinth, *Pistacia terebinthus* L. tree or shrub that can reach 5 m high (ALVAREZ *et al.*,2008) with impripinnate deciduous leaves Cecile (2005), elliptical oval, with unwinged petiole (TASSIN, 2012).

The rarity and the polymorphism of the leaves of this species in the region of study, led us to seek if it is the same species or another variety.

In order to answer this problem, we studied the morphometry of this species whose main objective is to identify the systematic position of *Pistacia terebinthus* L. in the region of Tlemcen.

MATERIAL AND METHODS

Study area:

The study area is located in the western part of northwestern Algeria, it is located in the mountains of Tlemcen, Beni snous to 835 m altitude (figure 1). characterized by a rugged terrain and a clay-limestone soil.

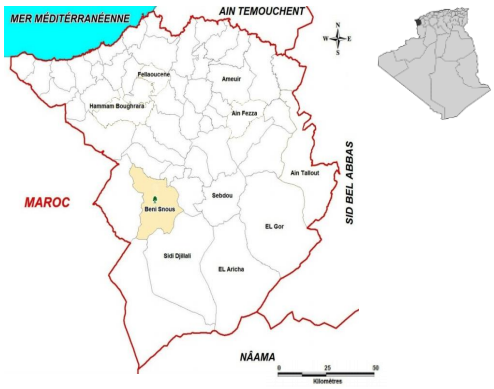

Fig. 1. Location of the study area

Bio Climate

The climate is characterized by a dry period that generally extends from April to October, while the wet period extends throughout the rest of the year.

The study area is located in the semi-arid stage with a temperate winter (Table 1).

The comparison between the recent period and the old (1913-1938) allowed us to confirm the presence of possible thermal changes evidenced by the increase in average annual temperatures for the majority of stations for Beni Bahdel. (AMARA, 2014)

Table 1

Emberger Q2 values and the bioclimatic levels

Stations	Période	m °C	Q2	Q3	Bioclimatic levels and thermic variants
Maghnia	1980-2013	3,41	28 ,38	28,48	Arid to temperate winter
	1913-1938	3,3	48,82	48,77	Semi-arid to temperate winter
Beni Bahdel	1970-1997	3,3	53,30	53,39	Semi-arid to temperate winter
	1913-1938	5,2	63,69	63,99	Semi-arid to temperate winter

The sampling

The sampling adopted is subjective, taking into account the floristic and ecological homogeneity of the station.

This subjective method consists of choosing samples at each station that appear to be the most representative and sufficiently homogeneous GOUNOT, (1969); LONG, (1974) integrating all structural situations and vegetation facies encountered.

The choice of the benisnous station was justified by the presence of good *Pistacia terebinthus* L. trees that were the most representative of the study area.

The method of study was based on the phytoecological approach on a very large scale, we are led to carry out the autoecology of this species by approaching the morphometric study of the

leaves of 16 most representative individuals, that is to say in total 1126 leaves and 7837 leaflets measured. We took 10 branches with an average of 7 leaves per branch (Figure 2).

The measurements were made at a rate of seventy leaves per tree and 6 to 7 leaflets per leaf; that is to say respectively a total of 1126 leaves and 7837 leaflets measured in all the station.

The parameters measured are:

- The number of leaves on each twig.
- The length of the nerves of each leaf in centimeters.
- The number of leaflets of each leaf.
- The length of each leaflet in centimeters.
- The width of each leaflet in centimeters.

The statistical analysis of linear correlation between the measured parameters was performed using minitab 16 software.

RESULTS AND DICUSSIONS

The measurements of morphological parameters of *Pistacia terebinthus* L. presented in **(**Table **2)** were taken from sixteen individuals at the study station.

Leaflet length varied between 3.30 and 4.93 cm and width between 1.38 and 2.43 cm.

QUEZEL AND SANTA (1962) reported that the length of the leaflets of *Pistacia terebinthus* L. is between 4 and 6 cm and the width between 2 and 3.5 cm 4-6 X 2-3.5 cm

Healthy leaves have a terminal leaflet with an average of 3.75 cm in length and 1.28 cm (LOUZABI *et al*., 2016)

The number of leaflets varies between 4 and 11 which is comparable to the results found by BOTINEAU, (2015), LOUZABI *et al.*, 2016 who reported a range between 5 and 11 leaflets.

For comparison, we report that the measurements of (QUEZEL ET SANTA 1962), BOTINEAU, (2015) and LOUZABI *et al*., (2016) are slightly higher compared to our results.

The average number of leaflets is about 07 leaflets per leaf. The average leaf length across the station and 8.15 cm.

The length of the leaves varies between 6.13 and 10.18 cm which remains lower compared to the maximum values found by LOUZABI *et al*., 2016 which are around 14.90 cm for healthy leaves.

The average number of leaves is about 07 leaves/stem.

Fig. 2. Leaves and leaflets of *Pistacia terebinthus* L. in the station of beni snous (by METRI 2017)

Table 2.

Measurements of morphological parameters of Pistacia terebinthus L. from the station of Beni-snous.

Characteristics of quantitative variables measured for leaves and leaflets of P. *terebithus*	**Mean ± SD**	**M. Min – M. Max**
length of leaflets (cm)	3,92 ± 0,32	3,30 - 4,93
width of leaflets (cm)	1,82 ± 0,22	1,38 - 2,43
Leaf length (cm)	8,15 ± 0,63	6,13 - 10,18
Number of leaflets / leaf	6,96 ± 0,52	6,10 - 8,46
Number of leaves/stems	7,04 ± 0,97	5,80 - 10,30

M. Min: Mean of the minima,M. Max: Mean of the maxima

1. Linear regression:

In order to show the degree of connection between the measured parameters, we used the regression equation "y=ax+b" to represent all possible correlations. The correlation coefficient indicates to what extent the relationship, if any, can be represented by a straight line (DEMELON, 1968).

From the analysis of the results (Table 3) we found that the leaflet size of the 16 individuals showed a slight variation.

Table 3.

Results of correlations between measured morphological parameters of Pistacia terebinthus L.

Correlated morphological parameters			
	Regression equation	R^2	**Correlation coefficient "r".**
Leaflet length / leaflet width	y = 2,6856 + 0,68008 x	20,54 %	0,4532
Leaflet length / Number of leaflets	y = 6,15416 - 0,320727 x	24,42 %	-0,4942
Leaflet width / Number of leaflets	y = 2,98363 - 0,167413 x	14,98 %	-0,3871
Leaflet length / Leaf length	y = 3,71022 + 0,0260368 x	0,34 %	0,0585
Leaflet width / Leaf length	y = 2,55166 - 0,089893 x	9,20 %	-0,3033
Leaflet length / number of leaves in the stem.	y = 2,95217 + 0,137758 x	16,76 %	0,4094
Leaflet width / number of leaves in the stem.	y = 2,12707 - 0,0437724 x	3,81 %	-0,1952

Statistically, the correlations between the pairs of morphological parameters are as follows (Figure 3):

Positive correlation with respectively r=0.45 and 0.40 for (Leaflet length/Leaflet width) and (Leaflet length/Number of leaves in the stem) indicating an average dependence between the length and width of leaflets on the one hand and the length of leaflets compared to the number of leaves on the other hand.

On the other hand the correlation is negative for the parameters (Leaflet length/number of leaflets), (Leaflet width/number of leaflets) and (Leaflet width/leaf length) is negative with an average dependence -0.49,-0.38, -0.30 meaning an evolution in the opposite direction.

Insignificant correlation for the rest of the measured parameters (Leaflet length/leaf length), Leaflet width/ number of leaves in the stem).

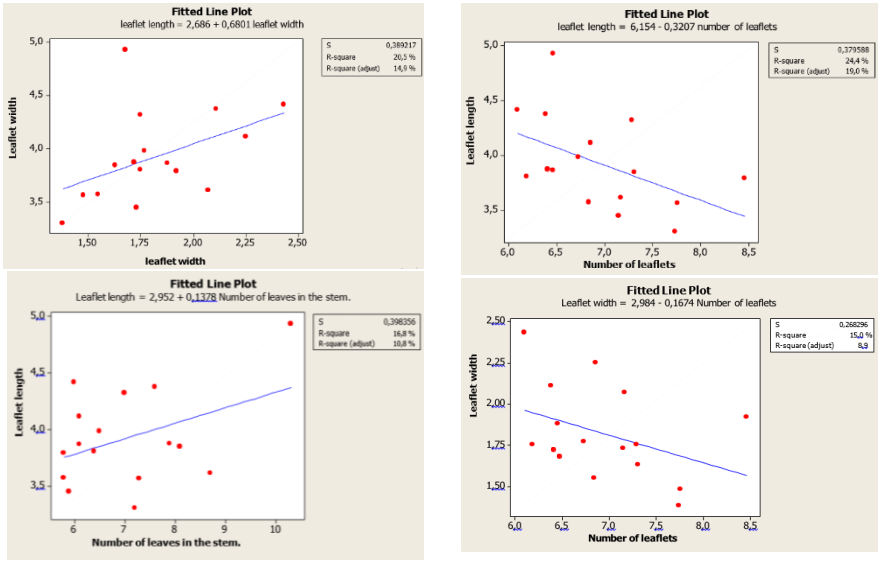

Fig. 3. The linear correlations between different measured parameters

CONCLUSIONS

The present study has as objective the study of (*Pistacia terebinthus* L.) from Beni snous. Morphometric measurements were carried out in order to find an intra-population variability of this species in the study station.

From the measurements made on 16 trees of the station of beni-snous, we found low coefficients of correlation, this rate of correlation is more interesting between the length of the leaflets and the width of the leaflets, (r = 0,4532; R^2 = 20.54%); and between leaflet length and width and number of leaflets, (Leaf length/number of leaflets r = -0.4942, R^2 = 24.42%; leaf width/number of leaflets r = -0.3871, R^2 = 14.98%.), and also between leaflet length and number of leaves in the shoot (r = 0.4094, R^2 = 16.76%).

The other correlation coefficients, values are very low.

According to the measurements of morphological parameters of *Pistacia terebinthus* L., the length of leaflets is between 3.3 cm and 4.93 cm and width between 1.38 cm and 2.43 cm; and the number of leaflets in a leaf and between 4 and 11.

And from the comparison of our result and the one of the bibliographic reference, it turned out to be the same species.

The slight difference between our results and the results of the authors, may be due to the age of the individuals or to ecological factors.

After this morphological study, it would be desirable to carry out a complementary histometric and genetic study of the terebinth pistachio from the same region to better understand its variability and adaptability to arid and semi-arid zones.

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