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Contribution to the study phytoecological of facies *Pistacia atlantica* Desf. in the Saharan Atlas (Béchar- Algeria)

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Abstract

The Atlas Pistachio (*Pistacia atlantica* Desf.) Is a very common in southern Algeria native species. Phytoecological a study group to *Pistacia* shows a perfect adaptation to soil and climatic environmental conditions predominate in the Oranian Saharan Atlas (Bechar). The Pistachio Atlas is a very hardy tree scrublands, with a very large amplitude bioclimatic where it currently appears between 0 and 3.7°C on altitudes between 700 and 1200m, this coincides with the levels of vegetation Meso and thermo-Mediterranean in the south, the slopes and cliffs of the Saharan Atlas. This essence merely a low rainfall of about 100 mm/year and sometimes less; this explains the amount of water low water levels of different indices. Despite its great ecological and economic values, Pistachio Atlas region is in a critical situation due to drought exacerbated by one year to another, its uncontrolled exploitation for firewood and fodder by population, and because of its grazing, preventing natural regeneration. A better understanding of the issues and factors in the decline of *Pistacia atlantica* contributes to the protection of biodiversity and better regeneration and expansion of this species in semi-arid areas.

Keywords: Pistacia atlantica, phyto-ecological, Saharan Atlas, Bechar.

1. Introduction

The Atlas Pistachio (*Pistacia atlantica*) is a spontaneous woody species quintessential southern foothill Sahara Atlas. It was abundant; now very sparse; it regenerates more than the tufts of jujube, which is the classic host [1]. Their common name refers to the atlas where this species grows mountains.

Systematic point of view, the species *Pistacia* belongs to angiosperms of the order Sapindales; in Eudicots and family of Anacardiaceae [2-3-4].

This natural heritage is threatened by degradation due to the combination of several natural factors (especially desertification, the scourge of silting, recurrent droughts and aridity) and especially anthropogenic, including over grazing. This has led to sound the alarm about these threats continues higher and higher, on natural resources.

The objective of this investigation carried out at the range of Atlas Pistachio in Bechar region (south-western Algeria) is to diagnose and characterize the natural phyto-ecological groups in *Pistacia atlantica* in relation Saharan climate.

2. Materials and methods

2.1. Location and description of study stations

The study area of Bechar (Figure 1) we have chosen best reflects the phyto-ecological diversity characteristic of the Saharan Atlas. To achieve our objective, so we opted for the North-south transects (Beni Ounif, Lahmar and Bechar) where it detects the presence of *Pistacia atlantica* groupings.

The study area made part of the pre-Saharan area (Saharan Atlas). It is located on quaternary glaze.

Table 2: Geographical characterization of study stations

Stations		**Station 1**	**Station 2**	**Station 3**	**Station 4**
Location		Bou Yala	Bou Ayech	Djedida	Oum Chegag
Department		Beni Ounif	Beni Ounif	Bechar	Lahmar
Common		Beni Ounif	Beni Ounif	Bechar	Mougheul
Altitude (m)		840	780	724	960
Physical entity		Mid-slope	Mi-versant/Reg	Mountain / river	Daya
Geographic coordinates	**X**	31°50’21’’00	31°96’66’’67	31°48’ 00”00	32°01’88’’89
	Y	1°28’34’’00	1°53’33’’33	1°43’60’’00	1°27’38’’89

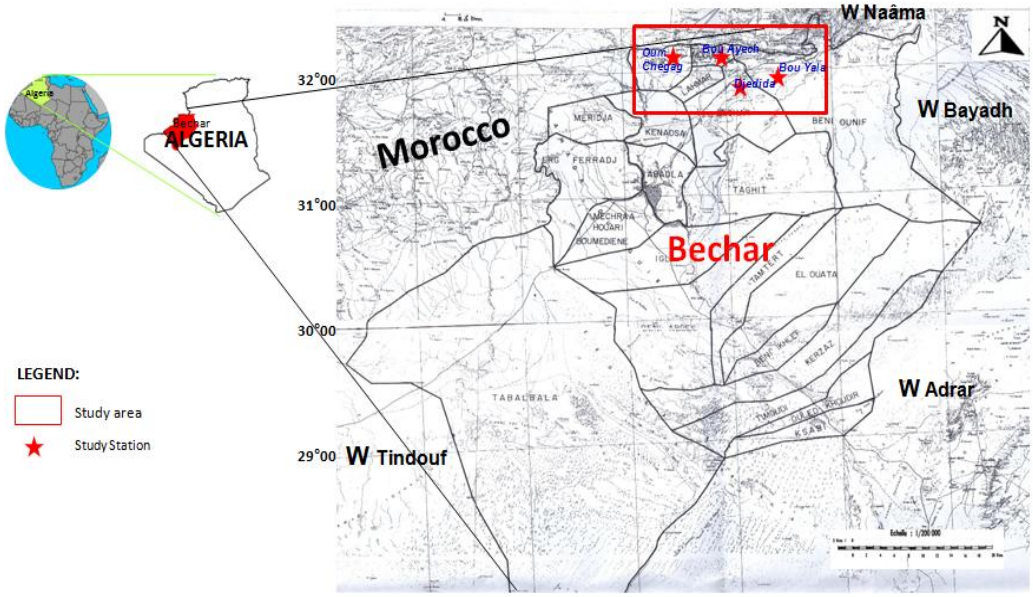


Figure 1: Location of the study area

2.2. Methodological approach

The methodology includes a device consisting of a series of transects located in different topographic units in the study area. The phytoecological surveys (with an area of 100 m²) are provided every 200m depending on the variability of vegetation and ecological conditions (topography, exposure).We opted for a systematic sampling of the kind that transect through the study area. This sampling will be carried out on facies physiognomically and geo-morphologically uniform.

This approach was been performed in three steps:

a- We have developed a technique to record the achievement of floristic surveys in the range of Atlas Pistachio. Measurements or estimates stational ecological data (geomorphology, topography, lithology and altitude) were performed.

b- The second step has carried out in the field, the continuity of which is the work in the laboratory. It is to verify the data collected and update.

c- Finally results should be synthesized to give the best possible statistical significance. Statistical analyzes were performed using the Ascending Hierarchical Clustering (A.H.C) and the Correspondence Factor Analysis (C.F.A) on 100 surveys phyto-ecological. The joint use of the C.F.A and the A.H.C which is justified only when you have to deal with a large number of records (observations) makes a very clean cut of all homogeneous floristic groups (environmental groups).

3. Results and discussion

3.1. Phytoecological characterization groupings Pistacia atlantica

In this part of our investigation, we based on a literature review very thorough on the species that we have completed an analysis of local edaphic-climatic and anthropogenic characteristics of the group to *Pistacia atlantica* in the region of Bechar.

These bibliographic work being done on Pistacia atlantica groups in North Africa include the work of the following authors: [5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21…...].

The analysis of results from a phytoecological study allowed us to understand the pre-Saharan climate adaptation relationship.

Table 2: Phytoecological characterization study stations

Station		**Bou Yala**	**Bou Ayech**	**Djedida**	**Oum Chegag**
Geomorphology		Glacis foothills of Jebel, mid-slope, Valley	Low and mid-slope alluvial terraces	Glacis foothills of Jebel	Daya, zone spreading
Geology		Quaternary	Cretaceous	Quaternary	Quaternary
Altitude		820 -880 m	740- 780 m	700- 760 m	900- 980 m
Slope		1 – 12 %	3 – 15 %	5 – 15 %	2 – 8 %
Element of the ground surface		Element and coarse sandy wind sailing	Element and coarse sandy wind sailing	Element and coarse sandy wind sailing	Thin Elements
Recovery of vegetation		35 - 45%	40-50 %	40-55 %	60- 90%
Floristic characteristics	*Pistacia atlantica*	+	+	+	+
	Ziziphus lotus	+	+	+	+
	Retama retam	+	+	+	+
	Artemisia herba-alba	+	+	+	+
	Helianthemum lippii	+	+	+	+
	Launaea glomerata	+	+	+	+
	Echinops spinosus	+	+	+	+
	Zilla macroptera	+	+	+	+
	Moricandia suffruticosa	+	+	+	+
	Rhus tripartitum	+	+	+	0
	Hammada scoparia	+	+	+	0
	Gymnocarpos decander	+	+	+	0
	Launaea arborescens	+	+	+	0
	Anvillea radiata	+	+	+	0
	Olea europaea	+	+	0	0
	Anabasis aretioides	+	+	0	0
	Teucrium polium	+	+	0	0
	Bubonium graveolens	+	+	0	0
	Vitex agnus-castus	+	0	+	0
	Marrubium desertii	0	+	0	+
	Acacia raddiana	0	0	+	0
	Juncus maritimus.	+	0	0	0
	Limoniastrum feei	0	+	+	0
	Lygeum spartum	0	+	0	0
	Astragalus gombo	0	0	0	+

* +: Presence, 0: Absence

The figure 2 shows the distribution of groups in the study area.

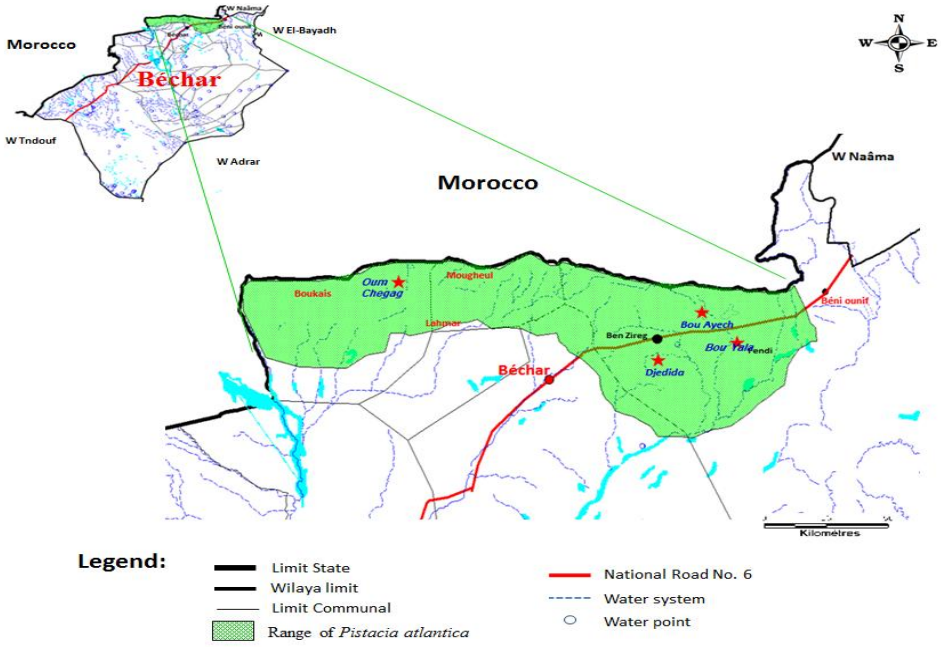


Figure 2: Range of *Pistacia atlantica* in the region of Bechar.

The bibliographic map different studies show different adaptive strategies of the plant. Moreover, *Pistacia* has a remarkable ecological amplitude and plasticity since the meeting from the heart of the Sahara to the edges of the wet bioclimate on the Rif Mountains (Morocco). It can occupy the clefts of the rocks and cliffs, deep soils on flat land or very rocky valley or large seasonally wet depressions [22].

It is also resistant to low temperatures that high temperatures. He is concerned, however frosts when a forest atmosphere does not protect it.

According Ait Radi [23], due to their late bloomer, flowers unambiguously escape the harmful effects of temperatures. It is very hardy tree xerophytic large amplitude with respect to climatic factors in no way affected by long periods of drought, with great bioclimatic amplitude.

It occurs from the margins of the Saharan bioclimatic up those damp; cool even in warm and temperate variants [24]. It has a large temperature range from a very low temperature of about 5 °C and resists even supports both low temperatures (-12 °C to Djelfa) and high temperatures (49 °C in Ghardaia) [1]. It is very demanding of edaphic point of view, it accommodates a wide range of soil: acid soils, siliceous and calcareous, with the exception of sandy soils [25]. Alyafi [26] was notes that the Atlas pistachio grows on alluvial soils dayas on soils rendzinas types and in mountainous regions.

In our approach *Pistacia atlantica* we could increase the body of knowledge on this plant by the various observations and analyzes in the areas of arid and semi-arid region of Bechar. Thus we have seen that the species can live in very dry areas allowing it to acclimate to different bioclimatic environments (0°C<m<3.7°C). The altitudinal level we were able to locate the species ranging between 700 and 1200 m and / or rainfall rarely exceeds 100 mm/year altitudes. Add to that the species is widespread in areas where the temperature exceeds 45 °C in summer and rainfall Quotient is greater than 7 [27-28-29].

The Pistachio Atlas which once formed dense stands is increasingly rare, mainly because of its low regeneration or the seeds germinate well not be that seedlings are grazed by wild herbivores as that servants. The only young subjects that may be encounter are those that have grown amid tufts of Sedra (*Ziziphus lotus*) which is the traditional host. *Ziziphus lotus*, thorny bush, is a barrier against grazing animals and protects the climate-anthropogenic impacts (wind, animal teeth etc.) until it grows.

During our trips we were able to land on a list of species associated with the Atlas Pistachio, it is include: *Zilla macropetera*, *Launaea arborescens*, *Anabasis aretioides*, *Gymoncarpos decander*, *Teucrium polium*, *Limoniastrum feei*, *Anvilea radiata* [27].
The presence of Atlas Pistachio (*Pistacia atlantica*) in the wild in some Saharan regions is proof of its successful cultivation in arid ecological conditions. In the Saharan Atlas Oran (North Bechar), the *Pistacia atlantica* is widely distributed, but localized in the troughs, to dayas, the shell ruptures.
He held there a huge area and covers an area of 300 000 hectares, comparable in magnitude to that of the set of all inter-Atlas high plains. The Pistachio Atlas is the relic state, located in the valley beds mainly those of BouYala, Smar, Koufane, in the southern region of Beni-ounif and most important settlements in the region of Oum Chegag [27-28-29] (Figure 2).

3.2. Contribution A.H.C and C.F.A on the distribution of Pistacia atlantica
Each step brings together two classes, nearest the partition. Prioritization ends when there is no more than one class [30].
The A.H.C analysis and C.F.A has to distinguish between different plants communities of Atlas Pistachio associated with various plant training.
The results are present as dendrogram grouping records according to their degree of similarity (Figure 3). The A.H.C is the complement of a factor analysis. It is to bring together individuals with similarities to a data set makes it possible to confirm the results previously obtained with the data analysis.

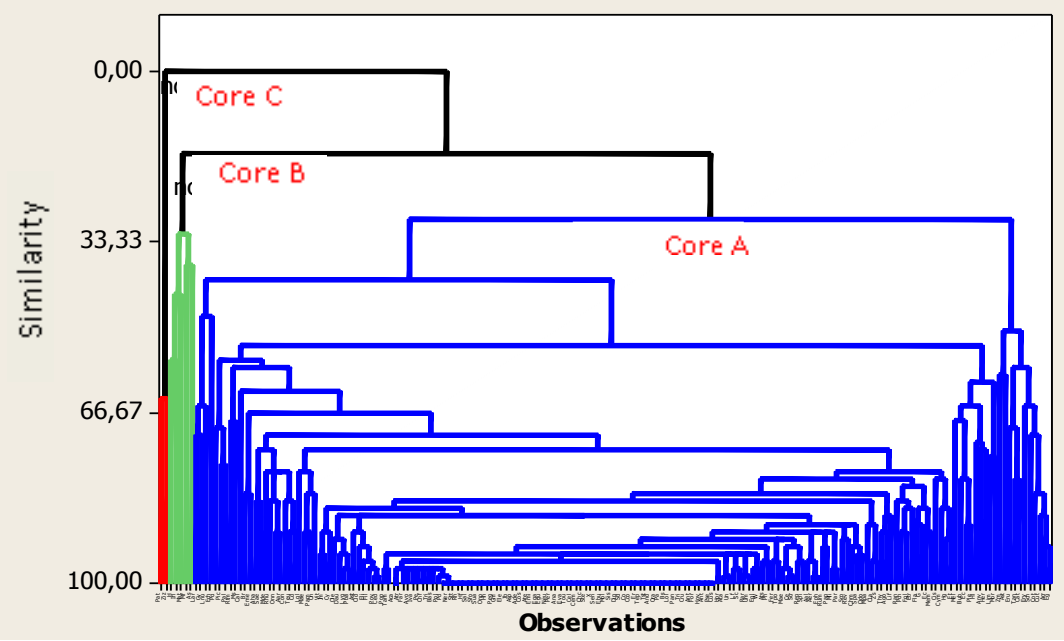
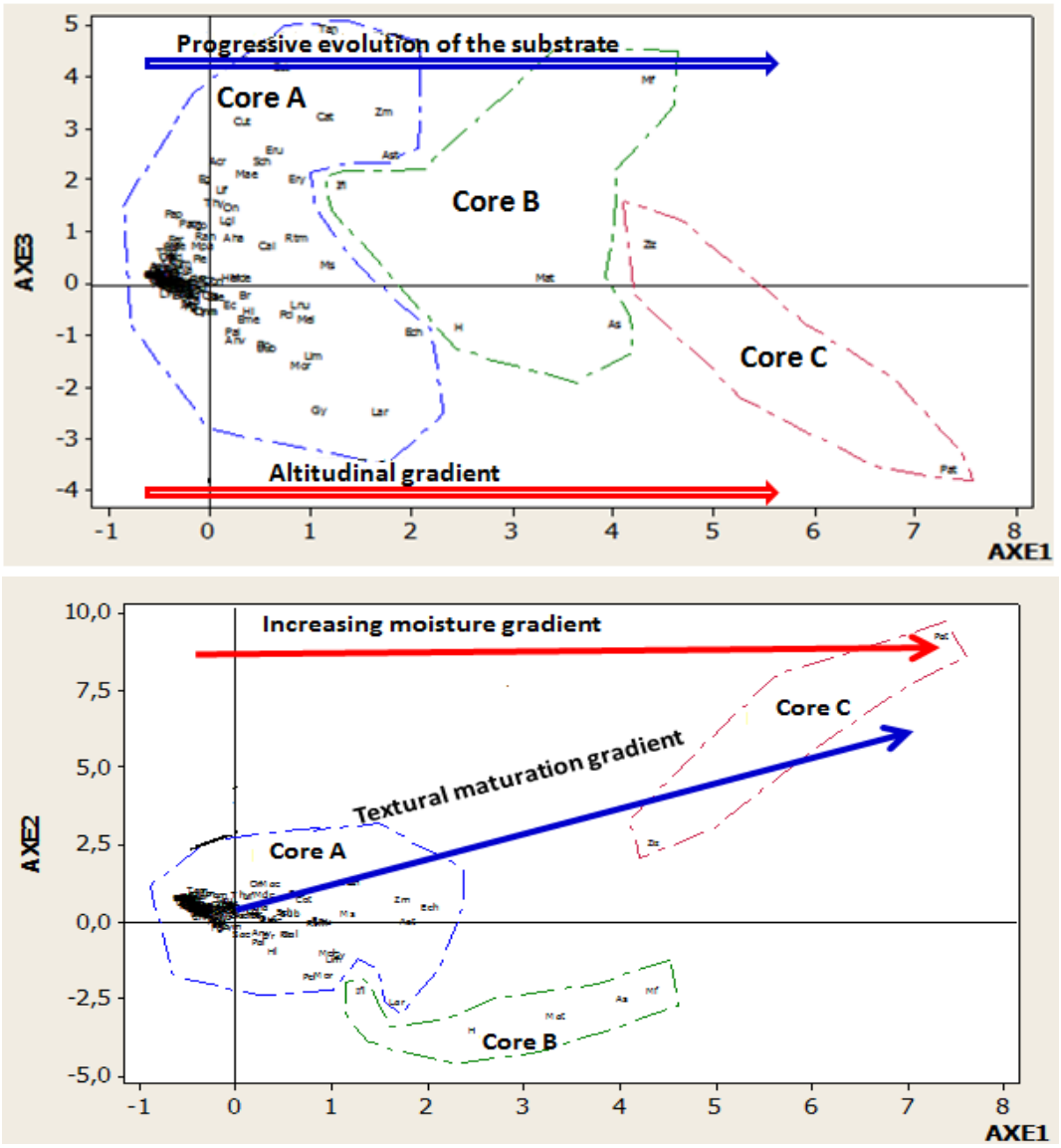


Figure 3: Dendrogram A.H.C of the total matrix species in the study area

The C.F.A takes into account the similarities between the readings of the same set to discriminate subsets of similar surveys over the affine. The similarity is expressed by a distance or proximity criterion chosen a priori in order to progressively build a series of sheets that fit together, and that, starting from the one in which each individual in a class. This type of analysis is widely used now. It allows the affinity group reports and remove those dissimilar based on their floristic content.
From the figure 4, which contains the results obtained by the C.F.A, there is the presence of three sets or classes of plant formation of the group in *Pistacia atlantica*.



Legend: Core A, Core B, Core C,

Pat: *Pistacia atlantica*, Zt: *Ziziphus lotus*, H: *Hammada scoparia*, Mf: *Moricandia foleyi*, As: *Asphodelus tenuifolius*, Lar: *Launaea arborescens*, Is: *Ifloga spicata*, Mat: *Matricaria pubescens*, Zm: *Zilla macroptera*, Es: *Echinops spinosus*, As: *Avena sterilis*, Pc: *Plantago ciliata*, Mc: *Morettia canescens*, Ev: *Eruca vesicaria*, Ms: *Moricandia suffruticosa*, Ca: *Catananche arenaria*, ……

Figure 4: Representation of the variables in the factorial design of species.

The Factorial Designs (1/2) and (3/1) are show the juxtaposition of the three large groups (C, B and C), which corroborates the results obtained from numerical analysis and confirms that the geomorphology matches the determining factor in the distribution of the group to *Pistacia atlantica*.

Multivariate data analysis has to prioritize the role of the main determinants in the distribution of training *Pistacia atlantica*. First, the key factors are identified a complex superposition of ecological factors including geomorphology, bedrock, altitude and latitude.

The interpretation by the C.F.A allows different groups to understand the complexity of the ecosystem and clarify existing affinities between some environmental groups. This analysis highlights the importance of soil quality and climate on the diversity of ecological groups.

According to the dendrogram of A.H.C floristic surveys of the study area (Figure 4), we found three groups of plant species related group of *Pistacia atlantica*:
- Core C (Group 1): Association *Pistacia atlantica* (Pat) and *Ziziphus lotus* (Zt).
- Core B (Group 2): *Hammada scoparia* (H) with the dominance of the following species*: Moricandia foleyi* (Mf), *Asphodelus tenuifolius* (As), *Launaea arborescens* (Lar), *Ifloga spicata* (Is) and *Matricaria pubescens* (Mat). Their appearance is directly linked to rainfall.
- Core A (Group3): *Zilla macroptera* (Zm), *Echinops spinosus* (Es), *Avena sterilis* (As), *Plantago ciliata* (Pc), *Morettia canescens* (Mc), *Eruca vesicaria* (Ev), *Moricandia suffruticosa* (Ms), *Catananche arenaria* (Ca)...

The distribution of species on the factorial plane 1/2; gradients which confirms the proposed individualization of the three sets is expressed through the presence/absence of therophytes (Annual plant species). This axis opposes indifferent species to substrates and independence from the water factor. However, when the year is rainy, the area is covered with a rich and varied pasture and nomadic settled occasionally. As for axis 2, the distribution of surveys and species is explained by a rainfall gradient. Axis 1 of the positive pole to the negative pole generally opposes the Saharan-Arabian species with those Mediterranean. So this axis reflects a gradient of decreasing aridity.
The factorial plane 3/1 (Figure 4) results in a delicate interpretation. The three sets are individualized and their projection in the long axis 1 illustrates a spatial disjunction similar to that obtained with the previous association.
This analysis allowed us to identify the main factors governing the distribution of training *Pistacia atlantica* in our study area. Axis 1 is a complex superposition of ecological factors. Indeed, the various geomorphological or topographical situations (banks, main river bed, alluvial terraces, daya) are retained as the main factor responsible for the floristic variation. A factor that adds lithological variations at has a coarse scale.
Furthermore, the spatial location of records (latitude and altitude) appears as a secondary factor along this axis. Finally, there is also a gradient, very important but noteworthy: This is the exceptional humidity of the rainy year in October 2008 with 174 mm. The second axis is clearly represented by a lithological gradient.

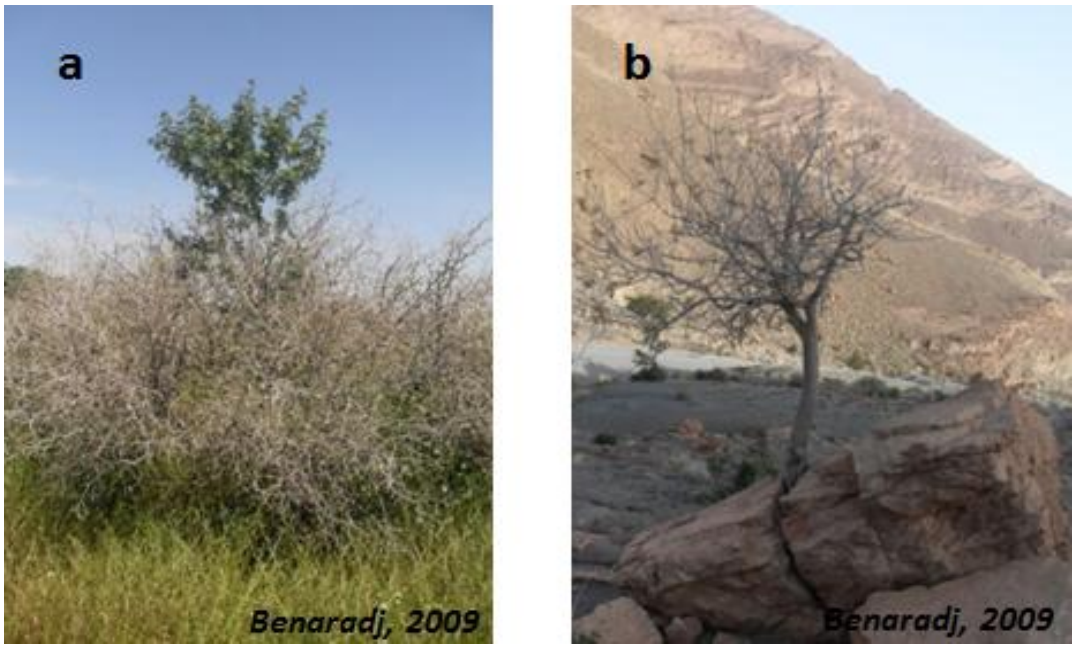


Figure 5: Regeneration of *Pistacia atlantica* a) in *Ziziphus lotus* b) on Bedrock

Pistachio trees are numerous and evenly distributed in small groups or isolated or scattered most often contracted in a bordering state mode valley, gullies and spreading areas or depressions occasionally put water in the cold season and that accumulates significant alluvial layers purposes. They are usually associated with the shelter of bushes jujube (*Ziziphus lotus*) (Figure 5) and under the shelter of R'tem (*Retama retam*) that protect and promote the germination of seedlings of Atlas Pistachio against grazing.

Conclusion

In light of the results obtained, it is possible to confirm that the *Pistacia atlantica* is fairly well represent in the Saharan Atlas Oranian in nature; it is well distributed generally in the troughs and gullies (water points) in scattered and isolated form, or as a grove in the daya of Oum Chegag.
This presence confirms that *Pistacia atlantica* area exists despite anthropozoogenic and climatic pressures and presents some regeneration.
Certainly *Pistacia atlantica* is a very plastic species, however its presence in the Saharan Atlas plays a role has a double aspect: socioeconomic (cooking, heating, therapeutic interest) and environmental (fight against desertification, the fight against erosion soil etc.).
Its conservation and multiplication is an unavoidable necessity. Forest managers and administrators must address the problem of recovery of this plant genetic resource and give it more importance.
The Atlas Pistachio (*Pistacia atlantica*) is a hardy tree, well adapted to xeric conditions (Saharan climate, arid and semi-arid). It can play an important role on several levels: forestry, ecological, therapeutics and socio - economic. This review highlights the importance of pistachio by adapting a more favourable resistance under typical Saharan bioclimatic. We know very well that *Pistacia atlantica* is a kind of future for Western Algeria, its adaptation to environmental stress enables a dynamic and certain biological recovery.

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