

Comparative Study of The Emergence and Growth of Young Seedlings of Five Varieties of Pistachio (*Pistacia vera* L.) of Syrian Origin

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ABSTRACT

The present work is to study the emergence and growth of seedlings of five pistachio varieties that are: Batouri, Achouri, Neb-Djemel, Adjmi and Bayadhi. The study was conducted in a greenhouse temperature and photoperiod were controlled. The seeds are germinated in pots filled with peat without going through the damp cold stratification at a temperature of 4°C. The results obtained showed that growth parameters (length and diameter of the plants) revealed significant tests while other parameters (emergence rate, root length and number of leaves per plant) had showed no significant tests. About the number of emerged plants per day, variety Achouri comes first while the variety Neb-Djemel comes last. About the number of emerged plants per day, variety Achouri comes first while the variety Neb-Djemel comes last. For the evolution of growth in height, it is on average 2cm per week until two months after emergence; then it becomes 0.37 and 0.88cm for the final week of growth.

KEYWORDS. Pistachio, variety, lifted, seedlings, growth.

1. INTRODUCTION

According [1], the pistachio is a fruit species belonging to the family Anacardiaceae. It is mainly grown in arid and semi-arid Asia (Middle East) and Africa (Maghreb) but also in Australia, some countries of America (USA and Mexico) and in the regions of Mediterranean Europe.

The original center of the pistachio is difficult to determine. The majority of stands of *Pistacia* and cultures of pistachio meet inside a region between 30 ° and 40 ° north parallel, the Mediterranean and the foothills of the Himalayas [2]; [3]; [4]; [5]; [6].

According [7], the species *Pistacia vera* L. is native to Central Asia.

According [8], the pistachio fruit grows naturally in arid regions of Asia (Middle East) and Africa (Maghreb) which are characterized by hot, dry summers and moderately cold winters.

It can be planted in poor soil called marginal, though it prefers relatively deep sandy clay soil, well drained, light and dry with a high content of limestone [9].

The main world producers of Pistachio nuts are Iran, the United States of America, Turkey and Syria.

The pistachio (*Pistacia vera* L.) is an interesting species in ecology, it was introduced in Algeria in the 1970s in semi-arid bioclimatic stage for the production of nuts and to engage in agroforestry. A few successful plantations cover only 400 hectares.

We know that the pistachio tree is dioeciously, seed sown gives as many males feet than female's feet. These give fruits whereas the first only are used for pollination, which must be transformed in female subjects by grafting. This technique depends directly on the diameter of the rootstock ($\geq 10\text{mm}$) [10]. Moreover when transplanting seedlings grafted orchard, they must be well provided with good root hairs supplied to ensure good resumption [11].

In this context, we conducted this study to compare between varieties to try to see which or which ensure a good lifted, better growth and good development of young seedlings for grafting.

2. MATERIAL AND METHODS

2.1. Plant material

This is pistachio seeds of five varieties at full maturity, harvested in September with adult subjects the seed park behavior orchard located at the experimental station of the ITAFV in Tighennif (Department of Mascara,

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Northwest - Algeria). This orchard aged about 20 years is composed of 162 trees including 143 females feet and 19 males' feet. A few biometric characteristics of these seeds are shown in Table 1 below.

Table 1. Characteristics of seeds of five varieties of pistachio

Varieties	Length (mm)	Width (mm)	Thickness (mm)
Achouri	15.32	5.79	5.53
Neb-djemel	17.17	7.08	5.57
Bayadhi	16.27	7.7	6.41
Adjmi	15.68	7.6	6.53
Batouri	17.31	7.54	6.63



Photo 1. Seeds of five varieties of fruit with pistachio epicarpes

2.2. Methods.

Direct sowing of 100 seeds with integuments were used for each variety studied. The seedling was carried out in plastic pots (20 cm long and 10 cm wide) open, pierced at the bottom and filled with peat. Each seed lot is identified with a label bearing the name of the variety of pistachio studied.

When the plantlets start their emergence, we proceed to count them daily until the stopping of the seedling emergence.

Regarding monitoring the growth of pistachio seedlings of five varieties it lasted two and a half months.

The results are expressed as a percentage of emergence rate (% ER), and by computing the emergence rate coefficient (coefficient Rate of Emergence: CRE) which is based on the formula of SAQUI and CARLETO (1978) in [12] which reads as follows: $CRE = 100/N \times \sum_i n_i/j_i$

N is the number of sown seeds, j_i the number of days after sowing and n_i the number of seedlings emerged j_i day.

For growth monitoring, thirty seedlings of each variety were selected high greenhouse. The growth of the stem and main root is measured using a graduated ruler in millimeters. As regards the diameter is measured from 5 cm from the collet of the plant with digital calipers.

The parameters of the growth of the aerial part of the plant: the length and diameter of the rod and the average number of leaves per seedling have been noted every week. Nevertheless the length of the root system was measured about seventy days after sowing.

Data analysis.

The results were analyzed focused on the study of variance factor 1 (variety type) with comparison of means with the Newman-Keuls test (Fisher test) at a 5% level of probability using the software " XLSTAT Version 2015 ". Once a factor proved significant, it allows for homogeneous groups between the different varieties of pistachio tested.

3. RESULTS AND DISCUSSION

3.1. Lifted Rate

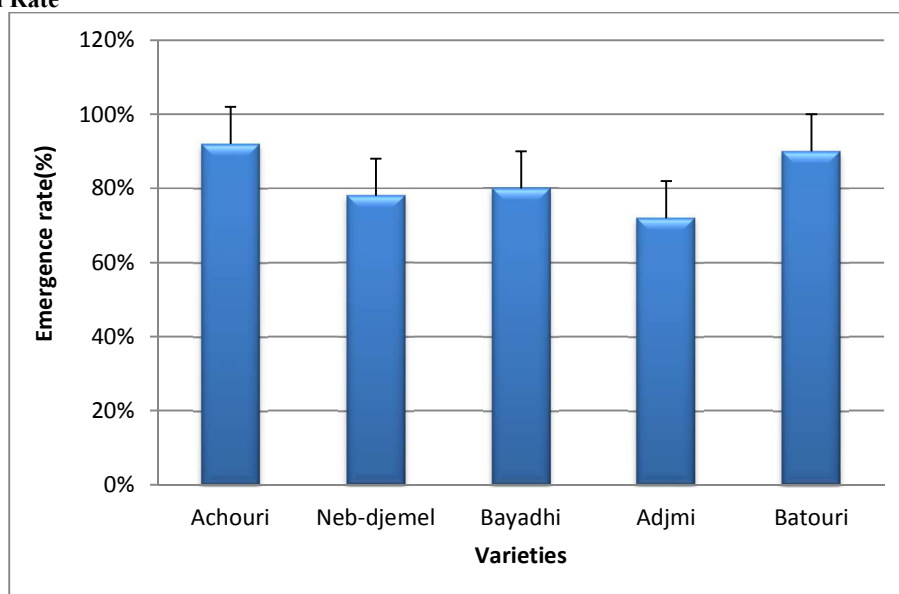


Figure 1. Lifted rate of seedlings of five varieties of *Pistacia vera* L.

The data in Figure 1 show the rate of seedling emergence of true pistachio whose seeds come from the site of the Technical Institute of Arboriculture and the Vine (ITAFV) and which have not undergone any treatment. Examination of this figure shows that the seeds of the variety Achouri and Batouri have the highest emergence rate (90-92%); while those of the Adjmi variety have the lowest rate (72%). This is probably due mainly to the difference in the germination capacity of the seeds of these varieties and to the embryonic dormancy which can be long in seeds of the variety Adjmi. Although the seeds of Neb-Djemel variety has the lowest dehiscence rate of 9.62% [13], they recorded an intermediate lifted rate of 78%. As to the variety Adjmi was a lifted rate of 80%. According to the work of [13], the seeds of variety Achouri put into greenhouse germination in containers obtained a 100% emergence rate. While the work of [14] for seed germination in open field registered 60% emergence rate for the variety Achouri against 83% for Bayadhi variety. The variety Neb Djemel had the lowest emergence rate of 47%.

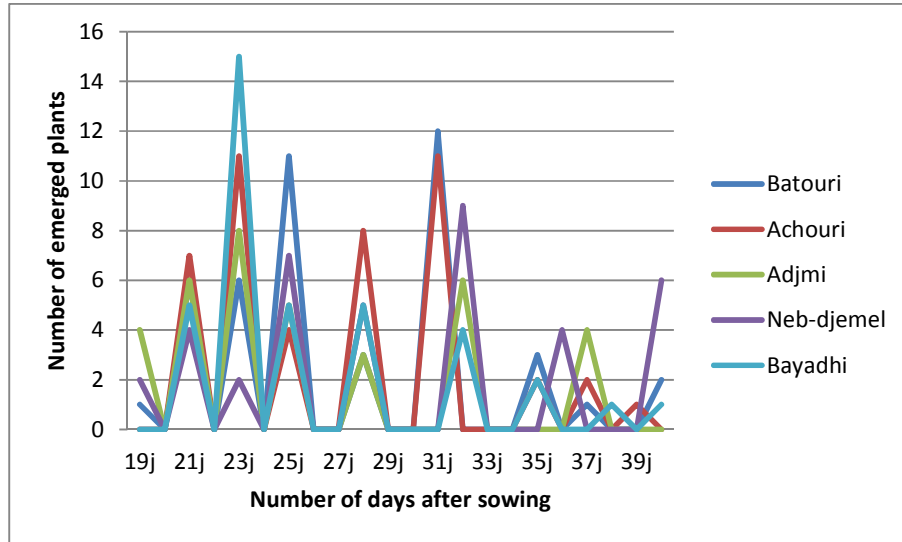
Remember, the seeds we have used in our trials come from the harvest of the year. [15] Found that germination in vitro from 100% with isolated embryos of freshly harvested seeds to 87.3 and 30.9% with those from seeds stored respectively between 12-18 months and over 24 months. This clearly indicates that beyond a year of conservation, seeds of *Pistacia vera* gradually lose their ability to germinate and viability after 24 months.

The analysis of variance revealed no significant effect at the 0.05 level between the different varieties as the calculated F (1.44) is lower than the theoretical F (2.40) (Table 2).

Table 2. Table summarizing of randomized ANOVA (a factor) (lifted rate)

Source of the variations	df	Sum of squares	Average square	F of Fisher	Proba. Critical	Theoretical F 0.05
Treatment	4	0.744	0.186	1.44758577	0.21891734	2.40848837
Error	245	31.48	0.1284898			
Total	249	32.224				

3.2. Kinetics of the lifting

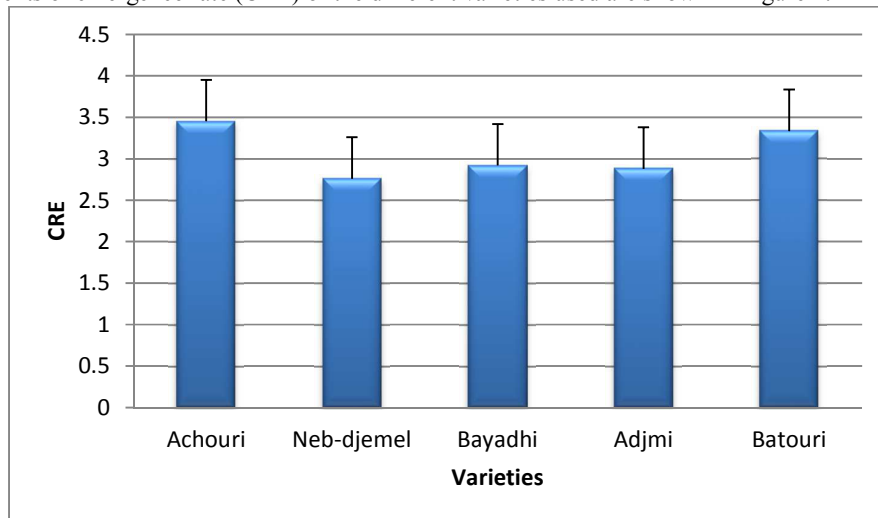
**Figure 2.** Lifting of kinetic seedlings of five varieties of *Pistacia vera* L.

The exploitation of results in the kinetics of the lifting of *Pistacia vera* seedlings presented in Figure 2 allows the following observations:

- The first plants appearing after 19 days of sowing varieties for Batouri, Adjmi and Neb-Djemel, while the varieties Achouri and Bayadhi 21 days after planting.
- The maximum for waiver of seedlings was reached after sowing 31journs for Batouri variety (24) after 23journs for Bayadhi variety (30) Achouri (22) and Adjmi (16). As to the variety Neb-Djemel it reached the peak of lifted (18) after 31journs seedlings.
- For the entire duration of lifted, it varies from 36 to 42 days (Adjmi and Bayadhi).

3.3. Emergence of the seedling

The coefficients of emergence rate (CRE) of the different varieties used are shown in Figure 4.

**Figure 3.** The coefficients of emergence rate (CRE) seedlings of five varieties of *Pistacia vera* L.

Those are the varieties Achouri Batouri and which present the highest value of the emergence rate coefficient with a value which varies between 3.33 and 3.45 emerged seedlings / day. The time between between the first and the last seedling is 18 days for variety Batouri and 20days for the variety Achouri.

Varieties Neb Djemel, Adjmi and Bayadhi recorded almost the same number of seedlings emerged per day which varies between 2.76 and 2.92. The time between the first and the last seedling is 16 days for variety Adjmi, 19 jours for Neb-Djemel variety and 22jours for Bayadhi variety.

3.4. The seedling growth

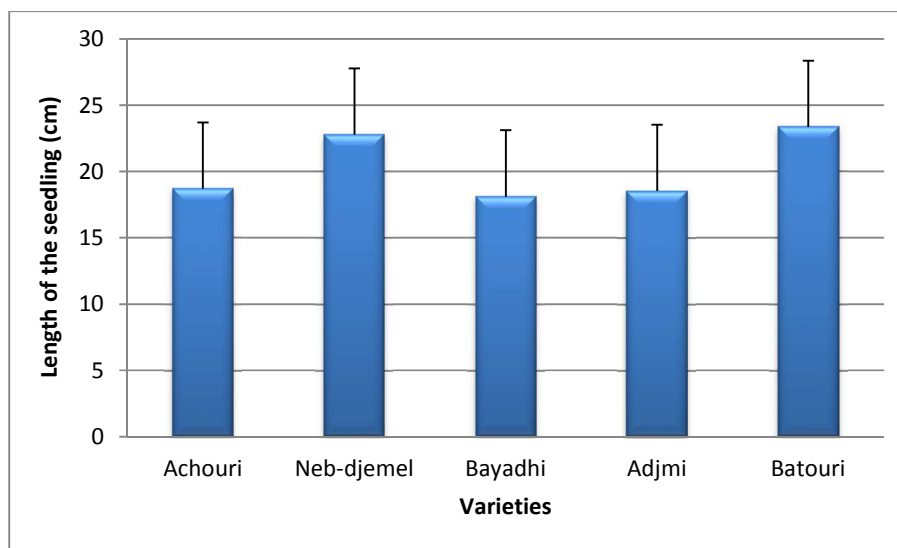


Figure 4. Aerial growth of seedlings of five varieties of *Pistacia vera* L.

The data in Figure 4 illustrating the evolution of aerial growth of seedlings grown from seeds of five varieties of *Pistacia vera* L. The examination of the results of this histogram shows that there is the effect of the type of the variety used pistachio on height growth. Indeed, the plants and varieties Batouri Neb Djemel have better development (22.78 to 23.36cm) with a small superiority of the former variety. About the varieties Adjmi, Achouri and Bayadhi the plants have undergone almost the same height growth (18.11 to 18.7cm). The works of [14] for seed germination set in the field recorded a height of 13.06cm to the plants of the variety Achouri and only 7.5cm for Adjmi variety.

These results support the use of nursery seed varieties Achouri and Batouri to obtain nursery rootstocks because they present an important development of the aerial part.

The analysis of variance for growth in stem length reveals a highly significant effect between the different varieties as the value of F calculated (15.44) is significantly higher than that of theoretical F (2.43) (Table 3) (Table 4).

Table 3. Table summarizing of randomized ANOVA (a factor) (height Growth)

Source of the variations	df	Sum of squares	Average square	F de Fisher	Prob. Critique	Theoretical F	F
Treatment	4	780.583333	195.145833	15.4419824	1.5201E-10	2.43406514	
Error	145	1832.41667	12.6373563				
Total	149	2613					

Table 4. Comparison of average stem length depending on the varieties. A and B represent two different groups to 5%.

Varieties	Average	Homogeneous groups
Achouri	18.7	A
Neb-djemel	22.7833333	B
Bayadhi	18.1166667	A
Adjmi	18.5333333	A
Batouri	23.3666667	B



Photo 2. Young seedlings of five varieties of *Pistacia vera* L (12months)

3.4.1. Evolution of height growth

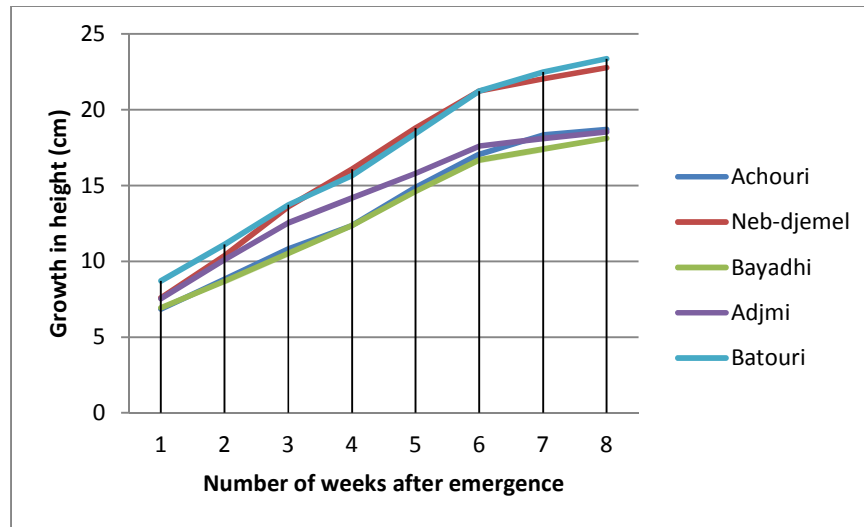


Figure 5. Evolution of aerial growth of seedlings of five varieties of *Pistacia vera* L.

According to the results of Figure 5, it was noted that height growth of seedlings of different varieties of pistachio is on average 2cm per week until two months after emergence. During the last two weeks of growth, the plantlets recorded a reduction of elongation which varies between 0.5 and 1.27cm for the penultimate week and between 0.37 and 0.88cm for the final week of growth.

3.5. Number of leaves per seedling

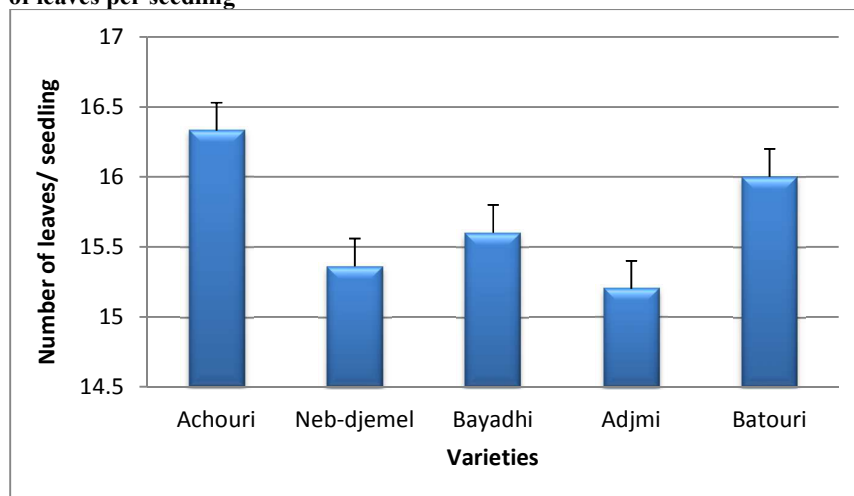


Figure 6. Number of leaves of seedlings of five varieties of *Pistacia vera* L.

According to Figure 6, we see that the number of leaves per shoot is not a function of its length but is based on the length of internodes because there are short internodes and other long (example shoot length of Achouri variety of 18.7cm with 16.33 leaves and the shoot length of the Batouri variety is 23.36cm with 16 sheets). As to varieties Adjmi, Neb Djemel and Bayadhi recorded almost the same number of leaves per plant (15). The analysis of variance for the number of leaves per seedling reveals the existence of an insignificant effect between the different varieties as the value of F calculated (1.89) is lower than theoretical F (2.43) (Table 5).

Table 5. Table summarizing of randomized ANOVA (a factor) (number of leaves per plant)

Source of the variations	df	Sum of squares	Average square	F de Fisher	Prob. Critique	Theoretical 0.05	F
Treatment	4	25.8666667	6.46666667	1.89952056	0.11364803	2.43406514	
Error	145	493.633333	3.40436782				
Total	149	519.5					

3.6. Collet diameter

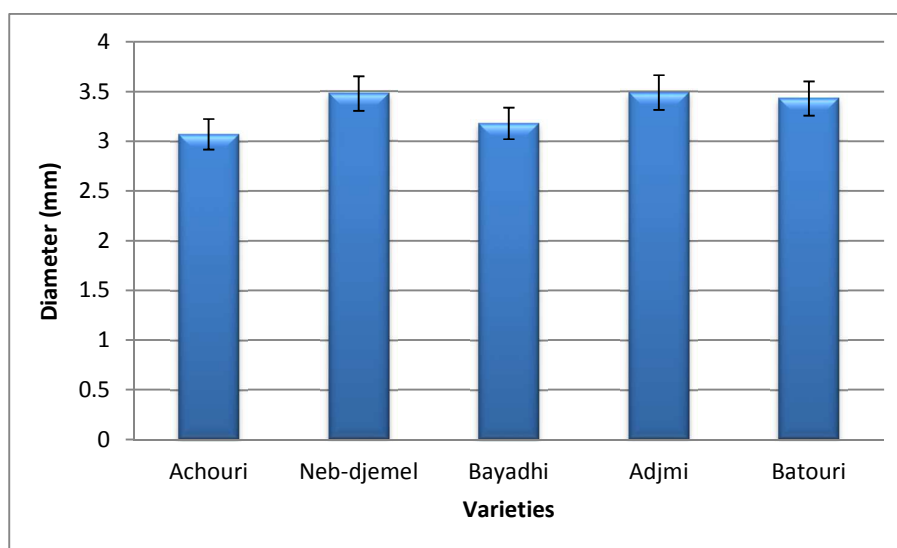


Figure 7. Collet diameter of seedlings of five varieties of *Pistacia vera* L.

The collet diameter of seedlings is not influenced by the type of variety of pistachio; however a small difference between the different varieties is noteworthy. For example between Adjmi and Achouri, a difference of 0.42 mm should be noted. Varieties Adjmi and Neb-Djemel recorded the same diameter is 3.48mm (Figure 7). According to the work of [14] for germination and growth and behavior in the open field, seedlings of the variety Achouri recorded a 2.7mm diameter against 1.2mm for the plants the Adjmi variety.

Analysis of variance revealed a significant effect between the different varieties as the calculated F (5.75) is higher than the theoretical F (2.43) (Table 6) (Table 7).

Table 6. Table summarizing of randomized ANOVA (a factor) (collet diameter)

Source of the variations	df	Sum of squares	Average square	F de Fisher	Prob. Critique	Theoretical 0.05	F
Treatment	4	4.35433733	1.08858433	5.75905401	0.00024914	2.43406514	
Error	145	27.4081	0.18902138				
Total	149	31.7624373					

Table 7. Comparison middle of the collar diameter depending on the varieties. A and B represent two different groups to 5%.

Varieties	Average	Homogeneous groups
Achouri	3.07466667	A
Neb-djemel	3.48133333	B
Bayadhi	3.185	A
Adjmi	3.491	B
Batouri	3.43066667	B

3.7. Root length

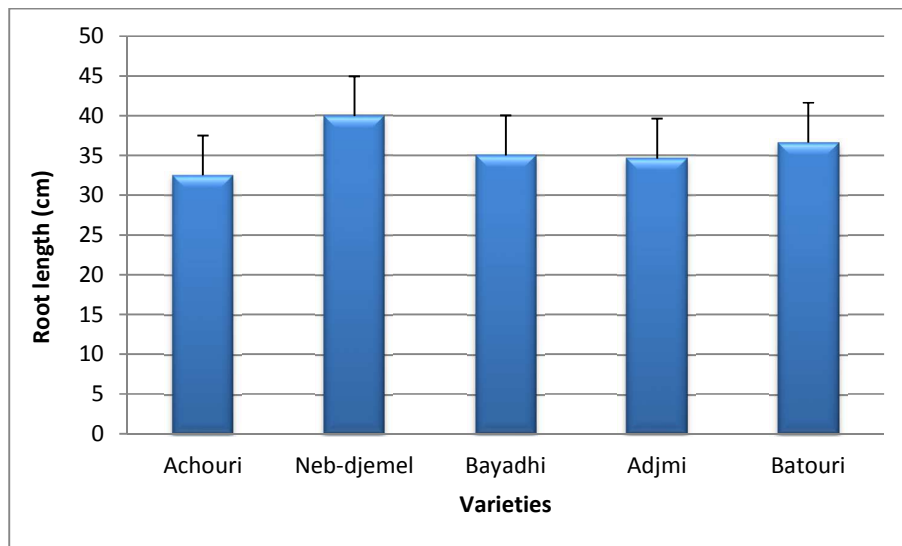


Figure 8. Length of the main root seedlings of five varieties of *Pistacia vera* L.

The most developed roots were obtained after ten weeks of rearing of Neb-Djemel variety with a length of 39.96 cm. The length of the main root of the variety Batouri comes second with 36.63 cm a difference of 3.33 cm compared to the first variety. Varieties Adjmi and Bayadhi recorded almost the same length of the main root respectively 34.63 cm and 35.03 cm.

As to the variety Achouri it had the lowest value of the main root which is 32.5cm (Figure 8).

Analysis of the variance revealed the existence of a non-significant effect between the different varieties since the calculated value of F (2.13) is lower than theoretical F (2.43) (Table 8).

Table 8. Table summarizing of randomized ANOVA (a factor) (length of the main root)

Source of the variations	ddl	Sum of squares	Average square	F de Fisher	Prob. Critique	Theoretical 0.05	F
Treatment	4	926.506667	231.626667	2.13306348	0.0796513	2.43406514	
Error	145	15745.3667	108.588736				
Total	149	16671.8733					

4. CONCLUSION

The pistachio is a much more rustic species compared to other fruit trees cultivated. Its importance lies in its great adaptability to adverse terrain (poor soils, saline soils), to dry climates and frost-free areas by its late flowering [16], [17]. Therefore, the pistachio is subject to the valorization of land that cannot allow the cultivation of fruit trees successfully. However, it is able to respond positively when grown in adverse soil and adverse climatic conditions.

The study we conducted on the emergence and growth of young seedlings of five varieties of pistachio took place in the experimental station of the University of Mascara. This study shows the possibility of growth of pistachio true in arid and semi-arid regions of Algeria, including Northwest regions of the country.

This study allowed us to meet the following observations:

- In terms of lifting, variety Achouri recorded the highest rate (92%) by against the variety Neb-Djemel which had the lowest rate (72%), this probably is due to dehiscence of seeds whose rate is the lowest (9.62%);
- For elongation, the pistachio plants Batouri have better development (23.36cm) followed by the variety Neb-Djemel (22.78Cm). As for varieties Achouri Bayadhi and Adjmi experienced almost the same height growth (18.11 and 18.7cm).
- Concerning the force, young seedlings from seeds of five varieties showed the average diameter value of the stem (3.07 to 3.49mm) with a small superiority to the plants of the variety Adjmi (0.42mm) relative to the value weaker than that of Achouri (3.07mm);
- For the length of the main root, Neb Djemel variety recorded the highest value (39.96cm) which precedes that of the variety (36.63cm) by 3.33cm. The variety closes the margin with 32.5cm.

- The number of leaves per plant is not a function of the stem height but it is related to the length between nodes (nodes between short and long). Indeed, we find that the Neb-Djemel variety was 22.78cm to the length of the rod against 15.36 leaves per plant, on the other side, the variety Achouri was 18.7cm for the length of the rod against 16.33 leaves per plant.

Seedling production Pistachio rootstock remains a very important area for the creation of new pistacheraies in Algeria. It is in this context the Ministry of Agriculture through the Arboriculture and the Technical Institute of Vine (ITAFV) of Tighennif (Mascara- Algeria) who has undertaken encouraging steps for installation through wilaya of Mascara and through neighboring wilayas (Saida, Naama, Tiaret, Laghouat ... etc.).

However, our farmers are not familiar with this species sometimes have no information concerning its existence in Algeria. It needs the popularization by the departments concerned to show the advantages of this culture, since it does not require fertile soil and plenty of water because it is a very hard species and our country is going through a period of drought especially the West.

Finally, the true culture of pistachio in Algeria needs more attention and encouragement in order to increase the areas planted with the aim of increasing the production of pistachios which contributes to improve the living standards of farmers and at the same time foreign exchange earnings for the country given the plummeting oil revenues. These can be exhausted while the earth remains forever until an inexhaustible resource.

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