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RESEARCH PAPER

Comparative effect of scarification and non-scarification of (*Pistacia atlantica*) seed in different media and environmental conditions.

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A B S T R A C T:

The effect of mechanical scarification on Pistacia atlantica seeds was studied on two different sites (indoor and outdoor) which has different environmental conditions in different media. The study examined 360 seeds (180 scarified and 180 non-scarified), 90 seeds were scarified on each site. Seeds sowed in three different media; Sandy soil, Compost and Peat moss. The statistical analysis applied on seedling parameters showed highly significant variation within-site level and between-site variation. The results of this study showed peat moss had best performance in most of parameters such as stem length 211.17mm, stem diameter 4.23mm, stem wet weight 6.04 mm, stem dry weight 2.59g, root length 484.42mm, root diameter 4.08mm, root wet weight 2.36g and root dry weight 1.08g. Also, interaction effect of scarification, indoor and Peat moss significantly increased all growth parameters.

KEY WORDS: scarification and non-scarification; *Pistacia atlantica* seed; different media.
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1. INTRODUCTION

Pistacia atlantica is one of the most broadly distributed species of *Pistacia* which belongs to Anacardiaceae family. It is a deciduous tree which is drought resistance and very tolerant to dry and hot weather. The key roots grow vertically over the soil 2 to 6m or more in depth which allow plant to absorb water profound in the soil during drought period (Chelli-Chaabouni et al., 2010) It is native to North Africa and southern Europe into Turkey, Iran and the Middle East at elevations from sea level to 5,000 feet. According to the number of *Pistacia* cultivars and genotypes, one of the rich resources of *Pistacia* in the world is Iran (Mahmoodabadi et al., 2012).

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Pistacia atlantica is mainly used for a variety traditional and industrial uses, including medicine and food such as blood clotting, throat infections , renal stones and gastralgia, periodontal disease (Farhoosh et al., 2008, Duru et al., 2003, Delazar et al., 2004). Also, tree nuts and their oils contain numerous bioactive and health-promoting components (Pourreza et al., 2008). According to Satil et al. (2003) fundamental oils of plants and their other products from minor metabolism have a great usage in food flavoring, folk medicine (Shekhany and Ahmed, 2018), fragrance, and pharmaceutical industries. *Pistacia* is typically propagated from seeds, and it might require more than 200 years for plants to reach one meter diameter and 25 meter in height (Zangeneh, 2003, Arefi et al., 2006). It is considered the greatest characteristic plant species of the pre-Saharian areas of the country (Yousfi et al., 2002). Stem elongation, leaf expansion and

bud break occur during spring, level growth between late March and mid-May (Crane and Iwakiri, 1981). However, *Pistacia* is sensitive to spring frost, and it might fall flowers and new vegetative growth in April frost.

As different pretreatments were used to break seed dormancy of the seeds that have hard seed coat to enhance germination (Hamad and Ali, 2011), seed scarification has been widely studied to clarify its influence on germination and growth speed. It is noted that scarification was critically significant for seed germination (John et al., 2015). Chaodumrikul et al. (2016) stated that scarification has an advantage that can break dormancy and enhance seed germination, Yet, scarification also might lead to abnormal seedlings, embryo damage, and dead seeds (Bradbeer, 1988). The objective of this study was to evaluate the effect of scarification, different growing media (peat moss, compost and sandy soil) and environmental condition (indoor and outdoor) on growth of *Pistacia atlantica* seeds.

2. MATERIALS AND METHODS

2.1 Experiment Site

This study was conducted from 25th January 2018 to 25 August 2018 in Grdarasha research field, college of Agriculture, Salahaddin University-Erbil-Iraq at an altitude 436 meters above sea level (Latitude North 36.16°, longitude East 44.03°). Monthly averages of air temperature and relative humidity in this area were recorded throughout the experiments period and shown in Table 1.

Table 1: Average of air temperature and relative humidity in outdoor during the period of the research.

Year	Month	Average of air temperature ˚C	Average of air humidity %
2018	January	10.4	54.0
	February	12.5	63.0
	March	16.7	48.3
	April	21.3	39.1
	May	26.2	36.5
	June	32.7	17.9
	July	35.2	14.7
	August	35.2	16.7

2.2 Treatment and experimental design

The experiment was arranged in RCBD design with 36 treatment units, three replications and three factors. The first factor was included manually scarification and was carried out by clipping 180 out of 360 seeds, and the seeds were clipped opposite the embryo using a scalpel. The second factor was involved utilizing three types of soil; peat moss, compost and sandy soil, and the third factor included two different environmental conditions (indoor (under tunnel) and outdoor). Under tunnel, condition of average of air temperature (26.4˚C) and air humidity (33.10 %) were recorded throughout the experiment period. In the experiment, seeds were put in polyethylene bags its size (30× 30× 45) (10 seeds planted into plastic bag). After rainfall season, the irrigation was performed for two days per week for all plants.

2.3 Parameters measurement

Length and diameter of stem and root for treatments were measured by (digital vernier caliper). The wet weight of stem and root was immediately measured by digital weighing after harvesting. In the lab, plants were dried in a hot air oven at 105 degrees oC, for at least 48 hours. Root and stem dry weight was obtained by weighing scale with accuracy of 0.0 g.

2.4 The statistical analysis

The results analyzed based on randomized complete block design (RCBD). The application treatments for the seedling growth experiment contain three media (peat moss, compost and sandy soil) with three replications; each replicate was contained ten seeds. All growth parameters were submitted to analysis of variance, the means were compared by least significant difference (L.S.D.) at probability level 0.05 for field, using (SAS Institute, 2005).

3. RESULTS AND DISCUSSION

3.1 Effect of seed scarification on the growth of *Pistacia atlantica*

Comparison between scarification and non-scarification seeds had no significantly differed for stem and root growth (Table 2). However,

Tigabu and Oden (2001) found that scarification treatment improve germination capacity and vigor of *Albizia gummifera* seeds, and mechanical scarification gave the highest germination and growth of plants. According to Valbuena and Vera (2002) germination of *Erica arborea* seeds can be increased by scarifying treatment.

3.2 Effect of growing media on the growth of *Pistacia atlantica*

A significantly positive effect of media on growth parameters was shown in Table 3. The seedlings which planted in peat moss were greater growth in term of stem length, stem diameter, stem wet weight, stem dry weight, root diameter, root wet weight and root dry weight (211.17mm, 4.23mm, 6.04g, 2.59g, 4.08mm, 2.36g, 1.08g respectively). However, root length was longer in compost soil (484mm) comparing with peat moss. This probably because compost does not keep water through it as peat moss keeps (Hasan et al., 2014); therefore, root in compost was longer attempting to find water. Although *Pistacia atlantica* gave the highest growth in peat moss, it is able to adopt with sandy soil. This is due to *Pistacia atlantica* is valuable species and can adopt with difficult environmental circumstances such as poor soil, low moisture in soil, hot and dry conditions (Hosseini et al., 2007).

3.3 Interaction effect of seed scarification and growing media on the growth of *Pistacia atlantica*

Scarified seeds in different media significantly differed in stem length, stem diameter, stem wet weight, root length, root diameter, root wet weight and root dry weight of seedlings (Table 4). Stem length in peat moss with non-scarification showed important difference (224.50mm), while the lowest stem length was observed in compost with non-scarification (97.00mm). However, stem diameter, stem wet weight, stem dry weight, root wet weight and root dry weight were highest in peat moss with scarification treatment (4.34mm, 6.32g and 2.68g, 2.57g and 1.12g respectively), and lowest in compost with scarification (2.40mm, 0.73g and 0.28g, 0.46g and 0.20g respectively). Root length was highest in peat moss with scarification (553.50mm), and lowest in sandy soil with non-scarification (282.17mm). Root diameter was highest in peat moss with non-scarification (4.09mm), nevertheless the lowest was in compost with scarification (2.37mm). In general, soil type is an important factor that can be influenced on physical and morphological traits of seedlings (Gholami et al., 2007).

3.4 Interaction effect of seed scarification and environmental condition on the growth of *Pistacia atlantica*

Statistical analysis of interaction between environmental condition and scarification has shown strong differences in growth parameters (Table-5). The highest stem length, stem diameter, stem wet weight and stem dry weight was obtained at indoor with scarification treatment (179.78mm, 3.93mm, 5.02g and 2.06g respectively), but the lowest was observed in outdoor with scarification (86.22mm, 2.38mm, 0.70g and 0.25g respectively). Root length was highest outdoor with non-scarification (479.33mm), yet the lowest length of root was indoor with non-scarification (289.78mm). Root diameter was highest indoor with non-scarification (3.81mm) and the lowest diameter was outdoor with scarification treatment (2.36mm). Root wet weight and root dry weight were highest indoor with scarification (2.07g and 0.93g respectively), and they were lowest in outdoor with scarification treatment (0.41g and 0.16g respectively). It has been displayed that temperature is one of the most significant environmental factors which can affect Pistacia seeds during growth stages (Hedhly et al., 2005). Further, temperature regulates both germination and dormancy and also light regulates germination. Generally, high temperatures reinforce dormancy or it may even induce it, and low temperatures could also induce seed dormancy in some circumstances, yet in numerous species they are stimulatory (Pons, 2000, Baskin and Baskin, 2004). In addition, mechanical scarification is also considered as an efficient factor in promoting seed germination for growth (Medina-Sanchez and Lindig-Cisneros, 2005).

3.5 Interaction effect of growing media and environmental condition on the growth of *Pistacia atlantica*

The interaction effect between environmental condition and growing media displayed high differences on plant growth under tunnel and outdoor (Table-6). Stem length and stem diameter

were highest under tunnel with peat moss (304.50mm and 5.27mm respectively) and they were lowest in outdoor with sandy soil (85.00mm and 2.47mm respectively). Stem wet weight and stem dry weight also were highest at indoor with peat moss (10.59g and 4.55g respectively), however, they were lowest at indoor with compost (0.59g and 0.26g respectively). However, root length was highest outdoor with peat moss (542.50mm), but the lowest of root length was at indoor with sandy soil (227.50mm). Root diameter, root wet weight and root dry weight were highest at indoor with peat moss (5.10mm, 3.82g and 1.81g respectively), and they were lowest in outdoor with sandy soil (2.51mm, 0.47g and 0.19g respectively). These results of the seedlings growth illustrated the importance of media and climate during plant growth. Vilela and Ravetta (2011) stated that soil types strongly affect survival and growth of plants, for instance, nitrogen concentration in soil tends to raise allocation of carbon to stem and foliage that improves a species and makes plant a better competitor for light. It can be said that, *Pistacia atlantica* requires special conservation during the early stages of growth (Gholami et al., 2007), though this species can adopt with different environmental conditions (Jazireai and Rastaghi, 2003, Vargas et al., 1998).

3.6 Interaction effect of seed scarification, growing media and environmental condition on the growth of *Pistacia atlantica*

Statistically, significant differences were observed in growth parameters with different climate, media and scarification treatment (Table-7). Stem length was highest at indoor with peat moss and scarification (321mm), while lowest length of stem was in outdoor with peat moss and scarification (74.67mm). Stem diameter showed the highest at indoor with peat moss and scarification (6.08mm), but the lowest was outdoor with sandy soil and scarification (2.07mm). Stem wet weight and stem dry weight were highest at indoor with peat moss and scarification (12.13g and 5.22g respectively), however, stem wet weight was lowest under tunnel with compost and scarification (0.44g). Stem dry weight was lowest in outdoor with scarification and peat moss (0.14g). Root length was greatest outdoor with compost and non-scarification (610.33mm), yet the lowest length of root showed at under tunnel with sandy soil and non-scarification (223mm). Root diameter was greatest under tunnel with peat moss and scarification (5.69mm), but it was lowest in outdoor with scarification and compost (2.31mm). Root wet weight and root dry weight were greatest under tunnel with peat moss and scarification (4.77g and 2.14g respectively), and they were lowest in outdoor with peat moss and scarification treatment (0.37g and 0.10g respectively). It is widely accepted that temperature is considered as an important factor controlling growth and development of plant, and seed germination is usually stimulated by temperature which interact positively and strongly with light and often with other factors including nitrate ions in the soil (Kakani et al., 2005). These results suggested that scarification with suitable environmental condition enhanced germination and growth because they may promote breaking of seed dormancy.

4. CONCLUSIONS

This study presented that media is significant factor which can affect growth parameters of seed and seedlings of *Pistacia atlantica* in terms of stem length, stem diameter, root length, root diameter, stem dry weight, stem wet weight, and root wet weight and root dry weight). Using peat moss and scarification treatment under tunnel (indoor) have shown remarkable growth for parameters. The results have indicated that scarification treatments and environmental condition are important factors to enhance development and growth of *Pistacia atlantica* seed.

Table 2: Effect of seed scarification on the growth of *Pistacia atlantica*

Treatment	Stem length (mm)	Stem diameter (mm)	Stem wet weight (g)	Stem dry weight (g)	Root Length (mm)	Root diameter (mm)	Root wet weight (g)	Root dry weight (g)
Scarification Seeds	133.00	3.15	2.86	1.16	381.06	3.06	1.24	0.54
Non-Scarification Seeds	141.67	3.50	2.64	1.14	384.56	3.46	1.29	0.60
L.S.D.> 0.05	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 3: Effect of selected media on the growth characteristics of *Pistacia atlantica*

Treatment	Stem length (mm)	Stem diameter (mm)	Stem wet weight (g)	Stem dry weight (g)	Root length (mm)	Root diameter (mm)	Root wet weight (g)	Root dry weight (g)
Sandy soil	97.08	2.77	0.81	0.35	280.00	2.64	0.69	0.31
Peat moss	211.17	4.23	6.04	2.59	384.42	4.08	2.36	1.08
Compost	103.75	2.98	1.39	0.51	484.00	3.07	0.76	0.35
L.S.D.> 0.05	48.62	0.57	1.60	0.71	139.47	0.52	0.52	0.24

Table 4: Interaction effect of media and seed scarification on the growth of *Pistacia atlantica*

Treatment		Stem length (mm)	Stem diameter (mm)	Stem wet weight (g)	Stem dry weight (g)	Root length (mm)	Root diameter (mm)	Root wet weight (g)	Root dry weight (g)
Sandy soil	Scarification	104.00	2.72	1.54	0.52	285.83	2.76	0.71	0.32
	Non-Scarification	103.50	3.24	1.25	0.50	282.17	3.38	0.81	0.34
Peat moss	Scarification	197.83	4.34	6.32	2.68	553.50	4.07	2.57	1.12
	Non-Scarification	224.50	4.11	5.77	2.51	415.33	4.09	2.14	1.03
Compost	Scarification	97.17	2.40	0.73	0.28	303.83	2.37	0.46	0.20
	Non-Scarification	97.00	3.15	0.90	0.42	456.17	2.92	0.92	0.44
L.S.D .> 0.05		98.39	1.25	4.09	1.77	203.12	1.18	1.40	0.67

Table 5: Interaction effect of environmental condition and seed scarification on the growth of *Pistacia atlantica*

Treatment		Stem length (mm)	Stem diameter (mm)	Stem wet weight (g)	Stem dry weight (g)	Root length (mm)	Root diameter (mm)	Root wet weight (g)	Root dry weight (g)
Indoor	Scarification	179.78	3.93	5.02	2.06	361.11	3.77	2.07	0.93
	Non-Scarification	164.89	3.66	3.83	1.61	289.78	3.81	1.61	0.82
Outdoor	Scarification	86.22	2.38	0.70	0.25	401.00	2.36	0.41	0.16
	Non-Scarification	118.44	3.33	1.44	0.67	479.33	3.11	0.97	0.39
L.S.D.> 0.05		88.96	1.06	3.60	1.58	177.17	0.97	1.21	0.56

Table 6: Interaction effect of environmental condition and growing media on the growth of *Pistacia atlantica*

Treatment		Stem length (mm)	Stem diameter (mm)	Stem wet weight (g)	Stem dry weigh (g)	Root length (mm)	Root diameter (mm)	Root wet weight (g)	Root dry weight (g)
Indoor	Soil	122.50	3.48	2.10	0.70	227.50	3.63	1.05	0.47
	Peat moss	304.50	5.27	10.59	4.55	426.33	5.10	3.82	1.81
	Compost	90.00	2.63	0.59	0.26	322.50	2.64	0.67	0.34
Outdoor	Soil	85.00	2.47	0.69	0.32	340.50	2.51	0.47	0.19
	Peat moss	117.83	3.18	1.49	0.64	542.50	3.06	0.89	0.34
	Compost	104.17	2.91	1.03	0.44	437.50	2.64	0.71	0.29
L.S.D.> 0.05		56.57	0.96	2.24	0.99	204.08	0.86	0.88	0.38

Table 7: Interaction effect of environmental condition, growing media and seed scarification on the growth of *Pistacia atlantica*

Treatment	Stem length (mm)	Stem diameter (mm)	Stem wet weight (g)	Stem dry weight (g)	Root length (mm)	Root diameter (mm)	Root wet weight (g)	Root dry weight (g)

In Door	Soil	Scarification	129.00	3.36	2.49	0.79	232.00	3.19	0.98	0.43
		Non-Scarification	116.00	3.60	1.70	0.60	223.00	4.07	1.11	0.51
	pet moss	Scarification	321.00	6.08	12.13	5.22	508.33	5.69	4.77	2.14
		Non-Scarification	288.00	4.45	9.04	3.88	344.33	4.50	2.87	1.48
	Compost	Scarification	89.33	2.34	0.44	0.18	343.00	2.42	0.46	0.22
		Non-Scarification	90.67	2.93	0.74	0.34	302.00	2.86	0.87	0.46
Out Door	Soil	Scarification	79.00	2.07	0.58	0.24	339.67	2.32	0.43	0.20
		Non-Scarification	91.00	2.87	0.79	0.39	341.33	2.69	0.51	0.17
	Pet moss	Scarification	74.67	2.60	0.50	0.14	598.67	2.45	0.37	0.10
		Non-Scarification	161.00	3.76	2.49	1.13	486.33	3.67	1.42	0.58
	Compost	Scarification	105.00	2.45	1.02	0.38	264.67	2.31	0.45	0.17
		Non-Scarification	103.33	3.36	1.05	0.49	610.33	2.97	0.97	0.42
L.S.D.> 0.05			81.23	1.15	3.20	1.41	278.94	1.04	1.04	0.48

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