Journal of University of Duhok., Vol. 20, No.1 (Agri. and Vet. Sciences), Pp 105-113, 2017
**DOI:** https://doi.org/10.26682/avuod.2017.20.1.12

# EFFECT OF PRE-SOWING TREATMENTS ON SEED GERMINATION OF *P.* eurycarpa AND *P. khinjuk* – KURDISTAN REGION

HONAR SAFAR MAHDI, WAJED ISSAM HUSSEIN, HARIKAR M. SALIH[*] and SAMI MOHAMED AMIN ALI YOUSSEF[**]
[*]Dept. of Recreation and Ecotourism, College of Agriculture, University of Duhok, Kurdistan region, Iraq.
[**]University of Montpellier-France.

***(Received: October 29, 2017; Accepted for publication: December 28, 2017)***

## ABSTRACT

**In the new global economic botany, seed germination ecology has become a central issue for increasing the number of the edible plants both in natural forest, cultivated field and nurseries. In this context, there has recently been an increasing amount of literature on the important economical value of Pistachio tree species for human livelihood activities and developments. In Kurdistan Region as a part of Zagrosian area and from ethnobotanical standpoint, Pistachio tree species are considered as an important natural resource of income to rural Kurdish people. Nevertheless, the farmers are often confronted to the difficulties of the seed germination of Pistachio tree species and the debate continues about the best pre-treatment for improving their propagation. Therefore, the main objective of this research is to analyze the effect of pre-sowing treatments on seed germination of two wild Pistachio tree species (*Pistacia eurycarpa* and *Pistacia khinjuk*) in Kurdistan Region. These pre-sowing treatments include hot water (for 5, 10 and 15 minutes), sulphuric acid scarification (for 5, 10 and 15 minutes), water soaking (for 1, 2 and 3 days), fruit (seed with exocarp) and untreated seeds (control). The results showed that the best seed germination (35%) was obtained from soaking in chemical scarification for 10 minutes for both pistachio species. While low germination rate (1%) achieved from fruits with exocarp for *P. khinjuk* with only 1%. On the other hand, the best seed germination for *P. eurocarpa* was obtained from soaking seeds in $H_2SO_4$ for 5 and 10 minutes (as 36%, 42% respectively). Meantime low germination rate was achieved from soaking seed in water for 2 and 3 days as 8% and 6% respectively. This research has been done to provide an alternative method for increasing the cultivation of (*Pistacia eurycarpa* and *Pistacia khinjuk*) seed germination in Kurdistan Region. Therefore, this study will serve as a base for future studies and investigations in issue of economic botany and improvement of the rural Kurdish livelihood activities.**

***KEYWORDS:*** *Pistacia spp*, Chemical scarification, Hot water, Exocarp, Stratification, Seedling growth, Seed germination.

## INTRODUCTION

Pistachio L. described by Linné in 1753, is a genus of deciduous trees and shrubs belonging to the family *Anacardiaceae* (a moderately family of about 600 species mainly distributed in warmer regions (i.e. tropical, subtropical, Mediterranean areas)).It contains about 20 taxa, native to subtropical and semiarid areas, the majority in Asia and the Mediterranean region, but one species extending into tropical Africa and another in Central America (Townsend and Guest, 1980; De Rougemont, 1989; Shahbaz, 2010). According to Flora of Iraq (Jeffrey, 1980), *Pistacia* genus is represented as a whole by 3 taxa for Iraq territories. They are *Pistcia vera* L. cultivated species; *P. khinjuk* Stocks natives species; *P. eurycarpa* Yalt. Native species; with the potential presence of some hybrid ones e.g. *P. eurycarpa P. khinjuk*. In Kurdistan Region territories, as a part of the Irano-Anatolianhotspot for biodiversity (Mittermeier et al., 2004; Youssef et al., 2015), these three Pistachio species are commonly founded in Irano-Anatolian region(Jeffrey, 1980).They occur widely in all Zagros mountain range (from SE Turkey to SW Iran throughout the NE Iraq (Kurdistan Region)) and foothills of Upper Mesopotamian (Shahbaz, 2010). In Zagrosian area context, these Pistachio trees have demonstrated a well adaptation to the harsh environmental conditions: poor soil, continental climate (the mean month temperature is up to + 40 C° in summer and – 10 C° in winter),

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and high anthropogenic pressure (Raeder-Roitzsch, 1969; Chaabouni and Gouta, 2002).

In the global economic botany approach, Pistachio tree species have become one of the central issues for human livelihood activities. In recent years, there has been an increasing amount of literature on the important economical value of Pistachio species, especially for their edible fruits, resins and antibiotic characteristics (Thakur and Rathore, 1991; Fatahi, 1996; Kaska, 2001; Padulosi and Hadj-Hassan., 2001; Sharifi, 2014). In Zagrosian area and from ethnobotanical standpoint, Pistachio species have various local uses by Kurdish people and considered as a profitable source of income to rural owners: Beside that the true Pistachio (*P. vera*) is well known for its edible fruits, widely used as dessert and in confectionery. The two native pistachio species (*P. eurycarpa* and *P. khinjuk*) also provide excellent evidences for living ethnobotanical activities in Kurdish societies (Townsend and Guest, 1980). Firstly, their edible wild fruits with coppery green color on drying, are collected in early autumn and then sold in traditional markets of Iraq through-out the year; Secondly, they provide excellent rootstocks for the for the cultivated true Pistachio.

In some Literatures, there some difficulties to propagate the seeds of Pistachio tree species. Their seeds are covered by hard coated; thus, the seed germination is difficult and low (Ellis et al., 1985; Isfendiyaroglu and Özeker, 2002, Acar and Ercisli., 2017). There are some pretreatments has been used to break this hard coat and encourage germination of seeds both kind of cold and normal stratification were improved germination of seeds (Crane and Forde, 1974, Acar and Ercisli., 2017). Chaabouni and Gouta (2002) highlighted that and germination rate were improved by treating seeds with acid scarification for two hours. The germination rates of *P. khinjuk* seeds were achieved good germination after treating seeds by stratification (Kafkas and Kaska, 1998). Soaking seeds in Sulfuric acid (chemical scarification) were encouraged by (Dirr and Heuser, 1987). Moreover, Scarified and stratified seeds were recommended by (Cole, 1994). Treating seeds with $H_2SO_4$ was the best treatment that improved the germination of Pistachio seeds (Ellis et al., 1985; Dirr and Heuser, 1987; Cole, 1994; Mackay, et al., 1995; Kafkas and Kaska, 1998). Debate continues about the best treatment for improving the seed germination of wild Pistachio tree species. Therefore, the purpose of this research is to investigate the seed germination ecology of two wild Pistachio tree species (*P. eurycarpa* and *P. khinjuk*) in Kurdistan Region. This research seeks to analyze in details the physical dormancy breaking by exposing seeds to chemical scarification, cold and hot stratifications, and fruits with exocarp.

## MATERIALS AND METHODS

### Research site

The research was conducted at the field of College of Agriculture/ University of Duhok (Latitude: 36°51 '32.39"N) and (Longitude: 42°52'58.95"E) elevation (473m) (Figure 1)**.** The study area categorized as a semi-arid region (Peel et al, 2007). Furthermore, the mean of temperature for 2015-2016 was 26 °C with precipitation (386mm) that started on October and ended on May (Youssef et al, 2017).


**Fig. (1):** Location of College of Agriculture Field in Duhok province – Kurdistan Region

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**Seeds collection and Treatment**

The seeds of pistachio were collected in October, 2014 from Mateen Mountain, Deralok District, Mergye Village (Latitude: 37°03'53.36"N) and (Longitude: 43°41'57.67"E) elevation (821m) (Figure 2), Duhok province, Kurdistan Region of Iraq as a native habitat according to Flora of Iraq. In this research three replication of seeds has been taken for hot water which were categorized to 5, 10, 15 minutes soaking; sulfuric acid ($H_2SO_4$) for 5, 10 and 15 minutes; seeds soaking and the last treatment was 1, 2, and 3 days soaking in water and only one replication for fruit with exocarp, and four observation with 25 seeds sown for each observation which became 1100 in total. After seeds were treated with these treatments they were planted in black pots with (Diameter 24 * 21.8 height) containing sandy soil at the field. The seeds were germinated counted starting on February2015 to the end of May on the daily bases. Seedling emergence count data were collected every week during the sown process. When the shoot of the seedling came above the ground considered as a seedling emerged.

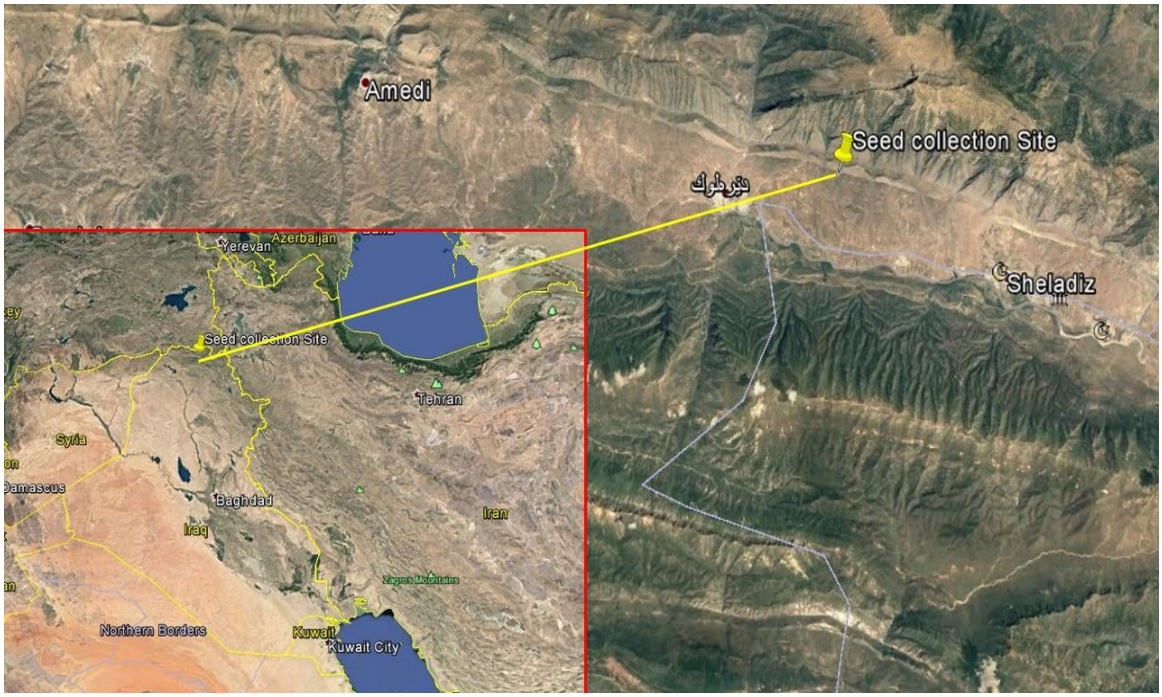


**Fig. (2):** Seed Collection Site, Deralok District, Duhok province – Kurdistan Region-Iraq

**Statistical analysis**

The research was managed and controlled in a field of Agriculture College and arranged in completely random factorial design by dividing 1100 seeds on 4 replication groups of each treatment. Then the data was analyzed by analysis of variance (ANOVA table) and Student-Newman-Keuls test using R-system program (R Development Core Team, 2017). For managing seed germination and seedling emergence Microsoft office (excel) has been used.**RESULTS AND DISCUSSION**

The results showed that there was a significant difference between the treatments.

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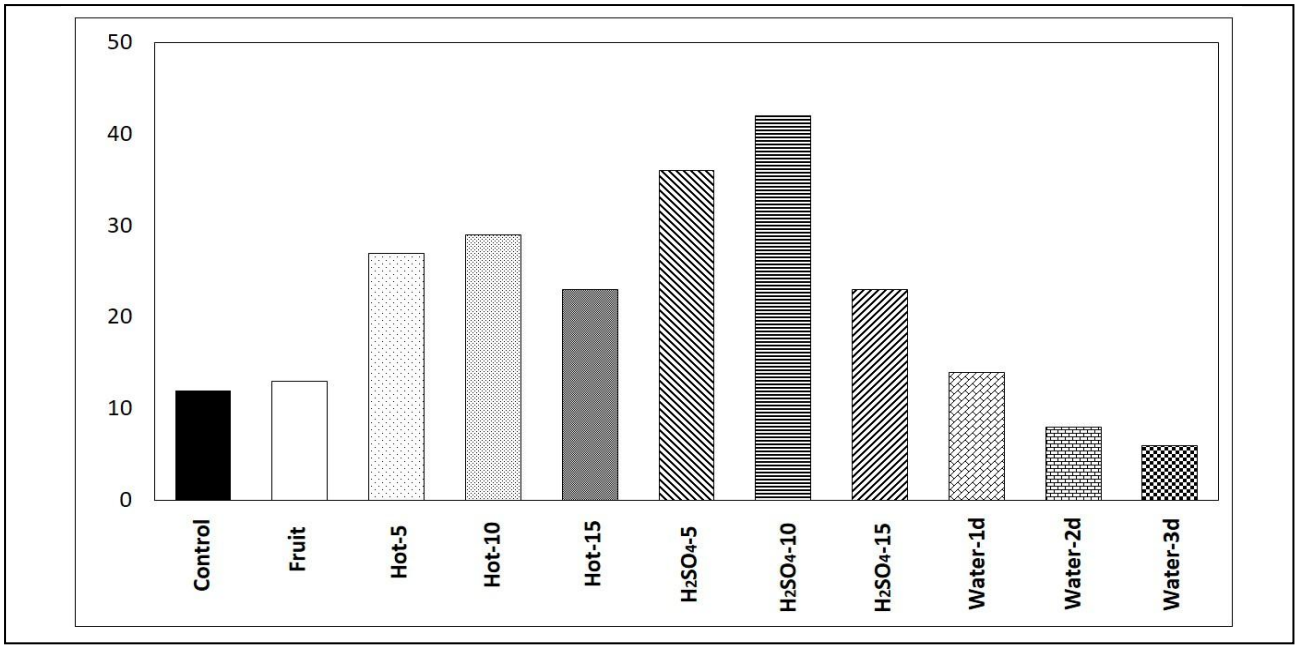


**Fig. (3):**Treatments and seed germination percentage of *P. eurycarpa*

***Pistacia eurycarpa***

The dormancy of seed might be inferred from embryo itself or tissues that enclosing embryo (Bewley and Black, 1994).There was low percentage of seed germination of *Pistacia spp.* due to hard endocarp that covered the seed (Isfendiyaroglu and Ozeker, 2002). The results demonstrated to no germination% difference between fruits (13%) and control (12%). While there was differences in seed germination percentage due to hot water (5, 10 and 15minutes) (27%, 29% and 23%) respectively, it is recognizable that the percentage of seed germination reduce at 15 minutes soaking in hot water this was attributed to seed embryos death due to duration of boiling water (Salih et al., 2016). Hot water could improve the germination percentage which leads to soften the seed coat to obtain water and exchanging gases (Mohamed-Yaseen et al., 1994). Such chemical scarification in agreement with that of Ahoton et al., (2009) who reported that there a significant improvement of seed germination with scarification, hence it consisted the fast tegument inhibition of the seeds and the water entry in the reserves that help initiating of the embryo metabolic reaction. Moreover, in general the effect of $H_2SO_4$ was greater than other treatments as mentioned by (Ellis et al., 1985; Dirr and Heuser, 1987; Cole, 1994; Mackay et al., 1995; Kafkas and Kaska, 1998), this is because of the exocarp of Pistachio species (Ellis et al., 1985; Isfendiyaroglu and Özeker, 2002). Which lead to soften that hard coats and the germination rate after soaking in $H_2SO_4$ (5, 10 and 15 minutes) was (36%, 42%, and 23%) subsequently (Figure 3).////The germination percentage of 10 minutes soaking in $H_2SO_4$ was better by 42% that 5 to 15 minutes and this is suggested by (Ellis et al, 1985 and Baskin and Baskin 2014). As well as, there was improvement of *Pistacia spp.* seed germination by treating seeds with chemical scarification (Ak et al., 1995). While there was a declining in rate of germination after 15 minutes soaking in $H_2SO_4$, this might be because the Acid enters inside the seeds which lead to kill the embryo. In comparison to control there was no significant impact of immersing seeds in Water for (1, 2 and 3 days) which were (14%, 8% and 6%) (Figure 3).

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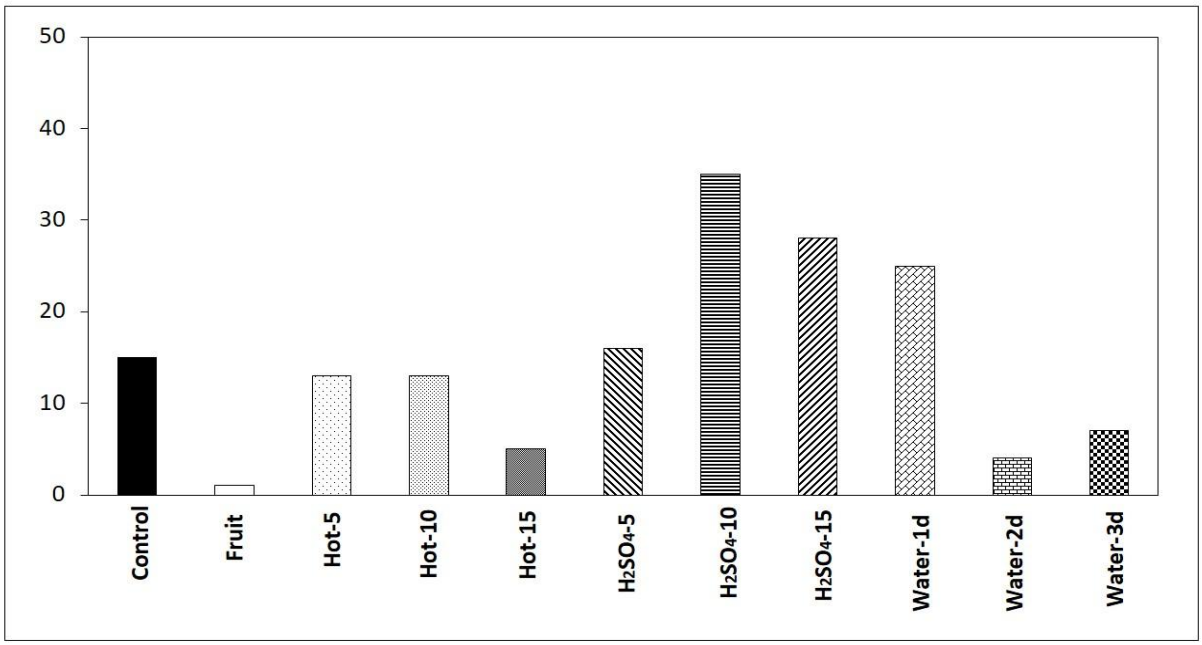


**Fig. (4):** Treatments and seed germination percentage of *P. Khinjuk Pistacia khinjuk*

The dormancy of seed might be inferred from embryo itself or tissues that enclosing embryo (Bewley and Black, 1994). The results revealed that the germination rate for sown fruit with exocarp was insignificant because of the turpentine substance which is exist in the outer layer of pistachio seeds (Bozorgi et al., 2013)that might kill the embryo. Furthermore, there was no significant difference of seed germination percentage of using hot water (5, 10 and 15minutes) (13%, 13% and 5%) respectively; comparing to control (15%), it is recognizable that the percentage of seed germination reduce at 15 minutes soaking in hot water this might be because of some seed embryos died due to duration time of boiling (Salih et al., 2016), Hot water could improve the germination percentage which leads to soften the seed coat to obtain water and exchanging gases (Longer and Degago, 1996). Moreover, in general the effect of $H_2SO_4$ was greater than other treatments as mentioned by (Ellis et al., 1985; Dirr and Heuser, 1987; Cole, 1994; Mackay et al., 1995; Kafkas and Kaska, 1998), this is because of the hard coats of Pistachio species (Ellis et al., 1985; Isfendiyaroglu and Özeker, 2002). Which lead to soften that hard coats and the germination rate after soaking in $H_2SO_4$ (5, 10 and 15 minutes) was (16%, 35%, and 28%) subsequently (Figure 4).///////It was obvious that the germination percentage of 10 minutes soaking in $H_2SO_4$ was better by 35% than 5 to 15 minutes and this was confirmed by (Abu-Qaoud, 2007). The results are in agreement with the results of Ahoton et al., (2009) who reported that there was significant improvement of seed treated with scarification, hence it consisted the fast tegument inhibition of the seeds and the water entry in the reserves that help initiating of the embryo metabolic reaction. As well as, *P. khinjuk* seed germination was improved by treatment with acid scarification with dehulled applications (Acar et al., 2017). In contrasts the study of (Kafkas and Kaska, 1998) stratification was the best treatment to achieve highest germination percentage. While there was a declining in rate of germination after 15 minutes soaked in $H_2SO_4$, this might attributed to harmful of acid. In comparison to control there was no significant impact of the seeds in Water for (1, 2 and 3 days) which were (25%, 4% and 7%) (Figure 4).

## CONCLUSION

The purpose of this experiment is to investigate effect of pre-treatment on germination rate of *P. eurycarpa* and *P. khinjuk* seeds where both tree species native to Kurdistan region. The study findings on pistachio species were demonstrated that scarified seeds chemically with $H_2SO_4$ (10 minutes) have a best germination rate for both *Pistacia* tree species. Furthermore, the results highlighted that other pre-treatment such as hot water on seeds germination of *Pistacia eurycarpa*. But there was no impact on seed germination rate

of *Pistacia khinjuk.* For the first time fruits with exocarp had been used to test the germination percentages but there was no effect on seed germination for *P. khinjuk* whereas, the fruits with exocarp had a slight influence on seed germination of *P. eurycarpa*. The research suggested to achieve a optimal seed germination from hard seed coat required soaking seeds scarified chemically with Sulfuric acid it is important to conduct a researches on seeds that had hard exocarp. This study has achieved to find out a new cultivation method of pistachio in Kurdistan Region. Therefore, this research will serve as a base for future studies and investigations in issue of economic botany and improvement of the rural Kurdish livelihood activities.

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**DOI:** https://doi.org/10.26682/avuod.2017.20.1.12

پوختە

د زانستێ رووەکی یێ جیهانی یێ نوی دا, ژینگەها چاندنا توڤی یا بویە ئیك ژ کێشین لسەر راوەستن ژ بو زێدەکرنا رووەکێن تێنە خارن د هەمی دارستانێن سروشتی دا و کێلگێن چاندنێ و نەمامگەها. دڤی دەربارەی دا, سەردەمێ نوکەدا گەلەك ڤەکولین هاتینە ئەنجامدان لسەر بهایێ ئابوری بێن دارێن ژ جورێ کەزان و بێمك و بکارئینانا وان ژ لایێ مروڤان ڤە. د هەرێما کوردستانێ دا وەك هاتیە دیارکرن ژ لایێ زانستێ (ئیپنوبوتانی) پەیوەندیا مروڤ و رووەکی, دارێن کەزانان تێنە هژمارتن ژ ژێدەرێن سروشتی بێن گرنگ بو ژیارا خەلکێ گوندان. سەرەرای هندێ, جوتیار توشی گەلەك ئاریشا دبن دەربارەی چاندنا فستق و کەزاناندا. گفتوگو یا بەردەوامە ژ بو باشترین ریکێن باشترنا زێدەبونا وان. مەبەستا سەرەکی ژ ڤێ ڤەکولینێ شیکرنا کاریگەریا مامەلەکرنا توڤی بەر چاندنی لسەر دوو جورێن دارێن کەزان و بێمکا ل هەرێما کوردستانێ. مامەلێن مە بکارئیناین پێك دێن ژ ئاڤا گەرم (5 و 10 و 15 خولەك), ترشێ کبریتیك (5 و 10 و 15 خولەك), ئاڤا ئاسایی (1 و 2 و 3 روژ), و فێقی (دگەل تیڤلێ کەسك), و توڤێن کونترولی. ئەنجامان دیارکر کو باشترین شینبونا توڤان ئەو بو ئەوا ترشێ کبریتیك بو ماوێ 10 خولەکا بو بێمکان برێژا 35%. بەلێ کێمترین شینبونا توڤی, توڤێ ب تیڤل ڤەبو برێژا 1%. ژ لایەکێ دیڤە, باشترین شینبونا توڤێن دارا کەزانێ ب نقومکرنا توڤی د ترشێ کبریتیك دا بو ماوێ (5 تا 10) خولەك دیڤکدا, بەلێ کێمترین شینبونا توڤی نقومکرنا د ئاڤێ دا بو ماوێ (2 بو 3) روژان. ئەڤ ڤەکولینە رێ خوشکەرەك بو بو پتر تێگەهشتن د ژینگەها چاندانا توڤی یا هەردوو جورێن دارێن کەزان و بێمك بێن کیڤی ل هەرێما کوردستانێ. ژ بەر ڤێ چەندێ, ئەڤ ڤەکولینە دێ بینە بنگەهەکێ زانیاریان و لێکولینێت پاشەروژێ د بواریّ زانستی ئابوری یا رووەکی و باشترکرنا داهاتی ژ بو خەلکێ گوندان.

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**DOI:** https://doi.org/10.26682/avuod.2017.20.1.12

الخلاصة

في علم النبات الاقتصادي العالمي الجديد، أصبحت بيئة إنبات البذور قضية مركزية لزيادة عدد النباتات الصالحة للأكل في كل من الغابات الطبيعية والمزارع المزروعة و المشاتل .وفي هذا السياق، هناك مؤخرا كمية متزايدة من المؤلفات عن القيمة الاقتصادية الهامة لأنواع أشجار البطم لأنشطة وتطورات سبل العيش البشرية .في إقليم كردستان كجزء من منطقة زاغروسيان ومن وجهة نظر إثنوبوتانيكال، تعتبر أنواع أشجار البطم مصدرا طبيعيا هاما للدخل للسكان الأكراد في المناطق الريفية . ومع ذلك، غالبا ما يواجه المزارعون صعوبات إنبات بذور أنواع أشجار البطم ويستمر النقاش حول أفضل علاج مسبق لتحسين انتشارها .ولذلك، فإن الهدف الرئيسي من هذا البحث هو تحليل تأثير المعالجة البذور على إنبات بذور نوعين من فصيلة البطم البري **(**بطم يوريكاربا و بطم كينجوك**)** في إقليم كردستان .وتشمل هذه العلاجات قبل البذر الماء الساخن **(**لمدة **5** و **10** و **15** دقيقة**)**، و تخديش بالحمض الكبريتيك **(**لمدة **5** و **10** و **15** دقيقة**)**، نقع فى المياه **(**لمدة **1** و **2** و **3** أيام**)**، ثمرة و البذور غير المعالجة **(**السيطرة**).**وأظهرت النتائج أن أفضل إنبات للبذور تم الحصول عليه من نقع المواد الكيميائية لمدة **10** دقائق لكل من أنواع البطم بنسبة **35**٪ .في حين كان هناك معدل إنبات منخفض تحقق من الثمرة لبطمخينجوك مع **1**٪ فقط.وفي الطرف الاخر, فأن افضل طريقة لأنبات البذور بطم يوريكاربا كانت عن طريق نقع البذور فيحمض الكبريتيك بالنسبة **5** و **10** دقائق مع **(36%**، **42%** علىالتوالي**).** وفي نفس الوقت اظهرت النتائجنسبة منخفض من انبات البذور المنقعة بالماء من **2** الى **3** أيام بالنسبة **(8%** و **6%** ايضاً على التوالي**).** وقداجريتهذاالبحثلإيجادطريقةبديلةفي زيادة انبات البذور وزراعة بطم يوريكاربا و بطم كينجوك في أقليم كوردستان العراق. ولذلك ،سوف تكون هذه الدراسة بمثابة قاعدة للدراسات والتحقيقات المستقبلية في قضية علم النبات الاقتصادي و تحسين أنشطة كسب العيش الكردية في الأرياف.