Iran Agricultural Research 5: 13-20 (1986).

GERMINATION STUDIES ON PISTACIA TEREBINTHUS L.[1]

A. Shekafandeh and B. Shaybany[2]

ABSTRACT

The nature of dormancy in seeds of *Pistacia terebinthus* L. was investigated. The main treatments consisted of: 1) sulfuric acid as a control which slightly increased germination percentage in comparison with the non-treated seeds which had no germination, 2) gibberellic acid (GA) and ethephon each at 500, 1000 and 2000 ppm, 3) KNO_3, $MnSO_4$ and $ZnSO_4$ each at 2000 ppm, and 4) chilling at 4°C for 5, 10, 15 and 20 days. Among the treatments, GA and ethephon at 500 ppm were most effective and caused 80 and 69% germination, respectively. It was shown that hard seed coat was not the only barrier to germination and the dormancy was partly due to physiological limitations as well.

تحقیقات کشاورزی ایران

(۱۳۶۵) ۲۰-۵:۱۳

بررسی جوانه‌زدن دربنه

اخترشکافنده وبیژن شیبانی

بترتیب دانشجوی سابق فوق لیسانس واستادسابق بخش باغبانی دانشکده کشاورزی دانشگاه شیراز

خلاصه

دراین مقاله رکوددربذوربنه (پسته‌وحشی)بررسی شده‌است . بنه‌دارای‌قوه‌نامیه‌ای‌حدود صفراست . برای ازبین بردن این رکودوافزایش درصدجوانه‌زدن تیمارهای مختلفی بکار برده‌شده‌که‌عبارتنداز: ۱) اسیدسولفوریک بعنوان کنترل که‌به‌مقدارجزئی‌درصدجوانه زدن راافزایش‌داده‌است . ۲) اسیدجیبرلیک واتفون باغلظتهای ۵۰۰،۱۰۰۰و۲۰۰۰ قسمت درمیلیون . ۳) نیترات‌پتاسیم ،سولفات منگنزوسولفات روی باغلظت ۲۰۰۰ قسمت در میلیون . ۴) سرمادهی دردمای ۴ درجه‌سانتیگرادبه‌مدت ۵،۱۰،۱۵و۲۰ روز.ازمیان این تیمارها اتفون واسیدجیبرلیک باغلظت ۵۰۰ قسمت درمیلیون بیش ازهمه مؤثربودندو بترتیب ۶۹ و ۸۰٪ جوانه‌زدن راسبب شده‌اند . دراین بررسی نشان داده‌شده‌است که

---

1. Contribution from the Department of Horticulture, College of Agriculture, Shiraz University, Shiraz, Iran. Paper No. K-559-64. Received 1 October 1985.

2. Former Graduate Student and former Professor, respectively.

پوشش سخت دانه تنها عامل رکود به شمار نمی‌آید بلکه دوره رکود تا حدی به محدودیتهای فیزیولوژیکی نیز بستگی دارد.

INTRODUCTION

Pistacia terebinthus L., commonly known as "beneh", grows in different types of soils in mountainous regions of Fars, Baloochestan and Khorasan provinces of Iran. Its characteristics and properties are similar to cultivated pistachio, (*P. vera* L.), but it is more salt tolerant and drought and disease resistant (2), and can be used as a rootstock for *P. vera* L.

Germination controlling mechanisms resulting in different types of dormancy are important in nature because they contribute to natural survival and to dissemination of species. For agricultural purposes various treatments such as growth regulators, sulfuric acid, light and low and alternate temperatures have been used in breaking various types of seed dormancy (3, 4, 7, 8, 9, 12).

Sulfuric acid scarification speeded germination, and increased the percentage of seeds that germinated. The effectiveness of the treatment was particularly pronounced with seeds of *P. terebinthus*, which are notoriously more difficult to germinate than those of *P. atlantica*. Scarification for 1½ hr resulted in 53% germination about two weeks after planting at which time none of the untreated seeds had germinated (2). Soaking seed of *P. terebinthus* in 500 ppm GA resulted in about two to four times as good germination as compared with water soaking for the same period (1).

Seeds of mulga (*Acacia aneura* F. J. Muell) germinated equally well in both dark and light if pre-treated with boiling water and allowed to gradually cool to room temperature (9). Kao (8) reported that removal of testa from *A. confusa* seeds reduced the number of days required for 50% germination from 10 to 16 days. Seeds of *A. dealbata* Link soaked for 24 hr in solutions of 0.2% $MnSO_4$, 0.1% H_3BO_4 or 0.2% $ZnSO_4$ germinated better than seeds soaked in distilled

water (4). Seeds of *Acacia cyanophylla* Lindl., treated with concentrated H_2SO_4 for 90 min and germinated at 15°C had 98.5% germination in six days as compared with the 4% of untreated check (10).

The nature of dormancy in seeds of myrtle (*Myrtus communis* L.) was investigated (7). The highest germination was obtained by treating the seeds with 100% cool sulfuric acid for 60 min and 80% cool sulfuric acid for 120 min. Hard seed coat was found to be the principal cause of poor seed germination.

Seeds of six grape cultivars showed an increase in percentage germination when treated with GA (100, 250, 500, 1000, or 2000 ppm). The rate of germination generally increased with concentration of GA (3). Seeds of the "Antonovka" apple were stratified at 1°C for 4-14 weeks. Maximum germination occurred with stratification for 10-14 weeks (12).

Beneh has a very low natural germination percentage and a few reports are available on its germination characteristics or on effects of varying environmental conditions on its seeds. The present research was conducted to determine the nature of seed dormancy and to increase the germination percentage by different treatments.

MATERIALS AND METHODS

Different methods for overcoming dormancy were employed in a preliminary work. These included mechanical scarification, soaking in water for 24 and 48 hr followed by mechanical scarification, treatment with sulfuric acid for 1.5 hr at room temperature and at 50°C, treating with such inorganic salts as $ZnSO_4$ and/or $MnSO_4$, and treatment with Gibberellic acid (GA) and ethephon after treating with concentrated sulfuric acid. Treated seeds were germinated at temperatures of 5, 10, 15, 20, 25, and 30°C.

In all of the above experiments, germination percentage was very low except for scarified, acid treated, and GA

treated seeds which had germination percentages of 24, 50 and 85, respectively. This suggested involvement of physical as well as physiological factors in dormancy. To further investigate those points, beneh seeds were obtained from the local market and seeds with green covers were separated. All seeds were soaked in concentrated sulfuric acid for 1.5 hr and then washed in running tap water for 24 hr. Main treatments consisted of 1) acid treatment alone used as a control 2) GA and ethephon each in concentrations of 500, 1000 and 2000 ppm, 3) KNO_3, $MnSO_4$ and $ZnSO_4$ at 2000 ppm and 4) chilling at 4°C for 5, 10, 15, and 20 days. Before germination all treated seeds were dipped in a 0.1% (w/w) suspension of captan fungicide in distilled water.

w/w suspension of Captan fungicide in distilled water.

The experiment was a completely randomized design with three replications, each plot consisting of one petri dish in which 100 seeds were placed on the top of two sheets of Whatman No. 1 filter paper. The filter paper was initially moistened with 0.1% Captan suspension in distilled water. During the germination period, distilled water was added to each petri dish as required. Germinated seeds were removed once every four days for a total period of one month. Seeds were considered germinated when radicles were clearly visible.

RESULTS AND DISCUSSION

All pre-sowing treatments showed increased germination percentage compared with nontreated seeds except 10 and 20 days at 4°C, 2000 ppm ethephon, KNO_3 and $MnSO_4$ treatments in which no significant effect on germination was observed (Table 1). It has been reported that seeds of *Acacia dealbata* soaked for 24 hr in 0.2% solution of $MnSO_4$ showed an increase in germination (4). However, we found no promotion of germination of beneh seeds treated with $MnSO_4$ (Fig. 1).

Among the treatments GA and ethephon each at 500 ppm were

Table 1. Effect of pre-sowing treatments on percent seed germination of *Pistacia terebinthus* L.

Treatments[†]	Total germination at room temperature (%)
Control	19fg[‡]
GA ppm	
500	80a
1000	51b
2000	45bcd
Ethephon ppm	
500	69a
1000	48bc
2000	28ef
Inorganic salts ppm	
KNO_3 2000	19fg
$MnSO_4$ 2000	10g
$ZnSO_4$ 2000	34cde
Low temperature 4°C	
5 d	36cde
10 d	32def
15 d	41bcde
20 d	29ef

[†]All seeds treated with concentrated sulfuric acid as a base treatments.

[‡]Means followed by the same letters are not significantly different at 5% level of probability, DMRT.

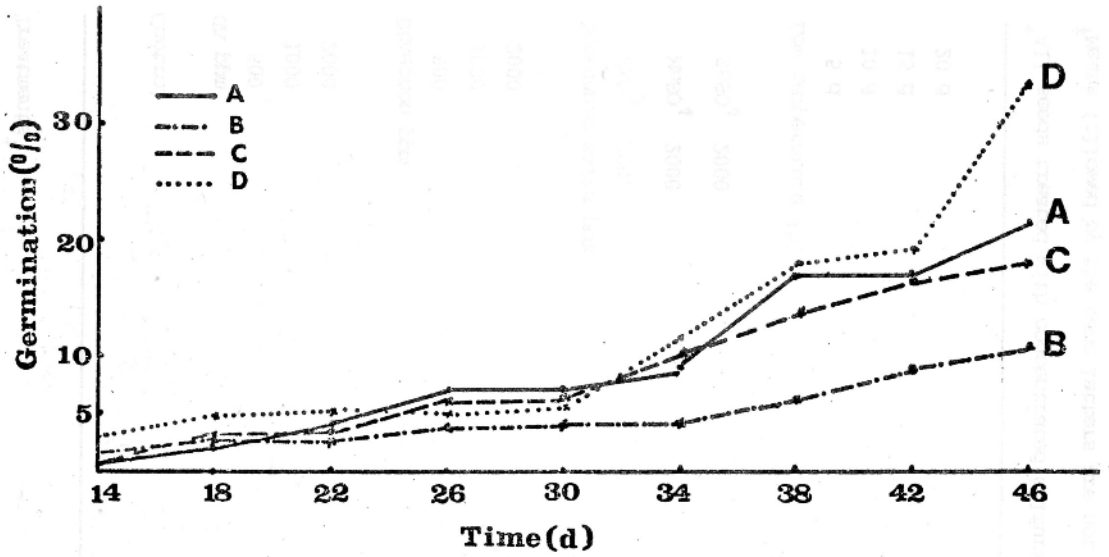

Fig. 1. Effect of pre-sowing treatments with inorganic salts on germination of *Pistacia terebinthus* seeds at room temperature. A) Control B) 2000 ppm $MnSO_4$ C) 2000 ppm KNO_3 D) 2000 ppm $ZnSO_4$.

the most effective treatments and caused 80 and 69% germination, respectively. Increasing the concentrations resulted in decreased germination percentage (Table 1). Chilling treatments in general resulted in higher germination percentages than nontreated seeds.

If a hard seed coat was the only cause of dormancy, germination rate should increase with scarification (7, 8, 10), but in the case of physiological dormancy longer time is necessary to overcome it (11, 12). Our results showed that the germination rate was very low during the first and second weeks of the test, while there was an increase in the germination rate during the third and fourth weeks.

These results indicate that beneh seeds have both a hard seed coat and physiological dormancy. This is also supported by our preliminary results in which seeds not receiving the acid treatment had germination percentage near zero. Acid treatment for scarifying the hard seed coat was not the only remedy and further treatments with GA or ethephon were necessary to improve the germination process.

LITERATURE CITED

1. Ayfer, M. and F.S. Eugenel. 1961. Effect of gibberellin and other factors on seed germination and early growth in *Pistacia* species. Proc. Amer. Soc. Hortic. Sci. 77: 308-315.
2. Crane, J.C. and H.S. Forde. 1974. Improved *Pistacia* seed germination. Calif. Agric. 28: 8-9.
3. Chadha, K.L. and V.N. Manon. 1969. Studies on the germination of grape seed. II. Germination of freshy extracted and after ripened grape seeds as influenced by gibberellic acid and thiourea treatments. J. Res. Ludhiana. 6: 821-828.
4. Heladze, V.C. and A.B. Malinjan. 1960. Experiments on the preplanting treatment of seeds with microelements.

Bull. Glav. Bot. Sada. 36: 103-104 (in Russian) Hortic. Abst. 31: 4955.

5. Hoffman, A. and J. Kummerow. 1962. Anatomical studies on flower, fruit and testa of *Acacia caven* (Mol.) Hook. et Arn., and characteristics of germination. Phyton. 19: 21-26.
6. Hogue, E.J. and L.J. Lacroix. 1970. Seed dormancy of Russian olive (*Elaegnus angustifolia* L.). J. Amer. Soc. Hortic. Sci. 95:449-452.
7. Khosh-Khui, M. and A. Bassiri. 1976. Physical dormancy in myrtle seed. Scientia Hortic. 5: 363-566.
8. Kao, C. 1971. The promotion of germination of seed of *Acacia confusa*. National Taiwan University, College of Agric. Memoris. 12: 132-137.
9. Preece, P.B. 1971. Concentrations to biology of mulga. II. Germination. Austral. J. Bot. 19: 35-49.
10. Shaybany, B. and I. Rouhani. 1976. Effect of presowing treatments and temperature on seed germination of *Acacia cyanophylla* Lindl. HortScience. 11: 381-383.
11. Simancik, F. 1970. Germination of seeds of *Prunus laura* L. after GA treatment at warm, cold and warm followed by cold stratifications. Proc. Int. Seed Test. Assoc. 35: 393-492.
12. Sladan, N.A. 1973. The effect of moisture-medium ratio and the duration of stratification on the rate of germination of "Antonovka" apple seed. Plant Propagator. 19: 12-17.