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# Effects of Mechanical, Chemical Scarification and Stratification on Seed Germination of *Prunus scoparia* (Spach.) And *Prunus webbii* (spach.) Vierh

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**Abstract:** 'Alook' (*Prunus scoparia* Spach) and 'Arjan' (*Prunus webbii* Vierh) are two wild almond species which grow naturally in vast area of Iran. Seeds of both species covered by stony endocarpe and poor seed germination is an important problem in propagation of these species. In the present study, the effects of two scarification methods (immersion in concentrate sulphuric acid for 0, 30 and 60 minutes or nicking) in combination stratification for 0, 15, 30 and 45 days on seed germination of these species were studied. Results showed that nicking plus stratification for 45 days, giving the best germination in *Prunus scoparia* and *Prunus webbii* (94 and 82.5%, respectively). Stratification requirements for scarified seeds with $H_2SO_4$ depends on the species. Immersion in $H_2SO_4$ for 30 minutes plus 30 days stratification increased the percentage germination of *Prunus scoparia* seeds (74.5%), but, treating of endocarp from *Prunus webbii* seeds with $H_2SO_4$ for 60 minutes plus stratification for 45 days, increased the germination (37%). It was concluded that in both species, before stratification, mechanical removal of seed endocarp is more efficient than immersion in $H_2SO_4$.

**Key words:** *Prunus scoparia* · *Prunus webbii* · seed germination · scraification · stratification

## INTRODUCTION

Approximately 12 species of wild almond are grown in Iran [1]. This wide diversity of wild almond species is an important genetic resource. 'Alook' (*Prunus scoparia* Spach) and 'Arjan' (*Prunus webbii* Vierh) are scattered in vast area of natural arid and semi-arid woodlands of Iran. In general, the most remarkable and positive characteristics of these species including: ability to survive on poor soils with high limestone content, soil conservation and protection, adaptability to drought and their resistance to some pests and diseases. In some regions of Iran, *P. scoparia* is used as rootstock for almond. These grafted plants have given acceptable results considering their relatively poor growing conditions. Also, seeds of *P. scoparia* consumed by local people, as a low cost and high quality protein supplement.

Traditionally, initial establishment of both species at a site depends on germination, but, little research has been done on this phase of the life cycle of both species. The usual propagation system is fall planting after soaking in water for 2-3 days. This method is effective if the seeds remain moist and are well protected from rodents and if temperature in the winter stays low for sufficient length of time. Also, in fall-sowing, it is important to sow early enough to allow seeds to after-ripen before the ground freezes. The length of the stratification period varies (depending on geographical region and genotype), therefore, the recommendation made for each species is different and is not exact. A substitute method for fall sowing could save labor and time.

Stony endocarp occur in all member of *Prunus* and seeds are often been thought to have seed coat dormancy and the endocarp may offer some resistance to germination [2, 3] and removal of the endocarp may hasten or increase germination in stone species [2-4]. Therefore, seeds of many species of *Prunus* require different scarification treatments before a period cold stratification [3-7]. Several mechanical or chemical scarification methods have used to crack, remove or soften the endocarp. Peach seeds can be removed from endocarp by applying pressure in the dorsal-vental axies [5]. Removal of the endocarp by hand, hastened or

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increased seed germination in almond [6, 8]. Nasir *et al.* [6] suggested that almond nuts should be boiled for 10 minutes before sowing to obtain the maximum germination. Acid scarification is another procedure to break physical dormancy in seeds (with intact stony endocarp) of almond [6]. Therefore, an understanding of the role of scarification treatments in promoting seed germination of *Prunus* seeds is important. Also, the seeds of most *Prunus* species have embryo dormancy and require a period of after-ripening, depends on the species and stratification requirements necessary for after-ripening depends on the species [3, 4, 7, 9, 10]. The approximate stratification period of *Prunus* seeds is 90-126 days at low temperature [3, 7, 10]. The wild almond species viz. *P. webbii* and *P. scoparia* differ from almond in their seed characteristics and there are no enough information available their seed germination. Stratification for 30 days has been recommended for *P. webbii* seeds [5]. Shekafandeh [11] reported that only stratification for 40 days at 4°C, increased the seed germination of *P. scoparia*, up to 90%.

The present study was undertaken to study the effects of scarification and stratification treatments on the seed germination of *P. scoparia* and *P. webbii*.

## MATERIALS AND METHODS

Fully mature fruits of *Prunus scoparia* and *Prunus webbii* were collected from natural resourse habitants of Fars province (south west of Iran). Fruits were gently crushed to release the seeds with stony endocarp (hereafter called seed). Seed characteristics of *P. scoparia* and *P.webbii* are listed in Table 1.

Dehuled seeds of both species were acid scarified by immersion in concentrated $H_2SO_4$ for 30 and 60 min or tip pinched with hand-clipper. Acid treated, tip pinched and untreated seeds were soaked in running water for 24 h. Tip pinched seeds with damaged embryo were removed. After mixing with peat-moss, the seeds were stored in plastic bags for 0, 15, 30 and 45 days at 5±1°C. After the stratification periods, seeds of each species were spread evenly on plastic trays, lined with moist filter paper and incubated in dark, at 25°C. Germination of the seeds was recorded an interval of 2 days, for 14 days. Protrusion of the radicle was the criterion for germination. Final germination percentages were Arc-*sin* transformed prior to statistical analysis. Means were back transformed for presentation. Mean Germination Time (MGT) and rate of germination (Grm $d^{-1}$) were also calculated for supplementary explanations. MGT was computed as follow [12]: MGT = $\sum n_i t_i / \sum n_i$, where $\sum n_i$ is the total number of germinated seeds during the germination test, $n_i$ is the number of germinated seeds on day $t_i$. and GRm,$d^{-1}$= 1/ MGT. The results were analysed by factorial analysis with four replication (each replication consist 50 seeds) and the means were compared with Duncan's Test.

## RESULTS

In both *P. scoparia* and *P.webbii*, control seeds (recievieng no scarification or stratification treatments) were not germinated. After 45 days stratification, control seeds germinated only to 6% in *P. scoparia* (Table 2) and to 8.5% in *P. webbii* (Table 3). Results showed that various duration of stratification significantly affected seed germination in scarified seeds of each species. After 15 days stratification, only tip pinching caused seed germination in *P. scoparia* (57%) and *P.webbii* (46%). After 30 days stratification, tip pinching or scarification with $H_2SO_4$ for 30 minutes had the higher seed germination percentage in *P. scoparia* (76 and 74.5%, respectively), but, olny tip pinching significantly shortened time to germination (4 days). In *P. webbii*, after 30 days stratification, only tip pinching significantly increased seed germination (73.5%). In both species, *P. scoparia* and *P. webbii*, germination percentage was increased and recorded the highest when seeds tip were pinched and stratified for 45 days (94 and 82.5%, respectively). In *P. scoparia*, after stratification for 45 days, no significant diffrences were observed between scarification with sulphuric acid for 30 or 60 minutes (47 and 49%, respectively), but, in *P. webbii,* after 45 days stratification, these two scarification treatments had significant differences (37 and 14%, respectively).

Table 1: Seed data of *P. scoparia* and *P. webbii*

| Seed charactristics | | | | | |
|---|---|---|---|---|---|
| | TW* (g) | Color | Width (mm) | Diameter (mm) | Length (mm) |
| *P. scoparia* | 443.73 | Brownish | 3.4 | 9.32 | 14.2 |
| *P. webbii* | 1560 | Bright brownish | 5.6 | 14.04 | 22.2 |

* TW: Thousand seed weight

Table 2: Effects of tip pinching, scarification with $H_2SO_4$ and stratification on percentage and Mean Germination Time (MGT) of seed germination of *P. scoparia*

| | Stratification (day) | | | |
|---|---|---|---|---|
| Treatment | 0 | 15 | 30 | 45 |
| Scarification | Germination (%) | | | |
| Control | 0*e | 0e | 8e | 6e |
| $H_2SO_4$ (30 min.) | 0e | 0e | 74.5b | 47cd |
| $H_2SO_4$ (60 min.) | 0e | 0e | 34.5d | 49cd |
| Tip pinching | 0e | 57c | 76b | 94a |
| | MGT (day) | | | |
| Control | 0d | 0d | 4.4c | 7.48a |
| $H_2SO_4$ (30 min.) | 0d | 0d | 6.6ab | 6.2ab |
| $H_2SO_4$ (60 min.) | 0d | 0d | 7.7a | 6.2ab |
| Tip pinching | 0d | 4bc | 4c | 4c |

* Means marked with the same letter in each column or row are not significantly ($p < 0.05$) different by Duncan's test.

Table 3: Effects of tip pinching, scarification with $H_2SO_4$ and stratification on percentage and Mean Germination Time (MGT) of seed germination of *P. webbii*

| | Stratification (day) | | | |
|---|---|---|---|---|
| Treatment | 0 | 15 | 30 | 45 |
| Scarification | Germination (%) | | | |
| Control | 0*f | 0f | 5.75ef | 8.5ef |
| $H_2SO_4$ (30 min.) | 0f | 0f | 8.0ef | 14.0e |
| $H_2SO_4$ (60 min.) | 0f | 0f | 16.5e | 37.0d |
| Tip pinching | 0f | 46c | 73.5b | 82.5a |
| | MGT (day) | | | |
| Control | 0c | 0c | 4.4b | 4.45b |
| $H_2SO_4$ (30 min.) | 0c | 0c | 5.0ab | 5.66ab |
| $H_2SO_4$ (60 min.) | 0c | 0c | 6.5a | 6.1ab |
| Tip pinching | 0c | 6.36a | 4.44b | 5.0ab |

*Means marked with the same letter in each column or row are not significantly ($p < 0.05$) different by Duncan's test.

Tip pinching significantly affected germination rate ($P<0.05$). No significant differences were observed between tip pinching plus stratification from 15 to 45 days for *P. scoparia* germination rate (Table 2.). In *P. webbii*, tip pinching +stratification for 30 and 45 days significantly accelerated seed germination when compared with 15 days (Table 3).

## DISCUSSION

In both *P. scoparia* and *P. webbii*, after stratification for 45 days, non scarified seeds have low gemination percenatge, but shorter stratification period (15 days) increased germination percentage of tip pinched seeds in *P. scoparia* and *P. webbii* (57 and 46%, rspectively). Thus seeds of both species have physical dormancy and hard seed-coat hinder germination. The inhibitory effect of seed coat on seed germination has also been reported in almond [4, 6, 8, 13] and amongst other *Prunus* species [3, 7]. Probably, endocarpe removal has led to increase seed moisture content and/or to remove possible inhibitior to germination However, reports are available showing that only stratification is required for seed germination of *P. scoparia* [11] and *P. webbii* [5]. Also, Grisez [14]suggested, because good germination has been attained on stratified seeds of nearly all species of *Prunus*, other pre-germination treatments are not necessary.

In both species, mechanical removal of seed coat is more effective than immersion in $H_2SO_4$, because germination percentage was lower in scarified seeds with $H_2SO_4$ than tip pinched seeds (Table 2 and 3). After 15 days stratification, germination could not be detected in seeds either treated with $H_2SO_4$ in both species, whereas tip pinching significantly increased percentage germination. These results demonstrates that differences in scarification can result in differences in the water or oxygen uptake by seeds. A weak effect of acid in scarification using almond seeds was found, previousley [6]. Also, Garcia *et al.* [13] reported that elimination of endocarpe reduced the period of stratification needed for germination in almond.

Although, determinal effects of oxygen and water in removal of dormancy in seeds of *Prunus* species has been reported [15], with regard to effectivness of tip pinching than scarification with sulphuric acid in promoting seed germination in *P. scoparia* and *P. webbii*, seems that effect of seed coat dormancy is due to physical inhibition for embryo.

In conclusion, in both species, combined effects of tip pinching and stratification caused increasing significant seed germination and stratification requirement was affected by scarification method

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