Advances in Environmental Biology, 4(2): 216-219, 2010
ISSN 1995-0756

This is a refereed journal and all articles are professionally screened and reviewed

ORIGINAL ARTICLE

Enhancing *Alcea Aucheri* (Boiss.) Alef. Seed Germination by Application of Some Scarification Treatments

[1]S. Shooshtarian and [2]H. Salehi

[1,2]Department of Horticultural Science, College of Agriculture, Shiraz University, Shiraz, Iran.
[1]Member of young researchers club Islamic Azad University, Mashhad branch

S. Shooshtarian and H. Salehi.: Enhancing *Alcea Aucheri* (Boiss.) Alef. Seed Germination by Application of Some Scarification Treatments: *Adv. Environ. Biol., C(): CC-CC, 2010*

ABSTRACT

Germination controlling mechanisms are important in nature, because they contribute to natural survival and dissemination of species. In this investigation the type of seed dormancy in *Alcea aucheri* (Boiss.) Alef. and the best treatment for its scarification was determined. Preliminary experiments showed least germinated seeds when the seeds kept in tap water without any treatment. Scarification with sand paper and cold sulphuric acid increased the germination percentage, whilst stratification and GA_3 application had no significant effect on seed germination. Hard seed coat was found to be the principal cause of poor seed germination. In this investigation, the best treatment for removing physical seed dormancy caused the highest germination percentage was scarification using the sand paper. *A. aucheri* (Boiss.) Alef. produces many beautiful flowers could last up to first severe cold in autumn and strongly can tolerates drought and needs minimum water to spread. According to the results of this experiment, this plant can be propagated by seed. Further experiments are needed for other treatments and domestication of this plant as an excellent xerophytes species .

***Key words*:** Seed germination, Xeriscaping, Physical dormancy, *Alcea aucheri* (Boiss.) Alef.

Introduction

The genus *Alcea*, a member of Malvaceae family consists of approximately 75 species worldwide distributing mainly in South-West Asia. Among these, 33 species grow in Iran [6,7,8] while 16 species are endemic to the country [10].

Regarding Iran, there are only a few studies on the taxonomy of the genus, since the report of *Alcea* in Flora Iranica [10]. However, because of the special geographical situation of Iran, further species could be expected to occur [8]. *Alcea aucheri* (Boiss.) Alef. is a perennial plant with 30 to 50 cm height, covered by high densely hairs and dingy appearance. Flowers are pink, whity-pink or dingy pink and appear among June and July, last up to first severe cold in autumn. The plant with acceptable appearance and low water requirement could be a good choice to use in xeriscaping in arid and semi-arid regions (Fig. 1). Its seed germination is inherently poor and becomes unpredictable, especially in semi-arid regions characterized by low rainfall [8]. Germination controlling mechanisms are important in nature, because they contribute to natural survival and to dissemination of species [4].

Mechanical scarification and concentrated sulphuric acid treatment have been widely used to improve seed germination of several hard seeded species [11]. The germination responses of *Medicago orbicularis* L. Bartal and *Astragalus hamosus* L., to mechanical, physical and chemical scarification, applied for removing seed dormancy, has been demonstrated that dormancy exclusively imposed by seed coat [9]. A seed germination investigation was conducted for purpose of rehabilitation of salty and

Corresponding Author:
S. Shooshtarian; Department of Horticultural Science, College of Agriculture, Shiraz University, Shiraz, Iran.
E-mail: s.shooshtarian@yahoo.com

arid lands in Australia with 18 native species by Commander *et al.* [2] which treatments were hot water, different temperatures, gibberellic acid, smoke water and karrikinolide.

Fig. 1: Flower of A. aucheri (Boiss.) Alef. can be used as a perennial xerophyte plant in dry and semi-dry landscape regions.

Since no report is available on the germination characteristics, or the effect of environmental conditions on *Alcea aucheri* (Boiss.) Alef. seeds germination, the objective of the present study was determining the nature of dormancy and the best treatment for removing the possible dormancy in the seeds.

Material and methods

Dry seeds of *A. aucheri* were collected from a native population distributed in 45 km South- East of Shiraz in Kouhanjan District (52º57´E and 29º14´N), Iran (Fig. 2) at 1500 m above the mean sea level, between July and August 2009. The meteorological data of this area is shown in Table 1. Long-term average of maximum and minimum temperatures is 28º C and 10.6º C, respectively and annual precipitation at this site is 276 mm. The absolute maximum and minimum temperatures of this region are 43.5 ˚C and -7 ˚C.

Collected seeds were treated with distilled water and left to dry at room temperature before use. Sulphuric acid was used in concentrations of 50, 75 and 100% for three levels of time including 10, 20 and 30 min at 25 ºC. Seeds were soaked in cold sulphuric acid solution (or distilled water in control treatment) and were then thoroughly rinsed three times with tap water. Durations of scarification with sand paper were 1-5 min.

For stratification, the seeds were kept under running tap water overnight and transferred to the refrigerator at 2 ºC for 1 month. Moreover, gibberellic acid in concentrations of 10 and 20 mg l^{-1} were applied as another treatment. Four replications were used including 50 seeds on a filter paper in a petri dish wetted with 5 ml of a 0.02% benomyl solution. The petri dishes were kept at room temperature averaging 25 ºC, and then germinated seeds were counted 2 weeks after the start of experiment. Experiment was conducted as a complete randomized design. Five treatments including an untreated control were compared. Data were analyzed in one-way ANOVA by MSTAT-C software. Means were compared using Duncan's test at 1% level.

Results and Discussion

Results have shown that gibberellic acid in both concentrations is not effective for germination induction in seeds compared to control. Furthermore, stratification had no significant effect on seed germination of *A. aucheri* (Table 2).

Sulphuric acid in some extent could induce germination in seeds which was increased by its concentrations and time increment. The best treatment for this species was determined as scarification with sand paper in 5 min which considerable of seeds were peeled. Increasing the duration of scarification was not effective in improving the seed germination because the seed coat and the embryo inside get highly damaged. As consequent we found that the most important cause of poor germination of *A. aucheri* is seed coats which prevent embryo to imbibe the water. This is in agreement with Akbari and Salehi [1] for *Symphoricarpus*, Khosh-Khui and Bassiri [4] for *Myrtus commiunis* L., Patane and Gresta [9] for *Medicago orbicularis* L. Bartal. and *Astragalus hamosus* L. and Delanoy *et al*. [3] for *Passiflora mollissima* (Kunch) L.H. Bailey.

In other word, each treatment that break seed coat and induce entrance of water into the seed can increase germination percentage of *A. aucheri.* This is the first report on seed germination studies of *A.aucheri* Alef. Further investigations are needed to determine the much better germination treatment and best cultural practices of this plant.

Conclusion

According to the results of this investigation, if the more seed germination is desired, it is suggested that the seeds should be only scarified with sand paper for 5 min. There is no need to stratify the seeds or application of hormonal treatment particularly GA_3. However, increasing the seed germination percentage should be the aim of subsequent studies on this plant. Further investigations are required to confirm the hypothesis presented here in other ecotypes of the species used. According to the results of this experiment and the native environment of this plant, results could apply in rehabilitation of arid zone as a perennial landscape ground cover plant.

Fig. 2: Map of Iran and Adjacent countries, showing distribution patterns of A. aucheri and position of Kouhanjan District, Shiraz, Fars province [8].

Table 1: Monthly average of mean temperature and precipitation at Kouhanjan, Fars, Iran for April 2008 to March 2009.

Month	***2008***		***2009***	
	Mean Temp. (ºC)	***Precipitation (mm)***	***Mean Temp. (ºC)***	***Precipitation (mm)***
April	18.2	7.2	14.4	144.5
May	22.4	0.1	22.9	0.0
June	27.9	0.0	27.7	0.1
July	30.3	0.0	30.1	0.0
August	30.6	0.1	30.8	3.2
September	27.4	0.0	26.9	0.0
October	22.3	0.0	21.7	0.0
November	16.1	5.6	16.8	3.2
December	9.4	5.9	9.7	100.5
January	64.9	6.1	8.0	16.0
February	29.4	8.1	9.1	4.9
March	0.0	12.9	13.86	0.6

Table 2: Effect of different treatments were used on germination percentage of *A. aucheri* seeds.

Treatments	Germination percentage
Scarification with sand paper for 1 min	$2.00^{fg\dagger}$
Scarification with sand paper for 2 min	6.00^{cd}
Scarification with sand paper for 3 min	5.00^{cdeff}
Scarification with sand paper for 4 min1	6.00^{b}
Scarification with sand paper for 5 min	42.00^{a}
Sulphuric acid 50% for 10	2.00^{fg}
Sulphuric acid 50% for 20	2.75^{defg}
Sulphuric acid 50% for 30	4.00^{cdefg}
Sulphuric acid 75% for 10	6.00^{cd}
Sulphuric acid 75% for 20	5.50^{cde}
Sulphuric acid 75% for 30	7.25^{c}
Sulphuric acid 100% for 10	2.50^{efg}
Sulphuric acid 100% for 20	1.50^{g}
Sulphuric acid 100% for 30	1.50^{g}
Gibberellic acid 10 mg l^{-1}	1.25^{g}
Gibberellic acid 20 mg l^{-1}	1.50^{g}
Stratification for 1 month	0.75^{g}
Control	1.00^{g}

†Means with the same letters have no significant difference at 5% level of Duncan's test.

Acknowledgement

We thank Dr. M. Pakravan (Department of Biology, Alzahra University) for identification of *Alcea* species through this study and Mr. F. Nikbakht for assisting in application of treatments in Physiology laboratory of Department of Horticultural Science, Shiraz University.

References

1. Akbari, M., H. Salehi, 2008. Physical Dormancy and the Best Scarification Treatment for Flower of an Hour (Hibiscus trionum L.) Seeds. Adv. in Nat. Appl. Sci., 2(1): 27-30.
2. Commander, L.E., D.J. Merritt, D.P. Rokich and K.W. Dixon, 2009. Seed biology of Australian arid zone species: Germination of 18 species used for rehabilitation. J.Arid.Environ. 73: 617-625.
3. Delanoy, M., P.V. Damme, X. Scheldman and J. Beltran, 2006. Germination of *Passiflora mollissima* (Kunch) L.H. Bailey, *Passiflora tricuspis* Mast. and *Passiflora nov* sp. seeds. Sci. Hort., 110: 198-203.
4. Khosh-Khui, M. and A. Bassiri, 1976. Physical dormancy in *myrtle* seed. Sci. Hort., 5: 363-366.
5. Pakravan, M., 2001. Systematic study of the genus *Alcea* (Malvaceae) in Iran. Unpublished Ph.D. Thesis, Tehran Universuty.
6. Pakravan, M. and A. Ghahreman, 2002. New species and new records of *Alcea* L.for the flora of Iran. Iran. J. Bot., 9: 245-247.
7. Pakravan, M., 2003. *Alcea ilamica* a new species from Iran. Rostaniha, 4: 93-97.
8. Pakravan, M. and A. Ghahreman, 2003. Some new combinations and synonyms in *Alcea* L. from Iran. Annalen Des Naturhistorischen Museums in Wien., 104: 713-716.
9. Patane, C. and F. Gresta, 2006. Germination of *Astragalus hamosus* and *Medicago orbicularis* as affected by seed coat dormancy breaking techniques. J. Arid Environ., 67: 165-173.
10. Riedel, I., 1976. Malvaceae. In: Rechinger, K.H. (ed.): Flora Iranica, Vol. 120. Graz: Akdemische Druck und Verlagsanstalt., 86: 54 Taf.
11. Tigabu, M. and P.C. Oden, 2001. Effect of seed scarification, gibberellic acid and temperature on seed germination of two multipurpose *Albizia* species from Ethiopia. Seed Sci. Technol., 29: 11-20.