African Journal of Biotechnology Vol. 10(73), pp. 16448-16451, 21 November, 2011
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB11.2660
ISSN 1684–5315 © 2011 Academic Journals

Full Length Research Paper

Effects of cracking and sowing time on germination of *Styrax officinalis* L. seeds

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Accepted 24 October, 2011

This study was conducted to explore the effects of cracking and sowing time on seed germination of a popular medicinal plant, *Styrax officinalis* L. in the forest nursery of Eğirdir, Turkey. Seeds were subjected to ten treatments with and without cracking in five sowing intervals 15 days apart. Seed germination started on the 3rd of April 2007 and continued for up to 21 days. The fastest germination (18 days) was observed on the 23rd of September 2006 with the cracking treatment and delayed germination (50 days) was seen in the 8th of September 2006 treatment. The highest germination percentage of 56% was obtained from the cracked seeds sown on the 23rd of September 2006. In conclusion, this species seeds should be cracked before sowing and planted in late September to obtain a high germination percentage.

Key words: *Styrax officinalis* L., germination, crack, sowing time.

INTRODUCTION

Styrax officinalis L. (Styracaceae) is a deciduous shrub found in Central America, Mexico, southeastern Europe, southwestern Asia and the Mediterranean region, including West and South Anatolia (Davis, 1972). This species, a drought-tolerant plant, is the only member of the *Styrax* genus native to arid regions of the Mediterranean Basin and Arabian Plateau (Jones, 1995). *S. officinalis* L. resin was used by the Romans, Egyptians, Phoenicians and Ionians as a condiment and incense (Vardar and Oflas, 1973).

Some crude extracts and fractions from different parts of the plant also have various medicinal properties, such as antioxidant and antimicrobial (Proestos et al., 2006); hemorrhoid (Gurhan and Ezer, 2004) and antifungal (Yanar et al., 2011). Moreover, the wood of this species is used for domestic and agricultural tools (Guarrera and Lucia, 2007).

Finally, *S. officinalis* L. plays an important role in apiculture (Sıralı and Deveci, 2002), erosion control activities (Acar and Gul, 1997) and usage as group of native landscape plants (Zencirkiran, 2009). Although, there are some studies focused on the phytochemistry of this species, thus far, no one has examined factors influencing its seed germination. Seed dormancy is an innate property of seeds that defines the environmental conditions in which the seed is able to germinate (Finch-Savage and Leubner-Metzger, 2006). Therefore, an understanding of many types of seed dormancy mechanisms is of ecological and economic importance.

For example, dormancy imposed by impermeable seed coats, induced by environmental light conditions, or due to immature embryos at dispersal are just a few of the mechanisms which have been described in different seeds (Eira and Caldas, 2000; Gezer and Yucedag, 2006). The level of seed dormancy varies both among and within species, and it is crucial for species to overcome seed dormancy. This study was conducted to explore the germination of *S. officinalis* L. seeds in relation to different treatments.

MATERIALS AND METHODS

S. officinalis L. has a wide distribution in the Mediterranean Region, coexisting with some maquis elements such as, *Paliurus spina*

Table 1. Treatments applied to seeds.

Number	Sowing time and treatment	Number	Sowing time and treatment
I	24th July 2006 with cracking	CIII	23rd August 2006
CI*	24th July 2006	IV	8th September 2006 with cracking
II	8th August 2006 with cracking	CIV	8th September 2006
CII	8th August 2006	V	23rd September 2006 with cracking
III	23rd August 2006 with cracking	CV	23rd September 2006

*CI: Control I and sowing time.

Table 2. Germination percentage (GP) and germination rate (GR) under different treatments for *S. officinalis* L. Seeds.

Treatment	F-Ratio	GP (%)	F-Ratio	GR (day)
I	283.707***	0.00[a1]	418.626***	0[a]
CI		0.00[a]		0[a]
II		0.00[a]		0[a]
CII		0.00[a]		0[a]
CIII		0.00[a]		0[a]
III		17.00[b]		39[e]
CIV		23.25[c]		50[f]
CV		31.50[d]		27[c]
IV		38.00[e]		30[d]
V		56.00[f]		18[b]

***: Means with different letters in each column are significantly different ($p<0.001$); [1]Means with the same letter in each column are not significantly different at $\alpha = 0.05$.

christi, Crataegus monogyna (L.) Jacq., *Fontanesia phillyreoides* L., *Pistecia terebintus* L., *Phillyrea latifolia* L., *Quercus coccifera* L., *Spartium junceum* L. and *Vitex agnus-castus* L.

Fruits of *S. officinalis* L. were collected from Egirdir, Turkey (37 39' N, 30 51' E, 1051 m asl) by hand-stripping in five different intervals spaced 15 days apart between the 24th of July and the 23rd of September, 2006. The fruits were obtained from 30 individuals that were at least 50 m apart. The fruits were also randomly sampled for all experiments and sown both with and without cracking using a depth of 3 cm at the sowing time (Table 1).

Seed sowing was done in boxes with a dimension of 60 × 200 cm filled with a mixture of 50% silt and forest soil and covered lightly with additional prepared soil. The experiment was laid out in a completely randomized design with four replications in Egirdir Forest Nursery (37° 53' N, 30° 52' E, 926 m asl). Fifty seeds were tested in each replication to determine the effect of cracking and sowing time on germination. A total of 200 seeds were used in each treatment.

Germinated seeds were counted once every three to four days starting from the first germination. Germination percentages and rates were recorded for each treatment. Daily germination percentages were summed to obtain cumulative germination percentages for each treatment on each assessment date. The following formula was used for determining germination rate (Pieper, 1952):

$$GR = \frac{(n_1 x t_1) + (n_2 x t_2) + (n_3 x t_3) + (n_i x t_i)}{T}$$

Where, GR is the germination rate; n is the number of days for each counting of germinated seeds; t is the number of germinated seeds in each counting day and T is the total number of germinated seeds.Data were transformed using arcsin square root and analyzed using SPSS ver.20. The analysis of variance (ANOVA) and Duncan's multiple range test (DMRT) were also used to compare treatments in order to understand whether they showed any statistically significant differences at the 5% level.

RESULTS AND DISCUSSION

Statistical analysis showed that the germination percentage (GP) was significantly affected by both cracking and sowing time ($p<0.001$). The highest GP of 56% was obtained from the seeds that were sown with cracking on the 23rd of September 2006. The seeds sown with cracking on the 8th of September 2006 had a GP of 38%. On the other hand, seeds sown with and without cracking on the 24th of July 2006 and the 8th of August 2006 and without cracking on the 23rd of August 2006 did not germinate (Table 2).

Seed germination started on the 3rd of April 2007 and continued up to 21 days. Different treatments significantly affected the germination period for the species. The fastest germination example least imbibition period (18 days) was observed in 23rd September 2006 with cracking treatment and delayed germination; highest imbibition period (50 days) was found in 8th September 2006 treatment (Table 2).

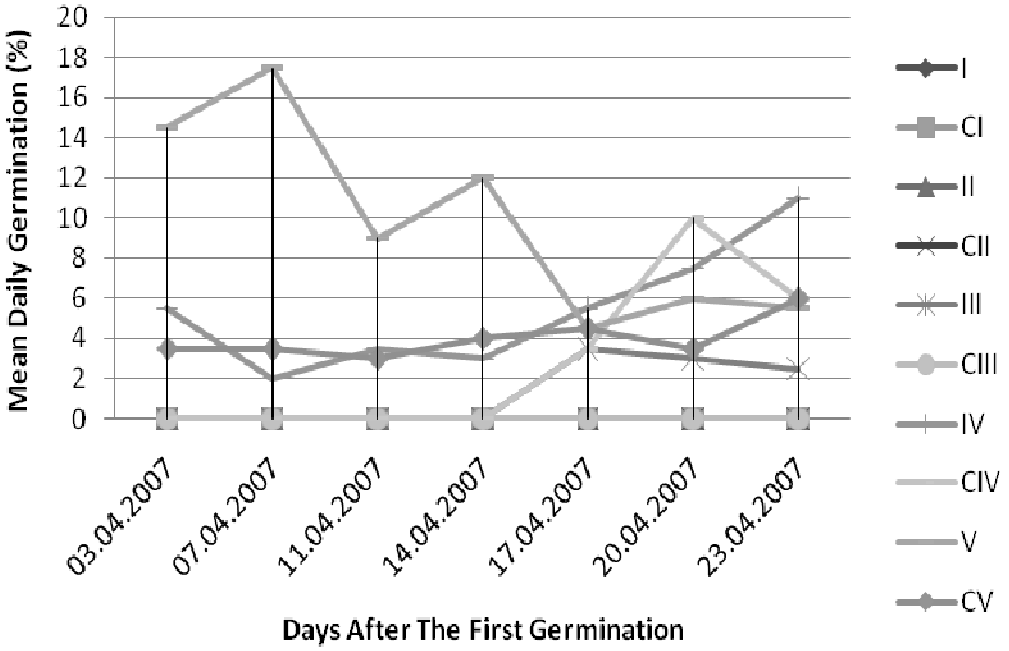

Figure 1. Mean daily germination (%) of *S. officinalis* L. seeds under different treatments.

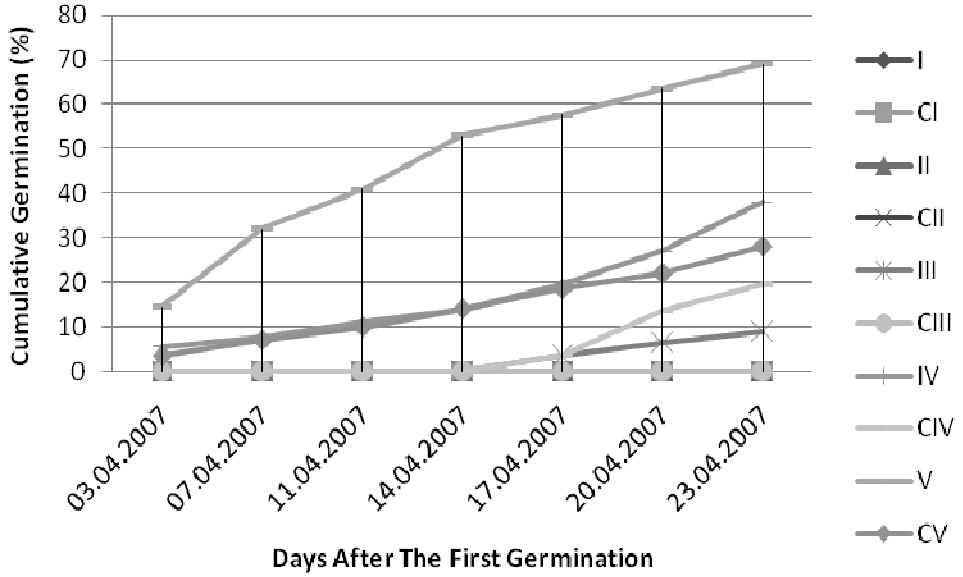

Figure 2. Cumulative germination (%) of *S. officinalis* L. seeds under different treatments

Mean daily germination percentage varied between different days of each treatment. The highest mean daily germination percentage was observed on the 4th day after the first germination (Figure 1). The cumulative germination percent in some treatments (IV, V and CV) increased constantly from the day after the first germination up to the end of germination, that is, 23rd April 2007 (Figure 2).

Considered as a whole, the results of this study suggest that *S. officinalis* L. seeds should be cracked and sown in late September to obtain high germination percentage. Deligoz et al. (2007) indicated that cracked *Zizyphus jujuba* seeds should be sown in December and January after they are treated with 100 ppm GA_3 for 12 h to obtain a high germination ratio. Accordingly, there is a need for nursery/laboratory studies that apply different pretreatments that may lead to optimal germination percentages and rates of growth of *S. officinalis* seeds. In conclusion, investigating the ecological demands, relationships with associated species and principles of seed and seedling production of *S. officinalis* will be

important to ensure the expected economic, social and collective-cultural benefits of this plant. The findings of the present study are suitable for Egirdir Forest Nursery and the other nurseries with similar environmental conditions.

ACKNOWLEDGEMENTS

The author sincerely thank Dr. Jessie Knowlton for her suggestion on the manuscript in terms of English, and also thankful to anonymous reviewers for their valuable comments on the manuscript.

REFERENCES

Acar FC, Gul A (1997). Ege Bölgesinde Erozyon Kontrolü Çalışmalarında Kullanılabilecek Bitki Türlerinin Vejetatif Yolla Üretilmesi. T.C. Çevre ve Orman Bakanlığı, Ege Ormancılık Araştırma Enstitüsü, Teknik Rapor No: 1, İzmir.

Davis PH (1972). Flora of Turkey and the East Aegean Islands. Edinburgh, Vol. 4.

Deligoz A, Gultekin HC, Yıldız D, Gultekin UG, Genc M (2007). Karaçalı (*Paliurus spina-christi* Mill.) ve Hunnap (*Zizyphus jujuba* Mill.) Tohumlarının Çimlendirilmesi Üzerine GA_3, Çıtlatma ve Ekim Zamanının Etkileri. Süleyman Demirel Üniversitesi Orman Fakültesi Dergisi, A (2): 51-60.

Eira MTS, Caldas LS (2000). Seed Dormancy and Germination as Concurrent Processes. R. Bras. Fisiol. Veg., Edição Especial, 12: 85-104.

Finch-Savage WE, Leubner-Metzger G (2006). Seed dormancy and the control of germination. New Phytologist, 171(3): 501-523.

Gezer A, Yucedag C (2006). Orman Ağaçları Tohumları ve Tohumdan Fidan Yetiştirme Tekniği, Süleyman Demirel Üniversitesi Yayın No 57, Isparta.

Guarrera PM, Lucia LM (2007). Ethnobotanical Remarks on Central and Southern Italy. J. Ethnobiol. Ethnomedicine, 3: p. 23.

Gurhan G, Ezer N (2004). Halk Arasında Hemoroit Tedavisinde Kullanılan Bitkiler-I. Hacettepe Üniv. Eczacılık Fakültesi Dergisi, 24(1): 37-55.

Jones VM (1995). Qumran Excavations, Cave of the column complex & Environs. Vendly Jones Research Institutes, Inc., Chapter 5 (Palynological Assessment), p. 60.

Pieper A (1952). Das Saatgut. P. Parey Verlag, Berlin, Hamburg, Germany.

Proestos C, Boziaris IS, Nychas G-JE, Komaitis M (2006). Analysis of flavonoids and phenolic acids in Grek aromatic plants: Investigation of their antioxidant capacity and antimicrobial activity. Food Chem. 95: 664-671

Sıralı R, Deveci M (2002). Investigation of the Important Bee (*Apis mellifera* L.) Plants in Thrace Region. Uludag Bee J. 2(1): 17-26.

Vardar V, Oflas S (1973). Qual. Plant. Mater. Veg. XXII, 2:145-148.

Yanar Y, Kadioglu I, Gokce A, Demirtas I, Goren N, Cam H, Whalon M (2011). *In vitro* antifungal activities of 26 plant extracts on mycelial growth of *Phytophthora infestans* (Mont.) de Bary. Afr. J. Biotechnol. 10(14): 2625-2629.

Zencirkiran M (2009). Determination of native woody landscape plants in Bursa and Uludag. Afr. J. Biotechnol. 8(21): 5737-5746.