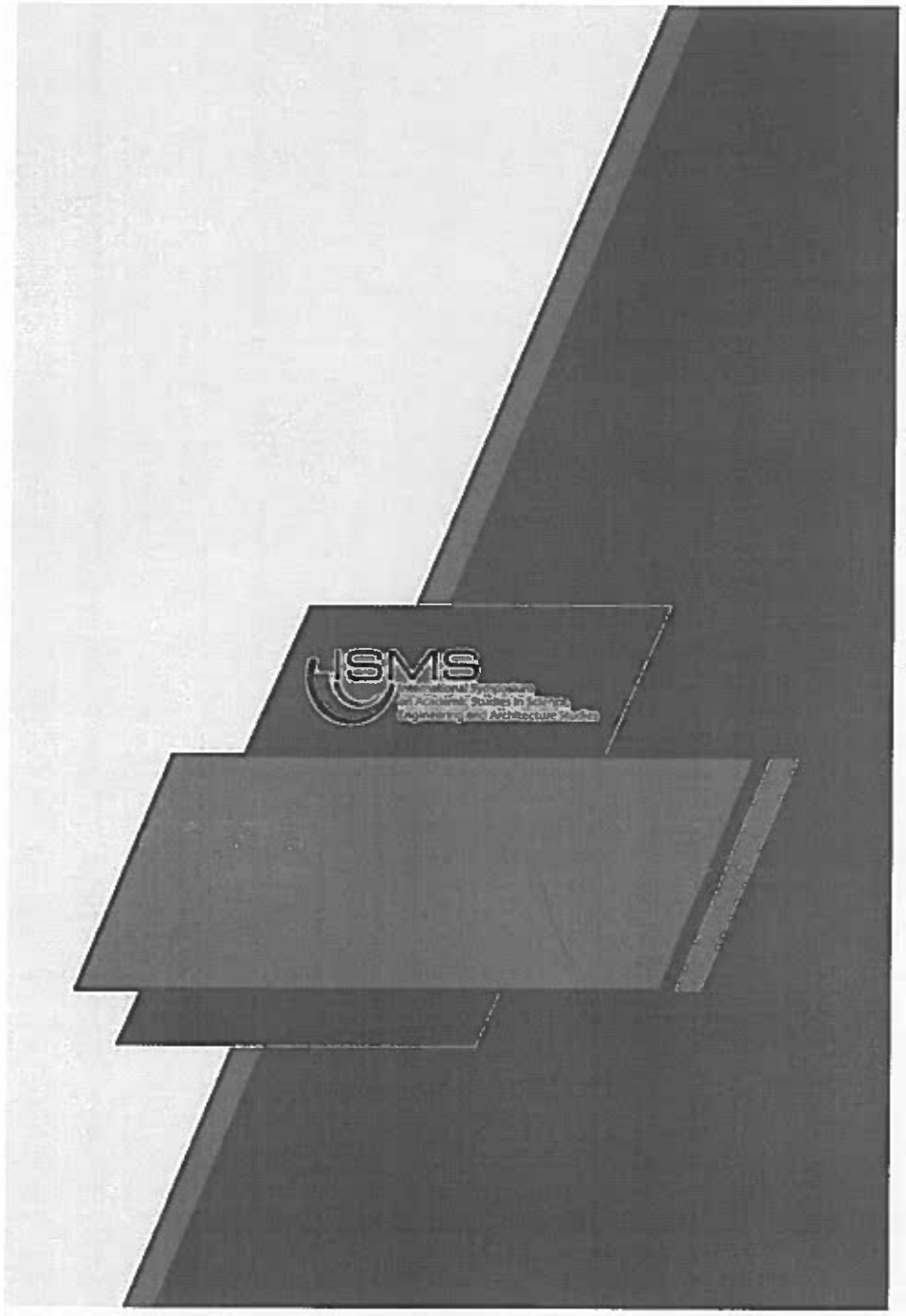


7th International Symposium on Academic Studies in Science, Engineering and Architecture Sciences

ISMS International Symposium on Academic Studies in Science, Engineering and Architecture Studies

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VII. Uluslararası

Fen, Mühendislik ve Mimarlık Bilimlerinde Akademik Çalışmalar Sempozyumu

15-17 Kasım, 2019, Ankara, Türkiye

ISMS International Symposium on Academic Studies in Science, Engineering and Architecture Studies

PROCEEDING BOOK

Editors
Prof. Dr. Halit Demir
Asst. Prof. Dr. Ayhan Güler

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TAM METİN KİTABI

ISBN: 978-605-7736-42-0
Publishing Director / Yayın Yönetmeni: Muhammet Özcan
Editors: Prof. Dr. Rıdvan Karapınar & Asst. Prof. Dr. Ayhan Güler
Cover Design / Kapak Tasarımı: Bülent Polat

ASOS YAYINEVİ
1st Edition / 1.baskı: December / Aralık 2019
Address / Adres: Çaydaçıra Mah. Hacı Ömer Bilginoğlu Cad. No: 67/2-4/MERKEZ/ELAZIĞ
Mail: asos@asosyayinlari.com
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ADAÇAYI (*Salvia officinalis*) TOHUMLARININ ÇİMLENMESİ ÜZERİNE DENİZ YOSUNU (*Ascophyllum nodosum*) EKSTRAKTI, METİL JASMONAT VE SAF SU İLE OZMOTİK KOŞULLANDIRMANIN ETKİSİ

Effect of Seaweed (*Ascophyllum nodosum*) Extract, Methyl Jasmonate and Distilled Water on The Germination of Sage (*Salvia officinalis*) Seeds

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Öz: Bu çalışma adaçayı (*Salvia officinalis*) tohumlarında bazı ön uygulamaların tohum canlılığı ve tohum gücü üzerine etkilerini araştırmak amacıyla yapılmıştır. Deniz yosunu ekstrtının 1:500 oranındaki çözeltisi, 1.0 mM dozundaki metil jasmonat (MeJA) çözeltisi ve saf su ile ile ozmotik koşullandırma (OK) uygulamaları tohumlara 20°C ve 1, 2 ve 3 gün süre ile yapılmıştır. Ozmotik koşullandırma uygulamaları 9 cm çapında, altına ve üstüne filtre kağıdı yerleştirilmiş petri kaplarında 1 gr tohuma 10 cc çözelti koyularak yapılmıştır. Uygulamalardan sonra tohumlar 25°C'de çimlendirme testlerine alınmıştır. Çalışma sonunda MeJA 2 gün ve Saf su 2 ve 3 gün OK uygulamaları, çimlenme oranını kontrole göre arttırmıştır. MeJA ve Saf su 2 ve 3 OK uygulamaları Deniz yosunu 1, 2 ve 3 gün uygulamaları ortalama çimlenme süresini kontrole göre istatistiki düzeyde kısaltmıştır. Bütün uygulamalar tohum performansının bir göstergesi olan çimlenme indeksini kontrole göre arttırmıştır. Adaçayı tohumlarında yüksek çimlenme oranı %86.5 ile Saf su ve MeJA 2 gün uyulmalarından elde edilirken, kontrol uygulamalarının çimlenme oranı %69.0 olmuştur. En yüksek ortalama çimlenme süresi 5.21 gün ile kontrol tohumlarından, en kısa 3.38 gün ile Saf su ile 3 gün OK uygulanmış tohumlardan elde edilmiştir. En yüksek çimlenme indeksi 13.39 ile saf su ile 3 gün OK uygulamasından elde edilmiş, en küçük çimlenme indeksi 7.28 gün ile kontrol uygulamalarından elde edilmiştir. Adaçayı tohumlarında, tohum çimlenmesi ve tohum gücü açısından ekim öncesi en ideal ön uygulamanın 3 gün süre ile Saf su ile OK uygulaması olduğu sonucuna varılmıştır.

Anahtar kelimeler: Çimlenme, Adaçayı, *Salvia Officinalis*, Tohum, ozmtik koşullandırma

Abstract: This study was conducted to investigate the effects of some preliminary treatments on seed viability and seed strength in sage (*Salvia officinalis*) seeds. Osmotic conditioning with 1:500 solution of seaweed extract, 1.0 mM methyl

jasmonate (MeJA) solution and distilled water were applied to the seeds at 20 °C and 1, 2 and 3 days. Osmotic conditioning applications were carried out in 9 cm petri dishes by placing 1 g of sage seed and 10 cc solution. Filter paper was placed on top and bottom of the petri dishes. After the application, the seeds were tested for germination at 25 °C. At the end of the study MeJA 2 days and Distilled water 2 and 3 days osmotic conditioning applications increased germination rate compared to the control. MeJA and Distilled water 2 and 3 osmotic conditioning applications, Seaweed 1, 2 and 3 days treatments significantly shortened the average germination period compared to the control. All applications increased germination index, which is an indicator of seed performance, compared to the control. High germination rate of sage seeds was obtained from Distilled water and MeJA 2 days treatments with 86.5%, while germination rate of the control applications was 69.0%. The highest mean germination time was obtained from the control seeds with 5.21 days and the shortest (3.38 days) was obtained from the seeds treated with osmotic conditioning with Distilled water for 3 days. The highest germination index (13.39) was obtained from the application of osmotic conditioning with distilled water for 13 days and the lowest germination index (7.28) was obtained from the control applications. In order to increase seed germination rate and seed vigor, sage seeds could be somatically conditioned with Distilled water for 3 days before planting.

Keywords: Germination, Sage, *Salvia officinalis*, Seed, Osmotic Conditioning

INTRODUCTION

Sage (*Salvia officinalis* L.) is a perennial essential oil bearing plant with woody stems, grayish leaves and blue to purplish flowers. It is native to the Mediterranean basin (Walker et al., 2004). Turkey is one of the major center of origins for *Salvia* spp since more than 97 species naturally grown in Asia minor (Kahraman et al., 2011). Sage is commonly grown as herbal tea and medicinal herb or as an ornamental garden plant worldwide.

Essential oils are synthesized by essential oil bearing plants as secondary metabolites. Essential oils are volatile, complex compounds that reflect the specific odor of plants (Bakkali et al., 2008). Historically sage species have been used as traditional medicine to control diseases caused by microorganisms. Biological activities of sage species are well known, Essential oil of sage species have anti-oxidant (Kolak et al., 2009), anti-inflammatory (Baricevic et al., 2001), anti-diabetic (Lima et al., 2006), antitumoral (Cardile et al., 2009), hypoglycemic (Alarcon-Aguilar et al., 2002), and anti-microbial (Özcan et al., 2009) and antimutagenic (Vukovic-Gacic et al., 2006) anti-viral (Loizzo et al., 2008).

Seeds of sage have dormancy due to the husks containing a mucilaginous layer. Therefore, it is needed to improve the germination of sage seeds to have vigorous seedling in the seedling market. The aim of

the current study was to determine effects osmotic conditioner on the seed viability and seed strength of sage (*S. officinalis*) seeds.

MATERIAL AND METHODS

Seed source

The sage seeds (*Salvia officinalis*) were harvested in 2018 growing season from the herbal garden of Erciyes University, Agriculture Faculty located in 38° 42'55'' N and 35° 32' 47'' E 1080 m above sea level. The seeds were shade dried and kept in a refrigerator at 6 until usage.

GERMINATION BIOASSAY

A laboratory work was carried out in factorial experiment design with tree replications. The Factors were osmotic conditioner (Maxicrop, MeJA, Distilled water and control) and application period (0, 1, 2 and 3 days). The 1: 500 concentration of commercial seaweed extract Maxicrop recommended by Sivritepe (2000) for pepper seeds and Demirkaya (2010) for pepper and onion seeds was used as osmotic solution. Osmotic conditioning applications with seaweed extract were performed for 1, 2 and 3 days at 20 °C according to Sivritepe (2000) and Demirkaya (2010). Filter papers were placed under and above a petri dish. One g of seed was weighed with a precision of 0.01 g and put into the Petri dish. After placing the seeds, 10 ml of seaweed extract solution prepared in the above dose was placed in each petri dish (Demirkaya, 2010). Methyl jasmonate (MeJA) applications were carried out in 1, 2 and 3 days application periods, 1.0 mM dose, 10 ml of freshly prepared MeJA solution was added after placing 1 g seed in the petri dish. The Petri dishes were replaced in a climate cabinet having a constant temperature of 20 °C (Demirkaya 2016). Osmotic conditioning applications with distilled water 1, 2 and 3 days application periods were carried out by pipetting 10 ml of distilled water in each petri dishes after placing 1 g seed in the petri dish. The Petri dishes were replaced in a climate cabinet having a constant temperature of 20 °C (Demirkaya 2016).

Germination percentage was calculated after 14 days application and expressed as percentage according to the following formula. Germination percentage = (Number of germinated seeds / Total Number of treated seeds) x 100. The mean germination time (MGT) was calculated according to the equation of (Ellis and Roberts 1981). $MGT = \Sigma(Dn)/\Sigma n$ (where D = number of days counted from the beginning of the germination test and n = number of seeds which germinate on day). The germination index (GI) was calculated according to (Copeland and McDonald 2012). $GI = \sum n / D$ (where n= number of seeds which germinate on day and D= number of days counted from the beginning of the germination test).

Statistical analysis

Experimental data were subjected to analysis of variance with "SPSS 13.0 for Windows" software and significant means were compared with the aid of LSD test at 0.05 significance level.

RESULTS AND DISCUSSION

The results of Table 1 show a great variation for mean germination rate, mean germination time and germination index among treatments and their application period.

Table 1. Application period, mean germination rate, mean germination time and mean germination index of *Salvia officinalis.*

Treatments	Application period (day)	Mean germination rate (%)	Mean Germination time (day)	Germination index
Control	0	69.0 bcd*	5.21 a	7.28 d
Maxicrop	1	75.5 abc	3.98 b	10.34 cb
	2	81.0 ab	3.68 b	11.58 ab
	3	82.0 ab	3.73 b	11.59 ab
MeJA	1	69.50 bcd	5.72 a	7.81 cd
	2	86.50 a	3.98 b	11.48 ab
	3	57.00 d	3.77 b	8.00 cd
Distilled water	1	64.50 cd	5.04 a	8.23 cd
	2	88.50 a	3.84 b	12.60 ab
	3	86.00 a	3.38 b	13.39 a

* Different letters indicate significant differences at $p<0.05$

When germination rate was ranged between 57.00 and 88.50%. The highest germination rate was obtained from distilled water application with 2 and 3 duration days. However, the lowest germination rate was obtained from 3 days MeJA treatment. Compared with the control treatment, all of the duration of Maxicrop applications had significantly greater germination rates. However, 3 days MeJA application had significantly lower germination rate compared with the control. Germination time varied between 5.21 and 3.38 days. The highest germination time was obtained from 1 day MeJA application with 5.72 days. The lowest germination time was obtained from 3 days distilled water application with 3.38 days. When germination index was considered, the highest germination index was obtained from 3 days distilled water application with 13.39. Compared with the control all of the treatment had higher germination index. The germination is the most comprehensive measurement parameter that combine germination percentage and germination speed. It can be attributed that improvement of uniform seed germination due to the completion of pre-germination process such DNA

mRNA, protein and membrane repair synthesis and repair and changed enzyme activities (McDonald, 2000; Jowkar et al., 2012; Wattanakulpakin et al., 2012). Seed osmotic conditioning synchronize the metabolism of the germinating seeds, enhance mitochondria number and production of ATP (Varier et al., 2010). It was reported that hydropriming improve seed germination rate and improve seedling vigor.

CONCLUSION

Seeds of sage species had dormancy. Therefore, germination of sage seed must be improved to get vigorous seedlings. Sage seed germination was improved by the application of osmotic conditioners. The best germination percentages were obtained from 1, 2 and 3 days Maxicrop, 2 days MeJA and 2 and 3 days distilled water applications. It could be concluded that seed osmotic conditioning is a very effective technique to improve seed germination and seedling growth.

REFERENCES

1. Walker JB, Sytsma KJ, Treutlein J, Wink M (2004). Salvia (Lamiaceae) is not monophyletic: Implications for the systematics, radiation and ecological specialization of Salvia and Tribe Menthae. Am. J. Bot. 91:1115-1125
2. Kahraman, A., Celep F., Doğan M., Guerin G.R., Bagherpour, S. (2011). Mericarp morphology and its systematic implications for the genus , L. section Hymenosphace Bentham (Lamiaceae) in Turkey. Plant Syst Evol 292: 33-39.
3. Bakkali, F., Averbeck, S., Averbeck, D., and Idaomar, M. (2008). Biological effects of essential oils – a review. *Food Chem. Toxicol.* 46, 446–475. doi: 10.1016/j.fct.2007.09.106
4. Kolak U, Kabouche A, Öztürk M, Kabouche Z, Topçu G, Ulubelen A. (2009). Antioxidant diterpenoids from the roots of *Salvia barrelieri*. Phytochem Anal;20(4):320–327. doi: 10.1002/pca.1130.
5. Baricevic, D., Sosa S., Della Loggia, R., Tubaro, A., Simonovska, B., Krasna, A., Zupancic, A. (2001). Topical anti-inflammatory activity of *Salvia officinalis* L. leaves: the relevance of ursolic acid. J Ethnopharmacol 75:125–32.
6. Lima C.F., Azevedo M.F., Araujo R., Fernandes-Ferreira M., Pereira-Wilson C. (2006). Metformin-like effects of *Salvia officinalis*: useful in diabetes prevention? Br J Nutr; 96:326-333.
7. Cardile, V, Russo, A., Formisano, C., Rigano, D., Senatore, F., Arnold, N.A., et al. (2009). Essential oils of *Salvia bracteata* and *Salvia rubifolia* from Lebanon: chemical composition, antimicrobial activity

and inhibitory effect on human melanoma cells. J Ethnopharmacol. 126: 265–72.

8. Alarcon-Aguilar F.J., Roman-Ramos R, Flores-Saenz J.L. and Aguirre-Garcia F. (2002). Investigation on the hypoglycaemic effects of extracts of four Mexican medicinal plants in normal and alloxandiabetic mice. Phytother Res. 16: pp. 383–386.
9. Özcan, B., Birgul, E.M., Coleri, A., Yolcu, H., Caliskan, M. (2009). In vitro antimicrobial and antioxidant activities of various extracts of Salvia microstegia (Boiss.) et. Bal. from Antakya, Turkey. Fresenius Environ Bull.; 18:658–62.
10. Vukovic-Gacic, B. Nikcevic, S. Beric-Bjedov, T. Knezevic-Vukcevic, J. and Simic, D. (2006. Antimutagenic effect of essential oil of Sage (*Salvia officinalis* L.) and its monoterpenes against UV-induced mutations in Escherichia coli and Saccharomyces cerevisiae". Food Chemical Toxicology, 44: 1730-1738.
11. Loizzo M.R., Saab A.M., Tundis R., Menichini F., Bonesi M., Piccolo V., Statti G. A,de Cindio B, Houghton P.J. and Menichini F. (2008). In vitro inhibitory activities of plants used in Lebanon traditional medicine against angiotensin converting enzyme (ACE) and digestive enzymes related to diabetes. J. Ethno. 119:109-116.
12. Sivritepe, H.Ö. (2000). Deniz Yosunu Ekstraktı (*Ascophyllum nodosum*) ile Yapılan Ozmotik Koşullandırma Uygulamalarının Biber Tohumlarında Canlılık Üzerine Etkileri. III. Sebze Tarımı Sempozyumu. 11-13 Eylül 2000, Isparta, 482-486.
13. Demirkaya, M. (2010). Deniz yosunu (Ascophyllum nodosum) Ekstraktı Uygulamalarının Biber ve Soğan Tohumlarının Canlılığı ve Gücüne Etkileri. Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 26: 217-224, http://fbe.erciyes.edu.tr ISSN.1012-2354.
14. Demirkaya, M. (2016). Metil Jasmonat ve Deniz Yosunu (Ascophyllum nodosum) Ekstraktı ile Ozmotik Koşullandırma Uygulamalarının Düşük Sıcaklıkta Biber Tohumlarının Çimlenme ve Ortalama Çimlenme Süresi Üzerine Etkileri. Selçuk Tarım Bilimleri Dergisi. Selçuk Tar Bil Der, 3: 42- 47.
15. Ellis, R. H., & Roberts, E. H. (1981). The quantification of ageing and survival in orthodox seeds. Seed Science and Technology (Netherlands).
16. Copeland, L. O., & McDonald, M. F. (2012). Principles of seed science and technology. Springer Science & Business Media
17. McDonald M.B. 2000. Seed priming. In Black M and Bewley J.D. (eds.), Seed technology and its biological basis. Sheffield Academic Press Ltd., Sheffield, England, pp. 287-325
18. Jowkar, M., Ghanbari, A., Moradi, F., Heidari, M. (2012). Alterations in seed vigor and antioxidant enzymes activities in Silybum

marianum under seed priming with KNO3. J. Med. Plants Res. 6:1176-1180.

19. Wattanakulpakin, P., Photchanachai, S., Ratanakhanokchai, K., Kyu, K.L., Ritthichai, P. and Miyagawa, S. (2012). Hydropriming effects on carbohydrate metabolism, antioxidant enzyme activity and seed vigor of maize (*Zea mays* L.). Afr. J. Biotechnol. 11:3537-3547.
20. Varier A, Vari A.K., Dadlani M. (2010). The subcellular basis of seed priming. Curr. Sci. 99:450-456.