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Effect of Pre-Chilling Duration and Kinetin on Germination of Capers (*Capparis spinosa var. spinosa and Capparis ovata var. canescens*) Seeds

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Abstract

This study was conducted to determine theeffects of pre-chilling and kinetin treatment on germination of *Capparis spinosa* var. *spinosa* and *Capparis ovata* var. *canescens* seeds. Seeds were kept 1, 2, 4, 6, 8 and 12 weeks for pre-chilling at +4 ºC. After the prechilling, Seeds were treated with distilled water, 100, 200, 400 and 800 ppm doses of kinetin and 2000 ppm dose of GA3 which was used as positive control for 24 hours at 22 ºC. The research was conducted with 4 repetitionin in fitler papers at 20±1 ºC in dark germination cabinet. The highest seed germination rate in *C. Ovate* was %6.75 in 6 weeks pre-chilling with 400 ppm kinetin.The highest germination in 2000 ppm GA3 (positive control) was %9 in 6 weeks pre-chilling. The highest seed germination rate in *C. spinosa* was %1.25 that was obtained from no pre-chilling with 800 ppm kinetin. GA3 was less effective than kinetin on germination of *C. spinosa* seeds. Germination of *C. spinosa* seeds was low and the highest seed germination in *C. spinosa* was %1 in 8 weeks pre-chilling with GA3 treatment. It was observed that GA3 increased the seed germination.

Key Words: *Capparis spinosa var. spinosa, Capparis ovata var. canescens*, Prechilling, Kinetin, Germination

Introduction

Almost around the globe, different varieties of capers are used for purposes like nutrition, medicine, erosion control and domestic decoration (Coşgevd.
2005).Its fruits, flower buds, and the new burgeons are used as food. But its most used part is its flower buds.These have international commercial value. They contain67 mgCa, 65mgP, 9mgFeand24.01g proteinin 100g of dry substance(Aktanvd.1981). Its pickles are used in salads, on pizzas or in other vegetarian foods, and also as a side with meals containing meat (Akgül 1996, Karavd. 1996). Its flower buds have antioxidant properties, and some of the chemicals it contains suppress the cancerous cells in the body.They also prevent the harm from the carcinogenic substances that come into the body. After the studies by the International Cancer Research Institute, capers are used in the preparation of extracts that are used for antitumor treatments (Anonim1997).Some of the materials in the plant have urinary stimulation and anti-hypertension properties. In its seeds, there are substances that regulate the liver, spleen and kidney functions, and which heal asthma and hemorrhoid, and which serve as aphrodisiac.Same aphrodisiac property is also seen in its fruits, along with pain relieving. Its peels contain substances that fight inflammation(Tansıvd.1997). It is also used for gaining strength and for appetite (Anonim2007).

Material and Methods

In this study, the following seeds harvested in late-September, early-October of 2010 were used:*Capparisspinosa*var. *spinosa*from AdanaHacıali Farm and *Capparisovata*var.*canescens*from HatayKırıkhanKaradurmuşlu village.

Germination media

Germination trials were carried on in a totally dark germination cabinet at 20±1 ºC among blotting papers. 10 ml distilled water was added for each blotting paper and was put in locked plastic bags to block vaporization.

Chart 3.1 Plant Hormones Being Used, Dissolvers, Dosages and Storage Conditions

Plant Growth Regulator	dissolver	dosages(ppm)	Storage Conditions(^{0}C)
		100	
Kinetin	1N NaOH	200	4
		400	
		800	
Giberellic Acid	%70 Ethanol	2000	4

In this research, to enhance the germination rate of caper seeds Kinetin (6-furfurylaminopurine), one of the hormone inciting sucker development, is used. Using 1N NaOH dissolver 100, 200, 400 and 800 ppm Kinetin dosage are gained. As control distilled water is used. Furthermore, according to Söyler and Arslan (2004), who state that the biggest germination rate is gained in researches conducted, 2000 ppm Gibberellic Acid ($C_{19}H_{21}O_6K$) Usage is evaluated as positive control (chart 3.1). In this way, it is aimed to compare the effects of 2000 ppm Giberellic Acid which has the most effect on germination and the effects of different dosages of Kinetin on caper seeds' germination.

Method

This research is conducted 4 times and each time 100 seeds are involved. Capers seeds belonging to 2 different kinds are entreated with 50% of sulphuric acid during 20 minutes and then washing with distilled water pod surface is worn away. Before pre-chilling seeds are waited at 20 oC during 48 hours in distilled water. After seeds have been waited at room temperature for 2 days, they are taken for pre-chilling in Petri plate on paper as damp-dry at +4 oC.

Control to seeds (without pre-chilling) is pre-chilled through waiting at +4 oC for 1,2,4,6,8 and 12 weeks (Chart 3.2).

Moreover, 100, 200, 400 and 800 ppm dosages of Kinetin and 2000 ppm Giberellic Acid are applied to the seeds taken from pre-chilling and also as a control, seeds are entreated in distilled water. In this application, seeds are entreated during 24 hours at 22 ºC with Kinetin Giberellic Acid and distilled water with stated dosages above.

Chart 3.2 pre-chilling duration and maturing temperature

Pre-Chillling Duration (Week)	Temperature (ºc)
0 (control)	-
1	4
2	4
4	4
6	4
8	4
12	4

To observe the effect of shelling the seeds on germination, seeds are shelled and these seeds are entreated separately with Kinetin Geberellic Acid and distilled water during 24 hours at 22 ºC.
Seeds to which Kinetin and Giberellic Acid are applied are taken to in a totally dark and 20±1 ºC' germination cabinet after 4 times application and in each time 100 seeds are put among 3 blotting paper. To observe the germination, seeds are accounted every day and seeds having 2 mm root length are accepted as germinated. On the 30th day, accounting germinated seeds germination percentage (%) is identified.
At the end of the 30th day, shelling the seeds empty seeds are identified and germination percentages are accounted through germinated seeds. Data gained from the research, being separately for each kind analysis of variance is carried out by using MSTAT-C software package 4 times according to experimental design of randomized parcels. Germination percentage is analyzed through arcsin transformation. To determine the importance between differences of applications Duncan' test is applied (Düzgüneş vd. 1987).

Results

Pre-Chilling And The Effects Of Kinetin Applications On Germination

This research is conducted to understand the effects of different pre-chilling applications and Kinetin dosages on the seeds of *Capparis Spinos Var, Spinosa, Capparis Ovata Var and Canescens. The Results of different pre-chilling duration applications ,Kinetin dosages and the result of variance analysis done with data about the percentages of the C. Ovata seeds' germination are shown in chart 4.1.*

According to the results of variance analysis given in chart 4.1., it is significant the effect of the pre-chilling duration on *C. Ovata* seeds' germination but no difference is observed among Kinetin dosages. The interaction of Pre-chilling duration and Kinetin dosages (AxB) is statistically found unimportant.

The highest germination percentage (6.75%) is gathered from the seeds which are applied 400 pmm Kinetin and 6 weeks pre-chilling among the *C. Ovata* seeds to which different pre-chilling durations and Kinetin dosages are applied. In GA_3 used as a positive control it is gathered from the seeds (16.0 %) which exposed to 2000 ppm and 6 weeks pre-chilling (chart 4.2).

In this study, effects of precooling time and kinetin dose on the germination rate of *Capparis ovate* and *Capparis spinosa* seeds are considered.

Chart 4.1. Variance Analysis Table Of Pre-Chilling And Kinetin Dosages On C. Ovata Seeds' Germination Percentage

Source of Variation	**Degree of freedom**	**Sum of squares**	**Mean of squares**	**F**
Pre-chilling duration (A)	6	1117.6	186.2	12.1 **
Error1	18	275.1	15.2	
Kinetin Dosages (B)	4	15.9	3.9	0.15
A X B	24	624.6	26	1
Error2	84	2159.1	25.7	

**$p<0.01$

According to the results of the study where kinetin and giberellic acid were applied following the precooling;highest rate of germination in *C.ovata* seedswas obtained from the positive control group of 2000 ppm GA_3 with 6 weeks of precooling with a value of %9 (Table 4.2). This result agrees with the finding of Söylera a n d Arslan (2002b). The researchers found the germination rate of GA_3 treated seeds to be between % 9-61. The highest rate (% 61) was obtained by the application of 2000 ppm GA_3 dose for 24 hours.

They obtained their highest germination rate from the 24 hour GA 3treatment. Precooling duration was found to be statistically significant for the germination of C.ovata seeds,but no difference was observed between the different kinetin doses. Interaction of precooling time and kinetin dose was found to have statistically insignificant effect on the germination of C. ovata seeds.

Chart 4.2 Germination Percentages of The C.Ovata Seeds Applied Different Pre-Chilling Duration and Kinetin Dosages (%)

	Control	**100**	**200**	**400**	**800**	**Average**	
Control	2	0.5	1	1	3	1.10 b2*	4.5
1	1	2	0.5	1.5	1	1.20 b2	5.5
2	1.5	2.5	0.5	3.5	3	2.10 b12	5.75
4	0.5	0	1	0	2.5	1.00 b2	3.25
6	2	5	4.5	6.75	2	4.05 a1	9
8	0.5	1.5	2	1.5	1	1.30 b2	3.75
12	5.75	5.5	3.5	1.5	3.75	4.00 a1	8.12
Average	1.96	2.28	2.21	2.25	1.82	2.1	5.69

*: letters at %5 level and numbers at %1 level show different groups.

After precooling, the seeds that are cracked and treated with kinetin and gibberellic acid showed improved germination rate compared to the uncracked seeds. Highest germination rate for the uncracked C. ovate seeds was % 9 (6weeks of precooling +2000ppmGA3),whereas cracked ones had % 100germination (no precooling + 2000 ppm GA3). UncrackedC.spinosa seeds had a highest germination rate of % 1.25 (no precooling + 800ppmkinetin),whereas cracked seeds had % 32 (1 week precooling,800 ppmkinetin)germination rate. These results agree with the findings of SöylerandArslan(2004). They looked at increasing the germination rate of capers seeds, andobtained highest rate as %74 from precooling at +4 ºC + GA3with seed cracking, followed by day-night regulation at 20-30 ºC. In another study, Arslana and Söyler (1999) obtained their highest germination rate from day-night treatment at 20 oC with 2000 ppm dose GA3 + KNO3 + cracked. When untreated control group and the seed-cracking group are compared, both in C.ovata and C.spinosa seed cracking led to substantial increase in the germination rate.

Another issue is the absence of embryo in the seed.Specifically speaking, in the C.spinosa, empty seed ratio went up to % 23.25,whereas in C. ovata, the same ratio maintained a highest value of % 5.5. This, in turn, negatively impacts the germination rate of capers seeds.

Generally speaking, when precooling times, kinetin, giberellic acid, and seed cracking are considered in terms of their effect on the germination of C.ovatave C.spinosa seeds, all of these effects have been observed to have a positive effect on the germination rate, cracking being the most effective one.

References

Akgül, A. 1996. Yeniden Keşfedilen Lezzet: Kapari (*Capparis spp.*) Gıda; Cilt: 21 (2): s.119-128.

Aktan, N., Bilgir, B. ve Elgin, E. 1981. Kapari Çiçeğinden Turşu Yapılması ve Dayanıklı Tutulması Üzerine Bir Araştırma. E.Ü.Z.F. Dergisi; Cilt: 18 (1,2,3): s. 259-273.

Anonim. 1997. Erozyona Karşı Köklü Çözüm Kapari (Gebere). Orman Bakanlığı, AGM Yayınları, No: 2, 47 s. Ankara.

Anonim. 2000. Web Sitesi: www.hort.purdue.edu/newcrop/cropfactsheets/caper.html, Erişim Tarihi: 04.05.2011

Anonim. 2004. Kapari Yurt İçi Piyasa ve Ürün Araştırması. Hazırlayan: Mualla Bilgin. İstanbul Ticaret Odası, Dış Ticaret Şubesi Araştırma Şubesi. Haziran 2004. İstanbul.

Anonim. 2007. Tarım ve Köyişleri Bakanlığı Yayın Dairesi Başkanlığı. Çiftçi Eğitim Serisi -61-. 2007. Kapari Tarımı. Hazırlayan: Dr. Fethullah TEKİN (Güneydoğu Anadolu Tar. Araş. Enst. Müd.). Ankara.

Anonim. 2012. Web Sitesi: www.agaclar.net, Erişim Tarihi: 21.01.2012

Anonim. 2012. Web Sitesi: www.masterpi.tr.gg, Erişim Tarihi: 30.01.2012

Anonim. 2012. Web Sitesi: www.sifaliotlar.org, Erişim Tarihi: 30.01.2012

Anonim. 2012. Web Sitesi: www.en.wikipedia.org, Erişim Tarihi: 30.01.2012

Anonim. 2012. Web Sitesi: www.luirig.altervista.org, Erişim Tarihi: 30.01.2012

Arslan, N. ve Söyler, D. 1998. Kebere (*Capparis ovata Desf.*) Çeliklerinin Köklenmesine Büyümeyi Düzenleyici Maddelerin Etkisi. Tarım Bilimleri Dergisi, 4 (3): 70-73.

Arslan, N., Söyler, D. 1999. Değişik Ön Muamele Görmüş Kebere (*Capparis spinosa* L.) Tohumlarının Çimlenmesi Üzerine Araştırmalar. Ekin; Cilt: 3(7): s. 78– 82.

Basbag, M., Toncer, Ö., Basbag, S. 2009. Effects of Different Temperatures and Duration on Germination of Caper (*Capparis ovata*) seeds. Department of Field Crops, Faculty of Agriculture, Dicle University, Diyarbakır, Turkey. Journal of Environmental Biology, Cilt: 30 (4) s. 621-624.

Corner, E. J. H. 1976. The Seed of Dicotyledons. Cambridge University Pres, UK. Vol. 1, 311 pp: Vol 2, 552 pp.

Coşge, B., Gürbüz, B., Söyler, D. ve Şekeroğlu, N. 2005. Kebere (*Capparis spp.*) Yetiştiriciliği ve Önemi (Derleme). Bitkisel Araştırma Dergisi (2005) Cilt: 2: s. 29-35

Düzgüneş, O., T. Kesici, O. Kavuncu ve F. Gürbüz. 1987. Araştırma ve Deneme Metotları (İstatistik Metodları II). A.Ü. Ziraat Fakültesi Yayınları:1021. Ders Kitabı, 295 s. Ankara. Gorini, F. 1981. Schde Orticole: Cappero. Informatore Di. Ortotlorofruitticoitura; 6: 3– 4.

Kara, Z., Ecevit, F., Karakaplan, S. 1996. Toprak Koruma Elemanı ve Yeni Bir Tarımsal Ürün Olarak Kapari (*Capparis* spp.).

Mersin Üniversitesi. Tarım-Çevre İlişkileri Sempozyumu, Doğal Kaynakların Sürdürülebilir Kullanımı. 13–15 Mayıs 1996, Mersin, 919–929.

Negbi, M., Rushkin, E., Koller, D. 1966. Dynamic aspects of water relations in germination of hirschfeldia incana seeds. Plant Cell Physiology 7: s. 363-376.

Orphanos, P. I., 1983. Germination of Caper (*Capparis Spinosa*) Seeds. Journal of Horticultural Science. Vol. 58 (2). 267-270

Özgüven, M., Sekin, S., Gürbüz, B., Şekeroğlu, N., Ayanoğlu, F. ve Eken, S. 2005. Tütün, Tıbbi ve Aromatik Bitkiler Üretimi ve Ticareti. TMMOB-TZMO Türkiye

Ziraat Mühendisliği VI. Teknik Kongresi. 3-7 Ocak 2005, Ankara 1: 491-501.

Pascual, B., San Bautista, A., Imbernón, A., López-Galarza, S., Alagarda, J. and Maroto, J. 2004. Seed Treatments for Improved Germination of Caper (*Capparis spinosa*). V. Seed Science and Technology, Volume 32, Number 2, July 2004 , pp. 637-642(6).

Salisbury, F. B., Ross, C.W. 1985. *Capparis* Plant Physiology, Wodsworth Publishing Company, 456 s.

Sayılır, A., Özzambak, E., Özen, Ş., Eşiyok, D. 2007. Kapari Türlerinin (*Capparis L.*) Tohumla ve Doku Kültürü İle Çoğaltılması Üzerine Araştırmalar, C.B.Ü. Fen Bilimleri Dergisi, 3.1 (2007) 71- 80.

Sozzi, G.O. ve Chiesa, A. 1995. Improvement of Caper (*Capparis spinosa* L.) Seed Germination By Breaking Seed Coat-Induced Dormancy. Scientia Horticulture, 62, s. 255- 61.

Söyler, D., Arslan, N. 2000. Kebere (Capparis spinosa L.) Çeliklerinin Köklenmesi Üzerine Bazı Büyümeyi Düzenleyici Maddelerin Etkileri. Turk J Agric For 24 (2000) 595-600 TÜBİTAK.

Söyler, D., Arslan, N. 2002a. Değişik Ortamların Kebere (Capparis ovata Desf.) Bitkisinin Gövde Çeliklerinin Köklenmesi Üzerine Etkisi. Ekin; Cilt: 6 (19): s. 70-73.

Söyler, D., Arslan, N. 2002b. Kebere (Capparis ovata) Tohumlarında Çimlenme Hızının Belirlenmesi Üzerine Bir Araştırma. 1.Tohumculuk Kongresi, 11-13 Eylül, İzmir, pp. 315-323 (2002).

Söyler, D. ve Arslan, N. 2004. Kebere (Capparis ovata Desf.) Tohumlarının Çimlenmesi Üzerine Farklı Ön Uygulamalar, Sıcaklık ve Işıklanmanın Etkisi. Tarım Bilimleri Dergisi. 2004. Cilt: 10 (2) s.127-132.

Söyler, D., Khawar, K. M. 2006. Effects of Prechilling, Scarification, Incubation Temperature, Photoperiod, KNO_3 and GA_3 Treatments on Germination of Caper (Capparis ovata Desf. var. Palaestina Zoh.) Seeds. Propagation of Ornamental Plants, Vol. 6, Number: 4, 159-164.

Söyler, D., Khawar, K. M. 2007. Seed Germination of Caper (Capparis ovata var. Herbacea) Using α Naphthalene Acetic Acid and Gibberellic Acid. International Journal of Agriculture & Biology, Vol. 9, No. 1, (1560–8530/2007/09–1–35– 37) http://www.fspublishers.org Erişim tarihi: 17.05.2011.

Tansı, S. 1996. Kebere (*Capparis* spp.)'nin Önemi ve Üretimi. Ç.Ü. Ziraat FakültesiDergisi, 11(4): 147– 154, Adana.

Tansı, S. Çulcu, A., Nacar, Ş. 1997. Kebere (*Capparis spinosa* L.) Tohumlarının Çimlenmesi Üzerine Araştırmalar. II. Tarla Bitkileri Kongresi Bildiri Kitabı, S: 681–683, Samsun.

Tonçer, Ö. 1999. Güneydoğu Anadolu Bölgesi Kebere (*Capparis ovata* Desf. var. *palaestina* Zoh.)'nin Çoğaltma Olanaklarının Araştırılması. Ç.Ü.Z.F. Tarla Bitkileri Bölümü Doktora Tezi, 164 s., Adana.

Varshney, S. K., Barsoul, C. S., Maheswari, M. L., Ogra, J. L. 1991. Phsio-chemical properties and nitrogen fractions of Rumen liquor of goats fed with hees (*Capparis horrida*) as a sole feed. Indian Veterinary Journal; 68 (2): 177-178.

Yıldırım, Z. 1998. Studies on the Improvement of Seed Germination in Caper Turkish Journal of Field Crops, Vol. 3, Num. 1, pp. 21-24, İzmir.

Zengin, F. Şan, H. M. 2003. Onobrychis altissima Gross. ve Onobrychis raditia (Desf.) Bieb. Fidelerinin Değişik Kinetin ve Gibberellik Asit Konsantrasyonlarına Karşı Bazı Büyüme Cevaplarının Araştırılması. G.Ü. Fen Bilimleri Dergisi, 16 (3): 449-455.

Zohary, M. 1960. The Species of Capparis in

the Mediterrian and the Near Eastren Countries. Bull. Res. Coun. Israel, SD. 49-65.