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EFFECTS OF DIFFERENT TREATMENTS ON SEED DORMANCY BREAKING AND GERMINATION IN *Acer cappadocicum* Gleditsch var. *cappadocicum*

UTJECAJ RAZLIČITIH TRETMANA NA PREKID DORMANTNOSTI I KLIJAVOST SJEMENA *Acer cappadocicum* Gleditsch *var. cappadocicum*

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SUMMARY

This study was carried out to determine effects of different pretreatment on seed germination and to overcome dormancy in *Acer cappadocicum* seeds. The seeds were collected in 2008 three times with aproximately 15-days intervals. In order to overcome dormancy, several germination treatments were applied. The treatments were (1) different seed collection time, (2)soaking in water, (3) cold-moist stratification and (4) GA_3 (gibberellic acid) application. The treated seeds were germinated in growing chamber at 5 ^{0}C and in greenhouse conditions. This research showed that seeds of *Acer cappadocicum* exhibit physiological dormancy and require stratification period to overcome seed dormancy. The highest germination percentage in the growing chamber subjected to GA_3 process after eight weeks of stratification treatment was 62 % for *Acer cappadocicum* seeds. The highest germination percentage in greenhouse was obtained with cold stratification after eight weeks (95 %). It was found out that GA_3 treatment had a significant effect on germination in growth chamber + 5 ^{0}C but GA_3 treatment didn't have a significant effect on germination in greenhouse conditions. GA_3 treatment and soaking of unstratified seeds in water for 48 hr didn't have any positive effect on germination value in greenhouse conditions. Although growth chamber and green house results both indicated that seed collection time did not seem to play a role as statistically on seed germination, Duncan's test showed that the third seed collection time was in a different group.

KEY WORDS: *Acer cappadocicum*; seed; dormancy; stratification; gibberellic acid

INTRODUCTION
UVOD

Acer cappadocicum var. *cappadocicum* has a wide geographic distribution in Caucasia, West Asia and the Himalayas**.** It is distributed Northeastern Anatolia in Turkey ranges between 400m and 1600m (Yaltirik 1971) and is also common in the region of Ordu, Giresun, Trabzon, Rize and Artvin in Turkey (Davis 1966; Anşin and Ozkan 1997). Maple wood has a light color and is used in veneer and furniture manufacturing. Kitchen cabinets, furniture, parquet and interior doors are extensively produced from maple wood in USA and Europe (Ulker and Hiziroglu 2018). Also, many of the maples have ornamental value due to their attractive foliage or interesting crown shape, as well as flowers or fruit (Zasada and Strong 2008).

Seeds of many trees and shrubs have dormancy at maturity and the mechanisms of dormancy which restrict germination differ according to species (Derkx 2000). *Acer* seeds are acccepted by several researchers in the class of seeds with seed dormancy (Bradbeer 1988; Derkx 2000; Piotto

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and Noi 2001). Also, several studies have shown that *Acer* seeds have dormant embryo (Webb and Wareing 1972; Pinfield et al. 1987; Pinfield and Stutchbury 1990). Pregermination requirements of *Acer* species seeds vary according to seed ripening time and the nature of dormancy (Phartyal et al. 2002). In Maple species, an endogenous dormancy is generally seen due to requiring a rest period after maturation of the embryo (Ucler and Turna 2005). This occurs in nature during the cold season or during cold stratification period in nursery practice (Piotto ve Noi 2001). Dormancy was removed by cold-moist stratification in many *Acer* species (Farmer and Cunningham 1981; Tylkowski 1995; Tremblay et al. 1996; Savage et al. 1998; Macdonald 1999; Gultekin 2007; Farhadi et al. 2013). In addition to cold-moist stratification, gibberellic acid also promotes breaking seed dormancy and stimulates seed germination in many species (Chen and Chang 1972; Beyhan et al. 1999; Phartyal et al. 2003; Drăghici and Abrudan 2010; Guney et al. 2015).

Although *Acer cappadocicum* spreads naturally in the Eastern Black sea forests, it can not be produced sufficiently in both private and forest nurseries. The use of naturally spreading species in reforestation studies is one of the main principles. In this study, seed dormancy removal of *Acer cappadocium*, one of the important *Acer* species of the eastern Black Sea region, were studied. The aim of the present study was to investigate the effect of different seed collection time, cold-moist stratification, GA_3 and soaking applications on seed dormancy breaking and germination in *Acer cappadocicum* seeds.

MATERIALS AND METHODS
MATERIJALI I METODE

Seed material – *Sjemenski materijal*

The seeds were collected from Trabzon –Sayrac village (857m, 52 05 65 N, 45 28 759 E,) in Trabzon, Turkey at three different times with 15-day intervals (on September 12, 2008; on September 27, 2008; on October 10, 2008). The beginning of the greyish brown colour of the seed was decided as first collection time (Chauhan and Arun 1998). Afterwards, the seeds were harvested at three times with aproximately 15-days intervals. Seed collected trees were marked with red oil paint. Thus, the same trees were used for different seed collection times. The harvested seeds were labeled and put into black plastic bags. The seeds were dewinged by hand and air-dried in the laboratory. The seeds were placed in glass jars after they reached approximately dry air humidity (10 ±2 %) and stored in a cooler. The initial moisture content, the 1000-seed weight and seed viability according to Tetrazolium test of *Acer cappadocicum* seeds were determined for each collection time. The initial moisture content was determined by using drying oven method at 104 ± 1 °C 17 hr (ISTA, 1996).

Table 1. Laboratory and Greenhouse Experiments
Tablica 1. Pokus u laboratoriju i u stakleniku

Treatments Postupci	Laboratory experiments Laboratorijski pokus	Greenhouse experiments Stakleнički pokus
1	No soaking and direct germination treatment Bez močenja i direktni postupak klijavosti	No soaking and direct sowing treatment Bez močenja i direktni postupak sjetve
2	48 hr soaking and germination treatment 48-satni postupak močenja i klijavosti	48 hr soaking and sowing 48 sati močenja i sjetve
3	8 week(w) stratification (st.) and germination treatment 8 tjedana (t) stratifikacije (st.) i klijanja	No soaking + 8 w stratification Bez močenja + 8 t stratifikacije
4	No soaking+50 ppm GA_3 Bez močenja + 50 ppm GA_3	48 hr soaking + 8 w stratification 48 sati močenja + 8 t stratifikacije
5	48 hr soaking + 50 ppm GA_3 48 sati močenja + 50 ppm GA_3	No soaking+ 100 ppm GA_3 Bez močenja +100 ppm GA_3
6	8 w stratification (st.) + 50 ppm GA_3 8 t stratifikacije (st.) + 50 ppm GA_3	48 h soaking+ 100ppm GA_3 48 sati močenja + 100ppm GA_3
7	No soaking +100 ppm GA_3 Bez močenja +100 ppm GA_3	No soaking+ 8w stratification+100ppm GA_3 Bez močenja + 8 t stratifikacije+100ppm GA_3
8	48 hr soaking + 100ppm GA_3 48 sati močenja + 100ppm GA_3	48 hr soaking+8 w stratification+ 100ppm GA_3 48 sati močenja+8 t stratifikacije+ 100ppm GA_3
9	8 w stratification + 100 ppm GA_3 8 t stratifikacije + 100 ppm GA_3	No soaking+ 400ppm GA_3 Bez močenja + 400ppm GA_3
10	No soaking +400 ppm GA_3 Bez močenja +400 ppm GA_3	48 hr soaking+ 400 ppm GA_3 48 sati močenja+ 400 ppm GA_3
11	48 hr soaking + 400ppm GA_3 48 sati močenja + 400ppm GA_3	No soaking+8w stratification+400ppm GA_3 Bez močenja +8 t stratifikacije+400ppm GA_3
12	8 w stratification + 400 ppm GA_3 8 t stratifikacije + 400 ppm GA_3	48 hr soaking+8 w stratification+ 400 ppm GA_3 48 sati močenja+8 t stratifikacije+ 400 ppm GA_3

Laboratory and Greenhouse experiments – *Pokus u laboratoriju i u stakleniku*

In this study, treatments of growth chamber and greenhouse are shown below (Table 1).

Laboratory Experiments – *Pokus u laboratoriju*

The seeds were soaked for 48 hr in water at room temperature (Genc 2007) before germination and sowing treatments in order to break dormancy caused by seed coat. Also, the seeds were treated with cold-moist stratification treatment to break seed dormancy. The seeds were mixed with approximately % 40 humidified sand and placed in plastic bags, and then stored in the refrigerator (at 4 ^{0}C) for cold-moist stratification treatment (Saatcioglu 1971; Jensen 2001; Yahyaoglu and Olmez 2004). In pre-experiments, the highest germination percentage of stratified seeds was obtained in seeds treated with stratification for 8 weeks. When the stratification period was prolonged, most of the seeds germinated during stratification period. Therefore, stratification priod was determined as 8 weeks in this study. As a different treatment, the seeds collected different collection time were treated with GA_3 (Giberellic acid; 50,100,400 ppm) for 24 hr and germinated in growth chamber (Table 1).

Germination tests were conducted in petri dishes covered with filter paper (ISTA 1996) and 100 (4 X 25) seeds were used for each germination test. Petri dishes and filter paper were sterilized in the oven at 160 ^{o}C for approximately 2 hours. Also, the seeds were sterilized in a % 2 sodium hypochlorite solition for 10 minute and rinsed in pure water for 5 minute before germination treatments (Jensen 2001). Petri dishes covered and randomly placed in growth chamber. The seeds with radicles longer than 3 mm were tought to be germinated and taken from the petri dishes (Jensen 2001). Germination tests were considered completed when there was no germination for 14 consecutive days (Tremblay et al. 1996). In pre-experiments, the highest germination percentage of *Acer cappadocicum* seeds was observed in germination experiments at + 5 ^{0}C. Therefore, in this study, the germination experiments were carried out at + 5 ^{0}C.

Greenhouse Experiments – *Pokus u stakleniku*

In order to evaluate the germination performance of *Acer cappadocicum* seeds in the greenhouse conditions, seed beds (soil) were used in the greenhouse at East Black Sea Forestry Research Institue. The seeds were subjected to soaking 48 hr water, 8 week stratification, soaking 48 hr water + 8 week stratification and GA_3 applications (100 and 400 ppm) (Table 1).100 seeds were used for each treatment. The seeds were sown on seed bed by using line sowing method (Genc 2007). 50 seeds were sown in each line and sand-forest soil mixture was used as cover material. The irrigation in greenhouse was doneby automatically. The temperature of morning, noon and evening in the greenhouse was recorded regularly from the beginning of germination to the end of germination. Germinants were recorded weekly.

Statistical Analysis – *Statistička analiza*

In the present study, data were analyzed using the SPSS statistical software. Correlation analysis, Analysis of variance (ANOVA), Duncan's test and İndependent samples t-test were used (Ozdamar 1999).

RESULTS
REZULTATI

Laboratory Experiments – *Pokus u laboratoriju*

The seeds collected at tree different times were germinated in the growing chamber at + 5 ^{0}C after they had been su-

Table 2. Results of ANOVA for effects of different pretreatments on seed germination
Tablica 2. Rezultati ANOVA za učinke različitih predtretmana na klijavost sjemena

Variable Source Izvor varijabolnosti	Sum of Squares Suma kvadrata	Degree of freedom Stupnjevi slobode	Mean square Srednji kvadrat	F – value F – vrijednost	*p* – value *P* – vrijednost
Collection time Vrijeme sakupljanja	786,88	2	393,44	1,80	0,17
Stratification Stratifikacija	19450,88	2	9725,44	44,48	0,00*
GA_3 application Primjena GA_3	1952,33	3	650,77	2,97	0,03*
Collection time x Stratification Vrijeme sakupljanja × Stratifikacija	832,44	4	208,11	0,95	0,43
Collection time x GA_3 application Vrijeme sakupljanja × primjena GA_3	83,33	6	13,88	0,06	0,99
Stratification x GA_3 application Stratifikacija × primjena GA_3	358,00	6	59,66	0,27	0,94
Collection time x Stratification x GA_3 application Vrijeme sakupljanja x stratifikacija x primjena GA_3	545,00	12	45,44	0,20	0,99

*p< 0,05 (There is a statistically difference)
*p< 0,05 (Postoji statistička razlika)

Table 3. Germination percentages and Duncan's test groups
Tablica 3. Procenata klijavosti i grupe Dunkanovog testa

Variable Source Izvor varijabilnosti	Treatments Tretmani	N	**Mean value** ± St. **deviation** **Srednja vrijednost** ± st. devijacija
Collection time Vrijeme sakupljanja	September 12	48	31,75 ± 16,21 **a**
	September 27	48	31,66 ± 18,97 **a**
	October 10	48	36,66 ± 19,32 **a**
*Stratification *Stratifikacija	8 week stratification	48	49,66 ±16,31 **a**
	No stratification	48	27,00 ± 13,29 **b**
	48 hour soaking water + no stratification	48	23,41 ± 12,51 **b**
GA_3 application Primjena GA_3	GA_3 1:No GA_3	36	27,33 ± 14,79 **a**
	GA_3 2:50 ppm GA_3	36	33,44 ± 16,03 **b**
	GA_3 3:100 ppm GA_3	36	36,66 ± 18,23 **b**
	GA_3 4: 400ppm GA_3	36	36,00 ± 22,28 **b**

*Pretreatments of stratification and 48 hour soaking + no startification were evaluated under this variable name
*Predtretmani stratifikacije i močenja + bez stratifikacije procijenjeni su pod ovim varijabilnim imenom

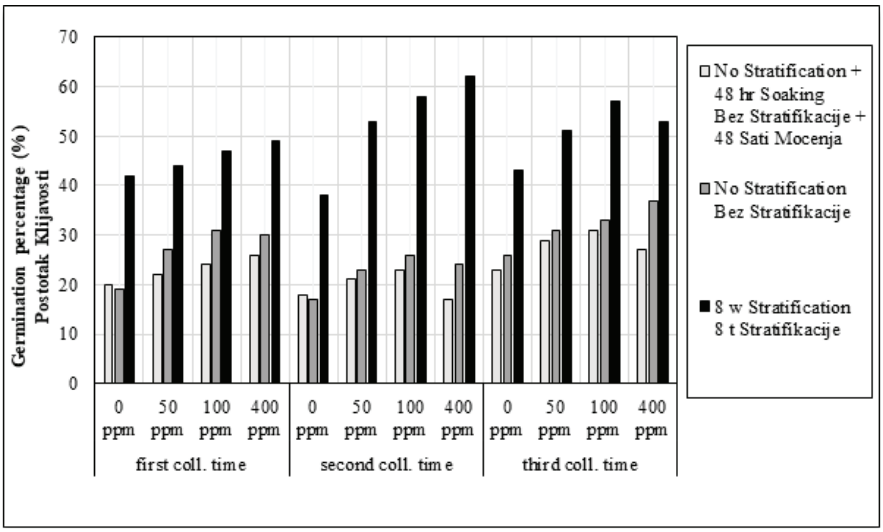

Figure 1. The effect of seed collection time, soaking in water, stratification and GA_3 treatments on germination
Slika 1. Utjecaj vremena prikupljanja sjemena, močenja u vodi, stratifikacije i primjene GA_3 na klijavost

bjected to soaking 48 hr water, 8 week stratification and GA_3 applications (50, 100 and 400 ppm). The difference between the treatments was tested by analyses of variance and the significance of differences between groups was tested by Duncan's test (Table 2 and Table 3)

There was no effect of seed collection time on germination. The highest germination percentage was recorded after 8 weeks of cold-moist stratification (49,6 %).This result showed that 8 weeks cold-moist stratification significantly increased germination. Soaking in water of nonstratified seeds (stratification 3) wasn't any significant difference on seed germination (Table 3). GA_3 treatment had a significant effect on germination (Table 2) but there wasn't any difference between GA_3 doses (Table 3).Germination percentages were also evaluated in terms of treatments (Figure 1).

The highest germination percentage in the growing chamber was obtained in seeds collected at second seed collection time and subjected to GA_3 process after eight weeks of stratification (62 %). Germination percentage was lower in control seeds. The soaking seeds in water for 48 hr wasn't any significant effect on germination (Figure 1).

Greenhouse Experiments – *Pokus u stakleniku*

The seeds collected at three different times were sown (15.01.2009) in the greenhouse after they had been subjected to soaking in water for 48 hr, stratification for 8 w and GA_3 treatments (100 and 400 ppm). The air temperature in the greenhouse was at +4 ^{0}C in the morning, +7 ^{0}C at noon and +9 ^{0}C in the evening at the begining of first germination (26.01.2009). The average temperature in the greenhouse was at +11 ^{0}C in the morning, at +15 ^{0}C at noon and at 19 ^{0}C in the evening until the last date of germination. Germinants were counted at weekly. The difference between the treatments was tested by analyses of variance and the significance of differences between groups was tested by Duncan's test (Table 4 and Table 5)

Table 4. Results of ANOVA for effects of different pretreatments in the greenhouse
Tablica 4. Rezultati ANOVA za učinke različitih predtretmana u stakleniku

Variable Source Izvor varijabolnosti	Sum of Squares Suma kvadrata	Degree of freedom Stupnjevi slobode	Mean square Srednji kvadrat	F –value F - vrijednost	***p* – value** ***P* - vrijednost**
Collection time Vrijeme sakupljanja	1713,44	2	856,72	2,51	0,09
Stratification Stratifikacija	13068,05	1	13068,05	38,30	0,00*
GA_3 application Primjena GA_3	71,44	2	35,72	0,105	0,90
Collection time x Stratification Vrijeme sakupljanja × Stratifikacija	425,44	2	212,72	0,62	0,54
Collection time x GA_3 application Vrijeme sakupljanja × primjena GA_3	85,22	4	21,30	0,06	0,99
Stratification x GA_3 application Stratifikacija × primjena GA_3	4,11	2	2,05	0,06	0,99
Collection time x Stratification x GA_3 application Vr. prik. Sjemena x Stratifikacija x primjena GA_3GA_3	167,88	4	41,97	0,12	0,97

*p< 0,05 (There is a statistically difference)

*p< 0,05 (Postoji statistička razlika)

Table 5. Germination percentages and Duncan's test groups of *Acer cappadocicum* seeds
Tablica 5. Procenat klijavosti i grupe Dunkanovog testa za sjeme Acer cappadocicum

Variable source Izvor varijabilnosti	Treatments Tretmani	Mean ± Std. Deviation Srednja ± std. devijacija
Collection time Vrijeme sakupljanja	September 12	59,83 ± 20,29**a**
	September 27	58,58 ± 21,27**a**
	October 10	69,50 ± 23,18**b**
*Stratification *Stratifikacija	8 week stratification	76,11 ± 17,79**a**
	No stratification	49,16 ± 16,73**b**
GA_3 application Primjena GA_3	GA_3 1:No GA_3	63,75 ± 23,45**a**
	GA_3 2:100 ppm GA_3	61,33 ± 23,72**a**
	GA_3 3:400 ppm GA_3	62,83 ± 18,99**a**

*The comparison of two independent populations was done by t test to evaluate the effect of stratification (P=0,000)

*Usporedba dviju neovisnih populacija napravljena je pomoću t testa kako bi se procijenili učinci stratifikacije(P=0,000)

Although there was no significant difference between seed collection time according to the analysis of variane (Table 4), Duncan's test showed that the third seed collection time was in a different group (Table 5). This was due to the test's sensitivity. The effect of stratification was significant on germination ($p<0.05$). While the avarage germination percentage of seeds sown after eight weeks of stratification period was 76.11 %, the germination percentage of seeds sown unstratified was 49,16 %. GA_3 treatment didn't have a significant effect on germination. Also, according to the results of the correlation analysis, there was a positive correlation between seed collection time and germination ($r=0.442$). In this study, t test was used to evaluate the effect of treatment of soaking in water. Accordingly, there was no significant difference between treatments (P=0.404).Germi-

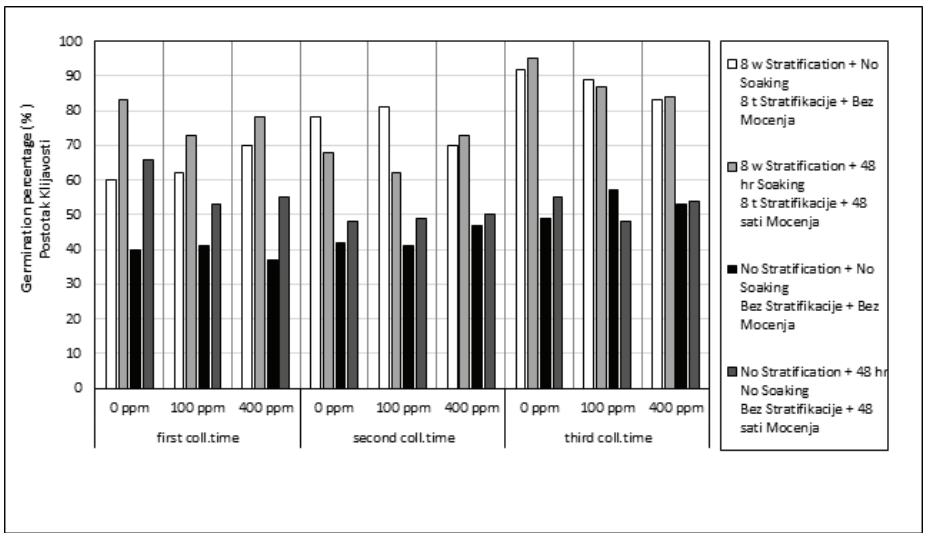

Figure 2. The effect of different pretreatments on germination of *Acer cappadocium* seeds in green house
Slika 2.Učinci različitih predtretmana na klijavost sjemena *Acer cappadocium* u stakleniku

nation percentages were also evaluated in terms of treatments (Figure 2).

The highest germination percentage in the greenhouse was observed in seeds collected at third seed collection time and subjected to eight weeks of stratification period after soaking in water for 48 hr without GA_3 treatment (95 %). GA_3 treatment and soaking of unstratified seeds in water for 48 hr didn't have any positive effect on germination value.

DISCUSSIONS
RASPRAVA

In this study, cold-moist stratification period was determined as eight weeks for *Acer cappadocicum* seeds in the preliminary trials. When the stratification period was prolonged, most of the seeds germinated during stratification period. Yahyaoglu et al. (2006) reported that seed germination during stratification period was an important factor in obtaining low germination in sowing. Because of this reason, stratification process should be continued to species requiring stratification period before germination process until the first germinant appear in stratification medium. Because, the germination of the seeds in stratification medium affected germination percentage negatively. Urgenc (1998) also reported that stratification period could extend from one week to 3-4 weeks or even longer depending on the species. If startification period extend, the seeds could begin to germinate during stratification medium. This situation was detected in some *Maple* species (Urgenc 1998; Piotto and Noi 2001; Bonner and Karrfalt 2008). The germination percentage of *Acer cappadocicum* seeds stratified for eight weeks was higher than seeds unstratified in both the growing chamber and the greenhouse conditions. This result underlines the fact that seeds of *Acer cappadocicum* exhibit physiological dormancy and require stratification period to overcome seed dormancy. Several researches have already investigated that some maples had seed dormancy and mature *Acer* seeds require at least eight weeks of cold moist stratification to overcome dormancy (Urgenc 1998; Macdonald 1999; Piotto and Noi 2001; Nasari et al. 2018). However, it is also stated that stratification period should be longer in order to break dormancy in seeds of *Acer saccharum* (Evans and Blazich 1999), five different *Acer* species (Yang and Lin 1999), *Acer ceasium* (Phartyal 2002). Also, Farhadi et al. (2013) pointed out that the highest germination value of *Acer velutinum* seeds was obtained after 16 weeks of cold-moist stratification. Furthermore, unlike the present study, Yılmaz (2007) reported that the dormancy of *Acer trautvetteri* seeds was completely removed by three months of chilling but all seed germinated during the chilling period. Therefore, in the present study, stratification period was suggested as eight weeks because of this situtation can be cause failure in sown. In this study, it was determined that soaking unstratified seeds in water for 48 hr before germination trial was no statistically significant effect on germination. However, when treatments evaluated on the basis of indivudual, the highest germination percentage in the greenhouse was obtained from seeds collected at third seed collection time and subjected to eight weeks of stratification period after soaking in water for 48 hr without GA_3 treatment (95 %) (Figure 2). Smilarly, after moist chilling for 16 weeks of seeds after soaking 48 hr in water and germinating at 5:15 ^{0}C, germination was 92 % in *Acer pensylvanicum* (Bourgoin and Simpson 2004). Furthermore, it was observed that soaking different *Acer* seeeds in water for 48 hr before germination trials increased germination rate (Webb and Dumbroff 1969; Webb 1974; Genc 2007). According to analysis of variance (Table 2), it was found out that GA_3 treatment had a significant effect on germination in growth chamber (+ 5 ^{0}C) but there wasn't any difference between GA_3 doses (Table 3). Smilarly, Pawlowski (2009) reported that breaking of dormancy was stimulated by Gibberellic acid in *Acer platanoides* seeds. GA_3 treatments of *Acer hyrcanum* seeds shortened the cold stratification period and increased germination but did not eliminate the requirement of cold stratification of the seeds (Naseri et al. 2018). In this study, it was found out that GA_3 treatment didn't have a significant effect on germination in greenhouse conditions. As a result of sowing in the greenhouse, it was observed that GA_3 treatment was less effective than cold moist stratification treatment for 8 weeks on the germination of the seeds. These results indicate very clearly that GA_3 treatment of *Acer cappadocicum* seeds especially stratified before sowing in greenhouse doesn't have a positive effect on germination. Therefore, GA_3 application should not preffered in the greenhouse sowing of *Acer cappadocicum* seeds. Similarly, Stejskalova et al. (2015) found out that in *Acer pseudoplatanus* gibberellic acid did not increase the germination percentage compared to stratified seeds. Furthermore, Webb and Wareing (1972) reported that GA_3 treatments had no effect for breaking dormancy in Acer *pseudoplatanus* seeds. Although growth chamber and green house results both indicated that seed collection time did not seem to play a role as statistically on seed germination, Duncan's test showed that the third seed collection time was in a different group (Table 5). The reason for this is the sensitivity of the the test. The highest germination (95 %) in the greenhouse was detected in the seeds collected at collection time 3. Also, there was a positive correlation between seed collection time and germination (r=0.442). As a result, the third collection time (in october) should be prefered as seed collection time in *Acer capppadocicum* seeds, considering that it may vary according to the climatic conditions of the year.

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SAŽETAK

Acer cappadocicum var. cappadocicum široko je rasprostranjen na Kavkazu, u Zapadnoj Aziji i na Himalaji. Javlja se u sjeveroistočnoj Anatoliji u Turskoj na visinama od 400 m do 1600 m, a uobičajen je i u regijama Ordu, Giresun, Trabzon, Rize i Artvin u Turskoj. Iako se *Acer cappadocicum* prirodno širi u šumama istočnog Crnog mora, on se ne može proizvesti u dovoljnim količinama u privatnim i šumskim rasadnicima. U istraživanju pošumljavanja jedno od glavnih načela odnosi se na korištenje prirodno rastućih vrsta. U ovom radu istraženo je otklanjanje dormantnosti sjemena *Acer cappadocicum,* jedne od važnih vrsta *Acer* u području istočnog Crnog mora. Ovaj rad bavi se istraživanjem utjecaja U ovom radu istražen je utjecaj predtretmana na klijavost sjemena i otklanjanja dormantnosti sjemena *Acer cappadocicum*. Sjeme je prikupljeno 2008. godine u tri navrata u intervalima od približno 15 dana. Kako bi se otklonila dormantnost, primijenjeno je nekoliko tretmana klijanja. Tretmani su uključivali (1) različito vrijeme prikupljanja sjemena, (2) potapanje u vodi, (3) hladno-vlažnu stratifikaciju i (4) primjenu GA_3 (giberelinska kiselina). Tretirano sjeme podvrgnuto je klijanju u komori rasta na temperaturi od 5 ^{0}C i u stakleničkim uvjetima. Ovim istraživanjem je utvrđeno da sjeme *Acer cappadocicum* pokazuje fiziološku dormantnost i da je za otklanjanje dormantnosti sjemena potrebno razdoblje stratifikacije. U preliminarnim pokusima sjeme *Acer cappadocicum* podvrgnuto je hladno-vlažnoj stratifikaciji tijekom osam tjedana. Kad je period stratifikacije produžen, većina sjemena proklijala je tijekom perioda stratifikacije. Najviši postotak klijavosti u komori rasta izloženom postupku s GA_3 nakon osam tjedana stratifikacije iznosio je 62. Najviši procenat klijavosti u stakleniku postignut je postupkom hladne stratifikacije nakon osam tjedana (95 %). Utvrđeno je da tretman s GA_3 nije imao značajniji utjecaj na klijavost u stakleničkim uvjetima. Prema tomu, za sijanje sjemena *Acer cappadocicum* u stakleničkim uvjetima ne preporučuje se primjena GA_3. Tretman s GA_3 i potapanje nestratificiranog sjemena u vodi 48 sati nije imao pozitivne učinke na vrijednosti klijavosti u stakleničkim uvjetima. Iako rezultati dobiveni u komori rasta i stakleniku pokazuju da vrijeme prikupljanja sjemena nije statistički utjecalo na klijavost sjemena, Dunkanov test ukazuje na to da se klijavost sjemena sakupljenog u trećem navratu signifikantno razlikuje u odnosu na klijavost sjemena sakupljenog u prva dva navrata. Rezultati pokazuju da je najbolje vrijeme za prikupljanje sjemena Acer cappadicucum ono iz trećeg navrata (u listopadu), ali ono može i varirati ovisno o klimatskim uvjetima tijekom godine.

KLJUČNE RIJEČI: *Acer cappadocicum*; sjeme; dormantnost; stratifikacija; giberelinska kiselina