Journal of Food Technology 3 (3): 393-396, 2005

Effects of Different Salt (NaCl), Nitrate (NO_3) and Acid (H_2SO_4, Hcl) Concentrations on the Germination of *Centaura amonicola* Hub.-Mor. (Section: Cyanoroides) Seeds

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Abstract: The aim of this study to determine germination eco-physiology of *Centurea amonicola* Hub.-Mor., common countryside in Turkey, under over grazing thread. For this aim, germination of the seeds investigated under two different photoperiod (8h light-16h darkness and 16h light- 8 h darkness) and in different concentrations of NaCl, KNO_3, H_2SO_4 and HCl solutions. There was no germination in 3%NaCl, 1-3% KNO_3, 1-3%H_2SO_4 and 2-3% HCI concentrations in each photoperiod. According to univariate variance analyse of germination test results, germination media with different (0,5%, 1%, 2% NaCl; 0,5%, 1%, 2%, 3% KNO_3; 0,5% H_2SO_4; 0,5%, 1% HCl concentrations and control (8h light-16h darkness and 16h light- 8 h darkness and 24 h light) were significant; photoperiod and photoperiod-treatment interaction were not significant on germination percentage. And different concentration levels, photoperiod and photoperiod x treatment interactions were significant on germination speed ($P<0.05$).

Key words: *Centaurea amonicola* Hub.-Mor., salt (NaCl), nitrate (KNO_3), acid (H_2SO_4, HCl), germination

INSTRUCTION

Number of *Centaurea* L. species is 500 in the world[15]. According to another research there is 600 species in Asia, North Africa and America [13, King, 1981; 12]. In Turkey flora, number of native species is 187 and 114 of them are endemic. Endemism rate is %60.4 [2, 3, Güner et al., 2000; 5, 14]. In South Anatolia region, *Centaura amonicola* Hub.-Mor. species is endemic and common in Mediterranean climate. Between 1200-1600m. altitudes, local communities are common. The seeds used in this study collected from Osmaniye; near Yarpuz-Agulu road (on south-west slopes), on open places in *Qercus* and *Pinus nigra* ssp. *pallasiana*, at 1240 m altitude, on 13.07.2002, at (N. 37°.04` E 36°.15`). Endemic *Centaura amonicola* Hub.-Mor. species has an attractive appearance and common in some areas locally. Studies on herbariums showed that *Centaura amonicola* Hub.-Mor. species has collected from only this region. This species is in vulnerable category in 'Red Data Book of Turkish Plants' book[6]. Especially in 2000-2004 period, the poulations were under continual devastation because of its brilliant appearence with purple flower and interesting capitulum. The heads was picked by scissors, dried and sold in florists. In addition to this, wide leafs and thornless stems used commonly in animal feeding. The species is under extinction threat because of excessive usage. So, it is necessary to determine the highest germination output and germination speed to reproduce the species to protect (In-situ and Ex-situ) and save biodiversity.

MATERIAL AND METHODS

Germination experiments were done in plant growing cabin (MLR-350 Model Sony, Japan). During experimentation the fixed temperature was considered (25°C±1°C) and the photoperiod (8 h light, 16 h dark daily photoperiod) was used. In each experiment series and for each concentration 100 dark colored seeds were utilized. Each of the germination experiments were replicated for times (4x100). Experiments were carried out in germination bed was formed on filter paper in glass plates (9 cm in diameter). During germination period, treatments, applied for each experiment series, were done equally and at the same time. Although the experiments continued 36 days, total series of germination was accepted the final 21 day of experimentation of completely stop. In the germination

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experiments 6 main experiments series (NaCl and KNO_3, dark milieu and control group) for each origin were arranged. In the germination experiments 6 main experiments series (NaCl, KNO_3, H_2SO_4, HCl, Dark milieu and Control group) for each origin were arranged. In these experiment series, the seeds were incubated in NaCl, KNO_3, H_2SO_4 and HCl in 0,5%, 1%, 2%, 3% concentrations, respectively. However, distilled water was only used in control group. In order to accept the seed to be germinated, it was considered that the radicula to touch the germination bed[16-19].

An example of calculations of seed germination speed was given. Calculated values which presents the seed germination speed, by this method were a significant. It is important to know both the germination percentage and germination speed; by this method were a significant. It is important to know both the germination percentage and germination speed. The methods of [4, 1].

The formula of Methods (DGT: Daily total germination; DGP: Daily germination percent; DGS: Daily germination speed; GS: Germination speed; $X_{1,2,3,4}$=1.2.3 and 4. glass plates)

$DTG=A= X_1 + X_2 + X_3 + X_4$
$DGP=B= A / 4$
$DGS=C= D (Days) \times B$
$GS= \Sigma (GP \times 100) / \Sigma GS$

Where X_1, X_2, X_3 and X_4 are the number of seeds germinated daily, A is the total of these seeds, B is the mean of seeds germinated daily in four different essays, D is the number of days used for seed germination, 100 is the constant and C is the daily germination speed.

Statistical analysis: The data were analysed by Anova Scheffe test. Germination speeds among different salt concentrations and 8 h light 16 h darkness and 16 h light-8 h darkness were similar. In each NaCl treatment group, germination percentage was decreased independently in high concentrations in 8h light-16h darkness and 16h light- 8 h darkness photoperiod. Germination percentage in 0,5% H_2SO_4 treatment was in parallel with 0,5%NaCl, 0,5% and 1% HCl. Germination percentages in different KNO_3 treatments were different from each other. Higher concentrations lowered the gemination percentages. There was no difference in 0,5% KNO_3 and the control group. And it was found a similar effect between two HCl treatment. 0,5% NaCl and 2% NaCl; 1% NaCl and 2%KNO_3; 2% NaCl and 0,5% H_2SO_4; 0,5%HCl and 1%HCl treatments showed similar effects on germination percentages.Germination percentages in different KNO_3 treatments were different from each other. Higher concentrations lowered the gemination percentages. It was found no different result between 1%KNO_3 and 24 h dark photoperiod treatmens. There was similar effect between two HCl treatment.There was no difference on germination percentages in each control photoperiod. It was showed that light density has a stimulator effect on germination percentage.According to univariate variance analyse of germination test results; treatments (0,5%, 1%, 2% NaCl; 0,5%, 1%, 2%, 3% KNO_3; 0,5% H_2SO_4; 0,5%, 1% HCl concentrations and control (8h light-16h darkness and 16h light- 8 h darkness and 24 h dark) were statistically significant, photoperiod and photoperiod x treatment interactions were insignificant on germination percentages ($P<0.05$), (Table 2).

And again, treatments (0,5%, 1%, 2% NaCl; 0,5%, 1%, 2%, 3% KNO_3; 0,5% H_2SO_4; 0,5%, 1% HCl concentrations and control (8h light-16h darkness and 16h light- 8 h darkness and 24 h dark), photoperiod and photoperiod x treatment interactions were significant on germination

Table 1: Germination percent and germination speed of *Centaurea amonicola* seeds under two photoperiod

		Photoperiod I (8 hd-16 hl)				Photoperiod II (8 hl-16 hd)			
Concentration		GS	GS ± SD	G %	GP ± SD	GS	GS ± SD	G %	GP ± SD
NaCl	0.5%	10.7^{a}	10.7±0.46	46.2^{f}	46.2±1.7	10.3^{ab}	10.3±0.5	33.0^{e}	33.0±1.4
	1%	9.7^{a}	9.7±0.63	25.5^{c}	25.5±1.7	10.4^{abc}	10.4±0.4	14.7^{b}	14.7±0.9
	2%	9.8^{a}	9.8±0.33	10.2^{a}	10.2±2.2	9.9^{a}	9.9±0.4	6.5^{a}	6.5±1.3
H_2SO_4	0.5 %	13.2^{a}	13.2±2.42	6^{a}	6.0±0.8	11.1^{abcd}	11.1±0.4	3.2^{a}	3.2±0.5
KNO_3	0.5%	10.9^{a}	10.9±0.3	60.7^{g}	60.7±2.2	12.3^{bcd}	12.3±0.3	44.7^{d}	44.7±1.3
	1%	11.1^{a}	11.1±0.46	34.7^{d}	34.7±1.3	11.1^{abcd}	11.1±0.4	28.0^{c}	28.0±1.1
	2%	9.8^{a}	9.8±0.9	16.2^{b}	16.2±1.3	10.1^{ab}	10.1±0.1	16.2^{b}	16.2±1.5
HCl	0.5%	10.1^{a}	10.1±1.7	8.2^{a}	8.2±1.7	10.2^{ab}	10.2±1.1	7.5^{a}	7.5±1.3
	1%	10.2^{a}	10.2±2.1	6^{a}	6.0±0.8	11.0^{abcd}	11.0±1.5	4.0^{a}	4.0±0.8
Control(8 h d-16h l)	HW	13.1^{a}	13.1±0.5	60.2^{g}	60.2±1.7	13.1^{cd}	13.1±0.4	56.5^{e}	56.5±2.1
Control(24 h Dark)	HW	12.9^{a}	12.9±1.6	40.5^{e}	40.5±2.1	12.7^{c}	12.7±0.7	29.0^{c}	29.0±3.6

Table 2: Univariate analysis of variance for germination percent and germination speed

	Germination Percent (%)				Germination Speed			
Source	Sum of Squares	df	F	Sign.	Sum of Squares	df	F	Sign.
Treatments	110.3	10	10.4	0.000	29737.0	10	109.9	0.000
Photoperiod	585.6	1	0.05	0.815	923.01	1	339.8	0.000
Treatments*Photoperiod	15.2	10	1.45	0.184	607.4	10	22.4	0.000

*Within each column, menans with the same letter are not significantly; 95 % significant;Anova Scheffe Tests

speeds (P<0.05), (Table 2).

RESULTS AND DISCUSSION

According to germination test results, lower salt concentrations had no effect on germination percentage and there was no germination in 3% NaCl media. Higher salt concentrations decreased germination percentages (Table 1). Salt treatment in germination tests on both wild and culture plant seeds have negative effects on germination because they raise osmotic potantial [20, 7, 8]. In cultivation of any species, it should be avoided from lands containing 2% and more salt concentrations to obtain high yield. In each photoperiod, there was germination in low (0,5%) H_2SO_4 concentration but in higher concentrations there was no germination. H_2SO_4 concentration hinders germination under all conditions.

It is known that KNO_3 is a growth regulator and germination stimulator for some plants[9]. In view of the germination percentage, it is noticed that germination percentage in 0,5% media in both photoperiod groups was higher than 24 h darkness photoperiod control group. Higher light intensity raised germination percentage. Excessive KNO_3 concentration hinders germination and have a negative correlation with germination percentage.

As a result of fast urbanisation, societies excessive industralisations tendencies and employment worries, acid rains appeared as an environmental problem [10, 11]. With acid rains, seed germination rate has began to decrease. In low HCl concentration media (0,5%, 1%) germination was at lowest levels and there was no germination at higher concentration levels. At high concentration levels, seeds contaminated. HCl hinders *Centaura amonicola* Hub.-Mor seeds germination.

In cultivation researches, economy is also important. Therefore, to know ideal germination medium is important to reproduction and protection of the species. In this study, *Centaura amonicola* Hub.-Mor seeds germination media investigated. According to the obtained results, the germination media should not contain excessive acid and salt concentration and there should be with medium KNO_3 concentration.

ACKNOWLEDGEMENTS

The authors thank the Curators of Herbaria GAZI, who allowed us to study their *Centaurea* specimens and during field study to help Prof. Dr. Ersin Yucel and Dr. Faik Ahmet Karaveliogullari.

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