African Journal of Agricultural Research Vol. 4 (3), pp. 259-261, March 2009
Available online at http://www.academicjournals.org/AJAR
ISSN 1991-637X © 2009 Academic Journals

Short Communication

Effect of temperature on germınatıon bıology ın *Centaurea* specıes

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Accepted 14 February, 2009

The temperature requirement is important factor for adaptation to an ecology of any plant species.Plant seeds growing in the places with high altitutes are excepted to well develop at lower temperatures. In addition, temperature highly determines when seeds will germinate under field conditions.With different flower colors and appearence, Centaurea is an annual,biennial and perennial plant genus,alternatively used for culture plants in landscape architecture works. *Centaurea virgata* growing at 1750 altitude were germinated at different temperatures.Their germination rate and their percentage of germination were investigated and the best germination temperature assessed. In this study,seeds from roadsides and fields of *Centaurea balsamita,Centaurea iberica* and *C. virgata* growing at 1750 altitute were germinated at different temperatures.Their germination speed and germination percentage were investigated and the best germination temperature was assessed.As a result, the best germination percentage and speed was *C. balsamita* at 15°C.

Key words: Seed, germination, *Centaurea.*

INTRODUCTION

Rapid population increase and industrialization damages the balance of the world. This situation effects human beings negatively and they see a need for spending time with a living in order to keep their own psychology proper and not break their bonds with nature.Especially those dealing with garden with garden grow plants in their small flower pots. As well as making use of the current gene potential of the plants and the commerciall benefits of the region from this sector,the gene potential is preserved and the garden also maintain their survivals by growing plants which are appropriate fort he climate conditions of that region.

The *Centaurea* species also including non-endemic species include the wild plants species which are spread over almost all of the geographic regions of Turkey. Some of the grass species belonging to this type are annual, where others are two or multi annual. This wild plant mostly likes regions like grasslands, fields, roads, fallow lands, historical places and recreational fields. *Centaurea virgata Lam* is a perennial plant and with its grassy, hard branch type has a height of 20 – 70 cm.

Its flowers are hard and rose-purple in color. It is found in dry hills, steps, or dry free fields and blooms between the 6 - 9. months. *Centaurea balsamita Lam* is an annual plant and has a straight body type. Its height can be range from 30 to 120 cm. It is found in step and fallow lands and blossoms in the 7 month, its flowers are yellow. *Centaurea iberica* Trev. ex Sprengel can be annual, biannual or perennial and can be found in fields, near roads and fields. It blossoms between the 6 - 8 months, and its flowers are pale pink. Its height can be range from 20 to 100 cm (Davis, 1975). In a study conducted in Eğirdir (Isparta) for determining the flowers that are used as medicine by the local habitants, it was found that *C. İberica* is being used against stomach aches, insect and snake bites. One should be careful while protecting and using plants. Because, some species which are not under threat currently are being used for various purposes or being damaged. There are plant groups which can face the danger of extinction in the future if not taken under control. *Centaurea,* one of the flowers which should be protected in the future with priority, is also shown as a potential fancy flower (Ekim et al., 2000).

There are mostly studies for germinating types and species used against wild plants. Depending on the species property and ecological conditions, the germination and growing temperature of the plants change. The increase in germination is seen mostly by increasing the temp-

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erature to its optimum value. Although there are various studies questioning the optimum temperature range for germination, it is known that the seeds are subjected to changing temperatures in their natural environments (Baskin and Baskin, 2001).

Anonymous (2008) reported that *Centaurea repens* seeds germination in the range of 0.5 - 35°C, optimum temperature 20 - 30°C and variable light and dark periods increases germination.

Centaurea depressa seeds kept at room temperatures for 1, 6 and 12 months after collection were subjected to germination at temperatures of 5, 10, 15, 25 and 30°C, the germination rate was 42% in the seeds that were kept at room temperature for 1 month and germinated at 5°C, 56% in the 12 month seeds at 10°C. In order to determine the effect of light on germination as well as temperature, it was observed that 12 h light and 12 h dark gave a germination rate of 28% and 24 h darkness gave a germination rate of 21% (Erciş et al., 1997). It was declared that light increase the germination of two month old *Centaurea cyanus* L. (cornflower) under continuous high temperature, but lowering the temperature has negative effects on germination. On the other hand it was also declared that more than 80% percent of the *Centaurea diffusa Lam* (Diffuse Knapweed) seeds germinate at 15°C and darkness, whereas 20°C temperature and darkness, 20 - 30°C temperature and darkness, 20 - 30°C temperature and light/darkness applications have less effect on the germination percentage. It was announced that, newly collected *Centaurea jacea* L. (Brown Knapweed) seeds germinate right after planting in unheated conditions that is similar to the exterior environment. Similarly, *Centaurea scabioa* L. (Greater Knapweed) seeds germinate with a rate of 94%, just like *Centaurea jacea* in regions similar to the external environment. It was reported that the *Centaurea solstitalis* L. (Yellow Starthistle) seeds germinate with a rate of 100% at 20°C darkness, 34% at 20 - 30°C darkness, 98% at 20 - 30°C light/darkness (Buhler and Hoffman, 1999).

In scope of these reasons, the paper was aimed to determine the effect of the temperature factor on the germination biology of the seeds which will be important while giving the decision of using the *C. virgata Lam*, *C. balsamita Lam* (*Stizolophus balsamita*), *C. iberica* Trev. ex Sprengel (*C.iberica*) species which both grow naturally and are being used against wild plants in agricultural fields, as fancy flowers.

MATERIALS AND METHODS

The working materials, *C. balsamita Lam*, *C. virgata Lam*. ve *C. iberica* Trev. ex Sprengel seeds, were collected from the campus of Yüzüncü Yıl University s during July to August of 2003, and they were kept at room temperature until they ripen. By considering the fact that pathogen and non-patogen organisms from the soil may effect the seeds, surface sterilization was made for 30 min in 10% sodium hydrochloride solution and for 1 h in dilute water. All the used glass petridishes, drying papers, pincers and other materials were sterilized at 200°C and all watering were done by dilute water. Drying papers were placed underneath and on top of the glass petri dishes. The "trial coincidence parts" were settled with 3 repetitions depending on the trial pattern and 100 seeds corresponded to each repetition.

Temperates whose effect on germination biology were determined as 5°C ± 1, 15 °C ± 1 and 20°C ± 1. Growth chambers were used at the specified temperatures and darkness. In accordance with the method recommended by Boz et al. (1993), Mennan and Uygur (1996), counting were made on days 1, 3,5, 7, 14, 21 and 28, seeds having a pollen tube growth of 0.5 cm were accepted as germinated and taken out of the dish. The germination speed coefficients of the germinated seeds were calculated as described by Günay (1982).

The data were analyzed using GLM(General Linear Model) procedure of SAS statistical package program. Duncan's multiple comparision test was used to determine significant differences (SAS, 1998).

RESULTS AND DISCUSSION

When the averages related to the temperatures are investigated, it can be said that 15°C increases the germination percentage as compared to other temperatures. As seen from Table 1 the percentage of germinated seeds are 71.44 at 15°C and the lowest is 46.22% at 5°C, the highest germination percentage is 71,44 at 15°C

Among the species, the best germination percentage was seen at *C. balsamita* with 90.22% and the lowest germination rate was seen at *C. iberica* with 18.67%.

At 5°C, *C. balsamita* is species with the highest germination percentage, but *C. virgata* is species with the lowest highest germination percentage. At 15°C species with the highest germination percentage is *C. balsamita* with 93.67%. At 15°C and 20°C temperatures, no significant difference between *C. virgata* and *C. balsamita* was found.

In Table 1 there is a difference between the small letters in the same row ($P < 0.05$). There is a difference between the averages labeled with different small letters in the upper index in the same row (Comparision of the species within the temperature levels). There is a difference between the averages labeled with different capital letters in the lower index in the same column (Comparision of temperature levels between the species). In the lowest row, there is a difference between the averages labeled with different capital letters.(Comparison of species), ın the right most column, there is a difference between the averages shown with different capital letters. (Comparision of temperature levels)

In Table 2, there is a difference between the small letters in the same row ($P < 0.05$). There is a difference between the averages labeled with different small letters in the upper index in the same row (Comparision of the species within the temperature levels).

There is a difference between the averages labeled with different capital letters in the lower index in the same column (Comparision of temperature levels between the species). In the lowest row, there is a difference between the averages labeled with different capital letters.

Table 1. Germination percentages at the end of 28 day for *Centerauera*, species germinated at different temperatures.

Temperatures	*C. virgata* %	*C. iberica* (%)	*C. balsamita* %	General %
5℃	49.33 ± 318$^{b}_{A}$	0.67± 0.33$^{c}_{C}$	88.67 ± 2.03$^{a}_{A}$	46.22 ± 12.77C
15℃	87.68 ± 393$^{a}_{A}$	33.00 ± 3.51 $^{b}_{B}$	93.67 ± 1.20 $^{a}_{A}$	71.44 ± 9.78 A
20℃	89.00 ± 153$^{a}_{A}$	22.33 ± 2.96 $^{b}_{A}$	88.33 ± 0.67$^{a}_{A}$	66.56 ± 11.10B
General average.	75.33 ± 6.68B	18.67 ± 4.94 C	90.22 ± 1.12A	61.41 ± 6.61

Model R^2 (%): 98.924 (%) CV: 6.98 Effect of species: (P<0.001). Effect of temperature: (P < 0.001). Effect of species x temperature interaction (P < 0.001).

Table 2. Germination speeds of Centaurea ssp. germinated at different temperatures.

Temperature	*C.virgata* %	*C.iberica* (%)	*C.balsamita* %	General %
5℃	4.89 ± 022 $^{a}_{B}$	3.57 ± 0.00$^{a}_{AB}$	6.78 ± 0.11$^{a}_{C}$	5.27 ± 0.49 B
15℃	7.83 ± 3.93 $^{b}_{B}$	8.11 ± 0.26$^{b}_{A}$	36.71± 3.72$^{a}_{A}$	15.16 ± 4.76A
20℃	13.27 ± 1.47$^{b}_{A}$	10.30 ± 0.45$^{c}_{A}$	22.98 ± 1.61$^{a}_{B}$	15.52 ± 2.02A
Generalavg.	8.66± 1.30 B	7.80 ± 1.00 B	20.34 ± 4.53 A	12.12 ± 1.88

Model R^2 (%) 97.254, CV: 15.76, Effect of species (P < 0.001), Effect of temperature (P < 0.001) and Effect of species x temperature interaction (P < 0.001).

(Comparison of species). In the right most column, there is a difference between the averages shown with different capital letters. (Comparison of temperature levels).

When the temperature averages related to germination speeds are concerned, the highest germination rate was observed at 15 and 20℃ in the same group, and the highest germination speed average was determined as 15.52 (Table 2).

When the averages between the species are compared, the species with the highest germination speed was *C. balsamita* with 20.34. The species with the lowest germination speed average was *C. iberica* with 7.80.

The germination temperatures and days are 18℃, 14 - 20 days for *Centaurea americana*, 15 - 18℃, 10 - 20 days for *C.* cyanus, 15 - 18℃ and 14 - 20 days for *Cucurbita moscahta* which is used as group plant and cutting plant at decoration studies (Hatipoğlu and Gülgün, 1999). When the germination speeds of *Centaurea* at different temperatures are investigated, the highest germination speed was seen at *C. balsamita* at 15℃ and the lowest germination rate was seen at *C. iberica* at 5℃. Erciş et al. (1997) have found that the optimum germination temperature of *C. depressa Bieb*. seeds is 5 - 10℃, whereas the germination rate decreases as temperature is increased which is parallel to the development seen in natural conditions (Erciş et al., 1997).

As a result, it was found that in all three species temperature increase effects the germination speed positively, in the two species other than *C. balsamita* the germination percentage is parallel with temperature increase and the best temperature for seeds that will be taken for agriculture is 15 - 20℃.

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