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EVALUATION OF SEED EMERGENCE, SEEDLING VIGOR ENHANCEMENT  
OF SOME POPULATIONS FROM *SATUREJA BACHTIARICA* WITH  
CHEMICAL, MECHANICAL AND PHYSIOLOGICAL TREATMENT

ABSTRACT

The seeds of 3 populations from *Satureja bachtiarica* were collected from three native vegetation areas (Simirom2, Sharkord and Yazd). The different treatments including: cold stratification, gibberlic acid (50 and 100 ppm) Potassium nitrate (0.2 and 0.4 percent). Physical scarification (sand paper), chemical scarification (Ethylic alcohol %70) and distilled water (control) were used for breaking dormancy of the seed samples. For greenhouse experiment, the seed samples were treated with treatments and then were sown in pots using randomize design with three replications. Emergence percentage, emergence speed, length of root and shoot, seedling length, root/shoot length ratio, vigor index, seedling fresh and dry weight, dry/fresh weight ratio were evaluated during 45 days of experiment. Comparing of population Semirom2 form savory of Bachtiry was higher than other population. It was concluded that effect of gibberlic acid and potassium nitrate was higher than physical scarification and chemical scarification comparing with control.

Key word: dormancy, germination, *Satureja bachtiarica* and vigor.

INTRODUCTION

The use of plants as medicine approach requires that this group of species should be used to multiply and grow. In addition for their use as drugs and prevent of them from, physical and genetic erosion, they should be conserved. Cultivation and domestication of plants were begun with the movement of human civilization (Zargary, 1997).The scientific name is Bachtiry Savory is *Satureja bachtiarica*. It is shrub species, cushion with multiple stems to 20 to 45 cm short, thin, multiple branches, covered with Short fur is gray and attached secretory glands.The geographical distribution of

this species in Iran includes the provinces of Kurdistan, Kermansah, Esphahan, Kohkeloiehand Boierahmad, Charmohal and Bachtiry and Fars . This species plant habitats such as rocky slopes - stony Iran Turan Region, height of 1300 to 2500 meters above the sea level (Jamzad, 2010)

The seed is the important agent of plant reproduction, also it has main roll for Maintenance and conservation of plant species in unfavorable condition. Also , the seeds has main roll for gene properties, distributions mechanism and plant establishment in different part of Iran. seed forms Greater part of human food, animal and bird (Sarmdniya, 1375). Seed production has created, the foundation of agriculture and further civilization. In this century, using techniques of selection, hybridization polyploidy and other methods,. Using these methods , the researchers have been able to produce new and best cultivars (Rahimian and Kosravy, 1999).

Moreover the seeds is a rich source of carbohydrates, protein and oil in a very simple and digestible and storage of genetic modification through variation and plant breeders are transferred to farmers and gardeners (Tvakol Afshari *et al.*, 2009). Two roles of the seeds are important in agriculture and horticulture because firstly, as an essential factor for proliferation and are considered for the starting point for many crops and secondly, the final product would be seed when it harvested by producer. The harvested crops include a range of seeds and it has varied products which directly used in human and animal nutrition.

The seeds are maintained in "gene banks" or "germplasm banks" at temperature of -20° C for a long time with 5% moisture content. Under these conditions, seeds of many of crops would be preserved their commercial viability for many years (Rahimian and Kosravy, 1999)

Plant growth regulator materials have been known as main agent of breaking dormancy of seeds. Gibberlic acid has important role in this type of materials. In order to breaking of dormancy potassium nitrate (0.2)% would be used (Dezfoly and Alikhany, 1999). During cold treatment, the seeds will affected by internal and external process and theses process Bringing forth of germination. The seeds which exposing enough to cold treatment, they would be gotten hormonal balance for germination. (Nasiri, 1387).

Given the importance of seed plants in the natural resources of gene banks, enhancement of seed germination and vigor of three populations Bachtiry savory were studied with using physical and physiological seed treatments in 2010-2011.

#### MATERIALS AND METHODS

Six hundred seeds from three populations Bachtiry savory was investigated in the greenhouse. The seeds were disinfected with liquid fungicides of vitawax tiram 1% for 5 min. Treatment including chilling treatment (4 weeks at 4°C), physical Scarification (abrasive paper) and chemical Scarification (alcohol), use of hormone gibberellic acid (50 and 100 ppm) and po-

tassium nitrate (0.2%, 0.4%) were compared by control. For the greenhouse experiment, seeds were sown in pots and temperature 30-20°C and 10000 lux of light during the day and 12-5°C were at night. Percentage and emergence rate of seeds after 3, 6, 9, 12, 15, 18 and 21 days, were recorded. Seedlings growth was complete for 45 days. The germination characteristics including: germination percentage, speed of germination, length of root and shoot, seedling length, ratio of root length by shoot length, vigor index, fresh weight and dry weight, ratio of dry weight by fresh weight were evaluated during experiment. According to (Maguire, 1962), the speeds of germination were calculated by following equation:

$$GS = \frac{\sum n}{\sum n(n \times DN)} \times 100$$

where;

$n$  is the number of seeds germinated on day  $Dn$ ,  $Dn$  is the number of days from sowing, corresponding to  $n$ , and the highest  $GS$  is the fastest speed. The vigour index is measured as seedling performance, which relates together the germination percentage of a seed sample and the growth of the seedlings produced after a given time (Abdul-Baki and Anderson, 1973). It is calculated according to the following equation:

$$V_i = \frac{\%G_r \times MSH}{100}$$

where:

$V_i$  = vigour index,  $\%G_r$  = final germination percentage,  $MSH$  = mean seedling height

The data were analyzed by factorial experiment with the software of Minitab 13.311 and Sas.

## RESULT

Analysis of variance showed that was significant at 1% level between populations, treatments for all traits. Between population and treatment, there were significant differences for all traits except for percentage emergence and emergence rate). Comparing of mean seed emergence characteristics of three population Bachtary savory showed that population of Semirim 2 had higher germination characteristics than the Yazd and Shar kord (Table 1).

Table 1

**Mean square of seed emergence characteristics of population, treatment and interaction between them for *Satureja bachtiarica* in greenhouse condition**

Parameter	Name of the source				CV
	Population	Treatment	Population × Treatment	Error	
D.F.	2	7	14	7	
Percent of Emergence	23592**	561**	175ns	197	41
Speed of Emergence	379**	8.2**	3.2ns	2.7	45
Shoot length	1280**	459**	79**	26	35
Root length	97.3**	22.1**	13**	1.8	32
Seedling length	2227**	609**	110**	41	34
Root/shoot length ratio	0.062**	0.038**	0.083**	0.011	30
Vigor index	2709**	156**	40ns	51	75
Fresh weight	2260**	436**	64*	28	34
Dry weight	32.88**	5.93ns	6.81ns	3.79	64

\*, \*\*= respectively significance 5% and 1%

#### *Seed emergence percentage and Speed of emergence rate*

Effect of treatment on seed emergence percentage of three population of Bachtary savory proved that seed emergence percentage and speed of emergence of Yazd population was maximum as 27%, 2.6 sprout /day by effect of GA50 treatment compare with control and other treatments but the minimum emergence percentage speed of emergence and were related to alcohol treatment as 5% and 0.45 sprout/day. Seed emergence percentage of Shahre kord was 30% 3 by effect of gibberlic acid 50 ppm but the minimum seed emergence percentage was 5 % by effect of scarification of sand paper. Also there was no any emergence of seed by alcohol treatment.

Maximum seed emergence percentage of population of Semirom 2 was 89%by effect of KNO<sub>3</sub> 2% treatment but it was minimum as rate of 45% with alcohol treatment. Maximum speed of emergence of Shar kord was 1.6 sprout /day with effect of gibberlic acid 50 ppm but the minimum speed of emergence of Shar kord was related to alcohol treatment as 0.3 sprout /day (Table 2). With effect of nitrate Potassium 0.2% and 0.4% maximum speed of emergence was obtained as 10 sprout /day but its minimum was related to sand paper and alcohol treatment as 5 sprout/day (Table 2).

Table 2

**Mean Comparison seed emergence characteristics of three population  
*Satureja bachtiarica* in greenhouse condition**

Name of population	Emergence [%]	Speed of germination/day	Seedling length [mm]	Vigor index	Fresh weight [mg]	Dry weight [mg]
Yazd	14b	1.3b	13.8b	2.75b	9b	2.2b
Sharkord	13b	0.9b	12b	2.22b	8b	1.7b
Semirom2	70a	8.3a	30.9a	23.4a	29a	4.2a

#### *Seedling length and vigour index*

Comparing of seedling length and vigor index of three population showed that the seedling length and vigor index of Semirom population 31mm and 23 was higher than the other two populations (Yazd and Sharkord). With effect of gibberlic acid 50 ppm, seedling length and vigor index of Yazd population (46mm), (12.5) were maximum compare with control and other treatments but with alcohol and sand paper treatment their minimum value was 1 mm, 0.05 by Alcohol treatment. Also maximum seedling length and vigor index of the vigor index of ShareKord as 25, 8 were obtained by effect of gibberlic acid 50 ppm but their minimum values as 3 mm , 0.2 , was related to KNO<sub>3</sub> 0.2% compare with control and other treatments (Table 3). Effect treatments on Semirom population showed that seedling length and vigor index o as 40mm and 33 , were achieved by effect of gibberlic acid 50 ppm treatment but their minimum value as 14.5 mm, was related to alcohol treatment.

#### *Fresh and dry weights*

Fresh and dry weights of three population showed that the seedling length and vigor index of Semirom population 29 mm and 4.2 was higher than the other two populations (Yazd and Sharkord) Table 2. With effect of gibberlic acid 50 ppm , Fresh and dry weights seedling of Yazd population (32 gr), (5 gr) were maximum compare with control and other treatments but with alcohol treatment fresh weights minimum value was 1mg, (Table 3). Also maximum Fresh and dry weights seedling of ShareKord as 32, 2 were obtained by effect of gibberlic acid 50 ppm but their minimum values as 3 mg 0 was related to sand paper scarification compare with control and other treatments (Table 3). Effect treatments on Semirom population showed that fresh weight and dry weight as 38 and 5 were achieved by effect of gibberlic acid 50 ppm treatment but their minimum value as 12.5 gr, 3 gr was related to alcohol treatment (Table 3).

Table 3

**Mean Comparison seed emergence characteristics of three population *Satureja bachtiarica* with effect of treatment in greenhouse condition**

Name of population	Treatment	Emergence [%]	Speed of emergence per day	Seedling length [mm]	Vigor index	Fresh weight [mg]	Dry weight [mg]
Yazd	Control	15v-y	1.24s-t	10.13t-w	1.64s-t	9o-y	2i-l
	Alcohol	5y	0.48s-t	1w	0.05t	1y	*0
	Cold	15v-y	1.53r-t	8.33u-w	1.36t	3w-y	1 1
	GA100	10w-y	0.98s-t	12.86r-w	1.32t	8p-y	1.5k-l
	GA50	26.6r-y	2.59n-t	45.8b-f	12.49k-t	31.67f-q	5c-l
	KNO3 0.2%	15v-y	1.19s-t	10.6s-w	1.65s-t	7.33q-y	1 1
	KNO3 0.4%	10w-y	1.02s-t	3.4w	-	1.33y	0
	Seraf	7.5x-y	0.23t	7.6u-w	0.65t	3.5u-y	1 1
Sharkord	Control	6.6x-y	0.5s-t	8.2u-w	0.6t	6.33r-y	1 1
	Alcohol						
	Cold	13.3v-y	1.16s-t	14.46p-w	2.3s-t	3.33v-y	2i-l
	GA100	15v-y	1.17s-t	14.93p-w	2.32s-t	15 1-y	2 i-l
	GA50	30p-y	1.63r-t	25.26j-t	7.57p-t	20.67j-y	1.66j-l
	KNO3 0.2%	6.6x-y	0.60s-t	3.13w	0.21t	4.33t-y	-
	KNO3 0.4%	13.3v-y	1.15s-t	12.93q-w	2.33s-t	5s-y	1.5k-l
	Seraf	5y	0.33t	4.86v-w	0.24t	2x-y	-
Semirrom2	Control	64d-n	7.2e-k	28.73g-r	16.96h-t	23.67h-y	5.66b-l
	Alcohol	45.3k-u	5 j-r	14.5p-w	9.08o-t	12.5m-y	3.5e-l
	Cold	74.6a-k	8.9d-j	34.86f-n	26.02c-o	29f-t	1.33k-l
	GA100	78.6a-i	9.6c-g	35.6f-n	28.88b-k	38.33f-l	2.33h-l
	GA50	78.6a-i	9.9b-g	40.4e-k	32.93a-i	37.67f-m	4.66c-l
	KNO3 0.2%	89.3a-e	10.3b-g	32.13f-o	30.38a-j	32.67f-p	3f-l
	KNO3 0.4%	78.6a-i	10.3b-g	25.6j-s	21.05g-r	31.5f-r	6f-k
	Seraf	48j-t	5j-r	26.35 i-s	13.17k-t	21.5j-x	9a-c

Means of each columns followed by the same letters had no significant differences (P#0.05) based on DMRT method. \*: the amount of sample was little, it has fresh weight but the scale of measuring would not be able to show dry weight because of its sensitivity

#### DISCUSSION

Comparing of mean seed germination characteristics of Bachtiry savory showed that Semirom2 population had higher of emergence percentage speed of emergence than the other two population. Effect of cold gibberlic acid and Potassium nitrate treatment on mean seed germination characteristics of three population of Bachtiry savory were more than control and other treatment but it was lower by physical scarification (sand paper) and alcohol treatment. This result was similar with result of Alizadeh *et al.*, (2013); Hossienpour Ghazveni (2011); Rahmanpour, and Majd, (1999) because they reported that using of cold treatment, hormone of gibberlic acid and potassium nitrate were induce to increase of root and shoot length (seedling length) and vigour index.

With regard of result it was proved. With regard of increasing of gibberlic acid on fresh and dry weigh of population of sahandy savory, the same result was obtained by Farajpour *et al* (2010) for the species of Achilla . Also the same result was achieved by Tavily *et al.*, (2010) for the species of of *Salsola rigida*.

#### CONCLUSION

- Regarding of result and discussion it was proved that seed germination characteristics of Semirom 2 population was higher than two population of Yazd and Share kord
- Comparing effect of different treatment, gibberlic acid 50 ppm was more effective on seed germination enhancement compare with control, physical and chemical scarification
- Also with more effective of gibberlic acid treatment on seed germination enhancement of the population it was clarified that the type of dormancy of the population of Bachtiry savoury was physiological dormancy.

#### REFERENCE

- Abdul-Baki, A.A., Anderson J.D., 1973. Vigor determination in soybean seed by multiplication. *Crop Sci* 3: 630- 633.
- Alizadeh, M. A., Arab, H.A., Tabai Aghdaei, R., Nasiri, M., Jafari A.A., 2012. Evaluation germination and vigor of seed and seedling for some population of *Satureja sahendica* with physical and chemical treatment. The Proceeding of 12 th Iranian Crop Science Congress. 4-6 September 2012,
- Farajpour, M., Ebrahimi M., Maddah Arefi H., Amiri R., Ebrahimi M., 2010. Evaluation of effect on different treatment in breaking dormancy and induce germination of seed Achilla. Proceedings of the Scientific Conference on Medicinal Plants Development in Iran, Februray 28 March 1, 2010, Tehran-Iran, pp: 189.
- Dezfoly, H., Alikhany M., 1999. Dormancy and emergence of seed. Shaid Chamran University of Ahvaz, Iran, Pages: 246.
- Hossienpour Ghazveni, A., 2011. Evaluation germination and vigour problem in four ecotype in laboratory and greenhouse. M.Sc. Thesis, Azad university-Unit of Takestan.
- Jamzad, Z., 2010. Thymus and Savory of Iran. Research Istitute of Forest and Rangeland, Tehran, Iran, pp: 81-132
- Maguire, J.D., 1962. Speed of germination: In selection and evaluation for seedling vigor. *Crop Sci.*, 2: 176-177.
- Rahimian R.V., Kosravy M., 1999. Seed Physiology. 2<sup>nd</sup> Edn., Jihad University of, Mashhad. Iran, pp: 96
- Rahmanpour, A. and A.F. Majd, 1999. Breaking dormancy and germination method of the seed of *Eremurus stenophyllus* by physical and chemicakl method. *Res. Scient. J. Aromatic Med. Plant*, 21: 357-370
- Sarmadnia, Gh.H. (1997): Translation of seed technology, Published by Jahad University of Mashad

- Tavily A., Safary B. Sabery M., 2010. Effect comparing by using of gibbelic acid and potasim nitrat on seed enhancement germination characteristics of *Salsola rigida* research and scientific. *J. Rangeland Desert*, 2: 272-280.
- Tvakol Afsharyi, R., Soraky A.A., Ghashemy A.F. , 2009. *Seed Technology and its Biological Basis*. Theran University Press, Tehran, Iran.
- Zargary A., 1997. *Plant Medicin*. 6<sup>th</sup> Edn., Theran University Press, Tehran, Iran.