Vegetative and Reproductive Characteristics of Iranian Gole-Gav-Zaban (*Echium amoenum* Fisch & C. A. Mey) Accessions Cultivated in Mazandaran Province

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Abstract: Iranian Gole-Gav-Zaban (*Echium amoenum* Fisch & C. A. Mey) belonged to Boraginaceae family and is considered as a valuable Iranian endemic medicinal plant that has been used widely as traditional medicine since long times. Because of its convenience and being acceptance as a remedy for different sort of diseases by people. Use one of these (besides) side a little research has been ever done on this valuable endemic medicinal plant. There for is drastically short amount of available information about it. hence there is need of more work. By these descriptions, in present study, measuring of vegetative and reproductive character of Iranian Gole-Gav-Zaban was aimed. For fulfilling these aims (objects), accessions were planted in a completely randomized design with three replications in June 2010. Bushes characteristics were observed and documented. In the vegetative phases there weren't considerable difference among accessions. But from the aspect of flower field character, the difference was significant.

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1. Introduction

Echium genus (Boraginaceae) has four species in Iran (Mozaffarian, 1996) and only *Echium amoenum* Fisch & C. A. Mey has medicinal usages (Akbarinia *et al*., 2007). In Iran, the dry violet–blue petals of it has long been used as tonic, tranquillizer, diaphoretic, cough suppressant and a remedy for sore throat and pneumonia in traditional medicine (Amin, 1991; Hooper, 1937). In spite of this fact, *E. amoenum* is totally known as a traditional herb by costumers not only in Iran but as a recently exported product which is gradually founding its right place in the past few years. Sufficient investigation has not taken place (carried on) on it. Various phytochemical petals' studying proved the existence (presence) of some compounds for instance anthocyanins, flavonoids aglycones, saponins, unsaturated terpenoids, sterols and the least amount of essential oil (Shafaghi *et al*., 2002; Mehrabani *et al*., 2005; Heidari *et al*., 2006). But still there is a gap to be filled. This study is just a small step to uncover some of the characteristics of this plant. Investigation the effect of plant's accessions on bushes growth, flower yield and oil amount are considered as the objects of this study.

2. Material and Methods

2.1. Field planting

The study area is the Foshkor basin which is (one mountainous region of Chalous, Alborz Mountain, Mazandaran province) located in the north of Iran, between longitudes 36°15' E and latitude 51°18' N. Seeds of different accessions of *E. amoenum* were collected from different regions of Iran (Tehran, Zardband, Esfahan, Hamedan, Rahim Abad (Gylan province) plus native accession from Foshkor). Then they were planted in a field that was located in Foshkor in a completely randomized design with three replications in June 2008. The distance was 40 cm in and between rows. The soil characters are followed at the table number 1.

The seed planting depth was 1-1.5 cm. At the first year of planting, the herbs didn't flower (and therefore or consequently) no seed was produced. In the first year, germination time and four-leaf stage were documented. After, completing chilling requirement, the bushes at the end of March regrow and at the beginning of April they passed rosette phase and produced flowering stems. In the second year (2009), time of stem, full blossom, bushes height at full blossom, number of flower for each bush, dry to wet flower weight rate were considered. The first picking up was done on May 8th. This way was continued up to the middle of August. In full blossom period, flowers were picked every other day and dried in room temperature isolated from sun shine. In each time, picked flowers were numbered and dried to wet flower weight rate were measured. Grinded petals were used as experiment samples. Mature seeds were collected. The weight of 1000 seeds of (for) each accession was measured.

Table 1. Soil characteristics of cultivation region

Character	Measure
Sand (%)	46
Loam (%)	38
Clay (%)	16
Soil Texture	Loam
EC (*mMho*)	0.602
pH	6.6
Potassium (ppm)	192
Phosphor (ppm)	28.4
Total N (%)	0.3
Organic carbon (%)	3.43

2.2. Oil extraction

Seeds were cleaned and grounded. For each accession, ten grams of the prepared seeds powder were measured and the oil was extracted by soxhlet type apparatus for 6-7 hours. Hexane was used as solution (4). The solvent was removed under vacuum in a rotary evaporator (EYELA, N.N. Series, Rikakikai Co. Ltd., Tokyo, Japan) (Azadmard-Damirchi and Duta, 2005).

2.3. Statistical analysis

Analysis of plural was done with SAS9.1 software and differences among treatments were tested with Duncan test (Level of significance $p<0.05$).

3. Results and discussion

3.1. Effect of accessions on vegetative characters

All the cultivated accessions had been stemmed and they started flowering at the same period so the differences between them were not considerable. Full blooming time and height at the full blooming didn't show any considerable difference.

Since there is a lack of information on this plant phenotype (morphology), we present some of our observations below.

- *E. amoenum* (its seed) germinates epigeal and the cotyledons came out of the ground.
- It is a long-day plant. In first year its form is rosette. By the increase in day time length and temperature, it produces flowering stem and begins flowering. *E. amoenum* needs a cold temperature period in order to flower. Because of this character, sowing in spring does not lead to flowering in the following summer.
- Flowering stem comes out from the angle between leaf and stem.
- Main Flower stem and secondary Flower stems start to grow from angles between leave and the stem and plant around respectively.
- It is a perennial and hardy plant. The leaves keep their greenish under the snow for a while.
- The inflorescence is raceme. At the end of calyces, limpid sticky sweat liquid gathers. Two flowers from the inflorescence often bloom at the same time. So the first flowers produce seed while the upper flowers are still blooming. This lead to seed dropping.
- To produce seed there is an absolute need for pollen from another bush. Self-pollination cannot lead to seed production. Pollination takes place by insects.
- Seed is in acne form with four, three and sometimes two and rarely with single seed. They are stick in tight calyces. The seed coat is hard and groove.

Table 2. Mean comparison of vegetative and reproductive characteristics of various accessions of Iranian Gole Gav Zaban at the first year by using Duncan test in 5% level

	Characteristics			
Accessions	Days to germination	Days to four-leaf stage	Days to stem	flowering
Tehran	47[a]	100[a]	-[b]	-[b]
Hamedan	48[a]	99.3[a]	149.6[a]	159.6[a]
Esfehan	47[a]	97.7[a]	148.3[a]	158.3[a]
Roodbar	37.7[a]	98.7[a]	158[a]	166[a]
Rahim Abad	48.7[a]	102.3[a]	-[b]	-[b]
Zardband	49[a]	105[a]	152[a]	161[a]
Ezzat Abad Sofla	47.7[a]	102.7[a]	161[a]	164[a]
Feshkoor	*	*	-[b]	-[b]

*The native accession was collected from the natural habitat and then transplanted to the field, due to this, time of its germination and four-leaf stage were vague.

In the first year, Esfahan accession stemmed sooner than others and the native accession was the last accession which stemmed. In total, the difference was not punctual. Among other vegetative characters, the differences were not significant neither.

Table 3. Mean comparison of vegetative and reproductive characteristics of various accessions of Iranian Gole Gav Zaban at the second year by using Duncan test in 5% level.

	Characteristics					
Accessions	Days to stem	Days to flower bud appearance	Days to First Flower	Days to full bloom	Plant Height at the beginning of flowering	Plant Height at the full bloom
Tehran	55[ab]	59.66[a]	64[a]	72[a]	38.3[ab]	63.33[a]
Hamedan	52[b]	59[a]	60.66[a]	70[a]	36.66[ab]	66[a]
Esfehan	49.66[b]	55.3[a]	61[a]	72[a]	33[b]	66.33[a]
Roodbar	52.33[ab]	58[a]	62[a]	70.33[a]	37[ab]	68.66[a]
Rahim Abad	55.66[ab]	56.3[a]	60[a]	68.66[a]	37.33[ab]	63[a]
Zardband	54.33[ab]	58.66[a]	63.66[a]	72.66[a]	44.33[ab]	70.66[a]
Ezzat Abad Sofla	57.33[a]	61.33[a]	65.66[a]	76.66[a]	39[ab]	62[a]
Feshkoor	58[a]	61.66[a]	65.33[a]	74.66[a]	39[ab]	66.33[a]

3.2. The effect of accessions on yield and wet to dry weight rate

The flowers numbers were counted in each picking up. Among the accessions Tehran accession occupied the first rank. The lowest amount was observed in Rodbar accession. Flowering yield had not shown difference in 5% level. Wet to dry weight rate for each accession was measured and it did not revealed considerable difference.

Table 4. Mean comparison of flower's yielding characteristics of various accessions of Iranian Gole Gav Zaban by using Duncan test in 5% level

	Characteristics		
Accessions	Flower number in plant	Flower yielding (in g/6m^2)	Ratio of dry weight to fresh
Tehran	1922[a]	1133.8[a]	6.61[a]
Hamedan	1665[a]	1006.2[a]	7.26[a]
Esfehan	1626[ab]	804[ab]	8a
Roodbar	1145[c]	581.6[c]	7.55[a]
Rahim Abad	1573[ab]	981.5[ab]	6.57[a]
Zardband	1601[ab]	886.6[ab]	6.52[a]
Ezzat Abad Sofla	1247[bc]	744.8[bc]	6.42[a]
Feshkoor	1269[c]	669.7[bc]	8.33[a]

3.3. 1000 seeds weight and oil percentage

The result showed that 1000 seeds weight and oil percentage among the repetition and treatments in 5% level of Duncan test weren't meaningful. 1000 seed's weight and oil amount are shown at the table number 5.

Table 5. Mean comparison of 1000-seed weight and oil content of various accessions of Iranian Gole Gav Zaban using Duncan test in 5% level

Accessions	1000-seed weight (g)	Oil content (%)
Tehran	7.75[a]	35.98[a]
Hamedan	8.41[a]	32.33[a]
Esfehan	8[a]	35.37[a]
Roodbar	8.6[a]	32.2[a]
Rahim Abad	9.2[a]	36.14[a]
Zardband	8[a]	34.4[a]
Ezzat Abad Sofla	8.76[a]	35.3[a]
Feshkoor	8.76[a]	33.1[a]

It was revealed that with 7 irrigation period the dry weight of flower would be 420 kilograms per hectare (Akbarinia and Pileforush, 2009) but in this study the yield were dramatically more than their report. This huge amount of difference could be explained by the impact of different climate, because the field was located in a mountainous region with rainy and foggy days (almost every day) this condition leaded to more lateral stem, more flowers and it prolonged flowering period as well. As mentioned before, due to the little amount of research on this plant, there is a limitation for comparison the results with other reports. Although it is acceptable that secondary metabolites are basically made beside (under the control of) plants genetic and it considered as an important factor, but the synthesis of secondary metabolites is clearly under the effect of the environmental conditions. It has already seen the major effects of the environmental conditions on the medical plant on the growth progress of medical plant quantity and quality of the active substances (Omidbaigi, 2007). Hence when it said that among different accessions at their 1000 seeds weigh and extracted oil amount, no

considerable difference were observed, It could be related to the same climate that they were grown.

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