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Effect of Sex Form and Environment on Biomass Yield in *Valeriana jatamansi* Jones

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Abstract

The germplasm of *Valeriana jatamansi* Jones were collected from high altitude of different parts of Uttarakhand and Himanchal Pradesh. The *valeriana* is a perennial herb up to 45 cm tall and stem tufted. The rootstock of this plant has powerful nervine, stimulant, carminative and antispasmodic medicinal properties. The main photochemical present in the epidermal layer of the rootstock of the plant are valerianic acid, formic acid, acetic acid and borneol. The three sex forms viz., gynoecious, gynomonoecious and bisexual were identified from the germplasm collected from various places. During *kharif* season of 2007 these sex forms were evaluated for fresh aerial biomass, dry aerial biomass, fresh rootstock and dry rootstock per plant, grown under partial shade and open environment. The analysis of variance revealed that there was significant difference among all the sex forms for all traits studied. The present study shows that the bisexual form of *Valeriana* was significantly superior to gynoceious and gynomonoecious forms for all the characters, under both open and partial shade environment. The dry aerial biomass and dry rootstock biomass in bisexual form under open condition were highest (16.36 g, 13.43 g) followed by gynomonoecious (15.49 g, 13.10 g) and gynoecious forms (14.50 g, 12.19 g), respectively. Thus, the bisexual form of *Valeriana jatamansi* Jones planted in open environment is recommended for high biomass yield and is considered better for commercial cultivation. further, it may be included in breeding programs as a recipient parent to better genotypes.

Key words : Gynoecious, Gynomonecious, *Valeriana,* Biodiversity, Biomass yield.

There has been considerable genetic erosion and heavy loss of biodiversity of medicinal plants due to their indiscriminate collection from the forest. According to the World Health Organization, about 80% of the world population depends on traditional system of medicines and 95% of raw material for their formation comes from forests. In India, about half a million tonnes of dry raw material is indiscriminately and destructively harvested from wild resources each year (1). The Indian Himalyan Region (IHR) which is the richest reservoir of biological diversity in the world is undergoing irrational extraction of wild medicinal herbs from its natural habitat leading to endangering of many of its high valuable gene banks. The community based cultivation of superior genotype of endangered medicinal plants (EMPs) is a possible solution to meet bulk market demand of raw material and to reduce *in situ* harvesting pressure (2).This requires identification of superior genotypes, mechanisms and improved agro-techniques to preserve and commercialize the endangered and valuable medicinal plants.*Valerian jatamansi* Jones belonging to family Valerianaceae is found growing in wild state in restricted pockets between 1800—2200 m altitude in sub-alpine and alpine regions. The rootstock contains medicinal properties and is used in both traditional and modern systems of medicine. Traditionally it is used for treating hysterical fits, hypochondriasis, nervous unrest, epilepsy, asthma, leprosy and cholera (3). The therapeutical properties like sedative and tranquilizing effects of *V. jatamansi* Jones are due to the presence of a group of compounds termed as valepotriates in its rootstock and leaves (4). Due to its high demand it is being ruthlessly extracted from its natural habitat which has led to impart it an endangered status. Keeping this in view, the present study was conducted to identify the best performing line from the collected germplasm of *V. jatamansi* Jones in terms of biomass yield of rootstock.

Methods

The germplasm of *V. jatamansi* Jones was collected in 2005 from high altitude of different parts of

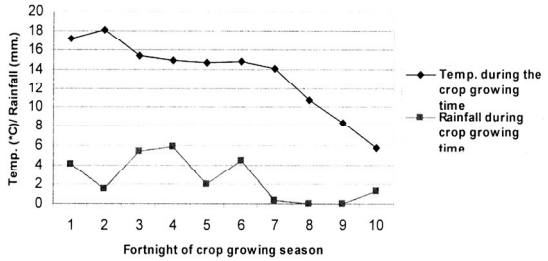

Figure 1. Temperature and rainfall recorded during crop growing season.

Uttarakhand and Himanchal Pradesh. Three different sex forms viz., gynomonoecious and bisexual were identified and further multiplied by root cuttings in the breeding block of VCSG., College of Horticulture, GBPUAT, Bharsar, Pauri Garhwal, Uttarakhand. The centre is situated at an elevation of 2200 m. above mean sea level. The daily recorded data of rainfall (mm.) and temperature (C) during crop growing season were averaged fortnightly and presented in Figure 1.

The plants prepared by root cuttings were planted in June, 2007. Two environment conditions i.e. open field and partial shade were provided to the plants. The experiment was laid down in randomized block design with seven replications. Each replication consisted of four rows, each row 1 meter in length. The planting distance between rows was 45 cm and plant to plant distance was kept at 30 cm. The appropriate culture operations like weeding and hoeing were performed regularly during growing season. The material was evaluated for four traits viz., fresh aerial biomass, dry aerial biomass, fresh weight of rootstock and dry weight of rootstock and dry weight of rootstock per plant in the month of November, 2007. The data were recorded on five randomly selected plants from each replicated plot from both the environments. The character means of the identified lines for each replication wereanalyzed following the linear model (5). Various parameters of analysis of variance and coefficient of variance were computed (6, 7).

Results and Discussion

Under both the environments, all the three sex forms showed significant variation for all the traits studied, indicating, the presence of wide variability. The coefficient of variation was higher for all the traits under partial shade as compared to open environment which shows relatively more influence of the environment under partial shade condition (Table 1). The observations recorded on all the four traits indicated that, all the three sex forms viz., gynoecious, gynomonoecious and bisexual performed better under open environment condition (Fig. 2). The average aerial biomass per plant ranged between 14.50 to 16.36 g and fresh aerial biomass per plant ranged between 148.17 to 155.12 g under open environment with a general mean of 15.45 and 151.55 g, respectively (Table 2). Earlier workers (8) have also reported the significant effect of environment on the morphological characters in Valeriana.

Under both partial shade and open environment, the bisexual form exhibited highest dry rootstock (9.23 g, 13.43 g) and dry aerial (15.80 g, 16.36 g) biomass per plant, respectively as compared to gynoecious and gynomonoecious forms (Table 2). The superior bisexual sex form of Valeriana also exhibited better performance for dry aerial and dry rootstock biomass in the open field as compared to partial shade condition

Table 1. Estimated mean squares for biomass yield of *Valeriana jatamansi* under partial shade (PS) and open environments (OE). *, ** significance at 5% and 1 % level of probability.

		Mean squares							
		Replication		Genotype		Error		Coefficient of variation	
	df	6		2		12			
	Characters	PS	OE	PS	OE	PS	OE	PS	OE
1	Fresh aerial biomass/plant (g)	1.238	3.609	160.565**	84.757**	4.818	4.176	1.54	1.35
2	Dry aerial biomass/plant (g)	1.735	1.440	17.882**	6.063**	0.280	0.250	3.74	3.23
3	Fresh rootstock biomass/plant (g)	1.138	2.514	99.597**	19.871**	2.820	1.375	4.30	1.59
4	Dry rootstock biomass/plant (g)	0.969	1.885	3.088**	2.881*	0.394	0.396	7.26	4.87

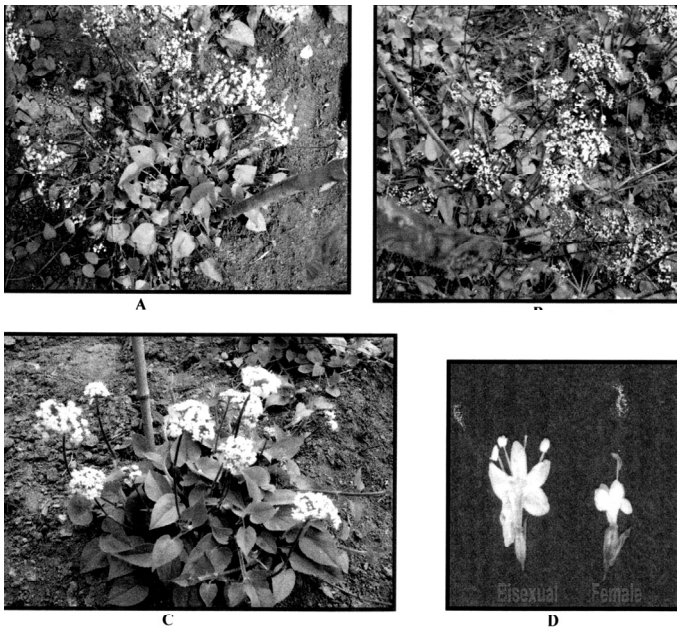

Figure 2. Phenotypes of various, forms of *Valeriana jatamansi* Jones. A = Gynoecious form, B = Gynomonoecious form C = Bisexual forms, D = Types of flower in Valeriana

(Table 2). This result is in accordance with the findings (9), carried out their experiment on irradiation response on photosynthesis and the observation on rootstock length and biomass yield (10).

On the basis of present study it is suggested that for higher biomass yield, bisexual form of *Valeriana jatamansi* Jones should be cultivated in open environment. During selection and development of high yielding genotypes for both dry rootstock biomass and dry aerial biomass yield the main emphasis must be given on bisexual form and it may be included in hybridization programmes as a recipient parent.

Table 2. Biomass yield of *Valeriana jatamansi* under partial shade (PS) and open environments (OE).

	Sex form	Fresh aerial biomass/plant (g)		Dry aerial biomass/plant (g)		Fresh rootstock biomass/plant (g)		Dry rootstock biomass/plant (g)	
		PS	OE	PS	OE	PS	OE	PS	OE
1	Gynoecious	138.49	148.17	12.61	14.50	34.96	72.04	7.92	12.19
2	Gynomonoecious	142.43	151.35	13.99	15.49	39.67	73.65	8.76	13.10
3	Bisexual	148.02	155.12	15.80	16.36	42.42	75.41	9.23	13.43
4	General mean	142.989	151.55	14.13	15.45	39.01	73.70	8.64	12.91
5	SE ±	0.830	0.772	0.199	0.189	0.635	0.443	0.237	0.238

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