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Morphological studies among female and hermaphrodite plants of *Valeriana jatamansi* Jones-an endangered medicinal plant of temperate Himalayas

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Abstract
Valeriana jatamansi Jones (syn. *V. wallichii* DC) belonging to family Valerianaceae is an important endangered medicinal and aromatic plant of temperate Himalayas. The species is gynodioecious in nature with co-existence of female and hermaphrodite plants growing separately. During the present investigation seed raised plants of the two floral morphotypes *i.e* female and hermaphrodite plants have been compared for various qualitative morphological parameters *viz.* plant height, leaf characters, number of flowering spikes, petiole length, petiole diameter, aerial and underground biomass at two years growth stage.The results revealed that no significant variation have been observed in all the parameters except plant height and number of leaves among female and hermaphrodite plants.

Keywords: Morphological studies, hermaphrodite plants, Valeriana jatamansi, medicinal plant

Introduction
Valeriana jatamansi Jones Syn. *Valeriana wallichii* DC (Bennet, 1987) [2] also known as Indian valerian in English, Mushkbala or Sugandhbala in hindi and Tagar in Sanskrit is an pubescent perennial herb, having horizontal thick rootstock with descending fibrous roots (Sharma R, 2003) [14]. The species is native of temperate Himalayas at an altitude zone of 1500-3000 m (Kirtikar and Basu, 1975) [7]. It is a well known medicinal plant used for treating epilepsy, leprosy, insomnia, hysteria and used as mild sedative for nervous tension (Houghton, 1999) [5], stress and anxiety, encourages ulcer and wound healing, high blood pressure and intestinal colic. The species is source of valepotriates, valerenic acid derivatives (valerenic acid, acetoxy valerenic, and hydroxyvalerenic acid) (Ron *et al*., 2000; Singh *et al.*, 2010) [13, 17]. Among these, valerenic acid and valepotriates are often used for drug preparation (Singh *et al*., 2006; Singh *et al*., 2010) [16, 17]. Due to over-exploitation of its roots and rhizomes, it is labelled as endangered plant species in Himalayan region. It has also been listed as endangered species by National Medicinal Plant Board for conservation (www.nmpb.nic.in). The species propagates sexually through seeds and asexually through rhizomes. The species is gynodioecious with co-existence of female and hermaphrodite plants growing separately (Raina and Srivastava, 1992) [11] The female flowers are markedly smaller than hermaphrodite flowers. Although it is also reported as dioecious, polygamous or occasionally polygamomonoecious (Prakash, 1999) [9]. There are reports of seasonal variation of plant growth, biomass and production of secondary metabolites in Valeriana spp. (Bos *et al*., 1998; Singh *et al.*, 2000) [3, 15]. Indian Valerian, *Valeriana jatamansi* remains a subject of interest due to its extensive use in traditional and modern medicine, variability in morphology, reproductive behaviour and source of active ingredients. Therefore keeping in view the economic importance, threatened status of the species and morphological variability in terms of quantitative characters within species, present study have been conducted to compare morphological variability among female and hermaphrodite plants of *V.Jatamansi.*

Material and methods
The experiment was carried out at Medicinal and Aromatic Plants Research Farm, Shilly, Distt. Solan (Altitude 1550 m amsl, latitude-N 30^0 54' 30" and longitude E 77^0 07' 30") and in the laboratory of Department of Forest Products, College of Forestry, Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during 2014 to 2016. Seed raised plants of *Valeriana jatamansi* sourced from UHFVAL (INGR 11036) and UHFVAL A type has been utilized for the present investigation. The plants were marked into female and hermaphrodite category on flowering stage.

Both the floral morphotypes were assessed for recording quantitative morphological parameters *i.e* leaf length, leaf width, ratio of leaf length and leaf width, number of leaves, number of flowering spikes, petiole length, petiole diameter, fresh and dry aerial and underground biomass and ratio of aerial and underground biomass. Leaf parameters were recorded at radical leaf stage. The plants were planted at a spacing of 30 cm × 45 cm under open sunny conditions and uprooted after two years. A minimum of 10 randomly selected plants were taken for the observations.

Results and discussion

During the present investigation female and hermaphrodite plants (Fig 1 and Fig 2) of the species was comparatively evaluated for different qualitative morphological traits *viz*. plant height, leaf length, leaf width, ratio of leaf length and leaf width, number of leaves, number of flowering spikes, petiole length, petiole diameter, plantlets or clones other than main plant, fresh aerial and underground biomass, dry aerial and underground biomass, ratio of aerial and underground biomass. The results revealed that no significant differences were observed among female and hermaphrodite plants except plant height and number of leaves (Table 1 and 2). Among female plants leaf length ranged between 9.07 cm - 13.00 cm and in hermaphrodite plants it ranged between 9.17 cm -11.77 cm. Maximum leaf length was recorded in female plants (10.4 cm) which was statistically at par with hermaphrodite plants (10.3 cm). Leaf width in female plants ranged between 8.60 to 12.73cm and in hermaphrodite plants ranged between 9.13 to 11.83. Maximum leaf width was recorded in hermaphrodite plants (10.2 cm) which was found to be statistically at par with female plants (9.9 cm). In case of ratio between leaf length and leaf width maximum ratio was recorded in female plants (1.1cm), values being statistically at par with hermaphrodite plants (1.0 cm). The plant height in female plants ranged between 48.4 cm to 80 cm and in hermaphrodite plants it ranged between 44.2 to 68.2 cm. Female plants were found to be taller (63.8cm) than hermaphrodite plants (51.7cm) (Fig.3). However (Mukherjee *et al*., 2014; Rather, 2011) [8, 12] reported female plants as shorter than hermaphrodite plants. Plant height is highly plastic character and varies according to environmental conditions. The number of leaves in female plants ranged between 22 to 118 and in hermaphrodite plants it ranged between 16 to 225. Hermaphrodite plants were found to have more number of leaves (77.4) than female plants (63.4 cm) (Fig.4). The number of flowering spikes/shoots in female plants ranged between 13 to 27 and in hermaphrodite plants it ranged between 8 to 25. Maximum number of flowering spikes were recorded in female plants (19.6) which was statistically at par with hermaphrodite plants (14.1). The range of petiole length among female plants varied between 18.33 cm to 30.83 cm and in hermaphrodite plants it varied between 17.67 to 30.50 cm. Maximum petiole length was recorded in female plants (22.2 cm) which was statistically at par with hermaphrodite plants (20.6 cm). In case of petiole diameter the range varied between 3.38 to 5.67 mm in female plants and between 3.79 to 7.04 mm in hermaphrodite plants. Maximum petiole diameter was recorded in female plants (4.9mm) which was statistically at par with hermaphrodite plants (4.8mm).

Biomass of female and hermaphrodite plants was also evaluated for aerial biomass (fresh /dry), rootstock biomass (fresh/dry) and ratio of aerial biomass to underground biomass and the data revealed that incase of aerial biomass, maximum fresh weight (60.7 g) and dry weight (13.41 g) per plant were recorded in hermaphrodite plants which were found to be statistically at par with fresh weight (54 g) and dry weight (12.04g) of female plants respectively. For rootstock biomass maximum fresh (68.3 g) and dry (19.84g) weight /plant were observed in female plants which were statistically at par with fresh (61.3 g) and dry (17.85 g) weight of hermaphrodite plants. Rootstock comprising rhizome and roots are official part of the plant which is source of essential oil and valepotriates. Hence plants with higher rootstock biomass could be used for cultivation and meeting needs of pharmaceutical industries as it is indicative of more chemical yield. Ratio between aerial and underground biomass for fresh and dry weight was found maximum in hermaphrodite plants *i.e* (0.91) for fresh weight and (0.64) for dry weight which was found to be statistically at par with female plants, (0.80) for fresh weight and (0.62) for dry weight. Similar studies have been conducted on this species by (Karnwal *et al.,* 2012; Chakraborty *et al*., 2015) [6]. For higher biomass yield, Karnwal *et al*., 2012 [6] suggested that hermaphrodite form was superior than female plants. Chakraborty *et al*., 2015 [4] selected lines on the basis of performance of female and hermaphrodite plants for further selection of varieties.

Fig 1: Inflorescence of female plant

Fig 2: Inflorescence of hermaphrodite plant

Table 1: Qualitative morphological traits of two floral morphotypes – female and hermaphrodite plants

Plant type	Leaf length (cm)	Leaf width (cm)	Ratio of LL&LW(cm)	Plant height (cm)	No. of leaves	No. of flowering spikes	Petiole length (cm)	Petiole diameter (mm)
Female	10.4 (9.07-13.00)	9.9 (8.60-12.73)	1.1 (0.99-1.11)	63.8 (48.4-80)	63.4 (22-118)	19.6 (13-27)	22.2 (18.33-30.83)	4.9 (3.38-5.67)
Hermaphrodite	10.3 (9.17-11.77)	10.2 (9.13-11.83)	1.0 (0.99-1.04)	51.7 (44.2-68.2)	77.4 (16-225)	14.1 (8-25)	20.6 (17.67-30.50)	4.8 (3.79-7.04)
t cal. 5%	0.237	0.677	3.028	3.028*	3.357*	0.615	0.956	0.956

t tab at 5%-2.101

Table 2: Per plant biomass yield of two floral morphotypes-female and hermaphrodite plants

Plant type	Aerial biomass (g/plant)		Rootstock biomass (g/plant)		Ratio of aerial and underground biomass	
	Fresh weight	Dry weight	Fresh weight	Dry weight	Fresh weight	Dry weight
Female	54 (22-111)	12.04 (4.83-17.19)	68.3 (23-103)	19.84 (5.75-35.79)	0.80	0.62
Hermaphrodite	60.7 (11-149)	13.41 (2.16-40.23)	61.3 (13-129)	17.85 (4.59-38.59)	0.91	0.64
t cal. 5%	0.336	0.275	0.275	0.463	0.425	0.911

t tab at 5%-2.101

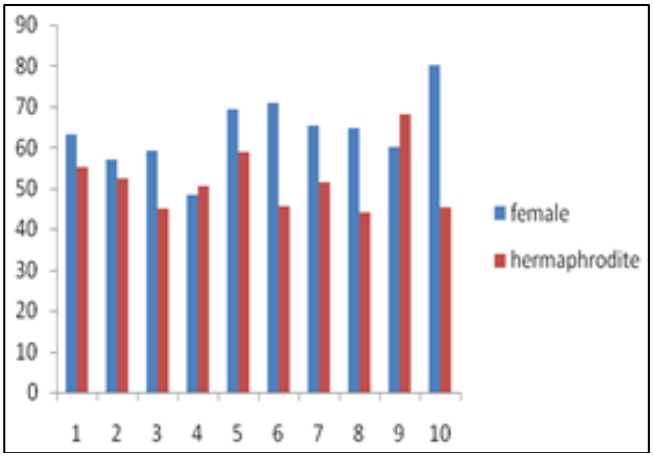

Fig 3: Variation in plant height among female and hermaphrodite plants.

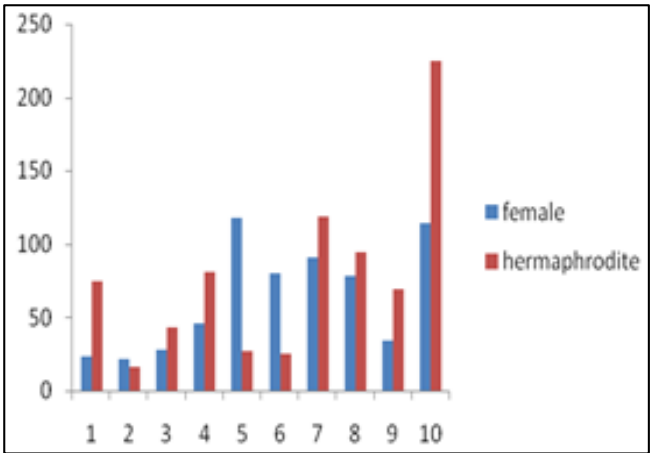

Fig 4: Variation in number of leaves among female and hermaphrodite plants

Conclusion

The results of the present study revealed that the two floral morphotypes *i.e* female and hermaphrodite plants of *Valeriana jatamansi* did not show significant variation with each other in terms of quantitative morphological traits except plant height and number of leaves. Plant height was found maximum in female plants and number of leaves was found maximum in hermaphrodite plants. The underground portion containing rhizomes and roots are official parts of the plant and though at par values were recorded between female and hermaphrodite plants for rootstock biomass but further correlation studies from phytochemical aspect would be helpful for the breeders to isolate elite strains and in varietal development. The female plants with superior traits should be encouraged for cultivation as they can be directly used in hybridization programmes without emasculation.

References

1. Becker H, Chavadeoi S. Valepotriate production of normal and colchicine-treated cell suspension cultures of *Valeriana wallichii.* Journal of Natural Products. 1989; 48:17-21.
2. Bennet SSR. Name changes in flowering plants of India and adjacent regions. Treseas Publishers, Dehra Dun, India. 1987, 583.
3. Bos R, Woerdenbag HJ, Putten FMS, Hendriks H, Scheffer JJC. Seasonal variations of the essential oil, valerenic acid and derivatives, and valepotriates in *Valeriana officinalis* roots and rhizomes, and the selection of plants suitable for phytomedicines. Planta Medica. 1998; 64(2):143-147.
4. Chakraborty S, Mukherjee D, Baskey S. Selection of lines of *Valeriana jatamansi* Jones, a high value medicinal plant in North Eastern Himalayan region. Indian Journal of Genetics and Plant Breeding. 2015; 75(3):404-407.
5. Houghton PJ. The scientific basis for the reputed activity of valerian. Journal of Pharmacy and Pharmacology. 1999; 51(5):505-512.
6. Karnwal MK Rai R, Singh VP. Effect of sex form and environment on biomass yield in *Valeriana jatamansi* Jones. Progressive Horticulture. 2012; 44(1):55-59.
7. Kritikar KR, Basu BD. Indian Medicinal Plants. M/s Bishen Singh Mahendra Pal Singh, Dehra Dun. 1975; 7:311-312.
8. Mukherjee D, Chakraborty S. Studies on ecology, habitats diversification and seed germination behaviour of Valeriana jatamansi Jones: A critical endangered plant International Journal of Agricultural Sciences. 2014; 4(5):203-209.
9. Prakash V. Indian Valerianaceae. A Monograph on medicinally important Family. Scientific Publishers, India. 1999.

10. Raina NS, Raina R, Rana RC, Sharma P. Floral studies in gynodioecious Valeriana jatamansi. Journal of Research, SKUAST-J. 2010; 9(1):87-94.
11. Raina R, Srivastava LJ. Floral polymorphism in *Valeriana Jatamansi*. Indian Journal of Plant Genetic Resources. 1992; 5(2):93-94.
12. Rather AM, Nawchoo IA, Wani AA, Ganie AH. Effect of habitat diversification and temperature on *Valeriana jatamansi*. New York Science Journal. 2011; 4:57-59.
13. Ron BH, Willis CV, Bone K, Morgan M. Herbal products: active constituents, mode of action and quality control. Nutrition Research Reviews. 2000; 13:47-77.
14. Sharma R. Medicinal plants of India-An Encyclopedia. Daya Publishing House, New Delhi. 2003.
15. Singh RD, Ahuja PS, Nagar PK, Kaul VK, Singh B, Vats SK *et al* Effect of manuring and shade on yield and quality of *Valeriana wallichii.* Journal of Medicinal and Aromatic Plant Sciences. 2000: 22(1B):669-670.
16. Singh N, Gupta AP, Singh B, Kaul VK. Quantification of valeric acid in *Valeriana jatamansi* and *Valeriana officinalis* by HPTLC. Chromatographia. 2006; 63:209-213.
17. Singh RD, Gopichand Meena RL, Sharma B, Singh B, Kaul VK, Ahuja PS. Seasonal variation of bioactive components in *Valeriana jatamansi* from Himanchal Pradesh, India. Industrial Crops and Products. 2010; 32:292-296.
18. Wagner H, Juric K, Schaette R. Comprehensive studies on sedative action of the Valeraina extracts, valepotriates and their degradation products. Planta Medica. 1980; 39(4):358-365.