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EVALUATION OF SINGLE-WHORLED BALSAM (*IMPATIENS BALSAMINA*) GERMPLASM FOR GROWTH, FLOWERING AND SEED ATTRIBUTES

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ABSTRACT

A field experiment was carried out to evaluate the single-whorled balsam germplasm for growth, flowering and seed attributes at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. There were 16 single-whorled balsam germplasm in the form of seeds as the experimental material was used and the experiment was laid out in Randomized Block Design with three replications. Results of study showed that genotype BS-2 resulted in maximum number of primary branches per plant (8.00) secondary branches per plant (16.00), leaf length (12.36 cm), maximum duration of flowering (61 days) and highest 1000 seed weight (10.60 g) among all the genotypes. Genotype BS-5 exhibited the highest number of flowers per plant (221.00), whereas genotype BS-8 showed the lowest number of flowers per plant (109) and the lowest seed yield (9.13 g). These findings provide valuable insights into the selection of superior balsam genotypes for horticultural improvement.

Keywords: Test weight, Genetic variability, Flower longevity, Flower diameter

Introduction

Balsam (*Impatience balsamina* L.) belongs to the family Balsaminaceae is one of the important rainy seasons annual grown in India. It is commonly known as *Gulmendhi* in Hindi, *Dushpatrijati* in Sanskrit, *Kasittumbai* in Tamil, and *GulMehendi* in Urdu (Lim, 2014). The generic name is derived from the Latin word *impatiens* (inpatient), an allusion to the behaviour of the pods which, when ripe, burst open on slight pressure, scattering the seeds (Randhawa and Mukhopadhyay, 2000). It is native to southern Asia in India and Burma, but has been cultivated widely (Singh, 2014). It is widely grown in gardens and has naturalized in disturbed areas as a common escape from cultivation in tropical and subtropical areas. Although a warm-climate species, it still can be grown outdoors after the last frost in temperate areas. It is adaptable to many soils including heavy clay soils but prefers a moist, well-drained, humus-rich soil. It grows in full sun to partial shade. Balsam is an erect, annual herb, 30-150 cm in height. The stem is glabrous or weakly pubescent when young, succulent and sparsely branched with swollen nodes. This annual is ideal for beds and is also grown in mixed borders and long walks. The dwarf varieties make excellent pot plants. Apart from its ornamental value, it has several other uses. The flowers are mucilaginous and cooling and are employed for lumbago, intercostal neuralgia, and snakebites (Lim, 2013). The flowers and their alcoholic extract possess marked antibiotic activities against some bacteria (Chopra and Nayar, 1986). Juice obtained from white petals is applied topically for dermatitis and urticaria (Khare, 2012). Evaluation of the genotypic performances of balsam in several environments provides useful information to identify their adaptation and stability (Pal *et al*., 2018a). The information regarding suitable genotypes under eastern Uttar Pradesh conditions is lacking. Hence, to assess

the suitability of balsam germplasm for different purposes, the present investigation was undertaken.

Materials and Methods

The experiment was conducted at Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P. during the rainy season of 2014. The experiment was laid out in a Randomized Block Design (RBD) with three replications. This investigation was conducted under open conditions. Sixteen single-whorled genotypes of balsam collected from different parts of the country were sown in a nursery. Nursery preparation work was started in July 2014. Raised nursery beds were prepared of 3×1 m size. Well, rotten farm yard manure was incorporated at 5kg/m^2. Seeds of each germplasm were sown evenly in a well-managed nursery for raising seedlings. The seedlings having uniform growth and vigour were transplanted with a spacing of 60 × 60 cm and a plot size of 2.40 m × 2.40 m each. Standard cultural practices recommended for balsam were followed uniformly for all the experimental plots. Data on randomly selected plants of each germplasm were taken on the various parameters of growth, flowering, and seed yield, and statistical analysis was done at a 5% level of significance (Panse and Sukhmate, 1985).

Table 1: Balsam genotypes and their flower color according to the flower color chart released by Royal Horticultural Society

Genotype	Flower colour
BS1	Red group 43 B
BS2	Purple group 77 B
BS3	Purple group 77 B
BS4	Red group 56 C
BS5	Purple group 77 B
BS6	Red group 56 C
BS7	Red group 56 A
BS8	Red purple group 61 B
BS9	Purple group 77 B
BS10	Red group 56 A
BS11	Violet group 84 A
BS12	Purple group 77 A
BS13	Red group 56 C
BS14	Red group 43 B
BS15	Red group 38 B
BS16	Purple group 77 B

Result and Discussion

The analysis of variance at a 5% level of significance revealed significant differences among the genotypes for all the sixteen characters studied indicating the presence of a wide range of genetic variability in the genotypes of double whorled balsam which indicates the considerable scope for their improvement through selection.

Growth parameters

The maximum number of primary branches (8.00) and secondary branches (16.01) was found in genotype BS2 which was statistically at par with genotype BS13 (15.96) for secondary branches. The maximum leaf length was observed in genotype BS2 (12.36 cm) which was statistically at par with genotype BS4 (11.86 cm), BS15 (12.00 cm), BS12 (11.94 cm) and BS16 (11.69 cm). However, maximum leaf width was observed in genotype BS2 (2.68 cm) and maximum fresh weight of leaf was observed in BS2 (46 g) which was statistically at par with genotype BS6 (0.42 g), BS15 (0.41 g) and BS13 (0.39 g). The maximum plant spread was found in genotype BS14 (61.16 cm) which was statistically at par with genotype BS15 (60 cm) and BS16 (55.16 cm). However, maximum plant height was found in genotype BS12 (84 cm). Kanamadi, V.C. and Patil, A.A. (1993) in chrysanthemum, Munikrishnappa *et. al.* (2013); Chowdhuri *et al.* (2016) in China aster, and Patil *et al.* (2022) in chrysanthemum also conducted germplasm studies for different growth parameters and found significant variation among different genotypes.

Table 2: Performance of different genotypes of *Impatiens balsamina* for growth parameters.

Genotypes	No. of primary branches/plant	No. of secondary branches/plant	Plant spread (cm)	Plant height (cm)	Length of leaves (cm)	Width of leaves (cm)	Fresh weight of leaves (g)	Dry weight of leaves (g)
BS1	7.83	9.25	45.66	72.13	10.80	1.97	0.37	0.043
BS2	8.00	16.01	39.16	83.70	12.36	2.68	0.46	0.056
BS3	5.00	10.02	31.66	75.26	9.66	2.40	0.27	0.056
BS4	3.83	6.46	31.67	64.73	11.86	2.49	0.37	0.070
BS5	7.33	12.16	47.16	74.86	10.69	2.12	0.32	0.050
BS6	6.83	8.31	46.20	65.13	11.01	2.31	0.42	0.060
BS7	5.83	11.18	35.00	69.40	10.77	2.32	0.28	0.050
BS8	6.00	11.93	30.00	52.66	11.00	1.83	0.26	0.043

BS9	5.83	9.54	49.00	83.56	11.02	2.41	0.28	0.050
BS10	6.83	14.23	39.85	83.73	9.81	2.24	0.24	0.043
BS11	5.16	11.16	45.50	83.96	10.17	2.04	0.31	0.043
BS12	5.50	13.50	38.33	84.00	11.94	2.32	0.33	0.040
BS13	7.66	15.96	26.33	71.96	10.85	2.14	0.39	0.050
BS14	7.66	14.18	61.16	78.26	10.49	2.10	0.35	0.046
BS15	7.16	13.55	60.00	73.06	12.00	2.25	0.41	0.053
BS16	6.50	13.15	55.16	83.86	11.69	2.04	0.37	0.046
Mean	6.43	11.91	42.61	75.02	11.00	2.23	0.34	0.050
S.Em$_{\pm}$	0.42	0.57	2.52	4.29	0.32	0.13	0.02	0.0037
C.D.5%	1.27	1.71	7.53	12.81	0.96	0.40	0.076	0.011

Flowering parameters

Days to bud initiation was found earliest in genotype BS9 and BS10 (21.83 days) whereas, genotype BS13 (31.16 days) has taken maximum days to bud initiation. For days to flowering the earliest flowering was observed in genotype BS2 (25.00 days) which was statistically at par with genotype BS9 (26.66 days) and BS10 (27.83 days) whereas, genotype BS7 (37.00 days) took taken maximum days for flowering. The maximum floral bud diameter was observed in genotype BS15 (0.89 cm) which was statistically at par with BS2 (0.87 cm). A similar result was observed in double-whorled balsam also by Pal *et al*. (2018b). However, the maximum flower diameter was found in genotype BS15 (4.12 cm) which was statistically at par with genotype BS8 (3.87 cm) and BS9 (3.76 cm) whereas, the minimum flower diameter was found in genotype BS16 (3.06 cm). The maximum flower longevity was found in the genotype BS4 (6.86 days) which was statistically at par with BS2 (6.80 days) followed by others and the minimum flower longevity was found in genotype BS1 and BS9 (4.00 days). However, several flowers per plant and flowering duration are the most important parameters where a maximum number of flowers per plant was observed in genotype BS5 (221.00) which was statistically at par with genotypes BS4 (217.00) and BS6 (213.33) whereas, the minimum number of flowers was observed in genotype BS8 (109.00). The longest duration of flowering was observed in genotype BS2 (61.00 days) which was statistically at par with genotype BS9 (58.00 days) whereas, the minimum was observed in genotype BS4 (40.00 days). Observation made in this experiment is similar to earlier workers in Gaillardia (Hegde and Gopinath, 2003) and in Marigold (Singh and Singh, 2005) who noticed significant variations in various flowering parameters among different flower crops under different agroclimatic conditions.

Table 3: Performance of different genotypes of *Impatiens balsamina* for flowering parameters.

Genotypes	Days to bud initiation	Days to flowering	Flower longevity (days)	Duration of flowering (days)	Bud diameter (cm)	Flower diameter (cm)	Length of peduncle (cm)	No. of petals/ flower	No. of flowers/ plant
BS1	30.00	35.00	4.00	45.00	0.71	3.70	1.43	3.00	189.66
BS2	23.66	25.00	6.80	61.00	0.87	3.36	1.74	3.00	172.00
BS3	24.50	29.33	4.93	53.33	0.69	3.40	1.70	3.00	112.66
BS4	27.50	31.16	6.86	40.00	0.74	3.48	1.63	3.00	217.00
BS5	23.83	33.66	5.60	46.00	0.70	3.31	1.50	3.00	221.00
BS6	25.16	32.33	4.60	52.33	0.74	3.48	1.49	3.00	213.33
BS7	30.66	37.00	5.46	55.66	0.59	3.70	2.04	3.00	163.33
BS8	23.16	30.00	5.73	41.33	0.79	3.87	1.38	3.00	109.00
BS9	21.83	26.66	4.00	58.00	0.72	3.76	1.56	3.00	176.00
BS10	21.83	27.83	4.86	55.00	0.67	3.57	1.53	3.00	161.33
BS11	28.66	34.66	6.66	49.33	0.70	3.60	1.61	3.00	156.33
BS12	27.66	35.66	5.60	49.00	0.73	3.54	1.63	3.00	127.33
BS13	31.16	36.33	6.73	51.33	0.79	3.65	1.50	3.00	195.00
BS14	28.16	31.33	6.66	46.00	0.78	3.58	1.50	3.00	131.66
BS15	27.00	32.00	4.73	56.00	0.89	4.12	1.60	3.00	129.00
BS16	27.16	36.33	5.86	57.00	0.68	3.06	1.47	3.00	134.00
Mean	**26.37**	**32.14**	**5.57**	**51.02**	**0.74**	**3.57**	**1.58**	**3.00**	**163.04**
S.Em$_{\pm}$	0.84	1.15	0.3778	1.07	0.02	0.1332	0.068	0.0456	6.53
C.D. 5%	2.53	3.45	1.12	3.21	0.08	0.39	0.20	0.13	19.50

Seed parameters

The maximum number of seeds per plant was found in genotype BS1 (2447.90) which was statistically at par with genotype BS5 (2285.33) and BS6 (2219.03) whereas, the minimum number of seeds per plant was found in BS3 (1087.36). Earliest days to seed ripening were observed in genotype BS9 (20.83 days) which was statistically at par with genotype BS11 (22.83 days) and in genotype BS6 (30.16 days) took more time in seed ripening among all genotypes. The highest number of seeds per pod was found in genotypes BS1 and BS16 (12.90) and the minimum number of seeds per pod was found in BS13 (9.16). The highest number of pods per plant was observed in genotype BS5 (221.00) which was statistically at par with genotype BS4 (217.00) and BS6 (213.33.) whereas, the minimum number of pod per plant was found in genotype BS8 (109.00). A similar result was also observed in china aster Kolur et al (2022) while the effect of genetic variability on seed production plays a crucial role in Balsam Singh and Singh (2007) The maximum seed yield per plant was observed in genotype BS6 (23.43 g) whereas, the minimum was found in genotype BS8 (9.13 g). However, the highest 1000 seed weight was found in genotype BS2 (10.60 g) whereas, the minimum was found in genotype BS8 (7.16 g). Variation for these parameters due to the germplasm of the plant also coincides with the result of Chrysanthemum (Baskaran *et al*., 2009).

Table 4: Performance of different genotypes of *Impatiens balsamina* for seed parameters

Genotypes	Days to seed ripening	No. of seed per pod	No. of pods per plant	No. of seed /Plant	Seed yield/ Plant (g)	1000 Seed weight (g)
BS1	28.83	12.90	189.66	2447.90	18.98	7.73
BS2	26.50	12.36	172.00	2114.23	22.46	10.60
BS3	27.66	9.66	112.66	1087.36	10.13	9.33
BS4	28.00	9.67	217.00	2096.53	21.59	10.30
BS5	27.33	10.40	221.00	2285.33	21.77	9.53
BS6	30.16	10.43	213.33	2219.03	23.43	10.56
BS7	25.83	12.83	163.33	2094.63	19.41	9.26
BS8	27.83	11.63	109.00	1271.20	9.13	7.16
BS9	20.83	12.16	176.00	2061.83	20.11	8.76
BS10	26.50	12.30	161.33	1981.30	16.46	8.53
BS11	22.83	12.60	156.33	1970.10	20.34	10.43
BS12	27.33	11.70	127.33	1491.60	13.95	9.46
BS13	27.00	9.16	195.00	1783.43	15.29	8.56
BS14	28.16	11.23	131.66	1479.86	12.27	7.63
BS15	26.66	11.43	129.00	1476.83	11.93	8.10
BS16	24.83	12.90	134.00	1727.50	14.46	8.36
Mean	26.64	11.46	163.04	1849.29	16.98	9.02
$S.Em_{\pm}$	0.67	0.27	6.53	83.03	1.15	0.259
C.D. 5%	**2.012**	**0.80**	**19.50**	**247.68**	**3.45**	**0.747**

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