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EVALUATION OF DIFFERENT TYPE SINGLE WHORLED GERMPLASM OF BALSAM (*Impatiens balsamina* L.)

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Abstract: *Balsam (Impatiens balsamina) is a widely grown flowering annual and commonly known as balsam or gulmehdi or rose balsam. It is a native of the Himalayas (India) and has colourful flowers. Very meager work so far has been done on variability studies in balsam. Therefore, present study was undertaken to evaluate 27 germplasm of balsam. A field experiment was conducted during rainy season at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The experiment was laid out in Randomized Block Design with three replications. Seedlings having uniform growth and vigour were transplanted at 60 × 60 cm spacing. Observations were recorded on growth and seed characters and were analyzed statistically. Among different genotypes of single whorled balsam, BS-7 had maximum plant spread (74.00 cm) and BS-13 had maximum stem diameter (5.93 cm) whereas BS-5 had maximum plant height (79.00 cm). The maximum no. of primary branches/plant (13.33), no. of secondary branches/plant (29.67) and no. of flowers/plant (516.67) were recorded in germplasm BS-21. The minimum time (16.00 days) and maximum time to flower bud initiation (32.00 days) was by germplasm BS-22 and BS-15 and BS-26, respectively. The maximum duration of flowering was recorded by BS-14 (68.00 days), while maximum longevity of flower in BS-27 (8.00 days). The flower size was found maximum in BS-18 (6.17 cm). Germplasm BS-23 produced highest seed yield/plant (53.94 g) whereas; BS-19 resulted in maximum 1000-seed weight (12.80 g).*

Keywords: *Balsam, germplasm, growth, flowering, seed and single whorled*

Introduction: Balsam (*Impatiens balsamina*) is a widely grown flowering annual and commonly known as balsam or gulmehdi or rose balsam. It is a native of the Himalayas (India) and has colourful flowers. Balsam belongs to family Balsaminaceae. The blooms are very colourful and pink in colour. It looks just like an orchid plant growing in the wild. The flap of a petal looks like a helmet and this plant is also called the policeman's helmet. Balsam is an ideal flowering plant for beds and is grown in borders and along walks. Varieties of different genus from one another in height, branching behaviour, shape and size of leaves, colour and size of the flower and shape of the spur. The information on performance of balsam is very meager work or not available. Hence, there is a great need to evaluate the performance of the annuals and identity the most suitable germplasm, which can be grown in large scale. Therefore, present study was undertaken to evaluate 27 germplasm of single whorled balsam.

Materials and Methods

A field experiment was conducted during rainy season at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. Single whored, 27 balsam germplasm were taken for the present study. The experiment was laid out in Randomized Block Design with three replications. Seedlings having uniform growth and vigour were transplanted at 60 × 60 cm spacing. All the recommended agronomical package of practices were followed to grow a healthy crop. In each replication, randomly three plants in each germplasm were selected for observation. The observations were recorded on

sixteen characters viz., plant height, diameter of stem, plant spread, no. of primary branches /plant, no. of secondary branches/ plant, leaf length, leaf width, days to bud initiation, days taken to flowering, duration of flowering, flower longevity, bud diameter, diameter of flower, no. of flowers /plant, 1000- seed weight and seed yield/plant and were analyzed statistically.

Results and Discussion

Results of vegetative parameters were presented in the Table 1, revealed that significant differences among germplasm for all the characters. The maximum plant height was recorded in BS-5 (83.33 cm) and minimum in BS-27 (30.00 cm). The plants were dwarf in nature in germplasm BS-27 (30.00 cm) and it was statistically at par with BS-16 (31.33 cm) and BS-21 (32.33 cm), where plants were tallest in BS-5 (83.33 cm) and it was statistically at par with BS-12 (79.00 cm). Many of the germplasm were found to be medium statured. Variation in plant height may be due to varied growth rate among the genotype. Among the germplasm, maximum (5.93 cm) diameter of stem was observed in BS-12, which was statistically at par to BS-3 (5.60 cm) and BS-4 (5.93 cm), while minimum in BS-1 (2.67 cm). Actually, stem diameter indicate mechanical strength of the stem and amount of food reserves. The maximum plant spread was recorded by BS-7 (74.00 cm) and minimum in BS-26 (37.00 cm). BS-6 was statistically at par with BS-7 (74.00 cm). Being the source of photosynthesis, plant canopy have significant role in deciding the yield of flower. The germplasm BS-21 produced maximum number of primary (13.33) and secondary branches/plant (29.67), while minimum number of primary (3.67) and secondary branches/plant (7.00) were noted in BS-5 and BS-26, respectively. The variation in number of branches/plant as influenced by different varieties has been advocated [1] and balsam [2]; in marigold [3] and chrysanthemum [4]. Significant difference is due to the genetic constitution of genotype which has close bearing on the response to selection [5]. It was observed that BS-20 had maximum (22.33 cm) leaf length and minimum in BS-10 (5.00 cm), while maximum leaf width was recorded in BS-17 (6.27 cm) and minimum in BS-20 (2.07 cm) and BS-20 is statistically at par with BS-27 (2.30 cm), BS-22 (2.20 cm), BS-19 (2.33 cm) and BS-10 (2.33 cm). Wide variation in leaf length and leaf width among the genotypes is mainly due to genetic nature of the germplasm.

Table 1: Mean performance of single whorled balsam genotypes with respect to different vegetative attributes.

Germplasm	Plant height (cm)	Diameter of stem (cm)	Plant spread (cm)	No. of primary branches /plant	No. of secondary branches /plant	Leaf length (cm)	Leaf width (cm)
BS 1	68.33	2.67	40.33	9.00	17.00	14.33	4.00
BS 2	76.00	3.63	54.33	9.00	20.00	9.67	3.87
BS 3	46.67	5.60	61.67	6.00	13.67	11.67	2.63
BS 4	72.67	5.93	39.67	9.33	18.00	13.33	4.60
BS 5	83.33	4.37	70.00	7.00	22.67	13.33	5.70
BS 6	70.00	4.03	73.0	10.67	22.33	12.33	3.07
BS 7	78.33	3.73	74.00	10.00	22.00	9.67	4.07
BS 8	68.00	3.60	61.67	10.33	24.00	7.33	2.80
BS 9	57.67	3.23	50.00	9.67	22.67	12.33	5.03
BS 10	74.67	3.80	55.67	6.33	13.33	5.00	2.33
BS 11	63.67	4.03	67.00	8.67	20.00	6.33	4.07
BS 12	79.00	5.93	39.00	5.00	12.00	5.33	5.17
BS 13	52.00	4.07	43.00	7.00	15.00	14.67	4.27
BS 14	57.33	4.00	54.33	8.00	17.67	17.00	5.00
BS 15	56.33	4.57	54.33	9.33	19.00	17.33	2.83
BS 16	31.33	3.77	61.00	8.33	21.00	8.67	4.67
BS 17	69.33	4.57	64.00	11.00	21.00	16.33	6.27
BS 18	60.00	3.60	55.00	9.00	17.00	20.67	5.60
BS 19	49.00	4.10	43.00	6.33	9.67	8.67	2.33
BS 20	66.67	4.37	51.00	8.33	12.67	22.33	2.07
BS 21	32.33	3.70	68.00	13.33	29.67	8.67	3.27
BS 22	46.67	4.60	55.67	10.33	22.67	5.33	2.20
BS 23	69.33	4.10	57.67	7.67	10.33	12.33	2.80
BS 24	69.67	4.70	51.67	8.33	9.33	16.00	5.00
BS 25	48.67	4.37	42.00	6.00	12.00	11.67	6.10
BS 26	75.67	4.97	37.00	3.67	7.00	8.67	5.57
BS 27	30.00	4.33	53.67	7.33	17.00	16.67	2.30
S. Em±	2.34	0.44	1.30	0.67	1.19	0.73	0.21
C.D. at 5%	4.53	0.85	2.52	1.29	2.30	1.41	0.40

Data regarding days taken to bud initiation determines, whether a germplasm is early or late flowering which is an important parameter to selection of suitability of variety/germplasm for production (Table 2). The minimum time to bud initiation was taken by BS-22 (16.00 days) and maximum by BS-15 and BS-26 (32.00 days) and it was observed that BS-26 statistically at par with BS-8 (29.67 days), BS-9 (31.00 days), BS-12 (31.00 days), BS-13 (31.00 days), BS-15 (31.00 days), BS-25 (30.00 days) and BS-27 (29.60 days). These results were also experimentally substantiated [6] in balsam and carnation [7], who noticed that various varieties of different flower crops shows variation in days taken to initiation of flower bud. The results of present investigation exhibited significant variation in days taken to flowering, duration of flowering and flower longevity. Early flowering were observed in BS-22 and it take the minimum time (20.00 days) for flowering, whereas late flowering was observed in BS-12 (37.00 days) and it was statistically at par with BS-8 (35.33 days), BS-9 (35.33 days), BS-13 (35.67 days), BS-14 (34.67 days), BS-15 (35.67 days), BS-24 (34.33 days), BS-25 (36.33 days) and BS-27 (34.33 days). The time taken for flowering indicates that the germplasm early or late in flowering in flower crops. The maximum duration of flowering was recorded by BS-14 (68.00 days) and it was statistically at par with BS-8 (67.33 days), BS-10 (65.00 days), BS-18 (65.67 days), BS-24 (67.00 days) and BS-25 (64.67 days), while minimum flowering duration was recorded in BS-4 (37.67 days). It was observed that the maximum longevity of flower in BS-27 (8.00 days) and it was statistically at par with BS-4 (7.00 days), BS-7 (7.00 days), BS-14 (7.00 days), BS-16 (7.00 days) and BS-19 (7.00 days), while minimum flowering duration was recorded in BS-18 (4.00 days). These variations were attributed to genetic characters of the balsam. The results obtained [8] in dahlia confirmed the ethnicity of the present investigation. Among different germplasm of balsam, flower bud diameter ranged from 0.28 to 0.57 cm and diameter of flower ranged from 2.80 to 6.17 cm (Table 2). The maximum bud diameter was recorded in BS-22 (0.57 cm) followed by BS-1 (0.50 cm), BS-3 (0.47 cm), BS-8 (0.50 cm), BS-9 (0.50 cm), BS-12 (0.47 cm), BS-16 (0.47 cm), BS-18 (0.50 cm), BS-19 (0.50 cm), BS-21 (0.50 cm) and BS-25 (0.50 cm) and they are statistically at par with BS-22. The minimum bud diameter was recorded by BS-7 (0.28 cm). The maximum diameter of flower was recorded in BS-18 (6.17 cm) followed by BS-17 (5.17 cm), BS-25 (4.80 cm), BS-14 (4.60 cm), BS-7 (4.33 cm) and BS-26 (4.23 cm), whereas minimum in BS-23 (2.70 cm). These results were corroborated with the findings [8] in dahlia and marigold [1]. The maximum number of flowers per plant was noted in germplasm BS-21 (516.67) followed by BS-8 (486.67), BS-17 (450.00), BS-4 (433.33) and BS-7 (410.00) while minimum in BS-26 (120.00). BS-21 is statistically at par with BS-8. Variation due to additive effect was found controlling the traits flower diameter and number of flowers/plant. This can be improved in the desired direction via selection [9]. The present study is also lent credence with the findings [6] in marigold and in dahlia [8].

Table 2: Mean performance of single whorled balsam genotypes with respect to different flowering and seed attributes.

Germplasm	Days to bud initiation	Days to flowering	Duration of flowering (days)	Flower longevity (days)	Bud diameter (cm)	Diameter of flower (cm)	Length of peduncle (cm)	No. of flowers /plant	No. of seeds /pod	1000-seeds weight (g)	Seed yield/plant (g)
BS 1	25.67	29.33	57.67	6.00	0.50	2.80	2.18	353.33	8.33	9.00	26.37
BS 2	23.67	27.33	55.00	5.33	0.38	3.33	1.53	390.00	11.00	8.50	36.66
BS 3	22.33	26.67	47.67	4.67	0.47	4.10	1.53	323.33	14.00	6.50	39.77
BS 4	24.00	32.00	37.67	7.00	0.40	3.27	2.03	433.33	8.00	9.00	30.8.3
BS 5	26.33	31.60	52.00	4.67	0.40	2.83	1.22	336.67	15.67	9.09	48.38
BS 6	26.33	28.33	62.00	5.00	0.40	3.80	1.40	380.00	11.67	11.18	39.43
BS 7	28.00	33.00	55.00	7.00	0.28	4.33	1.97	410.00	14.67	8.00	48.08
BS 8	29.67	35.33	67.33	5.00	0.50	2.90	1.77	486.67	8.00	7.40	29.35
BS 9	31.00	35.33	52.67	6.67	0.50	3.27	1.37	330.00	10.67	8.20	32.55
BS 10	22.00	29.00	65.00	6.00	0.40	2.80	1.50	283.33	7.67	8.30	17.89
BS 11	28.00	32.67	58.00	5.00	0.40	3.17	2.27	316.67	8.00	7.20	13.61
BS 12	31.00	37.00	46.67	4.67	0.47	4.77	1.60	193.33	12.00	9.80	18.90
BS 13	31.00	35.67	64.67	4.67	0.40	2.83	2.17	286.67	12.67	10.50	38.48
BS 14	27.00	34.67	68.00	7.00	0.43	4.60	1.10	333.33	9.00	9.50	28.34
BS 15	32.00	35.67	42.33	4.67	0.40	2.80	1.50	320.00	12.67	9.50	37.65
BS 16	27.67	30.33	38.60	7.00	0.47	2.80	1.97	253.33	13.00	11.50	37.99
BS 17	24.67	28.33	63.33	6.67	0.32	5.17	1.63	450.00	13.33	8.90	53.25
BS 18	19.33	24.33	65.67	4.00	0.50	6.17	1.20	303.33	15.67	9.90	47.02
BS 19	26.33	31.00	55.67	7.00	0.50	2.93	2.00	193.33	16.33	12.80	37.88

BS 20	22.00	26.33	54.33	5.33	0.35	3.27	1.07	256.67	15.00	11.00	42.06
BS 21	27.33	31.33	42.67	5.67	0.50	2.77	1.58	516.67	9.67	6.70	33.70
BS 22	16.00	20.00	43.67	4.33	0.57	4.20	1.53	333.33	13.00	7.90	38.22
BS 23	25.33	27.67	47.67	6.67	0.35	2.70	1.93	280.10	17.00	11.20	53.94
BS 24	24.33	34.33	67.00	6.00	0.37	3.20	1.50	300.10	16.33	8.60	42.60
BS 25	30.00	36.33	64.67	4.33	0.50	4.80	1.80	180.00	10.00	9.30	16.85
BS 26	32.00	33.67	55.00	6.67	0.43	4.23	1.30	120.00	14.00	8.20	13.72
BS 27	29.60	34.33	53.67	8.00	0.35	3.00	1.90	316.67	12.00	8.50	31.07
S.Em±	1.44	1.50	1.80	0.67	0.052	0.34	0.10	23.87	0.96	0.32	1.98
C.D. at 5%	2.79	2.91	3.66	1.29	0.10	0.65	0.19	46.30	1.86	0.62	3.84

Data regarding for seed characters were presented in Table 2. Maximum 1000-seed weight was recorded in BS-19 (12.80 g) followed by BS-16 (11.50 g), BS-23 (11.20 g), BS-20 (11.00 g) and BS-13 (10.50 g) and minimum in BS-3 (6.50 g). The highest seed yield per plant was recorded in BS-23 (53.94 g) followed by BS-17 (53.25 g), BS-5 (48.38 g), BS-7 (48.08 g), BS-18 (47.02 g), BS-24 (42.60 g) and BS-20 (43.06 g) and BS-23 statistically at par with BS-17, while minimum seed yield was recorded in BS-11 (13.61 g) which was statistically at par with BS-25 and BS-26. This was due to genetic differences among the various germplasm. The results obtained [10] in heliconias and in marigold [11] is in close conformity with the present findings.

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