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Evaluation of Balsam Genotype for Pot Culture and Bedding Purpose

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ABSTRACT

A field experiment was carried out with 23 genotypes of balsam (*Impatiens balsamina* L.) to evaluate the single and double whorled balsam germplasm for pot culture and bedding purpose with an objective to identify suitable genotypes for gardening. The experiment was conducted during the rainy season 2023 at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. These genotypes show significant variation at 5% level of significance for different characters under study. Result of study showed that the maximum number of plant spread/plant (83.44 cm) and maximum number of secondary branches/plant (34.22) was exhibited by genotype G-11. Maximum leaf width (2.73 cm), stem diameter (2.30 cm). Flower longevity (7.67 days), early seed ripening (18.78 days), maximum number of seeds per plant (3500.89) and seed yield per plant (37.77 g) was recorded in genotype G-7. Maximum plant height was recorded in genotype G-17 (89.48 cm).

Keywords Balsam, Single whorled, Double whorled, Pot culture, Bedding purpose.

INTRODUCTION

The term "Impatiens" originates from the Latin word for impatient, denoting the rapid dispersal of seeds from its fruit pod. Within the diverse genus of *Impatiens*, one notable species is an annual herb belonging to the Balsaminaceae family. This species is prevalent in various Asian countries, including China, India, Korea and Indonesia (Qian *et al.* 2023). *Impatiens balsamina* is recognized by several common names such as balsam, garden balsam and rose balsam. However, it has earned the additional nickname "touch me not" in Western countries due to a distinctive trait. The unique mechanism of seed dispersal has captured the curiosity of observers and adds to the allure of this plant species.

Balsam (*Impatiens balsamina* L.) is an upright annual herb, commonly cultivated as a flowering plant, native of the Himalayas (India). It is a short-lived, moderately hardy plant that blooms freely and has a compact growth habit (Singh and Singh 2007). The flowers are vividly pink and colorful, much like wild orchids. They closely resemble orchids growing

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naturally in the wild (Maurya *et al.* 2015). The plant is extensively grown as an ornamental herb. This annual is perfect for garden beds and is also used in mixed borders and along walkways, while the dwarf varieties are excellent for pot cultivation (Pal *et al*. 2018).

Bedding plants offer a wide variety of flower colors and shapes, making them versatile for different landscape settings. They brighten up areas, whether planted in the ground or in containers, enhancing spaces like porches, decks or patios (Black 1994). Similarly, pot gardening is also gaining popularity due to its flexibility in moving plants and controlling temperature and humidity, making it suitable for different plant needs and enhancing aesthetics both indoors and outdoors (Trivedi 2004).

MATERIALS AND METHODS

The current study was carried out at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, during the rainy season of 2023. Twenty-three (single whorled and double whorled) genotypes of balsam were evaluated in a Randomize Block Design with three replications. A healthy, disease-free seedlings exhibiting uniform and vigorous growth were transplanted in 10 inch earthen pots after reaching a height of approximately 8–10 cm. Throughout the entire experimental period, manual watering using a watering can was administered to the pots based on their specific requirements. Additionally, various intercultural operations such as hoeing, weeding, removal of dried, dead and diseased leaves and shoots, as well as the application of pesticides and fungicides to address insects pests and diseases, were diligently carried out as needed. Data on randomly selected plants of each germplasm were taken on the various parameters of growth, flowering and seed yield and statistical analysis were done at 5% level of significance (Panse and Sukhatme 1954).

RESULTS AND DISCUSSION

Significant variation was observed in growth parameters such as the number of branches, leaf length and width, plant spread and plant height. These variations help decide how suitable the plants are for different uses. For pot culture, shorter plants with compact growth are better because they are easier to manage and aesthetic appeal in pots. Conversely, taller plants with a broader spread are favored for bedding purposes to achieve a striking appearance and cover more area. These findings match earlier research on ornamental plants and show the wide range of uses for different plant types in gardening.

Growth parameters

A significant variation was observed in various growth parameters, including the number of primary and secondary branches per plant, leaf length, leaf width, plant spread and plant height as detailed in Table 1. All growth parameters are crucial as they determine the various metabolic activities of a plant, influencing its suitability for different purposes. For instance, plant height is a critical factor when selecting plants for pot culture and bedding purposes. In pot culture, shorter plants are often preferred for their compact growth, which makes them more manageable and aesthetically pleasing in containers. Conversely, for bedding purposes, taller plants may be desirable as they can create a more dramatic visual impact and provide better ground coverage. Germplasm G-17 showed the maximum plant height (89.48 cm) which was statistically comparable to G-1 (87.17), G-7 (86.89), G-5 (85.21), G-12 (83.73), G-10 (83.00) and G-3(81.67), however minimum plant height (64.43 cm) was found in G-15 followed by G-14 (65.93 cm), G-23 (67.06 cm), G-21 (67.59 cm) and G-6 (69.33 cm). Plants with a wide spread can cover more ground area, providing a fuller, more cohesive appearance in garden beds. The maximum plant spread was noted in germplasm G-11 (83.44 cm), whereas germplasm G-22 (54.11 cm) shows the minimum plant spread which is suitable for indoor planting. The maximum leaf length was observed in germplasm G-17 (15.19 cm), whereas germplasm G-7 showed the maximum leaf width (2.73 cm). The maximum number of secondary branches per plant was observed in germplasm G-11 (34.22), whereas the maximum number of primary branches per plant was found in G-4 (19.67). Genotype G-16 exhibited the maximum number of leaves per plant (601.78), where germplasm G-17 showed the maximum stem diameter (2.37 cm). Singh and Jauhari (2006) in snapdragon,

Table 1. Performance of different genotypes of *Impatiens balsamina* for growth parameters.

Genotypes	Plant height (cm)	Plant spread (cm)	Leaf length (cm)	Leaf width (cm)	No. of primary branches	No. of secondary branches	No. of leaves	Stem diameter
G1	87.16	75.33	11.85	2.02	12.67	6.33	408.45	2.07
G2	75.61	76.56	11.54	2.144	12.11	13.78	420.55	1.88
G3	81.67	75.78	10.39	2.16	15.33	13.22	498.56	2.01
G4	73.92	69.11	10.63	2.376	19.67	24.78	496.78	2.18
G5	85.21	73.89	11.96	2.18	15.66	15.34	335.22	2.18
G6	69.33	77.33	11.92	2.12	15.22	14.22	466.11	2.11
G7	86.89	77.11	13.47	2.736	14.45	12.22	440.22	2.30
G8	76.53	81.22	10.98	2.5	15.00	26.44	433.22	2.23
G9	79.33	82.67	9.24	2.38	13.78	17.33	316.22	2.17
G10	82.79	75.22	10.05	1.964	19.44	15.22	333.44	1.95
G11	70.13	83.44	10.45	2.204	14.78	34.22	275.34	1.98
G12	83.73	63.89	10.28	2.34	11.89	21.56	358.22	2.21
G13	75.10	69.67	7.81	2.068	15.67	24.55	346.67	2.00
G14	65.93	63.78	9.51	2.036	14.89	26.33	460.45	1.96
G15	64.43	63.16	11.84	2.192	6.22	17.00	503.89	2.14
G16	72.37	72.56	11.01	2.28	14.11	22.44	601.78	1.91
G17	89.48	67.11	15.19	2.356	9.11	16.11	211.33	2.37
G18	75.94	76.89	12.58	2.212	9.67	12.89	253.00	2.23
G19	71.01	66.44	11.94	1.712	9.44	19.67	283.22	1.98
G20	77.07	72.78	13.01	2.34	9.22	16.78	281.00	1.99
G21	67.59	80.56	12.84	2.348	11.33	21.00	483.22	2.16
G22	75.89	54.11	11.22	2.22	9.44	25.11	321.11	2.08
G23	67.06	71.95	12.35	2.64	11.89	24.67	291.11	2.00
SEm±	**2.88**	**3.01**	**0.57**	**0.15**	**1.12**	**5.92**	**30.91**	**0.09**
CD at 5%	**8.22**	**8.61**	**1.59**	**0.43**	**3.19**	**2.07**	**88.40**	**0.27**

Kumari and Singh (2022) in marigold, Santhosh *et al*. (2020) in China aster who also observed notable differences among various genotypes.

Flowering parameters

Annuals and ornamental herbs are essential in gardening due to their vibrant colors, diverse forms and various textures, which enhance the aesthetic and functional value of garden spaces. These plants provide versatility in garden design, suitable for borders, beds, containers, and hanging baskets. Understanding the flowering parameters of these plants is essential for effective garden planning given in Table 2. The time takes for a plant to start budding is an essential element in deciding if a genotype will flower early or late. This aspect is particularly important for evaluating the potential of a variety or genotype for

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

Genotypes	Days taken to bud initiation	Days to flowering	Flower diameter (cm)	Flower longevity	Total flowers/plant	Flowering duration
G1	46.11	60	2.96	6.34	182.78	54.33
G2	46.45	57.33	2.43	5.56	219.78	54.89
G3	46.56	60.00	2.70	5.89	310.00	60.33
G4	46.67	61.55	3.05	6.67	310.55	68.44
G5	47.44	60.78	3.35	7.44	320.44	71.11
G6	53.78	63.33	2.50	6.89	262.11	65.00
G7	50.56	64.56	2.70	7.66	332.22	44.11
G8	52.22	64.67	3.17	7.67	344.00	65.22
G9	44.22	54.44	2.66	6.44	261.67	48.56
G10	49.00	64.11	2.38	6.00	282.78	60.89
G11	47.11	63.00	3.01	6.33	323.55	56.56

Table 2. Continued.

Genotypes	Days taken to bud initiation	Days to flowering	Flower diameter (cm)	Flower longevity	Total flowers/plant	Flowering duration
G12	48.00	65.78	3.68	7.33	345.00	57.00
G13	42.33	57.22	2.80	6.44	193.44	66.55
G14	50.67	64.99	2.99	7.55	301.78	62.11
G15	48.00	65.11	3.27	7.44	257.89	58.44
G16	48.78	64.22	3.52	7.67	293.33	66.22
G17	53.33	58.89	2.73	6.44	163.55	57.00
G18	54.00	64.67	2.82	6.44	123.67	51.93
G19	53.67	70.22	1.92	7.00	289.67	57.00
G20	58.33	59.33	2.79	5.67	214.78	69.56
G21	54.00	67.56	3.43	7.11	143.22	49.78
G22	47.22	67.22	3.69	6.55	150.44	63.33
G23	47.56	63.89	3.41	7.33	228.11	63.00
SEm±	**0.69**	**1.05**	**0.13**	**0.37**	**25.94**	**2.43**
CD at 5%	**1.97**	**2.99**	**0.37**	**1.07**	**74.17**	**6.94**

high aesthetic appeal, particularly during times when there are few flowers in bloom. Early flower bud was observed in genotype G-13 (42.33 days), whereas germplasm G-20 (58.33 days) took maximum days for bud initiation. Among the various types of germplasm studied, G-9 showed the earliest flowering (54.44 days), whereas genotype G-19 took the longest time to flower (70.22 days). A combination of syncronize and early flowering will always be desirable to enhance the beauty of any landscape. The maximum flower longevity was noted in germplasm G-7, G-8 and G-16 (7.67 days), while the minimum flower longevity was

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

Genotypes	Days taken to seed ripening	Seeds per pod	Pods per plant	No. of seeds/plant	1000 seeds weight (g)	Seed yield per plant (g)
G1	21.78	10.44	182.78	1860.11	6.83	12.7
G2	22.22	9.22	219.78	2110.00	8.08	17.05
G3	34.44	9.89	310.00	3049.22	8.38	25.55
G4	39.56	11.11	310.55	3483.22	10.38	36.16
G5	48.22	10.33	320.44	3317.56	8.18	27.14
G6	29.56	5.78	262.11	1519.66	9.81	14.91
G7	18.78	10.45	332.22	3500.89	10.79	37.77
G8	43.78	9.56	344.00	3302.00	9.1	30.04
G9	27.89	5.11	261.67	1361.00	6.93	9.43
G10	24.22	9.89	282.78	2799.11	10.38	29.05
G11	40.89	10.22	323.55	3328.56	10.28	34.22
G12	38.45	6.11	345.00	2110.89	12.45	26.28
G13	37.00	8.22	193.44	1559.78	7.88	12.29
G14	44.11	8.89	301.78	2677.89	10.27	27.5
G15	25.89	8.33	257.89	2161.45	7.22	15.61
G16	47.67	8.67	293.33	2556.55	10.74	27.46
G17	28.78	9.78	163.55	1617.67	9.33	15.09
G18	28.22	8.11	123.67	1001.99	9.37	9.06
G19	27.44	7.89	289.67	2267.45	8.52	19.32
G20	27.00	9.22	214.78	2024.55	9.28	18.79
G21	39.67	8.11	143.22	1160.00	9.93	11.52
G22	46.55	7.22	150.44	1148.00	11.83	13.58
G23	26.33	8.00	228.11	1824.33	9.59	17.49
SEm±	**2.47**	**0.61**	**25.94**	**308.21**	**0.11**	**1.14**
CD at 5%	**7.07**	**1.76**	**74.17**	**881.39**	**0.32**	**3.26**

observed in germplasm G-2 (5.56 days). The size of the flowers affects the overall design and proportion of garden spaces, ensuring a balanced and visually pleasing arrangement. Larger flowers can serve as focal points, while smaller flowers can add texture and fill gaps, enhancing the overall composition. Germplasm G-22 exhibited the maximum flower diameter (3.69 cm), whereas, the minimum flower diameter was observed in genotype G-19 (1.92 cm). Flowers with longer blooming periods ensure sustained visual appeal. Present study reveals significant variations in the duration of flowering among different germplasms. Genotype G-5 exhibited the maximum flowering duration (71.11 days), while genotype G-7 showed the minimum flowering duration (44.11 days). Observation made in this experiment is similar to earlier workers Singh *et al.* (2011) in snapdragon, Choudhary *et al.* (2014) in marigold, Byadwal *et al.* (2018) and Bhaskarwar *et al.* (2016) in gaillardia, Nighut *et al.* (2023) and Dharmendra *et al.* (2019) in China aster.

Seed parameters

Significant differences were observed regarding seed characters among various genotypes given in Table 3. Across various germplasm, G-5 showed the maximum duration for seed ripening (48.22 days), whereas genotype G-7 exhibited early seed ripening (18.78 days). Genotype G-4 exhibited the maximum number of seeds per pod (11.11) and the minimum number of seeds per pod was observed in G-9 (5.11). Among the various germplasms, genotype G-7 exhibited the maximum number of seeds per plant (3500.89). Conversely, genotype G-18 resulted in the minimum number of seeds per plant (1002.00). A significant diversity in the 1000 seed weight among different germplasms. Germplasm G-12 exhibited the maximum 1000 seeds weight (12.45 g), whereas G-1 reported the minimum 1000 seeds weight (6.83 g) followed by G-9 (6.93 g). Germplasm G-7 exhibited the maximum seed yield per plant (37.77 g), which significantly differed from G-4 (36.16 g), G-11 (34.22 g), G-8 (30.04 g) and G-10 (29.05 g). Conversely, the minimum seed yield was recorded in genotype G-18 (9.39 g). Variation for these parameters due to germplasm of plant was also coincide with the result of Singh *et al.* (2014) in snapdragon, Singh *et al.* (2008) and Pramila *et al.* (2011) in marigold, Chakraborty *et al.* (2019) in China aster.

CONCLUSION

Genotypes G-5, G-12, G-13, G-8, G-15 and G-22 are excellent for their long flowering periods and resistance to pests and diseases. For bedding, G-1, G-2, G-4, G-14, G-20 and G-23 are ideal due to their continuous blooms and uniform growth, with G-1 and G-2 providing height for depth and visual appeal. For pot culture, G-5, G-8, G-11, G-22 and G-23 are ideal due to their compact, bushy growth, with G-5, G-8 and G-11 offering particularly vibrant and double whorled flowers.

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