Indian Journal of Agriculture and Allied Sciences
A Refereed Research Journal

ISSN 2395-1109
Volume: 1, No.: 3, Year: 2015

Received: 16.09.2015, Accepted: 21.09.2015

STUDIES ON GENETIC PARAMETERS AND CORRELATION IN SINGLE WHORLED BALSAM (*Impatiens balsamina* L.)

Anil K. Singh, Jitendra K. Maurya, A.K. Pal, Bijendra K. Singh and S.V. Singh[1]
Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221 005, U.P. and [1]Department of Horticulture, SMMTD Post Graduate College, Ballia, U.P., Corresponding Author : Anil K. Singh

Abstract: *A field experiment for 32 single whorled balsam germplasm were conducted during rainy season at the Horticulture Research Farm, Department of Horticulture, I.Ag.Sc., B.H.U., Varanasi. The mean sum of squares were highly significant for all the traits except diameter of stem and bud diameter which, indicating the presence of wide range of variability in the germplasm. Maximum range of variability was recorded for number of flowers/plant followed by seed yield/plant, plant height, plant spread, number of secondary branches/plant, leaf length, duration of flowering, days taken to flowering and days to bud initiation. PCV varied from 14.17% (days taken to flowering) to 38.42% (leaf length) while GCV from 8.04% (flower longevity) to 37.69% (length of leaf). High values of PCV and GCV were recorded for leaf length, leaf width, seed yield/plant, number of secondary branches/plant, number of flowers/plant, diameter of flower, number of primary branches/plant, plant height, diameter of stem, bud diameter and flower longevity. High heritability was observed for all the characters except diameter of stem, flowering longevity and bud diameter. High genetic advance coupled with high heritability was observed for plant height, plant spread, number of secondary branches/plant, duration of flowering, number of flowers/plant and seed yield/plant which indicates that additive gene effects were more important for these traits. Seed yield/plant was found to be significantly and positively associated with plant spread, number of primary branches/plant, number of secondary branches/plant, leaf length, leaf width, number flowers/plant and 1000-seed weight, while negative and significant correlation were found with diameter of stem, days to bud initiation, days taken to flowering and bud diameter at phenotypic and genotypic level, respectively. Therefore, these characters should be taken into consideration while making selection for improvement of seed yield/plant.*
Keywords: *Balsam, single whorled, genetic variability, heritability and genetic advance.*

Introduction: Balsam (*Impatiens balsamina* L.) 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. The generic name of balsam is derived from Latin word impatiens (Impatient), an allusion to the behaviour of the pods which, when ripe, burst open on a slight pressure, scattering the seeds [1]. It is a rainy season annual flowering plant and grown in summer and rainy season. It can with stand heavy rains and high humidity in atmosphere than other annuals. The flowers are single in pure or variegated colours. Dominating colours are red, pink, violet, rose and white. Success of breeding programme of any crop depends on availability of genetic diversity. Generally varieties can be found in both domesticated and naturalized habitats in the form of local landraces, modern varieties as well as wide strains [2]. The information on performance of balsam is very meager or not available. Therefore, an attempt was made in present investigation to estimate the extent of variability, heritability, genetic advance and correlation analysis by utilizing 27 divergent 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 whorled, 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, number of primary branches/plant, number 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, number of flowers /plant, 1000- seed weight and seed yield/plant. The mean values obtained were used for determining phenotypic coefficient of variation [3], heritability [4] and expected genetic advance [5]. The correlation coefficients were calculated as per methods given [6].

Results and Discussion

The mean, range, genotypic and phenotypic coefficient of variations (GCV and PCV), heritability and genetic advance as percent of mean for all the traits are presented in Table 1. In the material studied, maximum range of variability (120.00-516.67) was recorded for number of flowers/plant followed by seed yield/plant (13.61-53.94 g), plant height (38.00-83.33 cm), plant spread (37.00-74.00 cm), number of secondary branches/plant (7.00-29.67), leaf length (5.33-22.33), duration of flowering (37.67-68.00), days taken to flowering (20.00-37.00) and days to bud initiation (16.00-32.00). The range of mean values could present rough estimates about the variation of magnitude of divergence present among different genotypes. But GCV and PCV are of greater use in determining the extent of variability present within the materials. In the present investigation, genotypes were found to possess a high to moderate phenotypic variation for various characters as revealed by PCV. PCV varied from 14.17% (days taken to flowering) to 38.42% (leaf length). PCV expressed in terms of percentage was comparatively high for leaf length, leaf width, seed yield/plant, number of secondary branches/plant, number of flowers/plant, diameter of flower, number of primary branches/plant, plant height, diameter of stem, bud diameter and flower longevity; moderate for plant spread, days to bud initiation, days taken to flowering, duration of flowering, flowering longevity and 1000-seed weight. As the estimates of phenotypic variability cannot differentiate between the effects of genetic and environmental effects, so the study of genetic variability is effective in partitioning out the real genetic differences. Higher GCV more chances of improvement in that character. In the present study, GCV was comparatively high for leaf length, leaf width, seed yield/plant, number of secondary branches/plant, number of flowers/plant, diameter of flower, number of primary branches/plant and plant height; moderate for diameter of stem, plant spread, days to bud initiation, days taken to flowering, duration of flowering, flowering longevity, bud diameter and 1000-seed weight. In all the cases GCV was less than the corresponding PVC, indicating the role of environment in the expression of the traits under observation. The difference between GCV and PCV were more in case of flower longevity, diameter of stem and bud diameter. The large differences between GCV and PCV indicated that environmental effects to a large extent influenced the traits. The characters having high GVC possessed better potential for further gain and improvement through selection [3].

The relative amount of heritable portion of total variation was found out with the help of heritability estimates and genetic advance. In the present study, high heritability estimates were obtained for all the characters except diameter of stem, flowering longevity and bud diameter. The high estimates of heritability for these characters suggested that selection based on phenotypic performance would be more effective. High heritability (>60%) combined with high genetic advance (30%) was observed for the characters plant height, diameter of stem, plant spread, number of primary branches/plant, number of secondary branches/plant, length of leaf, width of leaf, duration of flowering, diameter of flower, number of flowers/plant and seed yield/plant which indicates that these characters can be improved by simple selection.

Estimation of correlation coefficients among seed yield/plant contributing characters in balsam population at genotypic and phenotypic level for sixteen different traits among the 27 single whorled germplasm of balsam are presented in Table 2. The results revealed that the estimates of genotypic correlation coefficient were higher than their corresponding phenotypic correlation for most of the traits. Similar results were obtained in Antirrhinum [7] it indicated that though there is strong inherent association between various characters the phenotypes expression is reduced under the influence of environment. In many cases the phenotypic and genotypic correlations were very close which indicating less environmental influence. Also emphasized the role of environment in diluting the expression of true genetic potential of associated characters [5]. Similar results were reported in Dahlia [8]. In many cases the phenotypic and genotypic correlations were very close indicating less environmental influence. In present investigation, seed yield/plant was found to be significantly and positively associated with plant spread (0.441 and 0.455), number of primary branches/plant (0.358 and 0.419), number of secondary branches/plant (0.209 and 0.450), leaf length (0.438 and 0.450), leaf width (0.094 and 0.091), number flowers/plant (0.349 and 0.348) and 1000-seed weight (0.343 and 0.361), while negative and significant correlation were found with diameter of stem (-0.090 and -0.093), days to bud initiation (-0.347 and -0.395), days taken to flowering (-0.404 and -0.441) and bud diameter (-0.264 and -0.436) at phenotypic and genotypic level, respectively. Therefore, these characters should be taken into consideration while making selection for improvement of seed yield. The other characters which had significant positive correlations were observed for 1000-seed weight with leaf length. Number of flowers/plant was significantly associated with plant spread, number of primary branches/plant and number of secondary branches/plant at both the levels. Similar results were obtained in chrysanthemum [9], in marigold [10,11] and in *gaillardia pulchella* [12]. Diameter of flower significantly and positively associated with plant height, diameter of stem, leaf length, leaf width, duration of flowering and bud diameter at both the levels. So, from the present investigation, it becomes clear that for improving the flowering diameter it is possible to select germplasm through other traits such as plant height, diameter of stem, leaf length, leaf width, duration of flowering and bud diameter as these traits are significantly and positively correlated with diameter of flower. Obtained similar results in marigold and *gaillardia pulchella* respectively [10,11]. Bud diameter was significantly and positively associated with number of primary branches/plant; flower longevity with days to bud initiation and days taken to flowering; duration of flowering with plant height, leaf length, leaf width and days taken to flowering; days taken to flowering with diameter of stem, leaf width and days to bud initiation; days to bud initiation with leaf width; leaf width with plant height, number of secondary branches/plant and leaf length; leaf length with number of primary branches/plant; number of secondary branches/plant with plant spread and number of primary branches/plant at phenotypic and genotypic levels, respectively. Number of primary branches/plant was significantly and positively associated with plant spread at both levels. Similar observations were made in zinnia [13] and in chrysanthemum [9]. A significantly negative genotypic and phenotypic correlation was also recorded for 1000-seed weight with plant spread; number of primary branches/plant, number of secondary branches/plant, days taken to flowering and diameter of flower; number of flowers/plant with diameter of stem, days to bud initiation, days taken to flowering, bud diameter and diameter of flower; diameter of flower with number of primary branches/plant, number of secondary branches/plant, days to bud initiation, days taken to flowering and flower longevity; bud diameter with plant height, diameter of stem, plant spread, leaf length, days to bud initiation, days taken to flowering and flower longevity; flower longevity with plant height, plant spread, number of secondary branches/plant, leaf and duration of flowering; duration of flowering with diameter of plant and number of primary branches/plant; days taken to flowering with plant spread, number of primary branches/plant and secondary branches/plant; days to bud initiation with plant spread, number of primary branches/plant and leaf length; leaf length with plant spread and number of secondary branches/ plant; number of secondary branches/plant with plant height and diameter of stem; number of primary branches/plant with plant height and plant spread and plant spread with diameter of stem at both levels. Results indicated that the number of primary branches/ plant, number of secondary branches/plant, number of flowers/ plant and seed yield/plant has high heritability combined with high genetic advance and are highly correlated to seed yield/plant. So, seed yield/plant in balsam can be improved by simple selection of these traits.

Table 1: Estimation of variance and other genetic parameters in *Impatiens balsamina* (single whorled)

Traits	Range	Mean	Standard Error ± SE	MSS Values	Phenotypic variance	Genotypic variance	P.C.V.	G.C.V.	Heritability (h^2 %)	Genetic advance	Genetic gain (%)
Plant height (cm)	30.00–83.30	61.19	2.34	670.95**	229.10	220.91	24.74	24.29	96.40	30.06	49.12
Diameter of stem (cm)	2.67–5.93	4.23	0.44	1.69	0.76	0.46	20.64	16.08	60.70	1.06	55.05
Plant spread (cm)	37.00–74.00	54.72	1.30	343.53**	116.20	113.62	19.70	19.48	97.80	21.72	39.69
No. of primary branches/plant	3.67–13.33	8.30	0.67	12.61**	4.65	3.88	25.99	24.00	85.30	3.79	45.66
No. of secondary branches/plant	7.00–29.67	17.35	1.19	88.33**	30.82	28.70	32.00	30.88	93.10	10.66	61.44
Length of leaf (cm)	5.33-22.33	12.03	0.73	62.54**	21.36	20.55	38.42	37.69	96.20	9.16	76.14
Width of leaf (cm)	2.20–6.27	3.87	0.21	5.81**	1.77	1.70	34.39	33.73	96.20	2.64	68.21
Days to bud initiation (days)	16.00–32.00	26.38	1.44	47.42**	17.90	14.75	16.04	14.56	82.40	7.18	27.21
Days taken to flowering	20.00–37.00	31.17	1.50	51.60**	19.50	16.09	14.17	12.87	82.50	7.50	24.06
Duration of flowering (days)	37.67–68.00	54.56	1.89	268.20**	92.27	87.55	17.67	17.15	94.20	18.72	34.31
Flowering longevity (days)	4.00–7.67	5.77	0.67	3.94**	1.77	1.08	23.07	8.04	61.10	1.68	29.11
Bud diameter (cm)	0.28–0.57	0.42	0.052	0.014	0.0072	0.0032	20.21	13.58	45.10	0.08	19.04
Diameter of flower (cm)	2.77–6.17	3.58	0.34	2.50**	0.94	0.77	27.21	24.57	81.50	1.64	45.81
No. of flowers/plant	120.00–516.67	321.48	23.87	25326.48**	9012.28	8155.76	29.53	28.09	90.50	177.01	55.06
1000-seed weight (g)	6.73–12.27	9.13	0.32	0.89	1.94	1.78	15.26	14.62	91.80	2.64	28.91
Seed yield/plant (g)	13.61–53.94	34.61	1.98	3395.29**	133.30	127.38	33.36	32.61	95.60	22.73	65.67

P.C.V. = Phenotypic coefficient of variation
G.C.V = Genotypic coefficient of variation

Table 2: Phenotypic and genotypic correlation coefficient for different traits of *Impatiens balsamina* (single whorled)

Traits		Diameter of stem (cm)	Plant spread (cm)	No. of primary branches	No. of secondary branches	Leaf length (cm)	Leaf width (cm)	Days to bud initiation	Days taken to flowering	Duration of flowering (days)	Flower longevity (days)	Bud diameter (cm)	Diameter of flower (cm)	No. of flower /plant	1000-seed weight (g)	Seed yield/ plant (g)
Plant height (cm)	P	0.093*	-0.015	-0.145**	-0.181**	-0.065	0.188**	-0.031	0.035	0.325**	-0.091*	-0.331**	0.107**	0.010	-0.061	0.023
	G	0.130**	-0.018	-0.167**	-0.199**	-0.069	0.195**	-0.037	0.032	0.347**	-0.099*	-0.457**	0.141**	0.011	-0.075	0.015
Diameter of stem (cm)	P		-0.223**	-0.282**	-0.329**	-0.059	0.004	-0.013	0.103*	-0.315**	-0.046	-0.139**	0.223**	-0.204**	-0.016	-0.090*
	G		-0.297**	-0.504**	-0.414**	-0.075	0.009	-0.010	0.083*	-0.390**	-0.071	-0.098*	0.252**	-0.281**	-0.007	-0.093*
Plant spread (cm)	P			0.530**	0.629**	-0.090*	-0.027	-0.179**	-0.247**	0.019	-0.109*	-0.245**	-0.037	0.555**	-0.247**	0.441**
	G			0.578**	0.659**	-0.101*	-0.025	-0.192**	-0.270**	0.015	-0.142**	-0.352**	-0.048	0.586**	-0.261**	0.455**
No. of primary branches	P				0.757**	0.106*	0.049	-0.191**	-0.189**	-0.063	-0.081	-0.043	-0.101*	0.783**	-0.234**	0.358**
	G				0.857**	0.113*	0.073	-0.226**	-0.267**	-0.079	-0.065	0.013	-0.080*	0.910**	-0.286**	0.419**
No. of secondary branches	P					-0.125**	0.126**	-0.056	-0.122**	-0.194**	-0.123**	0.115**	-0.105*	0.774**	-0.387**	0.209**
	G					-0.122**	0.127**	-0.024	-0.107*	-0.200**	-0.181**	0.138**	-0.107*	0.813**	-0.424**	0.450**
Length of leaf (cm)	P						0.208**	-0.100*	-0.066	0.164**	0.000	-0.231**	0.197**	0.030	0.382**	0.438**
	G						0.216**	-0.107*	-0.066	0.168**	0.026	-0.351**	0.206**	0.024	0.340**	0.450**
Width of leaf (cm)	P							0.134**	0.257**	0.265**	-0.129**	-0.038	0.420**	0.065	-0.009	0.094*
	G							0.164**	0.309**	0.278**	-0.139**	-0.019	0.478**	0.052	-0.005	0.091*
Days to bud initiation	P								0.875**	-0.012	0.192**	-0.134**	-0.219**	-0.180**	-0.070	-0.347**
	G								0.911**	-0.024	0.263**	0.098*	-0.223**	-0.185**	-0.066	-0.395**
Days to taken to flowering	P									0.110*	0.174**	-0.159**	-0.180**	-0.144**	-0.130**	-0.404**
	G									0.128**	0.241**	-0.095*	-0.189**	-0.144**	-0.145**	-0.441**
Duration of flowering	P										-0.173**	-0.023	0.277**	-0.063	-0.009	-0.020
	G										-0.202**	-0.046	0.327**	-0.037	-0.006	-0.083*
Flower longevity (days)	P											-0.213**	0-0.165**	-0.005	0.043	-0.020
	G											-0.496**	-0.242**	0.060	0.047	-0.022
Bud diameter (cm)	P												0.105*	-0.095*	-0.028	-0.264*
	G												0.093*	-0.167**	-0.053	-0.436**
Diameter of flower (cm)	P													-0.119*	-0.055	0.035
	G													-0.147**	-0.054	0.042
No. of flowers/ plant	P														-0.447**	0.349**
	G														-0.495**	0.348**
1000-seed weight (g)	P															0.343**
	G															0.361**

References

1. Randhawa, G.S. and Mukhopadhyay, A. (2004). Floriculture in India. 6th edition. Allied publisher Pvt. Ltd., pp 87-88.
2. Paisooksantivatana, Y., Kako, S. and Seko, H. (2001). Isoenzyme polymorphism in *Curcuma alismatifolia* Gagnep (Zingiberacae) populations from Thailand. *Scientia Horticulturae*, 88(4): 299-307.
3. Burton, G.W. and De Vane, E.W. (1953). Estimating heritability in tall fescus (*Festuea arondinacea*) for replicated clonal material. *Agronomy Journal*, 45: 478-81.
4. Hanson, G.H., Robinson, H.F. and Comstock, R.E. (1956). Biometrical studies of yield in segregating population of *Korean Lespedeza*. *Agronomy Journal*, 48:267-282.
5. Johnson, H.W. Robinson, H.F. and Comstock, R.E. (1955). Estimates of genetic and environmental variability in soybean. *Agronomy Journal*, 47: 314-18.
6. Al-Jibouri, H.A., Millar, P.A. and Robinson, H.F. (1958). Genotypic and environmental Variances in an upland cotton cross of inter specific origin. *Agronomy Journal*, 50: 633-636.
7. Priya, C.V. (1992). Genetic variability studies in antirrhinum (*Antirrhinum majus* L.). M.Sc. Thesis, University of Agriculture Sciences, Bangalore, India.
8. Bhattacharya, S.K. and Wahi, S.D. (1982). Correlation study in dahlia. *Horticulture Journal*, 1: 75-80.
9. Sirohi, P.S. and Behera, T.K. (1999). Correlation and path analysis studies in *chrysanthemum*. *Journal of Ornamental Horticulture*, New Series, 2(2): 80-83.
10. Naik, B. Hemla, Patil, A.A., Basavaraj, N. and Patil, V.S. (2004). Correlation studies in African marigold (*Tagete erecta* L.) genotypes. *Journal of Ornamental Horticulture*, 7(3-4):81-86.
11. Pratap, Bhanu; Tewari, G.N. and Mishra, L.N. (1999). Correlation studies in marigold, *Journal of Ornamental Horticulture*, 2(2): 84-88.
12. Hegde, P.S. and Gopinath, G. (2003). Correlation and path coefficient analysis studies in *Gaillardia pulchella*. *Journal of Ornamental Horticulture.* 6(4):385-389.
13. Jhon, A.Q., Pal, T.M. and Neelofar. (1994). Genetic variability and correlation studies in zinnia (*Zinnia elegans* Jacq.). *Journal of Ornamental Horticulture.* 2(1-2):1-4.