Indian Res. J. Genet. & Biotech. 9(3) August: 427 – 431 (2017)

Studies On Genetic Advances And Heritability In Gerbera (*Gerbera jamesonii Bolus ex. Hooker F.)*

Pushpendra Kumar[1],V.M.Prasad[2] and Anil Kumar[3]

[1&3]R.B.(PG). College , Agra
[2]Department of Horticulture, Allahabad School of Agriculture,Sam Higginbottom Institute of Agriculture, Technology and Sciences,Allahabad-211007

(Received : June, 2017 : Revised : July, 2017; Accepted : July, 2017)

Abstract

Twenty genotypes of gerbera were evaluated under naturally-ventilated polyhouse in Completely Randomized Block Design during the year 2014-15 and 2015-16 to determine genetic variability, heritability and genetic advance for 18 quantitative traits, based on which selection may be made. Analysis of Variance showed significant differences among genotypes for all the characters studied. Results revealed that magnitude of the Phenotypic Coefficient of Variation (PCV) was higher than Genotypic Coefficient of Variation (GCV) for all the traits, indicating greater genotype and environment interaction. Heritability in the broad sense ranged from 27.54 % (Length of ray florets) to 94.13% (Number of Suckers Per Plant) in 2014-15. Similarly 24.62 % (Stalk length (cm)) to 93.21 % (Flower yield per year (no)) in 2015-16. High heritability (>50%) was observed for all the traits except Plant height (cm), Flower diameter, Stalk length (cm), Length of ray florets, Number of Whorls and B:C ratio during 2014-15 and Plant Spread (cm), Flower diameter, Stalk length (cm) and Flower disc diameter (cm) in 2015-16.. High heritability, coupled with high genetic advance over per cent of mean, was observed for Number of Suckers Per Plant, Days to first flower bud initiation, Vase life in fresh water, Flower yield per year (no), Stalk diameter (cm) showed high heritability with high genetic advance as per cent of mean.

Key Words : Genetic advances,Heritability,PCV,GCV,Naturally-Ventilated Polyhouse,RBD etc

Introduction

Gerbera (*Gerbera jamesonii* Bolus ex. Hooker F.), belonging to family Asteraceae, is suitable both for export and domestic market, because of its potential to withstand in long transportation. It is a diploid species with somatic chromosome number 2n= 50. The modern gerbera arose from *G. jamesonii* hybridized with *G. viridifolia* and possibly other species. It is commonly known as Transvaal Daisy, Barberton Daisy or African Daisy are a small group of temperate and tropical Asiatic and African perennial herbs. Gerbera came into dictionary of Floriculture after it was discovered by pre -Linnaean botanist Gronovious, but it received its fortunate name in honour of German naturalist, Traugot Gerber,

Corresponding author's e-mail : karhanapk99@gmail.com
Published by Indian Society of Genetics, Biotechnology Research and Development,
5, E Biotech Bhawan, Nikhil Estate, Mugalia Road, Shastripuram, Sikandra, Agra 282007
Online management by www.isgbrd.co.in

who travelled extensively in Russia.This group at present comprises 45 species, native to tropical Asia and Africa. About seven species were recorded in India distributed in temperate Himalayas from Kashmir to Nepal at an altitude of 1300 to 3200 metres. It is considered as nature's one of the beautiful creations because of the excellent flowers with exquisite shape, size, and vibrant colours. It finds utility in garden beds, rock gardens, pot culture and also used extensively as cut flower. They produce very attractive flower heads. The attractive cut-flowers of gerbera are widely used in bouquets and flower arrangements. Its cut blooms remain fresh at least for a week and are in great demand for presentation and interior decoration.Crop improvement programmes currently focus on developing of hybrid cultivars to boost productivity and profitability. Gerbera is a vegetatively propagated crop through suckers on commercial scale and selection is an easy method for varietal improvement in it. Selection is effective only when the observed variability in the population is heritable in nature. Genetic variability among parents is a pre-requisite for selecting suitable parents in a breeding programme for various economic characters. Several flower traits in gerbera have been examined using quantitative genetic approaches (Chobe et al,2010; Anop Kumari et al,2011; Rajiv Kumar et al, 2013). Genotypic and phenotypic coefficients of variation are useful in detecting the quantum of variability present in genotypes. The main purpose of estimating heritability and genetic parameters that compose heritability estimate is to compare the expected gains from selection based on alternative selection strategies (Holland et al, 2003). Therefore, information on variability, heritability and genetic advance is very important for selection of traits desired. With this background in view, the present study was undertaken to assess and estimate the magnitude and nature of variation among twenty genotypes of gerbera with respect to various vegetative, flower and yield attributes which could be utilized in crop improvement programme.

Materials and Methods

The present study was carried out at Hi-Tech Horticulture Farm in Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad during the year 2014-15 and 2015-16 in Completely Randomized Block design, with three replications. Experimental material consisted of 20 genotypes of gerbera, viz., Carona, visa, Fredi, Barbara, Orange, Dream, 1132, 1131, 1134, 1220, Alicia, Silves, Livia, Angelo, Dorr, Setubal, Caiman, Toscanna, Alochete, Orange, Katja, Barbara, Lima. Gerbera cultivars were raised in a naturally ventilated polyhouse (NVP) which was oriented in North-South direction with a size of 28 m length, 20 m width (28 m × 20 m = 560 m^2) with central height of 6 m. Healthy tissue cultured plants of 30 days old (two leaf stage) were obtained from Aurcadia Agro,Vadodara,Gujarat.which are developed by Aurcadia Agro,Vadodara,Gujarat. They were planted at the spacing of 30 × 30 cm under naturally ventilated polyhouse conditions. Then the beds were irrigated thoroughly (with hose irrigation immediately after planting) to maintain the optimum soil moisture condition. Uniform

cultural practices were imposed on all the genotypes to ensure good growth of the crop. Data were recorded on six plants from each genotype for 18 traits, viz. , Plant height (cm), Number of Leaves Per Plant, Number of Suckers Per Plant, Plant Spread (cm), Leaf Area (cm2), Days to first flower bud initiation, Flower diameter, Stalk length (cm), Stalk diameter (cm), Length of ray florets, Number of Whorls, Flower disc diameter (cm), Vase life in fresh water, Gross return (Rs) per 560 m2, Net profit, B:C ratio, Number of ray florets and Flower yield per year (no). Phenotypic and genotypic co-efficients of variation were calculated using the procedure suggested by Singh and Choudhury (1985). Heritability in the broad sense and genetic advance expressed in per cent of mean were calculated as per Burton 1952).

Results and discussion

Extent of variability was measured in terms of mean, range, genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) along with per cent heritability (h^2) and genetic advance over per cent mean and is presented in Table 1. Phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the characters during both the ears, indicating the role of environment in expression of the genotype. Higher PCV than GCV for various traits are reported by Anop Kumari et al (2011) and Rajiv Kumar et al (2012). However, close correspondence was seen between GCV and PCV for some characters like Number of Suckers Per Plant, Number of Leaves Per Plant, Days to first flower bud initiation, Vase life in fresh water and Flower yield per year (no) in 2014-15 and Number of Suckers Per Plant, Number of Leaves Per Plant, Days to first flower bud initiation and Flower yield per year (no) in 2015-16 indicating little influence of environment on these characters. Genotypic coefficient of variation helps to measure genetic variability with regard to a character and, therefore, it is not possible to partition existing heritable variation in a population based solely on this estimate. Estimates of heritability in a broad sense give a measure of transmission of characters from one generation to another, thus, giving an idea about the heritable portion of variability which enables the plant breeder to isolate elite selections in the crop. Heritability and genetic advance increase efficiency of selection in a breeding programme by assessing influence of the environmental factors, and additive gene action. Heritability in the broad sense ranged from 27.54 % (Length of ray florets) to 94.13% (Number of Suckers Per Plant) in 2014-15. Similarly 24.62 % (Stalk length (cm)) to 93.21 % (Flower yield per year (no)) in 2015-16. High heritability (>50%) was observed for all the traits except Plant height (cm), Flower diameter, Stalk length (cm), Length of ray florets, Number of Whorls and B:C ratio during 2014-15 and Plant Spread (cm), Flower diameter, Stalk length (cm) and Flower disc diameter (cm) in 2015-16. Magnitude of heritable variability is the most important aspect of genetic constitution of a genotype and has a close bearing on the response to selection (Panse, 1957). Similar findings were also reported by Chobe et al (2010) and Anop Kumari et al (2011), Senapati et al. (2016). Genetic advance (as per cent of mean) ranged between 4.85 and 3.21 (Stalk length (cm)) and

53.13 and 63.51% (Number of Suckers Per Plant). High genetic advance was observed for Number of Suckers Per Plant, Flower yield per year (no), Net profit, Vase life in fresh water, Days to first flower bud initiation and Flower disc diameter (cm) during both the years. Moderate genetic advance was recorded for Flower diameter, Leaf Area (cm^2), while, Stalk length (cm), Plant Spread (cm) and Length of ray florets. GCV and heritability (broad sense) do not suffice when determining the amount of variation that is heritable (Burton, 1952). Heritable variation can be determined with greater accuracy when heritability is studied along with genetic advance. Heritability, along with genetic gain, is a more useful criterion for predicting resultant effects of selecting the best individual (Johnson et al, 1955). High heritability, with high genetic advance, means that the character in question is governed by additive gene action (Anop Kumari et al , 2011). In the present study, Number of Suckers Per Plant, Days to first flower bud initiation, Vase life in fresh water, Flower yield per year (no), Stalk diameter (cm) showed high heritability with high genetic advance as per cent of mean. High heritability and high genetic advance for number of leaves per plant (Anand et al., 2013; Anop Kumari et al, 2013), leaf width (Rajiv Kumar et al, 2012), disc diameter and stalk length have also been reported. High heritability with medium genetic advance as per cent of mean was observed for Number of Leaves Per Plant, Leaf Area (cm^2) and Plant Spread (cm) indicating the presence of dominant and epistatic gene effects. It can thus be inferring that these characters can be improved through hybridization.

Table 1. Mean and range of different parameters of gerbera

Traits	2014-15			2015-16			Heritability (%)	
	Mean	Minimum	Maximum	Mean	Minimum	Maximum	2014-15	2015-16
Plant height (cm)	38.40	34.46	41.90	37.53	32.99	43.45	42.79	74.51
Number of Leaves Per Plant	32.46	29.36	37.45	31.64	28.70	37.94	79.45	66.76
Number of Suckers Per Plant	3.06	2.13	4.95	3.12	2.07	5.19	94.13	94.82
Plant Spread (cm)	42.86	39.56	47.04	42.45	38.81	46.32	59.68	34.62
Leaf Area (cm^2)	202.11	185.60	218.67	196.52	168.89	215.09	59.55	65.52
Days to first flower bud initiation	63.38	54.68	71.25	65.42	55.48	76.84	83.57	86.48
Flower diameter	11.97	10.44	13.71	11.67	10.15	13.97	36.51	47.07
Stalk length (cm)	59.32	53.29	63.62	58.58	52.72	63.11	45.32	24.62
Stalk diameter (cm)	0.59	0.54	0.66	0.60	0.50	0.68	59.06	73.04
Length of ray florets	4.35	3.92	5.05	4.60	3.78	5.53	27.54	62.29
Number of Whorls	10.73	9.49	12.19	10.34	8.62	12.37	51.62	65.40
Flower disc diameter (cm)	2.28	1.99	2.87	2.28	1.86	2.86	33.30	56.08
Vase life in fresh water	13.70	12.16	16.75	13.63	10.76	16.26	82.75	47.75
Gross return (Rs) per 560 m^2	3.93	3.23	4.51	4.08	3.30	4.55	53.27	85.66
Net profit	2.66	1.96	3.24	2.92	2.14	3.39	53.27	85.66
B:C ratio	2.09	1.54	2.55	2.52	1.85	2.93	53.62	85.80
Number of ray florets	64.20	57.07	71.42	66.38	57.83	73.06	40.10	69.68
Flower yield per year (no)	221.11	198.05	277.86	235.97	204.32	272.13	94.74	93.21

Table 2. Mean and range of different parameters of gerbera

Traits	GCV (%)		PCV (%)		Genetic advance		Genetic Advance value % means	
Plant height (cm)	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Number of Leaves Per Plant	4.52	7.40	6.90	8.57	2.34	4.94	6.09	13.16
Number of Suckers Per Plant	7.99	7.17	8.97	8.78	4.77	3.82	14.68	12.07
Plant Spread (cm)	26.58	31.66	27.40	32.51	1.63	1.98	53.13	63.51
Leaf Area (cm2)	4.65	3.89	6.02	6.60	3.17	2.00	7.40	4.71
Days to first flower bud initiation	4.35	5.72	5.63	7.06	13.97	18.74	6.91	9.53
Flower diameter	7.92	9.29	8.67	9.99	9.46	11.64	14.92	17.80
Stalk length (cm)	6.14	6.65	10.16	9.70	0.92	1.10	7.64	9.41
Stalk diameter (cm)	3.50	3.14	5.20	6.33	2.88	1.88	4.85	3.21
Length of ray florets	5.52	9.31	7.18	10.89	0.05	0.10	8.74	16.39
Number of Whorls	5.06	9.43	9.64	11.95	0.24	0.71	5.47	15.33
Flower disc diameter (cm)	7.41	9.25	10.32	11.44	1.18	1.59	10.97	15.41
Vase life in fresh water	8.59	11.53	14.89	15.40	0.23	0.41	10.21	17.79
Gross return (Rs) per 560 m^2	10.11	9.88	11.11	14.30	2.60	1.92	18.94	14.07
Net profit	7.61	8.01	10.43	8.66	0.45	0.62	11.44	15.27
B:C ratio	11.25	11.18	15.41	12.08	0.45	0.62	16.91	21.32
Number of ray florets	11.28	11.21	15.41	12.10	0.36	0.54	17.02	21.39
Flower yield per year (no)	4.86	6.66	7.67	7.98	4.07	7.61	6.34	11.46

References

1. Anand, M.; Sankari, A.; Arulmozhiyan, R. (2013).Evaluation of commercial cultivars of cut gerbera (*Gerbera jamesonii* Bolus ex Hooker F.) under polyhouse in Shevaroy condition of Eastern Ghats.*Journal of Horticultural Sciences* ,Vol. 8 , No. 2 , pp. 199-203
2. Anop Kumari, Patel, K.S. and Choudhary, Mahesh. 2013.Genetic variability studies in gerbera. Res. Pl. Biol.,1:1-4
3. Benemann, D. de P.; Arge, L. W. P.; Barros, W. S.; Bianchi, V. J.; Segeren, M. I.; Peters, J. A. (2013).Genetic divergence among *Gerbera* spp. genotypes based on morphological traits.*Journal of Agricultural Science (Toronto)* ,Vol. 5 , No. 5 , pp. 35-45
4. Burton, G.W. 1952. Quantitative inheritance in grasses Proceedings of the 6th International Grassland Congress, Pennsylvania, Pa, USA, August 1952, 1 :277-283
5. Chobe, R.R., Pachankar, P.B. and Warade, S.D. 2010. Studies on genetic variability and heritability in gerbera. Asian J. Hort., 5:356-358
6. Panse, V.G. 1957. Genetics of qualitative characters in relation to plant breeding. Ind. J. Genet.,17:318-328
7. Rajiv Kumar, Deka, Bidyut C. and Venugopalan, R. 2012.Genetic variability and trait association studies in gerbera (Gerbera jamesonii) for quantitative traits.Ind. J. Agril. Sci.,82:615–619
8. Senapati, A. K. Priyanka Prajapati and Alka Singh (2013). Genetic variability and heritability studies in *Gerbera jamesonii* Bolus African Journal of Agricultural Research 8(41), pp. 5090-5092.
9. Singh, R.K. and Chaudhary, B.D. 1985. Biometrical Methods in Quantitative Genetic Analysis. Kalyani Publishers, New Delhi, p 318.
10. Verma S, Kumar S, Singh D (2008). Studies on variability for various quantitative traits in rose (Rosa spp.). J. Ornam. Hort.11(1):62-65.