academicJournals

Vol. 8(41), pp. 5090-5092, 24 October, 2013
DOI: 10.5897/AJAR2013.8038
ISSN 1991-637X ©2013 Academic Journals
http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Short Communication

Genetic variability and heritability studies in *Gerbera jamesonii* Bolus

A. K. Senapati[1], Priyanka Prajapati[2]* and Alka Singh[2]

[1]Department of Post Harvest Technology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari - 396450, Gujarat, India.
[2]Department of Floriculture and Landscape Architecture, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari - 396450, Gujarat, India.

Accepted 15 October, 2013

Twelve genotypes of gerbera (*Gerbera jamesonii)* were evaluated to determine the genetic variability, heritability, genetic advance, and genetic advance as percent of mean for 13 contributing characters. Significant variations were recorded for the various characters studied. Phenotypic and genotypic coefficients of variation were highest for the number of leaves per plant, number of clumps per plant and leaf area index, indicating presence of sufficient genetic variability for selection in these traits. High heritability and high genetic advance for number of leaves per plant, leaf area index and fresh weight indicated the presence of additive gene effects in these traits and their amicability for direct selection. The non additive gene effects were evident in petal thickness, hollowness of the stalk, fresh weight, flower diameter, stalk diameter and neck diameter thus, warranting use of heterosis breeding for these characters. The selection on the basis of number of leaves per plant, number of clumps per plant and leaf area index will be more effective for further breeding programme.

Key words: Gerbera, heritability, variability, genetic advance, phenotypic and genotypic coefficients of variation.

INTRODUCTION

Gerbera (*Gerbera jamesonii*) belongs to the family Asteraceae, a popular cut flower grown throughout the world in a wide range of climatic conditions. It is popularly known as 'Barberton daisy' or 'Transvaal daisy'. Genus *Gerbera L.* consists of 30 species, which are of Asiatic and South African origin. Among the different species, *G. jamesonii* is the only species under cultivation. Modern gerbera arose from *G. jamesonii* hybridized with *Gerbera viridifolia* and possibly other species (Leffring, 1973). There is a wide range of variation available in this flower. On an average, the annual flower is 20 to 35 flower stick per plant and it directly related to the cultivar (Li et al., 2008; Singh and Mandhar, 2004).

The consumer preferences changes with time. Hence, crop improvement is the need of the time to sustain the availability of desirable cultivars. Improvement through selection depends upon the variability existing in the available genotypes, which may be either due to different genetic constitution of cultivars or variations in the growing environments. 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 variance, heritability and other genetic parameters are reported to be subject to fluctuations with changing environments (Lal et al., 1985).

Genetic variability in a group of germplasm is a

*Corresponding author. E-mail: priyanka.p.prajapati@gmail.com.

pre-requisite for a successful breeding programme. Since, most of the characters influencing yield are polygenic, it is essential for plant breeders to estimate the type of variation available in the germplasm. The type of breeding programme for developing suitable varieties depends largely on the availability of genetic variability in a given species. Heritability estimated, gave a measure of transmission of characters from one generation to the other, as consistency in the performance of the selection depends on the heritable portion of the variability (Falconer, 1981). Thus, the variation and the estimates of the heritability and genetic advance are the important parameters on which the success of selection lies. With this background in view, the present study was undertaken to assess and estimate the magnitude and nature of variation among 12 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 investigation was conducted at Green house Complex, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari (Gujarat) during the rabi season of year 2010 to 2011 and 2011 to 2012. Twelve genotypes of tissue cultured plantlets viz., Stanza, Fana, CF Gold, Diego, Cherany, CF Orange, Lion, Venezia, Torbin, Jaffana, Kento, and Ice Queen, were planted a year before in 2009 before the commencement of the present study. Eight week old plantlets of these 12 genotypes were procured from Germini Agro Pvt. Limited, Pune and planted in raised bed of 45 cm height, 60 cm width and 30 cm pathway at a spacing of 30 cm × 30 cm in double row zig-zag system in completely randomized system with 3 replications. The recommended package of practices was followed for raising the crop. Twenty plants from 12 genotypes were selected randomly from net plot and were tagged for recording the observations during the two years.

The average was worked out and results of pooled analysis were used to study genetic parameters on various vegetative growth, flowering, quality, and yield characters as per genotypes. The genotypic and phenotypic coefficients of variation were estimated according to the methods of Panse and Sukhatme (1967). Parameters of variability were calculated as per the formula given by Burton (1952). Heritability, genetic advance and expected genetic gain were calculated by the formula suggested by Johnson et al. (1955). The mean and standard errors were worked out as per standard methods and coefficients of variations were computed.

RESULTS AND DISCUSSION

Results in Table 1 indicated a considerable range of variation with respect to Phenotypic, Genotypic and Environmental coefficient of variation. Variation in the experimental material was also reflected by high value of mean and range for maximum characters, as shown in Table 1. The study revealed that, the estimates of Phenotypic Coefficient of Variation (PCV) were higher than their corresponding values of Genotypic Coefficient of Variation (GCV) for almost all the characters under consideration indicating that, the apparent variation was not only due to genotypes but also due to the influence of environmental in the expression of genotypes. The results were in agreement with the results of Chobe et al. (2010) in Gerbera and Verma et al. (2008) in Rose.

The PCV and GCV were estimated from the corresponding variances and were used for the assessment of variability among the characters studied. Amongst all the characters studied, the highest GCV and PCV were recorded for number of leaves per plant, followed by number of clumps per plant, leaf area index and hollowness of the stalk, indicating high variation in these characters, predicting greater scope for improvement of these four characters. Similarly, high variability has been reported by Kumari et al. (2011) for number of flowers per plant and leaf area index in Gerbera.

The estimates of heritability in broad sense give a measure of transmission of characters from one generation to another, thus giving an idea of heritable portion of variability and enabling the plant breeder in isolating the elite selection in the crop. Heritability and genetic advance increase the efficiency of the selection in a breeding programme by assessing the influence of environmental factors and additive gene action. The estimates of heritability in broad sense specifying the heritable portion of total variation, helps in identification of the appropriate characters for selection. High estimates of heritability were recorded for number of leaves per plant followed by leaf area index, fresh weight of flower, hollowness of the stalk, clumps per plant, number of flowers per plant, neck diameter, stalk diameter, petal thickness, leaf area, stalk length, plant height, and flower diameter, reflecting the importance of these traits in selection programme. The magnitude of heritable variability is the most important aspect of genetic constitution of the response to selection (Panse, 1957). Similar findings were reported by Kannan and Rammdas (1990) in Gerbera.

Since heritability estimates are influenced by environment, genetic material and also other factors hence their utility will be restricted. Thus, heritability in conjunction with genetic advance would give a more reliable index of selection value (Johnson et al., 1955). GCV and heritability (broad sense) are not sufficient to determine the amount of variation which is heritable (Burton, 1952).

Heritable variation can be determined with greater accuracy when heritability along with genetic advance is studied. High heritability with high genetic advance tells that, the character is governed by additive gene action, for that simple selection is advocated. In the present study, leaf area showed the high heritability along with high genetic advance, followed by number of leaves per plant and number of flowers per plant per year. Thus, selection on the basis of these characters would be more effective for further breeding programs, as also reported by Kumari et al. (2011), Kolte (2008) and Nair and Shiva (2003). Chobe et al. (2010) reported high heritability along with genetic advance as percent of mean for number of ray

Table 1. Mean, range, ECV (%), GCV (%), PCV (%), Heritability, genetic advance, and genetic advance as percent of mean for various growth, flowering, and yield parameters in Gerbera (*G. jamesonii* Bolus) in pooled analysis.

S/N	Character	Mean	Range		ECV (%)	GCV (%)	PCV (%)	Heritability (%)	Genetic advance	Genetic advance as percent of mean
			Minimum	Maximum						
1	Number of flowers per plant per year	27.01	20.28	41.84	2.91	23.28	23.46	98.46	12.85	47.58
2	Plant height	46.53	40.87	54.68	2.34	8.41	8.73	92.82	7.76	16.68
3	Number of leaves per plant	35.54	16.33	49.17	2.86	34.54	34.65	99.32	25.20	70.90
4	Number of clumps per plant	4.50	2.35	7.05	3.92	33.16	33.39	98.62	3.05	67.84
5	Leaf area (cm^2)	114.52	90.42	134.61	2.83	14.45	14.72	96.31	33.44	29.20
6	Leaf area Index	3.50	1.86	5.07	3.10	30.30	30.46	98.96	2.17	62.09
7	Flower diameter (cm)	9.87	8.66	10.84	2.07	7.08	7.38	92.09	1.38	14.00
8	Fresh weight (g)	4.18	3.82	4.85	0.79	7.39	7.43	98.88	0.63	15.14
9	Petal thickness mm)	0.454	0.331	0.545	2.80	14.65	14.92	96.46	0.13	29.65
10	Neck diameter (mm)	3.24	2.14	4.43	3.10	20.96	21.19	97.87	1.38	42.72
11	Stalk diameter (mm)	5.24	4.08	6.58	2.89	15.24	21.19	96.50	1.38	42.72
12	Stalk length (cm)	53.47	41.98	63.66	2.69	12.73	13.01	95.72	13.72	25.66
13	Hollowness of the stalk (mm)	1.51	1.01	2.09	3.37	29.33	29.52	98.70	0.91	60.03

florets, leaf area, and number of days to first flowering, vase life and number of flowers per plant. High heritability along with high genetic gain indicated in these characters was due to considerable additive gene effects (Panse and Sukhatme, 1967). Estimates of genetic advance help in understanding the type of gene action involved in the expression of various polygenic characters.

Conclusion

In the present study, high heritability accompanied with low genetic advance for the characters petal thickness, fresh weight, hollowness of the stalk, and number of clumps per plant is indicative of non-additive gene action. Chobe et al. (2010) reported high heritability along with lower genetic advance for number of days required for first flowering, vase life and number of flowers per plant per year. Selection of individual plants based on leaf area, number of leaves per plant and number of flowers per plant per year which showed high heritability along with high genetic gain might therefore be effective for crop improvement.

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