J. Hortl. Sci.
Vol. 8(1):111-113, 2013

Short communication

Studies on genetic variability in gerbera (*Gerbera jamesonii* Bolus ex. Hooker F.)

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ABSTRACT

Thirteen genotypes of gerbera were evaluated under naturally-ventilated polyhouse in Completely Randomized Block Design during the year 2011-12 to determine genetic variability, heritability and genetic advance for 15 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. High (>20%) PCV and GCV was observed for number of leaves/plant and leaf width. Heritability estimates ranged from 24.03% (number of suckers/plant/year) to 93.5% (length of ray floret). High heritability (>60%) was observed for all traits except number of suckers/plant/year, flower diameter and flower-stalk diameter. High heritability, coupled with high genetic advance over per cent of mean, was observed for number of leaves/plant, leaf length, leaf width, days to bud-burst, days to first-flower opening, disc diameter, flower-stalk length, number of ray florets per flower head with length and width of ray florets.

Key words: Gerbera, genetic variability, heritability, genetic advance

Gerbera (*Gerbera jamesonii* Bolus ex. Hooker F.), belonging to family Asteraceae, is an important cut-flower grown for both domestic export markets. It is used in floral arrangements, flower beds, borders, pots and rock gardens. Crop improvement programmes currently focus on developing of hybrid cultivars to boost productivity and profitability. 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,* 2012). 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. The present study was undertaken to ascertain magnitude and extent of genetic variability, heritability and genetic advance with regard to quantitative traits for 13 genotypes of gerbera, to help identify potential traits for selection.

The present study was carried out at Division of Ornamental Crops, Indian Institute of Horticultural Research, Hessaraghatta, Bangalore during the year 2011-2012 in Completely Randomized Block design, with six replications. Experimental material consisted of 13 genotypes of gerbera, viz., Ambeta, Amelie, Amlet, Askye, Cocuy, Dameblanche, Julia, Muriel, Naike, Natasha, Nuvola, Sonata and Top Model. The experiment was conducted in a naturally ventilated polyhouse. Tissue culture plants of all the genotypes were planted at 40 cm x 30 cm spacing, accommodating six plants/m^2. 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 15 traits, viz., number of leaves/plant, leaf length (cm), leaf width (cm), plant spread (cm), number of suckers/plant/year, days to bud-burst, days to first-flower opening, flower diameter (cm), disc diameter (cm), flower-stalk length (cm), flower-stalk diameter (mm), number of ray florets/flower-head, length of ray florets (cm), width of ray florets (cm) and number of flowers/plant/month. 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). Statistical package 'Biostat IIHR, version 1.0' was used for statistical analysis.

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, indicating the role of environment in expression of the genotype. Anop Kumari *et al* (2011) and Rajiv Kumar *et al* (2012) also reported higher PCV than GCV for various traits. However, close correspondence was seen between GCV and PCV for some characters like leaf width, plant spread, days to bud-burst, disc diameter, flower-stalk length, and, length and width of ray florets, 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.

High heritability (>60%) was observed for all the traits except number of suckers/plant/year, flower diameter and flower-stalk diameter, indicating a possible role of additive gene-action. 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). Heritability in the broad sense ranged from 24.03% (number of suckers/plant/year) to 93.5% (length of ray floret). Genetic advance (as per cent of mean) ranged between 5.21 (flower diameter) and 42.66% (leaf width). High genetic advance was observed for number of leaves/plant, leaf length, leaf width, days to bud-burst, days to first-flower opening, disc diameter, flower-stalk length, number of ray florets/flower head, and length and width of ray florets. Moderate genetic advance was recorded for plant-spread and number of flowers/plant, while, number of suckers/plant, flower diameter and flower-stalk diameter recorded a low genetic advance.

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 leaves/plant, leaf length, leaf width, days to bud-burst, days to first-flower opening, disc diameter, flower-stalk length,

Table 1. Mean, range, genotypic and phenotypic coefficients of variation, heritability and genetic advance for 15 traits in 13 genotypes of gerbera

Character	Mean ± SEm	Range		GCV (%)	PCV (%)	Heritability (%)	Genetic Advance over per cent of Mean
		Min.	Max.				
Number of leaves/plant	10.98 ± 0.77	6.83	15.83	24.84	30.30	67.21	34.42
Leaf length (cm)	37.50 ± 0.83	29.83	44.83	12.14	13.26	82.50	20.64
Leaf width (cm)	15.00 ± 0.64	10.33	22.16	24.48	26.62	84.59	42.66
Plant spread (cm)	62.69 ± 1.32	52.50	74.00	10.10	11.43	78.06	16.25
Number of suckers/plant/year	1.50 ± 0.17	1.16	2.00	16.82	34.31	24.03	8.00
Days to bud-burst	65.91 ± 1.60	56.16	97.33	15.76	16.86	87.37	28.37
Days to first-flower opening	72.10 ± 1.63	62.16	105.33	14.96	16.01	87.29	26.90
Flower diameter (cm)	10.74 ± 0.17	9.96	11.93	4.54	6.08	55.87	5.21
Disc diameter (cm)	2.95 ± 0.06	2.30	3.78	15.98	16.80	90.49	29.83
Flower-stalk length (cm)	57.39 ± 1.28	45.66	66.50	11.88	12.97	84.02	20.57
Flower-stalk diameter (mm)	6.06 ± 0.22	5.25	7.05	8.34	12.08	47.63	8.25
Number of ray florets/flower head	59.84 ± 2.43	38.83	84.66	17.85	20.30	77.31	28.44
Length of ray florets (cm)	4.57 ± 0.06	3.78	5.59	13.49	13.95	93.50	26.03
Width of ray florets (cm)	1.06 ± 0.02	0.84	1.44	17.13	17.93	91.29	32.07
Number of flowers/plant/month	3.40 ± 0.07	2.80	3.85	9.02	10.71	71.05	13.23

GCV: genotypic coefficient of variation; PCV: phenotypic coefficient of variation

number of ray florets/flower head, and, length and width of ray florets showed high heritability with high genetic advance as per cent of mean. High heritability and high genetic advance for number of leaves per plant (Anirban and Dastidar, 2005; Anop Kumari *et al*, 2011), leaf width (Rajiv Kumar *et al*, 2012), disc diameter and stalk length (Anuradha and Gowda, 1999) have also been reported. High heritability with medium genetic advance as per cent of mean was observed for plant-spread and number of flowers/ plant/month, indicating the presence of dominant and epistatic gene effects. It can thus be inferring that these characters can be improved through hybridization.

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(MS Received 30 August 2012, Accepted 21 March 2013, Revised 23 March 2013)