International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(5): 1657-1660

Received: 11-07-2017
Accepted: 14-08-2017

Ravi R Girange
P.G. Students, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Nilima Gobade
P.G. Students, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Pankaj R Sante
Horticulture Section, ASPEE College of Horticulture, Navsari. Gujrat, India

Abhinav C Bhaskarwar
P.G. Students, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Correspondence
Ravi R Girange
P.G. Students, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Genetic variability studies for various quantitative traits in Gaillardia

Ravi R Girange, Nilima Gobade, Pankaj R Sante and Abhinav C Bhaskarwar

Abstract
To assess the genetic variability present in seven genotypes (6 local collections and one check i.e (Double Mix) of gaillardia the experiment was conducted in a randomized block design with three replication in a plot size of 3.0 m x 3.6 m The plants were transplanted at spacing 60 x 45 cm. during the year 2015-16 in the Horticulture Section, College of Agriculture, Nagpur. Genetic variability and heritability studies indicated that there were highly significant differences between the genotypes for yield of flower ha^{-1} and fifteen other characters. Comparison of genotypic and phenotypic co-efficient of variation for different traits indicated that the values of PCV were higher as compared to GCV due to the influence of environment. The coefficient of variation both at genotypic and phenotypic levels were maximum for disc diameter, dry weight of flower, weight of flower, shelf life and leaf area. Therefore dry weight of flower, yield of flowers ha^{-1}, diameter of flower, plant height and plant spread. Heritability estimates for all the characters except dry weight of flower were high. High heritability along with high genetic advance as per cent of mean was observed for dry weight of plant, yield of flowers ha^{-1}, diameter of flower, plant height and plant spread which were due to additive gene effects thus suggesting that selection for these characters would be very effective. Based on these seven traits, genotypes NG 02, NG 01 and NG 03 were found significantly superior and identified for further purification and multiplication for their commercial exploitation

Keywords: gaillardia, variability, genetic advance, heritability

Introduction

Gaillardia, commonly known as blanket flower or fire wheel, belong to the family compositae and is a native to central and western united states. The plants possess brilliant daisy-like flower with single, double and semi double forms. The large centres of flowers are rose-purple and the densely frilled petals are yellow, orange, crimson or copper scarlet. The genus was in honour of gaillard de marentoneau, an 18th century French botanist. Out of twenty species available in the genus gaillardia, only two species, gaillardia pulchella, is annual and gaillardia aristata, is a perennial are under cultivation. Flowers are small and numerous, born in solitary, usually showy heads which is stated as capitulam with 4 to 6 cm in diameter. Individual flowers in a capitulam are called florets which ranged from one to ten according with cultivars or genotypes. As a member of asteraceae. It has both ray and disc florets which are pistillate and hermaphrodite, respectively. The crop produce flowers in a wide range of colors such as yellow, orange, cream, scarlet, bronze, brick-red, red and can be grown all around the year. These wide uses depend on the variable performance of different genotypes. The sources of any breeding programme for developing suitable varieties depends largely on the availability of genetic variability in a given species. Heritability estimates give 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, thus enable the plant breeder in isolating the elite selection in the crop. Since, most of the characters influence yield and are polygenetic, it is essential for plant breeders to estimate the type of variation available in the germplasm. Use of open pollinated crops for exploiting increased variations especially in heterozygous crop like gaillardia is gaining considerable importance. Estimation of heritability reveals transmission of characters from one generation to another generation. Heritability alone is not useful for breeding programmes, heritability along with genetic advance is pre-requisite for selection process.

The adequate information on extent of variability parameters may be helpful to improve the yield by selecting the yield component traits because yield is a complex trait, whose manifestation depends on the component traits. Being a cross pollinated crop there is need of high yielding variety with specific coloured flowers to overcome farmer's predicament. Variability results due to differences either in the genetic constitution of the individuals of a population or in the environment in which they are grown. Selection is effective when there is genetic variability. Hence, an insight into the magnitude of genetic variability present in a population is very important for starting a judicious attempt in the present study.

Materials and Methods

The present study was carried out at, Horticulture Section, College of Agriculture, Nagpur during the year 2016. Experimental material consisted of seven genotypes of gaillardia *viz.*, Double Mix, NG 01, NG 02, NG 03, NG 04, NG 05 and NG 06 collected from different places and Double Mix. The experiment was laid out in Randomized Block Design (RBD) with three replications. For planting of gaillardia plot was prepared at the dimention of 3.0 m X 3.6 m. Before planting, the seed were treated with copper oxychloride (0.1%) and the individual seed weighing 300-350 g were selected for planting. The treated seed were planted at 5 cm depth at spacing at 60 x 45 cm between the plant and row as per the standard recommendation on 2 Oct, 2015. Uniform cultural practices were followed throughout the experimentation. The data were recorded on five random plants from each genotype in each replication for sixteen characters which includes vegetative parameters like plant height, number of branches plant^{-1}, plant spread, leaf area, fresh weight, dry weight and flowering parameters *viz.*, days to first flower bud initiation, days to opening of flower, days to 50 per cent flowering, days to first harvesting, flowering span and yield hectare^{-1}. Data were subjected to statistical analysis as per method given by Panse and Sukhatme[6]. Genetic parameters like genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were estimated according to Singh and Chaudhary and heritability in broad sense as suggested by Falconer and genetic advance was calculated using the formula given by Johnson *et al.*

Results and Discussion

The analysis of variance revealed that mean squares were significant for all the sixteen characters studied. This suggested the presence of wide range of variability for different characters in the material studied. The results pertaining to various genetic parameters *viz.*, phenotypic coefficient of variation (PCV), genotypic co-efficient of variation, heritability and genetic advance as per cent of mean are presented in Table 1.

In this study the highest range of variation was reported with yield of flower ha^{-1} (40.88), plant height (21.40), and number of flower plant^{-1} (12.54). The results are in close conformity with the work done by Singh and Singh (2005) [8], Singh *et al.*, (2007) [9] and Kavitha and Anburani (2010) [4] in marigold who also reported highest range of variation for yield of flower ha^{-1}, plant height and flower plant^{-1}. This indicated the presence of considerable amount of genetic variation in marigold genotypes. These results revealed that characters like yield of flower ha^{-1}, plant height, and number of flower plant^{-1} showing maximum mean and range can be considered as traits for selecting superior genotypes. Such high proportion of mean and range values for yield of flower ha^{-1}, plant height, and number of flower plant^{-1} were also reported by Kavitha and Anburani (2010) [4] in marigold. Higher extent of variation reflecting in high range could be attributed to difference in the genetic composition of the rose genotypes collected from different places. This might be due to genetic characteristic and/or acclimatization to the environment from were collected.

Results in table 1 indicated a considerable range of variation with respect to phenotypic and genotypic coefficient of variation. The estimates of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the sixteen characters under consideration indicating higher degree of environmental influence in the expression of the genotypes. These results are in agreement with the results of Singh and Kumar (2008) [10], Singh and Misra (2008) [11], Kavitha and Anburani (2010) [4] and Kumar *et al.* (2014) [5] who also reported higher value of PCV than GCV for different characters in marigold indicating high degree of environmental influence. The PCV and GCV were estimated from the corresponding variances and were used for the assessment of variability among the characters studied. Genotypic and phenotypic coefficient of variation exhibited the values from low to high category.

High GCV was exhibited for disc diameter of flower (61.98%), dry weight of flower (35.27%), leaf area (21.70%). Moderate GCV was noticed for yield of flower per ha^{-1} (19.42%), Diameter of flower (14.70%), Shelf life (11.24%). Low GCV was observed for plant spread (EW-9.86%) and (NS-9.06), Plant height (9.64%), Number of branches plant^{-1} (9.28%), Number of flower plant^{-1} (9.27%), Flowering span (7.02%), Days to pening of flower (6.23%), Days to first bud initiation (5.49%), Weight of flower (5.14%), Harvesting of flowers (4.45%) and Days to 50% flowering (3.56%).

Similarly phenotypic coefficient of variation was also observed to be low to high for different characters. High PCV was exhibited for disc diameter (69.77%), Dry weight of plant (35.27%), Weight of flower (28.25%), Leaf area (26.65%), shelf life (22.26%). Moderate PCV was noticed for yield of flower hectare^{-1} (19.72%), diameter of flower (15.48%), days to opening of flower (15.27%), number of branches plant^{-1} (13.99%), Number of flowers plant^{-1} (10.48%), plant height (10.06%). Low PCV was observed for plant spread (EW (10.50) and NS (9.78%) Flowering span (8.27%), days to first bud initiation (6.53%), harvesting of flower (5.23%) and days to 50% flowering (4.73%).

Amongst all the characters studied, the highest GCV and PCV were recorded for disc diameter, dry weight of plant, weight of flower, shelf life and leaf area. Indicating high variation in these characters, predicting greater scope for improvement of these fifteen characters. Higher GCV for above mentioned characters can effectively be utilized in formulating breeding strategy. Similarly, high variability has been reported by Anuja, and Jahnavi. (2012) [1], Kavitha and Anburani (2010) [4], Singh *et al.* (2007) [9] and Singh and Singh (2005) [8] for disc diameter, yield of flowers ha^{-1}, weight of flower, number of flower plant^{-1} in marigold. PCV and GCV detect the amount of variability in the available germplasm. Selection based on lying variability alone is efficiency governed by heritability and genetic advance. It predicts the resultant effect for selecting the best individuals. Heritability estimates give 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 effect.

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 values were recorded for all the sixteen characters except for weight of flower reflecting the importance of these traits in selection programme. This indicated that these characters were governed by a polygenes or additive gene effect and therefore, selection of these characters would be more effective for yield improvement. These findings suggested scope of improvement of these characters through direct selection which was in line with the work of Singh *et al*. (2007) [9], Singh and Misra (2008) [11] and Singh *et al.* (2009) who also reported high heritability for these traits. The magnitude of heritable variability is the most important aspect of genetic constitution of the genetic material which has close bearing on the response to selection.

Genetic advance as percentage of mean value were high for the characters studied dry weight of plant, yield of flower hectare^{-1}, plant height except for number of branches plant^{-1}, plant spread, leaf area, days to 50% flowering, days to flower bud initiation, days to first opening of flower from bud emergence, days to 50 % flowering, harvesting of flowers, flowering span, number of flowers plant^{-1}, diameter of flower, disc diameter of flower, weight of flower, shelf life.

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) [3]. 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. Heritability estimates along with high genetic advance is more useful criterion in predicting the resultant effect for selecting the best individual. This is due to the fact that a character may have very high heritability but very less phenotypic variation gives rise to very low genetic gain. In the present study, high heritability along with high genetic gain was observed for dry weight of plant (99.98%, 296.73), yield of flowers ha^{-1} (97.04, 24.82%), plant height (91.82%, 14.06%), diameter of flower (90.18%, 1.82%), plant spread EW-(88.17%, 11.29%), NS-(85.84%, 10.05%), respectively. Estimates of genetic advance help in understanding the type of gene action involved in the expression of various polygenic characters. High heritability along with high genetic gain indicated that in these characters was due to considerable additive gene effects. Thus, selection on the basis of these characters would be more effective for further breeding programs. It revealed that crop improvement could be brought about by practicing phenotypic selection. This association owing to additive gene effects indicating that selection for these characters on phenotypic performance would be more effective. Similar to this finding, Singh *et al.* (2007) [9] and Kavitha and Anburani (2010) [4] also reported high heritability accompanied with high genetic advance is most likely due to additive gene effect and selection may be effective in marigold.

Out of the sixteen characters mentioned above, five characters *viz.*, dry weight of flower, yield of flowers ha^{-1}, diameter of flower, plant height and plant spread exhibited high heritability and genetic advance. Therefore, based on these five traits, genotypes NG 02, NG 01, NG 03 were found to significantly superior over check (Double Mix) for four characters as observed from table 2. These were followed by NG 03 which was significantly superior for four characters.

Table 1: Genotypic and phenotypic co-efficient of variation, heritability and genetic advance as per cent of mean among different African marigold genotypes

Characters		Range	General Mean ± S.E.	GCV (%)	PCV (%)	Heritability (%)	GA (%) of mean
Plant height		21.40 (64.28-85.68)	517.19±1.73	9.64	10.06	91.82	14.06
Number of branches plant^{-1}		6.53 (16.92-23.45)	142.99±1.74	9.28	13.99	44.03	0.59
Plant Spread at 50% flowering	NS	15.53 (50.98-66.51)	406.71±1.75	9.06	9.78	85.84	10.05
	EW	16.70 (51.68-68.38)	414.45±1.75	9.86	10.50	88.17	11.29
Leaf area at 50% flowering		9.38 (8.43-17.81)	96.67±1.74	21.70	26.65	66.26	5.02
Dry weight of plant		388.66 (224.67-613.33)	2859.32±1.75	35.27	35.27	99.98	296.73
Days to first flower bud initiation		9.96 (55.49-65.45)	422.70±1.74	5.49	6.53	70.59	5.73
Days to opening of flower		2.30 (7.13-9.43)	58.62±0.95	6.23	15.27	16.64	0.44
Days to 50% flowering		7.16 65.19-72.35)	481.77±1.73	3.56	4.73	56.80	3.81
Harvesting of flower		10.38 (72.35-82.73)	542.46±1.75	4.45	5.23	76.21	6.03
Flowering span		10.59 (44.65-55.24)	343.12±1.75	7.02	8.27	72.15	6.02
Number of flower plant^{-1}		12.54 (38.65-51.19)	309.33±1.74	9.27	10.48	78.58	7.48
Yield of flowers ha^{-1}		40.88 (43.60-84.48)	440.88±1.75	19.42	19.72	97.04	24.82
Diameter of flower		2.72 (5.00-7.72)	44.18±0.25	14.70	15.48	90.18	1.82
Disc diameter of flower		1.38 (0.19-1.57)	5.50±0.21	61.98	69.77	78.93	0.89
Weight of flower		1.90 (2.90-4.80)	26.94±0.87	5.14	28.25	3.32	0.07
Shelf life		1.29 (2.34-3.63)	20.22±0.45	11.24	22.26	25.49	0.34

Table 2: Performance of marigold genotypes for twenty different traits

Genotypes	Plant height (cm)	Number of branches plant^{-1}	Plant spread at 50% flowering (cm)		Leaf area at 50% flowering (cm^2)	Dry weight of plant	Days to first flower bud initiation (days)	Days to opening of flower from bud emergence (days)	Days to 50% flowering (days)	Harvesting of flower (Days)
			N-W	E-W						
T_1-Double Mix	79.87	18.48	53.35	54.15	12.10	286.33	65.45	9.43	72.35	82.73
T_2-NG 01	70.96	19.98	62.48	64.52	13.50	613.33	57.38	7.51	66.35	74.37
T_3-NG 02	64.28	16.92	66.51	68.38	8.43	555.00	60.45	8.50	68.27	77.46
T_4 -NG 03	68.24	23.45	57.32	58.52	14.41	474.33	58.30	8.04	67.47	75.53
T_5-NG 04	75.75	20.42	55.62	55.62	17.53	322.33	55.49	7.13	65.19	72.35
T_6-NG 05	85.68	21.12	50.98	51.68	17.81	383.33	62.53	8.85	70.29	79.66
T_7-NG 06	72.41	22.62	60.45	61.58	12.89	224.67	63.10	9.15	71.85	80.36
Mean	73.88	20.42	58.10	59.20	13.81	408.47	60.38	8.37	68.82	77.49
SEd	1.73	1.74	1.75	1.75	1.74	1.75	1.74	0.95	1.73	1.75
LSD (0.05)	3.65	3.66	3.67	3.67	3.66	3.67	3.66	2.00	3.67	3.67
CV (%)	2.87	10.46	3.67	3.61	15.48	0.52	3.54	13.95	3.11	2.76

Genotypes	Flowering span (days)	Number of flower plant^{-1}	Yield of flowers ha^{-1}	Diameter of fully opened flower (cm)	Disc diameter of flower (cm)	Weight of flower (g)	Shelf life (days)
T_1-Double Mix	48.69	40.39	43.60	5.00	1.57	2.90	3.30
T_2-NG 01	44.65	42.60	60.38	6.31	0.50	3.81	3.00
T_3-NG 02	50.17	38.65	68.40	7.72	0.40	4.80	3.63
T_4 -NG 03	47.39	51.19	84.48	7.06	0.54	4.43	2.81
T_5-NG 04	55.24	43.34	64.87	6.67	0.19	4.06	2.34
T_6-NG 05	51.47	45.88	61.35	6.05	1.04	3.62	2.63
T_7-NG 06	45.51	47.28	57.80	5.37	1.27	3.32	2.51
Mean	63.30	44.19	62.98	6.31	0.78	3.84	2.88
SEd	1.75	1.74	1.75	0.25	0.21	0.87	0.45
LSD (0.05)	3.66	3.67	3.66	0.53	0.43	1.83	0.95
CV (%)	4.36	4.84	3.39	4.85	32.02	27.77	19.22

Conclusion

From the various aspects of genetic parameters (GCV, PCV, heritability and genetic advance expressed as percentage of mean), studied in this experiment, five characters i.e., *viz.*, disc diameter of flower, dry weight of plant, weight of flower, shelf life and leaf area. Therefore dry weight of flower, yield of flowers ha^{-1}, diameter of flower, plant height and plant spread exhibited high heritability and genetic advance. were identified for primary selection as they had high GCV, PCV, high heritability along with genetic advance. Considering these characters, the three genotypes NG 02, NG 01, and NG 03 which showed significantly superiority in mean performance were identified for further purification and multiplication for their commercial exploitation

References

1. Anuja S, K Jahnavi. Variability and genetic advance studies in French marigold (*Tagetes patula L*.). Asian J. Hort. 2012; 7(2):362-364.
2. Falconer DS. Introduction to Quantitative genetics. Oliver a14nd Boyd. Ltd. Edinburgh, 1981.
3. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability in soybean. Agron. J. 1955; 47:314-318.
4. Kavitha R, A Anburani. Genetic variability in African marigold (*Tagetes erecta* L.). Asian J. Hort. 2010; 5(2):344-346.
5. Kumar A. Bhanu Pratap and Karmabeer. Studies on genetic variability and character association in French marigold (*Tagetes patula* L). Trends In Bioscience. 2014; 7(2):122-124.
6. Singh RK, Choudhary BD. Biometrical methods in Qunatitative genetic analysis. Kalyani Publications. Ludhiana, 1979.
7. Singh P, Narayana SS. Biometrical techniques in plant breeding. Kalyani Publishers, New Delhi, 2000, 182.
8. Singh D, Singh AK. Correlation and path coefficient analysis in marigold (*Tagetes spp.*).Prog. Hort. 2005; 37(2):385-388.
9. Singh SRP, MM Syamal, O Sharma. Studies on Genetic variability in Marigold. Indian J. Hort. 2007; 64(4):483-485.
10. Singh D, S Kumar. Studied on genetic variability, heritability, genetic advance and correlation in marigold. J. Orna. Hort. 2008; 11(1):27-31.
11. Singh D, KK Misra. Genetic variability in quantitative characters of marigold. Indian J. Hort. 2008; 65(2):187-192.
12. Panse VG, Sukhatme PV. Statistical Methodsfor Agricultural Workers (2nd Edn.) Indian Council of Agricultural Research, New Delhi, 1957.
13. Vishnupriya AK, M Jawaharalal, N Manivannan. Variability studies in African marigold (*Tagetes erecta L*.). The Bioscan. 2015; 10(1):407-409.