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Genetic Variability Studies in Marigold

Latha S.* **and P.R. Dharmatti**

Department of Horticulture

University of Agriculture Science, Dharwad-580005, Karnataka, India

*Corresponding Author E-mail: lathas805@gmail.com

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ABSTRACT

The present investigation was carried out in UAS, Dharwad. Twenty six genotypes of marigold were evaluated for twelve growth, flowering and yield attributes to study their genetic parameters such as variability, heritability, genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV). All traits showed significant difference among the genotypes. The maximum value of GCV and PCV were recorded for number of petals per flower and plant height. The highest broad sense heritability was recorded for flower yield (t/ha), flower yield (g/plant), number of flowers per plant, flower diameter and number of petals per flower. Highest genetic advance over mean was recorded for plant height, flower yield (t/ha), flower yield (g/plant), flower diameter and internodal length. High heritability and genetic advance as percent mean are due to additive type of gene action.

Key words: *Genotype, Genetic advance, Heritability, GCV, PCV.*

INTRODUCTION

Marigold is one of the most commonly grown commercial flower crops in India, belongs to the family Asteraceae. The genus *Tagetes* is having two popularly grown species such as *Tagetes erecta* L. and *Tagetes patula* L. which have their origin in Mexico and South Africa, respectively. Today, there is huge demand for natural colours of marigold, calendula, hibiscus, gomphrena, petunia etc., in the international market. Marigold is being grown for the important source of carotenoid pigments. The principal pigment present in the flowers is xanthophyll[1]. Marigold is grown for cut flowers, making garlands, decoration during pooja and several religious functions, besides its use in landscape gardening. Success of crop improvement programme depends on the magnitude of the genetic variability and the efficiency of selection.

As the phenotypic expression of traits is the product of the heritable and non-heritable components, assessment of the genetic parameters such as genetic co efficient of variation, heritability and genetic advance are required for effective selection. Inheritance of a quantitative trait is often influenced by variation in other traits which may show association due to pleiotropy or genetic linkage. The studies on variability and genetic parameters are of paramount importance for crop improvement programme.

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Since meagre information is available on these aspects. In view of above facts, an attempt was made with an objective to study the genetic variability in marigold genotypes.

MATERIAL AND METHODS

The present investigation was carried out in College of Agriculture, UAS, Dharwad, during 2015-2016. The experiment was laid out in randomized complete block design (RCBD), comprising of 26 genotypes (Table 1) with two replications. The seeds of all genotypes were sown in nursery bed to raise seedlings and transplanting was done after one month of sowing with spacing of 60 x 45 cm. The observations were recorded on five randomly selected plants from each replication. The genotypes were assessed and observations were recorded for various growth and flowering related traits *viz.* plant height, internodal length, number of primary and secondary branches, number of leaves, leaf area, flower diameter, number of petals per flower, petal meal yield, number of flowers per plant and flower yield. Phenotypic and genotypic co-efficient of variation were calculated by using the formulae suggested by Cockerham[3]. The broad sense heritability (h^2BS) was estimated by following the procedure suggested by Weber and Moorthy. The expected genetic advance as per cent of mean for each character was predicted by the formula given by Johnson *et al.*[4].

RESULTS AND DISCUSSION

In any breeding programme, the mean performance and variability are the important factors for selection. Based on mean performance undesirable plant may be eliminated and also variability may be used for selection procedure. With a view to understand the extent to which the observed variations are due to genetic factors, the range, mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), broad sense heritability (h^2) and genetic advance as per cent mean (GAM) were worked out and are presented in Table 1.

In the present study, the estimates of phenotypic coefficient of variation (PCV) were higher than their corresponding genotypic coefficient of variation (GCV) for all the characters. The maximum value of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were recorded for number of petals per flower (51.77 % and 64.26 %, respectively) and plant height (42.95 % and 58.01 %, respectively). The moderate value of GCV and PCV were recorded for internodal length (34.59 % and 47.27 %, respectively), leaf area (28.32 % and 42.40 %, respectively) flower diameter (31.70 % and 39.05 %, respectively), flower yield (g/plant) (28.46 % and 31.43 %, respectively) and flower yield (t/ha) (28.54 % and 31.25 %, respectively) compare to other characters, indicating the presence of high amount of genetic variability for these traits and effective for selection because the response to selection is directly proportional to the variability present in the experimental material. These results are in conformity with the previous results as reported by Namita *et al.*[6], Pratap *et al.*[7] and Anil Kumar *et al.*[2] in marigold. The lower value of GCV and PCV was observed for primary branches (14.16 % and 26.99 %, respectively), secondary branches (14.72 % and 26.93 %, respectively), petal meal yield (6.89 % and 9.19 %, respectively) and number of flowers per plant (18.77 % and 20.63 %, respectively). These results are in confirmation with the findings of Namita *et al.*[6], Anil Kumar *et al.*[2], Yuvraj and Dhatt[10]. Narrow difference between PCV and GCV revealed that variability existing among different genotypes of marigold was mainly due to genetic makeup and there was less environmental influence on the expression of this trait. Same results had also been recorded by Singh *et al.*[8] in marigold.

The genotypes showed high heritability for most of the traits, and it was ranged from 52.46 to 91.32 per cent. The highest broad sense heritability was recorded for flower yield (t/ha) (91.32 %), flower yield (g/plant) (90.82 %), number of flowers per plant (90.97 %), flower diameter (81.17 %)

and number of petals per flower (80.56 %). This indicates good correspondence between genotypic and phenotypic values and thereby low environmental effect on the expression of these characters. These results are in agreement with the findings of Mathew *et al.*[5], Namita *et al*.[6], Yuvraj and Dhatt[10] in marigold. The lowest heritability was recorded for primary branches (52.46 %), secondary branches (54.68 %) and number of leaves (54.19 %). These findings are similar with the findings reported earlier in marigold. These findings are similar with the findings reported earlier in marigold[8].

Heritability estimates alone do not provide reliable information about the gene action governing the expression of a particular character and also it does not provide the information of the amount of genetic progress that would result from the selection of best individuals. Highest genetic advance over mean was recorded for plant height (65.59 %), flower yield (t/ha) (56.90 %), flower yield (g/plant) (56.60 %), Flower Diameter (53.58 %) and internodal length (53.16 %). The genotypic variations for such characters are probably due to high additive gene effects and least influenced by the environment. Similar results were also reported by Namita *et al.*[6], Anil Kumar *et al.*[2] and Singh *et al.*[8] in marigold. However, low genetic advance was reported for petal meal yield, primary branches, secondary branches and number of leaves, therefore, selection for these characters would not be much effective. The studies revealed that genetically diverse genotypes should be further utilized as parents in crop improvement programme for the development of the varieties/ hybrids with broad genetic base.

Table 1: Genotypes under study

Sl. No.	Genotype
1	Pusa Narangi Gainda
2	Pusa Basanti Gainda
3	Double Orange
4	Yellow Gate
5	Bhuvana
6	Harmony Boy
7	Spraymix
8	Pusa Narangi Orange
9	Coimbatore Yellow
10	Yellow Threaser
11	Orange Gate
12	Nilakkotai Yellow
13	Nilakkotai Orange
14	Garland White
15	Garland Yellow
16	Marigold Yellow
17	Marigold Orange
18	Orange Dive
19	DWD – 1
20	DWD – 2
21	French Yellow
22	French Gold
23	DWD Yellow
24	DWD – CY
25	DWD Gold
26	DWD Orange

Table 2: Variability, heritability and genetic advance for growth and yield parameters of marigold genotypes

Sl. No.	Characters	Range	Mean	GCV (%)	PCV (%)	h^2BS (%)	GAM (%)
1	Plant height (cm)	24.25 – 102.13	73.25	42.95	58.01	74.04	65.59
2	Internodal length (cm)	1.87 – 7.06	4.93	34.59	47.27	73.19	53.16
3	Number of Primary branches per plant	12.25 – 21.90	16.49	14.16	26.99	52.46	16.19
4	Number of secondary branches per plant	27.90 – 56.37	43.66	14.72	26.93	54.68	16.81
5	Number of leaves per plant	133.03 – 295.29	246.39	13.80	25.14	54.19	17.12
6	Leaf area (dm^2)	22.90 – 72.67	47.45	28.32	42.40	66.80	39.07
7	Flower diameter (cm)	2.12 – 8.27	5.71	31.70	39.05	81.17	53.58
8	Number of petals per flower	25.17 – 259.71	154.38	51.77	64.26	80.56	86.71
9	Petal meal yield (g/kg)	81.75 – 119.66	98.29	6.89	9.19	74.97	14.19
10	Number of flowers per plant	29.50 – 81.67	62.10	18.77	20.63	90.97	37.71
11	Flower yield (g/plant)	147.98 – 576.19	403.75	28.46	31.43	90.82	56.60
12	Flower yield (t/ha)	4.59 – 17.86	12.52	28.54	31.25	91.32	56.90

GCV- Genotypic co-efficient of variation

PCV- Phenotypic co-efficient of variation

h^2_{BS}- Broad sense heritability

GAM- Genetic advance as percent of mean

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