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GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN MARIGOLD HYBRIDS (*Tagetes* spp.)

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ABSTRACT
Genetic variability, heritabality and genetic advance studies showed high range for number of flower per plant (19.57-44.10) and fresh weight of flower (2.94-16.89 g). The co-efficient of variation (PCV and GCV) was maximum for number of flower per plant (PCV = 50.33, GCV = 52.56) and minimum for diameter of flower (PCV = 17.21, GCV = 16.90). The highest value of heritability was obtained for fresh weight of leaves (100.0), number of flower per plant (100.0), fresh weight of flower (99.0) and flower yield ton per hectare (99.0). High heritability with low genetic gain was observed for diameter of flower (h^2 = 96.0, GA = 2.31), peduncle length (h^2 = 97.0, GA = 2.23), fresh weight of flower (h^2 = 99.0, GA = 8.51) and dry weight of flower (h^2 = 94.0, GA = 0.71). As the high heritability and genetic advance as percent mean are due to additive type of gene action selection will be effective for all the characters in both crosses.

INTRODUCTION

Marigold (*Tagetes* spp.), which occupies a prominent place in ornamental Horticulture, is one of the commercially exploited flower crops belonging to the family Asteraceae. Estimation of genetic variability in the germplasm of a particular crop is prerequisite for making any effective breeding programme. Most of the important characters including yield are highly influenced by environment, since they are polygenically controlled, which make the selection process difficult. Heritability is an index for calculating the influence of environment on the expression of genotypes. Estimates of genetic advance together with heritability would be helpful in assessing the nature of gene action. Therefore, present investigation was carried out for estimating genetic variability, heritability and genetic advance for various vegetative and floral characters in 12 hybrids of marigold *(Tagetes* spp*)*. Marigold has a high ability to tolerate and accumulate lead and it might be a promising plant for phytoremediation of Lead contaminated soils (Rajalakshmi and Sudha, 2011). Being a cross pollinated crop there is need of high yielding variety with specific coloured flowers to overcome farmer's predicament (Vishnupriy *et al.,* 2015). Development of high yielding semi tall varieties of marigold requires genetically stable genotypes having high yield potential (Bharathi *et al.*,2014). 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 (Angadi and Archana, 2014). This paper deals with the magnitude of variation among hybrids with respect to various traits which can be further utilized in crop improvement programme.

MATERIALS AND METHODS

The present investigation was carried out at Floriculture Unit of New Orchard, Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad with the objective to find out the suitable marigold hybrids for cultivation under Dharwad condition. The experiment was laid out in a Randomized Block Design (RBD) with three replications. Statistical analysis of data was carried out by following analysis of RCBD as described by Sundar Raj *et al.* (1972). Thirty days old healthy and uniformly grown seedlings were used for transplanting with a spacing of 60 cm x 45 cm. This experiment having 12 hybrids *viz*. Majestic Yellow, Double Orange, Inca Mix, Kilimanjaro White, Mysore Gold, Garland Orange, Indam Gold, Bonanza Mix, Indam Yellow, Indam Yellow New, Sarpan-11 (Orange), Sarpan Hybrid Marigold-33 (Yellow).

The observations were recorded on Plant height, Number of primary branches, Number of secondary branches, Plant spread North-South, Plant spread East-West, diameter of flower, number of petals per flower, peduncle length, fresh weight of flower, dry weight of flower, petal meal, xanthophyll yield and flower yield per hectare.

Phenotypic and genotypic variance and Coefficient of variation were calculated as per Singh and Chaudhary (1979).

Heritability was estimated as a ratio of genotypic variance (Falconer,1981). Genetic advance was calculated by using formula given by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

Genotypic and phenotypic coefficients of variation were high plant height and number branches. Similar observations were made by Nalawadi (1982), Ponnuswami *et al*. (1985), Chezhian *et al*. (1985a), Rao and Negi (1990) and Jankiram and Rao (1991).

PCV and GCV were high for peduncle length, fresh weight of flower, flower bud initiation, number of flowers per plant, flower yield. Similar observations were made by Janakiram and Rao (1991), Kishore and Raghava (2001), Singh Kanwar and Saha (2006), Ponnuswami *et al*. (1985), Nalawadi (1982), Rao and Negi (1990), Deepti Singh and Santosh Kumar (2003), Vibha Singhal and Srivastava (2003), Singh and Sen (2000). Earliness and quality parameters showed greater variability in French and African marigold was also observed by Bhati and Chitkara (1988). High PCV was recorded than GCV for all the characters studied which indicates greater genotype and environmental interaction. Kishore and Raghava (2001) and Sreekala *et al*. (2002) observed high GCV and PCV for flower weight per plant. Moderate estimates of GCV and PCV were observed for characters like dry weight of flower and for diameter.

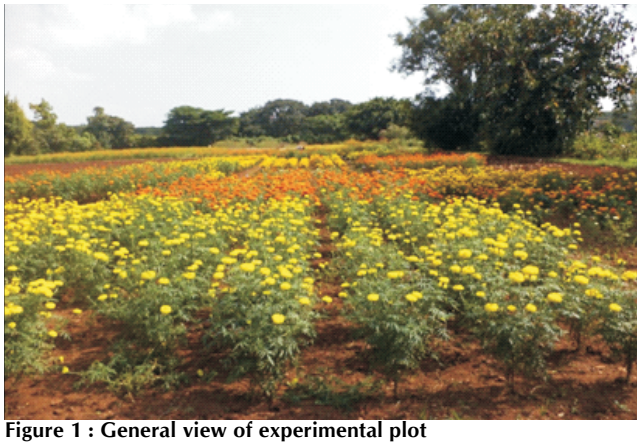

Figure 1 : General view of experimental plot

In the present study high range of genotypic coefficient of variation observed for total xanthophylls by Sreekala *et al*. (2002). Higher estimate of GCV and PCV indicates wide range of genetic variability; hence there is scope for improvement of these characters. In the present study low GCV and PCV were not recorded for the traits studied.

In the present investigation, high heritability was observed for all the character except for secondary branches and fresh weight of plant showed medium heritability. High heritability on flower weight was observed by Janakiram and Rao (1991) and Singh and Sen (2000) in African marigold .

High heritability coupled with moderate genetic advance was observed for plant height by Negi *et al*. (1983) and in African marigold by Janakiram and Rao (1991), plant spread (N-S, E-W) in African marigold by Kishore and Raghava (2001).

High heritability coupled with low genetic advance was observed for number of primary branches, flower diameter, flower weight and peduncle length. Indicating predominance of non-additive gene effects and evident that these traits influenced by environment. Thus character would offer low response to selection. For improving such character hybridization followed by selection would be better option. Similar results were reported in African marigold by Kishore and Raghava (2001) for flower diameter.

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Table 1 : Estimates of variability, heritability and genetic advance for various characters in Marigold (*Tagetes spp.*)

Sl. No.	Characters	Range		GCV (%)	PCV (%)	Heritability (%)	Genetic advance
		Max.	Min.				
1	Plant height (cm)	71.33	21.93	33.52	34.14	0.96	31.88
2	Number of primary branches	9.9	5.67	16.73	17.27	0.94	2.6
3	Number of secondary branches	31.17	14.8	22.34	29.91	0.56	6.95
4	Plant spread North-South (cm)	32.9	17.9	13.12	15.46	0.72	6.16
5	Plant spread East-West (cm)	29.43	18.03	12.36	12.92	0.92	6.31
6	Diameter of flower (cm)	8.5	4.7	16.9	17.21	0.96	2.31
7	Peduncle length (cm)	6.6	3.53	21.1	21.47	0.97	2.23
8	Fresh weight of flower (g)	16.89	2.94	33.48	33.72	0.99	8.51
9	Dry weight of flower (g)	1.49	0.32	30.86	31.79	0.94	0.71
10	Number of flowers per plant	44.1	19.57	52.56	50.33	1	33.44
11	Flower yield (t/ha)	23.71	3.59	44.73	45.05	0.99	13.31
12	Petal meal yield (q/ha)	30.33	3.68	50.06	50.14	1	16.92
13	Xanthophyll (g/kg)	24.01	6.12	31.86	32.54	0.96	10.84

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