

VARIABILITY STUDIES IN AFRICAN MARIGOLD (*TAGETES ERECTA* L.)

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ABSTRACT

The present investigation was undertaken to study the genetic parameters such as, heritability, genotypic and phenotypic coefficient of variation (GCV, PCV) for ten characters of F_2 progenies in two cross combinations viz., Coimbatore Local Orange X Siracole and Siracole X Coimbatore Local Orange. Both crosses differed in mean performance for all the characters except for number of flowers per plant and number of days taken for flower bud appearance. Phenotypic coefficient of variation was higher than the genotypic coefficient of variation. High PCV and GCV were observed for number of primary branches, number of secondary branches, single flower weight, flower compactness and total flower weight. High heritability was observed for days taken for flower bud appearance, total crop duration and number of flowers per plant. High heritability along with high genetic advance as percent mean were recorded in both the crosses for days taken for flower bud appearance and number of flowers per plant whereas moderate to high heritability and genetic advance as percent mean for other characters in both crosses. 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 erecta* L.) is an important loose flower which is used for religious purpose. It is also used as insecticide, nematicide, for pigment extraction and medicinal purpose. The flowers are available in different forms and different hues of colour, so it fetches importance for flower arrangements. Nowadays, varieties of African marigold are less vigorous, prone to lodging and low yielding. Development of high yielding semi tall varieties of marigold requires genetically stable genotypes having high yield potential (Bharathi *et al.*, 2014). Selection of superior variety depends upon the variation. Variability in a population with respect to character is an essential requirement for a successful breeding programme. Use of open pollinated crops for exploiting increased variations especially in heterozygous crop like marigold is gaining considerable importance (Singh and Misra, 2008). 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). Being a cross pollinated crop there is need of high yielding variety with specific coloured flowers to overcome farmer's predicament. Based on the requirement, this research work has been undertaken to assess and estimate the magnitude of variation among the F_2

population with respect to various traits which can be further utilized in crop improvement programme.

MATERIALS AND METHODS

The present experiment was carried out at the Department of Floriculture and Landscaping, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 2014. The F_2 population of two crosses viz., Coimbatore Local Orange x Siracole, Siracole x Coimbatore Local Orange) were selected based on the superior yield and yield contributing characters. The parent Coimbatore Local Orange having highest single flower weight and the parent Siracole having orange coloured with highly firm flower heads and also semi tall in nature. The crop was raised during rainy season (July- November, 2014). The plot size was 3.2 x 3.2 m and one month old seedlings were transplanted to main field with spacing of 60 cm x 40 cm. Observations were recorded on single plant basis for plant spread (cm), number of primary branches per plant, number of secondary branches per plant, days taken for flower bud appearance, total duration, flower size (cm), single flower weight (g), number of flowers per plant, flower compactness and total flower yield per plant (g). The genotypic and phenotypic coefficient of variation was estimated according to the methods of Burton (1952). Heritability in broad sense was calculated as per method given by Lush (1949) and Robinson *et al.* (1949). The expected genetic advance as per cent of mean was worked out as suggested by Johnson *et al.* (1955).

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.

In the present study, among the two crosses, Siracole x Coimbatore Local Orange crosses found to be significantly superior for number of primary branches, number of secondary branches, total crop duration, flower size, single flower weight, flower yield and flower compactness (Table 1). These findings are in line with report of Bharathi (2014). The cross combination Coimbatore Local Orange x Siracole recorded highest plant spread. Both crosses, different significantly for all traits except for flower bud appearance and number of flowers per plant.

Variability of characters are a good index of the transmission of characters from parents to their offspring. Heritability plays an important role in the selection process in plant breeding because, it is an estimate from additive genetic variance and it plays an important role in the selection of elite genotypes from segregating population.

The phenotypic coefficient of variation (PCV) was higher than those of genotypic coefficient of variation for all the traits (Table 1) which indicated greater genotype x environment interactions. This result is in accordance with the report of Singh and Misra (2008), Sharma and Raghuvanshi (2011 and, Panwar *et al.* (2013). High phenotypic and genotypic coefficient of variation (PCV and GCV) was found for flower compactness followed by flower yield per plant in the cross Coimbatore Local Orange x Siracole. The same trend was observed in the population of its reciprocal cross. Higher PCV and GCV were observed in African marigold for the characters flower yield per plant (Janakiram and Rao 1995, Singh and Singh, 2010) and for flower compactness in addition to flower yield per plant (Bharathi, 2014). Moderate phenotypic and genotypic coefficients of variation (PCV and GCV) were obtained for days taken for flower bud appearance and plant spread in the population of cross combination Coimbatore Local Orange x Siracole. Days taken for flower bud appearance and plant spread recorded moderate phenotypic and genotypic coefficient of variation (PCV and GCV) in its

reciprocal cross. It indicated that selection would be difficult for these characters, as the genotypic effect would be modified by the environmental effect. This results in agreement with the results of Sharma and Raghuvansi (2011) who recorded moderate variation for flower bud appearance in French marigold.

The cross combination, Coimbatore Local Orange x Siracole showed almost moderate to high heritability for all traits except flower compactness. High heritability was observed for number of secondary branches, days taken for flower bud appearance, total crop duration and number of flowers per plant. The population of its reciprocal cross recorded high heritability for days taken for flower bud appearance, total crop duration, number of flowers per plant and single flower weight. These findings suggest the scope for improvement of these characters through direct selection. The results of the present study were supported by Mishra *et al.* (2001) who also observed high heritability for total crop duration in carnation, Singh and Misra (2008) recorded high heritability for number of secondary branches and single flower weight, Singh and Kumar (2008) for number of flowers per plant and days taken for flower bud appearance.

Heritability alone is not useful for selection process. Heritability along with genetic advance increases the efficiency of selection in a breeding programme by assessing the influence of environmental factors and additive gene action. The cross combination, Coimbatore Local Orange x Siracole recorded high heritability along with high genetic advance as per cent mean for number of secondary branches, days taken for flower bud appearance and number of flowers per plant. These results are in line with the findings of Kishore and Raghava (2001), Karuppaiah and Kumar (2011) for secondary branches, Pattnaik and Mohanty (2002) for number of flowers per plant in marigold, Singh and Kumar (2008) for days taken for flower bud appearance. The cross combination, Siracole x Coimbatore Local Orange recorded high heritability along with high genetic advance for days taken for flower bud appearance, number of flowers per plant and single flower weight. Singh and Singh (2010) and Panwar *et al.* (2013) recorded similar results for single flower weight. This revealed that the characters are governed by the additive type of action and these characters are useful for phenotypic selection.

Table 1: Genetic parameters for morphological and yield parameters of F₂ population

Variability parameter	Crosses/ parent	Plant spread (cm)	Number of primary branches per plant	Number of secondary branches per plant	Days taken for flower bud appearance (days)	Total crop duration (days)	Number of flowers per plant	Flower size (cm)	Single flower weight (g)	Flower compactness	Total Flower yield (g/plant)
Mean	C4	54.91 ^a	11.91 ^b	28.49 ^b	50.63	115.12 ^b	97.69 ^a	4.26 ^b	4.76 ^b	1.07 ^b	476.10 ^b
	C5	45.71 ^b	13.16 ^a	29.02 ^a	49.32 ^a	118.07 ^a	98.03 ^a	4.51 ^a	5.85 ^a	1.40 ^a	565.89 ^a
PCV (%)	C4	14.91	32.80	33.40	14.21	7.54	20.75	28.04	43.55	145.34	58.28
	C5	17.92	29.99	24.87	14.92	8.16	20.66	27.56	38.08	117.25	51.12
GCV (%)	C4	11.20	24.82	28.60	11.93	6.02	16.31	19.52	32.54	60.99	39.74
	C5	13.64	22.86	18.22	12.64	6.86	16.23	19.97	29.92	59.76	36.42
Heritability (%)	C4	56.45	57.25	73.33	70.48	63.67	61.81	48.49	55.83	17.61	46.50
	C5	57.99	58.12	53.65	71.78	70.51	61.74	52.54	61.73	25.97	50.77
GAM (%)	C4	17.34	38.68	50.45	20.63	9.89	26.42	28.01	50.09	52.72	55.83
	C5	21.40	35.90	27.48	22.06	11.86	26.28	29.83	48.43	62.73	53.46

C4- Coimbatore Local Orange x Siracole, C5- Siracole x Coimbatore Local Orange; a, b – Similar letters indicate significantly on par among crosses

The study suggested that high heritability along with genetic advance was recorded in cross viz., Coimbatore Local Orange x Siracole for number of secondary branches, days taken for flower bud appearance, number of flowers per plant and cross Siracole x Coimbatore Local Orange viz., for days taken for flower bud appearance, number of flowers per plant, single flower weight. Thus, these characters could be improved through simple selection procedure due to the presence of additive type of gene action.

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