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Variability, heritability and genetic advance for yield, yield attributes and xanthophyll content in African marigold (*Tagetes erecta* L.)

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ABSTRACT

An investigation was carried out with 34 genotypes of African marigold to assess the variability, heritability and genetic advance to identify superior genotypes for further crop breeding programmes. High GCV was observed for number of flower heads per plant followed by xanthophyll content, number of branches per plant, flower yield per plant, flower head size and flower head weight. High heritability estimates of more than 95% were observed for plant height, stem girth, number of branches per plant, days to first flowering, flower head diameter, flower head size, number of flowers per plant, flower yield per plant and xanthophyll content. When heritability and genetic advance as per cent of mean were considered together, the characters like number of flowers per plant and flower head weight recorded the highest values.

Key words : African marigold, genetic advance, heritability, variability

INTRODUCTION

Marigold (*Tagetes erecta* L.) is one of the important commercial annual flower crops belonging to the family Compositae, grown in many districts of Tamil Nadu. Marigold is native of Central and South America, especially Mexico (Kaplan, 1960). The excellent keeping quality of flowers, long duration of flowering and attractive colours make them most popular. They can be grown in various types of soils and climate and almost any part of the year except in very cold winter. The main breeding objectives in marigold are increasing yield, early maturity, good shape, attractive colour flower head and xanthophyll content. Particularly, very little work has been done towards the genetic improvement of this plant for economic characters. Expression of yield and xanthophyll content is the outcome of interaction of several characters. Further, these are not only polygenically controlled, but also considerably influenced by the fluctuating environmental conditions. Hence, an attempt was made to study variability, heritability and genetic advance in 34 genotypes of African marigold including local and released varieties.

MATERIALS AND METHODS

The present investigation was carried out at Floriculture Complex, Department of Horticulture, Faculty of Agriculture, Annamalai University during the period 2002-04. Thirty-four genotypes of African marigold (*Tagetes erecta* L.) collected from diverse sources were used for the present study. Among the genotypes, 14 were obtained from Thiruvannamalai district local, seven from Madurai district local, five from Dindugul district, five from Chidambaram Taluk local (Cuddalore district) and the remaining two were collected from Coimbatore and Bangalore. Thirty-four genotypes were assessed in a field experiment under randomized block design with three replications. Twenty plants were maintained in each replication with spacing of 20 x 30 cm between row and plant, respectively. Cultural practices including need-based plant protection measures were followed as per recommendations (Yadav and Bose, 1983).

Observations were recorded on three randomly tagged plants from each genotype in each replication. The mean of the values of the three plants in each replication was utilized for statistical analysis. Observations were recorded on the following characters viz.,

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plant height, stem girth, number of branches per plant, days to first flowering, flower head diameter, flower head size, flower stalk length, flower head weight, number of flowers per plant, flower yield per plant and xanthophyll content. The phenotypic and genotypic coefficients of variations (PCV : GCV) were calculated as suggested by Burton (1952) and expressed in per cent. Heritability in the broad sense was calculated according to Robinson (1966) and expressed in per cent. Genetic advance was worked out based on the formula given by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

Before embarking on any selection programme, it is imperative to have knowledge on the magnitude of variability and the extent of heritable variation present in the material for the desired characters. Since the variance involves units, the estimates like phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV), which are devoid of measurements, are essential for valid comparison of different characters. The data on PCV and GCV for different traits that are presented in Table 1 confirmed the existence of wide variation. The GCV for different characters ranged from 11.32% for flower head diameter to 45.99% for number of flowers per plant. In general, high GCV observed for number of flowers per plant, flower head weight, flower head size, flower yield per plant, number of branches per plant and xanthophyll content which also confirmed the extent of fixable variation that is present among the genotypes which can be exploited.

Table 1. Estimates of coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean for various characters in African marigold (*Tagetes erecta* L.)

S. No.	Characters	Coefficient of variation (%)		Heritability	Genetic advance	Genetic advance as per cent of mean
		Phenotypic	Genotypic			
1.	Plant height	19.25	19.25	99.97	40.73	39.64
2.	Stem girth	14.85	14.64	99.84	8.69	50.87
3.	No. of branches/plant	24.73	24.71	97.18	1.19	29.74
4.	Days to first flowering	17.41	17.40	99.87	14.08	35.82
5.	Flower head diameter	11.49	11.32	97.14	1.45	22.99
6.	Flower head size	32.94	32.94	99.98	26.31	67.85
7.	Flower stalk length	13.24	13.11	98.10	1.65	26.76
8.	Flower head weight	35.47	35.39	99.61	5.05	72.78
9.	No. of flowers/plant	46.03	45.99	99.87	30.46	94.09
10.	Flower yield/plant	32.66	32.66	99.99	127.19	67.29
11.	Xanthophyll content	20.97	20.90	99.32	2.44	42.91

The comparison of the PCV and GCV values for different traits revealed that the difference was narrow for all the 11 characters. High amount of fixable variation in African marigold has been reported by several workers for different traits viz., individual flower yield per plant and flower yield per hectare (Samantaray *et al.*, 1999) and days to flowering and its durability (Nandkishore and Raghava, 2001). Sreekala *et al.* (2002) and Pattnaik and Mohanty (2002) compared the PCV and GCV values of different traits and the differences were narrow for flower diameter, plant height, plant spread, number of branches, days to flower, flower weight, flower yield per plant and total xanthophyll. These suggest that these characters may be less influenced by the environment.

The genetic coefficient of variation alone may not offer full scope to assess the relative amount of heritable variation present in the genotypes under study. Hence, a quantitative estimate of that portion of variability that is due to genetic effect is most important. This estimate is termed as heritability, which has a close bearing on its response to selection of genotypes, can be based on phenotypic performance. Thus, heritability precisely provides information on the relative efficiency of selection and to determine the extent to which different characters will respond to selection procedure. In the present study, the highest heritability estimated in broad sense was observed for flower yield per plant (99.99%) followed by flower head size (99.98%) and plant height (99.97%).

The heritability for all other traits was in the range of 97-100%. These results go in line with findings of Nandkishore and Raghava (2001), Sreekala *et al.* (2002), Pattnaik and Mohanty (2002) and Banu Pratap *et al.* (2003) in African marigold. This result is in congruent with the findings of Singh (2003) in Dahlia. High heritability values obtained for most of the traits in the present study showed that these traits may generally be governed by additive gene action and hence, the phenotype would provide a fairly reliable measure of the genotype which provides scope for selection on phenotypic performance. Johnson *et al.* (1955) were of the view that the heritability values alongwith estimates of genetic gain would be more useful and reliable than heritability value alone. Heritability would provide information only on the magnitude of inheritance of a quantitative character, while genetic advance will be helpful in formulating appropriate selection procedure. In the present study, the traits viz., number of flowers per plant, flower head weight, flower head size, and flower yield per plant recorded high heritability values combined with higher values of genetic advance as per cent of mean. High heritability combined with moderate values of genetic advance over the mean values was observed for stem girth, plant height, days to first flowering and xanthophyll content. This suggests substantial additive gene effect governing these characters and phenotypic selection will be useful in improving these traits. Despite high heritability, the genetic advance as per cent over mean was low for number of branches per plant, flower head diameter and flower stalk length, which may be attributed to non additive gene effects, involving dominance deviation and epistatic influences. This result is in accordance with the findings of Syamal and Kumar (2002) in dahlia and Palai *et al.* (2003) in hybrid tea rose. A number of reports in other flower crops also support the findings of the present study. Hence, it may be concluded that the characters viz., number of branches per plant, flower head size, flower head weight, number of flowers per plant, flower yield per plant, and xanthophyll content exhibited high variability and hence, exceedingly amenable and provide scope for crop development programme. In the present study, high heritability with high genetic advance was observed for the traits viz., number of flowers per plant, flower head weight, flower head size, and flower yield per plant and hence these traits can be improved by practising simple selection method.

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