Journal of Ornamental Horticulture, New Series Vol. 5 (2): 5-7 (2002)

ASSESSMENT OF VARIABILITY FOR CAROTENOIDS AND YIELD COMPONENTS IN AFRICAN MARIGOLD

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ABSTRACT

Assessment of variability by simple measures of variability for different carotenoids and yield components were carried out with 10 selected genotypes in African marigold. Study revealed very high variability for total carotenoids and its fractions like total xanthophyll, xanthophyll esters, free xanthophyll and lutein, compared to morphological characters/yield components. Also, there was high environmental influence for all the characters studied. Heritability estimates were high for different carotenoids, but among the morphological characters, flower diameter and flower weight showed maximum heritability. The study indicated that there is sufficient variability for carotenoids in marigold, so genetic improvement programmes for this character in marigold can be initiated.

Key words : *African marigold, caroteroid, variability*

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 (Singh and Narayanan, 2000). Diversity among parental lines is a prerequisite for heterosis breeding. Hence, an insight into the magnitude of genetic variability present in a population is very important for starting a judicious breeding programme.

Carotenoids in marigold (*Tagetes spp.*) has emerged as a poultry feed mix and food colourant. Lutein, a major component of marigold carotenoid is having therapeutic values (Gau *et al.*, 1983). To start with breeding approaches for improvement of carotenoids, the assessment of variability is a must. Also, considerable influence of morphological and yield characters on total carotenoid yield has been proved (Sreekala *et al.*, 2002). So variability studies for yield components is also having due significance, which has been attempted in the present study.

MATERIALS AND METHODS

From the existing germplasm of African marigold *(Tagetes erecta* L.), 10 genotypes were selected for the present study in the Division of Floriculture and Landscaping, IARI, New Delhi. Three of them were male sterile lines, having apetalous flowers and the remaining seven were orange coloured normal flowered lines or varieties.

The experiment was laid out in a randomised block design with three replications. Seeds were sown in September 1998 and one month old seedlings were transplanted to the main field at a spacing of 45 x 45 cm. Biometrical characters were recorded at mid-flowering stage, while number of flowers and flower yield were recorded throughout the flowering duration.

For analysis of carotenoids, flowers at full bloom stages were harvested. The total carotenoid content of the flower petal and components such as

total xanthophylls, xanthophyll esters and free xanthophylls were estimated using the procedure suggested by Strain (1942) with modifications adopted from Quackenbush and Miller (1972). The major component, lutein was estimated according to method of Philip and Bery (1976).

Genetic parameters were calculated according to the methods suggested by Burton (1952) and Singh and Narayanan (2000).

RESULTS AND DISCUSSION

Phenotypic and genotypic variances and heritability for yield components are given in Table 1. Except for flower diameter, all other characters showed higher phenotypic variance compared to genotypic variance. Consequently genotypic coefficient of variation for all the characters under study were very low compared to respective phenotypic coefficient of variation. Among yield components, flower diameter showed maximum variance, followed by flower weight and flower yield per plant. The differences between genotypic and phenotypic coefficient of variation were not conspicuous for flower diameter, which indicated that there is minimum influence of environment on this character.

Heritability values indicate that there is very high heritability (92.20%) for flower diameter, which points out that selection can be a good method for genetic improvement of this character. Heritability value for flower weight was also very high. High values of heritability in the broad sense was recorded for plant height, plant spread, number of branches, and flower yield per plant. Days to flower, number of flowers per plant and total flowering duration showed low to medium heritability. Low heritability and wide variation between genotypic and phenotypic coefficient of variation suggested that improvement of these characters through selection is not viable.

Total carotenoids and all its fractions under study showed higher phenotypic variance compared to genotypic variance suggesting the environmental influence on this trait. The genotypic coefficient of variation was high for total carotenoids and all its fractions under study compared to morphological characters. The genotypic variance is contributed by additive, dominance and interaction variance. Higher variance for the characters mentioned indicated that there is high genetic variability and genetic improvement is possible by simple selection.

For all the components of carotenoids under study, phenotypic coefficient of variation was higher than genotypic coefficient of variation, indicating that there was high degree of environmental influence. From the genetic variance values (Table 2) it is clear that the environmental influences are maximum on total carotenoids. For total xanthophyll, xanthophyll esters and lutein the differences between genotypic and phenotypic coefficient of variation were not high indicating that selection can also be practiced for improvement of these components but for total carotenoids and free xanthophylls, the environmental influences were prominent and selection for these characters may be misleading.

Very high heritability for total xanthophyll, xanthophyll esters and lutein compared to other

Table 1. Phenotypic and genotypic variances and heritability for yield components

Genetic parameters	Plant height (cm)	Plant spread (cm)	No. of branches	Days to flower	No. of flowers/ plant	Flower weight (g)	Flower diameter (cm)	Flowering duration (days)	Flower yield/ plant (g)
Genotypic variance	35.45	25.47	1.58	0.45	11.58	14.15	5.05	4.18	304.33
Phenotypic variance	93.56	68.44	4.42	3.60	54.79	20.79	5.48	19.54	844.03
Heritability (%)	37.90	37.30	35.70	12.70	21.10	68.10	92.20	21.50	36.10
GCV (%)	8.66	8.70	14.95	0.63	12.54	29.54	36.29	1.18	28.06
PCV (%)	14.07	14.26	25.03	1.78	27.28	35.81	37.80	2.55	46.73

Table 2. Phenotypic and genotypic variances, heritability and genetic advance for carotenoids in parents

Genetic parameters	Total carotenoids	Total xanthophyll	Xanthophyll esters	Free xanthophyll	Lutein
Genotypic variances	1.91	1.64	1.38	0.016	0.95
Phenotypic variances	2.19	1.79	1.53	0.025	1.01
GCV (%)	57.83	57.43	60.24	45.18	57.67
PCV (%)	61.92	59.96	53.43	56.46	59.47
Heritability broadsense (%) (from parents)	87.21	91.62	90.20	62.13	97.06
Heritability narrowsense (%) (from line x tester)	10.00	49.92	31.00	9.38	28.11

traits indicated that genetic improvement of these traits are possible by selection but heritability in the narrowsense should be calculated for confirmation of the possibility for selection, since these traits are highly influenced by the environment.

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(Received : October 4, 2000; accepted : November 20, 2000)