Studies on genetic variability, heritability, genetic advance and character association in marigold (*Tagetes* spp.) under North Karnataka region

Abstract

Twenty cultivars of marigold (*Tagetes* spp) were evaluated to determine genetic variability, heritability, genetic gain and character association for growth and yieldcontributing characters. The magnitude of PCV was higher than the GCV for all the fourteen characters under study. The estimates of genotypic and phenotypic coefficient of variations were ranged from 10.87 % to 50.65 % and 11.48 % to 50.96 % respectively.Heritability was high for all the growth and flowering parameters and ranged from 89.60 % to 99.00 %. Highest heritability was observed for leaf width (99.00 %) followed by flower yield per plant (98.90 %). High genetic advance and genetic advance as per cent of mean were observed highest in plant height (42.08) and leaf width (96.34 %). Correlation coefficient analysis indicated that the characters *viz*., plant height, plant spread in east-west and north-south direction, number of primary and secondary branches per plant, leaf length, number of flowers per plant, individual flower weight, flower diameter and flowering duration exhibited positive significant correlation (genotypic and phenotypic) with flower yield per plant. Our investigation indicated that these characters are important in deciding the flower yield per plant. Hence, these characters may be considered as selection indices for deciding flower yield per plant and might be considered as selection indices in marigold improvement programme.

Keywords: Marigold,genetic variability, heritability, genetic advance, correlation coefficient

1. Introduction

Marigold (*Tagetes* spp.) belongs to the family asteraceae and native of South and Central America.*Tagetes erecta* (African marigold) and *Tagetes patula* (French marigold) are commonly grow species for loose flower production which are either single, semi double or double types. It is one of the most important traditional flower crops grown across the country, owing to its ornamental and industrial uses. It is widely grown for its loose flowers used for religious offerings, social functions, bedding plant in landscape gardening and extraction of carotenoids raised the importance of this crop and increased the area under its cultivation. It is also grown for landscaping and occupies an ever increasing demand in medicinal and industrial sector. Marigold is suggested as trap crop for monitoring the *Helicoverpa*incidence in most of vegetable crops and has nematicidal properties.To improve the yield through selection of better varieties, knowledge of the genetic variability and nature of association of flower yield and its components is very essential. For most of the traits, the knowledge about degree of phenotypic and genotypic coefficients of variation and correlation of the traits is important. Such a study may be useful and effective in selection for simultaneous improvement of the component characters that contribute towards yield.

2. Materials and methods

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The present investigation was carried out during Rabi season at Department of Floriculture and Landscape Architecture research block, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot.Twenty cultivars collected from diverse source comprising of eleven African marigold and nine French marigold cultivars were grown in a randomized complete block design (RCBD) with three replications. Seeds of all the cultivars were sown on the protrays to raise seedlings. Transplanting of seedlings was done when they attain three to four true leaves stage.The cultivars were planted with a spacing of 60 x 45 cm with all the agronomical practices and plant protection measures. The observations were recorded on five randomly tagged five plants from each cultivar of each replication. For all the characters under study,the mean values of randomly selected plants were calculated for each observation.Genotypic and phenotypic coefficients of variation were estimated according to Burton and Devane (1953) based on estimate of genotypic and phenotypic variance and Genotypic and phenotypic correlation coefficients were estimated assuggestedbyPanseandSukhatme(1985).

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3. Results and Discussion

3.1 Genetic variability, heritability and genetic advance:

The results indicated (Table 1.) significant differences among the genotypes for twenty three characters studies in this experiment. In present study, the magnitude of PCV was higher than the GCV for all the fourteen characters under study and narrow gap between PCV and GCV were observed for all the characters under study, suggested less influence of the environment on these characters. Similar findings were also reported by Sreekala *et al.* (2002) and Namita *et al.* (2008) in marigold.The estimates of genotypic and phenotypic coefficient of variations were ranged from10.87 % to 50.65 % and 11.48 % to 50.96 % respectively. The estimates of GCV and PCV were higher for the all fourteen characters. The results are in agreement with the findings of Santhosh *et al.* (2018) and Kumar *et al.* (2019) in marigold.

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High heritability estimates associated with high genetic advance mean of per cent was noticed for plant height, plant spread in east-west direction, plant spread in north-south direction, number of primary branches and secondary branches, stem diameter, leaf length, leaf width, number of flowers per plant, flower yield per plot, flower yield per ha, individual flower weight, flower diameter, flowering duration and shelf life indicating the role of additive gene action and hence simple selection may be rewarding. These results were in conformity with the results ofKavitha and Anburani (2009)in marigold. High estimates of heritability are of great importance to the plant breeder as it will enable the plant breeder to formulate criteria based on phenotypic performance. If heritability of a character is very high, a selection for the character is fairly easy because there would be a close correspondence between the genotype and the phenotype due to a relatively smaller contribution of the environment to the phenotype. High heritability coupled with low genetic advance indicating the operation of non-additive gene actions in the inheritance of this trait and the desired results may not be obtained by simple selection. The high heritability is being exhibited due to favourable influence of environment rather than cultivar selection for such traits may not be rewarding (Namita *et al.*, 2008).

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Table 1. Genetic variability estimates for growth, yield and quality parameters in different marigold cultivars

Sl. No	Characters	Mean	Range		GCV (%)	PCV (%)	h^2(%)	GA	GAM (%)
			Max	Min					
1	Plant height	56.00	80.77	26.94	36.71	37.17	98.70	42.08	75.14
2	Plant spread [E-W] (cm)	40.35	50.55	28.43	18.14	18.62	94.90	14.68	36.39
3	Plant spread [N-S] (cm)	38.58	49.28	25.80	17.60	18.11	94.40	13.59	35.23
4	Primary branches	17.18	22.70	12.30	17.88	18.50	93.40	6.11	35.59
5	Secondary branches	26.62	33.45	19.75	14.42	15.18	90.20	7.51	28.20
6	Stem diameter (cm)	1.27	1.53	0.99	33.00	33.76	95.60	0.90	66.46
7	Leaf length (cm)	6.72	14.90	3.46	41.58	42.21	97.00	5.67	84.36
8	Leaf width (cm)	5.15	12.47	2.65	47.01	47.26	99.00	4.96	96.34
9	Number of flowers per plant	98.10	122.60	77.60	10.87	11.48	89.60	20.79	21.19
10	Flower yield per plant (g)	399.01	604.26	178.44	36.79	37.20	98.90	30.73	75.37
11	Individual flower weight (g)	4.11	7.14	1.09	50.65	50.96	98.80	4.26	71.30
12	Flower diameter (cm)	4.36	6.57	2.20	32.93	33.13	94.50	2.94	67.42
13	Flowering duration (days)	54.21	71.45	39.25	18.85	19.48	93.60	20.38	37.59
14	Shelf life (days)	4.41	6.33	2.22	27.66	28.27	95.70	2.46	55.74

GCV: Genotypic coefficient of variance, **PCV:** Phenotypic coefficient of variance, **h^2:** Heritability (Broad sense),

GA: Genetic advance, **GAM:** Genetic advance as percent mean

3.2 Correlation coefficient analysis

The potential programme expected in accomplishing the objectives demands knowledge of inter relationship among various component characters contributing the yield, while helps the breeder in the formulation of simultaneous selection schemes. Character associations may vary with environmental conditions. Association of economically important yield characters of quantitative nature is quite used as basis for selection. Since, breeder has to handle a very large population in achieving the objectives, it is impossible to evaluate the population for each and every quantitative trait. Therefore, it is necessary to have the estimates of correlation of yield with other traits for which the genotypes could be assessed visually or measured easily. This correlation analysis helps in examining the possibility of improving yield through indirect selection of its component traits which are highly correlated with yield prior to any breeding programme for genetic improvement in crops. It is imperative to obtain information regarding the inter relationship of different plant characters with yield and among themselves, since it facilitates a quick assignment of high yielding genotypes in selection program. The real or true association could be known only through genotypic correlation which eliminates the environmental influence.

The positive and significant to correlation (genotypic and phenotypic) of flower yield per plant was obtained withplant height, plant spread in east-west direction, plant spread in north-south direction, number of primary branches, number of secondary branches, leaf length, number of flowers per plant, individual flower weight, flower diameter and flowering duration (Table 2 &3). The associations of these characters with flower yield per plant are in desirable direction and selection of these traits may ultimately improve the yield.(Table 1). The positive and significant to highly significant correlation of flower yield

per plant was also observed by Singh and Saha (2009), with plant height and weight per flower; Karuppaiah and Kumar (2010) with flower diameter, flower size, Flower weight, number of flowers per plant and xanthophyll content, Kavitha and Anburani (2010) with number of flowers per plant, number of laterals per plant, flower head size, stem girth, plant height and xanthophyll content,Bharathi*et al.* (2014) with plant height, stem girth, number of flowers per plant, flower size, single flower weight and number of flowers per plant, Choudhary *et al.* (2015) for plant spread, stem diameter, number of primary branches per plant, number of secondary branches per plant, number of flowers per plant, flower size, number of secondary branches per plant, duration of flowering and fresh weight of flower.

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Table 2. Genotypic correlation of flower yield and its contributing traits in different marigold cultivars

@	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14
X1	**1**	0.994**	0.993**	0.425	0.897**	0.949**	0.757**	-0.436	0.735**	0.986**	0.359	0.439	0.597**	0.971**
X2		**1**	0.780**	0.609**	0.969**	0.981**	0.822**	-0.300	0.878**	0.781**	0.976**	0.915**	-0.388	0.594**
X3			**1**	0.746**	0.716**	0.550*	0.633**	0.412	0.574**	0.471*	0.639**	0.625**	0.774**	0.570**
X4				**1**	-0.350	0.433	0.521*	0.628**	0.630**	0.801**	0.786**	0.877**	0.542*	0.528*
X5					**1**	0.703**	-0.389	0.619**	0.664**	0.423	0.361	-0.402	-0.431	0.524*
X6						**1**	-0.335	0.692**	-0.381	0.383	-0.257	0.482*	-0.303	0.424
X7							**1**	0.575**	0.643**	-0.290	-0.432	0.363	0.544*	0.461*
X8								**1**	0.422	0.485*	0.598**	-0.448*	0.651**	0.433
X9									**1**	0.789**	0.340	-0.810**	0.496*	0.608**
X10										**1**	0.992**	-0.417	0.879**	0.583**
X11											**1**	0.900**	-0.335	0.987**
X12												**1**	0.642**	0.903**
X13													**1**	0.250
X14														**1**

* Significant at 5% level ** Significant at 1% level

X_1-Plant height (cm), X_2-Plant spread [East-West] (cm), X_3-Plant spread [North-South] (cm), X_4-Primary branches, X_5-Secondary branches, X_6-Stem diameter (cm), X_7-Leaf length (cm), X_8-Leaf width (cm), X_9-Number of flowers per plant, X_{10}-Individual flower weight (g), X_{11}-Flower diameter (cm), X_{12}-Flowering duration (days), X_{13}-Shelf life (days), X_{14}-Flower yield per plant (g)

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Table 3. Phenotypic correlation of flower yield and its contributing traits in different marigold cultivars

@	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14
X1	**1**	0.976**	0.965**	0.397	0.852**	0.927**	0.741**	-0.389	0.697**	0.969**	0.328	0.410	0.574**	0.951**
X2		**1**	0.720**	0.579**	0.912**	0.932**	0.790**	-0.279	0.836**	0.759**	0.936**	0.885**	-0.350	0.580**
X3			**1**	0.726**	0.645**	0.511*	0.594**	-0.396	0.568**	0.459*	0.607**	0.580**	0.741**	0.564**

X4				**1**	-0.324	0.402	0.490*	0.593**	0.579**	0.776**	0.749**	-0.821**	0.523*	0.504*
X5					**1**	0.684**	-0.350	0.604**	0.585**	-0.395	0.323	-0.382	-0.418	0.486*
X6						**1**	-0.273	0.656**	-0.355	-0.358	-0.231	0.453*	-0.285	0.418
X7							**1**	0.481*	0.622**	0.264	-0.419	0.337	0.515*	0.435
X8								**1**	0.412	0.468*	-0.587**	-0.433	0.629**	0.422
X9									**1**	0.758**	0.318	-0.785**	0.456*	0.578**
X10										**1**	0.977**	-0.384	0.856**	0.566**
X11											**1**	0.861**	-0.316	0.957**
X12												**1**	0.626**	0.875**
X13													**1**	0.235
X14														**1**

* Significant at 5% level ** Significant at 1% level

X_1-Plant height (cm), X_2-Plant spread [East-West] (cm), X_3-Plant spread [North-South] (cm), X_4-Primary branches, X_5-Secondary branches, X_6-Stem diameter (cm), X_7-Leaf length (cm), X_8-Leaf width (cm), X_9-Number of flowers per plant, X_{10}-Individual flower weight (g), X_{11}-Flower diameter (cm), X_{12}-Flowering duration (days), X_{13}-Shelf life (days), X_{14}-Flower yield per plant (g)

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4. Conclusion

High estimates of PCV and GCV were recorded which indicates the sufficient variability in the available germplasm,indicate the existence of wide range of genetic variability. High estimates of heritability coupled with high genetic suggesting the role of additive gene action in the inheritance of these characters and positive significant correlation (genotypic and phenotypic) with flower yield per plant.Hence, there is a good scope for the improvement of these characters through selection and responsiveness of these traits to appropriate selection for evolution of improved cultivars of marigold due to low influence of environment whereas these traits had a more importance for selection in breeding programme.

5. References

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