

## Marigold Genotypes Characterization Using Morphological Characters

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### ABSTRACT

The study was conducted on performance of 20 genotypes of marigold under tropical conditions of Tirupati. Experiment was laid out in Randomized block design (RBD) with three replications, at Citrus Research Station, Tirupati during two winter season of 2016-17 and 2017-18. All the genotypes showed significant variations for growth, flowering and yield parameters. Twenty genotypes of marigold were selected and their different morphological characters both at vegetative and flowering stages were determined and categorized on the basis of their plant characters. All the genotypes showed significant variations for different growth, flowering and yield parameters. The maximum plant height (103.8 cm) was recorded in genotype Yellow Benz Tall and minimum (27.9 cm) in African Vanilla. The maximum number of branches per plant (20.2) was recorded in genotype Yellow Benz Tall and minimum in Suvarna Orange. The highest fresh weight of plant (586.1 g) was found in genotype Semi Tall Orange which was statistically at par with Yellow Keonic (572.6 g) and significant to all other genotypes, whereas it was lowest (73.3 g) in AW Dwarf Yellow. Among these genotypes, Inca Orange took minimum days to first flower opening (36.6 days), whereas the maximum days to first flower opening (59.2 days) were recorded in Suvarna Orange. The maximum fresh weight of flower (16.1 g) was recorded in genotype Vikrant Yellow, whereas it was the minimum in AW Dwarf Yellow (2.2 g). The genotype Pusa Narangi Gainda exhibited better performance in terms of number of flowers per plant (70.4) and flower yield per plant was highest in Astagandha(874.9 g).

words: Characterization, flowering, genotypes, growth, marigold, plant characters

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### INTRODUCTION

Among loose flower crops, marigold (*Tagetes* Linn.) is one of the most important commercial flower crops grown worldwide. It belongs to the family Asteraceae and is native to the South and Central America, especially Mexico, where it is being utilized in traditional medicine as well as for ornamental purpose (15). In India, marigold ranks first among the loose flowers followed by chrysanthemum, jasmine, tuberose and crossandra (8). Genus *Tagetes* consists of 33 species, out of these species, *Tagetes erecta* L., commonly called African marigold and *Tagetes patula* L. popular as French marigold are of great horticultural importance and are grown commercially for exquisite blooms. Both the species of marigold are suitable for garden display and grown commercially for use as cut flowers and loose flowers. It is highly suitable as a bedding plant in an herbaceous border and is also ideal for newly planted shrubberies to provide colour and to fill the space.

Characterization and identification of cultivars is crucial to variety release programme and in the coming times of WTO regime for the registration of the genotypes /cultivars. Until a collection has been properly evaluated, it has little practical use (4). Characterization should eventually lead to a system of recording and storing useful data that can be readily retrieved and made available to others and help in planning breeding programmes (5).

Practically a variety must be distinct, uniform and stable in the characters that are adopted for use in varietal characterization and identification. The marigold has tremendous diversity with respect to growth habit and morphology. The ability to distinguish and identify varieties of cultivated species is fundamental to the operation of germplasm improvement programme. Characterization based on the qualitative characters is useful in their identification, because of reliability of qualitative and attributes over environments. Therefore, the study will be very helpful for taxonomic characterization of different genotypes.

## MATERIAL AND METHODS

The experiment was conducted at Citrus Research Station, Tirupati from November, 2016-17 and September, 2017-18. The soil of the experimental field is red loamy with pH 6.4. The region lies in Seshachalam hill ranges dominated by sedimentary rocky-hilly terrain. It receives an average rainfall of 900- 1000 mm with sub-humid conditions and remains almost free from frost. During summers the temperature touches the mark of 42-45 degrees centigrade, whereas during winters it falls to 18- 20o C. The source of planting material is from Indian Institute of Horticultural Research, Namdhari Seeds and Indus Seeds Bangalore.

The materials utilized for the present study consisted of 20 genotypes of African marigold (*Tagetes erecta*J) Raised nursery beds of size 3.0 x 1.0 m were first prepared and drenched with captan (0.01%). Seeds of different genotypes were sown in lines. The nursery beds were watered daily twice for first 10 days and daily once for the remaining period. The seedlings were ready for transplanting at 28-30 days after sowing. One month old, healthy, vigorous and uniform seedlings were selected and transplanted in 60 beds during September. The plot size was kept 3x3m and in each plot consisted of 30 plants and they were transplanted at a spacing of at a spacing of 30 x 30 cm in beds of at a depth of 6-8 cm in three replications. All the fertilizer and protection measures was carried out as per the recommendations. The plants were earthed-up after one month of planting by making ridges along the plant rows. The observations were recorded on five randomly selected plants in each treatment plot and the mean values were statistically analyzed using analysis of variance technique. Five plants were selected in each replication of each genotype for taking observations after discarding the border plants at both the ends. All observations on the plant and its related parts were made at full bloom stage. The experimental data of two years relating each parameter were pooled and statistically analyzed by technique of analysis of variance using randomized block design.

## RESULTS AND DISCUSSION

The different morphological characteristics of 20 genotypes were collected for the characterization of individual genotypes of marigold and shown in Table 1. Based on plant growth habit, the marigold genotypes were classified into two groups i.e. compact and open. Out of these seven genotypes showed compact, whereas remaining thirteen genotypes showed open growth habit. Similarly, the examination of branching habit, seven genotypes exhibited full branching habit, while remaining thirteen genotypes showed basal branching habit. There was no genotype with middle and top branching habit. Based on stem colour, the genotypes assessed were classified into green, dark green and purple which represented on eleven, four and six genotypes respectively. The variation between the genotypes for different morphological characters may be attributes to the differences in the genetic make-up of these genotypes. The above results are in conformity with the findings of in marigold (10) and in cluster bean (17).

The marigold genotypes assessed exhibited two different shapes of stem viz., smooth and ridged, where sixteen genotypes had smooth and remaining four genotypes exhibited ridge shape of stem. Likewise on the basis of stem pubescence, the two main groups of marigold genotypes were distinguished as glabrous and non-glabrous. Most of the genotypes sixteen were found glabrous, while only four genotypes showed non glabrous nature. Qualitative characters are considered as marker characters in the identification of genotypes of marigold, which are less influenced by environmental fluctuations. These results are in congruence with the findings in dahlia (1), marigold (10) and Christmas rose (24).

Among the twenty genotypes, on the basis of leaf colour, the four main groups of marigold genotypes were distinguished as pale green, light green and dark green. Four genotypes showed pale green, another five genotypes had light green and eleven genotypes had dark green color of leaves. Thus, there appeared not much larger difference in leaf colour of most of the genotypes. For leaflet shape, the genotypes exhibited two discrete leaf shapes viz., narrow pointed and oval pointed. Out of twenty genotypes five genotypes possessed narrow pointed and remaining fifteen genotypes showed oval pointed leaflet shape. On the basis of leaflet margin two main groups were made i. e. smooth, serrated and highly serrated. For the characterization of marigold genotypes, six genotypes showed serrated margin, fourteen genotypes expressed smooth margin of leaflets. The genotypes of marigold were classified into glabrous and non-glabrous groups on the basis of leaf pubescence. The five genotypes come under glabrous category, whereas fifteen genotypes come under non-glabrous category. (3,13,19) also substantiated that the flower colour, presence and absence of pod hair, colour of hair and seed colour were the most stable characters across the agro-climatic zones.

Based on the presence or absence of disc, thirteen genotypes were placed in visible group, while remaining seven genotypes in invisible group. According to the size of flower the marigold genotypes were classified into two main groups viz., medium and big flowered. The medium group size of flowers included only ten genotypes and remaining big size included ten genotypes. Similar observations have already been reported in chrysanthemum (6) and in gladiolus (7) for characterization and categorization of different genotypes.

The data recorded in Table 2 show significant differences among genotypes for various vegetative parameters. The maximum plant height (103.8 cm) was recorded in genotype Yellow Benz Tall followed by Semi Tall Orange (96.3 cm) and Arjun Yellow (85.7 cm), whereas it was minimum (27.9 cm) in African Vanilla. The highest number of branches per plant (20.2) was observed in genotype Yellow Benz Tall, which was statistically superior to all other genotypes and the minimum (8.4) in Suvarna Orange. The highest fresh weight of plant (586.1 g) was found in genotype Semi Tall Orange which was statistically at par with Yellow Keonic (572.6 g) and significant to all other genotypes, whereas lowest fresh weight of plant (73.3g), was recorded in AW Dwarf Yellow. The above results are in accordance with the findings of (14,18,21) in marigold, who obtained similar trends while evaluating different genotypes of African marigold.

The stalk length is very important parameters for marigold cut flowers. It is one of the characters, which decide the quality of cut flowers. The results of flower stalk length clearly indicated that the genotype Yellow Benz Tall, Pusa Narangi Gaiinda, Tennis Ball was significantly superior to other genotypes with mean value 26-22 cm. Moreover the genotype AW Dwarf Yellow was found to have minimum stalk length 4.0 cm. The variation in plant height, number of branches, fresh weight of plant and stalk length may be due to the congenial environment to express the dominant genes in the genotypes. The increase in this character could be due to higher uptake of nitrogen. Nitrogen is a very important constituent of protoplasm and its favourable effect on chlorophyll content of leaves might have increased the synthesis of carbohydrates, amino acids, etc. from which phytohormones have been synthesized resulting in increase in vegetative characters (11). Variation in these vegetative growth parameters has also been reported by (20,21) in marigold germplasm. The data presented show significant variations in terms of days taken to first flower opening and these ranged from 59 to 36 days. The genotype Inca Orange took minimum days to first flower opening (36.6 days) which was at par with the genotype AW Dwarf Orange (39.7 days) while genotypes Suvarna Orange took the maximum number of days to first flower opening (59.2 days). The maximum number of flowers per plant (70.6) was recorded in Pusa Narangi Gaiinda which was statistically at par with all the genotypes, whereas it was minimum (28.1) in genotype African Vanilla. The marked variation for various flowering attributes might be due to genetic make-up of the genotypes. This could be due to more dry matter accumulation because of absorption of more nitrogen and other nutrients and nutrients uptake in addition to prevailing environment conditions. The above results are in conformity with the findings in China aster (12) and in marigold (9,16).

The maximum fresh weight of flower (16.2 g) was recorded in genotype Astagandha followed by Vikrant Yellow (16.1g) whereas the minimum fresh weight of flower (2.2 g) was observed in genotype AW Dwarf Yellow. This could be due to variation in number

offlowers as it is negatively correlated with the average weight of flowers. Similar observations have been reported in chrysanthemum (2).

Yield is one of the most important characters for commercial flower cultivation in marigold. Highly significant differences were observed in flower yield per plant among the genotypes. The maximum flower yield per plant (874.9 g) was recorded in genotype Astagandha followed by Vikrant Yellow (867.2 g) while it was minimum (89.3 g) in AW Dwarf Yellow. The above results are in accordance with the findings of (23) who obtained similar trends, while evaluating different germplasm of French and African marigold.

**Table 1 Characterisation of marigold genotypes for morphological characters**

S no	Genotypes	Plant Growth habit	Branching habit	Stem color	Stem shape	Stem pubescence	Leaf color	Leaf shape	Leaf margin	Leaf pubescence	Disc floret	Floret size
1	Pusankarangi Ganda	Open	Basal	Dark green	Smooth	Glabrous	Light green	Pointed	Smooth	Non glabrous	Non visible	Medium
2	Inca Yellow	Compact	Full	Green	Ridged	Non glabrous	Dark green	Narrow	Serrated	Glabrous	Non visible	Big
3	Inca Orange	Compact	Full	Purple	Ridged	Non glabrous	Dark green	Narrow	Serrated	Glabrous	Non visible	Big
4	Suvarna Orange	Open	Basal	Dark green	Smooth	Glabrous	Pale green	Pointed	Smooth	Non glabrous	Visible	Medium
5	Yellow Keonic	Open	Basal	Dark green	Smooth	Non glabrous	Dark green	Pointed	Smooth	Non glabrous	Non visible	Medium
6	Suvarna Yellow	Open	Basal	Dark green	Smooth	Glabrous	Pale green	Pointed	Smooth	Non glabrous	Visible	Medium
7	African Vanilla	Compact	Full	Dark green	Smooth	Glabrous	Dark green	Pointed	Serrated	Glabrous	Visible	Big
8	DoubleOrange	Open	Basal	Purple	Smooth	Glabrous	Light green	Pointed	Smooth	Non glabrous	Non visible	Big

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Medium	Medium	Medium	Big	Medium	Big	Big	Big	Big	Big	Big	Big	Medium	Medium
Non visible	Non visible	Non visible	Non visible	Visible	Visible	Visible	Visible	Non visible	Non visible	Non visible	Non visible	Non visible	Non visible
Non glabrous	Non glabrous	glabrous	glabrous	Non glabrous	Non glabrous	Non glabrous	Glabrous	Non glabrous	Non glabrous	Glabrous	Glabrous	Glabrous	
Smooth	Smooth	Smooth	Serrated	Serrated	Smooth	Smooth	Smooth	Serrated	Smooth	Smooth	Smooth	Smooth	Smooth
Narrow	Pointed	Pointed	Narrow	Narrow	Pointed	Pointed	Pointed	Pointed	Pointed	Pointed	Pointed	Narrow	Pointed
Dark green	Light green	Light green	Dark green	Dark green	Pale green	Dark green	Pale green	Dark green	Dark green	Light green	Dark green	Light green	Light green
Glabrous	Glabrous	Glabrous	Non glabrous	Non glabrous	Glabrous	Non glabrous	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous
Smooth	Smooth	Smooth	Ridged	Ridged	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Dark green	Dark green	Green	Purple	Dark green	Dark green	Dark green	Dark green	purple	Dark green	Dark green	Green	Green	Green
Basal	Basal	Full	Full	Basal	Basal	Basal	Full	Basal	Basal	Basal	Basal	Basal	Full
Open	Open	Compact	Compact	Open	Compact	Open	Compact	Open	Compact	Open	Open	Open	Open
Anandkeonic	Semi tall Orange	Arjun Yellow	Astagantha	AM Mixed	Tennis Ball	Yellow Max	Rocket Gold	Vikrant Yellow	Yellow Benz Tall	Arka Agni	AW Dwarf Yellow		
9	10	11	12	13	14	15	16	17	18	19	20		

**Table 2: Mean performance of marigold genotypes for various growth related traits**

Genotype	Plant Height	Stalk length	No of Primary branches	Fresh wt of plant	Days for flowering	No of flowers /plant	Fresh wt of flowers (g)	Flower yeild/plant (g)
PusaNarangiGainda	80.92	24.50	12.55	359.03	41.23	70.67	7.32	320.70
Inca Yellow	32.15	6.53	14.12	319.77	44.05	31.00	8.80	246.87
Inca Orange	30.17	4.60	9.50	80.50	36.67	43.50	2.30	108.63
Suvarna Orange	80.67	24.17	8.47	215.37	59.25	59.25	6.53	268.40
Yellow Keonic	62.67	16.95	13.78	572.60	49.25	62.17	9.60	533.00
Suvarna Yellow	60.53	9.22	12.35	365.84	52.07	53.17	13.80	726.53
African Vanilla	27.92	4.57	15.02	173.23	52.17	28.17	6.45	183.00
Double Orange	72.13	14.15	11.35	421.52	39.05	63.00	7.60	569.53
AnandKeonic	61.88	11.17	10.12	260.32	39.47	57.67	9.63	446.77
Semi tall Orange	96.30	9.30	11.28	586.12	51.55	58.83	10.10	618.77
Arjun Yellow	85.78	9.27	12.18	301.90	52.73	43.50	9.53	413.10
Astagandha	58.02	8.22	11.38	351.70	55.93	54.17	16.20	874.97
AM Mixed	48.96	6.75	16.35	348.75	51.43	34.00	9.57	340.03
Tennis Ball	53.53	22.07	12.15	445.30	56.60	58.00	9.70	581.70
Yellow Max	57.35	9.02	9.18	253.83	41.45	43.50	9.40	442.10
Rocket Gold	67.15	15.18	10.23	441.58	48.37	53.00	8.37	474.93
Vikrant Yellow	77.50	9.17	13.08	286.83	46.90	51.83	16.15	867.23
Yellow Benz Tall	103.83	26.97	20.23	453.23	45.10	62.00	8.42	571.47
Arka Agni	81.13	20.55	11.67	343.78	43.80	38.83	8.48	351.20
AW Dwarf Yellow	33.37	4.03	10.02	73.33	39.72	40.33	2.20	89.30
CD	1.243	0.354	0.270	11.157	1.69	1.84	0.32	5.973
SE(m)	0.432	0.123	0.094	3.882	0.59	0.64	0.111	2.078

## CONCLUSION

Thus, it may be concluded that variations in these cultivars are due to genetic and environmental interaction. The results of the present investigation suggested that the plant and flower characters viz., plant growth habit, branching habit, stem colour, stalk shape, stem pubescence, leaf colour, leaflet shape and margin, leaf pubescence, days taken to first flower opening, stalk length, number of flowers per plant, fresh weight of flowers were found quite useful in characterization and categorization of marigold genotypes and such these traits could be utilized as good descriptors in the identification and maintenance of marigold genotypes. The genotypes Yellow Benz Tall exhibited best performance on number of branches per plant, and PusaNarangiGainda with maximum number of flowers per plant and Astagandha with maximum flower yield per plant.

## REFERENCES

- Adhya, S. R. (2010). Characterization and evaluation of dahlia (*Dahlia spp.*) germplasm. M. Sc. thesis, Bangabandhu Sheikh MujiburRahman Agricultural University, Salna, Gazipur, Bangladesh.
- Batra, A., Banerji, B. K and Dwivedi, A. K (2012). Morphological and biochemical characterization of chrysanthemum cultivars. *Indian Sci. Indus. Res. News* **20** : 192-95.
- Chakravorty, A. and Ghosh, P. D. (2012). Characterization of landraces of rice following DUS guidelines. *Res.Plant Bio.* **2** : 30-40.
- Chang, T. T. (1976). Genetic conservation of rice germplasm for evaluation and utilization. Technical Bulletin. IRRI, Los Banos, Philippines. pp. 1-15.
- Dabas, B. S., Mathur, P. N. and Pareek, S. K (1994). Collection, characterization and maintenance of plant genetic resources of millets, arid legumes, medicinal plants and aromatic plants. In : *Ex-situ Conservation of Plant Genetic Resources*, Rana, R. S., Saxena P. K., Tyagi, R. K, Saxena, S. and Mitter, V. (eds.). NBPGR, ICAR, New Delhi. pp. 72-80.
- Gupta, V. N. and Datta, S. K (2005). Morphological and chemical characterization of 30 small flowered chrysanthemum cultivars. *J. Orn. Hort.* **8** : 91-95.

7. Hossain, M. D., Talukder, K H., Asaduzzaman, M., Mahmud, F., Amin, N. and Sayed, M. A. (2011). Study on morphological characteristics of different genotypes of gladiolus flower. *J. Sci. Foundation* **9** : 01-08.
8. Kavitha, R. and Anburani, A. (2009). Genetic diversity in African marigold (*Tagetes erecta* L.) genotypes. *J. Orn. Hort.* **12** :198-201.
9. Khanvilkar, M. H., Kokate, K D. and Mahalle, S. S. (2003). Performance of African marigold (*Tagetes erecta*) in North Konkan Coastal Zone of Maharashtra. *J. Maharashtra Agric. Univ* **28** : 333-34.
10. Mathew, R. (2004). Genetical studies and characterization in marigold. Ph. D. thesis, CCS Haryana Agricultural University, Hisar, Haryana, India.
11. Maynard, G. and David, M. O. (1987). The Physiology of Plants under Stress. Willy Interscience Publications, New York.
12. Munikrishnappa, P. M., Patil, A.A., Patil, V. S., Patil, B. N., Channappagoudar, B. B. and Alloli, T. B. (2013). Studies on the growth and yield parameters of different genotypes of China aster (*Callistephus chinensis* Nees.). *Karnataka J. Agric. Sci.* **26** : 107-10.
13. Nancee (2012). Genetic characterization in vegetable cowpea [*Vigna unguiculata* (L.) Walp.]. M. Sc. thesis, CCS Haryana Agricultural University, Hisar, Haryana, India.
14. Narsude, P. B., Kadam, A. S. and Patil, V. K. (2010). Studies on the growth and yield attributes of different African marigold (*Tagetes erecta* L.) genotypes under Marathwada conditions. *Asian J. Hort.* **5** : 284-86.
15. Panwar, S., Singh, K. P., Janakiram, T. and Namita (2013). Genetic variability, heritability and genetic advance in African marigold (*Tagetes erecta* L.) genotypes. *Prog. Hort.* **45** : 135-40.
16. Raghuvanshi, A. and Sharma, B. P. (2011). Varietal evaluation of French marigold (*Tagetes patula* Ninn.) under mid-hill zone of Himachal Pradesh. *Prog. Agric.* **11** : 123-26.
17. Rana, R. (2006). Characterization and vigour assessment of cluster bean [*Cyamopsis* Haryana Agricultural University, Hisar, Haryana, India
18. Rao, C. C., Goud, P. V., Reddy, K. M. and Padmaja, G. (2005). Screening of African marigold (*Tagetes erecta* L.) cultivars for flower yield and carotenoid pigments. *Indian J. Hort.* **62** : 276-79.
19. Sharma, A., Sehrawat, S. K., Singhrot, R. S. and Tele, A. (2010). Morphological and chemical characterization of *Psidium* species. *Nat. Bot. Hort. Agrobot. Cluj.* **38** : 28-32.
20. Singh, A. K. and Singh, D. (2010). Genetic variability, heritability and genetic advance in marigold. *Indian J. Hort.* **67** : 132-36.
21. Singh, D. and Singh, A. K. (2005). Evaluation of French marigold (*Tagetes patula* L.) and wild marigold (*Tagetes minuta* L.) under sub mountainous Tarai conditions. *J. Orn. Hort.* **8** : 134-36.
22. Singh, D. and Singh, A. K. (2006). Characterization of African marigold (*Tagetes erecta* L.) genotypes using morphological characters. *J. Orn. Hort.* **9** : 40-42.
23. Singh, D., Sen, N. L. and Sindhu, S. S. (2003). Evaluation of marigold germplasm under semi-arid conditions of Rajasthan. *Haryana J. Hort. Sci.* **32** :206-09.
24. Susek, A. (2008). Morphological descriptors of christmas rose (*Helleborus niger* L.). *Agricultura* **5** : 27-31.