Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2019; 8(5): 2476-2478
Received: 10-07-2019
Accepted: 12-08-2019

**Omem Tamut**
Ph.D. Scholar, ICAR-Indian Agricultural Research Institute, New Delhi, India

**Kanwar Pal Singh**
Professor, Principal Scientist, Division of Floriculture and Landscaping, IAR, New Delhi, India

**Corresponding Author:**
**Omem Tamut**
Ph.D. Scholar, ICAR-Indian Agricultural Research Institute, New Delhi, India

# Studies on genetic variability, heritability and genetic advance in French marigold (*Tagetes patula*)

**Omem Tamut and Kanwar Pal Singh**

**Abstract**
The eleven genotypes of French marigold (*Tagetes patula*) numbered as var. Dainty Marietta, Boy-O-Boy, Gulzafri Orange, Gulzafri Yellow, Bolero Red, Queen Sophia, Pusa Arpita, Orange Winner, Red Brocade, F/R-8 and F/R-2, were evaluated to determine genetic variability, heritability, genetic gain for twenty three contributing characters. In present study, the magnitude of PCV was higher than the GCV for all the twenty three characters under study. Heritability was high for all the growth and flowering parameters which ranged from 86.57 % to 99.34 %. Highest heritability was observed for fresh weight per flower (99.34%) followed by flower yield per plant (99.24%). High genetic advance and genetic advance as per cent of mean was observed highest in flower yield per plant (464.27) followed by number of flowers per plant (93.66). The estimates of genotypic and phenotypic coefficient of variations were ranged from 12.32 % to 63.15% and 12.65% to 63.39%, respectively. The characters like weight of flowers per plant, weight of flowers per plants, number of disc florets per flower and number of flowers per plant could be exploited for improvement through crop breeding programme.

**Keywords:** French marigold, genetic variability, heritability, genetic advance

## Introduction

Floriculture is expanding very fast as an industry world over, lot of importance is being given to this sector due to its multiple uses, satisfying the aesthetic needs of the people, creating more employment, ensuring higher rate of returns to rural people and facilitating earning more foreign exchange. More specifically, they are being used as raw materials in the manufacture of essence, perfumes, medicines and confectioneries for direct consumption by the society. In India, large amount of total floriculture area is under loose or traditional flower production. India's is share in the world floriculture trade is around 0.6% and approximately 328.00 thousand hectares area was under cultivation in floriculture with production of 1,695 thousand tonnes loose flowers during 2016-17 (3rd Estimates APEDA). Enormous genetic diversity, varied agro climatic conditions and versatile human resources offer India a unique scope for diversification into new avenues which have not been explored to a greater extent.

Marigold (*Tagetes* sp.) which belongs to the family asteraceae and native of South and Central America, especially Mexico is one of the most popular loose flower crops grown in India due to its ease in cultivation, low nutrient requirement, easily availability of planting material and adaptation under wide range of growing conditions. Major marigold growing states are Karnataka, Gujarat, Maharashtra, Haryana, Punjab, Andhra Pradesh, Uttar Pradesh, Chhattisgarh, Odisha, Jammu & Kashmir, West Bengal, Tamil Nadu, *etc.* It occupies an area of marigolds occupies an area of 66.13 Thousand Ha. with production of 603.18 Thousand MT loose flower (NHB database, 2015-16) [1].

Marigold species, *Tagetes erecta* (African marigold) and *Tagetes patula* (French marigold) are commonly groe for loose flower flower production which are either single, semi double or double. Depending on the species, *Tagetes* species grow well in almost any type of soil and are known to have good tolerance to biotic and abiotic stresses. These species are also used in landscaping or bedding due to their variable plant height, flower color and forms. Marigold flower are used for festive occasions, marriages, religious ceremonies, social functions *etc* owing to its wide range of attractive colors.

## Materials and Methods

The field experiment was carried out at the research farm of Division of Floriculture and Landscaping, ICAR-Indian Agricultural Research Institute, New Delhi, at 77◦ 12' E longitude 28◦40'N latitude and at an altitude of 228.16m above the mean sea level. The experimental design was a randomized block with three replications.

The materials utilized for the present study consisted of genotypes of French marigold (*Tagetes patula*). The seeds of were sown in the protrays with soilless mixtures comprising of cocopeat: perlite: vermiculite in ratio of 3:1:1 and planted inpolyhouse during rainy season, i.e. June during 2014. Irrigation was given daily with rosecan so as to maintain proper moisture. Drenching was done with 19:19:19 @ 0.5% (5g/l) at 15 days after sowing. Transplanting of these seedlings was carried when plants reached four to five leaf stage after sowing. The seedlings were then transplanted at spacing of 45×45 cm and Basal dose of N: P: K: @ 12.8g and 8.0g, respectively per square meter was applied at the timing of planting. Foliar application of urea (0.1%) was given after one month of transplanting of seedlings.

In rainy season crop, weekly irrigation was applied. Hoeing and weeding were done as and when required. Five plants were selected for taking observations after discarding the border plants at both the ends. Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1967) [2] using the mean values of random plant in each replication from all treatments. Genotypic and phenotypic coefficients of variation were estimated according to Burton and Devane (1953) [3] based on estimate of genotypic and phenotypic variance.

## Results and Discussion

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 twenty three 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*. (2003) [4] and Namita *et al*. (2008) [5] in marigold.

It was indicating the importance and influence of interaction of environment expression of the characters. The presence of narrow gap between PCV and GCV for all the characters under study, suggested less influence of the environment on these characters. The estimates of genetic parameters like phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability ($h^2$ broad sense) and genetic advance as per cent of mean (GAM) are presented in table (Table1).

The estimates of genotypic and phenotypic coefficient of variations were ranged from 12.32 % to 63.15% and 12.65% to 63.39%, respectively. The estimates of GCV and PCV were higher for the characters such as plant height, plant spread, pedicel length, leaf biomass, leaf length, leaf width, internodal length, total chlorophyll, duration of flowering, biomass at flower initiation, number of flowers per plant, flower longevity on the plant, flower diameter, fresh weight per flower, dry weight per flower, flower yield per plant and shelf life. The results are in agreement with the findings of Namita *et al*. (2008) [5] in marigold.

In the present investigation, high heritability estimates associated with high high genetic advance mean of per cent was noticed for plant height, plant spread, leaf biomass, days to first bud initiation, days to bud opening, days to first flowering, duration of flowering, biomass at flower initiation, flower yield per plant and harvest index, indicating the role of additive gene action and hence simple selection may be rewarding. These results were in confirmity with the results of Mishra *et al*. (1997) [6], in dahlia, Janakiram and Rao (1995) [7], Singh and Singh (2010) [8], Kavitha and Anburani (2010) [9] and Singh and Saha (2006) [10] in marigold. Similar finding reported by Talukdar *et al*. (2003) [11], Sirohi and Behera (2000) [12] and Barigidad (1992) [13] in chrysanthemum.) also reported the heritability estimates for all characters were high (>80%), except for number of harvests of loose flower. 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 were recorded for number of primary branches, pedicel length, stem girth, leaf length, leaf width, intermodal length, total chlorophyll flower longevity on the plant, flower diameter, fresh weight per flower, dry weight per flower and shelf life, 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 favorable influence of environment rather than genotype, selection for such traits may not be rewarding (Namita *et al*., 2008) [5].

**Table 1:** Estimates of genetic parameters for morphological related traits

| S.N | Characters | Heritability (%) | Genetic Advance | Genetic Advance as per cent mean | Genotypic coefficient of variation (%) | Phenotypic coefficient of variation (%) |
|---|---|---|---|---|---|---|
| 1 | Plant height (cm) | 93.1 | 38.22 | 63.55 | 31.97 | 33.14 |
| 2 | Plant spread (cm) | 94.02 | 27.52 | 53.26 | 26.66 | 27.5 |
| 3 | Number of primary branches | 86.57 | 4.46 | 37.73 | 19.69 | 21.16 |
| 4 | Pedicel length (cm) | 92.29 | 2.73 | 40.42 | 20.42 | 21.26 |
| 5 | Stem girth (cm) | 94.8 | 0.34 | 24.71 | 12.32 | 12.65 |
| 6 | Leaf biomass (g) | 98.43 | 60.42 | 53.3 | 26.08 | 26.29 |
| 7 | Leaf length | 94.38 | 5.81 | 49.44 | 24.7 | 25.43 |
| 8 | Leaf width | 94.92 | 3.23 | 45.84 | 22.84 | 23.44 |
| 9 | Internodal length (cm) | 94.74 | 0.92 | 45.42 | 22.65 | 23.27 |
| 10 | Total chl. (mg/g) | 92.5 | 1.24 | 44.27 | 22.35 | 23.24 |
| 11 | Days to first bud initiation | 94.93 | 26.64 | 38.81 | 19.34 | 19.85 |
| 12 | Days to bud opening | 95.83 | 26.09 | 28.97 | 14.37 | 14.68 |
| 13 | Days to first flowering | 95.66 | 25.5 | 27.76 | 13.78 | 14.09 |
| 14 | Duration of flowering (days) | 94.95 | 35.12 | 44.84 | 22.34 | 22.93 |
| 15 | Biomass at flower initiation (g) | 96.38 | 89.35 | 54.22 | 26.81 | 27.31 |
| 16 | Number of flower per plant | 96.05 | 93.66 | 95.9 | 47.5 | 48.47 |
| 17 | Flower longevity on the plant (days) | 97.27 | 6.07 | 41.83 | 20.59 | 20.88 |
| 18 | Flower diameter (cm) | 92.52 | 2.41 | 51.75 | 26.12 | 27.15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 19 | Fresh weight flower(g) | 99.34 | 2.33 | 63.46 | 30.91 | 31.01 |
| 20 | Dry weight per flower(g) | 95.65 | 0.25 | 67.64 | 33.57 | 34.33 |
| 21 | Flower yield per plant (g) | 99.24 | 464.3 | 129.6 | 63.15 | 63.39 |
| 22 | Harvest index (%) | 89.91 | 22.4 | 37.16 | 19.02 | 20.06 |
| 23 | Shelf life (days) | 94.32 | 0.93 | 41.24 | 20.61 | 21.22 |

## Conclusion

High estimates of PCV and GCV were recorded indicating sufficient variability in the germplasm for the characters *viz*., number of flowers per plant and flower yield whereas moderate estimates were observed in plant height, plant spread, leaf biomass, leaf length, biomass at flower initiation, flower diameter etc., indicate the existence of wide range of genetic variability. High estimates of heritability coupled with high genetic advance were recorded in flower yield, number of flowers per plant, biomass at flower initiation, leaf biomass suggesting the role of additive gene action in the inheritance of these characters. 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 genotypes of gaillardia due to low influence of environment whereas these traits had a more importance for selection in breeding programme.

## References


1. Anonymous. Indian Horticulture Database, National Horticulture Board. 2017.
2. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers 2nd Edn ICAR, New Delhi. 1967, 361.
3. Burton GW, Devane EW. Estimating heritability in tall fescue (*Festuca arundinaceae*) from replicated clonal material. Agronomy Journal. 1953; 45:478-481.
4. Sreekala C, Raghava SPS, Misra RL, Voleti SR. Assessment of variability for carotenoids and yield components African marigold. Journal of Ornamental Horticulture. 2003; 5(2):5-7.
5. Namita, Singh KP, Raju DVS, Prasad KV, Bharadwaj C. Studies on genetic variability, heritability and genetic advance in French marigold (*Tagetes patula*) genotypes. Journal of Ornamental Horticulture. 2008; 12(1):30-34.
6. Mishra YK, Joshi RP, Solanki SS. Genetic variability in Dahlia. Progressive Horticulture. 1997; 29(1-2):61-64.
7. Janakiram T, Rao TM. Effect of plant density on genetic parameters in African marigold (*Tagetes erecta* L.). Indian Journal of Horticulture. 1995; 52(4):309-312.
8. Singh D, Misra KK. Diallel analysis for combining ability in marigold (*Tagetus spp*). Karnataka Journal of Agricultural Sciences. 2010; 23(2):298-301.
9. Kavitha R, Anburani A. Genetic variability in African marigold (*Tagetes erecta* L.). Asian Journal of Horticulture. 2010; 5(2):344-346.
10. Singh KP, Saha TN. Genetic variability, heritability and genetic advance in French marigold (*Tagetes patula* L.). Indian Journal of Plant Genetic Research. 2006; 19(2):42-43.
11. Talukdar MC, Mahanta S, Sharma B, Das S. Extent of genetic variation for growth and floral characters in chrysanthemum cultivars under Assam condition. Journal of Ornamental Horticulture. 2003; 6(3):201-211.
12. Sirohi PS, Behera TK. Correlation and path analysis studies in chrysanthemum. Journal of Ornamental Horticulture. 1999; 2(2):80-83.
13. Barigagad H, Patil AA, Nalawadi UG. Variability studies in chrysanthemum. Progressive Horticulture. 1992; 24(1-2):55-59.