Plant Archives Vol. 24, Special Issue (GABELS), 2024 pp.639-644 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.SP-GABELS.100

EVALUATION AND GENETIC VARIABILITY ESTIMATION FOR PLANT GROWTH AND FLOWER YIELD-RELATED TRAITS AMONG THE DIVERSE GENOTYPES OF *TABERNAEMONTANA DIVARICATA*

Anasubai S. Hosagoudar*, Sateesh R. Patil, Sarvamangala Cholin, Balaji S Kulkarni, Shankar Meti, Laxman Kukanoor and H.P. Maheswarappa
University of Horticultural Sciences, Udyanagiri campus, Bagalkot-587103, Karnataka, India
*Corresponding Author E-mail: anu.handaragall@gmail.com

ABSTRACT

In the present experiment sixteen crepe jasmine (*Tabernaemontana divaricata)* genotypes in a Randomized complete Block Design with two replications at UHS, Bagalkot during 2020-22. The genotypes comprised eleven single-flower types and the remaining five were double-flower types. Among the single flower types, three were dwarf types and four were variegated. A total of nineteen quantitative traits including growth and yield parameters were recorded. Analysis of variance revealed significant variation among the genotypes for all the parameters studied indicating the scope for improvement. Among the genotypes, UHSB_CJ 14 recorded the highest plant height (110.41cm), whereas, UHSB_CJ8 the highest plant spread (N-S and E-W) was recorded in (102.48cm and 102.38 cm respectively). Among the flowering parameters, bud and flower diameter, bud length, and corolla length were recorded as highest in genotype UHSB_CJ11 (12.83 mm, 5.29 cm, 2.40cm, and 4.44cm respectively). Bud weight per plant was highest in UHSB_CJ 8 (171.99g). Among the genetic variability estimates, higher Genotypic coefficient of variation (GCV), Phenotypic coefficient of variation (PCV) and high estimates of heritability (h^2) coupled with genetic advance (GA) high genetic advance over percent of mean and were observed for all majority of the evaluated traits. The presence of genetic variability and superiority among the genotypes is attributed to both genetic and environmental influence. Some of the genotypes with higher yields and unique flower types were found suitable for commercial cultivation and landscaping.

Keywords : *Tabernaemontana divaricata,* genetic variability, GCV, PCV.

Introduction

Tabernaemontana, commonly known as Crepe jasmine belongs to the family Apocynaceae. It is an evergreen ornamental shrub native to India and now cultivated throughout Southeast Asia, as well as the warmer regions of continental Asia (Samanta *et al*., 2015). Approximately 100 species of *Tabernaemontana* are widely distributed in tropical countries around the world, including Brazil, Egypt, India, Sri Lanka, Vietnam, Malaysia, and Thailand. In India, it occurs in the upper Gangetic plain of West Bengal, Khasi Hills, Assam, Hills of Vishakapatnam, Karnataka, and Kerala. The plant is cultivated as an ornamental plant and grows wild in hedges and shady forests (Samanta *et al*., 2015).

The plant generally grows to a height of 5–6 feet (1.5–1.8 m) and is dichotomously branched. The large, shiny leaves are deep green and about 6 inches (15 cm) in length and 2 inches (5.1 cm) in width. The waxy blossoms are found in small clusters on the stem tips. Generally, the flowers are single and have the characteristic 'pinwheel' shape, also seen in other genera in the family Apocynaceae, such as Vinca and Nerium. Both single and double-flowered forms are cultivated and usually white. The plant blooms in spring but flowers appear sporadically throughout the year. The flowers of the single forms are unscented, but the double-flowered form has a pleasing fragrance (Niranjan *et al*., 2023).

Tabernaemontana species are popular ornamental plants due to their diverse flowering habits and adaptability. In recent times, farmers in southern parts of Karnataka have been cultivating this crop for garland making and religious purposes, as it can supply flowers throughout the year, unlike seasonal jasmine species. The TMC can be classified into single, double, dwarf, and variegated based on their morphological characteristics, but this method has led to numerous synonyms and posed challenges in classification. It is crucial to collect and evaluate different *Tabernaemontana* genotypes for crop improvement programs, as there is limited research on diversity and variability in this region.

Genotypic and phenotypic coefficients of variation are useful in detecting the genetic and environmental variability present in the genotypes (Kumar, 2014). Crop improvement depends on the magnitude of genetic variability and the extent to which the desirable characters are heritable. Heritability along with genetic advance increases the efficiency of selection in the breeding program by indirectly assessing the influence of environmental factors and predicting gene action (Vishnupriya *et al*., 2015)

Hence, the present study was conducted to generate the basic information on perse performance, genetic variability and heritability of important growth and yield characteristics among sixteen *Tabernaemontana* genotypes collected from different parts of Karnataka.

Material and Methods

The experiment was conducted on different genotypes of *Tabernaemontana* at Floriculture Block, MHREC, University of Horticultural Sciences, Bagalkot. The experiment was laid out in Randomized Complete Block Design (RCBD) with sixteen genotypes which were replicated twice. The different genotypes of *Tabernaemontana* were collected from different parts of Karnataka. Semi-hard wood and tip cuttings were brought and raised in the nursery. The collection includes 16 genotypes of *Tabernaemontana*. The collections consist of eleven single types and among them three were dwarf. Of these single types four were variegated. The remaining five were double-flowered (Table 1).

Five plants were randomly selected from each genotype in each replication for recording observations on growth, flowering, and yield characters (Table 2 and 3). The data collected on the quantitative characters were subjected to statistical analysis. The statistical analysis was done by adopting the standard procedures of ANOVA (Panse and Sukhatme, 1985). The critical difference was worked out at a five percent (0.05) probability. Analysis was carried out using MS Excel® spreadsheet and OPSTAT (Sheoran *et al*).

Results and Discussion

Analysis of variance revealed significant variation among the *Tabernaemontana* genotypes studied for all the evaluated growth and yield-related traits indicating the existence of genetic variation and the scope for selection of genotypes for further crop improvement programmes. Genotype, UHSB_CJ14 showed superior performance for plant height (110.41cm), whereas UHSB_CJ4 showed superior performance for primary and secondary branches (3.60 and 10.70), Lowest plant height (26.38cm) was noticed in UHSB_ CJ 15 and its plant spread was also found least. Significantly highest plant spread in East-West and North-South directions (102.48cm and 102.38 cm respectively) and leaf area index (8.81) was noticed in genotype UHSB_ CJ 8. The genotype UHSB_CJ2 (3.75 cm) was significantly superior over all other genotypes except UHSB_CJ3 (3.58 cm) which was on par with UHSB_CJ2. Significantly lesser intermodal length (0.59cm) was noticed in UHSB_CJ15.

The spread of these plants is due to the production of a greater number of branches per plant, branching habit and inter-nodal length, which are specific to the genotype. Kulkarni and Reddy (2004) also reported similar results in chrysanthemums, stating that the difference in the number of branches could be attributed to the genetic makeup of the cultivars. An increased number of branches leads to the production of more leaves, which in turn enhances the yield of flowers by improving the source and sink relationship. A similar trend was noticed by Gupta *et al*. (2015) in dahlia and Chowdhuri *et al*. (2015) in China aster genotypes and Ramachandrudu, Thangam (2010) in Crossandra and Kumar *et al*. (2024) in Nerium.

Among the flowering and flower yield-related parameters**,** the highest number of inflorescences per plant was recorded in the genotype UHSB_CJ6 (40.00) followed by the genotype UHSB_CJ8 and UHSB_CJ2 (36.70 and34.90 respectively). In addition, UHSB_CJ 2 also showed superior performance for the highest number of flowers per inflorescence (14. 30), bud and flower diameter (5.18mm), and bud weight per plant (165.10 g). The highest number of petals was found in double flower types such as UHSB_CJ 13 (48.10), followed by genotype UHSB_CJ 10 (14.85). Bud diameter and flower diameter were found highest in the genotype UHSB_CJ11 (12.83 mm and 5.29 cm respectively)**.** While minimum bud diameter and flower diameter were recorded in the genotype UHSB_CJ 15 (1.83 mm and 1.84 cm respectively).

Bud length of genotype UHSB_CJ 11 (2.40 cm) was significantly superior over all other genotypes. The highest corolla tube length and 100 bud weight was noticed in genotype UHSB_CJ 3 (2.48 cm and 319.50 g respectively) whereas, UHSB_CJ 15 recorded the shortest bud length and corolla tube length (1.03 cm and0.24 cm) respectively. The maximum shelf life of buds was also noticed highest in genotype UHSB_CJ13 (97.50hrs). Significantly lower shelf life of buds is noticed in UHSB_CJ 16 (11hrs). This might be due to the variation in genetic makeup leading to differential accumulation of carbohydrates and also due to disparity in sensitivity to ethylene as reported earlier in Nerium by Rajiv *et al.* (2018).

The variation in yield characteristics may be due to the genetic nature of the cultivar and also the effect of agroclimatic conditions. The varietal differences in yield potential may also be attributed to the gene effect. Similar results were obtained by Parashuram *et al.* (2018)in Nerium.

The higher yield is a result of certain plant characteristics, such as increased height, number of leaves and leaf area. These features may lead to greater production of photosynthates and accumulation of dry matter, which ultimately results in the production of a greater number of flowers per plant. Similar results were observed in Dahlia by Gupta *et al*. (2015), China aster by Tirakannanavar *et al*. (2015).

The estimates of various genetic variability parameters *viz.*, Genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sense, Genetic advance, Genetic advance over percent of mean for various characters are presented in Table 4. Higher GCV and PCV were recorded in the parameters like hundred bud weight (129.67 and 130.06 % respectively), No. of petals (112.97 and 113.14% respectively), Leaf area index (103.23 and 104.88% respectively), Shelf life of buds (65.76 and 65.80% respectively), bud length (61.76 and 63.38%), Bud diameter (58.98 and 59.99% respectively), bud weight/ plant (50.11 and 51.10% respectively), intermodal length (41.93 and 42.54% respectively), plant height (35.47 and 35.76% respectively), No. of inflorescence/ branch (33.12 and 36.63 %), plant spread E-W and N-S (28.48, 27.31 and 28.68, 27.59 % respectively), corolla length (26.91 and 30.16% respectively), No. of primary and secondary branches (24.95, 24.67 and 31.65, 34.27%) , flower diameter (22.71 and 27.99% respectively) and corolla tube length (19.72 and 24.12% respectively). This suggests that presence of sufficient genetic variability. Narrow differences between GCV and PCV were observed for all the characters which indicated the least influence of environment on these characters. Similar results were reported by Kumar *et al.* (2015) in Chrysanthemum, Hedge *et al.* (2022) in Dahlia.

The high estimate of heritability coupled with high genetic advance over percent of mean and genetic advance were observed for all the growth and flowering parameters. Plant height (98.36% and 72.47% respectively), plant spread N-S and E-W (97.99, 55.69% and 98.58 and 58.25% respectively), Leaf area index (96.86% and 209.29% respectively). No of flowers/inflorescence (83.35% and 50.988% respectively), Bud diameter (96.68% and 119.48%), corolla tube length (66.84% and 33.21%), 100 flower wt.(99.85% and267.54%), Shelf life of buds(99.86% and 135.37%) and Bud wt/plant (96.14% and 101.22%). Indicating the presence of additive gene action for these traits. Similar results were reported by Raghupathi *et al.* (2019) in Dahlia and Rajiv *et al.* (2012) in gerbera. Hence, these characters can be relied upon for further crop improvement.

Conclusion

The present study on the genotypic evaluation of *Tabernaemontana divaricata* indicates that each genotype possesses unique and specific characteristics, making them suitable for various applications such as preparation of garland and veni, religious purpose and landscaping. Based on both phenotypic and genotypic data, genotype UHSB_CJ3 was found to be good for commercial cultivation due to its corolla tube length, bud diameter, and growth parameters. On the other hand, genotypes UHSB_CJ11 and UHSB_CJ13 were identified as suitable for landscaping purposes. Further utilization of these genotypes in crop improvement programs helps to develop novel varieties through hybridization or mutation breeding.

Table 1 : List of genotypes for used for evaluation

S. No.	Genotype	Plant type (Growth habit)	Flower type
1	UHSB_CJ1	Normal	Single
2	UHSB_CJ2	Normal	Single
3	UHSB_CJ3	Normal	Single
4	UHSB_CJ4	Dwarf	Single
5	UHSB_CJ5	Normal	Single
6	UHSB_CJ6	Normal	Single
7	UHSB_ CJ 7	Normal, Variegated	Single
8	UHSB_ CJ 8	Normal, Variegated	Single
9	UHSB_ CJ 9	Normal	Single
10	UHSB_ CJ 10	Normal	Double
11	UHSB_ CJ 11	Normal	Double
12	UHSB_ CJ 12	Dwarf	Semi Double
13	UHSB_ CJ 13	Normal	Double
14	UHSB_ CJ 14	Normal	Double
15	UHSB_ CJ 15	Dwarf variegated	Single
16	UHSB_ CJ 16	Dwarf variegated	Single

Table 2: Performance of crepe jasmine genotypes for vegetative and floral characters

Sl. No.	Genotypes	Plant height (cm)	Plant spread (E-W) (cm)	Plant spread (N-S) (cm)	Primary branches (No'S)	Secondary branches (No'S)	Internodal length (cm)	Leaf area index	No. of inflorescence/ branch	No. of flowers/ inflorescence
1	UHSB_CJ1	87.03	71.38	72.90	1.80	3.50	2.80	2.95	29.40	9.40
2	UHSB_CJ2	97.91	81.39	81.53	1.80	6.90	3.75	4.17	34.90	14.30
3	UHSB_CJ3	85.30	71.75	73.15	1.80	3.50	3.58	2.94	27.20	11.50
4	UHSB_CJ4	34.51	49.03	47.44	3.60	10.70	0.91	0.48	23.90	8.90
5	UHSB_CJ5	80.80	62.68	67.40	3.60	7.10	2.73	0.84	22.20	7.50
6	UHSB_CJ6	95.98	99.35	96.44	2.10	6.10	3.24	1.67	40.00	12.20
7	UHSB_ CJ 7	71.64	66.84	73.31	2.20	6.50	2.08	0.47	18.00	9.10
8	UHSB_ CJ 8	102.95	102.48	102.38	1.90	6.50	3.13	8.81	36.70	11.00
9	UHSB_ CJ 9	82.26	76.64	81.09	2.90	7.60	3.02	1.96	25.60	12.40
10	UHSB_ CJ 10	73.68	78.00	81.79	2.10	5.50	3.15	1.73	22.80	6.40
11	UHSB_ CJ 11	74.93	87.09	79.45	1.20	5.50	2.34	1.82	20.50	8.20
12	UHSB_ CJ 12	48.40	60.00	60.71	1.90	5.15	1.60	0.60	22.20	9.70
13	UHSB_ CJ 13	89.63	63.10	63.44	2.00	9.00	2.60	1.70	12.70	4.60
14	UHSB_ CJ 14	110.41	80.95	79.95	2.40	6.10	2.05	1.95	18.30	7.60
15	UHSB_ CJ 15	26.38	34.36	34.98	2.40	8.10	0.59	0.29	8.00	5.90
16	UHSB_ CJ 16	27.95	31.58	37.78	2.50	9.80	0.61	0.19	32.40	8.00
S.Em±		**2.39**	**1.68**	**1.93**	**0.31**	**1.13**	**0.12**	**0.27**	**2.73**	**0.79**
CD 5%		**7.21**	**5.08**	**5.82**	**0.94**	**3.41**	**0.36**	**0.80**	**8.23**	**2.37**

Table 3 : Performance of crepe jasmine genotypes for floral quality parameters and yield

Sl. No.	Genotypes	Bud diameter mm)	Flower diameter (cm)	Bud length (cm)	Corolla length (cm)	Corolla tube length (cm)	No. of petals	100 bud wt	Shelf life of buds (hrs)	Bud wt/plant
1	UHSB_CJ1	8.19	3.86	1.11	3.14	2.25	5.00	62.95	73.00	136.05
2	UHSB_CJ2	5.43	5.18	0.83	2.91	1.75	5.00	22.08	24.50	165.10
3	UHSB_CJ3	7.83	3.86	1.19	3.25	2.48	5.00	58.38	75.50	143.79
4	UHSB_CJ4	3.04	2.33	0.39	2.08	1.31	5.00	8.13	24.50	44.33
5	UHSB_CJ5	3.15	4.10	0.64	2.36	1.85	5.00	18.83	33.00	156.37
6	UHSB_CJ6	4.49	4.65	0.74	2.64	1.69	5.00	22.26	25.00	117.32
7	UHSB_ CJ 7	3.01	4.30	0.50	2.10	1.56	5.00	11.53	27.50	47.27
8	UHSB_ CJ 8	4.35	4.32	0.66	2.55	1.67	5.00	21.69	28.50	171.99
9	UHSB_ CJ 9	4.65	4.21	0.73	2.60	1.56	5.00	17.77	27.50	86.56
10	UHSB_ CJ 10	12.55	5.11	2.09	3.86	1.78	13.30	283.00	95.00	90.29
11	UHSB_ CJ 11	12.83	5.29	2.40	4.44	1.86	13.20	260.50	97.00	85.64
12	UHSB_ CJ 12	6.17	3.75	1.50	3.35	1.25	12.90	62.98	82.00	108.66
13	UHSB_ CJ 13	12.28	4.84	1.89	3.54	1.92	49.00	319.50	97.50	98.45
14	UHSB_ CJ 14	12.07	4.57	1.70	3.47	1.52	13.10	149.90	95.50	129.97
15	UHSB_ CJ 15	1.83	1.84	0.24	1.34	1.03	5.00	5.51	11.50	11.12
16	UHSB_ CJ 16	3.03	2.45	0.40	1.80	1.30	5.00	6.12	11.00	13.97
S.Em±		**0.51**	**0.47**	**0.11**	**0.27**	**0.16**	**0.43**	**2.88**	**0.90**	**7.12**
CD 5%		**1.53**	**1.41**	**0.32**	**0.82**	**0.50**	**1.31**	**8.68**	**2.72**	**21.47**

Table 4 : Estimates of components of variance, heritability and genetic advance over mean for growth, flowering and yield parameters of Tabernaemontana genotypes

S No	Traits	Genotypic Coefficient of Variations	Phenotypic Coefficient of Variations	Heritability (%)	Genetic Advance	Genetic Advance value % means
1	Plant height	35.472	35.765	98.369	53.817	72.474
2	Primary branches	24.951	31.657	62.118	0.917	40.509
3	Secondary branches	24.67	34.27	51.822	2.459	36.585
4	Internodal length	41.93	42.543	97.139	2.032	85.13
5	Plant spread N-S	27.312	27.59	97.999	38.921	55.698
6	Plant spread E-W	28.48	28.683	98.584	40.653	58.251
7	Leaf area index	103.232	104.889	96.866	4.264	209.299
8	No. of inflorescence/ branch	33.123	36.63	81.769	15.225	61.701
9	No.of flowers/inflorescence	27.11	29.694	83.354	4.675	50.988
10	Bud diameter	58.989	59.991	96.686	7.833	119.487
11	Flower diameter	22.717	27.993	65.857	1.535	37.977
12	Bud length	61.765	63.38	94.967	1.318	123.992
13	Corolla length	26.91	30.16	79.609	1.404	49.46
14	Corolla tube length	19.724	24.125	66.841	0.556	33.219
15	No.of petals	112.972	113.146	99.693	22.728	232.365
16	100 flower wt	129.968	130.06	99.858	222.579	267.544
17	Shelf life of buds (hrs)	65.762	65.808	99.86	70.098	135.374
18	Bud wt/plant	50.111	51.106	96.147	101.653	101.221

Acknowledgment

The research was conducted with financial support from Staff research and PG grants of the University of Horticultural Science, Bagalkot.

References

Gupta, A.K., Jaiswal, N.K. and Saravanan, S. (2015). Varietal evaluation of different hybrids of Dahlia (*Dahlia variabilis L.).Int. J. Agric. Sci. Res.,* 5(1), 55-58.

Gupta, A.K., Jaiswal, N.K. and Saravanan, S. (2015). Varietal evaluation of different hybrids of dahlia (*Dahlia variabilis* L.) under Allahabad agro-climatic conditions. *International Journal of Agricultural Science and Research* (IJASR), 5(1), 55-58.

Hegde, B.N., Shirol, A.M., Harshavardhan, M. and Pavan, Kumar P. (2022). Evaluation of genetic variability, heritability and genetic advances In Dahlia (*Dahlia Variabilis* L.) Genotypes. *Asian Jr. of Microbiol. Biotech. Env. Sci.,* 24(2), 388-392.

Kulkarni, B.S., Reddy, B.S. (2004). Vegetative growth, flower yield and quality of different chrysanthemum cultivars. *J Orn. Hort.,* 7(3-4), 32-36.

Kumar, A.G., Jayajasmine, A., Bini Sundar, S.T., Elayaraja, K. and Vasanth, S. (2024). Ex-situ evaluation of genetic diversity in indigenous Nerium accessions. *Indian J. Hortic.,* 81(1), 61-67.

Parashuram, M., Rajadurai, K.R. and Haripriya, S. (2018). Evaluation of nerium cultivars for morphological, flowering and yield traits under Coimbatore conditions. *International Journal of Chemical Studies*, 6(3), 497-501.

Raghupathi, B., Mitra, S., Saon, B. (2019). Evaluation of genetic variability, correlation and path co-efficient analysis for cut flower attributing traits in medium decorative dahlia (*Dahlia variabilis* L.) *J Pharmacognosy and Phytochem.* 8(1), 465-469.

Rajiv, G., Jawaharlal, M., Subramanian, S., Sudhakar, D. and Uma, D. (2018). Studies on morphological characteristics and categorization of nerium accessions based on utility. *Electronic Journal of Plant Breeding*, 9(3), 1100-1106.

Rajiv, K., Deka, B.C., Venugopalan, R. (2012). Genetic variability and trait association studies in gerbera (*Gerbera jamesonii*) for quantitative traits. *Int. J Agric. Sci.,* 82(7), 615-619.

Ramachandrudu, K., and Thangam, M. (2010). Characterization and evaluation of local germplasm of crossandra (*Crossandra undulaefolia* Salisb.). *J. Ornam. Hortic*., 13(2), 138-141.

Niranjana, S., Visalakshi, M., Ganga, M., Irene Vethamoni, P. and Manikanda Boopathi, N. (2023). Evaluation of *Tabernaemontana divaricata* accessions for loose flower production. *Int. J. Environ. Clim. Change.*, 13(10), 2718-2725.

Samanta Dipu, Lahiri Kotisree, J Madhumita, Mukhopadhya and Mukhopadhyay Sandip (2015), Karyo morphological Analysis of different varieties of *Tabernaemontana coronaria. Cytologia,* 80(1), 67–73.

Sheoran, O.P., Tonk, D.S., Kaushik, L.S., Hasija, R.C. and Pannu, R.S. (1998). Statistical Software Package for Agricultural Research Workers. Recent Advances in information theory, Statistics & Computer Applications by D.S. Hooda & R.C. Hasija Department of Mathematics Statistics, CCS HAU, Hisar (139-143).

Tirakannanavar, S., Katagi, A., Jagadeesha, R.C. and Halesh, G.K. (2015). Studies on genotypic evaluation and correlation studies in China aster (*Callistephus chinensis* (L.)Nees.). *Indian Res. J. Genet.Biotech.*, 7(2), 179–186.

Vishnupriya, A.K., Jawaharlal, M. and Manivannan, N. (2015). Variability studies in African Marigold. *The Bioscan.,* 10(1), 407-409.