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Assessment of Genetic Variability, Heritability and Correlation in Crossandra (*Crossandra infundibuliformis* (L.) (Nees) Genotypes

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was carried out to study the performance of crossandra genotypes for morphological, flowering, yield, quality and screening for nematode resistance at the Department of Floriculture and Landscape Architecture, Tamil Nadu Agricultural University, Coimbatore during the year 2018-2019. Ten genotypes were investigated for ten quantitative characters viz., Plant height (cm), Plant spread both E-W& N-S (cm), No. of primary branches, Number of leaves, 100 flower weight (g), Number of flowers per spike, Number of spikes per plant, Rachis length and Yield per plant (g). The presence and magnitude of genetic variability is prerequisite for any breeding program. It will be useful for quantifying the genetic variability, heritability and genetic advance of genotypes to identify for high yielding characters. Phenotypic coefficient of variation was higher than the genotypic coefficient of variation for all the parameters recorded which shows greater influence

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over environment in plants. High GCV and PCV were recorded for plant height, number of leaves, rachis length, number of spikes per plant and yield per plant. High heritability with high genetic advance was noted in plant height, number of leaves, primary branches, number of spikes per plant, number of flowers per spike, 100 flower weight, rachis length and yield per plant. High heritability with high genetic advance is an important character for selection and these are traits controlled by additive gene action. From the correlation studies, yield per plant was positively correlated with number of primary branches, number of spikes per plant and rachis length. Further,positive and significant correlation was also recorded in rachis length, plant spread, number of spikes per plant and number of flowers per spike. Hence, simultaneous selection for the above traits would be more rewarding to bring improvement in crossandra.

Keywords: Genetic variability; correlation; crossandra genotypes.

1. INTRODUCTION

"Crossandra *(Crossandra infundibuliformis* (L.) (Nees**)** is a commercial loose flower crop mostly grown in southern region of India, The performance of genotypes exhibit wide range of variability with the climatic condition of their growing habitat and genetic potential of the individual genotype. The estimated area under crossandra cultivation in Tamil Nadu was 610 hectares and 2050 tonnes of production with productivity of 3.36 tonnes during 2016- 2017" (Data.gov.in, 2016-2017). "It also has some considerable medicinal property to cure wounds, aphrodisiac and pyorrhea" (Malars of India, 2016). Genotypic and phenotypic coefficient of variation shows the extent of variability in different traits due to environment and inherent capacity of genotype. Correlation also helps to improve the yield related components using association between yield and yield components. Based on these observations, genotypes will be selected for further breeding program. Therefore, the present study is focussed on to assess the genetic variability present in the population by using coefficient of variation and study the heritability of the character and the correlation among yield and component traits.

2. MATERIALS AND METHODS

The present investigation was carried out to study the performance of crossandra genotypes for morphological, flowering, yield, quality and screening for nematode resistance at the Department of Floriculture and Landscape Architecture, Tamil Nadu Agricultural University, Coimbatore during the year 2018-2019. Ten genotypes were raised in randomized block design with three replications. "The rooted cuttings collected from different locations were transplanted into the field in one side ridge with the spacing of 60 × 45 cm. Before transplanting, the rooted cuttings were dipped in carbendazim (1g/l of water) to avoid fungal infection. Planting was done in the early morning hours and irrigation was given immediately after transplanting to minimize the transplanting shock. After good establishment, irrigation was given once in a week and gap filling was done regularly. The data was collected on ten yield and yield contributing characters *viz.,* Plant height (cm), Plant spread both E-W& N-S (cm), No. of primary branches, Number of leaves, 100 flower weight (g), Number of flowers per spike, Number of spikes per plant, Rachis length and Yield per plant (g). Among different genotypes, five plants were randomly selected and tagged for taking observations and the mean value was calculated for analysis on three replications. The cultivation practices like irrigation, weeding, fertilization and pesticide application *etc*. were followed on proper times. The analysis of variance of RBD and their significance for all the characters" were worked out as suggested by Panse and Sukhatme (1954). The various genetic parameters *viz.,* ECV, GCV, PCV, heritability and GAM were calculated by adopting the formulae given by Johnson et al*.,* (1955).

3. RESULTS AND DISCUSSION

The mean performance of all the characters is presented in Table 1.Among the genotypes collected, Arka Shravya (54.66 cm) recorded the maximum plant height followed by Arka Ambara (48.16 cm). The variation in genotypes might be due to the genetic makeup of the individual genotype (Kulkarni and Reddy, 2004). The increased variation in plant height may also be due to elongation in meristematic region, rapid cell division and maximum internodal length of the plant. Arka Shravya recorded maximum East-West (44.00 cm) and North- South (33.33 cm) plant spread. The maximum plant spread may be

due to the production of more number of branches per plant, branching habit, internodal length, flowering habit and genetic character of each genotype. Variation in plant spread might be due to additive gene action of the genotype. Similar results were obtained in Arka Shravya by Priyanka et al. (2017) and Tejaswi et al. (2019) in crossandra. The maximum number of primary branches (4.60) was observed in genotypes Arka Shravya, Arka Kanaka and Arka Ambara. This trait directly contributes to growth parameters of genotypes. Genotype Arka Shravya (210.00) recorded the maximum number of leaves followed by Arka Kanaka (198.00). This trait might be depending on number of branches and genetical makeup of the individual genotype. Similar increased variation were observed by Poornima et al. (2006); Zosiamliana et al. (2013) in china aster, Uddin et al. (2015); Suvija et al. (2016); Singh et al. (2017) and Niki et al. (2016) in chrysanthemum.

"Maximum flower yield per plant was recorded in genotype Arka Shravya. Generally, this character depends on various independent characters like plant height, plant spread, more number of leaves, leaf area, flower size, weight of the flower, number of spikes and flowers per plant which help in production of more photosynthates resulting in high yield. The difference in flower yield potential is related to the additive gene effect" (Ramachandrudu and Thangam, 2010; Priyanka et al., 2017; Tejaswi et al., 2019) in crossandra.

The presence and magnitude of genetic variability is prerequisite for any breeding program. It will be useful for quantifying the genetic variability, heritability and genetic advance of genotypes to identify for high yielding characters. Phenotypic coefficient of variation recorded was higher than the genotypic coefficient of variation for all the parameters which shows that greater influence over environment in plants. High GCV and PCV were recorded for plant height, number of leaves, rachis length, number of spikes per plant and yield per plant. It indicates that maximum variability is observed in these characters. Moderate GCV and PCV was noticed in number of primary branches and 100 flower weight. Low GCV and PCV was found in plant spread.

"High heritability was found in all the characters recorded. High heritability value of a particular character had less influence of environment which is highly useful in selecting genetically good individual. High heritability with high genetic advance was noted in plant height, number of leaves, primary branches, number of spikes per plant, number of flowers per spike, 100 flower weight, rachis length and yield per plant. High heritability with high genetic advance is an important character for selection and these are traits controlled by additive gene action. Higher heritability with moderate genetic advance was recorded in plant spread. It is due to additive and non-additive gene effect. This character can be improved through hybridization or by selection" (Pornima et al., 2006). Similar reports were reported by Kadam et al. (2014) in gladiolus, Poornima et al. (2006) and Sankari et al. (2019) in china aster. The PCA analysis identified plant height, shoot number, plant spread, internode length, spike number, yield, flower weight, and leaf width as highly contributing traits for total variation. (Ashok Kumar, et al. 2024.)

3.1 Correlation Studies

"The correlation coefficient shows a strong association between plant morphological characters coupled with yield. A positive correlation between desirable characters is favorable to the plant breeder for using the genotypes in improvement of both the characters. Yield per plant was positively and significantly correlated with number of primary branches, number of spikes per plant and rachis length. Positive and significant correlation was also recorded in rachis length, plant spread, number of spikes per plant and number of flowers per spike. Number of spikes per plant was positively and significantly correlated with plant height, plant spread, number of primary branches and number of leaves. Positive and significant correlation was observed in number of flowers per spike with plant spread. 100 flower weight was positively and significantly correlated with number of primary branches. Number of leaves was positively and significantly correlated with plant height, number of primary branches and plant spread. Number of primary branches was positively and significantly correlated with plant height and plant spread. Positive and significant correlation was noted in plant spread and plant height" (Poornima et al., 2006) in China aster and Kumar et al. (2012) in chrysanthemum (Vinodh and Kannan, 2020).

Table 1. Mean performance of ten genotypes for different characters

Genotypes	Plant height (cm)	Plant spread (cm) 120 DAT		No.of primary branches	No.of Leaves	Days to flower	100 flower weight (g)	Rachis length (cm)	Number of spikes per plant	Number of flowers per spike	Flower yield per plant (g)
	120 DAT	N-S	E-W								
Arka Shravya	54.66	33.33	44.00	4.60	210.00	61.33	6.86	13.25	72.00	53.33	142.00
Arka Kanaka	47.33	31.05	35.00	4.60	198.00	69.33	7.18	8.60	51.00	33.33	112.00
Arka Shreeya	45.20	27.06	33.00	4.30	168.67	63.00	8.99	6.33	49.00	29.33	98.00
Arka Ambara	48.16	29.73	36.20	4.60	186.89	65.00	7.14	8.33	47.00	30.66	87.00
Arka Chenna	37.26	28.98	32.08	3.80	132.26	64.23	7.12	5.60	29.00	20.00	84.00
Nilakkottai local	43.00	31.00	36.50	3.60	146.33	67.66	6.02	7.33	23.00	29.33	41.00
Dharmapuri local	38.66	25.54	31.65	3.20	128.34	78.89	5.75	6.53	13.00	28.00	22.00
Delhi crossandra	24.45	27.98	32.65	3.40	72.25	64.02	6.58	8.40	20.00	38.33	72.00
Villupuram local	37.67	26.65	33.65	3.40	136.52	63.00	6.26	6.67	32.00	31.55	81.00
Neyveli local	35.65	27.02	33.82	3.60	112.53	68.42	5.98	6.40	25.00	29.01	80.00
Mean	41.20	28.83	34.85	3.90	149.17	66.48	6.78	7.74	36.10	32.28	81.90
S. Ed	2.09	1.44	1.73	0.20	7.45	3.35	0.35	0.36	1.80	1.52	4.10
CD (*P*=0.05)	4.17	2.88	3.46	0.39	14.89	6.70	0.70	0.71	3.60	3.03	8.19

Table 2. Mean, genotypic and phenotypic co- efficient variation, heritability and genetic advance as percent of mean for different parameters of crossandra genotypes

S.No	Characters	Mean	GCV	PCV	Heritability	GA (%) of mean
1	Plant height 120 DAT	41.20	20.05	20.90	92.00	39.62
2	Plant spread 120 DAT in N-S direction	28.83	7.74	9.70	63.74	12.74
3	Plant spread 120 DAT in E-W direction	34.85	9.79	11.38	74.00	17.34
4	No. of primary branches on 120 DAT	3.90	13.91	15.10	85.05	26.44
5	Number of leaves at 120 days	149.17	28.10	28.70	95.88	56.67
6	100 flower weight	6.79	13.32	14.66	82.70	24.96
7	Number of flowers per spike	32.29	26.76	27.31	95.97	54.00
8	Number of spikes per plant	36.10	50.05	50.38	98.66	102.40
9	Rachis length	7.74	28.05	28.57	96.44	56.76
10	Yield per plant	81.90	41.32	40.92	98.00	83.42

Table 3. Genotypic correlation coefficient for different characters of crossandra genotypes

	1	2	3	4	5	6	7	8	9	10
1	1	0.637*	0.717*	0.798**	0.977**	0.346	0.366	0.813**	0.539	0.530
2		1	0.835**	0.679*	0.649*	0.107	0.571	0.682*	0.765**	0.591
3		.	1	0.593	0.664*	0.006	0.814**	0.758*	0.906**	0.619
4				1	0.866**	0.635*	0.379	0.907**	0.555	0.788**
5					1	0.422	0.358	0.859**	0.537	0.611
6						1	-0.010	0.569	0.011	0.536
7							1	0.622	0.946**	0.585
8								1	0.719*	0.905**
9									1	0.634*
10									.	1

1- Plant height 120 DAT *2- Plant spread 120 DAT in N-S direction*
3- Plant spread 120 DAT in E-W direction *4- Primary branches in 120 DAT*
5- Number of leaves *6- 100 flower weight*
7- Number of flowers per spike *8- Number of spikes per plant*
9- Rachis length *10- yield per plant*
**Significant at 5% level* ***Significant at 1% level*

4. CONCLUSION

High heritability with high genetic advance was noted in plant height, number of leaves, primary branches, number of spikes per plant, number of flowers per spike, 100 flower weight, rachis length and yield per plant. High heritability with high genetic advance is an important character for selection and these are traits controlled by additive gene action. Further molecular characterization is essential for crossandra crop improvement programs.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors declare that No AI technologies have been used during writing or editing this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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