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Genetic variability of Custard Apple (*Annona squamosa* L.) Genotypes under Southern Rajasthan

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ABSTRACT: In the present investigation, an attempt has been made to generate information on genetic variability using thirty custard apple genotypes. The variability, heritability and genetic advance as percent of mean were performed for 22 selected characters among selected custard apple genotypes. The thirty genotypes were collected from the Udaipur, Rajsamand and Chittorgarh districts of Rajasthan. The higher phenotypic coefficient of variation was observed over genotypic coefficient of variation for all traits, indicating the dominance of environmental factors over these traits. Maximum GCV and PCV were recorded for pulp: seed ratio (37.95 and 38.62), number of flakes without seeds (29.32 and 29.98), non-reducing sugar (27.65 and 28.50), shelf life (25.84 and 27.16), acidity (22.58 and 24.19) and number of seeds fruit (21.71 and 22.85). The heritability estimation was varied from 45.97 to 96.76 % for traits under study. High heritability observed for fruit weight, pulp: seed ratio, number of flakes without seeds and non-reducing sugar. Genetic advance as percentage of mean was also found high for pulp: seed ratio, number of flakes without seeds, non-reducing sugar and shelf life. Hence, these traits imply the potential for crop improvement through clonal selection and wide hybridization.

Keywords: Custard apple, GCV, PCV, Heritability and Genetic Advance.

INTRODUCTION

Custard apple (*Annona squamosa* L.) is a most choicest semi-arid fruit tree which can tolerant high temperature by natural dormancy during hot summer in the family of *Annonaceae* have chromosome number 2n = 14. It is mainly of tropical origin and also found in areas of subtropical climate. It is called sugar apple, sweet sop and custard apple. In India, it's also commonly known as shareffa, sitaphal or seetaphal in Hindi language. Annona means that year's harvest and squamosa means scaly pertaining to the dimensions like structure of the fruit surface. Custard apple has been naturalized within the Deccan upland because of its hardy nature and hence, it's a very important dryland fruit crop. In India it's cultivated in Maharashtra, Rajasthan, Gujarat, Madhya Pradesh, Andhra Pradesh, Chhattisgarh, Karnataka, Bihar, Orissa and Tamil Nadu states. Besides India, it is also very common in China, Phillippines, Egypt and Central Africa. Among Annonaceous fruits, custard apple is most favourite in India. It is presently grown in an area of about 29.87 thousand hectares with a production of 387.26 MT (Anonymous, 2023) and the average productivity is 765 q/ha, whereas Rajasthan occupies 5.34 thousand hectares with 4.60 MT production and the average productivity is 600 q/ha. (Anonymous, 2023). In Maharashtra, the custard apple is widely grown on over an area of 32,845 hectares (Anonymous, 2023). In Rajasthan state no commercial cultivation exists at farmers field for custard apple but found in wild sanctuary and forest areas of Udaipur, Chittorgarh, Rajsamand, Sirohi, Swai Madhopur districts with limited fruit production on wastelands. The varietal or genetic differences get masked by confusing varietal identification in custard apple. In this regard's knowledge of the genetic variability of different genotypes are important to form a basis for conservation, genetic improvement and promotion of domestication of the population with desirable traits, hence estimation of genetic variability parameters like GCV, PCV, ECV, heritability and GA% is very important to identify elite genotypes.

METERIAL AND METHODS

Thirty custard apple (*Annona squamosa* L.) genotypes were evaluated at three districts of Rajasthan i.e., Udaipur, Rajsamand and Chittorgarh during 2018-19 to 2019-20 using RCBD design with three replications and observations were recorded on 22 different quantitative and qualitative traits. genetic variability parameters were estimated for 22 characters under study as suggested by Hanson *et al.* (1956) ; Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The genetic variability with respect to 22 characters in 30 genotypes were estimated in terms of range, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) along with heritability (h^2) and genetic advance as per cent over mean (GAM) are presented in Table 1. Higher values of GCV and PCV were observed for, pulp: seed ratio, fruit weight, number of flakes without seeds, non-reducing sugar, shelf life and acidity. The phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all the traits studied, indicating that the apparent variation is due to genotype and the influence of the environment. Similar results are in confirmation with study by Yadav *et al*. (2017); Chandel *et al*. (2018); Anita *et al*. (2019); Goutam *et al*. (2019); Janapika *et al*. (2021).

Genotypic coefficient of variation (GCV). Genotypic coefficient of variation (GCV) was estimated for the 22 characters ranging from thickness of fruit rind (7.68) to pulp to seed ratio (37.95). Higher extent of GCV was recorded for pulp to seed ratio (37.95) followed by number of flakes without seeds (29.32), non-reducing sugar (27.65), shelf life (25.84) and acidity (22.58). These findings are in agreement with the study of George *et al*. (1999); Chandel *et al*. (2018); Arivazhagan *et al*. (2019); Janapika *et al*. (2021).

Phenotypic coefficient of variation (PCV). The phenotypic coefficient of variation (PCV) was estimated for the 22 characters ranging from time of harvest maturity (9.56) to pulp: seed ratio (38.62). Higher magnitude of PCV was recorded for pulp: seed ratio (38.62) followed by number of flakes without seeds (29.98), non- reducing sugar (28.50), shelf life (27.16) and acidity (24.19) these results indicate the dominance of PCV over the GCV. Similar results were confirmed by Chandel *et al*. (2018); Anita *et al*. (2019); Arivazhagan *et al*. (2019).

Heritability. The higher heritability in terms of broad sense was recorded for the characters *viz*. fruit weight (96.76), pulp: seed ratio (96.57), number of flakes without seeds (95.68), non-reducing sugar (94.12), flower size (92.06) and tree height (91.73). These traits are less influenced by environmental factors due to additive gene action. Similar findings were reported by Islam *et al*. (2010); Singh *et al*. (1997); Wang and Luo (2001); Chandel *et al*. (2018); Janapika *et al*. (2021).

Genetic Advances. The genetic advance estimation was found higher in fruit weight (87.30) followed by time of harvest maturity (16.86), number of flakes with seeds (13.91), number of seeds fruits (13.83) and pulp: seed ratio (9.22). Similar observations were reported by Islam *et al*. (2010); Anita *et al*. (2019); Arivazhagan *et al*. (2019); Janapika *et al*. (2021).

Table 1: Genetic variability parameters for different characters of custard apple genotypes.

Sr. No.	Characters	Range		GCV	PCV	ECV	h^2 (%) (BS)	GA	GA % mean
		Max	Min						
1.	Tree height (m)	3.32	1.80	15.15	15.82	4.55	91.73	0.76	29.90
2.	Leaf length (cm)	12.21	6.97	15.49	16.77	6.41	85.36	2.71	29.50
3.	Leaf breadth (cm)	5.72	2.94	17.43	18.68	6.73	87.01	1.42	33.49
4.	Petiole length (cm)	2.12	1.05	10.81	13.63	8.28	62.95	0.23	17.67
5.	Flower size (cm)	3.74	2.51	10.90	11.36	3.20	92.06	0.63	21.54
6.	Fruit length (cm)	11.18	6.00	14.44	15.70	6.17	84.54	2.37	27.35
7.	Fruit diameter (cm)	11.54	5.49	14.58	16.24	7.15	80.60	2.26	26.97
8.	Fruit weight (g)	327.23	145.55	20.31	20.65	3.71	96.76	87.30	41.17
9.	No. of flakes with seeds	49.43	20.41	21.71	22.78	6.66	91.39	13.91	42.76
10.	No. of flakes without seeds	25.57	7.57	29.32	29.98	6.23	95.68	8.94	59.09
11.	Thickness of fruit rind (cm)	2.20	1.08	7.68	11.33	8.32	45.97	0.18	10.72
12.	Core length (cm)	6.49	2.55	15.27	17.91	9.36	72.69	1.23	26.83
13.	Shelf life (cm)	6.68	2.00	25.84	27.16	8.35	90.53	1.93	50.65
14.	Time of harvest maturity (days)	150.01	100.86	7.88	9.56	5.40	68.02	16.86	13.39
15.	No. of seeds fruit	48.43	20.35	21.71	22.85	7.17	90.28	13.83	42.50
16.	Weight of 100 seeds (g)	37.15	18.49	13.52	15.99	8.53	71.51	6.00	23.56
17.	Pulp: Seed ratio	26.06	4.98	37.95	38.62	7.15	96.57	9.22	78.83
18.	TSS (Brix)	29.62	14.74	10.63	12.94	7.38	67.49	3.97	17.99
19.	Acidity (%)	0.36	0.12	22.58	24.19	0.87	87.10	0.09	43.41
20.	Non -Reducing sugar (%)	3.80	1.12	27.65	28.50	6.91	94.12	1.23	55.27
21.	Reducing sugar (%)	25.70	14.60	9.36	12.63	8.48	54.90	2.67	14.29
22.	Total sugar (%)	28.33	16.23	9.35	11.94	7.43	61.28	3.15	15.08

CONCLUSIONS

Based on the present investigation, the higher extent of heritability (in broad sense) coupled with high genetic advance was recorded for most of the characters revealing additive genetic effect. It was observed that PCV was higher than GCV for all the selected characters studied. Highest GCV and PCV is recorded for pulp: seed ratio (37.95 and 38.62), number of flakes without seeds (29.32 and 29.98), non-reducing sugar (27.65 and 28.50), shelf life (25.84 and 27.16), acidity (22.58 and 24.19) and number of seeds fruit (21.71 and 22.85) respectively. On the basis of information obtained from the present study, it indicates that there is an existence of greater amount of genetic variability for all the characters in different genotypes, which can be efficiently utilized for improvement of custard apple genotypes by choosing effective breeding program based on genetic makeup of different traits.

FUTURE SCOPE

The present investigation will help in understanding the degree of genetic variability present among the custard apple genotypes under southern Rajasthan which lay the foundation stone for selecting superior genotypes for future variety development program through clonal selection and inter-varietal hybridization or to get the GI tag for the particular genotype.

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Conflict of Interest. None.

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