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GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN CASHEWNUT (*ANACARDIUM OCCIDENTALE* L.)

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ABSTRACT

The nature and magnitude of genetic variability and their inter-relationship were studied for nut yield and its eleven component traits in 17 genotypes of cashewnut (*Anacardium occidentale* L.). High estimates of genotypic coefficients of variation, heritability and genetic advance were observed for sex ratio, fruit set, number of fruits and apple weight, indicating their reliability for effecting selections for high nut yield. Fruit set per panicle and single nut weight were the best contributors to nut yield per plant and further, the nut weight and apple weight showed high positive association with nut yield both at genotypic and phenotypic levels. Hence, the studies revealed the importance of nut weight, fruit set and apple weight as selection criteria for improvement of nut yield in cashewnut.

Key words: Genetic variability, character association, nut yield, cashewnut.

Cashewnut (*Anacardium occidentale* L.), an important tropical tree crop is grown for its edible kernel and apple (ripe juicy fruits). The plant is hardy and well suited to dryland condition. It normally takes about four years after planting for initiation of flowering, hence, the relationship of nut yield to its component characters is of great importance for effective selection. The present study aims to assess the degree of association between nut yield and its component traits in cashewnut.

MATERIALS AND METHODS

The study was carried out during 1993 on 17 cultivars of cashewnut (*Anacardium occidentale* L.) at the Ranasinghpur Cashew Research Station, O.U.A.T., Bhubaneswar. The grafted plants were planted during 1989–90 in randomized block design with two replications and the plants flowered in 1992. Observations were recorded on 12 different

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quantitative traits (Table 1) on four random plants per treatment in each replication and the mean data were used for analysis of variance and covariance [1]. From the variance and covariance components, coefficients of variation at phenotypic (PCV) and genotypic (GCV) levels [2], heritability in broadsense (H) [3] and expected genetic advance (GA) [4] were computed. The genotypic and phenotypic correlation coefficients [5], which were used for path coefficient analysis at genotypic and phenotypic levels [6] were also estimated.

RESULTS AND DISCUSSION

Studies on variation and genetic parameters revealed that all the traits exhibited significant differences (Table 1), indicating the presence of sufficient genetic variability in the material. The results further revealed that sex ratio (hermaphrodite to male flowers), fruit set, fruits per panicle, nut yield per plant and single apple weight had high H, high GA and high GCV; hence these characters have maximum scope for further improvement through selection. In case of total staminate and perfect flowers, high H and high GA were associate with moderate GCV and it may be easier to select for these characters. However, high H with moderate GA and moderate GCV for nut weight, flowering panicles and panicle length indicated that simultaneous improvement for these characters could also be

Table 1. Genetic variability parameters in cashewnut

Character	Mean	Range	Variance	PCV (%)	GCV (%)	Herit-ability (%)	Genetic advance (% of mean)
Leaf area (cm^2)	80.5	53.3–113.6	423.6*	20.6	14.8	52.0	21.9
Flowering panicles/m^2 of canopy surface	20.0	9.6–30.0	44.1*	19.9	18.6	87.2	30.1
Panicle length (cm)	16.8	9.9–26.1	20.9*	25.6	21.0	67.4	42.3
Perfect flowers/panicle	145.5	76.5–261.5	5589.3*	36.6	36.1	97.3	73.3
Staminate flowers/panicle	445.5	123.5–802.2	63361.8*	36.5	36.3	98.8	84.9
Sex ratio	0.3	0.1–1.0	0.1*	70.1	69.8	99.2	141.6
Fruit set/panicle (number)	14.4	5.8–32.5	89.6*	47.3	45.5	92.6	90.3
Fruits/panicle (number)	3.8	1.6–11.4	9.7*	58.5	58.1	98.4	118.5
Apple weight (g)	45.7	17.4–88.3	390.3*	38.0	37.2	96.1	75.2
Total sugar content (%)	8.5	6.0–10.7	1.8*	12.6	9.5	57.6	15.0
Nut weight (g)	6.2	3.2–8.9	26.3*	27.2	26.6	92.7	56.9
Nut yield/plant (kg)	0.9	0.3–2.8	12.5*	60.3	55.6	85.1	106.2

*Significant at 1% level.

Table 2. Genotypic (G) and phenotypic (P) correlation coefficients in cashewnut

Character		Flowering panicles per m^2 of canopy surface	Panicle length	Perfect flowers per panicle	Stami-nate flowers per panicle	Sex ratio	Fruit set per panicle	Fruits per panicle	Apple weight	Total sugar con-tent	Nut weight	Nut yield per plant
Leaf area	G	0.31	-0.59*	0.39	0.51*	-0.22	0.39	-0.06	0.46	0.32	0.65**	0.34
	P	0.26	-0.25	0.26	0.40	-0.18	0.31	-0.07	0.34	0.28	0.54*	0.18
Flowering panicles per m^2 of canopy surface	G		-0.02	0.22	0.55*	-0.37	0.31	-0.13	0.37	0.15	0.56*	0.31
	P		-0.03	0.22	0.50*	-0.34	0.28	-0.14	0.35	0.20	0.48*	0.29
Panicle length	G			-0.16	-0.10	0.00	0.17	-0.04	-0.38	0.02	-0.32	0.22
	P			-0.13	-0.07	-0.01	0.13	-0.08	-0.24	0.01	-0.22	0.14
Perfect flowers per panicle	G				-0.24	0.54*	0.62**	-0.06	0.09	0.41	0.51*	0.10
	P				-0.24	0.54*	0.58*	-0.06	0.10	0.30	0.15	0.07
Staminate flowers per panicle	G					-0.80**	-0.05	-0.15	0.27	-0.13	0.59*	0.14
	P					-0.79**	-0.05	-0.15	0.27	-0.11	0.58*	0.11
Sex ratio	G						0.24	0.14	-0.29	0.04	-0.44	-0.23
	P						0.22	0.14	-0.29	0.03	-0.43	-0.21
Fruits set per panicle	G							-0.04	0.46	0.42	0.27	0.10
	P							-0.03	0.44	0.21	0.25	0.13
Fruits per panicle	G								-0.46	-0.03	-0.43	-0.01
	P								-0.46	-0.05	-0.41	0.02
Apple weight	G									0.38	0.77**	0.38
	P									0.28	0.73**	0.34
Total sugar content	G										0.43	0.30
	P										0.31	0.20
Nut weight	G											0.45
	P											0.35

*,** Significant at 5% and 1% levels, respectively.

achieved. The remaining traits are unsuitable for improvement by direct selection alone. The narrow range of difference between PCV and GCV in traits like total number of staminate flowers, perfect flowers, sex ratio, fruit retention and apple weight indicated these characters were least influenced by environment.

Correlation studies (Table 2) showed that for most character pairs, genotypic and phenotypic associations were in the same direction and the genotypic estimates were higher than the phenotypic ones, indicating an inherent association between the characters. High significant positive association between nut weight and apple weight was observed both at genotypic and phenotypic levels, which indicated that increase in apple size had direct bearing on nut size. Further, nut yield, the most important economic trait, exhibited highest positive association with nut weight, followed by apple weight both at genotypic and phenotypic

Table 3. Direct (in bold) and indirect effects of eleven component characters on nut yield of cashewnut at genotype level

Character	Leaf area	Flowering panicles per m^2 of canopy surface	Panicle length	Perfect flowers per panicle	Staminate flowers per panicle	Sex ratio	Fruit set per panicle	Fruits/ per panicle	Apple weight	Total sugar content	Nut weight	Nut yield per plant
Leaf area	**-2.94**	-0.04	2.34	-0.86	-0.33	0.33	1.96	0.08	-2.51	0.27	2.04	0.34
Panicles per m^2 of canopy surface	-0.91	**-0.14**	0.07	-0.49	-0.35	0.56	1.56	0.18	-2.06	0.13	1.76	0.31
Panicle length	1.73	0.00	**-3.99**	0.35	0.06	0.01	0.87	0.06	2.10	0.02	-0.99	0.22
Perfect flowers per panicle	-1.14	-0.03	0.64	**-2.22**	0.15	-0.82	3.09	0.08	-0.49	0.35	0.48	0.10
Staminate flowers per panicle	-1.51	-0.08	0.40	0.53	**-0.64**	1.21	-0.24	0.21	-1.50	-0.11	1.86	0.14
Sex ratio	0.64	0.05	0.01	-1.19	0.51	**-1.51**	1.21	-0.19	1.62	0.03	-1.40	-0.23
Fruit set per panicle	-1.15	-0.04	-0.69	-1.37	0.03	-0.37	**5.00**	0.05	-2.55	0.36	0.84	0.10
Fruits per panicle	0.18	0.02	0.17	0.13	0.10	-0.21	-0.18	**-1.36**	2.54	-0.02	-1.36	-0.01
Apple weight	-1.34	-0.05	1.52	-0.20	-0.17	0.45	2.31	0.63	**-5.50**	0.33	2.41	0.38
Total sugar content	-0.94	-0.02	-0.09	-0.90	0.08	-0.05	2.09	0.04	-2.10	**0.85**	1.35	0.30
Nut weight	-1.91	-0.08	1.26	-0.34	-0.38	0.67	1.34	0.59	-4.22	0.37	**3.14**	0.45

Residual = 0.83.

levels. The negative correlation of nut weight with panicle length, sex ratio, and number of fruits/panicle indicated that an increase in number of fruits per plant and sex ratio would results in reduction of nut size. The negative association of fruit set with number of staminate flowers per panicle, number of fruits retained/panicle, and positive association with the remaining characters indicated that increase in the number of male flowers would decrease the fruit set. But if the fruit set is low, a smaller per cent of the fruits drop leading to increase in fruit retention and vice versa.

The direct and indirect effects of different traits on nut yield at genotypic level (Table 3) revealed that the highest direct effect (5.00) of fruit set was intensified further with marginal indirect effects via nut weight, total sugar content and number of fruits. Further, the nut weight had also a high direct effect (3.14) on yield and considerable negative indirect effects via apple weight, leaf area, number of staminate and perfect flowers. Hence, selection for larger sized nuts would reduce the apple weight, leaf area, number of staminate and perfect flowers, but there would be improvement in yield by compensation through increase in fruit set per panicle, panicle length and number of fruits retained. The direct positive effect (0.85) of total sugar content on nut yield was further intensified due to indirect effects via fruit set and nut weight.

This study on variability and character associations in cashewnut suggested that among the 12 traits studied, nut weight followed by fruit set per panicle and apple weight were the most important components of nut yield, and can be used effectively as selection criteria for improvement of yield in cashewnut.

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