



Variability and Correlation Studies for Nut Characters in Coconut

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ABSTRACT

Thirteen genotypes of coconut (*Cocos nucifera* L.) were studied for various attributes of nut size and yield. The population under study exhibited significant variation for all the characters except kernel thickness. In general, the size and weight of nut has inverse correlation with nuts/palm. The correlation studies further, revealed that the important characters like size, volume, weight of copra and oil yield are mutually exclusive. Thus, the yield performance in terms of copra yield or oil yield/ha appears to be complex one. The characters viz., volume of husked nut, weight of husked nut, shell and kernel are under control of additive gene action whereas the characters weight of husk and copra were found to be governed by additive as well as non-additive gene action. In spite of the complex mutual relationship of number of nuts/ palm, the genotypes Phillipines, Lakshadweep ordinary, T x D (Orange) and Pratap could be rated as elite yielding types considering the copra and oil yield.

Key words : Coconut, nuts/palm, correlation coefficients, genotypic and phenotypic coefficients of variation heretability, genetic advance, copra and oil yield.

Each palm represented a replication.

The data was subjected to statistical analysis by following the technique of ANOVA applicable to a randomized block design having five replications (Panse and Sukhatme, 1978). The correlation and biometrial analysis to the data confined year 1988 were done according to the technique suggested by Singh and Chaudhari (1979).

RESULTS AND DISCUSSION

The performance of thirteen coconut genotypes for nine nut characters along with nut yield/palm is given in Table 1. The variation for almost all the characters except kernel thickness was statistically significant. The yield performance for the year 1988 showed highly significant variation. For this year the genotype Pratap had maximum yield (228.20 nuts/palm) followed by Lakshadweep ordinary (182.80 nuts/palm). New Guinea exhibited the lowest yield (92 nuts/palm). From the average yield data (No. of nuts/palm) pooled over 10 years, it is apparent that performance of Pratap, Lakshadweep ordinary, T x D (Orange) and Banawali Yellow Round is high above the population mean (117.51 nuts/palm). Among the three high nut yielding cultures the weight of husked nut was higher in T x D (610.92 g) than in Pratap (449.86 g) and

Coconut is grown in Maharashtra for the copra and edible oil. Yield of coconut is usually expressed in terms of nuts/palm. However, for several attributes of nuts like volume, husk weight, copra weight, oil percentage etc. The yield of coconut is expressed in number of nuts/palm may not be necessarily equivalent to oil yield or copra yield/ palm. The current investigation is aimed at assessing the mutual relationships of some of the important nut characters and its implication for improvement of economic yield through the understanding of the kind of genetic control and extent of variability in this crop.

adult coconut palms during 1988. These palms were planted in 1958. Thirteen genotypes namely Gangabondam, Phillipines, Fiji, F. M. S. (Federated Malayan States), New Guine, Lakshadweep ordinary, T x D (Orange), Pratap (Banawali Green Round), Banawali Yellow Long, Banawali Green Long and West Coast Tall constituted the experimental material. Fully matured nuts of five palms of each genotype were harvested and ten nuts were randomly selected (2 bunches/palm and 2 nuts/bunch) to record the nut characters namely husked nut weight (g), husked nut volume (ml), weight of shell (g), weight of husk (g), weight of kernel (g), meat thickness (mm) and nuts/bunch. Nuts were dried to constant weight to record copra observations and oil percentage was estimated. The yield data of the year 1988 and averaged over 10 years was considered for study.

MATERIALS AND METHODS

The study was conducted on

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Lakshadweep ordinary (379.34 g). The three genotypes also showed similar trend of variation for volume of husked nut and weight of shell. The weight of husk/nut was substantially high above the population mean in T x D and Lakshadweep ordinary, but it was noticeably low in Pratap. The kernal yield/nut was highest in Philippines (393.16 g) followed by T. x D. Pratap and Lakshadweep ordinary had relatively lower kernal weight in comparison with population mean and the highest yielding culture. Similar trend was noticed in copra yield. The oil percentage was highest in Lakshadweep ordinary (74%) followed by T x D. Further, Pratap showed maximum kernel thickness and maximum number of nuts/bunch. From this it is clear that, it is difficult to postulate the single nut type with all merits combined together in a particular genotype as most of the attributes like number of nuts/bunch, weight of husked nut, volume of husked nut etc. are mutually exclusive to

each other. The relative importance of various attributes of nut could be understood from the correlation studies.

The magnitudes of correlation coefficient are presented in Table 2. The husked nut weight showed highly significant positive correlation with nut volume, weight of shell and copra. It did not show association with weight of husk, oil percentage and kernel thickness. The loose but negative correlation of husked nut weight with nuts/bunch and nuts/palm indicated the mutual exclusiveness of single nut weight and number of nuts /palm. The volume of husked nut further, showed highly significant correlation with weight of shell, kernal and copra. Its loose but negative correlation with nuts/bunch and nuts/palm warrants the inverse relationship between size and number of nuts. The kernel weight showed highly significant positive correlation with copra. The characters like oil percentage and kernel thickness did

not show association with any of the nut characters under study. However, the negative but significant association of kernel weight with number of nuts warrants that it is appropriate to regard the number of nuts as an only criterion for selecting the high yielding types of coconut.

The genetic parameters for various nut attributes are also presented in Table 2. The highly significant mean square values for almost all characters except kernel thickness suggested that the population under study possesses appreciable amount of variation. Such a variation in base population is an important factor in determining the feasibility of increasing yield and improving the related characters. Maximum phenotypic Coefficient of Variation (PCV) was noticed for nuts/palm followed by volume of husked nut. The PCV values were also appreciably high for weight of shell, husk, kernel and copra. Oil content and number of nuts/bunch showed

Table 1. Nut characters and yield in thirteen coconut genotypes.

Cultivar	Husked nut wt. (g)	Husked nut volume (ml)	Wt. of shell (g)	Wt. of husk (g)	Wt. of meat (g)	Wt. of copra (g)	Oil (g)	Meat thickness (mm)	Nuts/bunch	Yield in nuts/palm (1988)	Av. yield of 10 years from 1979 to 88
Gangabondam	497.04	513	130.10	224.98	300.48	182.70	68.40	12.20	5.70	95.20	94.92
Philippines	777.26	825	205.94	377.80	393.16	213.78	69.90	12.50	4.20	128.80	107.37
Fiji	538.74	528	173.00	343.04	273.52	165.82	70.60	12.30	8.00	96.40	111.48
F.M.S.	352.72	305	104.50	379.98	198.08	123.18	68.70	11.70	6.00	156.00	116.40
New Guinea	609.52	524	194.04	474.54	271.10	170.78	70.00	11.00	5.00	92.00	101.80
Lakshadweep ordinary	379.34	356	128.48	405.05	202.88	134.46	74.20	11.90	13.20	182.80	154.03
TxD (Orange)	610.92	596	153.10	440.20	308.42	171.70	70.82	12.88	7.20	165.80	137.88
Pratap	449.86	429	123.14	325.28	243.92	149.66	68.30	13.16	17.00	228.20	148.28
Banawali Yellow Long	420.62	404	132.68	342.96	220.48	143.80	69.40	12.00	10.10	163.20	108.96
Banawali Yellow Round	432.20	406	134.00	290.88	223.46	139.88	68.30	11.40	11.20	142.80	131.43
Banawali Red Round	413.14	428	148.74	343.00	231.10	151.50	70.04	11.40	5.40	131.60	108.55
Banawali Green	441.68	428	122.56	357.82	246.92	172.12	68.50	11.50	6.40	136.40	112.16
West Coast Tall	496.94	427	146.58	305.94	248.42	154.50	68.10	12.20	10.00	150.40	94.37
S. Em±	37.74	42.13	9.72	32.36	18.79	15.04	0.97	-	2.30	18.15	5.37
C.D. at 5%	104.62	116.78	26.95	89.70	52.07	41.69	2.69	-	6.38	50.32	14.08

Table 2. Correlation coefficients and genetic parameters among various nut characters and yield in thirteen genotypes of coconut.

Particulars	Wt. of husked nut	Vol. of husked nut	Wt. of shell	Wt. of husk	Wt. of meat	Wt. of copra	Oil (%)	Meat thickness	Nuts/bunch	Nuts/palm
Husked nut wt.		0.966*	0.879**	0.297	0.943**	0.884**	0.036	0.298	-0.439	-0.372
Husked nut Vol.			0.822**	0.175	0.980	0.923**	0.052	0.359	-0.448	0.357
Wt. of shell				0.396	0.737**	0.716**	0.209	-0.008	-0.448	-0.518
Wt. of husk					0.069	0.023	0.544	-0.156	-0.198	0.055
Wt. of meat						0.952**	-0.040	0.406	-0.470	-0.365
Wt. of copra							-0.078	0.252	-0.517	-0.473
Oil (%)								-0.004	0.084	0.081
Meat thickness									0.404	0.504
Nuts/bunch										0.784**
Mean	493.846	474.538	145.912	354.728	258.617	159.526	69.635	12.011	8.423	143.815
Mean square for varieties	67834	85606	4317.477**	20809.	13909.	2801.	14.699**	1.919	70.016**	7257.782**
	925**	896**		627**	959**	353**				
Genotypic Coefficient of Variation	22.313	26.103	19.004	15.733	19.057	11.457	2.034	3.148	0.350	23.290
Phenotypic Coefficient of Variation	28.105	32.794	24.148	25.761	25.040	23.994	3.730	9.662	0.705	36.596
Environmental Coefficient of Variation	5.792	6.691	5.144	10.028	5.983	12.537	1.696	6.514	0.355	13.306
Heritability (H^2_b)	0.630	0.634	0.619	0.373	0.579	0.228	0.297	0.106	0.247	0.405
Genetic advance on % mean basis	36.475	42.830	30.792	19.794	29.866	11.269	2.282	2.110	0.359	30.532

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

very poor values of PCV. Kernel thickness had moderately high values of PCV. In general, the values of Genotypic Coefficient of Variation (GCV) were smaller than those of PCV for corresponding characters. Maximum GCV was noticed in volume of husked nut followed by nuts/palm. The PCV values of weight of shell, husk, kernel and copra were also moderately high. Nuts/bunch, oil percentage and kernel thickness showed relatively low values of GCV. The difference between PCV and GCV indicates the extent of the impact of environmental components on expression of characters. Nut yield/palm weight of copra and husk showed high values of Environmental Coefficient of Variation (ECV) which indicated the these attributes are very sensitive to fluctuations in environmental factor. Kernel thickness, weight of kernel, husked nut and shell and volume of husked

nut showed moderate values of ECV. Importantly, the value of ECV for kernel thickness was noticeably high in respect to the GCV and PCV for the character. This indicated that kernel thickness is greatly under the influence of environmental factors. Weight of husked nut, shell and kernel and volume of husked nut showed high magnitudes of heritability which indicated that these characters possess great degree of inheritance in further generation. The heritability estimates for weight of husk, copra, oil content, nut/bunch and nuts/palm were moderately high. Kernel thickness possess very low heritability. The genetic advance expressed on percent mean basis was high for volume of husked nut, weight of husked nut, shell and kernel and yield/palm. The high estimates of heritability for these characters along with high genetic advance suggested that volume of husked nut, weight of

husked nut, shell and kernel are under control of additive gene action. Liyanage and Sakai (1960) also recorded high heritability value for weight of husked coconut. Weight of husk and copra showed moderate values of heritability as well as genetic advance and hence would be regarded as under control of additive as well as non-additive gene action. Oil content, kernel thickness and number of nuts/bunch showed low values of heritability as well as genetic advance. This is an indication of complex and poorly understood genetic control for these characters. The characters with high additive gene action are expected to show a straight response to selection but those under the control of non-additive gene effects and not having any kind of genetic control need to be improved by indirect selection method on the basis of correlated response.

Coconut palm is grown in Maharashtra mostly for copra and the oil yield could be considered as the most important attribute. The comparatively low nut yielding variety philippines has a high merit for copra and oil yield/ha (4017 and 2808 kg, respectively). The coconut cultivars which yield fewer medium or big sized nuts may give as much copra as produced by other cultivars yielding a large number of small sized nuts (Thampan, 1982). Importantly high copra and oil yield per hectare was

maintained by the high nut yielding genotypes namely Lakshadweep ordinary (3624 and 2689 kg, respectively), Pratap (3884 and 2653 kg, respectively) and T x D (4143 and 2934 kg, respectively). Thus inspite of the complex mutual relationship between size, volume and weight of nut with the final economically important attributes viz., copra and oil yield, the genotypes Philippines, T x D, Lakshadweep ordinary and Pratap may be rated as elite types of coconut.

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Pollination and Fruit Set Studies in Pomegranate

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ABSTRACT

The percentage fruit set obtained by various modes of pollination exhibited considerable differences among the pomegranate (*Punica granatum* L.) cultivars. The maximum fruit setting (79%) resulted from open pollination followed by hand pollination (66.2%), self pollination (43.3% and least (26.4%) in the emasculated buds when allowed for natural open pollination. These results indicate that both self and cross pollination are effective in the pomegranate and is considered to be often cross pollinated crop. The hermaphrodite flowers played an important role in higher fruit set than intermediary type flowers.

Key words : Pomegranate, pollination, fruit set.

Pomegranate flowers exhibit heterostyly. Both self and cross pollination were reported in pomegranate. Gammie and Patwardhan (1929) indicated that pomegranate is a cross pollinated crop. On the other hand, Pross (1938) working with four pomegranate varieties in central Asia, considered pomegranate to

be a self pollinated crop. To ascertain precise nature of either cross or self compatibility/incompatibility and fruitfulness of pomegranate varieties, fruit set by different modes of pollination was studied.

MATERIALS AND METHODS

The investigation was carried out during the spring season of flowering in 1990. Ten year old uniform trees of commercial

pomegranate cultivars viz. Ganesh, G-137, Dholka, Bassein seedless, Jellore seedless, G.K.V.K. (Jyoti) and promising Muscat selections namely P-23 and P-26 grown in the varietal block of All India Co-ordinated Research Project of Arid Zone Fruits, Rahuri were used as experimental material. Four modes of pollination as described were tried on hermaphrodite (perfect) and intermediary flowers (Nath and Randhwa, 1959).

i) Natural or open pollination : Flower buds were tagged before anthesis and they were observed for subsequent fruit setting.

ii) Self pollination : Individual flower buds were covered with butter paper bags a day prior to

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