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Study of correlation and index ranging of markingnut (*Semecarpus anacardium* L.) Genotypes in Nanded district of Marathwada region

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Abstract
The present investigation entitled "Study of Correlation and Index Ranging of Markingnut (*Semecarpus anacardium* L.) Genotypes in Nanded District of Marathwada Region" was carried out on twenty strain of Markingnut from Nanded district of Marathwada region in Maharashtra. The correlation studies among 17 characters it was exhibited highest significant positive association of hypocarp weight, fruit weight, kernel weight, volume of tree, fruit volume, hypocarp length, hypocarp volume and size of fruit with yield of tree. In the study of superior types of markingnut genotypes there were wide range of variability was noticed with respect to growth, fruiting parameter and chemical characteristics. The genotypes ND-7, ND-8, ND-16 could be rated as most promising genotypes in Nanded district of Marathawada region on the basis of the yield of different genotypes.

Keywords: Markingnut, genotype, fruit characters, correlation, index ranging

Introduction
The Markingnut (*Semecarpus anacardium* L.) is important dry land fruit crops which belong to family Anacardiaceae. The important relatives of this fruit crop are Mango, Cashewnut, Pistachios and Charoli (*Buchanania lanzan*). There are about 69 genera and 500 species belong to anacardiaceae and 6 species are reported to be existing on large scale in India. Trees are distributed in Indo Malyasian region and Australia. In India the trees are found in the sub Himalayan tract from beaseastword extending in the outer hills, Assam Khasi Hills, Central India, Gujarat, Konkan Southern Maharashtra and in the deciduous forest of all district in the southern India. This is used for production of insecticides, antiseptic, and termites repellants and wood preservatives. This is used all over all over India as marking ink. The juice has medicinal properties also. This can be used anticancer (Oesophogous and mouth), and against blood pressure leprosy, snake bite and scorpion sting (Chopra et. al.1956) [1]. The edible kernel present inside the seed has almond like taste. The kernel is rich in protein (26.4 %), fat (36.4 %), minerals (3.6 %) like calcium, phosphorous, ferrous and vitamins like Thiamine, Riboflavin and licotinic acid.

Material and methods
The present investigation entitled: "Study of Correlation and Index Ranging of Marking nut (*Semecarpus anacardium* L.) Genotypes in Nanded district of Marathwada Region" was carried out to locate superior types of Marking nut by survey and selection of marking nut trees existing naturally in Nanded region during the year 2011-12. Markingnut can be grown under dryland without using any input. The tropical and semiarid climate of Marathwada region is best suited for growing of Marking nut. It can be grown on hills, hillocks, on bunds and the waste lands. This tree can be grown as an avenue and shade tree and can be included in social forestry programme. It is mostly grown in wild condition. In this region there is not any orchard of Marking nut. The tree is raised from seedlings.
The Statistical analysis (Correlation studies) of the superior quality Markingnuts genotypes (*Semecarpus anacardium* L.) were carried on following points.
The results were worked with four different approaches

1. Variability consisting of coefficient of variation, standard deviation and 't' values were calculated for percent variability and difference among individual strains.
2. The simple correlation between characters was worked out by the procedure suggested by Snedecor and Chochran (1989) [3]. The weight of the fruit per tree was taken as dependent (effect) and other characters as independent variables.
3. On the basis of physical characters of the fruit, which contribute to the dependent variable (yield).

4. On the basis of mean values of characters, 60 strains of markingnut were classified into various groups with specific range of units for the sake of explanation

The range value of different characters of 60 genotypes of markingnut was worked out to study the range indexing. The various growth and fruit characters were analysed to determine the perspective range determination in marking nut. The Mean, Standard deviation and Coefficient of variation of the above characters was calculated to full fill the need of index ranging.

Results and discussion

A. Correlation Among different characters

The value of correlation coefficient among different characters in Nanded districts of Marathwada region ware compared with yield of tree and given in Table. 1. Finding analogous to this correlation studies had also reported in charoli accession that highest significant positive association of weight of fruit, volume of fruit, size of fruit, weight of mesocarp, weight of seed, weight of seed coat, weight of kernel and panicles per tree with fruits yield per tree (Munde *et al.* 2002) [2].

1. Volume of tree

The data presented in Tables 1 revealed that positive and highly significant correlation of volume of tree with yield of tree. Highly negative and significant correlation was observed with size of Fruit, seed to hypocarp ratio and positive and significant correlation with fruit weight, fruit volume, fruit length, hypocarp weight, hypocarp length, hypocarp volume, hypocarp breadth and fruit dry weight. The weak negative and non-significant correlation with fruit breadth.

2. Panicle per tree

The data presented in Tables 1 revealed with respect to panicle per tree showed a positive and highly significant correlation with yield of tree, fruit weight, fruit volume, fruit length, fruit dry weight, hypocarp weight, hypocarp length, hypocarp volume, hypocarp breadth, size of fruit, hypocarp dry weight, and oil content. Highly negative and non-significant correlation was observed with seed to hypocarp ratio and kernel weight. The weak negative and non-significant correlation with fruit breadth.

3. Fruit weight

The data presented in Tables 1 revealed it was observed that a positive and highly significant correlation was observed between fruit weight with yield of tree, fruit volume, fruit length, fruit dry weight size of fruit hypocarp weight, hypocarp length, hypocarp volume, and hypocarp breadth. Highly significant and negative correlation with seed to hypocarp ratio and kernel weight. The weak negative and non-significant correlation was observed with fruit breadth.

4. Fruit Volume

The data presented in Tables 1 revealed it was observed that positive and highly significant correlation was observed between fruit volume with yield of tree, fruit length, fruit dry weight, hypocarp volume, hypocarp breadth, size of fruit, hypocarp dry weight, and oil content. Highly negative and significant correlation was observed among seed to hypocarp ratio. The weak negative and non-significant correlation was observed with fruit breadth.

5. Fruit length

According to Table 1 there were positive and highly significant correlation observed between fruit length with yield per tree, fruit dry weight, hypocarp length, hypocarp volume, hypocarp breadth, size of fruit, hypocarp dry weight and oil content. Fruit length having negative and highly significant correlation was observed in seed to hypocarp ratio. The weak negative non-significant correlation with fruit breadth and kernel weight.

6. Fruit breadth

According to Table 1 there were positive and highly significant correlation was observed between fruit breadth and oil content. There is negative and highly significant correlation was observed in hypocarp volume. And weak negative non-significant correlation was observed I fruit dry weight, hypocarp weight, hypocarp length, hypocarp volume, hypocarp breadth, size of fruit. And weak non-significant correlations were observed in seed to hypocarp ratio and kernel weight.

7. Fruit dry weight

According to Table 1 it was observed that positive and highly significant correlation were observed between fruit dry weight and yield per tree, hypocarp weight, hypocarp length, hypocarp volume, hypocarp breadth, size of fruit and oil content. There is negative and highly significant correlation was observed in seed to hypocarp ratio and kernel weight.

8. Hypocarp weight.

According to Table 1 it was observed that positive and highly significant correlation were observed between hypocarp weight with yield per tree, hypocarp length, hypocarp volume, hypocarp breadth, size of fruit, hypocarp dry weight. Negative and highly significant correlation was observed seed to hypocarp ratio. The weak negative non-significant correlation was observed with kernel weight.

9. Hypocarp length

The data presented in Tables 1 noticed that positive and highly significant correlation were observed with yield per tree, hypocarp volume, hypocarp breadth, size of fruit, and hypocarp dry weight. Negative and highly significant correlation was observed with seed to hypocarp ratio. Weak negative non-significant correlation was observed in oil content and kernel weight.

10. Hypocarp volume

According to Table 1 positive and highly significant correlation was observed between hypocarp volume and yield per tree hypocarp breadth, size of fruit, hypocarp dry weight and oil content. Negative and significant correlation was observed seed to hypocarp ratio and kernel weight.

11. Hypocarp breadth

According to Table 1 it was revealed that positive and significant correlation were observed between hypocarp breadth and yield per tree, size of fruit, hypocarp dry weight and oil content. Negative and highly significant correlation was observed in seed to hypocarp ratio.

12. Size of fruit

From the Tables 1 it was observed that highly significant strong correlation was observed between size of fruit and yield per tree, hypocarp dry weight and oil content. Negative and highly significant correlation was observed in seed to hypocarp ratio. And weak negative and non- significant correlation was observed in kernel weight.

13. Seed to hypocarp ratio

According to Tables 1 it was observed that negative significant correlation of seed to hypocarp ratio with yield per tree. Positive and highly significant correlation was observed in oil content weak non-significant correlation was observed in kernel weight.

14. Kernel weight

According to Tables 1 it was noticed that positive and highly significant correlation was observed between kernel weight and oil content. Negative and highly significant correlation was observed hypocarp dry weight and yield per tree.

15. Hypocarp dry weight

From the Table 1 it was noticed that there were strongly positive and highly significant correlation between hypocarp dry weights with yield per tree.

16. Oil content

From the Table 1 it was revealed that, there was highly strong positive and significant correlation was observed between oil content and yield per tree.

Table 1: Correlation among different characters in Nanded district.

Characters	Volume of tree	Panicle per branch	Fruit weight	Fruit volume	Fruit length	Fruit breadth	Fruit dry weight	Hypocarp weight	Hypocarp length	Hypocarp volume	Hypocarp breadth	Size of fruit	Seed to hypocarp ratio	Kernel weight	Hypocarp dry weight	Oil content	Yield kg/tree
Volume of tree	1.000	0.970**	0.989**	0.990**	0.971**	-0.282	0.936**	0.949**	0.907**	0.901**	0.932**	-0.580**	-0.760**	0.964**	0.964**	0.871**	0.742**
Panicle per branch		1.000	0.975**	0.960**	0.942**	-0.304	0.885**	0.969**	0.870**	0.848**	0.882**	0.891**	-0.588**	-0.694**	0.929**	0.666**	0.683**
Fruit weight			1.000	0.978**	0.965**	-0.253	0.923**	0.957**	0.884**	0.880**	0.900**	0.910**	-0.537**	-0.749**	0.958**	0.574**	0.707**
Fruit volume				1.000	0.985**	-0.269	0.943**	0.935**	0.933**	0.931**	0.954**	0.954**	-0.574**	0.722*8	0.981**	0.817**	0.794**
Fruit length					1.000	-0.275	0.947**	0.932**	0.944**	0.951**	0.957**	0.970**	-0.577**	-0.725**	0.978**	0.810**	0.829**
Fruit breadth						1.000	-0.186	-0.351	-0.257	-0.173	-0.386	-0.297	0.412	0.281	-0.208	0.844**	-0.311
Fruit dry weight							1.000	0.829**	0.956**	0.970**	0.913**	0.964**	-0.567**	-0.554**	0.927**	0.910**	0.859**
Hypocarp weight								1.000	0.813**	0.793**	0.859**	0.849**	-0.621**	-0.700**	0.916**	0.934**	0.618**
Hypocarp length									1.000	0.985**	0.914**	0.989**	-0.560**	0.690**	0.931**	-0.222	0.922**
Hypocarp volume										1.000	0.922**	0.986**	-0.536**	-0.684**	0.932**	0.941**	0.925**
Hypocarp breadth											1.000	0.956**	-0.553**	-0.653**	0.920**	0.760**	0.873**
Size of fruit												1.000	-0.554**	-0.695**	0.943**	0.967**	0.923**
Seed to hypocarp ratio													1.000	0.522	-0.578**	0.985**	-0.410
Kernel weight														1.000	-0.711**	0.942**	-0.727*
Hypocarp dry weight															1.000	0.979**	0.790**
Oil content																1.000	0.962**
Yield kg/tree																	1.000
Genotypes	**Volume (cu.m)**	**Panicle/ tree**	**Fruit wt. (g)**	**Fruit volume (ml)**	**Fruit length (cm)**	**Fruit breadth (cm)**	**Fruit dry weight (g)**	**Hypocarp weight (g)**	**Hypocarp length (cm)**	**Hypocarp volume (ml)**	**Hypocarp breadth (cm)**	**Size of fruit (cm2)**	**Seed to hypocarp ratio**	**Kernal weight (g)**	**Hypocarp dry weight (g)**	**Oil content (%)**	**Yield/ kg**
ND-1	103.13	260.00	10.53	8.50	3.30	2.23	1.53	4.23	1.42	3.31	1.70	6.58	2.48	0.98	0.70	40.80	27.50
ND-2	98.07	151.00	9.30	7.10	2.89	2.11	1.30	3.20	1.49	3.20	1.60	7.30	2.90	0.87	0.45	39.82	6.00
ND-3	41.08	240.00	4.40	4.00	2.90	1.62	1.21	3.10	1.53	3.52	3.09	5.40	1.41	0.19	0.40	36.72	20.90
ND-4	101.75	180.00	4.15	4.03	2.89	1.64	1.21	3.63	1.38	3.20	2.17	7.20	1.14	0.13	0.55	28.20	10.15
ND-5	72.04	310.00	7.12	5.12	3.10	2.32	1.32	3.92	1.39	3.22	1.72	5.70	1.81	0.52	0.57	30.75	70.08
ND-6	22.58	192.00	8.17	6.20	4.12	2.92	1.87	4.52	1.82	3.87	2.57	5.35	1.80	0.57	0.67	31.30	28.30
ND-7	98.75	380.00	5.24	4.38	2.92	1.31	1.27	3.61	2.82	3.32	1.70	8.35	1.45	0.63	0.70	30.70	80.53
ND-8	78.28	358.00	7.21	5.80	3.16	1.42	2.03	5.57	2.03	4.52	1.92	5.45	1.29	0.61	0.78	37.42	75.20
ND-9	100.33	254.00	6.30	4.75	2.92	2.42	1.91	3.71	1.87	3.30	1.98	5.77	1.69	0.71	0.45	39.30	60.90
ND-10	57.00	230.00	12.50	10.30	4.27	3.10	3.17	7.32	1.89	5.32	1.74	7.80	1.70	1.00	1.30	27.50	50.70
ND-11	64.72	190.00	13.70	11.05	5.90	3.17	3.21	7.29	1.65	3.37	1.62	9.39	1.87	1.03	1.07	29.00	20.00
ND-12	52.53	172.00	10.58	8.05	4.80	2.98	2.97	5.67	1.65	4.70	2.63	8.74	1.86	0.98	0.74	33.50	18.00
ND-13	58.98	168.00	5.30	4.30	2.93	1.30	1.31	3.32	1.68	6.50	1.93	9.24	1.59	0.57	0.47	34.10	12.50
ND-14	18.31	217.00	7.42	5.80	3.01	2.81	1.93	4.21	2.00	3.50	2.35	8.35	1.76	0.39	0.63	30.40	37.00
ND-15	106.57	164.00	16.03	14.20	4.92	3.25	5.40	10.60	2.85	7.20	3.25	12.30	1.51	1.09	1.90	41.90	21.00
ND-16	118.30	323.00	8.21	6.33	3.02	2.67	2.73	3.21	1.90	3.20	2.72	7.75	2.55	0.82	0.49	40.60	72.12
ND-17	106.33	274.00	6.40	5.40	2.93	1.42	1.87	3.19	1.95	3.21	1.76	9.35	2.00	0.39	0.50	41.70	45.00
ND-18	69.12	231.00	7.32	5.70	4.20	1.92	1.30	4.27	1.42	3.60	2.59	10.31	1.71	0.41	0.53	37.50	62.30
ND-19	56.87	187.00	4.90	4.00	2.90	2.12	1.22	3.58	1.40	3.23	1.83	9.30	1.36	0.21	0.43	36.30	19.20
ND-20	102.03	189.00	9.18	7.20	3.05	2.97	1.87	3.54	1.47	3.25	1.67	7.49	2.59	0.52	0.51	29.50	27.00
Total	1526.77	4670.00	163.96	132.21	70.13	45.40	40.63	91.69	35.61	78.53	42.54	157.12	36.47	12.32	13.84	697.01	764.38
Averaage	76.34	233.50	8.19	6.61	3.51	2.27	2.03	4.58	1.78	3.92	2.12	7.86	1.82	0.61	0.69	34.85	38.22
SD	29.45	66.59	3.18	2.69	0.88	0.66	1.03	1.89	0.43	0.92	0.51	1.85	0.47	0.30	0.36	4.91	24.22
SE	6.59	14.90	0.71	0.60	0.20	0.14	0.23	0.43	0.09	0.61	0.11	0.41	0.11	0.07	0.08	1.09	5.41
CV	2.60	3.51	2.57	2.46	3.98	3.41	1.95	2.42	4.20	3.92	4.14	4.23	3.86	2.13	1.92	7.09	1.58

**Significnat at 1 %
*Significant at 5 %

Conclusions

The correlation studies exhibited highest significant positive association of hypocarp weight, fruit weight, kernel weight, volume of tree, fruit volume, hypocarp length, hypocarp volume and size of fruit with yield of tree.

In the study of superior types of markingnut genotypes there were wide range of variability was noticed with respect to growth and fruiting parameter, fruiting parameter and chemical characteristics. The genotypes ND-7, ND-8, ND-16 could be rated as most promising genotypes on the basis of the yield of different genotypes.

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