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Identification of elite seedling progenies of mango (*Mangifera indica* L.) for the morphological traits of the fruit under North eastern transitional zone of Karnataka

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Abstract

The investigation was carried out to identify the morphological parameters of the superior seedling progenies of mango in major mango growing parts of Bidar district, Karnataka. Among the 61 seedling selections selected for the investigation, the fruit yield was highest in 'CMS-67' (238 kg/tree) and 'GMS-02' in new and old plant category respectively. The maximum fruit weight (862.00 g), fruit width (117.62 mm), fruit volume (880.00 g/cc), pulp weight (647.72 g) and peel weight (127.30 g) was found in 'CMS-05'. The maximum fruit width was recorded in 'CMS-60'. The highest specific gravity (1.02 g/cc) of fruit was noticed in 'CMS-47'. The highest pulp percentage (81.77 %) with the lowest peel percentage (7.51 %) was recorded 'GMS-04'. The lowest peel content (11.31g) was observed in 'CMS-46'. The lowest stone weight (15.45 g) was noticed in 'GMS-01', the lowest stone percentage and the maximum pulp to stone ratio (17.24) was recorded in 'CMS-45'. The minimum non-edible part (27.40 g) was recorded in 'CMS-46'. The lowest non-edible percentage (18.23 %), lowest fruit to pulp ratio (1.22), highest pulp to peel ratio (10.89) and edible to non-edible ratio (4.49) was noticed in 'GMS-04'. The thicker peel (2.98 mm) was noticed in 'CMS-15' and 'CMS-05'.

Keywords: CMS, GMS, fruit yield, fruit weight, pulp percentage, pulp to stone ratio and specific gravity

Introduction

Mango (*Mangifera indica* L.) is an important member of the family Anacardiaceae, belongs to the order Sapindales and is the most important fruit crop in India having a great cultural, socio-economic and religious significance since ancient times. It is said to be originated in the Indo-Burma (Myanmar) region (De Candolle, 1904) [1]. Based on geographical distribution, polygenic trend, pollen morphology, chromosome number and breeding behavior indicated the highest concentration of species of *Mangifera* were found in Malayan peninsula followed by Sudan Islands and the Eastern peninsula comprising Burma, Thailand and Indo- China. Its long period of domestication in India is well evidenced from its mention in the ancient scripture.

Enormous genetic diversity of mango exists in India, which is the primary center of domestication. There are more than 2000 monoembryonic and polyembryonic mango cultivars in India (Anon., 2016) [2]. Considerable genetic diversity of this fruit exists in Karnataka with several named local cultivars and unnamed local land races. This genetic variability of mango can be exploited in breeding programs to produce high quality mangoes suitable for a variety of purposes.

Identification of superior elite clones is an important activity in the management of genetic resources in mango in the context of the present scenario of rapid extinction of such useful material. Still there is an immense potential of locating superior seedlings for collection, evaluation, conservation and utilization for the future crop improvement works. Keeping these in view, the present study was aimed to identify the superior seedling progenies of mango by the evaluation of their fruit morphology and quality traits.

Material and methods

An investigation on "Studies on variability in seedling progenies of mango under north-eastern transitional zone of Karnataka" was carried out at farmers field in Bidar district, Karnataka. The fruits were brought to the Department of Fruit Science, College of Horticulture, Bidar and were used for analysing the physicochemical characters during 2017-18.

Ten fruits were collected from each of the selected elite trees from the farmer's field in villages of Bidar. Forty eight trees from Chitta, six trees from Gonahalli, three trees from Mudbi and five trees from Yadlapura were selected. The fruits were labeled after they were plucked from the tree. Yield (kg/tree) was calculated by fruits were harvested at the correct stage of maturity and these fruits were weighed using a balance and the fruit yield on the weight basis was expressed in kilogram per tree. Fruit weight (g) measured by using a balance and expressed in gram. Fruit length (mm) of five fruits from the base of the fruit to the top of the groove at the calyx end was recorded with the help of Vernier calipers and the average was expressed in millimeter. The fruit width (mm) was taken by measuring the horizontal distance of the fruit at the centre using digital vernier calipers and expressed in millimeters. The fruit volume (ml) was determined by the conventional water displacement method and expressed in milliliter. Fruit specific gravity (g/cm^3) was calculated by the help of weight and volume of fruit. The peel and stone was separated from the fruit and weighed. The pulp weight was calculated by subtracting the stone and peel weight from the total fruit weight. The weight of peel, pulp and stone was expressed in percentage. Peel thickness is not the same at different parts of the fruit in most of the varieties. Therefore, the peel thickness was measured at three places i.e., at basal, middle and apical portion of fruit with the help of vernier calipers.

Results and discussions

The weight of fruit will have direct impact on the yield and productivity of the selection. Among the seedling selections, the fruit weight ranged from 87.17 g in 'CMS-46' to 862.00 g in 'CMS-60'. This variation in fruit weight indicated the better option for selection of this character. Similar results in fruit weight ranged from 178.00 g in 'BN Acc-8' to 474.00 g in 'BN Acc-25' (Begum *et al.*, 2013)^[3].

The fruit length showed variation among the selections which ranged from 52.32 mm in 'MMS-03' to 149.12 mm in 'CMS-60'. The fruit width varied from 51.39 mm in 'CMS-30' to 117.62 mm in 'CMS-05'. The variation among the accessions of 'Baneshan' ranged between 8.00 cm in 'BN Acc-5' and 13.00 cm in 'BN Acc-25' for fruit length, 6.00 cm in 'BN Acc-14' to 9.10 cm in 'BN Acc-4' for fruit width and 5.00 cm

in 'BN Acc-6' to 7.90 cm in 'BN Acc-16' for thickness (Begum *et al.*, 2013)^[3].

The fruit volume of seedling selections varied from 88.00 ml in 'CMS-46' to 880.00 ml in 'CMS-05'. The clones of Alphonso also had the similar fruit volume of 227.34 ml in 'AA-5' (Mukunda, 2004)^[4]. The volume of fruits was found to be lower than the fruit weight, which resulted in the value of specific gravity to be more than 1 in these selections.

There was no high difference among the seedling selections for specific gravity. However, the specific gravity ranged from 0.96 g per cc in 'CMS-32' to 1.02 g per cc in 'CMS-47' (Table -03). Similarly, specific gravity of the mango varieties in Kerala varied from 1.00 g per cc in 'H-151' to 1.02 g per cc in 'Alphonso' (Anila and Radha, 2003)^[5].

High pulp weight is an important character, which is essential for selection of the better selections in mango. The pulp weight among the seedling selections was found to be varied from 53.56 g in 'CMS-43' to 647.72 g in 'CMS-05'. Similarly, the pulp weight ranged from 76.05 g in 'CKR Acc-19' to 254.22 g in 'CKR Acc-29' (Begum *et al.*, 2014)^[6].

Peel of the mango fruit accounts to non edible portion of the fruit. Hence, less peel weight is a desirable character in mango. The peel weight in the present study varied from 11.31 g in 'CMS-46' to 127.30 g in 'CMS-05'. Likewise, the peel weight ranged from 29.90 g in 'CKR Acc-19' to 74.10 g in 'CKR Acc-29' (Begum *et al.*, 2014)^[6].

More pulp weight may not give the exact idea of edible portion present in the fruit. However, relative amount of the pulp gives better idea about the edible portion of fruit. The high pulp percentage, low peel percentage, low stone percentage and high pulp to stone ratio are the desirable characters in mango. Kaur *et al.*, (2014)^[7], reported the variation in pulp/stone ratio in mango from 1.80 in 'Local selection-1' to 7.29 in 'Langra Banarasi'. In the present study, pulp to stone ratio ranged from 1.67 in 'CMS-43' to 17.24 in 'CMS-45'.

Pulp percentage varied between 53.65 per cent in 'CMS-43' and 81.77 per cent in 'GMS-04' (Table-04). This result is confirmed with the range of pulp contents of mango from 54.30 per cent in 'CKR Acc-6' to 67.40 per cent in 'CKR Acc-29' (Begum *et al.*, 2014)^[6].

Fruit skin thickness was ranged from 0.64 mm in GMS-64 to 2.05 mm in CMS-15. The present findings are in agreement with Simi (2006)^[8], who reported similar range of fruit skin thickness (0.60 mm to 2.00 mm) in mango. The data pertaining to fruit to pulp ratio revealed wide differences among the cultivars. Lower the fruit to pulp ratio means higher the edible part. Fruit to pulp ratio ranged from 1.22 in GMS-05 to 1.86 in CMS-43.

Table 1: Fruit physical parameters of seedling selections

Selections	Yield (kg/tree)	Fruit weight (g)	Fruit length (mm)	Fruit width (mm)	Fruit volume (ml)	Specific gravity (g/cc)
CMS - 01	77.00	227.80	77.52	73.84	226.00	1.01
CMS - 05	44.00	862.00	139.40	117.62	880.00	0.98
CMS - 06	56.00	155.87	82.16	63.86	157.00	0.99
CMS - 09	53.00	260.40	94.80	76.13	258.00	1.01
CMS - 14	12.00	221.20	114.40	68.36	228.00	0.97
CMS - 15	47.00	393.33	118.34	81.25	393.00	1.00
CMS - 16	104.00	470.40	126.33	92.20	475.00	0.99
CMS - 17	14.00	171.20	78.05	72.91	173.00	0.99
CMS - 18	41.00	211.70	106.63	74.94	214.00	0.99
CMS - 19	32.00	194.60	99.48	83.29	201.00	0.97
CMS - 23	19.00	267.89	120.54	94.78	271.00	0.99
CMS - 24	46.00	194.50	90.81	72.23	196.00	0.99
CMS - 25	28.00	229.20	107.58	67.03	227.00	1.01
CMS - 26	41.00	283.20	97.27	92.51	280.00	1.01

CMS - 27	74.00	261.60	99.00	78.46	262.00	1.00
CMS - 29	26.00	170.40	84.00	73.64	176.00	0.97
CMS - 30	84.00	100.50	68.29	51.39	103.00	0.98
CMS - 31	33.00	368.40	95.61	92.93	368.00	1.00
CMS - 32	67.00	238.80	82.19	70.51	249.00	0.96
CMS - 33	162.00	293.00	108.79	80.77	290.00	1.01
CMS - 34	69.00	185.50	92.29	68.07	186.00	1.00
CMS - 35	52.00	204.17	93.28	64.08	206.00	0.99
CMS - 37	33.00	150.00	82.44	58.53	152.00	0.99
CMS - 40	77.00	168.40	93.03	66.70	168.00	1.00
CMS - 41	118.00	156.20	91.36	63.13	155.00	1.01
CMS - 42	53.00	500.00	122.23	102.20	510.00	0.98
CMS - 43	213.00	99.83	71.18	59.22	101.00	0.99
CMS - 44	57.00	148.00	74.76	68.47	148.00	1.00
CMS - 45	20.00	426.00	130.40	87.16	422.00	1.01
CMS - 46	104.00	87.17	70.27	57.59	88.00	0.99
CMS - 47	74.00	144.00	77.49	65.24	141.00	1.02
CMS - 49	58.00	314.60	100.14	83.29	316.00	1.00
CMS - 51	63.00	157.29	86.78	72.78	160.00	0.98
CMS - 52	11.00	175.60	89.42	59.19	179.00	0.98
CMS - 53	158.00	165.00	112.48	61.38	170.00	0.97
CMS - 54	41.00	147.20	89.86	72.90	150.00	0.98
CMS - 55	48.00	228.00	105.06	70.86	230.00	0.99
CMS - 56	46.00	177.83	86.46	69.67	176.00	1.01
CMS - 57	51.00	507.33	136.13	88.97	507.00	1.00
CMS - 58	31.00	273.75	88.86	84.92	274.00	1.00
CMS - 59	62.00	277.60	94.27	79.87	278.00	1.00
CMS - 60	34.00	753.40	149.12	106.24	746.00	1.01
CMS - 61	219.00	149.14	77.34	65.12	149.00	1.00
CMS - 62	51.40	199.50	97.90	67.49	198.00	1.01
CMS - 63	41.00	141.00	83.19	60.62	140.00	1.01
CMS - 67	238.00	198.00	86.34	61.16	196.00	1.01
CMS - 68	248.50	270.60	105.16	78.12	271.00	1.00
GMS - 01	280.00	123.57	68.20	60.61	122.00	1.01
GMS - 02	364.00	179.86	78.78	68.15	178.00	1.01
GMS - 03	251.00	137.71	87.52	55.41	140.00	0.98
GMS - 04	196.00	316.67	87.53	82.52	314.00	1.01
GMS - 05	186.00	335.29	114.26	74.86	332.00	1.01
GMS - 06	13.00	228.43	83.73	74.36	231.00	0.99
YMS - 01	42.00	124.20	70.64	58.06	127.00	0.98
YMS - 04	37.00	144.00	65.56	63.24	145.00	0.99
YMS - 05	39.00	193.20	88.05	57.84	191.00	1.01
YMS - 06	19.00	156.33	73.68	59.73	160.00	0.98
YMS - 07	62.00	178.80	77.46	67.23	177.00	1.01
MMS - 01	275.00	213.00	75.66	78.24	213.00	1.00
MMS - 02	297.00	166.66	86.39	58.24	168.00	0.99
MMS - 03	256.00	106.62	52.32	54.62	109.00	0.98
Max	364.00	862.00	149.12	117.62	880.00	1.02
Min	11.00	87.17	52.32	51.39	88.00	0.96
Range	353	774.83	96.80	66.23	792.00	0.06
Mean	92.59	239.11	93.24	72.70	240.18	0.99
SD	87.22	142.14	19.48	13.44	142.93	0.02
S.Em±	11.16	18.20	2.49	1.72	18.31	0.01
CV	94.21	59.44	20.89	18.49	59.51	1.39

Table 2: Pulp, peel and stone parameters of seedling selections

Selections	Pulp weight (g)	Peel weight (g)	Stone weight (g)	Peel thickness (mm)	% Pulp	% Peel	% Stone
CMS - 01	179.44	29.57	18.79	1.02	78.77	12.98	8.25
CMS - 05	647.72	127.3	86.98	2.98	75.14	14.77	10.09
CMS - 06	100.05	25.41	30.41	0.77	64.19	16.30	19.51
CMS - 09	196.01	39.21	25.18	1.64	75.27	15.06	9.67
CMS - 14	159.95	38.55	22.7	1.37	72.31	17.43	10.26
CMS - 15	252.67	84.57	56.09	2.98	64.24	21.50	14.26
CMS - 16	328.78	101.07	40.55	2.16	69.89	21.49	8.62
CMS - 17	103.41	46.77	21.02	1.85	60.40	27.32	12.28
CMS - 18	127.23	43.53	40.94	1.18	60.10	20.56	19.34
CMS - 19	125.22	26.43	42.95	1.02	64.35	13.58	22.07
CMS - 23	201.10	41.66	25.13	1.06	75.07	15.55	9.38

CMS - 24	124.44	37.83	32.23	1.29	63.98	19.45	16.57
CMS - 25	170.38	29.48	29.34	1.21	74.34	12.86	12.80
CMS - 26	206.94	41.88	34.38	1.26	73.07	14.79	12.14
CMS - 27	183.81	43.28	34.51	0.99	70.26	16.54	13.19
CMS - 29	101.19	36.70	32.51	1.20	59.38	21.54	19.08
CMS - 30	65.17	13.74	21.59	0.86	64.85	13.68	21.48
CMS - 31	273.44	69.39	25.57	1.38	74.22	18.84	6.94
CMS - 32	160.10	45.15	33.55	1.38	67.04	18.91	14.05
CMS - 33	208.08	47.53	37.39	1.44	71.02	16.22	12.76
CMS - 34	121.62	33.33	30.55	1.21	65.56	17.97	16.47
CMS - 35	145.75	33.86	24.56	1.38	71.39	16.58	12.03
CMS - 37	92.00	28.61	29.39	1.57	61.33	19.07	19.59
CMS - 40	112.90	35.22	20.28	1.51	67.04	20.91	12.04
CMS - 41	115.55	20.33	20.32	0.89	73.98	13.01	13.01
CMS - 42	334.98	114.92	50.1	2.64	67.00	22.98	10.02
CMS - 43	53.56	14.1	32.17	0.84	53.65	14.12	32.22
CMS - 44	98.39	18.83	30.78	0.86	66.48	12.72	20.80
CMS - 45	331.26	75.53	19.21	1.33	77.76	17.73	4.51
CMS - 46	59.77	11.31	16.09	1.24	68.57	12.98	18.46
CMS - 47	95.13	24.42	24.45	0.87	66.06	16.96	16.98
CMS - 49	231.05	47.21	36.34	1.11	73.44	15.01	11.55
CMS - 51	92.42	35.06	29.81	1.12	58.76	22.29	18.95
CMS - 52	110.84	38.91	25.85	1.05	63.12	22.16	14.72
CMS - 53	114.85	25.86	24.29	1.25	69.61	15.67	14.72
CMS - 54	93.20	38.07	15.93	1.03	63.32	25.86	10.82
CMS - 55	153.94	38.79	35.27	1.74	67.52	17.01	15.47
CMS - 56	113.96	41.07	22.8	0.97	64.08	23.10	12.82
CMS - 57	358.40	85.06	63.87	1.80	70.64	16.77	12.59
CMS - 58	188.17	46.3	39.28	1.15	68.74	16.91	14.35
CMS - 59	197.75	46.95	32.9	1.07	71.24	16.91	11.85
CMS - 60	594.65	95.01	63.74	1.95	78.93	12.61	8.46
CMS - 61	102.10	28.14	18.9	1.24	68.46	18.87	12.67
CMS - 62	131.50	38.33	29.67	1.25	65.91	19.21	14.87
CMS - 63	98.20	19.68	23.12	0.74	69.65	13.96	16.40
CMS - 67	141.50	29.37	27.13	1.35	71.46	14.83	13.70
CMS - 68	202.95	44.19	23.46	0.96	75.00	16.33	8.67
GMS - 01	94.28	13.84	15.45	0.77	76.30	11.20	12.50
GMS - 02	132.88	20.16	26.82	0.64	73.88	11.21	14.91
GMS - 03	106.66	12.13	18.92	0.87	77.45	8.81	13.74
GMS - 04	258.94	23.78	33.95	0.84	81.77	7.51	10.72
GMS - 05	261.83	34.27	39.19	1.17	78.09	10.22	11.69
GMS - 06	178.27	19.78	30.38	0.88	78.04	8.66	13.30
YMS - 01	82.23	24.32	17.65	1.42	66.21	19.58	14.21
YMS - 04	97.57	24.87	21.56	0.92	67.76	17.27	14.97
YMS - 05	125.57	29.38	38.25	1.22	64.99	15.21	19.80
YMS - 06	92.74	32.12	31.47	1.52	59.32	20.55	20.13
YMS - 07	109.45	30.37	38.98	1.54	61.21	16.99	21.80
MMS - 01	163.61	25.49	23.9	0.97	76.81	11.97	11.22
MMS - 02	96.66	36.9	33.1	1.26	58.00	22.14	19.86
MMS - 03	62.37	28.16	16.09	1.25	58.50	26.41	15.09
Max	647.72	127.30	86.98	2.98	81.77	27.32	32.22
Min	53.56	11.31	15.45	0.64	53.65	7.51	4.51
Range	594.16	115.99	71.53	2.34	28.12	19.81	27.71
Mean	168.28	39.89	30.94	1.29	68.76	16.87	14.35
SD	110.78	24.20	12.77	0.47	6.34	4.29	4.61
S.Em±	14.19	3.10	1.63	0.06	0.82	0.55	0.58
CV	65.84	60.68	41.26	37.20	9.23	25.40	32.06

Conclusions

'CMS-05' and 'GMS-04' were best selections among sixty-one selections with bold fruit of 862.00g, higher pulp content (647.72 g) and best pulp qualities like higher pulp percentage (81.77 %) with lowest peel percentage (7.51 %) was recorded 'GMS-04'. The lowest peel content (11.31g) respectively. CMS-67 and GMS-02 are the best in yield with a yield of 238 kg and 364.00 kg per tree.

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