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Studies on genetic diversity for morphological and biochemical aspects of mango (*Mangifera indica* L.) genotypes

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Abstract

The experiment entitled “Studies on genetic diversity for morphological and biochemical aspects of mango (*Mangifera indica* L.) Genotypes” was carried out during the year 2019 and 2020 on the basis of morphological characters of germplasm. A survey, collection and evaluation through screening of mango genotypes in the areas of Malihabad region of Lucknow and analytical work was done in the Horticulture laboratory of the Department of Horticulture, SAST, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P), India. The thirty mango genotypes were collected and evaluated for distinct morphological characters. These genotypes showed a wide range of variability in physical characters of fruit viz., fruit colour, fruit size, fruit weight, fruit length, fruit breadth, fruit volume, fruit specific gravity and fruit firmness respectively.

Keywords: Mango, genotypes, variability, morphological characters

Introduction

Mango (*Mangifera indica* L.) is one of the most important fruits in India and is considered as the national fruit. It belongs to the family Anacardiaceae and native of Indo-Burma region (De Candole 1904, Popenoe 1920, Mukherjee 1951) [14]. In the Indian sub-continent, it has been cultivated for four thousand years. Mango is most popular among the tropical fruits of the world and has been rightly described as ‘King of Fruits’ owing to its delicious taste, captivating flavour and attractive aroma. Mango fruits are rich sources of Vitamin A and good sources of Vitamin C. They contain good amount of minerals, particularly potassium. Ripe mango fruit is considered invigorating, refreshing and fattening. It is mainly used for both consumptions as ripe fruits and for processing into various products slice, jam, jelly, squashes, syrups, nectars, baby food, mango leather, toffee etc. Unripe fruits are also used for making chutney, amchur and pickles. Mango seed oil or mango butter is extracted from mango kernels resembling cocoa butter. The ash of burnt leaves is a household remedy for burns and scalds. The wood is used for furniture, floor and ceiling boards, window frames, packing boxes and splints, brush backs, plywood, shoe heal and agricultural implements. According to Hindu mythology mango is accepted as a holy tree and leaves and twigs are used in religious functions. Mango thrives well in tropical and sub-tropical climate. It can be grown from sea level to an altitude of about 1400 meters. The favourable temperature is 18⁰ C to 35⁰ C, though it can tolerate temperature high as 48⁰ C. if trees are given regular irrigation. Mango is found growing well in areas receiving 25 cm to 250 cm of annual rainfall. High humidity, rainfall and frost during flowering period are harmful India is having the largest available germplasm wealth of mango with about 1,000 cultivars. The characteristic of each variety varied widely at different places and the ultimate fruit quality largely depends on the selection of a variety suitable for a particular region (Iyer, 1987) [6]. Seedlings resulting from cross-pollination in this highly heterozygous crop have added to the variability of this crop in this region. The climate of Lucknow is quite suitable for quality mango production. A number of attempts have been made to find out, suitable mango genotypes with good phenotypic and physico-chemical attributes for this region. Further, confusion exists in the nomenclature of mangoes due to different local names for the same variety. Therefore, to identify superior parents, genetic characterization is a basic requirement for effective selection within the existing population or population arising out of hybridization. However, it is desirable to select suitable and genetically divergent parents, based on information about the genetic variability and genetic diversity presents in the available germplasm. A large number of mango varieties are being

grown in India, most of them do not satisfy the requirements of an ideal commercial variety and fail in competition with other countries. So, to work out morphological characters of different mango cultivars were taken for study. Therefore, evaluation of different mango cultivars for a given set of ecology is one of the pre-requisites for successful mango cultivation.

Materials and Methods

The proposed investigation entitled “Studies on genetic diversity for morphological and biochemical aspects of mango (*Mangifera indica* L.) genotypes” was carried out during the year 2019 and 2020 at farmers mango orchards in Malihabad region of Lucknow district and analytical work was done in the Horticulture laboratory, Department of horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, (U.P), India. There were 30 genotypes and replicated thrice. The experiment was laid out in Completely Randomized Design (CRD). The observations were recorded on morphological characters of fruit weight (g), fruit length (cm), fruit breadth (cm), fruit volume (ml), fruit specific gravity and fruit firmness (kg).

Results and Discussion

A perusal of data (Table-1) clearly revealed that a wide variability was observed in fruit colour, fruit shapes, fruit weight, fruit length, fruit breadth, fruit volume, specific gravity and fruit firmness of different mango genotypes. Fruit shape of these thirty mango genotypes deep orange- yellow, greenish red, apple green, row sienna, greenish, lime green, blood red, lemon green with amber yellow on exposed surface, lemon yellow, Canary yellow, on keeping change to raw sienna, succinum to crem yellow, golden-yellow colour, greenish to light yellow, green colour, lime green with lemon yellow extending downward, sea green, yellow cadmium and fruit shape of these mango genotypes categorized as ovate

oblique, oblong, oval, almost oval, almost oblong, oblong, almost oval, roundish, oblong to elliptical, oblongis oval, ovalis oblong, medium elliptic, medium oblong, reniform, oblong slightly oblique at the apical end, roundish, oblong with raised beak, almost oblique, uniform and oblique long. These results are close agreement with the findings Anil and Radha (2003) ^[1] who worked on five mango cultivars under Kerala condition and found oblong fruit shape in most of the cultivars. A careful scrutiny of the data indicates (Table 2 and 3) that there was a significant variation among the different genotypes in respect to fruit weight, length, breadth, volume and specific gravity observed in different germplasm of mango. The highest fruit weight (501.56 g), fruit length (12.74 cm), fruit breadth (8.69 cm) and fruit volume (478.65 ml) were produced by Fazli followed by fruit weight (328.24 g) fruit breadth (8.69 cm) fruit volume (478.65 ml) found in Langra and fruit length (10.98 cm) produced in Chuasa. The minimum fruit weight (160.68 g), fruit length (5.61 cm) fruit breadth (4.07 cm) and fruit volume (157.18 ml). were noted in local genotype MBL-6. Islam *et al.* (2009) ^[7] were reported that variation of fruit weight, length, breadth due to varietal characters of fruit. Lodh *et al.* (1974)., Singh *et al.* (1985) ^[13, 17] and Iqbal *et al.* (1995) they also reported the variation of fruit weight, length and breadth a wide range of variation were observed among the genotypes. Highest fruit specific gravity (1.047) noticed in Fazli followed by Amrapali (1.046) and minimum specific gravity found in Dashehari (1.009). Bihari *et al.* (2012) ^[3] they observed the significant variation for specific gravity which ranged from 0.81 to 1.06 among the fifty mango varieties. The maximum fruit firmness (14.85 Kg) found in langra followed by (13.96 Kg), Fazli and minimum (9.72 Kg) Shahtuki Sanudo *et al.* (1999). They also reported that significant variation of firmness in Mexico mango cultivars. Further they suggested that the use of only fruit traits can give a good perspective about mango diversity.

Table 1: Fruit colour and shape of mango genotypes

Treatments	Genotypes	Fruit colour	Fruit shape
T-1	Amrapali	Deep orange- yellow	Ovate oblique
T-2	Nayab	Greenish red	Oblong
T-3	Bombay Green	Apple green	Oval
T-4	Makhan	Row sienna	Almost oval
T-5	Green sweet	Greenish	Almost oblong
T-6	Langra	Lime green	Oblong
T-7	Hushnara	Blood red	Oblong
T-8	Desi-Sipia	Lemon green with amber yellow on exposed surface	Almost oval
T-9	Sultan	Lemon yellow	Roundish
T-10	Dashehari	Canary yellow, on keeping change to raw sienna	Oblong to elliptical
T-11	Zardalu	Succinum to crem yellow	Oblongish oval
T-12	Taimurya	Lemon yellow	Ovalis oblong
T-13	Desi – amin	Greenish	Medium elliptic
T-14	Chausa	Golden-yellow colour	Medium oblong
T-15	Lucknow safeda	Raw sienna	Reniform
T-16	Tukumi	Greenish to light yellow	Oblong slightly oblique at the apical end
T-17	Fazli	Green colour	Ovalis long
T-18	Ramkela	Lime green with lemon yellow extending downward	Roundish
T-19	Neelum	Sea green	Oblong with raised beak
T-20	Shahtuki	Yellow cadmium	Almost oblique
T-21	Khasam-khas	Yellow, turning brown later on	Irregular
T-22	Jauhari	Raw sienna	Uniform
T-23	Rangila	Canary yellow	Reniform
T-24	MBL-2	Greenish yellow	Oblong to elliptical
T-25	MBL-3	Yellowish	Oblique long
T-26	MBL-4	Greenish	Roundish

T-27	MBL-5	Sea green	Ovalis long
T-28	MBL-6	Leman green	Ovalis
T-29	MBL-7	Light green turning yellow	Oblong
T-30	MBL-8	Lime green	Oblique long

Table 2: Fruit weight, length and breadth of mango genotypes

Treatments	Genotypes	Fruit weight (g)			Weight length (cm)			Fruit breadth (cm)		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T-1	Amrapali	209.67	220.40	215.03	9.41	10.57	9.99	6.29	7.70	6.99
T-2	Nayab	185.96	181.24	183.60	7.33	7.03	7.18	5.79	5.24	5.51
T-3	Bombay Green	232.30	216.07	224.18	9.30	8.36	8.83	6.78	5.97	6.37
T-4	Makhan	196.94	206.20	201.57	7.99	8.40	8.19	6.01	7.05	6.53
T-5	Green sweet	170.23	164.44	167.33	7.90	7.04	7.47	5.38	4.98	5.18
T-6	Langra	326.96	329.72	328.34	10.77	10.83	10.54	7.52	7.59	7.55
T-7	Hushnara	180.68	187.54	184.31	9.20	9.73	9.46	5.61	6.08	5.84
T-8	Desi-Sipia	174.37	168.66	171.51	7.89	7.15	7.52	5.96	5.49	5.72
T-9	Sultan	254.40	257.14	255.77	8.12	8.32	8.22	6.26	6.36	6.31
T-10	Dashehari	170.36	174.17	172.26	10.13	10.31	10.22	6.13	5.27	5.20
T-11	Zardalu	204.04	208.12	206.08	10.11	10.16	10.13	5.67	5.78	5.72
T-12	Taimurya	192.98	191.86	192.42	8.89	8.86	8.87	5.44	5.33	5.38
T-13	Desi – amin	203.99	201.52	202.75	10.15	10.11	10.13	7.15	7.22	7.18
T-14	Chausa	304.54	302.91	303.72	10.80	11.17	10.98	7.29	7.07	7.18
T-15	Lucknow safeda	185.96	173.05	179.50	8.25	7.52	7.88	6.39	5.70	6.04
T-16	Tukumi	170.89	168.41	169.65	7.50	7.45	7.47	5.23	5.30	5.26
T-17	Fazli	496.68	506.45	501.56	12.33	13.15	12.74	8.31	9.07	8.69
T-18	Ramkela	219.81	227.94	223.86	6.86	7.09	6.97	6.41	6.61	6.51
T-19	Neelum	299.85	293.49	296.67	10.73	10.24	10.48	7.12	7.18	7.15
T-20	Shahtuki	174.42	170.53	172.47	6.33	6.02	6.17	4.43	4.18	4.30
T-21	Khasam-khas	172.84	175.40	174.12	6.16	7.09	6.62	4.22	4.25	8.23
T-22	Jauhari	186.22	182.52	184.37	6.95	6.99	6.97	4.41	4.36	4.38
T-23	Rangila	188.65	190.93	189.79	7.19	7.11	7.15	4.70	4.72	4.71
T-24	MBL-2	203.50	206.03	204.76	9.86	9.99	9.92	5.56	5.95	5.75
T-25	MBL-3	222.54	219.35	220.94	7.55	7.42	7.48	5.42	5.30	5.36
T-26	MBL-4	206.60	205.47	206.03	7.31	7.21	7.26	4.95	4.46	4.70
T-27	MBL-5	194.72	197.94	196.33	7.02	7.33	7.17	5.17	5.48	5.32
T-28	MBL-6	162.04	158.52	160.68	5.98	5.25	5.61	4.13	4.02	4.07
T-29	MBL-7	170.55	172.87	171.71	6.24	6.35	6.29	4.19	4.25	4.10
T-30	MBL-8	175.35	177.18	176.26	6.37	7.06	6.71	4.26	4.29	4.27
	S.Em±	5.487	3.888		0.274	0.223		0.171	0.201	
	C.D. at 5%	15.561	11.026		0.776	0.633		0.486	0.571	

Table 3: Fruit volume, specific gravity and firmness of thirty mango genotypes

Treatments	Genotypes	Fruit Volume (ml)			specific gravity			Fruit firmness (Kg)		
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
T-1	Amrapali	200.39	210.70	205.54	1.045	1.046	1.046	12.87	12.95	12.92
T-2	Nayab	182.69	178.21	180.45	1.018	1.017	1.017	11.11	10.60	10.85
T-3	Bombay Green	224.58	207.22	215.90	1.031	1.043	1.037	9.71	10.00	9.85
T-4	Makhan	192.75	202.65	197.70	1.022	1.018	1.020	9.82	10.87	10.34
T-5	Green sweet	166.07	160.19	163.13	1.025	1.027	1.026	10.31	11.18	10.74
T-6	Langra	293.19	316.43	304.81	1.039	1.042	1.040	14.75	14.96	14.85
T-7	Hushnara	177.11	182.91	180.01	1.020	1.025	1.022	13.70	14.01	13.85
T-8	Desi-Sipia	168.00	162.47	165.23	1.038	1.038	1.040	13.30	12.60	12.95
T-9	Sultan	246.04	247.88	246.96	1.034	1.037	1.035	9.99	10.04	10.01
T-10	Dashehari	168.40	172.78	170.59	1.011	1.008	1.009	11.54	11.31	11.42
T-11	Zardalu	198.67	201.92	200.29	1.027	1.031	1.029	12.83	12.33	12.58
T-12	Taimurya	185.55	185.06	185.30	1.040	1.037	1.038	13.82	13.99	13.90
T-13	Desi – amin	198.72	195.68	197.20	1.027	1.030	1.028	12.86	13.24	13.05
T-14	Chausa	313.29	289.86	301.59	1.043	1.045	1.044	13.41	12.91	13.16
T-15	Lucknow safeda	180.73	167.42	174.07	1.029	1.034	1.031	10.79	10.46	10.62
T-16	Tukumi	168.60	166.46	167.53	1.014	1.012	1.013	11.57	11.16	11.36
T-17	Fazli	473.78	483.52	478.65	1.048	1.047	1.047	14.06	13.80	13.96
T-18	Ramkela	212.76	219.97	216.36	1.033	1.036	1.034	12.90	13.09	12.99
T-19	Neelum	289.59	282.51	286.05	1.035	1.039	1.037	12.10	11.38	11.74
T-20	Shahtuki	169.81	165.60	167.70	1.028	1.030	1.029	9.65	9.80	9.72
T-21	Khasam-khas	170.86	170.82	170.84	1.023	1.027	1.025	10.68	10.51	10.59
T-22	Jauhari	182.81	179.41	181.11	1.019	1.017	1.018	10.50	10.34	10.42
T-23	Rangila	184.35	186.88	185.61	1.024	1.022	1.023	11.68	11.55	11.61

T-24	MBL-2	196.35	197.98	197.16	1.037	1.041	1.039	12.63	12.50	12.56
T-25	MBL-3	215.62	214.76	215.19	1.032	1.029	1.030	10.63	10.19	10.41
T-26	MBL-4	190.30	202.11	196.20	1.015	1.017	1.016	13.41	12.92	13.16
T-27	MBL-5	187.95	191.92	189.93	1.036	1.031	1.033	10.08	10.28	10.18
T-28	MBL-6	159.17	155.10	157.18	1.018	1.022	1.015	11.56	11.20	11.38
T-29	MBL-7	167.76	169.37	168.56	1.017	1.021	1.019	10.28	10.67	10.47
T-30	MBL-8	171.75	174.10	172.92	1.021	1.018	1.019	9.73	9.98	
	S.Em±	6.080	3.739		0.003	0.003		0.335	0.383	
	C.D. at 5%	17.243	10.604		0.008	0.007		0.950	1.086	

Conclusion

On the basis of findings of the present study, it can be concluded that the significant variation exists within the genotypes based on morphological characters. Thirty mango genotypes results showed, that highest fruit weight (501.56 g), fruit length (12.74 cm), fruit breadth (8.69 cm), fruit volume (478.65 ml) and fruit specific gravity (1.047) noticed in Fazli and fruit firmness (14.85 Kg) found in Langra.

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