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EVALUATION OF SUCKING TYPE OF MANGO STRAINS UNDER SUB MOUNTANE ZONE OF EASTERN PUNJAB (INDIA)

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ABSTRACT

Mango is heterozygous in nature and exhibits great diversity in seedling population. In order to broaden the genetic base, a survey of mango growing regions of Punjab (India) was made and more than 60 sucking mango strains were collected. The performance of twenty-six elite sucking mango strains was assessed in terms of vegetative growth, fruit yield and quality attributes. Maximum tree vigour was recorded in GN_9. All the strains were severely infested by floral malformation except in GN_3, GN_9, GN_{21}, GN_{22}, GN_{26}, GN_{35} and GN_{48}, where it was less than 5 per cent. Fruit yield ranged between 47.5 kg/tree in GN_{16} to 178.8 kg/tree in GN_6. GN_8 strain had bigger fruit weight and fruit length, whereas; highest peel weight, stone weight and fruit breadth was found in GN_6. The highest fruit pulp percentage was observed in GN_{13} and it ranged from 41.9% to 65.7% in rest of strains. Lower fruit length and breadth was noted in GN_1 (5.57 cm) & GN_{48} (4.46 cm), respectively. Total soluble solids in various strains varied from 13.2 (GN_{18}) to 22.9 per cent (GN_{49}), acidity from 0.32 (GN_{49}) to 0.61 per cent (GN_{21}) and TSS/acid ratio from 23.8 (GN_6) to 71.6 (GN_{49}). The fibre content was absent in GN_1, GN_5, GN_8, GN_{10}, GN_{16} & GN_{18}. Fruit colour was sindhuri yellow in GN_2, GN_5, GN_6, GN_{15}, GN_{17} and GN_{21}. Strains GN_3, GN_5, GN_6, GN_{12}, GN_{15}, GN_{19} and GN_{48} were found to be promising under Punjab agro-climatic conditions.

Key Words: Genetic variability, germplasm, *Mangifera indica* L.

INTRODUCTION

Mango (*Mangifera indica* L.) known as 'king of fruits', occupies an important position in the fruit industry of India. It has a growth history of at least 4000 years in the Indian sub-continent. The genus '*Mangifera*' originated in South-Eastern Asia belongs to family 'Anacardiaceae' and comprises sixty-nine species (Kostermans and Bompard, 1993). India has the world's largest mango germplasm, where more than one thousand vegetatively propagated varieties or wild types are cultivated (Bal, 2003). Majority of these have been selected as superior chance seedlings arisen from open cross-pollination. Since, time immemorial, propagation of mango was done through seeds. Hence, a large population of old mango seedlings is found growing in different parts of the country. These seedlings have shown wide genetic diversity in terms of fruit size, shape, colour, flavour, taste, time of maturity, fruit yield, bearing regularity,

resistance to malformation and other maladies (Singh and Sharma, 2005). Due to long history of cultivation in the country, mangoes are also known for sucking qualities. They possess ideal physico-chemical attributes like oblong shape, unrupturable skin, thin & abundant juice, scanty fibres, small stone, superior TSS/acid blend & flavour etc. Several workers have described the promising local mango seedlings under different agro-climatic conditions (Teaotia and Singh, 1963; Sharma et al., 1984; Dhillon et al., 2001) In Punjab (India), mango cultivation is practically confined to sub-mountane zone including *kandi* areas. These regions are famous for sucking type mangoes and exhibit a wide genetic variability. Hence, mango-growing regions of the Punjab state were surveyed in early seventies, to harness the natural unrecorded variability. As a result, more than sixty sucking type strains possessing desirable horticultural traits were collected and planted at Fruit Research Station, Gangian for their maintenance, conservation and as a build-up material for future breeding programmes. These strains were coded as GN_1 to GN_{60}. Importance of germplasm in crop improvement is well recognized, therefore, present study has been undertaken to discuss various vegetative and quality attributes for different sucking mango strains under sub-mountane conditions of Punjab.

MATERIALS AND METHODS

The investigations were carried-out at Punjab Agricultural University, Fruit Research Station, Gangian (Dasuya) Hoshiarpur. The experimental site was situated in the sub-mountane zone of Punjab (India) between latitude of 31^0N and longitude of 75^0E at an elevation of 248.9 m above the mean sea level. Twenty-six elite-sucking type mango strains having vigorous tree growth and uniform age of 28 years were selected for the evaluation of their performance during 2004-05. The plants were given uniform cultural practices during the course of studies. The vegetative growth parameters were recorded in the month of October after the growth cessation. Stem girth was estimated with measuring tape from the marked places at 15 cm height from the bud union. Tree height and spread (mean of North-South and East-West) was noted with meter rod. Fruit yield was recorded in kg/tree by counting and multiplying the number of fruits with average fruit weight. The floral malformation was noted in the month of April by counting the infected panicles and percentage was worked out from total number of panicles on the tree. The observations on fruit size, peel weight, stone weight, pulp per cent, pulp/stone ratio, fruit colour, flavour and time of maturity were recorded as per standard procedure. The juice was extracted from the pulp by straining through a muslin cloth and total soluble solids were noted with Bausch and Lamb hand refractometer in term of degree Brix (%) and values were corrected at 20^0C. Acidity was estimated by titration of known volume of juice against N/10 NaOH using phenolphthalein as an indicator.

RESULTS AND DISCUSSION

Tree characters, floral malformation and fruit yield

The results indicate (Table I) that the strain GN_9 was found to be most vigorous which recorded highest stem girth (196 cm); tree spread (11.75 m) and tree height (12.30 m). However, minimum stem girth, tree spread and height were found in GN_{11} (103.5 cm), GN_{49} (6.25 m) and GN_4 (7.78 m), respectively. Dhillon et al. (2001) also reported similar type of observations in respect to growth parameters in different sucking type mango selections. The lowest incidence of floral malformation was noted in GN_{21} (2.8%) followed by GN_3 (3.0%), GN_{35} (3.2%), GN_{26} & GN_{48} (3.5%), GN_9 (4.0%) and GN_{22} (4.5%). Maximum occurrence of this malady was observed in GN_{13} (19.6%), conversely, in other strains, it ranged from 5.2 per cent in GN_{23} to 18.2 per cent in GN_8. Wide variability in mango malformation exists, which can be exploited to identify the resistance in strains for future breeding programme. The highest average fruit yield of 178.4 kg was noted in GN_6. The second largest fruit yield of 171.5 kg was observed in GN_3, followed by GN_{19}. Strain-GN_{16} was the lowest (47.5 kg) fruit yielder. Similar type of variability in different

mango selections/varieties was also noted by many workers (Katrodia et al., 1989; Dhillon et al., 2001).

Fruit characters

The fruit weight also varied greatly in different strains (Table I) with maximum in GN_8 (220.2 g) and minimum (69.0 g) in GN_{23}. However, strains-GN_6, GN_{19}, GN_{12} & GN_{13} had fruit weight of 211.8, 188.0, 175.5 & 172.3 g, respectively. The highest peel and stone weight to the tune of 45.7 and 47.6 g, respectively was noted in GN_6 (Table II). The smallest stone with an average weight of 18.9 g was found in GN_{10}. Peel weight of the fruit was observed to be minimum (11.3 g) in GN_1. The average pulp/stone ratio in different strains varied from 1.32 to 3.85, being maximum in GN_{13} and minimum in GN_{17}. The highest pulp percentage of 66.9 was found in GN_{13}, closely followed by 65.7 in GN_{18} and 65.6 in GN_8. In remaining strains, it ranged from 41.9% to 63.3%, being lowest in GN_{23}. GN_8 recorded highest (10.61 cm) fruit length, followed by GN_{12} and GN_{13}, while lowest (5.57 cm) in GN_1. On the other hand, GN_6 had maximum (7.90 cm) fruit breadth and it was minimum (4.46 cm) in GN_{48}. Kulkarni and Rameshwar (1981) and Parida and Rao (1989) reported variation in fruit characters in different strains/cultivars of mango under agro-climatic conditions of Andhra Pradesh and Orissa, respectively.

Fruits with uniform and oblong shape fetch higher market price and considered good for processing. On the basis of fruit shape, strains are classified as ovate (GN_1, GN_3, GN_5, GN_{11}, GN_{22}, GN_{23}, GN_{26} & GN_{49}), oblong (GN_6, GN_7, GN_8, GN_{12}, GN_{13}, GN_{15}, GN_{16}, GN_{34} & GN_{48}) and ovate oblong (GN_2, GN_4, GN_9, GN_{10}, GN_{17}, GN_{18}, GN_{19}, GN_{21} & GN_{35}). Mukherjee et al. (1983) also classified mango varieties into three categories under West Bengal conditions. Fruit colour in most of strains was light green, greenish yellow, light yellow, yellowish green, yellow and pale yellow (Table III). Strains viz. GN_2, GN_5, GN_6, GN_{15}, GN_{17} & GN_{21} had bright, attractive yellow colour with red or sindhuri blush on their fruit skin. These can be used as a donor source for developing coloured mango hybrid cultivars. Singh and Jawanda (1963) reported similar observations in term of fruit skin colour in different sucking type mango strains.

Wide variability was recorded for the presence of flavour and aroma in fruits at the time of ripening, which is one of the most important characters for identifying sucking type mango strains. In present study, fruits of strains i.e. GN_2, GN_3, GN_6, GN_{12}, GN_{19} & GN_{48} had excellent taste, aroma and flavour. Fibres on the stone were absent in GN_1, GN_5, GN_8, GN_{10}, GN_{16} & GN_{18}, while all other strains were less or more fibrous. The fruit maturity in sucking type of mango has been classified as Early (I^{st} week of July), Mid (II^{nd} & III^{rd} week of July) and Late (beyond IV^{th} week of July).

Chemical characters

Chemical quality attributes among the different strains also depicted genetic variability (Table III). Juice extracted from fruit pulp of different strains-GN_{10}, GN_{15}, GN_{23} and GN_{49} contained more than 20 per cent total soluble solids content, though, the least to the tune of 13.2 per cent was observed in GN_{18}. Important sucking type mango strains grown under Uttar Pradesh state conditions have also shown variability in soluble solids from 13.5 to 18.2 per cent (Rabbani and Singh, 1989). The highest (0.61%) fruit acidity was noted in GN_{21} and this content varied from 0.53 to 0.60 percent in GN_{15}, GN_{12}, GN_{35}, GN_{22}, GN_4, GN_9 and GN_6. On the other hand, the lowest (0.32%) acidity was recorded in GN_{49}. Dhillon et al. (2001) also reported higher fruit acid content in sucking type mangoes; therefore, some strains can be selected for pickle purposes on the basis of other desirable characters. As far as TSS/acid ratio is concerned, the maximum (71.6) was found in GN_{49} and the minimum (23.8) in GN_6.

CONCLUSION

Based on overall performance with respect to vegetative, maturity period, fruiting and physico-chemical attributes, strains GN_3, GN_5, GN_6, GN_{12}, GN_{15}, GN_{19}, and GN_{48} have been found promising for sucking type of mangoes under sub-mountane conditions of Punjab.

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TABLES

Table 1: Vegetative, floral malformation and fruiting characteristics of sucking type mango strains

Strains	Common name	Stem girth (cm)	Tree height (m)	Spread (m)	Malformation (%)	Fruit Yield (kg/tree)	Fruit Weight (g)
GN_1	Gurmail da Amb	150.5	11.30	8.25	10.4	65.3	78.9
GN_2	Samrali	109.3	9.85	7.41	6.9	108.8	119.9
GN_3	Kukian de Chhalli	137.0	10.77	7.12	3.0	171.5	144.0
GN_4	Bijrore de Bud	151.0	7.78	8.58	15.9	142.3	158.2
GN_5	Hariana kanghi	135.0	9.67	9.40	13.8	126.1	126.6
GN_6	Punjab Beauty	148.0	10.52	10.35	7.5	178.4	211.8
GN_7	Mallian de Chhalli	124.7	9.10	7.05	13.4	71.4	124.3
GN_8	Padhaura late	163.5	12.05	11.23	18.2	118.6	220.2
GN_9	Sangtra	196.0	12.30	11.75	4.0	154.2	170.8
GN_{10}	Kubi	158.0	10.13	9.78	11.3	78.4	87.5
GN_{11}	Seb	103.5	9.25	7.75	12.1	61.8	137.1
GN_{12}	Bijrore de Chhalli	118.3	9.43	7.15	14.2	156.9	175.5
GN_{13}	Ruhkeora	123.0	9.25	7.00	19.6	54.1	172.3
GN_{15}	Jai kaur de Sindhuri	125.0	10.55	8.07	5.9	64.3	101.3
GN_{16}	Allaichi Dana	120.0	10.40	9.13	17.3	47.5	118.0
GN_{17}	Sindhuri	151.0	10.70	9.75	5.6	65.0	115.7
GN_{18}	Kalianwala	130.0	8.83	7.90	8.0	85.8	153.4
GN_{19}	Chhauni kalan de Chhalli	149.0	10.45	10.06	9.2	168.0	188.0
GN_{21}	Throlli de laltain	115.5	8.40	7.55	2.8	106.4	142.0
GN_{22}	Seedwala Gola	135.0	9.35	7.48	4.5	123.8	121.7
GN_{23}	Madhubala	157.0	9.63	9.65	5.2	55.0	69.0
GN_{26}	Mitha Bairowal	141.0	11.55	7.70	3.5	98.5	91.3
GN_{34}	Bajajan de Chhalli	111.0	9.60	7.38	6.1	107.3	165.0
GN_{35}	Brij Lal de Ambi	132.0	10.75	8.50	3.2	119.0	123.6
GN_{48}	Lala da Amb	125.0	8.40	10.20	3.5	125.0	85.5
GN_{49}	Kela	126.3	10.65	6.25	16.5	117.6	130.8

Table 2: Physical characteristics and fruit harvesting time of sucking type mango strains

Strains	Peel weight (g)	Stone weight (g)	Pulp/ stone ratio	Pulp (%)	Fruit length (cm)	Fruit breadth (cm)	Fruit harvesting time
GN_1	11.3	24.8	1.73	54.3	5.57	4.67	IInd week of July
GN_2	21.2	26.8	2.68	59.9	7.01	6.77	IIInd week of July
GN_3	29.5	33.8	2.39	56.0	8.93	5.85	IVnd week of July
GN_4	27.2	36.8	2.56	59.4	9.98	5.51	IIInd week of July
GN_5	21.4	32.1	2.28	57.7	7.47	6.21	Ist week of August
GN_6	45.7	47.6	2.49	55.9	9.32	7.90	IInd week of July
GN_7	18.2	36.3	1.93	56.2	6.68	4.83	IInd week of July
GN_8	33.5	42.2	3.43	65.6	10.61	6.36	IVth week of July
GN_9	30.9	34.9	3.01	61.5	8.37	6.14	IIIrd week of July
GN_{10}	13.2	18.9	2.93	63.3	7.19	4.49	IVth week of July
GN_{11}	25.1	36.7	2.05	54.9	8.40	6.12	IIIrd week of July
GN_{12}	26.9	40.8	2.64	61.4	10.58	5.65	IIIrd week of July
GN_{13}	27.0	30.0	3.85	66.9	10.42	5.58	Istweek of August
GN_{15}	15.5	27.5	3.12	57.6	7.15	4.76	IIIrd week of July
GN_{16}	20.2	40.6	1.41	48.5	7.21	4.73	IVth week of July
GN_{17}	22.1	40.3	1.32	46.1	6.87	5.35	IVth week of July
GN_{18}	25.8	26.8	3.76	65.7	8.63	6.02	IVth week of July
GN_{19}	39.0	46.0	2.24	54.8	9.72	6.54	IIIrd week of July
GN_{21}	32.3	37.3	1.94	51.0	8.06	6.18	IVth week of July
GN_{22}	23.7	25.7	2.81	59.4	7.44	5.27	IIIrd week of July
GN_{23}	19.6	20.5	1.42	41.9	6.44	4.72	IIIrd week of July
GN_{26}	20.7	25.5	1.77	49.4	6.55	4.58	IIIrd week of July
GN_{34}	24.6	42.3	2.32	59.5	9.88	5.74	IIIrd week of July
GN_{35}	26.0	32.4	2.01	52.8	8.72	6.28	IIIrd week of July
GN_{48}	17.5	20.2	2.37	55.9	6.22	4.46	IIIrd week of July
GN_{49}	26.2	29.3	2.57	57.6	7.74	5.47	Ist week of July

Table 3: Physico-chemical characteristics of sucking type mango strains

Strains	TSS (%)	Acidity (%)	TSS/ acid ratio	Fruit shape	Skin Colour	Fruit Taste	Flavour	Presence of fibre
GN_1	18.1	0.45	40.2	Ovate	Light Yellow	Excellent	Good	Absent
GN_2	18.0	0.34	52.9	Ovate oblong	Sindhuri	Superb	Pleasant	All over
GN_3	19.2	0.43	44.7	Ovate	Light Yellow	Superb	Pleasant	Sparsely
GN_4	17.5	0.59	29.7	Ovate oblong	Yellow	Excellent	Pleasant	Sparsely
GN_5	18.7	0.50	37.4	Ovate	Yellow with red blush	Excellent	Pleasant	Absent
GN_6	14.3	0.60	23.8	Oblong	Yellow with apple like blush	Superb	Pleasant	All over
GN_7	19.3	0.38	50.8	Oblong	Light Yellow	V. Good	Pleasant	All over
GN_8	17.6	0.46	38.3	Oblong	Greenish Yellow	Good	Pleasant	Absent
GN_9	15.5	0.59	26.3	Ovate oblong	Orange yallow	V. Good	V. Good	Present
GN_{10}	20.4	0.35	58.3	Ovate oblong	Yellow	Excellent	Pleasant	Absent
GN_{11}	15.8	0.41	38.5	Ovate	Yellowish green	Good	Good	Present
GN_{12}	18.5	0.54	34.3	Oblong	Yellowish green	V. Good	Pleasant	All over
GN_{13}	16.3	0.38	42.9	Oblong	Pale yellow	Good	Good	Sparse
GN_{15}	20.2	0.53	38.1	Oblong	Sindhuri yellow	V. Good	Pleasant	Abundant
GN_{16}	16.4	0.40	41.0	Oblong	Yellowish green	Good	Poor	Absent
GN_{17}	18.0	0.33	54.5	Ovate oblong	Light yellow with red blush	V. Good	Pleasant	All over
GN_{18}	13.2	0.43	30.7	Ovate oblong	Light green	Good	Good	Absent
GN_{19}	19.8	0.49	40.4	Ovate oblong	Yellow	Excellent	Pleasant	Medium
GN_{21}	19.3	0.61	31.6	Ovate oblong	Sindhuri Yellow	Good	Good	Present
GN_{22}	16.8	0.58	28.9	Ovate	Light Yellowish green	V. Good	Good	Medium
GN_{23}	22.2	0.33	67.3	Ovate	Light yellowish green	V. Good	Pleasant	Sparse
GN_{26}	17.5	0.35	50.0	Ovate	Light yellow	V. Good	Pleasant	Present
GN_{34}	18.5	0.34	54.4	Oblong	Reddish Yellow	V. Good	Pleasant	Sparse
GN_{35}	15.8	0.55	28.7	Ovate oblong	Light yellow	V. Good	V. Good	Present
GN_{48}	16.6	0.46	36.1	Oblong	Yellow	V. Good	Pleasant	All over
GN_{49}	22.9	0.32	71.6	Ovate	Green yellow	V. Good	Pleasant	Sparse