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Study on Horticultural Traits and Incidence of Physiological Disorders of Indigenous Seedling Mango Germplasm in Central and Sub-Montane Zones of Punjab

Gurbir Singh*

Department of Horticulture, Guru Nanak Dev University Amritsar, Punjab, India

***Corresponding author information:** Singh Gurbir, Department of Horticulture, Guru Nanak Dev University Amritsar, Punjab, India, E-mail: gurbirsingh011@gmail.com

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Abstract

A Survey on horticultural traits and incidence of physiological disorders of seedling mango germplasm was carried out in central and sub-montane zones of Punjab, during February to October 2012 (on year) and February to October 2013 (off year). The superior genotypes of seedling mangoes to peculiar character were selected on the basis of information provided by tree owners, local inhabitants and officials from Department of Horticulture, Punjab. Wide variability was recorded for eating quality in fruits at the time of ripening indicate that the fruit storage life in different evaluated seedling mango germplasm varied from 3 to 5 days. The time of fruit maturity also differed amongst the genetic resources under evaluation The seedling mango germplasm collected in central and sub-montane zone of Punjab were irregular, alternate and regular bearers. A wide range of variability was observed in fruit yield of collected germplasm. Thus, there is tremendous possibility of such material to act as source for further propagation as well as breeding material for hybridization to evolve new varieties with desirable traits.

Key words: *Mangifera indica*; Fruit quality; Yield; Variability; Diversity

Introduction

It belongs to genus Mangifera under family Anacardiaceae and order Sapindales comprising of 69 species, which are distributed throughout the world. Mango peel and pulp contain carotenoid pigments, vitamin C, polyphenols, omega-3 poly unsaturated fatty acids, proteins and carbohydrates along with minerals like calcium, phosphorus and iron. Fruit is utilized at all stages of its development. Young and unripe fruits are liked because of their acidic taste and are used for culinary purposes as well as for pickle, chutney and ambchoor (mango powder) making. Ripe fruits are utilized in preparing squash, jam, jelly, custard powder, mango leather and mango toffee. Its wood is used for making furniture, packing boxes, match boxes and also as a source of fuel. It is the national fruit of India, Pakistan and the Philippines and the national tree of Bangladesh. The heavy canopy of the seedling mango is a source of shelter and shade for both animals and humans and also good as a wind break against strong winds. No other fruit can be put to so many diversified uses in the form of processed product as the mango. Therefore, it is rightly acknowledged as the king of fruits in India. It enjoys the same popularity in the tropics as apple in the temperate regions [1].

Mango is grown commercially in India, Indonesia, Bangladesh, Philippines, Malaysia, Sri Lanka, Thailand, Pakistan, Egypt, Sudan, South Africa, West Indies, Hawai, Brazil and USA (Florida) etc. In India it is successfully growing in the states of Uttar Pradesh, Andhra Pradesh, Bihar, West Bengal, Kerala, Karnataka, Punjab and Haryana The mango is now cultivated mostly in frost-free tropical and warm subtropical climates, almost half of the world's mangoes are cultivated in India alone.

India is the largest producer of choicest table varieties of mango in the world and wide variability has been found in fruit shape, size and taste but commercial importance is given to nearly about 30 mango cultivars in the country. But still, mango industry lags far behind in the world due to low productivity, higher incidence of insect pests, diseases and physiological disorders etc. Mango is cross pollinated fruit crop and almost majority of mango cultivars under cultivation in the world are selections from open pollinated seedling populations **(Table 1)** [2].

Selection number	Collector code	Eating quality	Fruit storage life (Days)	Time of fruit maturity	Bearing behaviour	Yield/tree (kg)
1	AP- 1	Good	3	4th week of July	Irregular	158.2
2	AKCA -14	Good	5	2nd week of July	Alternate	149.3
3	GJB -1	Good	3	2nd week of July	Irregular	189.1
4	AA -101	Good	4	2nd week of July	Regular	179.2
5	AA-15	Good	4	2nd week of July	Irregular	297.1

6	AA-4	Very Good	4	2nd week of July	Irregular	349.5
7	AA -16	Very Good	3	2nd week of July	Irregular	291.4
8	AA -42	Excellent	5	4th week of July	Irregular	247.3
9	GRB-1	Good	3	2nd week of July	Irregular	79.5
10	AA-3	Good	5	1sr week of July	Irregular	345.15
11	GQ-3	Good	4	2nd week of July	Irregular	179.2
12	AA-20	Good	4	2nd week of July	Irregular	296.1
13	AUG.1	Good	3	4th week of July	Alternate	195.2
14	AA-9	Excellent	4	3rd week of July	Irregular	238.72
15	ABG-1	Excellent	4	3rd week of July	Regular	168.4
16	AGKB-64	Good	4	4th week of July	Regular	169.1
17	AA-29	Very Good	3	2nd week of July	Irregular	397.75
18	AA-39	Very Good	5	3rd week of July	Irregular	497.84
19	AA-2	Good	4	1st week of July	Irregula	349.41
20	AR-1	Good	5	4th week of July	Irregular	128.2
21	AA-8	Good	5	1st week of July	Irregular	287.76
22	AA-1	Good	4	1st week of July	Irregular	285.88
23	AA-7	Excellent	4	3rd week of July	Irregular	270.92
24	AKS-1	Good	4	2nd week of July	Alternate	1400.2
25	AA-19	Good	3	1st week of July	Irregular	385.96
Range		--	3.00-5.00	--	--	79.50-1400.20
Mean		--	3.96	--	--	301.41
S. Em. (±)		--	0.077	--	--	3.899
C.D. at 5%		--	0.156	--	--	7.84

Table 1: Horticultural traits of evaluated genotypes.

Materials and Methods

The present study was conducted in central and sub-montane zones of Punjab consecutively for three years during February to October 2012 (on year) and February to October 2013 (off year) and February to October 2014 (on year). More than hundred genotypes were selected on the basis of information provided by tree owners, local inhabitants and officials from Department of Horticulture, Punjab. Out of which twenty five superior genotype of seedling Mangoes to peculiar character were selected. The selected genotypes were evaluated with the help of IPGRI, Rome 'Mango Descriptor' for various vegetative, floral, fruit maturity, disorders and storage characters etc. Thirty fruits/sample were randomly selected from all the sides of the tree [3].

Yield/tree

The yield/tree was recorded at optimum maturity in kg for estimating yield of a particular tree, mango fruits were harvested and weighed on a physical balance and registered according to their providing marking.

Fruit maturity period

The time of maturity was dependent upon various external characters like appearance of waxy coating, dots on the fruits and relative size of the fruit, change in colour and firmness. Tapka, the natural fall of mature fruit is considered to be the indication of fruit maturity in mango. All the fruit samples for physic-chemical analysis were taken at optimum maturity. The maturity period for the evaluated types was recorded and classified as: (a) Early (b) Medium (c) Late

Fruit storage life

It was recorded number of days of storage of ripe fruits under ambient conditions after harvest.

Eating quality

The combined assessment of flavour/acidity, sweetness, aroma and astringency of TSS, acidity and sugars to be made and classified as:(a) Poor (b) Good (c) Very good (d) Excellent

Bearing behaviour

The regularity of bearing was assessed during the two successive years of the research study. However the knowledge about regularity of bearing in the past was also taken from the owner and employees of the orchards and are classified as: (a) Irregular (b) Regular (c) Alternate was documented from genotypes AA-19 and AP-19, respectively [5].

Physicochemical attributes horticultural traits and incidence of physiological disorders

Variations among different bio-chemical characteristics of mature ripe fruits of the seedling accessions had been displayed in Table. The evaluated seedling mango germplasm exhibited a high range of variability for total soluble solids content ranging from 13.30 to 20.30 per cent. Genotype AA-42 ranked top with TSS content. The present results are in accordance with the findings, who found considerable variation in the TSS among 22 Mango genotypes. Reported variation in TSS (14.4%-18.0%) in some late varieties of mango in gangetic plains of North India. The highest (0.81%) and lowest (0.39%) titrable acidity was recorded in genotype GQ-3 and AA-42, respectively. The outcomes with respect to acidity are partially in agreement with the previous work, who observed the range for acidity to the level of 0.14 to 0.34 per cent in different mango varieties. The highest TSS: acid ratio 52.05 was recorded in the genotype AA-42, followed by genotypes AA-9, AA-7, AA-29, ABG-1, AA-39 and AA-3 having TSS: acid ratio of 48.00, 41.52, 37.65, 36.34, 35.20 and 31.96, respectively. Also showed variation in TSS: acid ratio and the highest TSS: acid ratio (75.42) was recorded in Dashehari. The maximum reducing sugars (4.11%) was estimated in AA-42 and it was significantly superior most having the reducing sugars better than the rest. A similarity to this had been found in the investigation of Sanjay and Singh (2002), who also documented the highest reducing sugars content as 4.78% for Amarpali in Bihar condition. The maximum and minimum total sugar contents were documented as 16.10% and 11.25% in accessions AA-42 and GRB-1, respectively. The present results partially agreed with the findings, who reported 7.35 to 13.20 per cent total sugars in eight mango varieties. The observed variations for different physicochemical attributes among twenty five seedling mango germplasm might be attributed to climatic and varietals differences [5].

Results and Discussion

With respect to various horticultural traits such as eating quality, fruit storage life, time of fruit maturity, bearing behaviour and yield per tree are documented in Table. The genotyeps AA-7, AA-9, AA-42 and ABG-1 had excellent taste, flavour and aroma. Genotypes AA-4, AA-16, AA-29 and AA-39 had very good and rest of the genotypes having good taste, flavour and aroma. These results lend support from findings of earlier research workers. The highest keeping quality was recorded in genotypes AA-3, AA-8, AA-39 and AR-1 in which fruit remained sound condition for 5 days. Variation in fruit maturity in different seedling mango germplasm might be due to inherent genetic variation. The genotypes AA-1, AA-2, AA-3, AA-8 and AA-19 mature during 1st week of July and considered as early maturing genotypes. Late maturing genotypes which matured during 3rd and 4th week of July were AA-7, AA-9, AA-39, AA-42, ABG-1, AGKB-64, AP-1, AUG-1 and AR-1. Most of the seedling mango germplasm evaluated in the central and sub-mountain zones of Punjab were found to be irregular and/or alternative bearer in nature. However, genotypes AA-101, ABG-1 and AGKB-64 showed tendency towards regular bearing. The results regarding bearing habit are in good tune with the research findings of the genotype AKS-1 ranked first with yield (1400.20 kg/tree), followed by AA-39 (497.84 kg/tree), AA-29 (397.75 kg/tree) AA-19 (385.96 kg/tree), respectively, were high yielding genotypes. The minimum yield (79.50 kg/tree) was found in genotype GRB-1. The findings obtained in the present study lends support from the previous reports of, who also found high range of variation in yield per tree. The variation in the yield of evaluated seedling mango genotypes in the current investigation might be attributed to difference in growing conditions, genetic variations and cultural practices that ultimately influenced the size of the plant [6].

Fruits from evaluated germplasm were tested for incidence of disorders like malformation, black tip and spongy tissue. Considerable variation had been noticed with respect to occurrence of mango malformation, however none of the genotypes apparently exhibited the incidence of black tip and spongy tissue. The least occurrence of malformation (4.10%) was observed in genotype AR-1, it was followed by the genotypes AUG-1 (5.3%). Genotypes AP-1, AA-16, AKS-1 and AA-39 were also found comparatively less prone to mango malformation and considered as lightly affected genotypes. The variation in genotype susceptibility to mango malformation might be due to genetic makeup, season, climate and tree age. This result of the present study is in good confirmation with the earlier findings of, who recorded the incidence of malformation as low as 3.2% in mango under U.P condition. High range of variations in the occurrence of mango malformation also had been documented from investigation **(Table 2)** [7]**.**

Selection number	Collector code	Malformation	Black tip of mango	Spongy tissue
1	AP- 1	6.2	Absent	Absent
2	AKCA - 14	17.2	Absent	Absent
3	GJB -1	27.1	Absent	Absent
4	AA -101	11.2	Absent	Absent
5	AA-15	10.1	Absent	Absent
6	AA-4	13.4	Absent	Absent
7	AA -16	6.3	Absent	Absent
8	AA -42	9.1	Absent	Absent
9	GRB-1	25.2	Absent	Absent
10	AA-3	12.3	Absent	Absent
11	GQ-3	22.3	Absent	Absent
12	AA-20	9.4	Absent	Absent
13	AUG.1	5.3	Absent	Absent
14	AA-9	9.3	Absent	Absent
15	ABG-1	14.1	Absent	Absent
16	AGKB-64	18.1	Absent	Absent
17	AA-29	8.5	Absent	Absent
18	AA-39	8.2	Absent	Absent
19	AA-2	14.3	Absent	Absent

20	AR-1	4.1	Absent	Absent
21	AA-8	15.1	Absent	Absent
22	AA-1	16.4	Absent	Absent
23	AA-7	14.5	Absent	Absent
24	AKS-1	7.6	Absent	Absent
25	AA-19	8.3	Absent	Absent
Range		4.10-27.10	--	--
Mean		12.54	--	--
S. Em. (±)		0.046	--	--
C.D. at 5%		0.093	--	--

Table 2: Incidence of physiological disorders and mango malformation.

Conclusion

From the overall outcomes of the present investigation it is evident that the germplasm with desirable traits can be proved to be good genetic material for the utilization in future breeding programmes for improving the mango varieties in Punjab. The genotype AKS-1 recorded the highest tree height and canopy volume. The fruit set was the earliest in genotype GJB-1 and genotypes GQ-3 and AA-29 had the maximum sex ratio. Genotypes AKS-1 and AA-19 were excellent in terms of fruit weight and genotype AKS-1 along with AA-39, AA-29 and AA-19 were considered as high yielding genotypes. As far as fruit bio-chemical attributes are concerned genotype AA-42 proved to be the best with significantly higher TSS, reducing and total sugar content and lower acidity level. Amongst the evaluated germplasm AA-101, ABG-1 and AGKB-64 showed tendency towards regular bearing, whereas genotypes AR-1 and AUG-1 were showed the maximum resistance against mango malformation. Hence, genotypes such as AKS-1, GJB-1, GQ-1, AA-19, AA-29, AA-39, AA-42, AA-101, ABG-1, AGKB-64, AR-1 and AUG-1 can be included for future systematic breeding as well as hybridization programme of mango to inculcate and/or concentrate favourable attributes among the improved progenies.

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