GAU Research Journal 46(4) : 62-66 (October 2021)

Study on horticultural traits and incidence of physiological disorders of indigenous seedling mango germplasm in central and sub-montane zones of Punjab

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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 indicates 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,* Punjab; India introduction

INTRODUCTION:

Mango ! belongs to genus *Mangifera* under family Anacardiaceae and order Sapindales comprising of 69 species (Kostermans and Bompard, 1993), 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 amchoor (mango powder) making. Ripe fruits are utilized in preparing squash, jam, jelly, custard powder, mango leather (Amb papad) 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.

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.

MATERIAL AND METHOD 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

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. 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

Horticultural traits and incidence of physiological disorders

Results 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 – 1. The genotypes 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 Iyer and Subramanyam (1993) and Desai *et al*. (2000). 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. These findings are corroborated well with experimental outcomes of Boshra *et al*. (2007), Sharma *et al*. (2007) and Guirado *et al*. (2009). 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 Saha (1972) and Singh (1988). 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 Sanjay and Singh (2004) and Rao and Rao (2007), 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.

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 (Table – 2). 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 Dhar and Gupta (1979), 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 investigations of Singh and Mandal (1999), Pinto *et al*. (2000) and Prakash *et al*. (2006).

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. Genotypes AKS-1 along with AA-39, AA-29 and AA-19 were considered as high yielding genotypes. Amongst the evaluated germplasm AA-101, ABG-1 and AGKB-64 showed tendency towards regular bearing, where as genotypes AR-1 and AUG-1 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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Table 1: Horticultural traits of evaluated genotypes.

Selection number	Collector code	Eating quality	Fruit storage life (Days)	Time of fruit maturity	Bearing behaviour	Yield/ tree (kg)
1	AP- 1	Good	3.00	4th week of July	Irregular	158.20
2	AKCA - 14	Good	5.00	2nd week of July	Alternate	149.30
3	GJB -1	Good	3.00	2nd week of July	Irregular	189.10
4	AA -101	Good	4.00	2nd week of July	Regular	179.20
5	AA-15	Good	4.00	2nd week of July	Irregular	297.10
6	AA-4	Very Good	4.00	2nd week of July	Irregular	349.50
7	AA -16	Very Good	3.00	2nd week of July	Irregular	291.40
8	AA -42	Excellent	5.00	4th week of July	Irregular	247.30
9	GRB-1	Good	3.00	2nd week of July	Irregular	79.50
10	AA-3	Good	5.00	1sr week of July	Irregular	345.15
11	GQ-3	Good	4.00	2nd week of July	Irregular	179.20
12	AA-20	Good	4.00	2nd week of July	Irregular	296.10
13	AUG.1	Good	3.00	4th week of July	Alternate	195.20
14	AA-9	Excellent	4.00	3rd week of July	Irregular	238.72
15	ABG-1	Excellent	4.00	3rd week of July	Regular	168.40
16	AGKB-64	Good	4.00	4th week of July	Regular	169.10
17	AA-29	Very Good	3.00	2nd week of July	Irregular	397.75
18	AA-39	Very Good	5.00	3rd week of July	Irregular	497.84
19	AA-2	Good	4.00	1st week of July	Irregular	349.41
20	AR-1	Good	5.00	4th week of July	Irregular	128.20
21	AA-8	Good	5.00	1st week of July	Irregular	287.76

Selection number	Collector code	Eating quality	Fruit storage life (Days)	Time of fruit maturity	Bearing behaviour	Yield/ tree (kg)
22	AA-1	Good	4.00	1st week of July	Irregular	285.88
23	AA-7	Excellent	4.00	3rd week of July	Irregular	270.92
24	AKS-1	Good	4.00	2nd week of July	Alternate	1400.20
25	AA-19	Good	3.00	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**	**--**	**--**	**7.840**

Table 2: Incidence of physiological disorders and mango malformation.

Selection number	Collector code	Malformation (%)	Black tip of mango	Spongy tissue
1	AP- 1	6.20	Absent	Absent
2	AKCA – 14	17.20	Absent	Absent
3	GJB -1	27.10	Absent	Absent
4	AA -101	11.20	Absent	Absent
5	AA-15	10.10	Absent	Absent
6	AA-4	13.40	Absent	Absent
7	AA -16	6.30	Absent	Absent
8	AA -42	9.10	Absent	Absent
9	GRB-1	25.20	Absent	Absent
10	AA-3	12.30	Absent	Absent
11	GQ-3	22.30	Absent	Absent
12	AA-20	9.40	Absent	Absent
13	AUG.1	5.30	Absent	Absent
14	AA-9	9.30	Absent	Absent
15	ABG-1	14.10	Absent	Absent
16	AGKB-64	18.10	Absent	Absent
17	AA-29	8.50	Absent	Absent
18	AA-39	8.20	Absent	Absent
19	AA-2	14.30	Absent	Absent
20	AR-1	4.10	Absent	Absent
21	AA-8	15.10	Absent	Absent
22	AA-1	16.40	Absent	Absent
23	AA-7	14.50	Absent	Absent
24	AKS-1	7.60	Absent	Absent
25	AA-19	8.30	Absent	Absent
Range		**4.10-27.10**	**--**	**--**
Mean		**12.54**	**--**	**--**
S. Em. (±)		**0.046**	**--**	**--**
C.D. at 5%		**0.093**	**--**	**--**