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Short communication

Evaluation of mango genotypes for jelly seed disorder

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ABSTRACT

Twenty mango genotypes including indigenous cultivars, exotic cultivars and hybrids were assessed for incidence of jelly seed disorder in artificially and tree ripe fruits during 2013 & 2014. In general, the jelly seed frequency and thickness of jelly pulp was found to be higher in tree ripe fruits compared to artificially ripened fruits. Among indigenous mango cultivars, the frequency of jelly seed was maximum in Dushehari (21.3 and 36%) and minimum in Gulabkhas Green (13.3 and 21.3%) in artificially ripened and tree ripe fruits. In exotic mango cultivars, the jelly seed frequency in artificially as well as tree ripe fruits was maximum in Tommy Atkins (12.0 and 17.3%). Among mango hybrids, Pusa Pratibha showed maximum frequency of jelly seed in artificially and tree ripe fruits (13.3 and 18.7%). However, Pusa Arunima was found to be almost free from this disorder and none of fruits had jelly seed in both artificially ripened and tree ripe fruits.

Key words: Jelly seed, mango, *Mangifera indica*.

Mango is one of the most important tropical fruits, with India contributing about 40% of world production. Mango is closely linked with the history and culture of India. Having the maximum area and level of production among fruits, mango is acknowledged as the 'king of fruits' in Indian Sub continent. India produced 18.43 mt mangoes from an area of 2.52 mha during 2013-14. Indian mango export is hindered greatly by physiological disorders such as spongy tissue and internal tissue breakdown. However, during the last few years, jelly seed disorder has become a major issue in certain areas. The jelly seed is a physiological disorder caused by disintegration of the flesh around the seed into a jelly-like mass (Brecht *et al*., 1). The characteristic early symptoms of jelly seed are yellow colouration of the mesocarp around the stone. Later, disordered mesocarp develops an orange colour, whereas the surrounding tissue remains white or pale yellow (Raymond *et al*., 3). Although, several reports have appeared in the literature and a number of important varieties are grown in India, yet no systematic effort has been undertaken on screening of these varieties for incidence of jelly seed. Similarly, the physiological and biochemical changes associated with the jelly seed formation are not fully understood. Further, as jelly seed occurrence is only known when the fruit is cut open, its prior identification is very difficult. Jelly seed deteriorates the internal pulp quality of the fruit (Yahia, 6) and this disorder is common and also genotype-specific. The present investigation was aimed to screen the mango genotypes on the basis of occurrence of jelly seed disorder under Delhi conditions.

The present study was carried out during 2013 and 2014 at the Division of Fruits and Horticultural Technology, ICAR-IARI, New Delhi. Twenty mango genotypes, namely, Dushehari, Langra, Bombay Green, Khasulkhas, Gulabkhas Green, Amrapali, Mallika, Pusa Arunima, Pusa Surya, Pusa Pratibha, Pusa Shreshth, Pusa Peetamber, Pusa Lalima, H-8-11, H-1-11, Sensation, Tommy Atkins, St. Alexandrina, Primor-de-Amoreria and Selection-1 (open- pollinated Amrapali seedling) were evaluated for frequency of jelly seed in their fruits. The jelly seed disorder was observed in both artificially ripened and tree ripe fruits. The fruits were harvested randomly from all directions and canopy depth of the trees. Harvested fruits were cooled by dipping them in water and then cleaned for removing dirt and dust adhering on the surface. These cleaned fruits were air-dried at ambient condition and then wrapped with tissue paper and stored in CFB boxes for ripening. Another set of tree ripened fruits were harvested randomly from all directions and canopy depth of trees. Ripe fruits were cut open longitudinally in such a way that two slices having pulp and peel and one slice have pulp, stone and peel were separated. The characteristic symptoms of jelly seed was disintegration of the flesh around the seed into a jelly-like pulp (Brecht *et al.*, 1). The percentage of fruits showing jelly seed disorder was calculated by dividing the disorder affected fruits by total number of fruits examined. The thickness of mango pulp near the stone at middle portion of fruit having jelly seed disorder was also measured. The orchard soil (sandy loam) had pH ($7.17_{1:2}$), EC

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(0.21 dS/m), CEC (10.65 cmol kg^{-1}), organic carbon content (4.3 g kg^{-1} soil), N (225.72 kg/ha), P (48.83 kg/ha), K (48.93 kg/ha) and Ca (22.67 (kg/ha). The experiment was laid out in completely randomized design (CRD) with five replications and 10 fruits per replication. The data obtained from the experiments were analysed using OP Stat and the results were compared from ANOVA by calculating the LSD ($P \leq 0.05$) as suggested by Gomez and Gomez (2).

In mango, jelly seed disorder determines the quality and shelf-life of the fruits. The frequency and thickness of jelly pulp varied significantly among different mango genotypes ($P \leq 0.05$). In general the frequency and thickness of jelly pulp was found to be higher in tree ripe fruits, regardless of the genotypes. Among indigenous mango cultivars, the jelly seed frequency was maximum in Dushehari (21.3%) followed by Khashulkhas (17.3%) in artificially ripened fruits. However, the minimum incidence was noted in Gulabkhas Green (13.3%), which had non-significant differences with Langra and Bombay Green. Whereas, in tree ripened fruits the jelly seed frequency ranged between 18.7% in Khasulkhas to 36% in Dushehari. In exotic mango cultivars, the frequency of fruits having jelly seed disorder was significantly lower than indigenous cultivars. The frequency of jelly seed ranged between 0.0 to 12.0% in artificially ripened fruits. However, in tree ripe fruits, the frequency ranged between 6.7 to 17.3%. Among exotic cultivars, jelly seed frequency was maximum in Tommy Atkins in both artificially ripened and tree ripe fruits. Among hybrid mango varieties, the frequency of jelly seed was found to be maximum in Pusa Pratibha (13.3%), which had non-significant differences with Pusa Lalima (12.0%) under artificial ripening (Fig. 1 a,b). Moreover, none of the fruits of H-1-11, H-1-8 and Pusa Arunima had jelly seed disorder. Whereas, hybrid H-1-11 (5.3%) and H-1-8 (6.7%) had jelly seed disorder in tree ripe fruits. Interestingly, Pusa Arunima had no jelly seed disorder in both artificial and tree ripened fruits (Fig. 1 c,d). An open-pollinated seedling of Amrapali was also evaluated for jelly seed disorder and 7.3% artificially ripened fruits and 13.3% tree ripe fruits had jelly seed. Comparing all 20 mango genotypes, the maximum incidence of jelly seed was observed in Dushehari (Table 1).

The thickness of jelly pulp could be adjudged as a reliable indication of susceptibility of a particular genotype for this disorder. In case of artificially ripened fruits, the maximum thickness of jelly-like pulp was found in open-pollinated seedling (6.36 mm) followed by Dushehari (6.08 mm). Whereas, the thickness of jelly pulp ranged between 0.0 to 9.12 mm in tree ripe fruits. In tree ripe fruits, the maximum thickness was noted in Dushehari followed by Selection-1. It was also evident that tree ripe fruit had more thick jelly pulp than artificially ripened fruits, regardless of mango genotype (Table 1).

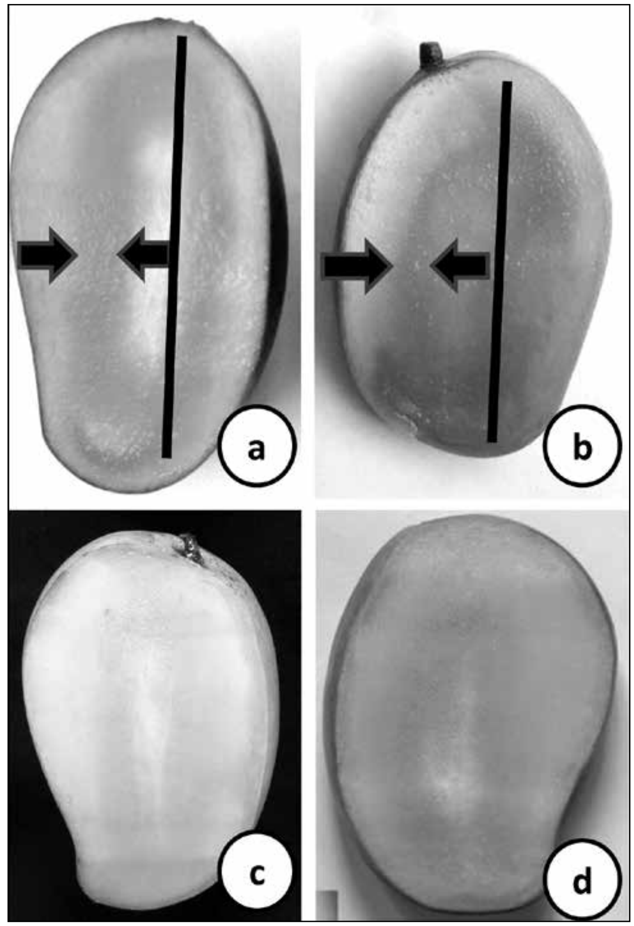

Fig. 1. Mango fruits with Jelly seed disorder (a, b) and without disorder (healthy) (c, d). Line shows the longitudinal distance of jelly, and arrows show thickness of jelly at equator.

The jelly seed is a physiological disorder caused by disintegration of the flesh around the seed into a jelly-like mass (Brecht *et al.*, 1). Wangchai *et al.* (5) reported that low Ca, K and high N in fruit tissues could cause jelly seed in mango. The difference in protein profiles and nutrient composition of jelly seed affected and normal fruits were studied by Singh and Kumari (4). They found that some of protein bands observed in healthy fruits were found missing in soft tissues. There are reports that this disorder could be reduced by increasing fruit calcium content *via* proper pre-harvest sprays. Jelly seed deteriorates the internal quality of the fruit and appears to be genotype-specific.

It is concluded from the present investigation that among indigenous cultivar Dushehari was most

Table 1. Incidence of jelly seed disorder in mango genotypes (two fruiting seasons pooled data).

Genotype	Artificially ripened fruit		Tree ripe fruit	
	Fruit (%)	Pulp thickness (mm)	Fruit (%)	Pulp thickness (mm)
Indigenous cultivar				
Bombay Green	14.7	4.12	22.7	6.24
Dushehari	21.3	6.08	36.0	9.12
Gulabkhas Green	13.3	4.68	21.3	6.92
Langra	13.4	3.80	25.3	4.12
Khasulkhas	17.3	4.12	18.7	5.08
Exotic cultivar				
Eldon	0.0	0.00	6.7	1.07
Primor-de-Amoreria	0.0	0.00	10.7	2.28
Sensation	0.0	0.00	8.0	1.20
St. Alexandrina	5.3	1.44	9.3	1.08
Tommy Atkins	12.0	2.60	17.3	3.12
Hybrid				
Amrapali	10.6	3.84	18.7	5.44
Mallika	5.3	3.04	9.3	2.08
H-1-11	0.0	0.00	5.3	2.13
H-8-11	0.0	0.00	6.7	2.24
Pusa Arunima	0.0	0.00	0.0	0.00
Pusa Lalima	12.0	4.08	16.0	5.16
Pusa Peetamber	5.3	2.64	9.3	3.12
Pusa Pratibha	13.3	3.24	18.7	5.08
Pusa Shreshth	8.0	2.80	13.3	3.00
Open-pollinated seedling				
Selection-1	7.3	6.36	13.3	8.10
LSD ($P \leq 0.05$)	2.6	0.96	5.80	1.08

susceptible followed by Khashulkhas. In case of exotic varieties Tommy Atkins was most affected. Mango hybrids, Pusa Pratibha, Pusa Lalima and Amrapali though also had jelly seeds but the frequencies were significantly lower than Dushehari. However, Pusa Arunima was found to be almost free from this disorder.

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