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INDUCED SOMATIC MUTATION IN MANGO, *MANGIFERA INDICA* L. cv. LANGRA

S.H. SIDDIQUI

Plant Genetics Division,
Atomic Energy Agricultural Research Centre, Tandojam, Pakistan.

Abatract

Dormant buds of mango *(Mangifera indica* L. cv. Langra) exposed to acute gamma-irradiation dosages of 1.0, 2.0, 3.0, 4.0, 5.0 and 6.0 kiloroentgens (kR.), were grafted onto one-year-old seedling stock. Dosages of 2.0 and 3.0 kR were found satisfactory for the purpose, as measured by bud lethality and scion growth. A bud graft from 3.0 kR bore fruits of excellent quanity. Compared with the control, the fruits were heavier, larger and had more creamish-yellow pulp. None of the other morphological changes expressed by the mutant fruits, observed over three fruiting seasons, were disadvantageous. The tree habit is being further investigated before the mutant can be considered for release as an improved cultivar.

Introduction

Mango is an important and relished fruit of the Indo-Pak subcontinent, where varietal improvement has largely been limited to selection of spontaneous mutants. Natural variability has thus played a much greater role in practical fruit breeding as compared with the artificially induced means of utilizing genetic variability. These somatic mutations, whether spontaneous or induced, manifest themselves phenotypically in a short time and can be propagated vegetatively. However, because of the rare occurrence of much bud sports, breeders have sought for methodology that shall prove to be a valuable breeding technique through (i) increasing the somatic mutation frequency and (ii) enhancing the frequency of generating new cultivars. Work with Mango *(Mangifera indica* L.) was initiated to determine the potential of inducing somatic mutations, in some choiced cultivars, that could incorporate improvements.

Materials and Methods

Twenty dormant buds of 'Langra' were irradiated with 1.0, 2.0, 3.0, 4.0, 5.0 and 6.0 kiloroentgens (kR) from a Cobalt-60 source and were grafted onto one-year-old seedling stock. The fruit comparisons, between the mutant and the control, were associated with morphological changes, size, soluble solids, flavour, texture, pigmentation, and other characteristics as described by Gangolly *et al.* (1957) and Singh (1960).

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Table 1. Mango fruit characteristics of the parent "Langra" cultivar and its γ-irradiation induced mutant

Fruit characteristic	Control	Mutant
Shape	Oblong-oblique	Ovate-oblong
Size	Medium	Large
Sinus	Absent	Slightly present
Shoulders	Long curve ending	Moderate curve
Apex	Round	Broadly pointed
Stalk	Oblique	Oblique
Base	Round	Round
Form of cavity	Absent	Slightly present
Beak	Pointed	Slightly prominent
Skin:		
Mature skin colour	Dark green	Light green
Mature skin texture	Smooth	Smooth
Ripe skin colour	Greenish yellow	Yellow
Gland dots	Prominent	Absent

Results and Discussion

Scion radiosensitivity, based upon survival percentage indicated 5.0 and 6.0 kR to be lethal doses. Inhibited growth and lethality are the most notable biological influences of high irradiation seed treatment. These influences here too were consistent with dormant bud treatment. The first year growth was generally inhibited, but appreciable radiation influence was manifested in some of 3.0 and all of 4.0 kR treated scions.

Table 2. Mango fruit and pulp measurements of the parent "Langra" cultivar and its γ-irradiation induced mutant

	Control	Mutant
Fruit measurements		
weight (gms.)	120.0	201.1
Length (cms.)	7.5	9.3
Breadth (cms.)	5.5	6.6
Pulp measurements		
Weight (gms.)	87.6	146.0

Dormant buds exposed to 2.0 and 3.0 kR gave considerable scion growth with interesting variability. These dosages have formed the upper working limits for acute-irradiation application in mango. Shoots from several irradiated buds bore fruit, but it was a bud graft from 3.0 kR that exhibited advantageous fruit variability that was positively expressed over three seasons. The results at the end of the third fruiting season form the basis of this report. (Tables 1–3).

The distinct morphological changes observed were the fruit shape, size, and skin colour (Fig. 1). Other minor morphological changes and similarities are summarized in Table 1. Variations after fruit ripening, for the mutant, were the creamish-yellow flesh colour, higher soluble solid, acidity ratio, and a 67.8 per cent enhanced reducing sugar content (Table 2). The mutant fruits compared with control were larger, heavier more pulpy and of excellent quality, with bearing that was mid-seasonal (Table 3 and Fig. 1). Other characteristics, of the control, were maintained.

Stadler (1930) expressed the possibility of utilizing X-ray as a source of inducing genetic changes in developing bud sports in apples; since then the concept has been successfully extended for the improvement of other fruits. The selected variants have predominantly been for fruit colour and morphology, that amongst others are essential components of consumer acceptance in horticultural crops. These beneficial fruit mutants,dealt here as a composite, comprised of changes for skin and flesh colour, texture, shape, skin pigmentation, in apples, cherries, grape-fruits, oranges, peaches, pears and plums (Bishop 1958, 1959a, 1959b; Granhall *et al.* 1949; Hensz 1972; Hough & Weaver 1959; Lapine 1971, 1972, 1973; Spiegal-Ray & Kochba 1975).

Table 3. Mango fruit flesh characteristics of the parent "Langra" cultivar and its γ-irradiation induced mutant

Flesh Characteristic	Control	Mutant
Fibreform (stone to pulp)	Scanty	Scanty
Flesh colour	Orange	Creamish-yellow
Flavour	Aromatic	Fragrant
Taste	Sweet	Sweet
Juice	Very juicy	Very juicy
Total soluble solids	18.0	18.4
Acidity	0.2	0.2
Reducing sugar	3.4	5.7
Non-reducing sugar	10.7	10.3

Fig. 1. Fruits of the mango cultivar Langra (right) and its γ-irradiation induced mutant (left). Noticeable are the shape and size changes in the mutant.

Our present findings positively extend the ideas of an earlier report (Siddiqui *et al.* 1966) that advantageous genetic variability can be induced in mango. There appears no limitation to the practical potential of utilizing the beneficial sports, but it is necessary to enhance the frequency of being able to generate, and process large scion numbers. This may encompass, (i) germ-plasm variation as related to stock source mediated by diverse mutagenic agents for treating the dormant meristematic tissue progenitor of the scion, and/or (ii) combining with the above and alien manipulation of the stock/scion relationship prior to, or after grafting the treated tissue.

Tree characteristic is another important component that contributes to a new cultivar release. For the cultivar to be manageable, productive, and withstand the rigours of the micro/macro environment, it must blend with the orchard in a way that the grower attains a maximum return with a balanced if not a lesser-input of established horticultural practices. Our variant of the 'Langra' cultivar though of excellent fruit quality, has still to be further evaluated before a categorization of "desirable horticultural tree type" is attributed to it. These observations are in progress.

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