

COMPARATIVE ANALYSIS OF TAXONOMIC CHARACTERS OF SINDHRI AND LANGRA VARIETIES OF MANGO (*MANGIFERA INDICA* L.) FOUND IN SINDH

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Abstract

Present study was carried out to analyze the taxonomic characters of Sindhri and Langra mango *Mangifera indica* L. varieties found in Sindh. Varieties were collected from Mirpurkhas district of Sindh for investigations. Both varieties revealed various differences in floral and fruit characteristics. Sizes of inflorescence were 28-30 cm. 25-28 cm. with conical, pyramidal shape in Sindhri and Langra respectively. Sindhri Mango flower was found 4-6 mm. and Langra Mango was 6-8 mm. Fruit was 15-17x7-9 cm. in Sindhri Mango with weight of 400-500 g and 9-11x6-8 cm. with weight 220-250 g in Langra Mango variety. Sindhri Mango flavour was pleasant aromatic, significantly different from Langra's flavour which was turpentine. The findings revealed that both varieties most recommended for human consumption and could be used in variety developing programmes.

Key words: Taxonomy, *Mangifera indica*, Pleasant, Conical, Pyramidal.

Introduction

The mango *Mangifera indica* L. belongs to the family Anacardiaceae and order Sapindales having about 40 species in S.E. Asia and Indo Malaya. In Pakistan it is represented by one cultivated species name *Mangifera indica* L., with many varieties. The family also contains other important genera like *Pistachio vera* L., and *Anacardium occidentale* L.

The mango commonly known as the "king of fruit" is the most popular fruit of the sub-continent Indo-Pakistan (Ibrahim, *et al.*, 2008). The mango is evergreen, deep rooted large tropical tree, and naturally adopted tropical and sub-tropical environment/climate. It occupies relatively the same position in the tropics as is enjoyed by the apple in temperate America or in Europe. In fact, it will be no exaggeration to say that because of its excellent flavor, attractive fragrance, beautiful shades of color, delicious taste and healthful value, mango is now recognized as one of the best fruit in the world market. Pakistan occupies 5th place in mango producing country and 3rd largest exporter of mango in the world (Akhtar *et al.*, 2010). The major mango producing areas include Khanewal, Multan, Bahawalpur, Rahim Yar Khan, Dera Ismael Khan, Sukkur, Hyderabad and Mirpurkhas (Ibrahim *et al.*, 2008). Mango was found in Indus valley when the army of Alexander the Great invaded it in 327 B.C. (Hayes, 1960). Mangos produced in Sindh are mostly greenish yellow in color with strong aroma and very sweet in taste. The total mango producing area is 60467 hectares in Sindh province, producing 0.4 million tons of mangoes every year. Source: Data was collected from the Horticulture Research Institute Mirpurkhas and Horticulture farm Sindh Agriculture University Tando Jam. Mirpurkhas district has the highest mango growing area with 12,196 hectares under mango cultivation.

The Mango has been under cultivation for 4000 years or even more (Candolle, A.D.E., 1904). The varieties of

mango, even in India alone, are almost beyond numbers. The Mughals particularly emperor Akbar was very fond of mangos and he had developed lakh bag (100, 00 mango trees) at Darbanga. The mango tree is long lived and seedling tree can attain more than 100 years while grafted one up to 80 or less. Some desi mango trees have been reported to be 300 years and still bear fruit. The mango is tolerant of soil and climatic conditions. The climate influences the time of flowering. There is some variation from year to year, but greater differences occur in different regions (Hayes, 1960). (Shirin, *et al.*, 2013) reported that the characteristics of most cultivars have not yet been studied systematically. In Sindh the mango flower blossoms in February-March, while some varieties of mango flower blossoms in April-May. Undoubtedly, mango is the leading commercial fruit and the most fancied among the public in Indo-Pak subcontinent. No other cultivated tropical fruit possesses such an extensive range of varieties as the mango.

Information on different varieties grown in Sindh is still lacking and this comparative taxonomic study will add more information as the basis for future varietal development programmes.

Taxonomic description Sindhri mango variety: Tree; Large growing, maximum height of the plant is (25-30ft.), Spreading, medium vigorous, medium branched, canopy round (Fig. 1). Stem; Erect, aerial, woody, branched, cylindrical, solid and woody. Leaves; Simple, alternate, petiolate, ex-stipulate, pale green, 14-26 x 4-8 cm, lanceolate, oblique, acute, petiole 3-4 cm., glabrous, slightly undulated, leaf margin entire (Fig. 2). Inflorescence; Conical, medium long, 28-30 cm. well branched, less compact, stalk color greenish white, with aromatic smell (Fig. 3). Flower; small arranged on Panicles, Pentamerous, hypogynous, Sub-sessile, complete, actinomorphic, 4-6 mm. in diameters, colour light green.

Calyx; Sepals, 5 lobes, gamosepalous, 3.3-4.2 mm, long, sepals adnate to the ovary wall, gamosepalous. Corolla; 5 petals, 3-3.7 mm. long, free at their base, polypetalous, aestivation imbricate. Stamens; 5 stamens, 2-2.2 mm. long, filament, one functional and rest are sterile, antisepalous; ditheous, basifixed, anthers are light pink, dehiscence by slits. Carpels; 3, tricarpeal, syncarpous, 2-2.1 mm. long, one is functional, ovary sessile and superior, placentation axile, anatropous ovule; style short; stigma lobed. Fruit; Medium large 15-17x7-9 cm., oblong-obovate (Fig. 4), basal sinus present, dorsal shoulder somewhat round, ventral shoulder elevated than dorsal shoulder, sinus present, beak missing, nak is present, apex rounded to pointed, base obliquely round, surface smooth, glands sparse, skin less gritty and medium thick, colour golden yellow (Fig. 5), pulp pale yellow with orange ting, firm, flavor rich, excellent, medium aroma bit like melons, taste very sweet, fruit quality excellent, keeping quality very good, fruit weight 400-500 gms., shelf life 5-6 days, yield 6-8 monds per tree. Stone; Medium long, 10-12x3-5 cm, full and thick, oblong- elliptical, deeply ridged, short, thick and sparse fibers measuring 2.5 cm. on ventral edge, upper and lower portion depressed, stone weight, 47-57 gm. Seed; Shape Medium thin, exalbuminous and mono-embryonic 7-8x3-4 cm, with 26-28 g in weight.

Taxonomic description Langramango variety: Tree; Medium or large 20-30ft, spreading, medium vigorous, round (Fig. 6). Stem; Erect, areal, branched, woody, cylindrical and solid. Leaves; Simple, alternate, dark green, 15-28x6-8 cm. petiole 4.3-5 cm. swollen at the base, elliptical- lanceolate, Cuneate, sub-acuminate, undulation medium (Fig. 7). Inflorescence; Pyramidal, medium long, 28-25 cm. in long, compact, well

branched, stalk color pinkish green and light pink throughout (Fig. 8). Flower; Pentamerous, hypogynous, bisexual, actinomorphic, 6-8 mm, light pink. Calyx, Sepals 5 lobes, gamosepalous, sepals adnate to ovary wall, 3.5-4 mm. long. Corolla; Petals 5, longer than sepals, 4-5 mm. long, antisepalous, polypetalous, and imbricate. Stamens; 5 one is functional, 2-2.5 mm. long, fertile stamen is longer than staminode and nearly equal to the length of pistil, antisepalous, anthers ditheous, basifixed, dehiscence by longitudinal slits, dark pink. Carpels; 3 carpels, tricarpeal, syncarpous, 2-2.2mm, one functional carpel; ovary sessile superior, one celled oblique with one pendulous anatropous ovule, placentation axile, style short, stigma lobed. Fruit; Medium ovate-oblongish, 9-11x6-8 cm (Fig. 9). basal sinus wanting in some cases very lightly marked, shoulders prominent, ventral shoulder slightly higher than dorsal shoulder, sinus present but weak, beak prominent, obtuse to round, base flattened, apex round, surface smooth, skin medium thin, surface skin is more gritty, glands prominent, scattered sparsely in the form of brown dots, color greenish -yellow (Fig. 10), pulp lemon yellow, firm, flavor turpentine, maximum aroma, taste sweet, fruit quality good, keeping quality medium, fruit weight 220-250 gms, 4-5 days shelf life and yield 5.5-7.5 monds per tree. Stone; Small oblong, 7-9x4-6x4-6 cm, thin medium ridged, vein almost level with surface, empty at apex rounded at basal end, full and thin, 3.3 fine and thin fibers on all over the surface, long sparse fibers on the entire ventral edge, ventral side of the stone is more depressed than dorsal side, stone weight 28-30 gm. Seed; Medium thin, exalbuminous, mono-embryonic, 5-6x3-4 cm, with 20-22 gm, in weight.



Fig. 1. Tree of *Sindhri* Mango variety.



Fig. 2. Leaves of *Sindhri* mango variety.



Fig. 3. Inflorescence of *Sindhri* Mango variety.



Fig. 4. Fruits of *Sindhri* mango variety.



Fig. 5. Ripened fruits of *Sindhri* mango variety.



Fig. 6. Tree of *Langra* mango variety.



Fig. 7. Leaves of *Langra* mango variety.



Fig. 9. Fruits of *Langra* mango variety.



Fig. 8. Inflorescence of *Langra* mango variety.



Fig. 10. Ripened fruits of *Langra* mango variety.

Materials and Methods

Mango orchard at Mirpurkhas district was surveyed; several trees of Sindhri and Langra mango varieties in normal health and bearing condition were first selected for describing each variety. The primary and secondary characters which account for the variation in two varieties of district Mirpurkhas were studied. The specimens of two varieties were collected, for taxonomic approaches first using morphology, field surveys and herbarium observations. Samples of both varieties i.e., Sindhri and Langra were mounted on herbarium sheets following the standard techniques and deposited in Sindh University Herbarium, Jamshoro. Taxonomic characters of both varieties were observed and noted for analysis. Mango fruit was also collected from site area for taxonomic study. Taxonomy of both varieties was provided with scientific descriptions. For gathering general information on mango production, grown varieties and challenges on mango marketing, literature search and interviews of selected growers were performed time to time in every growing season during 2013 to 2016. For conducting the individual interviews questioners were developed including questions regarding farms, different varieties, source of material and production data. For data analysis, only the most important information was used to give an overview. The literature focused on mango-related reports, available research publications, internet searches and research journals on mango varieties from libraries were obtained. In addition two individual growers were interviewed in a pilot study regarding the mango varieties on their farms at Hyderabad district. During this research study Horticulture Research institute Mirpurkhas mango orchard and mango festival

were visited for collecting the information from research experts. They briefed about the characteristics of mango varieties and descriptions of each variety were recorded. Data were recorded to study their quantitative and qualitative characters. All characteristics were recorded following the IPGRI descriptor, 2008 and IBPGR descriptor, 1989.

For recording fruit descriptions, a dozen typical fruits were selected at random from all exposed sides of each of the selected trees. From all fruits, only five were selected for final detailed description, though the remaining fruits were also utilized for recording data on the prominent variations between the various selected specimens. To record descriptions on the colour, flavor and taste it was necessary to include only such fruits that had attained full maturity. Shirin, *et al.*, (2013) studied fruit size, fruit shape, skin type, skin color, flavor, texture, taste, fiber, beak, sinus, apex, basal cavity all these characters were tested by keeping mature fruit of each cultivar in the laboratory.

Results and Discussions

Two varieties of *Mangifera indica* L., namely Sindhri and Langra were studied. The similarities and variations in the both varieties were observed and noted. Taxonomically both varieties showed some similarities but differed from each other in many aspects. During this research following similarities and differences were observed.

Details of vegetative characters are given in Table 1. Tree of Sindhri and Langra mango varieties were more or less equal in height, medium vigorous with round canopy. Sindhri mango variety was less spreading than Langra mango variety. Both varieties had tap root system with similar type of stems. But both varieties

showed distinct difference between leaf characteristics. Leaves of Sindhri were yellow green in color, whereas, Langra leaves were dark green in color with 14-26x4-8cm. 15-28x6-7cm. in size respectively. (Ibrahim, *et al.*, 2008) recorded the length and width of Sindhri mango variety was 16-20x4-7cm, and in Langra it was 18-20x5-7cm, which was varied from present study. Both varieties showed great difference in shape, particularly the leaf base and tip. Sindhri have lanceolate leaves with oblique base and acute tip shape. Langra have elliptical-lanceolate leaves with cuneate base and sub-accumbent tip shape. Petiole size in Sindhri mango variety was about 3-4 cm. while petiole of Langra mango variety was about 4-5 cm. Sindhri mango variety was slightly undulated with entire margin. Langra mango variety was medially undulated with slight wavy margin.

Both varieties also showed considerable differences in floral characters Table 2. As inflorescence of Sindhri mango variety was conical measuring 29-30 cm, less compact with greenish white stalk. Whereas, inflorescence of Langra mango variety was pyramidal measuring 27-28 cm, compact with pinkish green stalk. Flower of Sindhri mango variety was found 4-6 mm, in diameter and pale yellow in color at maturity while flower of Langra mango variety was larger by 2-2 mm long. in diameter and pink. Sepals 5 measuring 3.3-4.2 mm long, were in Sindhri mango variety whereas sepals of Langra mango variety were larger by 0.2 mm. long and were gamosepalous in both varieties. Corolla of both varieties was consists of five petals and were polypetalous. Petals of Sindhri mango variety measuring 3-3.7 mm, long whereas petals of Langra mango variety

were larger by 1-2.7 mm. long. Androecium of Sindhri mango variety was with five stamens were found, only one is functional measuring 2-2.2 mm, long, Whereas, in Langra stamens was 5 with one functional stamen and were larger by 0.3 mm. long. Gynoecium of both varieties were consists of 3 carpels. In Sindhri mango variety ovary was found 2-2.1 mm. in length. In Langra ovary was larger by 0.4 mm. in length.

Fruit is very important for mango varietal identification Table 3. Fruit of both varieties showed considerable comparative taxonomic differences in their shape, color, texture, size, weight and in yield. (Mukherjee, 1948) also classified different mango varieties on the basis of fruit shape. In Sindhri mango variety the shape of fruit was oblong-obovate and medium large. In Langra mango variety fruit was oval-oblong and medium. (Islam, *et al.*, 1992) observed the fruit shapes of mango varieties was oblong, ovate-oblong and roundish. The variation in fruit length and width was recorded. The maximum Fruit length and width was recorded in Sindhri mango variety was 15-17x7-9 cm (Fig. 11A). In Langra the length and width of fruit was 9-11x6-8 cm (Fig. 12B). (Bhuyan and Islam, 1986) recorded the range of fruit length 8-18 cm. (Shirinet *et al.*, 2013) recorded the length of Alamshahi was 8.9±0.07. (Ghose and Hussain, 1988) recorded the range of fruit width was 5.8-8-6 cm. In Sindhri basal sinus was present whereas in Langra it was slightly marked. Shoulders were prominent in both varieties while sinus was present in Sindhri mango variety but was weak in Langra. (Shirin *et al.*, 2013) found in the studied on mango varieties that some cultivar was found with pointed beak while others was with prominent beaks.

Table 1. Vegetative characters of *Sindhri* and *Langra* mango varieties.

S #	Variety	Tree size (ft.)	Leaf size (cm)	Leaf color	Leaf shape	Leaf base	Leaf tip	Petiole size (cm)
1.	Sindhri	25 – 30	14 – 26 4 – 8	Pale green	Lanceolate	Oblique	Acute	3 – 4
2.	Langra	20 – 30	24 – 28 6 – 10	Dark green	Elliptical-lanceolate	Cuneate	Sub-accumbent	4 – 5

Table 2. Floral characters of *Sindhri* and *Langra* mango *Mangifera indica* L. varieties.

S #	Variety	Infl. Size (cm)	Infl. Shape	Flower size (mm)	Flower color	Calyx size (mm)	Corolla size (mm)	Stamen size (mm)	Carpel size (mm)
1.	Sindhri	28 – 30	Conical	4 – 6	Pale yellow	3.3 – 4.2	3 – 3.7	2 – 2.2	2 – 2.1
2.	Langra	25 – 28	Pyramidal	6 – 8	Pink	3.5 – 4	4 – 5	2 – 2.5	2 – 2

Table 3. Fruit characters of *Sindhri* and *Langra* mango *Mangifera indica* L. varieties.

S#	Variety	Fruit size (cm)	Fruit wt. (gm)	Skin color	Pulp color	Flavor	Beak	Storage quality (Days)	Stone size (cm)	Stone wt. (gm)	Seed size (cm)	Seed wt. (gm)
	L	15-17	400-500	Yellow golden	Pale yellow	Pleasant aromatic	Absent	5-6	10-12		7-8	25-28
1.	Sindhri											
	W	7-9			Orange Ting				3-5		3-4	
	L	9-11		Greenish	Lemmon	Turpentine	Prominent	4-5	7-9		5-6	
2.	Langra	W	6-8	220-250	Yellow	Yellow			4-6	28-30	3-4	20-22

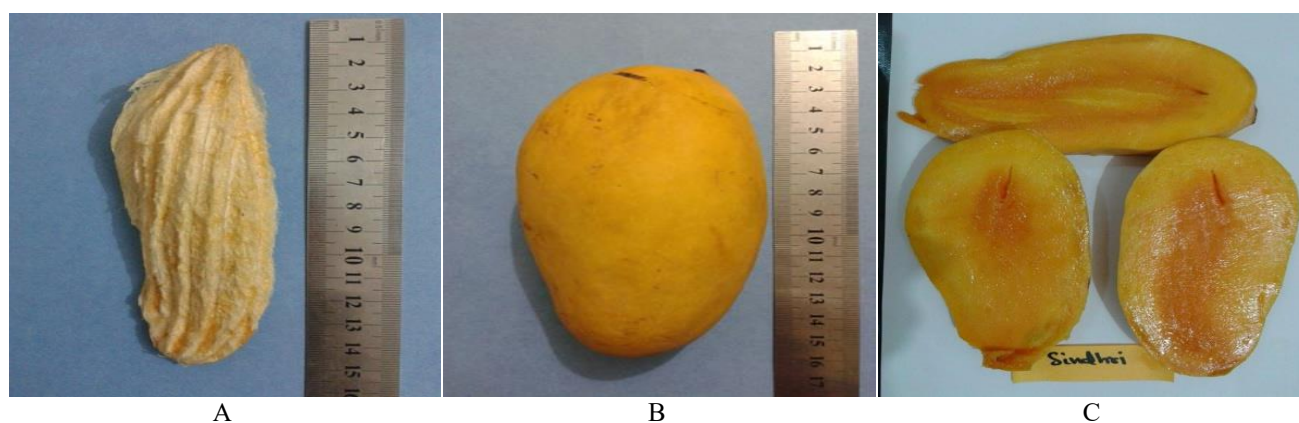


Fig. 11. A. Single fruit of *Sindhri*, B. Pulp of *Sindhri*, and C. Stone of *Sindhri*.

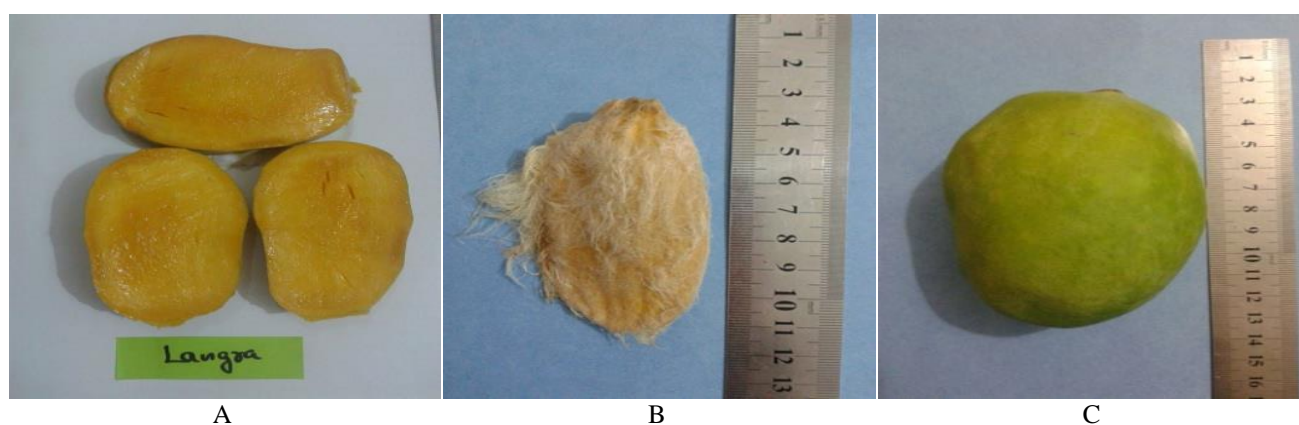


Fig. 12. A. Fruit of *Langra*, B. Pulp of *Langra*, and C. Stone of *Langra* mango variety.

Table 4. Stone and seed characters of *Sindhri* and *Langra* mango *Mangifera indica* L. varieties.

S. #	Variety		Fiber size (cm.)	Stone size (cm.)	Stone wt. (gm.)	Seed size (cm.)	Seed wt. (gm.)
1.	Sindhri	L	2.5	10–12 3–5	47–57	7–8 3–4	25–28
2.	Langra	L	3.3	7–9 4–6	28–30	5–6 3–2	20–22

In present study it was found that the beak was missing in Sindhri, whereas beak was prominent in Langra mango variety. (Anila & Radha, 2003) also found beak was absent in most of the cultivar. In Sindhri mango variety apex was round to pointed, base obliquely round. In Langra mango variety base was flattened and apex was rounded. Surface of fruit was smooth in both varieties while gland sparse, skin less gritty and medium thick in Sindhri mango variety. Glands prominent, skin was more gritty with brown dots and medium thin in Langra mango variety.

The color of fruit is an important for mango trading as the attractive color easily attracts the consumers. In Sindhri mango variety color of fruit was yellow golden, pulp pale yellow with orange ting (Fig. 11B), texture firm, flavor rich, medium aroma bit like melons, taste very sweet whereas color of fruit greenish yellow (Fig. 12B), pulp lemon yellow, texture firm, flavor turpentine with maximum aroma and taste sweet in Langra mango variety. (Bhuyan & Kobra, 2007) were observed the taste of mango fruit varied from excellent, good, intermediate and poor. (Aguorucu *et al.*,

2016) found that fleshy mesocarp is juicy in nature in each variety having different taste. Fruit quality of Sindhri mango variety was excellent whereas was good of Langra mango variety. Keeping quality was found better of Sindhri mango variety than Langra mango variety. Fruit weight of Sindhri mango was found 400-500g, with 5-6 days shelf life and yield was 6-8 monds/ tree. In Langra mango variety fruit weight was 220-250 gms, with 4-5 days shelf life and yield was 5 and half- 7 and half monds/ tree. (Shirin *et al.*, 2013) reported variation in fruit weight may be due to genetic differences among the cultivars, environmental influences and management practices. Table 4, represented the stone and seed characters of both varieties of mango. Stone medium long 10-12x3-5, oblong-elliptical (Fig. 11C) with 47-57 g, was in Sindhri mango variety, whereas, small 7-9x4-6 cm, oblong (Fig. 12C), 28-30 gms, was in Langra mango variety. Seed of both varieties were medium thin, while length of Sindhri mango was 7-8x3-4 cm with 26-28 g, in weight. In Langra mango variety seed length was 6-6x3-4 cm with 20-22 g, in weight.

Conclusion

During this research it has been observed that the comparative taxonomic studies of different mango varieties are very important to achieve commercial mango varieties in Sindh mango growing tract. Systematic characterization of the different mango varieties and evaluation of their performance in different mango growing regions is still missing. During this research both varieties have showed great differences. Conclusively both varieties were found to differ in their morphology regarding height of the plant, canopy formation, and spread, difference in leaves i.e. shape and size, inflorescence and fruit characteristics. Soil and climatic conditions are also involved in the variations among varieties. Considering the overall comparative taxonomic vegetative, floral and fruit characteristic of Sindhri and Langra mango varieties, the study revealed that Sindhri variety was found to be superior in its characteristics. Although in floral characters the size of flower of Langra mango variety was larger, 6-8 mm than Sindhri mango variety which was 4-5 mm long. The color and fragrance of flower were also conspicuous in Langra than Sindhri mango variety. Moreover it was also observed that fruit, weight of Sindhri mango 400-500, gm. with 6-8 monds/tree, than Langra 220-250 gm. with 5.5-7.5 monds/tree. Storage quality of Sindhri mango was 5-6 days as compare to Langra mango 4-5 days. Hence both varieties could give promising results if both used in the variety developing programmes. So the different varieties with desirable characters can be obtained, in all aspects i.e., vegetative, floral and fruit characteristics in different localities of Sindh province.

The present results were also useful to quantify the relationship and differences among the different varieties that could be used to improve commercial and varietal development of mangoes.

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