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## Mango: Taxonomy and botany

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### Abstract

Mango, a fruit native to India, is one of the most important fruit crops world-wide. The mango is a vascular, seed and flowering plant. It bears the botanical name as - *Mangifera indica* L.. It is economically the most important fruit crop in the Anacardiaceae (Cashew or poison ivy) Family. It is ironic that two of the most delectable nuts (cashew, pistachio) and one (mango) of the world's major fruit crops come from this family. The Genus of the mango is *Mangifera* which is divided into 5 lower divisions (Species) including the Species of the mango - *Mangifera indica*.

The mango tree has evergreen arbors with 10-40 m height with a crown of radius 10 m; grayish-brown bark, brown branchlets, crowded leaves. The seedling tree is long-lived with some specimens known to be over 300 years old and still fruiting; grafted tree lives only 80 years or less. The mango bark is usually dark grey-brown to black, rather smooth, superficially cracked or fissured inconspicuously, peeling off in irregular, rather thick pieces. The twigs are medium thick, smooth, apically angular, glabrous, glossy and dark green. The leaves are simple, alternately arranged, 15-45 cm in length and breadth 5-15 cm, with petiole of length 1-12 cm. The upper surface is shining dark green and the lower is glabrous light green. The emerging leaves on new growth flushes are bronze-red initially, and appear wilted. The leaves strongly smell like turpentine and contain a high content of mangiferin. The mango tree has a taproot 6-8 m and more long with a dense mass of superficial feeder roots which develop at the base of the trunk or slightly deeper and form anchor roots.

The mango panicle, born at shoot terminals, is branched with 6-40 cm length, possessing a large number (500- 6,000) of small (4 mm) greenish white or pinkish flowers. The flowers are radially symmetrical and have 5 petals 5-10 mm long, with a mild, sweet fragrance. The flower has a conspicuous 5-lobed disc between the petals and stamens. The mango fruit is a kidney-shaped juicy drupe with size 5-25 cm in length and a few gm to 1.8-2.26 kg in weight. The immature fruit has green peel that gradually turns yellow, orange, purple, red, or combinations of these colors as the fruit matures. The flesh of the mango is peach-like and juicy, with more or less numerous fibers radiating from the seed husk. The seed is large, flattened, kidney-shaped central stone constituting ~ 20% of the fruit weight. Seeds are either mono-embryonic or polyembryonic. The most characteristic feature of the mango fruit is the formation of a small conical projection developing laterally at the proximal end of the fruit, known as the beak. The fruit takes 4-5 months from flowering to ripen.

**Keywords:** mango, *Mangifera indica* L., taxonomy, botany

### 1. Introduction

Mango is one of the most important fruit crops world wide. Since ages, mango tree has been described as Kalpavriksha (wish granting tree) in India. It is known as the *king of fruits* and is the choicest fruit in India and abroad. Its long period of domestication in India is well evidenced from its mention in ancient scriptures. Mango is a part and parcel of cultural heritage of India. Today the mango tree and its fruit remain important Indian religious and cultural symbols. The mango is intimately associated with the history of agriculture and civilization in India<sup>[1]</sup>.

The Mango bears the botanical name as - *Mangifera indica* L. It is economically the most important fruit crop in the Anacardiaceae (Cashew or poison ivy) family. The other important members of this family include cashew, pistachio, and the mombins (*Spondias* spp.). The plants of this family are distinguished by their resinous bark and caustic oils in leaves, bark, and fruits. Apart from the edible fruits the Anacardiaceous plants also yield other valuable products like wood, gums and resins, wax and varnishes and tanning materials. It is also a family well known for the dermal irritation produced by some of its members, including some *Mangifera* species. These can cause some form of dermatitis in humans. It is, therefore, ironic that two of the most delectable nuts (cashew, pistachio) and one (mango) of the world's major fruit crops come from this family.

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Fig 1a: Vascular plants



Fig 1b: Seed plants



Fig 1c: Flowering plants

Superdivision- Spermatophyta contains five lower divisions known as the Divisions which are, (1) Coniferophyta – Conifers; (2) Cycadophyta – Cycads; (3) Ginkgophyta – Ginkgo; (4) Gnetophyta – Mormon tea and other gnetophytes and (5) Magnoliophyta – Flowering plants. The mango tree belongs to the Division-Magnoliophyta (Flowering plants) which is further divided into two categories known as the Classes which are, (1) Liliopsida – Monocotyledons and (2) Magnoliophyta – Dicotyledons (Flowering plants (Fig.-1c)).

The mango is a plant of the Class-Magnoliopsida (Dicotyledons) which contains further six lower divisions known as the Subclasses which are, (1) Asteridae; (2) Caryophyllidae; (3) Dilleniidae; (4) Hamamelididae; (5) Magnoliidae and (6) Rosidae. The Subclass of the mango is Rosidae which consists of eighteen lower divisions known as the Orders which are, (1) Apiales; (2) Celastrales; (3) Cornales; (4) Euphorbiales; (5) Fabales; (6) Geraniales; (7) Haloragales; (8) Linales; (9) Myrtales; (10) Podostemales; (11) Polygalales; (12) Proteales; (13) Rafflesiales; (14) Rhamnales; (15) Rhizophorales; (16) Rosales; (17) Santalales and (18) Sapindales.

The mango is a plant of the Order- Sapindales which has ten lower divisions known as the Families which include: (1) Aceraceae – Maple family; (2) Anacardiaceae – Sumac family; (3) Burseraceae – Frankincense family; (4) Hippocastanaceae – Horse-chestnut family; (5) Meliaceae – Mahogany family; (6) Rutaceae – Rue family; (7) Sapindaceae – Soapberry family; (8) Simaroubaceae – Quassia family; (9) FStaphyleaceae – Bladdernut family; (10) Zygophyllaceae – Creosote-bush family.

The Family of the mango is the Anacardiaceae – Sumac family, which consists of 22 Genera as (1) *Anacardium* L. – anacardium; (2) *Buchanania* Spreng. – buchanania; (3) *Camptosperma* Thwaites; (4) *Choerospondias* B.L. Burt & A.W. Hill; (5) *Comocladia* P. Br. – maidenplum ; (6) *Cotinus* Mill. – smoketree; (7) *Dracontomelon* Blume – dracontomelon P; (8) *Gluta* L. – gluta P; (9) *Lithrea* Miers ex Hook. & Arn. – lithrea; (10) *Malosma* Nutt. ex Abrams – laurel sumac; (11) *Mangifera* L. – mango P; (12) *Melanorrhoea* Wall. – melanorrhoea P; (13) *Metopium* P. Br. – Florida poison tree; (14) *Pistacia* L. – pistache; (15) *Rhus* L. – sumac P; (16) *Schinopsis* Engl. – schinopsis; (17) *Schinus* L. – peppertree P; (18) *Sclerocarya* Hochst. – sclerocarya P; (19) *Searsia* F.A. Barkley P; (20) *Semecarpus* L. f. – semecarpus; (21) *Spondias* L. – mombin; (22) *Toxicodendron* Mill. – poison oak.

The mango tree belongs to the Genus- *Mangifera* comprising of five categories known as the Species, namely, (1) *Mangifera altissima* Blanco – pahutan; (2) *Mangifera caesia* Jack ex Wall. – binjai P; (3) *Mangifera foetida* Lour. – bachang P; (4) *Mangifera indica* L. – mango P and (5) *Mangifera odorata* Griffith – kwini. The Species of the mango tree is *Mangifera indica* due to its origin in India and as the botanical classification was made first by Carl Linnaeus and thus, the mango tree bears the botanical name -*Mangifera indica* L. (the words of genus and species are written in italics with only the first letter of the name of the scientist in capital letter with dot). A brief classification of the mango tree is presented in Table-1

### 2.1. Family-Anacardiaceae (Cashew/Sumac)

The Anacardiaceae (the cashew or sumac) is a family of flowering plants bearing fruits that are drupes and in some cases producing urushiol, an irritant oily organic compound

## 2. Taxonomy

The mango tree belongs to the Kingdom – Plantae (Plants), which has only one lower division known as the Subkingdom Tracheobionta (Vascular plants (Fig.-1a)) which also contains only one lower division known as the Superdivision - Spermatophyta (Seed plants (Fig.-1b)) [2, 3]. The

with allergic properties found in plants of this family, especially, *Toxicodendron spp.* (e.g., poison oak, Lacquer Tree, poison ivy, poison sumac) and also in parts of the mango tree. The Anacardiaceae family includes numerous genera with several of economic importance. Notably important plants in this family include cashew (in the type genus *Anacardium*), mango, poison ivy, sumac, smoke tree, marula, yellow mombin, and cuachalalate. The genus *Pistacia* (which includes the pistachio and mastic tree) usually is now included in this family, but has sometimes been placed in its own family, *Pistaciaceae*.

Trees or shrubs of this family have inconspicuous flowers, highly poisonous, sometimes foul-smelling resinous or milky sap. The wood of the plants of the Anacardiaceae family has frequent occurrence of simple small holes in the vessels. The leaves are alternate or rarely opposite and without stipule. Flowers grow at the end of a branch or stem or at an angle from where the leaf joins the stem and have bracts. Members of this family produce cashew and pistacia nuts and others produce mango and marula fruits. Some members produce a viscous or adhesive fluid which turns black and is used as a varnish or for tanning and even as a mordant for red dyes. Medicinally, the edible nuts from this family have a reputation for being good for the brain.

## 2.2. Genus-*Mangifera*

The genus *Mangifera* consists of 69 species mostly restricted to tropical Asia. The highest diversity occurs in Malaysia, particularly in peninsular Malaya, Borneo and Sumatra representing heart of the distribution range of the genus. The natural occurrence of all the *Mangifera* species extends as far north as 27° latitude and as far east as the Caroline Islands. Wild mango trees occur in India, Sri Lanka, Bangladesh, Myanmar, Sikkim, Thailand, Kampuchea, Vietnam, Laos, southern China, Malaysia, Singapore, Indonesia, Brunei, the Philippines, Papua New Guinea, and the Solomon and Caroline Islands. Maximum species diversity exists in western Malaysia with about 28 species found in this region. *Mangifera* species are mostly distributed below 300 m but can occur at 600-1900 m above the sea level. The species is found as scattered individuals in tropical lowland rain forests on well-drained soils. Most of the species (~ 44) are found on well drained soils, periodically flooded (9 spp.) and some species occur in certain type of swamp forests. *Mangifera bomparidii*, *M. dongnaiensis* and *M. orophila* are mainly found in sub-montane forests above 1000 m and occasionally up to 1500-1700 m above sea level whereas few species like *M. caloneura*, *M. collina*, *M. timorensis*, *M. zeylanica* are acclimatized to seasonally dry climates in deciduous or semideciduous forests. *M. sylvatica* and wild *M. indica* can be found in Sikkim and southern China, at altitudes of 600-1900 m above sea level.

**Table 1:** Brief classification of mango

<b>Kingdom</b>	<b>Plantae – Plants</b>
Subkingdom	Tracheobionta – Vascular plants
Superdivision	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida – Dicotyledons
Subclass	Rosidae
Order	Sapindales
Family	Anacardiaceae – Sumac family
Genus	<i>Mangifera</i> – mango
Species	<i>Mangifera indica</i> L. – mango
Scientific Name	<i>Mangifera indica</i> L.

## 2.3. Species - *Mangifera indica*

The *Mangifera indica* L., a plant of the Anacardiaceae (the cashew or sumac) family and the genus-*Mangifera*, has evergreen arbors with 10-40 m height; grayish-brown bark, brown branchlets, glabrous thinly leathery often crowded leaves. Leaves are usually oblong or oblong-lanceolate, 12-30 cm long, 3.5-6.5 cm wide, apex acuminate, long acuminate or Apex acute, basally cuneate or subrounded, margin crisped, glabrous, leaf slightly glossy, lateral veins 20-25 pairs, ramped, raised on both sides, reticulate veins inconspicuous, petiole 2-6 cm long, upper ones slot, base expanded.

## 3. Botany of Mango

### 3.1. Tree

The mango tree (Fig.-2a) is evergreen plant with symmetrical shape in sufficiently open space [3-6]. It is a beautiful ornamental tree appreciated for its cooling shade. The tree has a long straight bole and is sympodially branched. The tree is erect and fast growing in summer with broad and rounded, or more upright canopy and a relatively slender crown. Considerable variation in canopy characteristics of Indian mango cultivars has been observed. Compactness of the canopy, branching pattern and leaf component shows eco-geographical dependence also. Mango trees grow to 10–40 m height, with a crown radius of 10 m. The tree is long-lived with some specimens known to be over 300 years old and still fruiting. Seedling trees live much more than 100 years whereas grafted ones live only 80 years or less. One of the largest trees known is that from Chandigarh (India), with a trunk of 3.5 m in diameter, limbs of 75 cm diameter, the crown spreading over 2250 m<sup>2</sup> with an annual production of about 16000 fruits in peak years at the age more than 100 years old. Seedling tree measuring a spread of 125 ft. and a girth of 25 ft. has been reported to exist in Brazil. Grafted trees are dwarf (6-9 m) with spreading branches. Some cultivars are spreading in growth habit.

### 3.2. Bark

The mango bark (Fig.-2b) is usually dark grey-brown to black, rather smooth, superficially cracked or fissured inconspicuously, peeling off in irregular, rather thick pieces. Exudate of the live bark is transparent, dark yellowish-brown, drying brown, consisting of a resin mixed with a gum. The bark contains 78% resin and 15% gum in addition to tannic acid. The terminal buds are small, enveloped by small, lanceolate acute bud scales. The twigs are medium thick, smooth, apically angular, glabrous, glossy and dark green.

### 3.3. Leaves / Foliage

The leaves (Fig.-2c) of mango are simple, exstipulate, alternately arranged. The petiole varies in length from 1 to 12 cm, always swollen at the base. It is grooved on the upper side. The phyllotaxy is usually 3/8 but as the leaves are arranged very closely at the tips they appear to be whorled. Leaves are variable in shapes like oval-lanceolate, lanceolate, oblong, linear-oblong, ovate, obovate-lanceolate or roundish-oblong. The apex ranges from acuminate to nearly round. The margin is usually entire, sometimes slightly undulated and wavy, rarely twisted or folded. The length and breadth vary in the ranges 15-45 cm and 5-15 cm, respectively, depending on variety and growth. The secondary veins are quite prominent, and in some of the varieties range from 18 to 30 pairs. The upper surface is shining and dark green while the lower is glabrous light green. The leaves appear in flushes. They are flaccid and pendulous when young. The colour of young

leaves generally vary from variety to variety, being tan-red, pink, yellow-brown in colour. Emerging leaves on new growth flushes are bronze-red initially, and appear wilted. One or two growth flushes occur per year, with flushes placed sporadically across the canopy of a given tree. Leaves may persist several years. As the leaf grows its colour changes from tan-red to green, passing through different shades and becomes dark green at maturity. The leaves have fibres and crackle when crushed. These often strongly smell like turpentine. The leaves contain a high content of mangiferin (a xanthone derivative).



Fig 2a: Tree



Fig.-2b: Bark



Fig.-2c: Foliage



Fig 2d: Roots

### 3.4. Roots

The mango tree has a unbranched long taproot (Fig.-2d) (up to 6 to 8 meters and more) plus a dense mass of superficial feeder roots. Feeder roots develop at the base of the trunk or slightly deeper which form anchor roots and sometimes a collection of feeder roots develops above the water table. The fibrous root system extends away from the drip line. Effective root system of an 18 year old mango tree may observe a 1.2 m

depth with lateral spread as far as 7.5 m. In deep soil the taproot descends to a depth of 6m, with profuse, wide-spreading feeder roots and anchor roots penetrating deeply into the soil.

### 3.5. Panicles / Inflorescence

The inflorescence (Fig.-2e) is branched panicle borne at shoot terminals, with 6–40 cm length, possessing large number of small (4 mm) greenish white or pinkish flowers. The inflorescence is a narrowly to broadly conical panicle depending upon cultivar and environmental conditions during its development. It is usually bracteate, but may sometimes be ebracteate. The bract, if present, is leafy, elliptical and concave. The color of the panicle may be yellowish-green, light green with crimson patches or with crimson flush on branches. The branching of the inflorescence is usually tertiary, rarely quaternary, but the ultimate branching is always cymose. Each panicle bears 500-6,000 flowers of which 1-70 % are bisexual, the remainder are male depending on the cultivar and temperature during its development. Both male and bisexual flowers are borne on the same tree. The flowers are radially symmetrical, and usually have 5 petals, streaked with red. There is usually only 1 fertile stamen per flower; the 4 other stamens are sterile. The flower has a conspicuous 5-lobed disk between the petals and stamens.

### 3.6. Flowers

The flowers (Fig.-2f) are produced in terminal panicles 10–40 cm long; each flower is small and white with five petals 5–10 mm long, with a mild, sweet fragrance. Mature terminal branches bear pyramidal flower panicles that have several hundred white flowers that are about a 0.6 cm wide when open. Most of the flowers function as males providing pollen, but some are bisexual and set fruit. Pollination is by flies, wasps, and bees. Hundreds and even as many as 3,000 - 4,000 small, yellowish or reddish flowers, 25- 98% male, the rest hermaphroditic, are borne in profuse, showy, erect, pyramidal, branched clusters 6-40 cm high. The size of both the male and hermaphrodite flowers varies from 6 to 8 mm in diameter. These flowers emit a volatile substance, causing allergic and respiratory problems for some persons. Few of the flowers in each inflorescence are perfect, so most of these do not produce pollen and are incapable of producing fruit. Panicles that arise later in the bloom season or in shaded parts of the canopy tend to have more hermaphroditic flowers. Panicles are initiated in terminal buds 1-3 months prior to flowering, triggered by low temperatures or seasonally dry conditions. Mango is distinct from most of the fruit crops in that chemical application is used to promote flowering and fruiting. Ethephon,  $\text{KNO}_3$  and naphthalene acetic acid (NAA) are used to either induce flowering, or enhance fruit set or the proportion of hermaphroditic flowers.

The flowers are subsessile, rarely pedicellate, and have a sweet smell. The pedicels are very short or missing; they are articulate with a panicle branch of the same diameter, which is often mistaken for the pedicel. The calyx is usually five-partite. The lobes are ovate-oblong and concave. The corolla consists of five pale yellow petals (rarely four to eight), which are twice as long as the calyx and contain three to five ridges on the ventral side. The petals are in bud imbricate and slightly contorted. They are thin, yellowish and after expanding horizontal, the upper half rather irregularly and not very pronouncedly reflexed, they are free at their base. The ridges are slightly dark. The upper half and the margin of the petal are white. On fading, the petals become pinkish.

Between the corolla and androecium there is an annular, fleshy, and five-lobed disc.

The androecium consists of stamens and staminodes, altogether five in number, of which usually one, or rarely two, is fertile and the rest are sterile. However, in cultivar Pico, three fertile stamens have been reported. As many as ten stamens, which occur in other members of the genus, may also occasionally be found in the form of primordia only. All the stamens are inserted on the inner margin of the disc. The position of the fertile stamen and pistil may be either parallel or oblique to each other. The fertile stamens are longer than the staminodes and are nearly equal to the length of the pistil. The colour of the anther is pink, which turns purple at the time of shedding. The ovary is sessile, one-celled, oblique and slightly compressed in its lateral aspect. It is placed on the disc. The ovule is anatropous and pendulous, and shows one-sided growth. The style arises from the edge of the ovary and ends in a simple stigma. Sometimes three carpels may develop in a flower.

### 3.7 Pollen

Pollen cannot be shed in high humidity or rain. Fertilization is also ineffective when night temperatures are below 22.8 °C. Mango is monoecious and self-fertile, so a single tree will produce fruits without cross pollination. Polyembryonic fruits may not require pollination at all. Branches may be ringed or leaves sprayed with chemicals to induce flowering, but the results are mixed. The pollen grains are of variable shapes, with the size varying from 20 to 35 µm. Small amount of pollen is produced in *M. indica*; the grains are sphaeroidal to prolate sphaeroidal, radially symmetrical, subangular in polar view, isopolar, with a few giant triploid ones of up to 50 µm, they are 3-monocolporate, goniotreme, sides convex-subprolate; apertures equidistant and zonal; ecto-aperture (colpus) extends slit-like from pole to pole.



Fig 2e: Panicles



Fig 2f: Flowers



Fig 2g: Fruits



Fig 2h: Seed

### 3.8. Fruit / Drupe

The mango fruit (Fig.-2g) is a kidney-shaped slightly compressed juicy stone fruit (drupe) It varies in size, shape, color, presence of fiber, flavor, taste and several other characters depending from cultivar to cultivar. Fruit may be nearly round, oval, ovoid-oblong, or somewhat kidney-shaped, often with a beak at the apex, and are usually more or less lop-sided depending on variety. The fruits grow at the end of a long, string-like stem (the former panicle), with sometimes two or more fruits to a stem. The fruit ranges from 5-25 cm in length and from a few grams to 1.8-2.26 kg. The skin is leathery, waxy, smooth, fairly thick, aromatic and ranges from light-or dark-green to clear yellow, yellow-orange, yellow and reddish-pink, or more or less blushed with bright-or dark-red or purple-red, with fine yellow, greenish or reddish dots, and thin or thick whitish, gray or purplish bloom, when fully ripe. The immature fruit has green skin that gradually turns yellow, orange, purple, red, or combinations of these colors as the fruit matures. Mature fruit has a characteristic fragrance and a smooth, thin, tough skin. The flesh of a mango is peach-like and juicy, with more or less numerous fibers radiating from the husk of the single large kidney-shaped seed. Fibers are more pronounced in fruits grown with hard water and chemical fertilizers. The flavor is pleasant and rich and high in sugars and acid. The flesh may vary in quality from soft, sweet, juicy and fiber-free in high-quality selected (clonal) varieties to turpentine-flavored and fibrous in unselected (wild) seedlings. This flesh is rich in vitamins A, C and D. The mango flesh is sometimes astringent (turpentine-like), and can have fibers extending from the endocarp (stone). The acrid juice, with turpentine like smell, present in the stalk or sometimes in the fruits, is due to myrcene and ocimene. Some undesirable seedlings or varieties are described as possessing a turpentine-like off-taste. The quality of the fruit is based on the scarcity of fiber and minimal turpentine taste.

### 3.9. Seeds

The seed (Fig.-2h) is large, flattened, kidney-shaped central stone contains one or more large, starchy embryos, producing

several seedlings that are identical but not always true to the parent type and can constitute up to 20% of fruit weight. It is impossible to distinguish true-to-type from zygotic seedlings from the same fruit. Some seedlings produce numerous tiny, parthenocarpic fruits (fruit development without fertilization) which fail to develop and abort. Each seed contains either one embryo (the so-called mono-embryonic cultivars) or more than one embryo (the so-called polyembryonic cultivars), producing several seedlings without fertilization pollination. Most of the seedlings will be nucellar (non-zygotic embryos produced from nucellar tissue – clones of the mother tree) as seedlings which have originated vegetatively, they are mostly true-to-type and genetically identical with the mother tree. Most Indian cultivars are mono-embryonic, while generally cultivars from Indonesia, Thailand and the Philippines are polyembryonic.

The most characteristic feature of the mango fruit is the formation of a small conical projection developing laterally at the proximal end of the fruit, known as the beak. It may be quite prominent in some, less so in others, while in some varieties it is represented merely by a dot. A wide sinus is always present just above this beak. The pistillate area of the fruit located near the base of the beak is known as the *nak*. The shape of the fruit varies from rounded to ovate-oblong or longish, with the length varying from 2.5 to 30 cm in different varieties. The base may be depressed or elevated or may be intermediate. The skin is gland-dotted and at maturity its colour exhibit different mixtures of green, yellow, and red shades. It may be smooth or rough. The acrid juice, with turpentine like smell, present in the stalk or sometimes in the fruits, is known as *chenp* in Hindi is due to myrcene and ocimene. Its main irritating constituent has been identified as an allergenic urushiol, 5-heptadecenylreorcinol.

The fruit takes four to five months from flowering to ripen. The crop is considered mature when the shoulder of the fruit broadens (fills out) and some fruits on the tree have begun to change color from green to yellow. Prior to this external color break, the fruit is considered mature when the flesh near the seed changes color from white to yellow. Mango should be picked before they are fully ripe, at which time they soften and fall. The fruit bruises easily and must be handled carefully to avoid damage. They are ripened at room temperature and then refrigerated. Mature mangoes keep fairly well under refrigeration for two to three weeks at 10 to 13 ° C. Generally, ripe mango has an orange-yellow or reddish peel and is juicy for eating, while exported fruit are often picked while under-ripe with green peels. Although producing ethylene while ripening, unripened exported mango do not have the same juiciness or flavor as fresh fruit. Like other drupaceous fruits, mangoes occur in both freestone and clingstone varieties.

### 3.10. Cultivars

There are several hundred of mango cultivars <sup>[6]</sup>. More than 1,000 known mango cultivars are derived from two strains of mango seed - monoembryonic (single embryo) and polyembryonic (multiple embryo). The monoembryonic hails from the Indian (original) strain of mango and the polyembryonic from the Indochinese. Over 500 cultivars of mango are known, many of which ripen in summer, while some give a double crop. In mango orchards, several cultivars are often grown in order to improve pollination. Many desired cultivars are monoembryonic and must be propagated by grafting otherwise they do not breed true. A common monoembryonic cultivar is Alphonso, an important export

product, considered as the king of mango. Cultivars that excel in one climate may fail elsewhere, e.g., Indian cultivars - Julie, a prolific cultivar in Jamaica, require annual fungicide treatments to escape the lethal fungal disease anthracnose in Florida. Asian mango cultivars are resistant to anthracnose.

The current world market is dominated by the cultivar Tommy Atkins, a seedling of Haden that first fruited in 1940 in southern Florida and was initially rejected commercially by Florida researchers.

Growers and importers worldwide have embraced the cultivar for its excellent productivity and disease resistance, shelf life, transportability, size, and appealing colour. Although the Tommy Atkins cultivar is commercially successful, other cultivars may be preferred by consumers for eating pleasure, such as Alphonso. Many commercial cultivars are grafted onto the cold-hardy rootstock of Gomera-1 mango cultivar, originally from Cuba. Its root system is well adapted to a coastal Mediterranean climate. Many of the over 1,000 mango cultivars are easily cultivated using grafted saplings, ranging from the turpentine mango (named for its strong taste of turpentine to the huevos de toro. Dwarf or semi-dwarf varieties serve as ornamental plants and can be grown in containers. A wide variety of diseases can afflict mango.

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