

Custard Apple An Economically Significant Major Arid Fruit Crops: Its Recent Varieties and Other Species

Bharti Choudhary¹ and Rahul Dongre²

¹Technical Officer, AICRP-AZF, Department of Horticulture, CoA, JNKVV, Jabalpur (M.P.)

² Scientist, Department of Forestry, CoA, JNKVV, Jabalpur (M.P.)

*Corresponding Author: bharati.choudhary06@gmail.com

Custard apple is one of the important topical fruit crops in India. The Annonaceous fruits originated in tropical America and are widely distributed in tropics and sub tropics. Among annonaceous fruits, custard apple is the most popular in India. It's distributed in Andhra Pradesh, Assam, Bihar, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Rajasthan and Tamil-Nadu as a scrub or hedge plant. Other annonnas are cultivated on a limited scale. Bullock's heart is more commonly found in south India than in north India. It is usually associated with gardens and compounds and not commercial orchards. *Cherimoya* is mostly restricted to Assam and hills of south India. *Atemoya* and sour sop are cultivated in some gardens as miscellaneous fruits. Custard apple (*Annona squamosa* L.) is commonly found in India and cultivated in an area of 47 thousand ha. with production of 407 thousand MT (NHB, 2020-21).

Custard apple, (genus *Annona*), of about 170 species of small trees or shrubs of the family Annonaceae. The number of genera and species in the family Annonaceae is still debated.

Edible species of custard apple is cherimoya (*A. Cherimola* Mill.), sugar apple (*A. squamosa* L.) hybrid between the two, atemoya, which has been assigned horticultural species status (*A. atemoya* Hort.) are the most popular ones.

The other annona species also producing edible fruits are bullock's heart (*A. reticulata* L.), Ilama (*A. diversifolia* Staff), and sour soup (*A. muricata* L.). The identification of *Annona* among botanically similar are very difficult and quite confused at times. Atemoya (Cherimoyax Custard apple) was mistakenly called custard apple for many years (Morton, 1987); custard apple is also frequently confused with *A. glabra* (Pinto et al., 2005)

Some of the Importance Species of *Annona*

1. ***Annona squamosa*:** English name custard apple, sweet soup, sugar apple; Indian name sitaphal,

sharifa, ate. It is widely cultivated species in India. The plant is deciduous, tall, woody shrub or small tree of about 5 to 6 meters in height with irregular spreading branches. The greenish yellow flowers arise at an extra axillary position, usually in clusters and rarely solitary. Fruits 250-300g; globular; green skin; sweet (20% sugar); non acidic; pulp creamy white; distinct segment, 60-80 seeds /fruit.

2. ***Annona cherimola*:** English Name Cherimola and Cherimoyar, Indian Name- Hanuman phal. The name cherimoya derives from the Quechua name 'chirimuya', which means 'cold seeds. Cherimoya is the only species adapted to subtropical or tropical highland conditions. It is a small, erect and spreading, deciduous tree, rarely reaching a height of more than 7.5 m. It was domesticated in the mid-elevation Andes of South America. The fruits are large green conical or heart-shaped compound fruit with 10-20 cm long with skin that gives the appearance of having overlapping scales or knobby warts. The ripened flesh is creamy white and contains numerous hard, inedible, brown or black, beanlike and glossy seeds. Fruits weight 250-300g, sub-globose, pine like aroma, 18% sugar, segment fused, 10-15 seeds /fruit. The fruits have fused ariols, non-gritty, sub acidic pulp with very good taste and flavour.
3. ***Annona muricata* (Sour Sop):** It is called as sour sop and prickly custard apple because the tree produces fruits that are slightly acidic taste when ripe. *A. muricata* tree is a native of the Caribbean and Central America. The tree is an evergreen with an erect growth habit to about 4 meters (13 ft) tall and cannot stand frost. The fruit is dark green, prickly (or bristled) fruits are egg-shaped and can be up to 30 cm long. The seed contains an average oil content of 24%. Fruits weight 500-750 g, heart shaped; dark green; fleshy pines, pulp is white; fibrous, juicy with mango like flavour; 11-14 %sugar

4. ***Annona reticulata* (Bullock's heart):** English name Bullocks Heart; Indian Name Ramphal. Bullock's heart is native of the Caribbean or South America. Leave is alternate, oblong or narrow-lanceolate. Flower is slender, with 3 outer fleshy, narrow petals 2-3 cm long; light-green externally and pale-yellow with a dark-red or purple spot on the inside at the base, borne in drooping clusters, fragrant and never opening fully. Fruit is compound, 8-16 cm in diameter, symmetrically heart-shaped, lopsided or irregular or nearly round or oblate with a deep or shallow depression at the base; rind thin but tough, may be yellow or brownish when ripe, with a pink, reddish or brownish-red blush and faintly, moderately or distinctly reticulated; pulp thick, cream white, custard-like, somewhat granular and sweet. Fruit is large (350-400g); smooth rind with hexagonal markings, pulp pale, gritty, flavored, 12.5% sugar and few seeds (30-40).
5. ***Annona glabra* (Pond Apple):** It is also known as Alligator-apple, Swamp apple, Corkwood, Bobwood, and Monkey-apple. The tree is native to Florida in the United States, the Caribbean, Central and South America, and West Africa. It is a known allopolyploid species. It grows in swamps, tolerant to saltwater, and cannot grow in dry soil. The trees grow to a height of around 10-12 m. They have thin, gray trunks and sometimes grow in clumps. The leaves are ovate to oblong with an acute tip, 8-15 cm long and 4-6 cm broad. The fruit is oblong to spherical and apple-sized or larger, 7-15 cm long and up to 9 cm diameter; the immature fruit is green on ripening it turns to yellow. While the grafts initially appear to be effective, a high percentage of them typically fail over time. Sour sop on Pond-apple rootstock has a dwarfing effect.
6. ***Annona senegalensis* (wild Sour Sop):** Wild sour sop also called as African custard-apple and wild custard apple. *Annona senegalensis* occurs in the form of shrub or small tree of height 2-6 m and rarely grows up to 11 m. The bark is smooth or coarse texture of gray-silver or gray-brown. The leaf is nearly round; flaking, showing lighter-hued spaces of under bark. Mature flower reaches up to 3 cm in diameter on a 2 cm stalks, either singular, or two to four, ascending from the leaf axils. It is a traditional food plant in Africa, the fruits of *A. senegalensis* have the potential to improve nutrition, boost food security, foster rural development and support sustainable land care is well known. Where it grows naturally, it is largely unheard of elsewhere (NRC, 2008).
7. ***Annona atemoya*:** *Atemoyas* are hybrids between *A.squamosa* X *A. cherimoya*, Indian Name - Lakshaman phal. The plant is semi-deciduous, sub-tropical tree being tolerant to frost; large spreading tree, 5m height. Fruit weight 500 g, globular green; white smooth pulp is very juicy with excellent sugar acid blend; large segments 10-15 seeds/ fruit. It is a hybrid with distinct improvement over custard apple in respect of seedlessness, fruit size, percent pulp and fruit quality. However low fruit set and yield are its drawbacks.
8. ***Annona diversifolia* (Ilama):** It is a tropical fruit tree found in Central America. The tree is erect at about 7.5m and often the branches begin at ground level. The leave is obovate or oblanceolate. The tree produces long and solitary flowers of maroon color. The fruit is cone-shaped, heart-shaped, or ovular similar to cherimoya. The fruit is 15 cm long and weight about as high as 900 gm. Ilama are of two types, viz., green and pink type.

Varieties of Custard apple

Introduced variety

- Mammoth: introduction from West Indies
- Barbados: This is also a introduction from West Indies,
- British Guiana: This is also a introduction from West Indies,

Exotic Varieties of Custard Apple in India

- **Thai Lessard:** It is one of the most important cultivars in tropical and subtropical areas. Pulp is sweet custard like. The fruit diameter is 7.5 to 12.50 cm with a lumpy green skin. At maturity the fruit colour turns to bluish or white blush and has

custard like white pulp with small black seeds. The sweet flesh is eaten fresh or used for milk shakes and ice creams. Older trees may continue fruiting into January during warm winter.

- **Kampong Mauve:** The fruit is round in shape or heart-shaped or ovate or conical, 2 to 3 inches in diameter, yellowish green, green, pink or purple in colour with attractive nature. The surface is a tuberculate and covered with a whitish bloom. The pulp is white, sweet and a little acidulous in flavor. The carpels, both of which normally contain a brown seed the size of a small bean, go together loosely or not at all. The distinction of custard apple from cherimoya is that it is difficult to distinguish capillary divisions in the flesh.
- **Israeli Selection:** Fruits are less seeded.
- **Israeli Hybrid:** Fruits are less seeded
- **Pink's Mammoth:** The tree produces commercial crops at the age of 6-7 years. Its fruit are large, ranging from 800 g to 2000 g.
- **KJ Pinks:** It is a bud sport of the custard apple 'Pink's Mammoth'. It is a high yielding variety and now being grown commercially. It is being used in the breeding program. This variety naturally sets fruit at 41 per cent, compared to less than three per cent for other varieties. It is very suitable for higher density training systems such as the Maroochy-V trellis and hedge row systems.
- **African Pride:** It was introduced into Australia from South Africa. It is a precocious and high yielding variety. Fruits are small to medium in size.
- **Bradley:** The tree bears small sized fruits having relatively smooth and thin skin.
- **Page :** It is a Florida cultivar which produces medium-sized fruit with prominent skin segments
- **Gefner:** It is an Israel cultivar, where it was introduced into Australia. Fruit are small to medium size, similar to 'Page'.

The Varieties Developed by Selection

- **Balanagar:** The selection was identified at Fruit Research Station, Sangareddy, Andhra Pradesh.

This is a good variety mostly grown in South India. It is also becoming popular in farmers of Gujarat. The variety is performing well in West Bengal. The tree produced average number of fruit (51.4) with fruit weight (137.0 to 264.0 g) and seed weight (5.7 g/fruit).

- **Red Sitaphal:** It is a distinct cultivar which probably originated in India as a chance seedling (Venkataratnam, 1965). Trees are dwarf, leaves have purplish mid rib. Fruits and floral parts are light reddish-purple colour. (Thakur and Singh, 1967). Number. of flowers /shoot 243, percent fruit set 3.97, with average number of fruits per tree 22.0, fruit weight 119 to 156.0 g, seeds / fruit was 50 and seed weight 5.2 g.
- **Gujarat Junagadh Custard Apple-1 (GJCA-1):** This variety was developed with clonal selection from Sindhan cultivar by the Department of Horticulture, Junagadh Agril. University, Junagadh (Gujarat) and released during 2009. It has higher plant height and plant spread as compared to local. The GJCA-1 produced higher fruit yield (27 kg/tree) with 45.86 per cent higher than Sindhan. The fruit is attractive, green colored, oblong with medium size. The pulp is in higher quantity with white, agreeable flavour with sweet taste. It is recommended for Saurashtra region of Gujarat.
- **AKP-CA-1:** It is a clonal selection from a high yielding type in the State Horticultural farm, Courtallam, Tamil Nadu released in 2003. It bears higher yield in rainfed vertisol (black soil). It is a drought tolerant variety which bears sweet fruits with TSS of 24.5 Brix and acidity of 0.2%. The tree gives mean fruit weigh of 207.5 g and 72 fruits per tree per year. It yields about 7300 kg fruits / ha (14.90 kg / tree which are 30.7 percent higher than 'Balanagar'). The first bearing commences in a graft/budded plant is 3-3 ½ years. It is suitable for cultivation in plains of Tamil Nadu especially in semi-arid regions and marginal soils of both vertisol and alfisol in dry tracts. It is also suitable for both rainfed and irrigated conditions.
- **NMK 1:** It is a selection made by Shri N.M. Kaspate in his orchard. 'NMK-1', is suitable for all

types of soils for plantation with a distance of 10 feet x 15 feet. The tree bears 100-125 fruit/tree, the yield and productivity of this selection is about 15-19 t/ha with 70-80% grade-1 fruits. Fruits of this selection are very attractive in colour and in size, have a smaller number of seeds per fruit and berry is quite big. The unique feature of this variety is that the fruit remains in the plant itself in good condition (un-ripped) for at least 20-25 days. This feature may help in adjusting the harvesting time based on market demand and cargo facilities. The harvesting of 'NMK1' can be done 2-3 times within 20-25 days as per the market convenience.

- **Annona -2:** The variety is developed by a farmer in Solapur district of Maharashtra. The fruits have less seeds and fruit size ranges from 500 to 750 g; fruit yield 16 to 19 tonnes per hectare, with revenue of Rs. 6 to 8 lakhs
- **Washington PI 98797:** It bears fruit number per tree (21.0), fruit weight ranged from 146 to 161g, seeds / fruit was 48, seed weight 6.9g /fruit, the pulp content is 38.1% with TSS 20.8 B, acidity 0.28%, reducing sugar 12.7% and total sugar 17.9%. Fruit yield / plant was 10.58 kg (Anon., 1987).

Variety Developed by Hybridization

- **Arka Sahan:** It is a hybrid of 'Island gem' (*Annona atemoya* Hort.) x 'Mammoth' (*A. squamosa* L.) The hybrid yields very sweet, fragrant, low seeded fruits having longer shelf life. The fruits are harvested during September-October. The average fruit weight is 210 g and normally takes about 6-7 days to ripe. The average fruit yield per plant is nearly 17 kg and 12 tonnes/ha. The creamy white colour flesh is juicy with mild pleasant aroma and tender with less number of seeds (9/100 g fruit) and large segments. Mesocarp color white, edible pulp 48.6%.
- **Mammoth:** This hybrid is resistant to drought. Though there is profuse flowering, fruit set was negligible. The fruit set can be improved by hand pollination with the pollen of *Annona squamosa* only. Hand pollination with *A. squamosa*

improved fruit set to 83%, while natural set was just 1.2%.

Some other important varieties of custard apple

- **British Guinea:** The tree given average number of fruits per tree 35.0, fruit weight 151.0 g and seed weight 8.4 g. The pulp content is 37.9% with TSS 23.30 B, acidity 0.27%, reducing sugar 15.0% and total sugar 17.9%.
- **Barbados Seedling:** The tree bears an average fruit number per tree 35.0, fruit weight 154.0 g and seed Weight 8.0 g. The fruit pulp content 41.2% with TSS 22.30 B, acidity 0.22%, reducing sugar 13.7% and total sugar 16.5%.
- **Local Sitaphal:** The traditional Sitaphal growing wild in the forest of India. Number of flowers /shoot 236.3, percent fruit set 16.34, number of fruits / tree 31, fruit weight 127 to 137 g, seeds / fruit was 48, seed weight 9.2 g /fruit. Fruit yield / plant was 20.7 kg (Anon., 1987). The performance of the variety is the best under semi-arid rainfed condition, only disadvantage is more number of seeds / fruit.
- **Island Gem:** Number of flowers /shoot was 257, percent fruit set was 1.21, and fruit weight 195 to 235 g, seeds / fruit was 31 and seed weight 6.5 g /fruit, pulp percent 51.7, TSS 26.6 Brix, acidity 0.26%, reducing sugar 11.8%, total sugar 15.3%. Yield / plant 2.64 kg and lowest yield / plant was recorded in this variety.
- **Sindhan:** It is very old and indigenous variety of Saurashtra region of Gujarat. It is more popular not only in farmers but in consumers also. Earlier it was naturally grown in forest of Gir and Gir nar as well as waste land of the region. However, now-a-days it is started Cultivation systematically due to its pleasant characteristics. The maximum area and Production of Sindhan goes to Bhavnagar and Junagadh districts of the state. The fruits of this variety are very attractive, green colored, big sized with higher fruit length and girth. The average weight of fruit is 150 to 200 g. The sugar content and TSS in fruit are 16.48% and 23.78%, respectively.

- **Seedless Atemoya:** Percent fruit set 6.34, fruit weight ranged from 186 to 215 g and yield / plant 8.29 kg.
- **Atemoya x Balanagar:** One of the highest yielders due to high fruit set. Number of flowers / shoots 44.0, percent fruit set 49.23, fruit weight ranged from 216 to 255 g, seeds / fruit was 55 and seed weight 11.5 g / fruit, pulp percent was 44.5, TSS 20.00 Brix, acidity 0.26%, reducing sugar 12.7%, total sugar 16.5% and yield / plant was 26.8 kg

The other varieties grown in different parts of India are 'NLD-5', 'NLD-8', 'NLD10', 'MMR-9', 'Bellary', 'Phythota-3', 'MMR-8', 'MMR-9', 'MMR-10' and 'Y. Palli-12'.

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