

Exploring biodiversity of custard apple for livelihood security

The wide range of genetic diversity in phenology, viz. growth, flowering, fruiting behaviour, and nutritional and qualitative characters in custard apple offers immense opportunity to explore the germplasm for superior genotypes from existing population growing under Gujarat. Since genetic diversity is important source of crop improvement for developing promising varieties for livelihood and health security, hence its collection, ex-situ conservation and characterization is necessary under rainfed conditions of semi-arid ecosystem of Gujarat. The conserved plant genetic resource could be need as a source of promising gene for creating improvement in yield, quality and high nutraceuticals value, and resistance to abiotic stresses through selection and hybridization.

CUSTARD apple (*Annona squamosa*) can be called as a delicacy of dry region due to its very sweet delicate pulp. It is a deciduous or semi-deciduous tall woody shrub of about 5-6 meters height having irregularly spreading branches. The fruits are rich in carbohydrate mainly in the form of sugars (23.5%), protein (1.6%), calcium (17mg/100g), phosphorus (47mg/100g) and iron (1.5mg/100g). It is one of finest fruits introduced in India from tropical America and found in wild and cultivated form in Asom, Bihar, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Uttar Pradesh, Andhra Pradesh, Telangana and Tamil Nadu. It grows throughout the plains of India at elevations not exceeding 4,000 ft. It mostly prefers a tropical climate, but can be grown successfully in hot to mild winter condition. The fruit plant tolerates



Naturally growing custard apple genotype in Malpur forest, Lunawada, Gujarat

Biodiversity Potential

The tree displays yellow trumpet shaped flowers that emit a pleasant sweet smell, with only a small number of flowers setting fruit. The fruits are variable in shape with outer being covered in rounded knobs, with the inside containing a custard like flesh. Custard apple contains antioxidant like vitamin C and vitamin A. The fruits are rich in potassium and magnesium that protect from cardiac diseases and control blood sugar. It is also rich source of copper content which help to cure constipation. Annonaceae family presents a large intra and inter-specific variability offering an ample scope for studying genetic variation. Despite this great variability, germplasm banks that contains *Annona* spp., mainly *Annona squamosa*, are rare throughout the India, which is a limiting factor for selecting and crossing among elite cultivars.

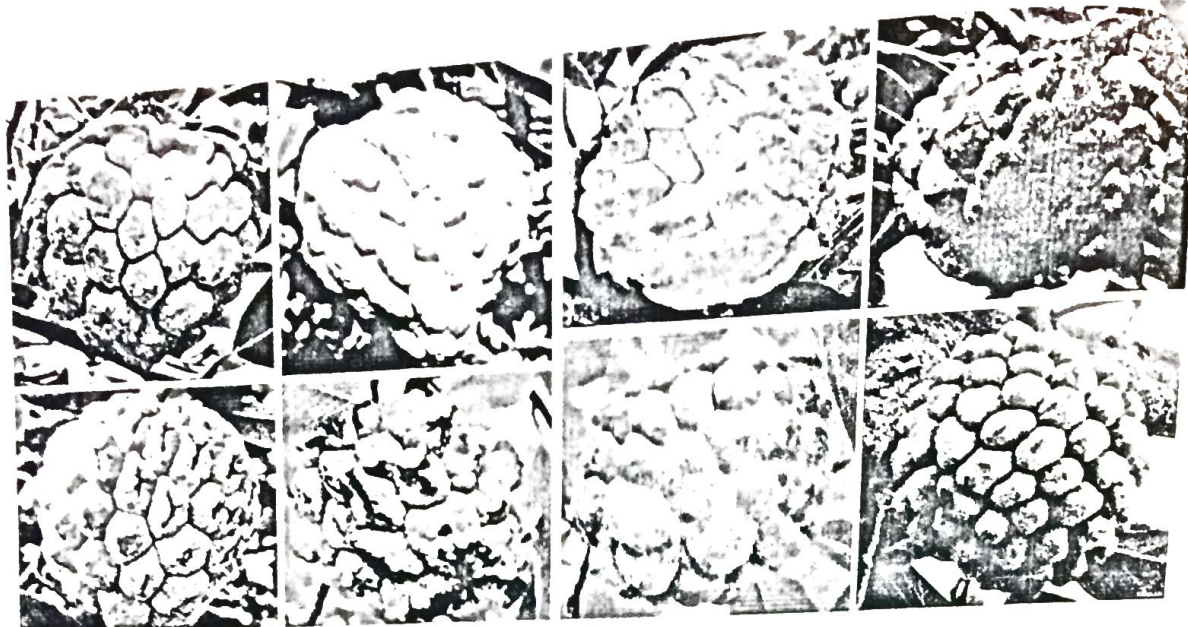


Flower stages in custard apple

wide soil and climate conditions, from saline soils to droughts. Farmers usually cultivate custard apple on hill tracts or barren lands.

The Survey

An extensive survey was made to collect superior germplasm, to determine variability for growth habit,



Variability in fruit colour, shape, size and flakes structure in different genotypes of custard apple

physical and biochemical traits and also to find out the elite genotypes having good fruit quality from wild genetic diversity rich regions of Gujarat (Malpur forest, hills of Santrampur, road side of Poyali, Hathimata, Godhra, Dediapada, Sagbara, Waghai) growing under different weather conditions.

The naturally-grown custard apple plants may be seen frequently in patches in the forest of Santrampur forest. Owing to its seed propagation in wild form, its adaptability has reached to the maximum in marginal areas as well as its native place. Since, there is fast genetic erosion in custard apple genotypes due to rapid deforestation, industrialization, animal grazing, uncontrolled urbanization and increasing population pressure in these areas, its collection and conservation has become most important as *ex-situ* conservation.

Some improved selection have been developed in the country that still do not perform very well due to one or another reason into particular region due to lack of certain desirable qualities for both desert and processing purpose and physiological incompatibility. Genetic diversity is important source of crop improvement for developing promising varieties for various purposes, hence its collection, conservation and characterization are very essential in field gene bank. The

source of promising genes for its further utilization in creating better yield, quality and having high medicinal significance and resistance to abiotic stress through selection of useful wild germplasm.

Thus, genetic improvement of custard apple is confined only to selection of promising genotypes and genetic transformation from seedling progenies. The existing custard apple population harbours a wide range of diversity. The wider the variability, the greater are the chances of improvement for various desirable traits. The information on nature and degree of genetic variability could be helpful for further improvement through selection and hybridization.

Vegetative characters

The growth habit in different genotypes is visually observed erect, spreading, semi-spreading and drooping foliage with dense and sparse type among

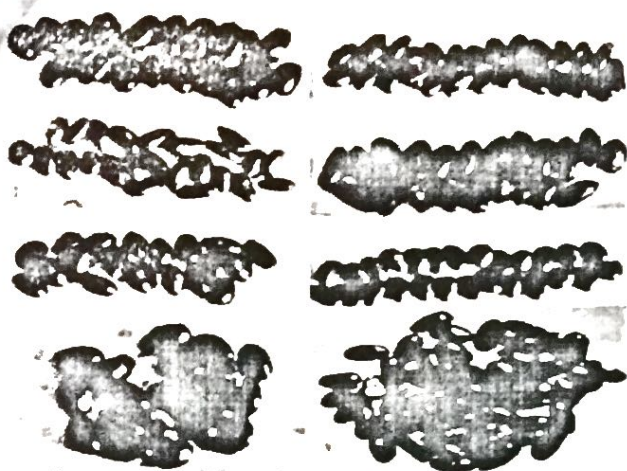


Fruit development in custard apple

all the characterised genotypes. Tree shapes of different genotypes are irregular, semi circular and elliptical types in Gujarat region of India. The leaf shape was oblong and narrow lanceolate, size with conspicuous veins.

Fruit

The fruits of different genotypes varied in their physico-chemical and morphological



Variability in seed colour, shape, and size of different genotypes of custard apple

characters, i.e. shape (nearly round, round, round spherical, obovat, obdeltoid and irregular), fruit colour (light green, pale green, yellowish green, dark green). Variability was also recorded with respect to fruit stem end cavity (sunken, depressed, highly depressed and shallow depressed). The stone shape was observed triangular, semi elliptical and elliptical and colour was black and dark brown in all the genotypes. The colour of pulp was found white and creamy. The fruits of different genotypes considerably varied with respect to measurable qualitative traits. The fruit weight, fruit length, fruit breadth, pulp weight, rind weight, rind thickness, seed weight, specific gravity, number of seeds per fruit, seed length, seed width, seed thickness, flakes with seed, flakes without seed, total flakes, flakes length and flakes width ranged between 110.45-335.37 g, 45.32-84.12 mm, 55.28-90.35 mm, 50.75-205.87 g, 33.47-143.28 g, 2.29-8.61 mm, 7.27-26.12 g/fruit and 0.85-1.37, 12-63, 9.40-15.60 mm, 5.12-8.32 mm, 2.90-5.10 mm, 12-63, 2-25, 22-68, 17.72-28.85 mm and 10.15-18.36 mm, respectively.

The genetic variability of fruit chemical attributes in total soluble sugar (26.61-32.63°Brix), fruit acidity (0.20-0.30%), vitamin C content (18.25-38.24 mg/100 ml of pulp), TSS: acidity ratio (88.70-156.75), reducing sugars (11.26-15.16%), total sugars (12.48-18.48%), magnesium (21.24-38.65 mg/100g fruit), potassium (257.26-295.74 mg/100 g fruit), sodium



Bearing behaviour in custard apple

(4.26-15.27 mg/100g fruit) and calcium (15.35-21.43 mg/100 g fruit) were observed among various genotypes.

SUMMARY

Thus, it may be concluded that various genotypes showed wide genetic diversity with respect to their physico-chemical attributes in Gujarat. The genotypes collected from Poyali and Hathimata areas showed very few numbers of seed, it may be useful in developing seedless variety in custard apple. Therefore, existing variability provide excellent opportunities for developing high-yielding selection having superior qualities both desert and processing purpose.

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