

## Hybridization in Tropical Fruit Crops

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### HYBRIDIZATION TECHNIQUES IN TROPICAL FRUIT CROPS

Then individual produced as a result of cross between two genetically different parent is known as hybrid. The procedure of developing hybrids is called as hybridization. It is an important method of combining desirable characters. The objective is to artificially create a variable population for the selection of types with desired combination of characters, combine the desired characters into a single individual, exploit and utilize the hybrid varieties.

#### STEPS:-

It involves the following steps:-

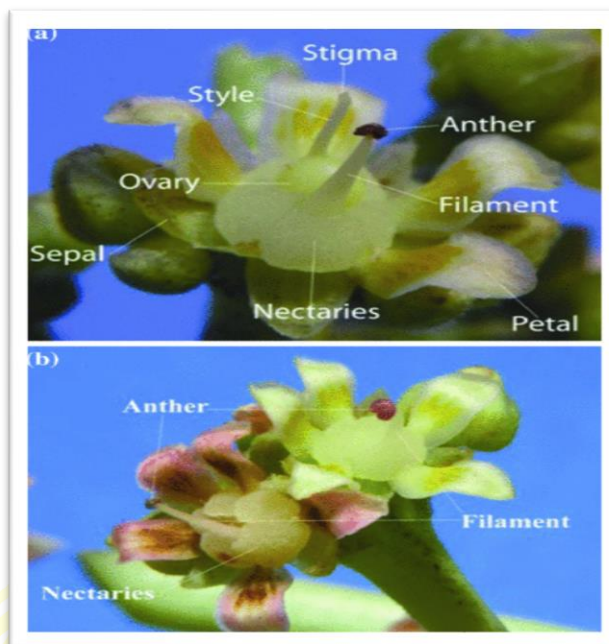
- Selection of parents
- Evaluation of parents
- Emasculation
- Bagging
- Tagging
- Pollination
- Harvesting and storage of F1 seeds

Approach to combine the characters by sexual crossing is far the most popular method for obtaining plants that have a more favorable combination of desirable traits. In fruit trees hybridization requires several decades.

**MANGO (*Mangifera indica*):-**

Since a large number of male and perfect flowers are borne on a mango panicle, it requires a special crossing technique.

- The panicle should be bagged with a muslin bag (60 cm x 30 cm) fully stretched and fixed with two rings and a rod made of spliced bamboo. A piece of thick iron wire can also be made into a good frame for stretching the muslin bag over the panicle.
- Staminate flowers of the selected panicle to be used as female parent should be removed daily before dehiscence.
- Panicles of the variety selected as male parent should also be bagged before their flowers begin to open.
- Freshly dehisced male flowers should be carried in a small petridish lined with a filter paper and covered with another petridish to protect the flower from contamination with foreign pollen carried by insects.
- Perfect flowers should be emasculated early in the morning before dehisced.
- Freshly dehisced anther of the male parent should gently be brushed against the stigma which should then be examined under lens to see if pollen grains have adhered to it.
- As the pollination of flowers in any one panicle is carried over a number of days, only the pollinated flowers should be allowed to remain on the panicle. It has been found advantageous to keep the panicles enclosed in bags till the fruits set and develop slightly.
- The conventional method of pollination is time consuming, cost intensive and inefficient because of tallness and difficult to handle trees and poor fruit set. ‘Caging technique’ for crossing, developed at IARI following the discovery of self incompatibility in Dashehari, Langra, Chausa and Bombay Green, involves planting of grafted plants of the self incompatible varieties along with those of male parents



enclosed in an insect proof cage and allowing pollination by freshly reared house flies and thus doing away with the tedious hand pollination.

### ACHIEVEMENT

Hybrid	Parentage	Remarks	Institute
Arka Aruna	Banganpalli x Alphonso	Dwarf tree, precocious, free from spongy tissue, fibreless	IIHR
Arka Puneet	Alphonso x Banganpalli	Vigorous, regular bearing, free from spongy tissue, good keeping quality	IIHR
Arka Anmol	Alphonso x Janardhan Pasand	Semi-vigorous tree, regular, high keeping quality	IIHR
Arka Neelkiran	Alphonso x Neelum	Semi-vigorous, regular, fruit with red blush, pulp deep yellow	IIHR
Arka Udaya	Amrapali x Arka Anmol	Regular bearing, late season variety, sweet, high yielding with long shelf life,	IIHR
Mallika	Neelum x Dasehari	Semi-vigorous, regular bearer, high TSS	IARI
Pusa Lalima	Dashehari x Sensation	Regular bearer, semi-vigorous suitable for closer planting. Fruits attractive in shape red peel and orange pulp, high $\beta$ -carotene content	IARI
Pusa Shreshth	Amrapali x Sensation	Regularity in bearing, attractive elongated shape, red peel and orange pulp. Plants are semi-vigorous and suitable for closer planting, higher pulp content	IARI
Pusa Peetamber	Amrapali x Lal Sundari	Moderately resistant to mango malformation and major insect pests of mango	IARI
Prabha Shankar	Bombai x Kalapadi	Regular bearer, medium in height	-do-
Jawahar	Gulab Khas x Mahmood Bahar	Semi-vigorous, precocious, regular bearing, high pulp content	-do-
Neeludin	Neelum x Himayuddin	Regular bearing, small fruit, pulpy, fibreless and aromatic	FRS, Kodur, AP
Neelgoa	Neelum x Yerra Mulgoa	Fibreless, juicy fruit	-do-
Neeleshan	Neelum x Baneshan	Fibreless, fragrant fruit, regular bearing, suitable for canning	-do-
Ratna	Neelum x Alphonso	Moderately vigorous, precocious, free from spongy tissue	KKV, Dapoli
Sindhu	Ratna x Alphonso	Regular bearing, parthenocarpic fruits borne in cluster, free from spongy tissue, non-viable seeds	-do-
Ruchi	Neelum x Alphonso	Good for pickling, regular bearer	-do-

## BANANA

### Interdiploid hybridization (2X2)

Diploids are the main source of genetic variability in breeding new commercial hybrids. Initially, breeding was started with the objective to incorporate the resistance against wilt in Gros Michel (as female parent) by using wild *M.acuminata* diploid as male parent. The tetraploid progeny was very tall but resistant to wilt.

Pollination is carried out between 7 to 10 AM, undehisced anthers of male flowers are collected and twisted gently to force them to dehisce. Using a soft hairbrush, the pollen grains are taken out and smeared gently over the stigmatic surface of the female flowers, which opened on the day of pollination. The pollinated flowers are to be covered with soft cloth bag.



### Triploid breeding

The crossing of diploid and tetraploid results in triploid. As tetraploids tends to produce a higher proportion of abortive gametes than diploids it is better to use them as male parents. Natural AAA triploid arose from the AA cultivars by chromosomes restitution at meiosis as an evolutionary course (Simmonds, 1962). Several synthetic AAA triploids have been bred out by using Highgate/Valery as female parents and wild /edible/ or improved *acuminata* diploids as the male.

### Tetraploid breeding

Tetraploids are bred by crossing a triploid female with improved diploid male (AA or AB). Seed fertile tetraploids are analyzed for potential usefulness in (4x) X (2x) crosses for synthesizing triploid hybrids



A number of good AAAA clones exist but remain unexploited. They were bred while breeding better export quality AAA clones. Similarly, AABB tetraploids is useful to breed AAB/ABB types. Important tetraploids for commercial adoption are e.g. Gold Finger (FHIA-01 AAAB), FHIA-02 (AAAA), FHIA-17, FHIA-21, BITA-1, BITA-2

### ACHIEVEMENT

- CO 1- (Kallar Laden x *Musa balbisiana* cv. Sawai) x Kadali – with pome flavour at lower altitude
- H110- Matti x Tongat – Dwarf
- H201- Barelli China x Pisang Lilin – Dwarf
- H21, H59, H89, H65 and H201- Leaf spot and burrowing nematode resistant
- FHIA hybrids- FHIA- 01, 02, 23, 17 etc. – wilt resistant

### GUAVA

#### ACHIVEMENT

Hybrid	Parentage	Remarks	Institute
Safed Jam	Allahabad Safeda x Kohir	Soft seeded large fruits with good quality	Sangareddy, Andhra Pradesh
Kohir Safed	Kohir x Allahabad Safeda	High yielding vigorous, fruits large, soft seeded and white fleshed	-do-
Arka Amulya	Allahabad Safeda x Seedless	Semi- vigorous, heavy yielder, fruits white fleshed, soft seeded with good keeping quality	IIHR
Hybrid 16-1	Apple colour x Allahabad Safeda	Bright red fruit skin, soft seeded with good keeping quality	IIHR
Arka Kiran	Kamsari x Purple Local	firm pulp and deep pink in colour with good keeping quality	IIHR
Hisar Safeda	Allahabad Safeda x Seedless	Upright tree growth, compact crown, round fruits with smooth surface, creamy white flesh, soft seeded	HAU, Hisar
Hisar Surkha	Apple Colour x Banarasi Surkha	Tree crown broad to compact, pink colour flesh	HAU, Hisar

## PROBLEMS IN FRUIT HYBRIDIZATION

- High heterozygosity
- Long juvenile phase
- Complex taxonomy
- Lack of information related to inheritance pattern of traits
- Chromosomal aberrations
- Nucellar embryony
- Cross and self incompatibility
- Requirement of large area for seedling evaluation

## FUTURE THURST

- Breeding for improved quality, increased productivity, annual bearing, pest and disease resistance
- Crop-trait specific breeding
  - Banana:** varieties with better fruit quality, resistance to fusarium race-4
  - Mango-** coloured cultivars with resistance against wilt and malformation
- Use of biotechnological tools like markers for identifying diverse parents for hybrid development
- Using marker assisted breeding to reduce the breeding cycle
- Use of techniques like embryo rescue to overcome post zygotic barriers in distant hybridization
- Use of morphological and molecular markers as pre selection criteria to select desirable hybrids

