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Thar Gaurav: High-yielding wood apple variety for dry land

Wood apple variety 'Thar Gaurav' has been developed at regional center, Central Horticultural Experiment Station, Godhra and released by ICAR-CIAH in the year, 2019. This genotype was collected from Indore, Madhya Pradesh and developed through selection and tested under rain-fed semi-arid conditions for 13 years. It is precocious bearer, high yielder (115.05 kg, 10th year) having bigger size (452.25 g), quality fruit (T.S.S. 140.02°B). It is drought hardy and belongs to early maturity group (1st week of November). It is rich in mineral content and highly suitable to grow under rain-fed semi-arid conditions. It can be planted at 5x5 m spacing to enhance the income per unit area with canopy management.

THE wood apple is an underutilized fruit tree. It is botanically known as *Feronia limonia* L. and belongs to family Rutaceae. In India, it is known as elephant apple, monkey fruit, curd fruit, *kaitha* and *kaith bel*. It is reported to be native of south India. It is found growing naturally in moist tropical-sub tropical and semi-arid regions, excluding high altitude and cold region. It prefers dry hot condition for flowering and fruiting. The pulp of mature fruit is brownish sticky, resinous, astringent, acidic or sweet with pleasant aroma and seed scattered throughout fruit. The different parts of plant like leaf, stem, bark, fruit and seed have medicinal and curative values. It is also considered as staple fruit of tribal community of Gujarat.

Vernacular names of wood apple in India

Language	Local name
English	Wood Apple, Elephant Apple, Monkey Fruit or Curd Fruit
Hindi	Kaitha, Kath Bel or Kabeet
Oriya	Kaitha
Sanskrit	Kapittha or Dadhistha
Telugu	Vellage Pandu
Tamil	Vilam Palam
Malayalam	Vilam Kai
Bengali	Koth Bel
Gujarati	Kothu
Malaysia	Belingai

Thar Gaurav

The wood apple variety, Thar Gaurav is developed through selection purely under rain-fed hot semi-arid ecosystem. This selection was made from Indore district of Madhya Pradesh in year of 2004-05 and established through soft wood *in-situ* grafting under field condition. The genotype was evaluated for 13 years for various desired horticultural traits at Central Horticultural Experiment Station (ICAR-CIAH), Vejalpur, Panchmahals (Godhra), Gujarat. It has been identified and released as variety at institute level in 2019. Based on the various parameters, it was found suitable to grow under stress conditions (moisture and temperature). Its growth habit is spreading, having drooping branches. Fruits mature after 230 days after fruit set. Fruits are rich in pectin and protein content.

Behaviour of plant growth

It is medium stature tree having spreading growth habits. The plant height, stem girth and plant spread were recorded 6.25 m, 56.36 cm and 4.81 × 5.12 m respectively, during 12th year of age under hot semi-arid conditions. The trunk is short, cylindrical with a symmetrical crown of foliage. The bark is dark grey coloured, rough, thick and have longitudinal furrow. The branches have axillary 2.1-2.43 cm stout spines whereas leaves odd pinnate of 9.12 × 7.82 cm size, with short petiole (3.25 × 2.08 cm) and flat rachis. The leaves are deciduous, alternate, dark green, leathery with minute toothed and have 7 leaflets which are opposite, sessile obovate tip and cuneate base. The tree sheds its leaves and branches are bare for a short period during January to February.

Flowering

The warm season appears to be conducive for the initiation of flower buds. The flowering occurs on new as well as old shoots in the month of March-April. Plant starts flowering in 4th year after budding or grafting. Numerous small flowers are born in small, loose, terminal or lateral panicles. The flowers are mainly staminate and hermaphrodite and have 9-12 stamens of

equal size. Flowers are light green to dull red in colour with 13.31 mm size. The calyx is very small in size (4.10 × 2.45 mm) with 5-6 lobes and petals are 5-6 elliptic-oblong, spreading or bent downwards having size (7.03 × 2.63 mm). The peak period of flowering takes place in first fortnight of April month while peak time of anthesis was observed in 8-10 AM under rain fed condition. The anthers were observed as basifixed dehiscing with a slit between two pollen sacs of each lobe. The fresh pollen grains have light green to dark yellow colour. The anthesis occurs between 8-10 AM and dehiscence period 8.30-10.30 AM under hot semi-arid ecosystem.

Striking features of Thar Gaurav (Wood Apple)

It is precocious bearer having dense canopy, and starts bearing in 4th year. It has bigger size fruit (452.25 g). It may be used as table fruit and processed as well. It is drought hardy and capable to give economic yield in aberrant agro-climate condition. Fruits emits strong pleasing aroma at full maturity. It belongs to early maturing group (1st week of November) with high yield (115.05 kg/plant in 10th year) under rainfed semi-arid condition. The fruit is rich in pectin (1.76%) and protein (pulp, 18.13% and seed, 24.38%), phosphorous (0.07%), potassium (1.73%), calcium (0.30%) and iron (16.72 mg) content. It is highly suitable for making of various value added products like pickles, RTS, jelly and powder etc.

Table 1. Main characters of 'Thar Gaurav' wood apple variety

Character	Thar Gaurav
Initiation of bloom	1st fortnight of March
Full Bloom	1st fortnight of April
End bloom	4th week of April
Colour of flower	Greenish-yellow
Fruit weight (g)	452.25
Pulp (%)	50.92
Fruit Shape	Oblong
Fruit Colour	Greenish-white
Fruit maturity	November
Seed wt. (g)/fruit	16.67
Seed length (mm)	7.12
Seed dia. (mm)	5.21
TSS (° Brix)	14.12
Seed oil (%)	28.60
Fruit pectin (%)	1.76
Nitrogen (%)	4.68
Phosphorous (%)	0.07
Potassium (%)	1.73
Calcium (%)	0.30
Magnesium (%)	0.45
Iron (mg)	16.72
Zinc (mg)	2.19
Copper (mg)	0.37

Maturity, ripening and yield

The fruits show greenish-white colour with dull rough brown skin at full maturity whereas ripe fruits gives strong pleasant aroma. Fruits attain maximum size in month of October than more or less stationary phase until the fruits are harvested. Fruits are generally ready to harvest after 225-240 days of fruit setting November). Generally, wood apple fruits are free from any disease and pest. The mature fruits can be stored for 12-15 days under normal condition. It gives yield 58.58 kg yield in 7th year and 124.36 kg/plant in 12th year under rainfed semi-arid condition.

Fruit quality

This selection has very good fruit quality and organoleptic taste. The fruit physio-chemical attributes in term of fruit weight (452.25 g), fruit size (103.67 x 96.66mm), pulp (50.92%), shell weight (180.12 g), TSS (14.12^{0}Brix), acidity (3.85%), total sugar (3.07%), reducing sugars (1.42%), fruit pectin (1.76%), fruit protein (18.13%), seed protein (24.38%), phosphorous (0.07%), potassium (1.73%), calcium (0.30%) and iron 16.72 mg exhibited better comparable value than check. The fruit shape and colour, and pulp colour were observed oblong, greenish-white and brownish, respectively. The fruits of this selection are bigger in size having better shelf life of 12-15 days at ambient conditions. The fruit may be used as table purpose and for value added products like pickles, RTS, chutney and powder.

Production Technology

Soil and climate

The wood apple can be grown in wide range of soils. For high yield potential and good plant growth, sandy loam or deep loam with 7-7.5 *p*H and well-drained soils are needed. It can be cultivated in a wide range of ecological conditions, reflecting its wide geographical distribution from tropical and sub-tropical to arid and semi-arid regions. It is highly suitable for semi-arid and arid ecosystem.

Plant propagation

It can be multiplied through soft wood grafting and patch budding during the month of March-April. In wood apple, *in-situ* soft wood grafting with 6-8 month scion shoot on 10-12 month old root stock gives >85% success and patch budding with 3-4 month scion shoot gives >70% success under semi-arid condition of western India. Therefore it is recommended to propagate wood apple tree by *in-situ* soft wood grafting under rain-fed semi-arid condition for better success and survival.

Orchard establishment

The pits of 90 × 90 x 90 cm are usually dug out during summer months (May). Well-decomposed organic matter

Fruit bearing in Thar Gaurav

Fruit setting in Thar Gaurav

Fruit setting in Thar Gaurav wood apple plant

Fruit shape, size and colour of mature fruit of Thar Gaurav

Fruiting in 5th year old plant of Thar Gaurav wood apple

Fruitng in 4th year of plant of Thar Taurav

Harvested fruit of Thar Gaurav wood apple fruit

Harvested fruits of Thar Gaurav wooad apple plant

Mature fruits of thar gaurav wood apple plant

Longitudinal section of Thar Gaurav fruit

Seeds of thar Gaurav wood apple fruit

Thar Gaurav wood apple block

Transverse section of Thar Gaurav wood apple fruit

Wood apple germplasm block at CHES (ICAR-CIAH), Godhra, Gujarat

Yield performance of Thar Gaurav

should be mixed with soil and pits are filled. Planting is done during the raining season when the soil in the pits has already settled. The plants should be irrigated immediately after planting and soil around the plant should be pressed to avoid air pocket. It can be planted at the distance of 5 m x 5 m for high productivity per unit area.

Irrigation management

It can be grow successfully without irrigation under semi-arid conditions. In the early age (up to 2 year), plants should be irrigated during summer for better growth and establishment of plant. Under dry land condition, planting should be done just after onset of rain so that plant could establish during rainy season. Water harvesting techniques during the rainy season should be considered, which encourages subsequent growth and fruiting during post monsoon season.

Nutrient management

An annual dose of 50 kg of FYM, 1.0 kg N, 500 g P and 500 g K per plant per year should be applied in full grown tree (10 year) and it should be applied each year in two splits during first week of July and last week of August under rainfed dry land condition.

Training and pruning

Wood apple plant should be trained with removing cross branches at initial growth stage of plant because grafted plant are vulnerable to lanky and spreading growth habits during initial 2-3 year, hence, staking, training and pruning is essentially required for proper frame work. The wood apple tree should be pruned during December-January.

Harvesting method

The fruit ripens in the month of November. The mature fruits are picked individually by hand picker having the small portion of stalk intact with fruit and in all cases care should be taken to avoid all possible damage to fruits during harvesting and storage to avoid post harvest losses.

For further interaction, please write to:
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