

Review Article

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Biodiversity in *Psidium species* and its Exploitation for Genetic Improvement

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ABSTRACT

Guava (*Psidium guajava* L; Myrtaceae) popularly known as “apple of tropics” is an important fruit crop of India. It is largely a self-pollinated crop, but cross-pollination also does occur. This results in a large variability in the seedling population. Among cultivars, substantial variation exists in terms of growth pattern, yielding behavior, fruit characters (peel, shape etc.) and physio-chemical composition, aroma, pulp to seed ratio, seed characters. Assessment of variability can be achieved through morphological characters, chemical composition and by biotechnological tools. Variability assessment morpho-agronomically can be done through descriptors by UPOV (1987), NBPGR (2002) and AICRP (CISH) Lucknow (2011). Broader variability in any crop offers good scope for breeding and improvement. About 160 cultivars are available in India, among which ‘Allahabad Safeda’ and ‘Sardar’ varieties are widely cultivated. Crop Improvement work attempted in India resulted in release of several superior selections/hybrids. Interspecific hybrids resistant to guava wilt were developed at CISH, Lucknow which are graft compatible with commercial varieties of *P. guajava*. Knowledge on genetic variability and germplasm could help in designing crosses, evaluation methods and breeding strategies.

Keywords

Guava, Variability, *Psidium species*, Breeding Methods, Varieties/Hybrids.

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Introduction

Guava (*Psidium guajava* L.) is a perennial tree fruit of tropics and subtropics offering great economic potential (Pathak and Ojha, 1993). It is commercially cultivated in Pakistan, Bangladesh, India, Thailand, Mexico, Brazil, USA and several other

countries of the world (Watson and Dallwitz, 2007). Leading world producers of guava include India and Mexico (Adsule and Kadam, 1995). It is an important fruit crop of India. It has gained considerable prominence on account of its high nutritive values, availability at moderated prices, pleasant aroma and good flavour. It is one of the

commonest fruits liked by the rich and the poor alike and is popularly known as “apple of the tropics”. It is one of the hardiest fruit trees, adaptable to a variety of soil and climatic conditions. It grows well even under neglected conditions and in fact, is even sometimes considered of a weed in Fiji and Hawaii.

It is the fifth most widely grown fruit crop of India. The area under guava is about 0.178 million hectares, producing 1.83 MT of fruit. Popular varieties of guava in India are Allahabad Safeda, Lucknow-49, Nagpur Seedless, Dharwar, etc. Bihar is the leading state in guava production, with 0.26 MT, followed by Maharashtra, Uttar Pradesh, Karnataka, West Bengal, Punjab, Andhra Pradesh, Gujarat, Orissa and Tamil Nadu.

Guava is largely a self-pollinated crop, but cross-pollination also does occur. This results in a large variability in the seedling population from which promising genotypes have been selected in different agro-climatic regions of the country. Assessment of variability can be achieved

through morphological characters, chemical composition, and cytological characters, however, they have several limitations especially in perennial crops. Despite the fact that morphological characters are often limited in number, they have a complex inheritance pattern and are vulnerable to environmental conditions, it is easy and cheap to carry them out, and can be carried out systematically.

Variability assessment morpho-agronomically can be done through descriptors by UPOV (1987), NBPGR (2002) and AICRP (CISH) Lucknow (2011). Knowledge on genetic variability and germplasm could help in designing crosses, evaluation methods and breeding strategies.

Psidium species

The genus *Psidium* belongs to the family Myrtaceae and has a basic chromosome number of $x=11$. All the cultivars of Indian guava belong to a single species, *Psidium guajava* L.

Hayes (1953) reported the genus to contain about 150 species, though only a few have been studied in detail.

Bailey (1919) reported that the two species, *pyriferum* and *pomiferum* mentioned by Linnaeus are nothing but trees with pear shaped and round shaped fruits. Subsequently, other species were recognized and documented.

The wild species of guava are of considerable importance in breeding programmes.

***P. Cattleianum* var. *cattleianum* (Sabine) syn: *P.littorale* (Raddi) var. *longipes* (Berg.)**

It is a wild subtropical species closely related to guava. It can adapt to many soil types and is quite cold resistant. It is a small tree or shrub with a smooth bark. Leaves are obovate elliptic and glabrous. Fruits are round, about 2.5 cm in diameter and very fragrant. The skin is thin, pulp is soft with numerous seeds. It has a sweet flavor and good aroma. It is also known as ‘Strawberry guava’ because of the sweet aroma reminiscent of strawberry. Since this lacks muskiness of the common guava, it is preferred among certain tribals (Normand, 1994).

***P. Cattleianum* (Sabine) var. *lucidum* syn: *P. littorale* (Raddi) var. *littorale* (Berg)**

It is a relatively hardy subtropical species. The fruits are small, globose, juicy, acidic and sulphur yellow in colour. It is also called ‘lemon guava’.



***P. friedrichsthalianum* (Niedenzu)**

It is a tall tree about 7-10m high. The branches are slender and smooth. Leaves are oval or oblong/oval, smooth, almost glossy above and pubescent below. Fruits are globose, small and sour. The fruits are good for jelly making because of their high acidity. Reported to be wilt and nematode (*M. incognita*) resistant, it is also called Chinese guava or Costa Rican guava.

***P. guineense* (Sw). Syn: *P. molle* (Bertol), *P. araca* (Raddi), *P. Schiedeana* Berg**

It is also called Brazilian or Castilian guava. It is a slow growing shrub, about 1 to 3m long and withstands short periods of drought. The leaves are oblong, scantily hairy on the upper side but coated beneath with pale or rusty hairs and distinctly dotted with glands. The fruits are round with yellow skin, pale yellow pulp surrounding the white central pulp. It contains numerous hard seeds (Mortan 1987).



***P. montanum* (swartz)**

It is generally found in the mountains of Jamaica. The branchlets are four angled, leaves oblong to oval, glabrous, fruits are round, pulp white with more number of seeds. It produces fruits of poor quality.

***P. araucanum* (soares-silva and proenca)**

A large tree with membranous leaves, brochidodromous venation, long petioles and peduncles, flowers solitary, axillary or ramiflorous or in short racemes, with two pairs of flowers. Fruits globose or pear shaped, thin pericarp, fruits yellowish green when mature, seeds angular or lenticulate.

P. acutangulum DC

The shrub or tree ranges in height from 26 to 40 ft. Its branchlets are quadrangular and winged near the leaf base and the new growth is finely hairy. Leaves are elliptical with very

short petioles. Fruits are round to pear shaped, pale yellow to yellowish white acidic pulp but well flavored pulp containing few hard, triangular seeds. The fruits are mixed with honey and eaten or, made into acid drinks or preserves.

Indian cultivars

Promising cultivars of different Indian states are given below:

| State | Varieties grown |
|----------------------------------|--|
| Andhra Pradesh | Allahabad safeda, Lucknow 49, Anakapalli, Banarasi, Chittidar, Hafshi, Sardar, Smooth Green, Safed Jam, Arka Mridula |
| Madhya Pradesh | L-49, Allahabad safeda, Gwalior-27, Hafshi, Seedless Chittidar |
| Jharkhand | L-49, Allahabad safeda |
| Karnataka | Allahabad Safeda, L-49, Arka Mridula, Arka Amulya, Bangalore, Dharwar |
| Assam | Am Sophri, Madhuri Am, Safrior Payere, Allahabad safeda, Lucknow 49 |
| Bihar & Jharkhand | Allahabad Safeda, Apple Colour, Chittidar, Hafshi, Harijha, Sardar, Selection-8 |
| Maharashtra & Gujarat | Nagpur seedless, Dharwar, Dholka, Kothrud, L-24, L-49, Nasik, Sindh |
| North-eastern States | Allahabad Safeda, Sardar, Red Fleshed. |
| Tamil Nadu | Anakapalli, Banarasi, Bangalore, Chittidar, Hafshi, Nagpur Seedless, Smooth Green |
| Uttar Pradesh | L-49, Allahabad Safeda, Lucknow Safeda, Apple Colour, Chittidar, Red Fleshed, Allahabad Surkha, Mirzapuri Seedless, CISH-G-1, CISH-G-2, CISH-G-3 |
| West Bengal | L-49, Allahabad Safeda, Dudhe Khaja, Gole Khaja, Baruipur, Chittidar, Harijha, |

Variability assestment

Large variability in the seedling population is a resultant of frequent cross-pollination and high heterozygosity. Many promising genotypes have been selected from a broad variability. Range of variability can be in the form of Broad leaf, Narrow leaf, Tree habit, Seedless, shape of fruit, pulp colour etc., Usually the easiest assessment of variation is

through phenotypic measures. The identification of large variation in plant population demands for the use of specific descriptors. This was first realized by the UPOV, Geneva (International Union for the Protection of new Varieties of Plants) guidelines published in 1987. NBPGR published a descriptor for guava with 29 characters (2002). The issue was not satisfactory among guava workers.



Pale yellowish green



Pale yellow



**yellow
greenish**



orange



Orange greenish



dark green



Red

Fig.1 Fruit peel colour



Smooth



Rough



Bumpy

Fig.2 Fruit Surface

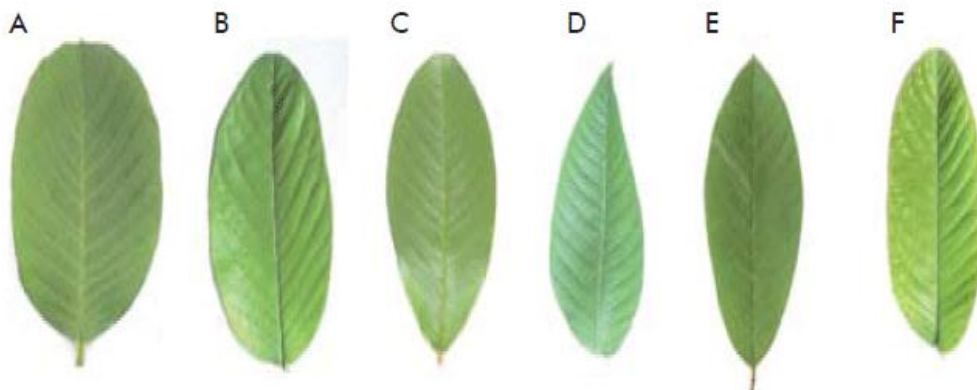


Figure 2. Mature leaf shape. A) Rounded. B) Ovate. C) Obovate. D) Trullate. E) Obtrull. F) Oblong.

Fig.3 Leaf shape

AICRP on subtropical fruits (CISH, Lucknow) in 2011 published guava descriptors with 48 characters. Rodriguez *et al.*, 2010 provided new illustrated elaborated descriptors in relation to the ones listed in the UPOV guidelines which provide more than 70 descriptors.

Though guava is an introduced crop in India considerable variability exist in guava particularly in the Indo-Gangatic plains. Despite such a huge variability in guava proper prospection, conservation, evaluation and management of guava germplasm is still lacking. Thus, scientific collection, evaluation and conservation of the wild, cultivated species would broader our germplasm.

It is very important to widen the genetic base of guava for effective breeding and selection program. Hence all the important varieties, *Psidium* species and allied genera should be introduced from exotic sources for assessing their performance.

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