

SHORT COMMUNICATION

Use of Fruit and Seed Characters for Identification of Edible *Artocarpus* species in India

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Abstract

The genus *Artocarpus* (family Moraceae) consists of underutilized fruit crops. Taxa, *Artocarpus chama* Buch.-Ham. (Assam), *A. hirsutus* Lam. (mainly in Western Ghats, including Kerala, Karnataka), *A. heterophyllus* Lam. (Assam, Odisha and Bihar), *A. communis* J. R. Forster and G. Forster (Western Ghats, Andaman and Nicobar), *A. lacucha* Buch.-Ham. (Andhra Pradesh, Jharkhand, Odisha) and *A. gomeziana* Wall. (Assam, Andaman and Nicobar) are commonly known for edible value in different parts of India. Identification of taxa based on fruit and seed characters is of most significance in plant genetic resource conservation. Hence, the present study was on the characters of fruit and seed of edible *Artocarpus* species in India used for identification and developing taxonomic key. Since some of the species are not commonly distributed, additional data from floristic literature and e-floras has been used to validate records on distribution.

Keywords: *Artocarpus*, Distribution, India, Taxonomic key, Field identification, Crop wild relatives..

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Introduction

The genus *Artocarpus* (family Moraceae) consists of taxa with evergreen and deciduous trees of underutilized fruit trees with a diversification centre in Southeast Asia. Jarrett (1959a, 1959b, 1960) refined *Artocarpus* after conducting extensive taxonomic research on local floras (Kochummen, 2000; Berg *et al.*, 2006, 2011). There are nearly 70 species; 6 species have edible value, *Artocarpus altilis* Fosberg, *A. chama* Buch.-Ham., *A. hirsutus* Lam., *A. heterophyllus* Lam., *A. communis* J. R. Forster and G. Forster, *A. lacucha* Buch.-Ham., *A. gomeziana* Wall. These taxa contain medicinally relevant secondary metabolites with biologically beneficial properties. In South-East Asia, Indonesia, the western portion of Java, and India, a variety of *Artocarpus* species are utilized as food and for traditional folk treatments.

Conservation of plant genetic resources management is essential for food security and agricultural biodiversity. Taxonomic identification must be ensured before the conservation of germplasm in a genebank. The endeavor of species identification and taxonomic classification has gone in era of molecular biology or ecology, where knowledge in this field of science is scarce (Ridley, 1986; Silva *et al.*, 2011; Kirchoff *et al.*, 2014).

The taxonomic keys generated in many species are insufficiently accessible to facilitate the identification of germplasm collections. They are not much used for identifying plant genetic resources as the germplasm is received in the form of seed or a part of the fruit. Taxonomic approaches based on fruit and seed traits are therefore essentially desired to accurately identify taxa, especially the underutilized species like *Artocarpus*.

Table 1: Distribution of *Artocarpus* spp. found in India

S. No.	Name of species	Distribution in World	Distribution in India	Source
1	<i>Artocarpus communis</i> J. R. Forster & G. Forster (syn- <i>Artocarpus altilis</i> (Parkinson) Fosberg; <i>A. incisus</i> (Thunberg) Linnaeus; <i>Radermachia incisus</i> (Thunberg)	Oceania from New Guinea through the Indo-Malayan Archipelago to western Micronesia	Western Ghats, Andaman and Nicobar Andhra Pradesh, Goa, Karnataka, Kerala, Lakshadweep	https://www.cabi.org/isc/datasheet/1822
2	<i>A. chama</i> Buch.-Ham. (syn.- <i>A. chaplasha</i> Roxb.; <i>A. melinoxylus</i> Gagnepain.)	Yunnan China, Bangladesh, Bhutan, India, Laos, Malaysia, Myanmar, Sikkim, Thailand	Hailakandi, Assam; Andaman and Nicobar	https://indiabiodiversity.org
3	<i>A. hirsutus</i> Lam. [(syn.- <i>Artocarpus pubescens</i> Willd., <i>Saccushirsutus</i> (Lam.) Kuntze]	Western Ghats, SW India, W Sri Lanka	Kerala, Karnataka, Maharashtra, Tamilnadu, Goa	https://en.wikipedia.org/wiki/Artocarpus_hirsutus https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:850390-1
4	<i>A. heterophyllus</i> Lam.	India, South East of Indian Subcontinent, China to Philippines	Southern States, Assam, Odisha, Gujarat, Bihar, Central Himalayas, Andaman and Nicobar	https://www.sciencedirect.com
5	<i>A. lacucha</i> Buch.-Ham. (syn. <i>A. lakoocha</i> Roxb., <i>A. dadah</i> Miq., <i>A. ficifolius</i> W.T.Wang, <i>A. dasyphyllus</i> Miq.)	Indian Subcontinent and SE Asia	Andhra Pradesh, Jharkhand, Odisha, Bombay, Assam, West Bengal, Andaman and Nicobar	Flora of Peninsular India, Dagar and Singh (1999)
6	<i>A. gomeziana</i> Wall.	Assam to Western Malesia	Lakhimpur, Assam, Andaman and Nicobar	Kanjilal and Das (1984) Flora of Assam.

Though, by visual observation of the *Artocarpus* tree during blooming as well as in the vegetative stage, species are well distinguishable on the basis of their morphology. When germplasm is received as part in the form of fruit or seed, it is always mandatory to confirm the identity. In this paper, six edible *Artocarpus* species in India have been studied and the key characteristics of fruit and seed resulted in the development of a field key.

Data was collected on the distribution of different *Artocarpus* species present worldwide and in India (Table 1 and 2). Nearly 20 wild and cultivated species are found in India, i.e., *Artocarpus forbesii* King., *A. bracteatus* King., *A. calophylla* Kurz., *A. kunstleri* King., *A. integrifolia* L.fil., *A. peduncularis* Kurz., *A. lowii* King., *A. maingayi* King., *A. scortechinii* King., *A. nobilis* Thwaites, *A. lanceaefolia* Roxb., *A. chama* Buch.-Ham., *A. lacucha* Buch.-Ham., *A. gomeziana* Wall., *A. denisoniana* King (Hooker, 1875), *A. nitidus* Trécul (singh *et al.*, 2017), *A. odoratissimus* Blanco.(Gupta and Chivers, 1999), *A. hirsutus* Lam. (Cokke, 1901), *A. communis* J. R. Forster and G. Forster and *A. heterophyllus* Lam. (Matthew, 1991). Among them 6 commonly occurring species of this genus have edible significance out of roughly 70 species worldwide present viz. *A. chama* Buch.-Ham., *A. hirsutus* Lam., *A. heterophyllus* Lam., *A. communis* J. R. Forster and G. Forster, *A. lacucha* Buchanan-Hamilton, *A. gomezianus* Wall.

Information on the distribution of *Artocarpus* spp. was collected from floras and e-flora of different states of India and China, along with other digital sources. Characters of

fruits and seeds were recorded from the flora of Assam, West Bengal, Andhra Pradesh, Bombay, Tamil nadu, Goa, Diu, Daman, Dadar and Nagar Haveli, Meghalaya, British India, Andaman and Nicobar and flora are critically analyzed for identifying characters of *Artocarpus* species. To represent all the data gathered from various flora, data on the fruit and seed characteristics of various Indian *Artocarpus* species were retrieved. Analysis of key characteristics of fruit and seed of these species was done to develop taxonomic keys.

Distribution

Information collected on the distribution of the above 6 species found in India is presented in Table 1.

Seed and Fruit Characters

The evidence collected on fruit and seed characters of edible *Artocarpus* spp. found in India in different flora are as follows:

Taxonomic key

The key taxonomic characters were recorded as observed and validated from the literature. Classifying fruit and seed characters have been pulled to prepare the taxonomic key as follows

Key to species in genus *Artocarpus*

- *Fruit smooth*

Fruit globose-sub lobed or wrinkled.

Table 2: Distribution information of *Artocarpus* spp. found in India

Floras	Hooker (1875)	Kanjilal and Das (1984)	Sanyal (1994)	Cokke (1901)	Matthew (1991)	Pullaiah and Moulali (1997)	Haridassan and Rao (1987)	Rao (1986)	Dagar and Singh (1999)
<i>A. communis</i> J.R. Forster & G. Forster					✓				✓
<i>A. chama</i> Buchanan-Hamilton	✓	✓					✓		✓
<i>A. hirsuta</i> Lam.	✓			✓				✓	
<i>A. heterophyllus</i> Lam.	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>A. lacucha</i> Buch-Ham	✓	✓	✓	✓		✓			✓
<i>A. gomeziana</i> Wall.	✓	✓					✓	✓	✓

Fruit 5 to 7 cm. diameter, yellow when ripe, reddish brown on drying; seed oblong, broad, 1.5 cm diameter.

-----*Artocarpus lacucha*

Fruit unevenly globose-ovoid; 1–3 cm.-----

Artocarpus gomezianus

- *Fruit not smooth*
- *Fruit tuberculate*
- *Fruit non-cauliflorous, tubercle soft*

Fruit globose, 5 to 6cm dia, rust-colored brown on maturity; flattish rarely acute tips of the anthocarps; seed oblong- ovoid, size 1 to 2 cm.----- *Artocarpus chama*

Fruit oblong, ellipsoid to conic-obovoid-globose, 15–30 × 8–15 cm, perianth not fleshy green to yellow, brown to black when mature; pericarp soft; mesocarp-milky white, fleshy calyx; seed oblong-cylindric -----*Artocarpus communis*

- *Fruit cauliflorous, stiff tubercles*

Hexagonal tubercles, large, oblong, 1 to 1.5 ft. long, oblong-globose-ellipsoid - irregularly shaped; pale yellow when young, yellowish-brown when mature; seed size of a nutmeg, narrowly elliptic-oblong-reniform, oily 2.5–4 × 2–2.5 cm -----*Artocarpus heterophyllus*

Fruit Spinous

Fruit ovoid, erect, size of a lemon, spines straight cylindrical hispid, 0.63 cm perforate;

Seed ovoid, 1 to 2 cm. ----- *Artocarpus hirsuta*

Keys for identification of *Artocarpus* species in the literature are cumbersome as they are based on characters of leaf, flowers, etc. They are difficult to consult when germplasm received in genebank is the form of fruit, part of fruit or seed. The present work attemptsto emphasize on correct identification of germplasm accessions prior to conserving them in gene bank using fruit and seed

characters of different *Artocarpus* species of India. The taxonomic key developed here is highly beneficial for the identification of *Artocarpus* species.

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