

# *Artocarpus heterophyllus* Lam.

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## MORACEAE (MULBERRY FAMILY)

### *Artocarpus philippensis*, *A. brasiliensis*, *A. maxima*

Apushpa, ashaya, banun, chakki, champa, herali, jack, jackfruit, kanthal, khanon, khnor, kos, langka, makmi, miiij, miiijnang, mit, nangka, pagal, pala, palasu, palavu, panas, panasa, panasam, peignai, pila, waraka, wela (Alam and others 1985, Brandis 1906, Gamble 1922, Gunasena 1993, Jensen 1995)

*Artocarpus heterophyllus* is the most widespread species of the genus. It forms forest associations with homesteads (Leuschner and Khaleque 1987, Topark-Ngarm 1990), tropical rain forests, dry evergreen forests, and the montane vegetation of mountain groups (Gunasena 1993). *Artocarpus heterophyllus* grows in the evergreen forests of the western hills of India, Sri Lanka, and the Deccan plain of Bangladesh (Alam and others 1985, Chopra and others 1963). It is normally found in association with permanent human settlement throughout the Indian subcontinent, Bangladesh, the coast of east Africa, Myanmar, northern Brazil, Jamaica, and Surinam (Alam and others 1985, Chopra and others 1963, Jarret 1959, Morton 1965, Purseglove 1968).

*Artocarpus heterophyllus* is a fairly fast-growing, large evergreen tree with a large, dense crown; it reaches 20 m in height and 30 to 60 cm d.b.h. It grows in a variety of soils including well-drained alluvial, sandy, or clay loam, and in soils with a pH range of 6 to 7.5 (Jensen 1995, Purseglove 1968). The species is sensitive to frost in its early life and cannot tolerate drought or wet (Singh 1960). If the root touches water, the tree will not bear fruit and might even die (Drury 1873). Occurring at elevations from 400 to 1200 m (Jensen 1995), it grows best where annual rainfall is 1250 mm (Gamble 1922) and the range of normal temperature is 16 to 35 °C.

The species is the national fruit tree of Bangladesh and a special class of timber tree in Sri Lanka. The heartwood is bright yellow; the density at 12 percent moisture content is about 0.69 g per cm<sup>3</sup>. The wood is strong, hard, durable, and easy to saw, machine, or carve. It is used in high-quality furniture, house construction (doors, windows, roof rafters), masts, oars, implements, and musical instruments such as violins and tambouras (Gunasena 1993). *Artocarpus heterophyllus* is in

many ways superior to teak (*Tectona grandis*) (Howard 1951). However, its strength is 75 to 80 percent that of teak (Wealth of India 1985). Roots of old trees are greatly prized for wood carving and picture framing (Morton 1965). Though heartwood is resistant to borer and termite attack, sapwood is highly susceptible to borer attack and perishes easily. Penetration of preservative is difficult but the wood seasons quickly. The fruit of *A. heterophyllus* is popular among the rural people of the Indian subcontinent. It enjoys special favor in some home gardens because it has numerous culinary uses and is abundant during the heavy monsoon rains. The seeds are eaten boiled or roasted or after soaking in syrup. The leaves and rind of the fruit are excellent sources of fodder (Jayawardena and Perera 1991). Parts of the tree are used to treat physical ailments. The unripe fruit is acrid, astringent, and carminative. The ripe fruit is laxative, cooling, and fattening and is useful in treating biliousness. The seeds are diuretic. Ash of the leaves is used to heal ulcers (Burkill 1935). An extract of the roots is used in treating skin diseases, asthma, and diarrhea. Mixed with vinegar, the latex promotes the healing of abscesses and snake bites and reduces glandular swelling (Jayaweera 1982). An infusion of mature leaves and bark is used to treat diabetes and gallstones (Gunaratne 1992). Finally, the heartwood yields a yellow dye when chips are boiled.

The tree begins to flower and fruit after about 5 years. However, grafted trees fruit earlier. Inflorescence is solitary, axillary, and cauliflorous, with ramiflorous, short, leafy shoots. Inflorescence occurs from November through January. Male heads are sessile or on short peduncled receptacles, sometimes borne on the ultimate twigs; female heads are on oblong ovoid receptacles with simple spatulate styles exerted to 1.5 mm, syncarpous, 30 to 100 cm by 25 to 30 cm, cylindrical or somewhat

clavate. The fruits are borne on the trunk and on the main branches. They are oval or oblong, 30 to 60 cm in length and 15 to 30 cm in diameter, and sometimes weigh as much as 10 to 50 kg. The skin is studded with short spikes, is pale green when immature, and becomes greenish-yellow to brown when ripe. The ripened fruit is sweet, fleshy, and has a crisp pericarp (Wealth of India 1985). Each fruit can contain between 100 and 500 seeds (Morton 1965), and each seed is enclosed in a yellowish, juicy sheath with a strong flavor. The seed is kidney-shaped and has thin, white, coriaceous, smooth testa. The seed is 25 to 30 by 15 to 20 mm with unequal cotyledons (Gunasena 1993).

Ripened fruits are collected April through September. Collectors climb the trees and remove the ripened fruits with a knife or scythe. The yellowish, juicy sheaths enclosing the seeds are separated by hand. In some cases, fruits are heaped for some days to rot the juicy sheath and pericarp. Then they are washed in water to separate the seeds from the sheath. Seeds are dried in partial shade on the ground and can be stored no longer than 1 month before planting. Seeds average 45 to 90 per kg.

Germination requires 3 to 8 weeks but is expedited by soaking in water for 24 hours (Hayes 1953). Panggabean (1979) reported that seeds stored in light or darkness at ambient temperatures or at 6 °C germinated 1 to 4 days after storage. After 22 days, germination ranged from 80 to 86 percent, and at 38 days none of the seeds germinated. The seeds germinate satisfactorily on coconut husks containing enough soil to cover the seed, and are outplanted with the husks.

*Artocarpus heterophyllus* propagates from seeds and cuttings. Direct sowing is preferred to transplanting because the taproot can sustain damage during transplantation (Gunasena 1993). High germination rate, early establishment, ease of method, and reduced cost favor direct sowing. Two or more seeds are sown at 3 by 3 m spacing. If properly established, the species grows rapidly in the first 5 years. At the end of the third year, *Swietenia macrophylla* King may be underplanted as a soil cover. By the end of the fifth year, the soil should be well protected and the forest floor kept very clean (McNeill 1937).

For rapid clonal propagation through tissue culture, using half MS salts and 2 mg per L IBA and NAA, juvenile shoots show 60 to 80 percent success in rooting (Jaiswal and Amin 1990). But Kamaluddin and others (1996) found more than 80 percent rooting success using a low-cost, nonmist polythene propagator when cuttings were taken from 3-month-old seedlings and treated with 0.2, 0.4, or 0.8 percent IBA. The growth of seedlings is slow to moderate during the first season, but fairly rapid in later years.

#### ADDITIONAL INFORMATION

A brown weevil, *Ochyromera artocarpus* Marshall, bores into tender buds and fruit resulting in fruit drop. A number of fungi have been observed attacking different parts of *A. heterophyllus*. *Ganoderma lucidum* causes root rot, *Corticium salmonicolor* causes twig blight and stem canker, and *Fomes durissimus* causes heart rot (Wealth of India 1985).

