

Broussonetia papyrifera

paper mulberry

(L.) Vent.

Moraceae

LOCAL NAMES

Burmese (malaing); English (paper mulberry tree, paper mulberry); French (mûrier à papier, murier à papier); German (papiermaulbeerbaum); Hindi (kachnar); Indonesian (saeh); Italian (gelso papirifero del giappone, moro della China); Japanese (aka, kodzu, kenname kowso, pokasa, aka kowso); Portuguese (amoreira do papel); Spanish (morera de papel); Tongan (hiapo); Trade name (paper mulberry)

BOTANIC DESCRIPTION

B. papyrifera is a small tree or shrub which grows naturally in Asian and Pacific countries (Thailand, China, Myanmar, Laos, Japan, Korea). It grows to 21 m high and 70 cm dbh, with a round and spreading crown. The spreading, grey-brown branches, marked with stipular scars are brittle, making it susceptible to wind damage. The bark is light grey, smooth, with shallow fissures or ridges.

Leaves alternate or sub-opposite, mulberry-like and papery. Some leaves are distinctly deep lobed, while others are un-lobed and several different shapes of leaves may appear on the same shoot. Petioles are 3-10 cm long while stipules are 1.6-2.0 cm long.

Male flower 3.5-7.5 cm long, yellowish-white, with pendulous catkin-like spikes; perianth campanulate, hairy, 4-lobed, and its segments are valvate. Female flowers in rounded clusters, globose pedunculate heads about 1.3 cm in diameter; persistent, hairy, clavate bracts subtend flowers.

Fruit shiny-reddish, fleshy, globose and compound with the achenes 1-2 cm long and wide hanging on long fleshy stalks.

The genus name 'Broussonetia' is named after P.N.V. Broussonet, a French naturalist, who took a male tree from a garden in Scotland and introduced it to Paris where a female tree was growing, thus enabling fruit to be described.

BIOLOGY

In India, leaves are shed between September and January and the new leaves appear in February or March. On average, *B. papyrifera* trees are leafless for 1-3 months. The flowers appear in March-April. The fruit ripens in the rainy season from July to September. Seed dispersed by birds.



Male inflorescences (Gerald D. Carr, University of Hawaii, www.forestryimages.org)



Habit at Keanae Arboretum Maui, Hawaii (Forest & Kim Starr)



Foliage and fruits at Strybing Arboretum, Golden Gate Park, San Francisco, CA (J.S. Peterson @ USDA-NRCS PLANTS Database)

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ECOLOGY

B. papyrifera prefers a sub-humid warm, sub-tropical monsoon climate in moist forests. The tree is remarkable for the variety of climates in which it can be grown, being hardy enough to survive in Europe. However its growth in cool climates is not as vigorous as in a warm, moist climate.

BIOPHYSICAL LIMITS

Altitude: 0-1000 m

Mean annual temperature: 12-30°C

Mean annual rainfall: 700-2500 mm

Soil type: *B. papyrifera* prefers moist, well-drained sandy loams and light soils

DOCUMENTED SPECIES DISTRIBUTION

Native: China, India, Japan, Korea, Republic of, Malaysia, Pakistan, Thailand

Exotic: Hungary, Indonesia, Italy, Spain, Tonga, Uganda, Zimbabwe



The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

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PRODUCTS

Food: Paper mulberry can be used as a food for both human and animal consumption. The flowers and young leaf of the variety *Brussonetia kurzii* has a protein content of 16-21%, together with nutrient minerals such as P, K, Ca and Mg and is suitable for human consumption. The fruit comprises a ball about 1.5 cm in diameter with numerous small edible fruits protruding-there is not much edible flesh but it has been reported to have a lovely flavour.

Fodder: Animals browse seedlings and saplings of *B. papyrifera*. Leaves are lopped for fodder with 67.7% of dry matter was digestible, crude protein 84.8%, crude fibre 65.5%, crude fat 35.0% and ash 50.3%. The leaves are also used for feeding silkworms.

Fibre: It has been known for almost 1500 years as a plant whose bark can be used to make paper of various grades up to the highest quality. The inner bark (bast) fibres is used for tapa (cloth) in the South Sea Islands while in Japan, Thailand, Myanmar, Indonesia it is used for special paper making, such as paper napkins, lens paper, cosmetic tissue and luxurious hand-made paper. The male flower spikes of *Artocarpus atilis* are blended with fibre of paper mulberry to make elegant loin cloths.

Timber: The wood is light-coloured, soft, greyish-white, even and straight grained. It is light, with a basic density of 506 kg/m³. The timber from *B. papyrifera*, being soft and brittle, is used mainly in the manufacture of cheap furniture, match sticks, packing cases, boxes, plywood, building-boards, sports equipment and pencils.

Tannin or dyestuff: The tree produces a natural green to yellow-green dye.

Medicine: It is said to be astringent, diuretic, tonic, vulnerary. The leaf juice is diaphoretic and laxative. The leaves are employed for blood sputum, vomiting blood, uterine bleeding, excess menstrual bleeding, bleeding wounds in Chinese medicine and for a bleeding stomach in Hawaii.

Other products: *B. papyrifera* has properties of a pesticide where *Helicoverpa armigera* restricted in its pupation and adult emergence after feeding on *B. papyrifera* leaf powder. The xylem also contains an antifungal substance

SERVICES

Erosion control: *B. papyrifera* establishes itself quickly on denuded and degraded sites in the form of a thick tree cover, fixing soils and preventing further erosion due to its dichotomous root system.

Shade or shelter: It's a good shelterbelt and windbreak

Soil improver: Mulch comprising of chopped leaves of *B. papyrifera*, applied at 4 ton/ha, improves soil moisture and phosphorus content, leading to increased crop production.

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TREE MANAGEMENT

The planting site should be well prepared to remove grass and weeds. Weeding is required only during the first year. Most plantations of *B. papyrifera* in India and Pakistan are from self-sown seed, coppice or root suckers. Plantations are worked on a short coppice rotation of 3-10 years, owing to the extremely rapid growth of the coppice shoots as the species gives a high yield.

It is a hardy, fast-growing tree and under favourable conditions (hot and moist climates), annual increments of 0.6-2.5 cm (diameter) and 2.6 m (height) have been recorded. With a 10-year rotation for pulp and paper production, annual yields of 8-12 t/ha can be expected in low rainfall areas and 21-30 t/ha in high rainfall areas. In Japan it is often grown on a short coppice rotation of 3-4 years.

B. papyrifera is a light demander but can grow under adverse light conditions as well. It is a highly invasive species and spreads quickly on newly exposed site. It spreads by seed, primarily through birds, and by root suckers, which it sends out in great numbers from its superficial roots. It is frost hardy but does not tolerate drought. It is sensitive to root competition and cannot grow on poor sites with heavy weed and grass growth. It is tolerant to urban pollution (including airborne sulphur dioxide), moisture-sapping wind in hot and dry regions, and nitrogen loading near fertilizer factories.

GERMPLASM MANAGEMENT

Seed storage behaviour is orthodox. There are about 540,000 seeds/kg.

PESTS AND DISEASES

B. papyrifera is attacked by *Helicoverpa armigera*, but it can be controlled by feeding them with a leaf powder of *B. papyrifera*, which restricts in its pupation and adult emergence. The vivid colour of the ripe fruits and their palatable fleshy stalks attract many birds, monkeys and rodents, causing extensive damage to seed. Browsing of the saplings and seedlings by wild and domestic animals can cause bushy growth of the trees. In the Solomon Islands, *Periconiella broussonetiae* (fungus) attack *B. papyrifera* while in Japan *Pseudomonas syringae* is the causal agent for a bacterial blight in this species

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FURTHER READING

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SUGGESTED CITATION

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