

Paper Mulberry

Rick Burnette



Figure 6. Paper mulberry tree, with a close-up view of the foliage and bark. *Source: Rick Burnette*

In the courtyard of the Bo Sang Handicraft Centre on the outskirts of Chiang Mai in northern Thailand, freshly painted umbrellas and parasols in bright colors are lined up to dry in the sun.

These products are made from sa paper; fibrous sheets produced from the

inner bark of the indigenous paper mulberry tree (*Broussonetia papyrifera* (L.) Vent; Figure 6).

Approximately 80 kilometers north of Bo Sang, an elderly ethnic Karen lady is picking tender paper mulberry leaves in a small grove on the edge of her village (Figure 7). The leaves will be cooked in a large tin over an open fire and fed to her pigs.

In the United States, via an internet forum, foragers are discussing the merits of the edible fruit produced by naturalized paper mulberry trees in their neighborhoods. Meanwhile, residents of Islamabad are recovering from spring allergies resulting largely from pollen produced by hundreds of thousands of wild paper mulberry trees. The pollen count in Pakistan's capitol surpasses 50,000 particles per cubic meter, compared to the 9,000 level that is considered serious in the US.

Paper mulberry is native to China, Japan, Korea, Laos, Cambodia, Thailand, Burma and Assam (India), but cultivated extensively elsewhere in Asia and the Pacific. It has also naturalized in parts of southern Europe and the USA (Kew 2016). According to the World Agroforestry Centre, paper mulberry prefers a sub-humid, warm, sub-tropical monsoon climate such as that found in parts of Southeast Asia and Northeast India. In temperate regions such as North America, growth is not as vigorous.



Figure 7. Harvesting paper mulberry leaves.
Source: Rick Burnette

Uses of Paper Mulberry

Throughout much of the Asia and Pacific region, paper mulberry is considered an asset offering a wide range of products and services that include:

Fiber

Bark fiber of the plant is often used for cordage. In Polynesia, the bark is processed into tapa cloth; strips of inner bark – known as bast – are removed from the outer bark, washed and pounded into multi-layer sheets. The finished tapas are traditionally painted and printed with decorative designs (Whistler and Elevitch 2006).

In parts of Thailand, Laos and surrounding regions, sa paper is also made from bark harvested from wild and planted trees. Fahrney *et al.* (2007) describe how strips of bark are removed from trees with the outer bark separated and discarded. After drying, the inner bark is boiled with wood ashes until soft. The resulting fiber slurry is poured into wooden frames supporting mesh screens that capture the inner bark fiber and allow excess liquid to drain away. The frames and contents are dried in the sun after which the resulting paper sheets are removed and bundled for use.

Fodder

Paper mulberry leaves have a significant level of protein - up to 20 percent on a dry matter basis - making it a good source of fodder (Amnat *et al.* 2001). In Southeast Asia, cattle and water buffalo graze the foliage, while boiled leaves are fed to pigs. Some farmers reportedly feed fresh leaves to carp and tilapia in their fish ponds (Fahrney *et al.* 2007).

Wood

Paper mulberry wood is light, soft and brittle, greyish-white in color with an even, straight grain. According to the World Agroforestry Centre (Orwa *et al.* 2009), the wood is used mainly in the manufacture of cheap furniture, match sticks, packing cases, boxes, plywood, building boards, sports equipment and pencils. Until his death in early 2016, Boyd Pridmore of Lakeland, Florida, promoted the strong, lightweight wood of naturalized paper mulberry, referring to it as Florida balsawood.

Food

The globose, bright orange fruit of paper mulberry is edible and sweet. Tender leaf shoots are steamed and eaten in Indonesia (Whistler and Elevitch 2006).

Medicine

Paper mulberry is used as traditional medicine in the Pacific and China; the plant's medical properties are described as "astringent, diuretic, tonic, vulnerary." The leaf juice has diaphoretic (inducing perspiration) and laxative qualities (Orwa *et al.* 2009).

Other

According to Anderson (1993), the Lahu people of upper Southeast Asia and Southwest China use the rough leaves of paper mulberry as sandpaper. The leaves are also reported to have pesticidal and antifungal properties (Orwa *et al.* 2009).

Environmental and agricultural benefits

Paper mulberry offers protection from soil erosion on disturbed sites by providing tree cover. It also yields soil-building and weed-controlling leaf litter (Orwa *et al.* 2009).

Establishment

Paper mulberry grows best in sites with significant sun exposure and with moist, well-drained sandy loams and light soils.

Whistler and Elevitch (2006) state that root shoots (suckers), portions of matted roots or stem cuttings are used for propagation. Root shoots are generally considered the best multiplication option. Using a sharp knife to harvest the shoots when they are 30–45 cm (12–18 in) in height, the taproots are kept intact. The harvested shoots can be left to "harden" in place for a month before transplanting them into pots or planting directly into the field. The prepared shoots can be planted as close as 80 cm (2.7 ft) apart in rows that are 1.2–1.8 m (4–6 ft) apart.

Fahrney *et al.* (2007) describe how both paper mulberry and teak (*Tectona grandis*) are planted in the rotational upland rice fields of northern Laos in preparation for long-term improved fallows. The spacing of paper mulberry and teak is at least 3 m by 3 m (10 ft by 10 ft), so that interplanted upland rice production remains possible for a few years until the fields are fallowed (Fahrney *et al.* 2007).

Tree Management and Life Span

Whistler and Elevitch (2006) report that while bark production can begin within six months of establishment, it usually takes 12-18 months for trees to reach the ideal harvest height of 3-4 m (10-13 ft). According to Fahrney *et al.* (2007), Lao farmers consider that the minimum stem diameter for harvest is “between the thickness of a thumb and a knife handle” or about 2 to 4 cm (0.79 to 1.58 in). Whereas suitable-sized primary trunks are used in the first harvest, secondary stems will be used in following collections.

Side branches are usually removed from the cut stems to assure a clean, straight stalk free of side branches. This helps to ensure that the tapa cloth will be free of major holes (Whistler and Elevitch 2006).

In warm, sub-humid climates, paper mulberry trees maintain leaves most of the year (they are leafless only one to three months). As a result, leaves can be harvested for forage or green manure almost year-round (Orwa *et al.* 2009).

Fahrney *et al.* (2007) were unable to determine how long paper mulberry trees in the upland rice fallows of Laos remain productive. However, Whistler and Elevitch (2006) state that trees in the Pacific can grow for many decades.

Invasiveness

Paper mulberry is dioecious, with male and female flowers produced on separate plants. Outside of its native range, should both male and female plants be present, paper mulberry can be invasive, as birds consume the fruit from “female” plants and spread the seeds. In the Australian state of Queensland, the Department of Agriculture, Fisheries and Forestry notes that paper mulberry has become sparsely naturalized. Concerned that the plant will develop into a significant problem in subtropical coastal and subcoastal areas, officials consider it a “high risk” species and recommend the removal of trees.

According to Kew Royal Botanic Gardens (2016), paper mulberry has also become naturalized in the United States and southern Europe. In the US, the plant was first introduced as a fast-growing shade tree (MacDonald *et al.* 2008). Paper mulberry establishes itself in open habitats, such as forest and field edges, and is found from Illinois to Massachusetts, south to Florida and west to Texas. Agricultural officials in Florida are concerned with its establishment across the state. Although it does not yet seem to have altered Florida’s plant communities, paper mulberry has increased in abundance. As a result, state officials recommend that the tree not be planted in Florida, and that existing plants be physically removed or chemically controlled in landscapes (MacDonald *et al.* 2008).

Internationally, paper mulberry is identified as an invasive weed in over a dozen countries (Swearingen *et al.* 2010) including Pakistan, Argentina and Uganda. In West Africa, Kyereh *et al.* (2014) report that since paper mulberry was introduced to Ghana in 1969, it has since become second only to *Chromolaena odorata* (Siam weed) as an invasive species; it is found mainly in disturbed forests and other open sites. Partly due to the invasive potential of paper mulberry, the Florida-based ECHO Seed Bank does not offer seeds of this species.

Curiously, in the Pacific islands, the plant is apparently not invasive, as all trees are male clones (no explanation was given as to how this came to be). In that region, paper mulberry is vegetatively propagated with cuttings. The tree also spreads slowly by easy-to-control root suckers (Whistler and Elevitch 2006).

Conclusion

Throughout much of Asia and the Pacific, paper mulberry serves as a significant fiber, fodder, food and wood resource. It also stabilizes and improves the soil on disturbed sites. However, its invasiveness combined with cases of aggravating pollen production make it unsuitable for introduction. As a result, there may only be a few options related to the introduction and use of paper mulberry:

- Limit the use of paper mulberry to within its native range.
- Outside of its native range, reduce or exterminate the tree (particularly fruit-bearing female plants) wherever it is perceived to be invasive.
- If paper mulberry must be planted outside of its native range, use the Pacific island model, with vegetative propagation (cloning) and establishment done only with plant material (i.e., root shoots) from male plants.

If you consider the establishment and use of paper mulberry, be sure to investigate any official recommendations and laws concerning the species. Also, as done in this article, review the literature to find out what others have experienced and learned. As always, when considering the introduction of a new crop, carefully weigh the known benefits against possible liabilities.

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Hayfever sufferers, be warned – avoid at all costs the allergy capital of the world (<http://www.pri.org/stories/2014-05-01/hayfever-sufferers-be-warned-avoid-all-costs-allergy-capital-world>). *PRI's The World*. Produced by Bradley Campbell, May 1, 2014.

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