

Paper mulberry

Broussonetia papyrifera



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Queensland
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Summary

Paper mulberry (*Broussonetia papyrifera*) is a fast-growing tree native to Taiwan and Japan.

Paper mulberry has a well-documented history as a significant pest overseas, especially in Pakistan, Uganda, Ghana and Argentina. Extensive naturalised populations exist in the eastern United States, parts of Asia, Europe, Africa, North and South America, and across the Pacific

Currently, paper mulberry is sparingly naturalised in Queensland. Populations have been detected in Brisbane and coastal northern Queensland.

Based on the evidence presented in this study, it seems reasonable to predict that paper mulberry could develop into a significant problem in subtropical coastal and subcoastal areas of Queensland. Within these areas, habitats most at risk are predicted to include riparian areas; semi-deciduous vine thickets/dry rainforest; closed forest margins/gaps; and disturbed, open sites, generally where there is relatively well-drained, fertile soil. In these habitats, paper mulberry could form dense thickets, perhaps replacing native vegetation and interfering with natural succession. If planted on grazing land, these thickets could replace pasture grasses. It is not expected to impact crops. Its pollen can cause significant allergy problems.

Paper mulberry is currently in its early stages of population development in Queensland. It appears to be a 'high-risk' species and a worthy candidate for preventative control. However, an assessment of the feasibility of eradication and/or control needs to be made.

Introduction

Identity and taxonomy

Species identity: *Broussonetia papyrifera* (L.) L'Her ex. Vent.

Synonyms: *Morus papyrifera* L.

Common names: Paper mulberry, tapa cloth tree

Family: Moraceae

Description

Broussonetia papyrifera is a deciduous tree growing up to 15 m tall, but often less than 12 m. It can reach 3–4 m tall in 6 months, but generally in 12–18 months (Whistler & Elevitch 2006). Leaves are simple, alternate, 8–20 cm long and variable in shape (unlobed, ovate cordate to deeply lobed, with lobed leaves more frequent on fast-growing young plants). The upper surface of the leaf is rough to touch (like sandpaper), whereas the underside is covered with soft hairs (densely tomentose).

When broken, the leaves exude a milky sap that stains clothing. The species is dioecious (separate male and female plants). Male flowers are yellowish white and arranged in an elongate inflorescence (up to 8 cm long), whereas female flowers take the form of a round inflorescence. Fruits are red to orange/yellow, sweet and 1–4 cm in diameter.



Figure 1. Leaves of *Broussonetia papyrifera*—photograph used with permission, Forest and Kim Starr, Plants of Hawaii, <<http://www.hear.org/starr/images/image/?q=060329-6801&o=plants>>



Figure 2. Seeds of *Broussonetia papyrifera*—photograph used with permission, Steve Hurst (USDA undated)

Reproduction and dispersal

On some islands in the Pacific, only male plants are cultivated and regeneration is purely vegetative. If male and female plants are present, long-range dispersal is via seeds. Fruits are dispersed by a range of frugivores, including fruit bats and birds (Bosu & Apetorgbor undated). In Ghana, fruits are produced twice each year. Seeds rarely germinate under dense forest canopies, but germination can be prolific in large canopy gaps, roadsides and abandoned farmland (Bosu & Apetorgbor undated). Root suckers are produced when the main stem is cut. Over time, this can lead to the formation of dense thickets. Root suckers can be cut, dug out and replanted (the main form of reproduction when ‘male clones’ are used for agroforestry).

Origin and distribution

The native range of *B. papyrifera* includes parts of China (Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanxi, Sichuan, Xizang, Yunnan and Zhejiang), Japan, Korea, Taiwan, Cambodia, Laos, Myanmar, Thailand, Vietnam and Malaysia (GRIN undated).

It has naturalised extensively across tropical, subtropical and warm temperate parts of the world, including the eastern United States, Europe, Africa (Ghana and Uganda), Asia and across the Pacific (including Hawaii) (Figure 3).



Figure 3. Global distribution of *Broussonetia papyrifera* (GBIF undated)

The broad naturalised range of *B. papyrifera* is typical of plant species that have been used by people for centuries. Whistler and Elevitch (2006) state that *B. papyrifera* is an ‘ancient introduction’ to many Pacific Islands, being used for centuries as a source of tapa cloth by Polynesians.

Status in Queensland

Currently, *B. papyrifera* is sparingly naturalised in Queensland. Wild populations have been detected in Brisbane and coastal northern Queensland (near Innisfail). According to the Queensland Herbarium, the species was first recorded in a garden near Brisbane in 1980. There is anecdotal evidence that the species has been sold in nurseries and at markets for at least 20 years, both in Queensland and New South Wales.

One of the most significant infestations in Brisbane is along Ithaca Creek, where a local bushcare group has been undertaking control. Naturalised specimens also exist around Toowong. While current impact is negligible and localised, potential impact is significant.

Elsewhere in Australia, *B. papyrifera* has been recorded in South Australia and New South Wales (near Nimbin).

Preferred habitat

B. papyrifera can tolerate a wide range of climates, including humid tropical (monsoon), humid and subhumid subtropical, and warm temperate areas. It can survive a 3–4 month dry season (Whistler & Elevitch 2006), but tends to be most abundant on soils that are generally moist. In Pakistan, it thrives around Islamabad, where annual rainfall is 1200 mm and the mean summer temperature around 35° C (Malik & Husain 2007). Owra et al. (2009) state that it grows in areas with an annual rainfall of 700–2500 mm, on 'moist, well-drained sandy loams and light soils'.

On islands in the Pacific, the plant is said to prefer 'light and medium textured soils' and tends to be cultivated on fertile, volcanic soils (Whistler & Elevitch 2006). In Pakistan, it thrives on moist loams, sandy loams and sandy clays that are high in organic matter (Malik & Husain 2007).

B. papyrifera is generally considered to be a 'pioneer' species—it is best adapted to colonise disturbed sites where there is full sun and ample soil moisture (it grows poorly under heavy shade). Preferred habitat includes riparian areas, moist gullies and gaps within subtropical closed forests (deciduous and semi-deciduous). Kew (undated) states that it prefers 'mixed deciduous and evergreen woodland, forest margins and secondary vegetation; a pioneer of disturbed sites'. Owra et al. (2009) state that it prefers a subhumid, warm, subtropical monsoon climate in moist forest.

In Ghana, *B. papyrifera* has invaded moist, semi-deciduous and dry semi-deciduous forests (Bosu & Apetorgbor undated). Near Islamabad (Pakistan), it is abundant within a mosaic of somewhat degraded 'scrub forest' dominated by *Acacia modesta*, *Lantana camara*, *Justicia adhatoda*, *Dodonea viscosa* and *Pinus roxburghii*. It has also invaded subtropical forest within national parks at the foothills of the Himalayas (Malik & Husain 2007). In Hawaii, it is often found along the banks of streams. In the United States it is said to prefer 'forests, field edges and disturbed areas' (Swearingen 2009).

History as a weed elsewhere

B. papyrifera is listed among the six worst plant invaders in Pakistan, where it is having a significant impact on native vegetation (Malik & Husain 2007). More specifically, Malik and Husain (2007) consider *B. papyrifera* to be ‘one of the most critical issues confronting the Margalla Hills National Park’, located in the foothills of the Himalayas. *B. papyrifera* is said to have invaded large areas and excluded native plant species. Over a 40-year period, *B. papyrifera* became ‘dominant’ around Islamabad (the capital of Pakistan)—it thrives along streams and ‘nallahs’ where there is adequate soil moisture and a history of disturbance to the native vegetation (Malik & Husain 2007; Khan et al. 2010). Its pollen is regarded to be the main cause of inhalant allergy in Islamabad.

Ghersa et al. (2002) considers *B. papyrifera* to be one of the worst invasive species in Pampa grasslands in Argentina.

In Uganda, *B. papyrifera* has become a dominant plant along many of the forest paths, roads and edges throughout the Mabira forest reserve (Morgan 2004, pers. obs., cited in Morgan & Overholt 2009). Similarly in Ghana, Bosu and Apetorgbor (undated) comment that ‘it is perhaps the most serious non-indigenous woody invasive plant in the closed forest zone of Ghana and the second most important plant invasive after *Chromolaena odorata* (Siam weed). Dense stands can be seen conspicuously in farms and along roads in and around Pra-Anum and Afram Headwaters forest reserves’. It was introduced into Ghana in 1969 to evaluate its potential for paper production and has since spread 100 km from the point of introduction.

B. papyrifera is listed as a weed in the United States (Holm et al. 1991), where it is considered ‘invasive’ in natural areas in Columbia, Florida, Georgia, Louisiana, Maryland, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee and Virginia (Swearingen 2009). It was recorded in Florida as early as 1903, and was subsequently planted widely in the south-east as an ornamental and shade tree. Randall (2002) lists a number of references that mention the species as either naturalised or weedy, mainly in the Pacific. In a review of invasive woody plants in the tropics, Binggeli et al. (1998) rated *B. papyrifera* as ‘moderately invasive’.

B. papyrifera is a fast-growing pioneer species that can dominate certain disturbed habitats, replacing other plant species and interfering with natural successions. It can form dense thickets of stems, especially after the parent tree is damaged or cut down.

Uses

B. papyrifera has been used for a variety of purposes around the world. It has a long history of cultivation by Polynesians, who made cloth from its bark. The species has been used to make paper and has been planted for agroforestry and as an ornamental. In Queensland, it is most likely used as a garden ornamental.

Pest potential in Queensland

Climate-matching software called Climatch (Bureau of Rural Sciences 2009) was applied to predict areas of Queensland where climate is similar to that experienced across the native and naturalised range of *B. papyrifera*. Substantial areas of eastern Queensland appear climatically suitable (Figure 4).

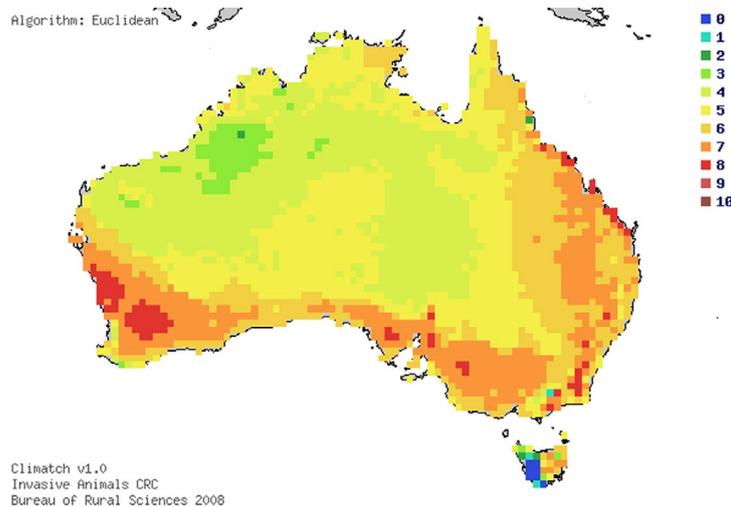


Figure 4. Area of Australia where climate appears suitable for *B. papyrifera*—red and dark orange indicate areas where climate is highly suitable; light orange and yellow indicate areas where climate is marginally suitable; green and blue indicate areas where climate is considered unsuitable for this species

B. papyrifera has several attributes that confer pest potential in Queensland:

- It is a significant pest in Pakistan, Uganda, Argentina and the United States.
- It is climatically well-suited to an extensive area of Queensland.
- It has an extensive naturalised range in over a dozen countries, including Asia, Europe, Africa, North and South America, and across the Pacific.

Hence, it seems reasonable to predict that *B. papyrifera* could become widespread and problematic in suitable habitat types in coastal and subcoastal Queensland (where climate, soil and land use are favourable). Habitats most at risk are predicted to include riparian areas; semi-deciduous (closed) forests and vine thickets (especially margins and gaps); and disturbed, open sites generally, where there is relatively well-drained, moist, fertile soil. In these habitats, *B. papyrifera* could form dense thickets, perhaps replacing native vegetation and interfering with natural succession. If planted on grazing land, these thickets could replace pasture grasses. It is not expected to impact crops. Its pollen has caused allergic problems for some people overseas.

B. papyrifera is currently in its early stages of population development in Queensland. Based on the evidence at hand, it appears to be a ‘high-risk’ species and a worthy candidate for preventative control. However, an assessment of the feasibility of eradication and/or control needs to be made.

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