The paper mulberry or tapa cloth plant (*Broussonetia papyrifera*)

Mike Wilcox

Broussonetia papyrifera (L.) L'Hérit. ex Vent. (Moraceae), the paper mulberry or tapa cloth plant is a small to medium-sized, fast-growing deciduous tree up to 15 m tall, native of southeast Asia, Korea, and China (including Taiwan) where it is called *gou shu*. It is very common in central China, in provinces such as Henan, Shaanxi, Beijing, Hubei, Hunan, Jiangsu, Zhejiang, and Chongqing. It grows there in secondary forests and on forest margins, and can even be seen commonly in cities growing on vacant lots and on the side of the road (it is said to be tolerant of air pollution – Barker 2002). It is also common in Japan, though it is not there considered to be indigenous (Matthews 1992). The Chinese today generally regard *gou shu* as a useless plant though it has been successfully used as a lure plant in the control of the mulberry longhorn beetle (*Apriona germari*) on poplars, and it was used in ancient times (in Japan, as well) for making paper and cloth (Barker 2002). At one time in Myanmar, a cottage industry thrived in which paper was made by pounding the bark with lime, and boiling. The pulp was spread out to dry in the sun. It is still used by tribal people in northern Thailand for making paper (Anderson 1993). It has become naturalised in the eastern USA, where it regarded as an environmental weed.

The juvenile leaves are characteristically lobed, while adult leaves are entire. The leaves have a soft texture, with prominent veins beneath, and the margins are shallowly toothed. It is dioecious, flowering in spring.

Figure 1. Juvenile leaves on root sucker shoots, Hortresearch, Mt Albert

The male flowers are borne in pendulous catkins and the female flowers form globose heads, followed by the fruit which is a compound (syncarp) of juicy, orange-red drupelets when ripe. It is well-known that to flower paper mulberry needs a marked seasonal climate with a cool winter, and does not flower in the tropics. In Auckland it flowers in October.

Figure 2. Adult leaves of *Broussonetia papyrifera*

Paper mulberry is commonly cultivated in Tonga and Samoa, and also in Fiji to a lesser extent. The plant is thought to have been brought to the Pacific as cuttings in ancient times from the Asian mainland or Taiwan, perhaps as early as 3000 BC, and thence probably by the Lapita people via the Bismarck Archipelago off New Guinea whose culture was well advanced by 1500 BC (Irwin 1992).

Figure 3. Male catkins, Robin Booth's nursery, Kerikeri

The first Maori settlers to New Zealand from eastern Polynesia brought with them kumara (*Ipomoea batatas*), taro (*Colocasia esculenta*), ti pore (*Cordyline fruticosa*), the bottle gourd, calabash gourd or hue (*Lagenaria siceraria*), and tapa cloth plant, paper mulberry or aute (*Broussonetia papyrifera*), all of which were still in cultivation (e.g. Tolaga Bay and Bay of Islands) when Captain Cook arrived in 1769 (Colenso 1880; Harris 1999). Harris illustrates a herbarium specimen collected in the Bay of Islands, New Zealand, during Cook's first voyage. Colenso observed that the plant became extinct in New Zealand about 1846, when the last plants were

destroyed by cattle in the Hokianga district. Horrocks (2004) records *Broussonetia* pollen and leaf hair phytoliths from a swamp at Rangihoua Bay, Northland.

Figure 4. Female flowers, University of Auckland

Tapa cloth plant died out in New Zealand, not necessarily because it did not grow well – it may have just not been of use to the Maori any more, so cultivation ceased (Matthews 1992). Today it can still be occasionally encountered here and there as a cultivated ornamental, probably from seed reintroduced from Asia - there are no old original cultivars in existence (Sykes 1969). There is a vigorous cultivated specimen (male) at Hortresearch, Mt Albert, Auckland, which has put up root suckers. Other Auckland examples are a small tree (female) at the Maori Studies area of the University of Auckland, a female tree at the Auckland Regional Botanic Gardens (pl. 1995), a sizeable specimen (male) on the corner of Rodney and Clarence Roads, Northcote, two male trees at the Remuera Motor Lodge, Minto St, and at Glenvar Road, Long Bay (former Miraflores Nursery). In Kerikeri, Robin Booth has propagated it from root suckers from an old tree (male) formerly occurring in Access Road.

Tapa or barkcloth, used for ceremonial clothing and artistic cloth, is made from the inner bark fibres (bast), and is a distinctive product of the Pacific Islands. Tapa making is now a lost art in many parts of Polynesia. In the tropical Pacific, paper mulberry does not flower or set seed, and must be grown by cuttings. In Tonga and Samoa in particular, it is grown in pure groves, and cut at the pole stage (often just one year old and just 3-5 cm in diameter and 4-5 m tall), for bark. The bark is stripped from the tree, and the inner bark is separated from the non-useable outer bark. After soaking in water the rolls or strips *(tutu* in Tonga) of inner bark are beaten with a grooved wooden mallet (*ike*), usually made from the wood of the *toa* tree (*Casuarina equisetifolia*) over an log anvil (*tutua*), softening and macerating the phloem fibres, which are an astonishing 25 cm in length (Barker 2002). Beaten strips (which can be as much as 50 cm wide, from the original 8-cm wide bark strips) are felted together by hand to make sheets. In Samoa, the tree and raw bark is known as *u'a*, and the cloth as *siapo.* In Tonga, the tree is known as *hiapo laumangamanga* (with deeply lobed leaves) or *hiapo laua'opo'opo'* (with crenate leaves), and the cloth is called *ngatu*, and is still a very important product there. In Fiji, on the island of Mothe in the Lau group, tapa cloth (*masi*) is still made. In Hawaii the tree is called *wauke*, and *aute* is (or was) its Maori name in New Zealand.

Figure 5. Ripe drupelets, Hangzhou, China

Barkcloth is made in different shades of colours, mostly white and brown. Often they are elaborately painted in a wide range of patterns. In the traditional context, the colours and patterns have social/ceremonial significance. Normally, painting is done by hand, often with the aid of pandanus leaf stencils. The main natural dyes used for colouring tapa cloth are anatto dye plant (*Bixa orellana*), the seeds of which give reds and oranges; mangrove (*Rhizophora mucronata*), the bark extract of which gives black; and koka or o'a (*Bischofia javanica*), extracts of the inner reddish bark giving a red-brown dye. The burnt seeds of candle nut (*Aleurites moluccana*) give a black marking oil used in both Tonga and Samoa for drawing designs on the tapa cloth.

Figure 6. The large tree at Hortresearch, Mt Albert

There are three others species in the genus – *B. kazinoki* Siebold, a 2-4 m shrub with small leaves and slender shoots from China, Taiwan, Japan and Korea; *B.*

kaempferi Siebold. var. *australis*, China, and *S. kaempferi* var. *kaempferi*, Japan; and *B. kurzii* (J. D. Hook.) Corner, a scandent shrub of SE Asia and China.

References

Anderson, E. F. 1993. *Plants and people of the Golden Triangle. Ethnobotany of the hill tribes of Northern Thailand*. Silkworm Books, Chiang Mai, Thailand

Barker, C. 2002. 432. *Broussonetia papyrifera*. *Curtis's Botanical Magazine* 19(1):8-18.

Colenso, W. 1880. On the vegetable food of the ancient New Zealanders before Cook's visit. *Transaction of the New Zealand Institute* 13:3-38.

Harris, W. 1999. The domestication of New Zealand plants. *In New Zealand Plants and their Story*, Proceedings of a conference held in Wellington, 1–3 October 1999, pp. 59-69.

Horrocks, M. 2004. Polynesian plant subsistence in prehistoric New Zealand: a summary of the microfossil evidence. *New Zealand Journal of Botany* 42:321-334.

Irwin, G. 1992. *The prehistoric exploration and colonisation of the Pacific*. Cambridge University Press.

James, K. E. 1988. *Making mats and barkcloth in the Kingdom of Tonga*.

Kooijman, S. 1988. *Polynesian barkcloth*. Shine Publications Ltd, UK.

Leach, H. M. 1984. *1000 years of gardening in New Zealand*. Reed, Wellington.

Matthews, P. J. 1996. Ethnobotany, and the origins of *Broussonetia papyrifera* in Polynesia: an essay of tapa prehistory. *In*: Davidson, J. M.; Irwin, G.; Leach, B. F.; Pawley, A.; Brown, D. ed. Oceanic culture history: Essays in honour of Roger Green. *New Zealand Journal of Archaeology Special Publication*. Pp 117-132.

Neich, R., Pendergrast, M. 1997. *Pacific tapa*. David Bateman, Auckland.

Neich, R.; Pendergrast, M. 2001. *Traditional tapa textile of the Pacific*. Thames & Hudson.

Sykes, W.R. 1969. *Broussonetia papyrifera*: an unusual case of sex reversion. *Journal of the Royal New Zealand Institute of Horticulture* [n.s.] 63-67.

Bear's-foot fern or silver hare's-foot (*Davallia griffithiana* Hook.) in Auckland

Mike Wilcox

The genus *Davallia* of the family Davalliaceae comprises some 29 species of tropical and subtropical ferns. They occur in Asia from the Himalayas to Japan, Australia, the Pacific, Africa/Madagascar, and one species, *Davallia canariensis* (L.) Sm., occurs in NW Africa/Macaronesia/SW-Europe.

Davallia griffithiana was recorded wild on a kahikatea tree in Matangi Road near Hamilton (de Lange 1987; Webb *et al.*, 1995; Brownsey & Smith-Dodsworth 2000). The plant was originally identified as being part of the Polynesian davallia (*Davallia feejeensis*) complex (now *Davallia solida* (Forst.) Sw. and its varieties), but later determined to be *D. griffithiana*.

On 23 May 2003 I found a thriving colony of this fern on a scoria wall in Mt Albert Road, Auckland (AK 283605). It had originated from a hanging basket from whence it spread to colonise the wall (Figure 1).

As stated by Webb *et al.* (1995) and Brownsey & Smith-Dodsworth (2000), *Davallia griffithiana* differs from the native *D. tasmanii*, including subsp. *cristata* (von Konrat *et al*. 1999), by the rhizome scales bearing teeth but lacking multicellular hairs, and by the indusia being rounded at their apices and attached along 2/3 the length of their sides.

Davallia griffithiana can be seen in cultivation in the Cool House at the Wintergarden, Auckland Domain.

Figure 1. *Davallia griffithiana* in Mt Albert.

References

Brownsey, P. J.; Smith-Dodsworth, J. 2000. *New Zealand ferns and allied plants*. Revised edition. David Bateman Ltd, Auckland.

de Lange, P. J. 1987. The indigenous vascular flora of a large gully system bordering the south eastern suburbs of Hamilton City. *Auckland Botanical Society Newsletter* 42(2):56-63.

von Konrat, M. J.; Braggins, J.E.; de Lange, P. J. 1999. *Davallia* (Pteridophyta) in New Zealand, including description of a new subsp. of *D. tasmanii*. *New Zealand Journal of Botany* 37:586-593.

Webb, C. J.; Sykes, W. R.; Garnock-Jones, P. J. 1995. Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 1986-1993. *New Zealand Journal of Botany* 33:151-182.