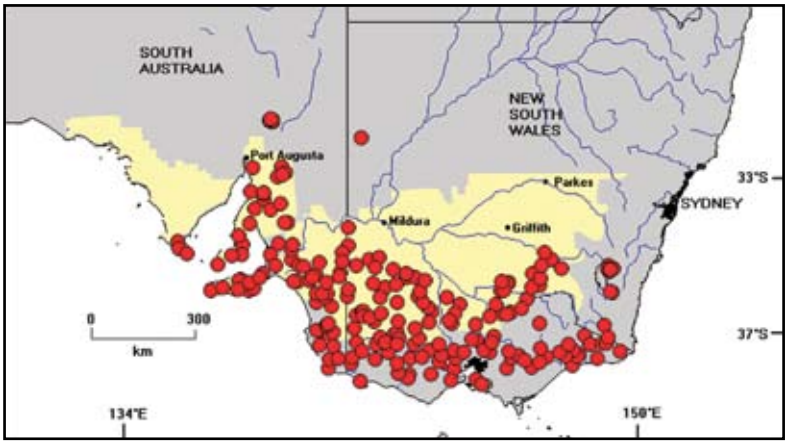
Acacia pycnantha Benth.

Common Names

Golden Wattle and more (see Cunningham *et al.* 1981). *Acacia pycnantha* is the official floral emblem of Australia (for details see Boden 1985, Hitchcock 1991 and Whibley & Symon 1992).



Map 49. Distribution of *A. pycnantha*.

Habit

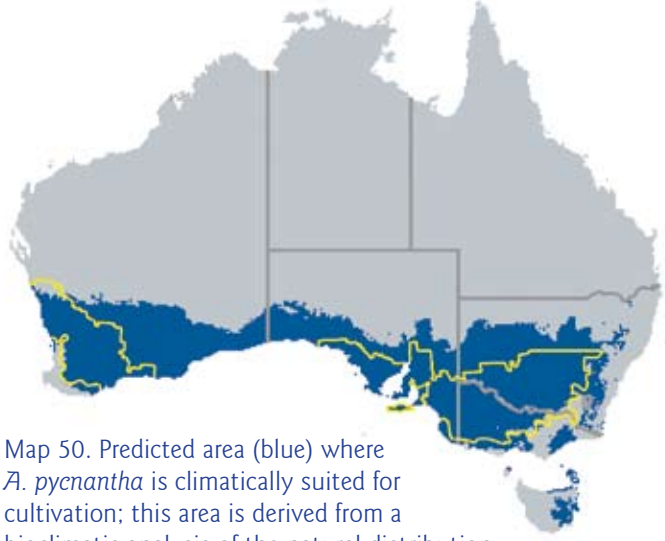
Shrubs 4–5 m high branching near ground level into 2–3 (–6) main stems, or single-stemmed trees to 8–10 m high, smaller (0.5–1 m tall) and/or spindly in some areas, largest plants occur in wetter areas of the range, the main stems are typically straight to sub-straight with few lateral branches and measure about 10–25 cm dbh; crowns terminal; strong, shallow lateral roots are developed, at least on skeletal soils. Bark smooth but aging finely to longitudinally fissured on main stems, especially towards their base, dark brown except pruinose on some forms.

Botanical descriptions and illustrations/photographs are provided by Maiden (1908a), Costermans (1981), Cunningham *et al.* (1981), Tame (1992), Whibley & Symon (1992), Maslin *et al.* (1998), Maslin (2001 & 2001a) and Kodela (2002).

Taxonomy

As discussed by Maslin (2001) *A. pycnantha* is a somewhat variable species. It is normally a tall shrub or tree, but small, spindly forms which flower when 0.5–1 m high sometimes occur (e.g. some plants in the Bendigo 'Whipstick' forest, Victoria). Plants with pruinose stems and branches are scattered throughout the range (e.g. the most northerly populations in South Australia). Costermans (1981) records two forms from Victoria, namely, plants from open forests with dark green shiny phyllodes and golden flower-heads, and plants from mallee areas with paler, dull, narrower phyllodes and paler coloured flower-heads. A pendulous variant and a pale-headed variant are known in cultivation (Elliot & Jones 1982).

Acacia pycnantha is referable to *Acacia* section *Phyllodineae*, a diverse, and probably artificial, group of about 408 species (Maslin 2001) which are characterized by having '1-nerved' phyllodes and flowers arranged in globular heads (see Maslin & Stirton 1998 and Maslin 2001 for discussion). Species of section *Phyllodineae* are widespread in Australia with the main centres of richness located in temperate and adjacent semiarid areas of eastern, southeastern and southwestern Australia; species number greatly decline in the arid zone and in northern tropical/subtropical areas (Hnatiuk & Maslin 1988 and Maslin & Pedley 1988).



Map 50. Predicted area (blue) where *A. pycnantha* is climatically suited for cultivation; this area is derived from a bioclimatic analysis of the natural distribution (red circles, Map 49), see also Table 5. Target area shown in yellow

Figure 24. *Acacia pycnantha*

A – Mature tree. (Photo: B.R. Maslin)

B – Adolescent tree (stems rather slender). (Photo: B.R. Maslin)

C – Mature plant (pruinose variant). (Photo: B.R. Maslin)

D – 4 year old plant in on-farm revegetation trial near Wagga Wagga. (insert 3 year old stem). (Photo: B.R. Maslin)

E – Section of stem (typical variant). (Photo: B.R. Maslin)

F – Section of stem (pruinose variant). (Photo: B.R. Maslin)

G –Branch showing golden heads in racemes. (Photo: B.R. Maslin)

Acacia pycnantha is not far removed taxonomically from a number of others detailed in this report, namely, *A. hakeoides*, *A. linearifolia* and *A. neriifolia*; members of the '*Acacia microbotrya* group' are related to these taxa. This species has its closest affinities with *A. hakeoides, A. williamsonii* (with which it hybridizes, see under **Genetics** below), *A. hamiltoniana* and *A. obtusata* (none of these species, except *A. hakeoides*, is detailed in this report). It has been reported as also hybridising with *A. podalyriifolia* in cultivation in Europe; these putative hybrids were described under the names *A. siebertiana* and *A. deneufvillei* (Maslin 2001). *Acacia pycnantha* is sometimes confused with *A. saligna* (see species profile below) but the two are not closely related; *A. saligna* is readily distinguished by the relatively large gland at the base of the phyllode. It is also sometimes confused with *A. obliquinervia* and *A. leiophylla*, and has affinities with *A. pedina* (none of these species are detailed in this report).

Distribution and habitat

Widespread in Victoria, extending west to the Flinders Range, Yorke Peninsula, southern Eyre Peninsula and Kangaroo Island in South Australia, with isolated occurrences in southern New South Wales, the Broken Hill area and near Canberra in the Australian Capital Territory. It is often of scattered occurrence in the drier inland parts of its range but is commonly locally abundant in wetter areas. This species is common in parts of the eastern target area but its distribution extends beyond the boundary of the region. *Acacia pycnantha* has become naturalized in wetter parts of Victoria and Tasmania, and in various places in New South Wales and south-west Western Australia; it is also regarded as a weed in parts of South Africa (see under **Weed potential** below). Grows on a wide variety of soils including calcareous sands, deep podsolic sands, red earths, clays and skeletal, stony loams in *Eucalyptus* forest or woodland, open scrub and heath. Whibley & Symon (1992) provide a detailed description of ecological preference for South Australian populations.

Flowering and fruiting

Flowers from late July to October/November. Floral development is described by Buttrose *et al.* (1981). Pods mature between November and January. Plants typically set seeds annually with very heavy crops being produced every couple of years; on average there are 33 000 viable seeds per kg (Maslin *et al.* 1998). The mature pods can be rapidly harvested manually and the seeds readily detach from the pods.

Biological features

Acacia pycnantha is reported to have a moderately fast growth rate, attaining about 0.5–1.5 m per year according to Maslin *et al.* (1998). At Mt Remarkable in South Australia (mean annual rainfall about 330 mm) we observed about 10 year old plants attaining 4–6 m in height with stems 6–13 cm dbh; these plants grew on skeletal soil with *Eucalyptus cladocalyx*. For additional growth information see below under **Performance and yield**. This species typically lives for 15–30 years according to Maslin *et al.* (1998). It does not sucker but older specimens do coppice, albeit poorly so (Maslin *et al.* 1998). It may form dense thickets (regeneration from seed), especially in disturbed sites such as roadverges and following fire; in these cases the plants often have spindly, erect stems. *Acacia pycnantha* is reputed to be drought-hardy (attested by the fact that plants grow well around Broken Hill without additional watering, fide Hall *et al.* 1972). The plants are somewhat frost-tender when young but according to Stelling (1998) mature plants are reasonably frost tolerant. The species flowers precociously (i.e. within 2–3 years of planting). Aspects of its pollination biology (and plant/animal interaction, especially in relation to nectar secretion by phyllode glands) is summarised by Whibley & Symon (1992) and discussed by Bonney (1994).

Genetics

Putative natural hybrids between *A. pycnantha* and *A. williamsonii* occur in the Bendigo 'Whipstick', Victoria and these plants superficially resemble *A. hakeoides*; other putative hybrids, of cultivated

origin (in Europe), involving *A. pycnantha* and *A. podalyriifolia* are *A. x deneufuillei* and *A. x siebertiana* (Maslin 2001).

Toxicity

Although the seeds contain protease inhibitors (Kortt 1985), such compounds are common and can be deactivated by heat treatment or cooking (Liener 1980, Harwood 1994).

Cultivation

Acacia pycnantha has been well known in cultivation as a ornamental for many years. It will grow in a variety of soils and (according to Anderson 1968) prefers a reasonably hot, low humidity climate with a moderate rainfall. Small plantings of *A. pycnantha* have been established for agronomic assessment of species currently in demand by processors of *Acacia* seed for the Australian native bushfood industry (Graham & Hart 1997). According to G.S. Perrin (in Maiden 1908a) *A. pycnantha* is more amenable to cultivation than *A. decurrens* in that it can be pruned to a better shape (prune central growth when young to encourage bushiness, Stelling 1998), occupies less space in plantations and its bark is much better to strip.

Establishment

Acacia pycnantha is readily propagated from seed which requires a boiling or hot water treatment to break dormancy. Harding (1940) examined the effects of various boiling/soaking pre-treatment methods and reported that boiling for 5 seconds was more effective than for 2 minutes and both were better than no treatment. The species has also been established by direct sowing on prepared soil (Hall *et al*. 1972).

Performance and yield

Performance under cultivation may be erratic, with individual plants dying for no apparent reason (Maslin *et al*. 1998). Plants are somewhat frost-tender when young and Maiden (1908a) suggested that by growing them in situations with a westerly aspect, so that the sun will not shine on them too early after a severe frost, would facilitate the cultivation of this species in rather cold districts.

Plants should be spaced widely, e.g. 8–10 m, for maximum flowering and seed production (Maslin *et al*. 1998).

We inspected a plantation of *A. pycnantha* near Wagga Wagga during this project. The site was located within the 450 mm rainfall zone and experienced occasional frosts; the land was ripped and controlled for weeds prior to planting. In one plot (which was direct seeded, using local provenances) four year old plants had attained 3 m in height and developed straight, robust main stems about 7 cm dbh. A second plot (a wetter site, seedlings planted) showed similarly robust plants that had attained 4 m in height with stems 7 cm dbh in just three years.

Maiden (1908a) reported on plants cultivated (on sand over clay) in New Zealand. At one site 4 year old plants reached about 2 m in height with stems 5 cm dbh, and at another 6 year old plants reached about 3 m with stems about 9 cm dbh (by comparison, 6 year old plants of *A. decurrens* in this same area attained about 6 m in height with stems 12 cm dbh). Maiden did not provide climate information for the site so it is not possible to determine how factors such as water availability, temperature or frost may have affected growth performance.

Pests and diseases

As noted by Maslin *et al*. (1998) *A. pycnantha* plants may be variously affected by a wide range of insect pests and diseases. These include the rust fungi *Uromyces phyllodorium*, *U. simplex* and *U. tepperianum* (Gibson 1975). It is also susceptible to Trichilogaster wasps which produce galls in the heads (thus

reducing or completely eliminating seed set); the degree of gall wasp infection varies from year to year and might be dependent upon seasonal conditions (Martin O'Leary, pers. comm.).

Weed potential

The species is an environmental weed in South Africa (Ross 1975 and Stirton 1980) and has become locally established in southern Europe (Whibley & Symon 1992). As discussed in Henderson (2001) *A. pycnantha* is a Declared Weed species in South Africa where attempts at control have included both the use of herbicides and biocontrol agents. Initial results from using bud-galling wasps (*Trichilogaster* species) indicate that they have considerable potential as a biocontrol agent of *A. pycnantha* by reducing seed set (see Olckers & Hill 1999 for review).

Within Australia *A. pycnantha* is naturalized in southwest Western Australia (where it is regarded as an environmental weed) and eastern Tasmania (Maslin 2001: see map on p. 615), and also in places in New South Wales (Kodela 2002). This species spreads by seed which is produced in profusion and which may remain viable in the soil for many decades.

Wood

Based on our limited field sampling the wood of this species appears to have moderately heavy wood with a well-developed heartwood. When cut a clear gum is exuded at interface of sapwood and heartwood. The wood sample collected split upon drying. According to Maslin *et al.* (1998) the wood is non-durable in ground contact.

Utilisation

Wood

Wood makes an excellent fuel (Maslin *et al.* 1998), it burns well and produces a hot fire (Stelling 1998).

Land use and environmental

In Victoria *A. pycnantha* is often included in shelterbelt plantings, with *Eucalyptus cladocalyx* (Maslin *et al.* 1998) and in western New South Wales it is planted as windbreaks (Cunningham *et al.* 1981). Langkamp & Plaisted (1987) report that the species has been used for mine-site rehabilitation at Broken Hill in western New South Wales. It is useful for soil stabilisation on account of its fibrous roots (Stelling 1998). A good source of food for wildlife (Stelling 1998).

Fodder

No reported usage.

Tannin

Formerly highly prized for its tannin-rich bark which, according to Maiden (1889), contains 25–40% tannin (but higher returns have been obtained according to Hall *et al.* 1972); the tannin quality may be superior to that of *A. mearnsii* (see Searle 1991 for review).

Human food

Acacia pycnantha is regarded by Maslin *et al.* (1998) as a promising species for the production of seed for human consumption. The seeds are reported to have been consumed by Aborigines in the south-east corner of South Australia (Campbell *et al.* 1946) and are apparently quite palatable (W. Bates in Maslin *et al.* 1998). Gum was also a food source for traditional aborigines (Cleland 1966); an analysis of gum characteristics is given in Anderson & Bell (1976).

Other uses

Widely planted as an ornamental, especially on account of its profusion of strongly perfumed, golden flower-heads. The phyllodes of *A. pycnantha* have been used to dye will a golden colour using an alum mordant (Martin 1974).

Potential for crop development

Acacia pycnantha is regarded as having prospects as a crop plant for high volume wood production. It is ranked as a categroy 2 species and would be suited for development as a phase crop (Table 6). This is a hardy, resilient species that neither root suckers nor coppices (or has only weak coppicing ability). It is capable of reasonably fast growth rates and producing good quantities of woody biomass (see Wagga Wagga trials noted above), but the wood is likely to be moderately dense (perhaps similar to *A. microbotrya* which averages about 830 kg/m^3) and if so it reduces its attraction for use in reconstituted wood products. The species is also capable of developing a good growth form but it is somewhat variable in this respect with plants from wetter areas generally attaining a more arborescent stature than those from drier inland sites (which may be shrubby or spindly, although on better watered sites in good soil some may develop into sizeable trees). The selection of appropriate provenances for trial purposes will therefore be important in its development as a crop plant. Apart from what has already been noted above other desirable attributes of this species are its reputed drought-hardiness, its adaptability to a variety of soil types, and its ability to establish very well when direct seeded. Potential secondary benefits that might be derived include tannin production and seed for human consumption. Hall *et al.* (1972) suggest that on better sites there may be economic potential for growing plantations of *A. pycnantha* on a 7–10 year rotation for tannin. Because *A. pycnantha* has the ability to flower (and presumably produce pod crops) at a young age it could result in the creation of a soil seed bank which may lead to the species becoming a weed during the subsequent annual crop phase (on the other hand seedling regeneration may possibly be treated as a form of green manure).

The area predicted to be climatically suitable for the cultivation of *A. pycnantha,* based on its natural climatic parameters, is shown in Map 50. This analysis indicates *A. pycnantha* is potentially suited for cultivation throughout both the eastern and western target areas. This climatic match to the target areas is one of the most comprehensive of all 35 species treated in this report. This species also appears suited to a wide range of sites but cultivation on heavy clay soils and waterlogged conditions is not recommended. The successful cultivation of *A. pycnantha* (the form originally described as *A. westonii* by Maiden 1921, which occurs naturally on Mt. Jerrabomberra) at the Australian National Botanic Gardens in Canberra suggests it has moderate to high levels of frost and cold tolerance (although young plants are reported to be frost tender).

A potential issue in any development of *A. pycnantha* as a crop is its demonstrable weediness. This species spreads by seeds which are produced in great abundance annually. Already it is proving to be an environmental weed in the vicinity of Narrogin, Western Australia, and it might be expected to pose similar problems in other semi-arid parts of the target zone, at least outside its natural geographic range. Therefore, caution must be exercised in any wide-scale use of *A. pycnantha*, and such use must be accompanied by a thorough weed risk assessment. The potential weed risk associated with this species may constrain its use to its native geographic range (see also discussion on other possible weed reduction strategies under **Weed potential of *Acacia* in target area** in the introduction to this report).