



Brachychiton acerifolius in flower, a common sight around eastern Australia in late spring to early summer, here seen in suburban Sydney (Blakehurst). The tree loses its leaves just prior to flowering. A spectacular sight. See pages 76 to 107.

Brachychiton

SIMON and MARIESE GRANT write about the history and importance of a quintessential Australian genus and describe some of the most frequently grown species.

Introduction

Brachychiton is a genus of trees and shrubs coming predominantly either from Australia's eastern rainforests or its northern semi-arid monsoon regions. Despite the fact that 30 out of 31 recognised species of *Brachychiton* come from Australia (the non-endemic species comes from Papua New Guinea and another species comes from both countries), even in its own country, few people know more than a couple of these trees. Admittedly a significant number of them come from remote often inaccessible areas of Australia and have not been used much in cultivation. Nevertheless they can be highly ornamental, spectacular trees or shrubs and the better known species are included amongst Australia's iconic trees. Perhaps the best known are the Illawarra flame tree (*B. acerifolius*) which stands out each spring like a fiery beacon dotting the Sydney skyline, the kurrajong (*B. populneus*), used by farmers in drought as a fodder crop, and the unusually shaped bottle tree (*B. rupestris*). However a number of others are also worthy plants.

Brachychiton belongs to the subfamily Sterculioideae of the family Malvaceae. Malvaceae (the mallows) include a number of economically important members such as cotton and cacao, as well as well-known garden plants like *Hibiscus*, hollyhock, *Hoheria* and *Tilia*. It also includes the subfamily Bombacoideae with its notable pachycaulous members (trees with disproportionately thick trunks for their height) such as *Bombax* itself, the baobabs and *Ceiba*. Over recent decades based on molecular studies, the family Malvaceae has undergone several revisions with some older families of plants submergered as subfamilies into Malvaceae and a number of genera moved to different subfamilies. In the process, a new subfamily Sterculioideae was created with just four clades. The four clades are Cola (containing the genera *Cola* and *Firmiana* amongst others), *Heritiera*, *Sterculia* and the Australasian and New Caledonian clade, *Brachychiton*. A 2006 molecular study indicated that Sterculioideae was most likely monophyletic (share a common ancestor) though the relationships between the clades has not been resolved.

The clade *Brachychiton* is made up of the genera *Brachychiton*, *Acropogon* from New Caledonia, *Argyrodendron* from Australia, New Guinea and Malesia, and the monotypic *Franciscodendron* from northeast Queensland.

The genus *Brachychiton*

Species in the genus *Brachychiton* are monoecious shrubs or trees that range from 1.45 m tall, upwards. Multi-stemmed in some shrub species, some of the taller species can develop quite bulbous trunks. Most are deciduous or semi-

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The different inflorescences of *Brachychiton* species: *B. acerifolius*, above left, has compound panicle inflorescences and *B. bidwillii*, above right, has botryoidal (grape-like) inflorescences.

photograph © J. Bevege



Brachychiton populneus subsp. *populneus* has axillary panicles.

deciduous in the dry season; a few evergreen ones can be deciduous in times of drought. The eastern forest species tend to drop their leaves before flowering.

Leaves are alternate and petiolate. The leaves show intraspecific variation ranging from entire to deeply dissected with 3–9 lobes. Juvenile leaves are often markedly different in shape to adult leaves and juvenile shaped leaves can be present in some species for over 25 years. *Brachychiton discolor* was incorrectly separated as two species, *B. discolor* and *B. luridum* by Mueller (1858) as a consequence.

The flowers are unisexual by abortion. The flower clusters may be arranged in panicles, two opposite branches (dichasia), like bunches of grapes (botryoids), triads and monads with the arrangement useful for identifying some species. The inflorescences are axillary, ramal (from branches) or even cauliflorous (from the trunk). The perianth of individual flowers is considered to consist of a coloured calyx of fused sepals (corolla absent) creating various



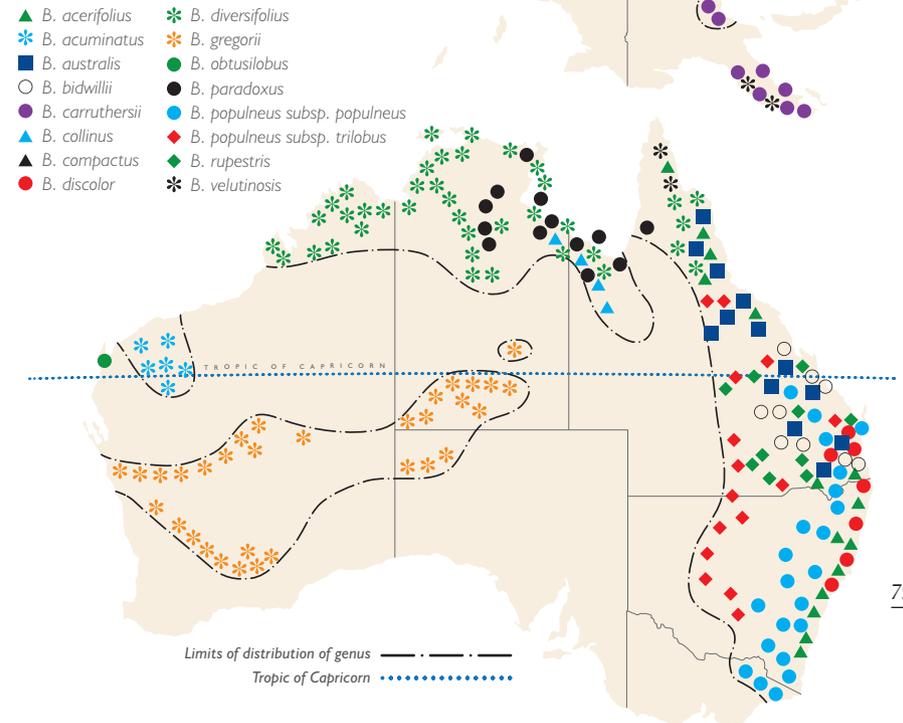
Above, left, 'Beau Belle', a *Brachychiton bidwillii* cultivar showing ramal (from branches) flowers and right, *B. spectabilis* × *B. bidwillii* hybrid showing cauliferous (from stems) flowers.

Table 1 Genus *Brachychiton*

SECTION	<i>Oxystele</i>		
	<i>B. acerifolius</i>	<i>B. carruthersii</i>	
SECTION	<i>Poecilodermis</i>		
	<i>B. diversifolius</i> subsp. <i>diversifolius</i>	<i>B. diversifolius</i> subsp. <i>orientalis</i> *	
	<i>B. populneus</i> subsp. <i>populneus</i>	<i>B. populneus</i> subsp. <i>populneus</i>	
	<i>B. populneus</i> subsp. <i>trilobus</i> *	<i>B. gregorii</i>	
SECTION	<i>Delabechea</i>		
	<i>B. compactus</i> *	<i>B. rupestris</i>	<i>B. sp Ormeau</i> **
SECTION	<i>Trichosiphon</i>		
	<i>B. acuminatus</i> *	<i>B. australis</i>	<i>B. collinus</i> *
	<i>B. obtusilobus</i> *		
SECTION	<i>Brachychiton</i>		
	<i>B. albidus</i> *	<i>B. bidwillii</i>	<i>B. chillagoensis</i> *
	<i>B. discolor</i>	<i>B. fitzgeraldianus</i> *	<i>B. garrawayae</i>
	<i>B. grandiflorus</i> *	<i>B. incanus</i>	<i>B. megaphyllus</i> *
	<i>B. muellerianus</i> *	<i>B. multicaulis</i> *	<i>B. paradoxus</i>
	<i>B. spectabilis</i> *	<i>B. tridentatus</i> *	<i>B. tuberculatus</i>
	<i>B. velutinosus</i>	<i>B. viridiflorus</i>	<i>B. viscidulus</i>
	<i>B. vitifolius</i>	<i>B. xanthophyllus</i> *	

*Described by Guymer (1988) **Still to be recognised as a species

Limits of distribution of genus *Brachychiton* and selected species based on the work of Guymer



campanulate shapes. The colours range from red, pink, orange-red to green or white, some with blotches of red. These differences help to separate the species and sections.

The female flowers have five carpels that can each develop into a woody fruit. The woody fruit of *Brachychiton* is a cymbiform (boat-shaped) follicle containing up to 140 seed (*B. carruthersii*) though usually 10–40. The seed are loosely enclosed in a hirsute exotestas in the follicle after it splits until the exposed surface has been abraded enough to allow them to fall free.

A list of currently recognised species is shown in Table 1, opposite. The map above, shows the extent of the genus as well as the distribution of a number of the species. Those not shown come from tropical areas of Western Australia, Northern Territory and Queensland.

History of *Brachychiton*

Fossils of *Brachychiton* estimated to be 50 million years old have been found in New South Wales and New Zealand. The landmass that was to become

New Zealand, New Caledonia and a few other islands separated from Australia whilst Australia was still connected to Antarctica 80–85 million years ago. There is evidence that *Brachychiton* were once rainforest trees that adapted to the drying continent as the Australian landmass moved north. Fossils from 45 million years ago of leaves apparently identical to the extant species *B. acerifolius* (a species that comes from the eastern rainforests) have been found near Lake Eyre, an area that is now desert. Also in more recent fossil deposits from northern Tasmania dating to the Oligocene (35 million years ago), macrofossil remnants of *Brachychiton* have been found amongst those of coniferous and angiosperm families found in today's eastern Australian rainforests that stretch from Tasmania to northern Queensland. This suggests similar climatic origins to those families, however, although not fully evaluated, even then there may have been some adaptations to reduce water loss. While the fossil leaves show similarities to the extant species that have been examined, in contrast to *B. acerifolius*, the abaxial stomata of the fossils have a covering of cutin masking their appearance and also thickened papillae over the abaxial cellular surface. Those features are most similar to *B. gregorii* a species now restricted to arid central Australia.

A number of species of *Brachychiton* have been traditionally used by Aboriginal peoples for thousands of years as a food source as well as for making rope and twine. The word 'Kurrajong', a common name used for several of the species, comes from the Dharug language, the traditional language of the Darug and Eora peoples of the Sydney basin. 'Ga-ra-jun' means 'fishing line' a reference to the lines and nets produced from the strong twine and rope made from its fibrous bark. The bark was stripped from the trees and soaked for several weeks to allow the fibres to separate. The separated fibres were then easily woven or spun as required to produce a range of goods including nets, twine, string and baskets. As a food source, the roots, stems, bark and especially the seeds, after double or prolonged roasting, were consumed for their nutrients including a high lipid content. The roasted seeds were either ground into flour or eaten without modification. They are described as having a nutritional value above that of acacia seeds though I am not sure of that as a recommendation, given that many acacia seeds are toxic and/or have negligible benefits. In dry areas, the cut roots can be used



Long dilly bag made of kurrajong (*Brachychiton populneus*) bark fibre and grass twine from coastal northern NSW, late nineteenth century.



Brachychiton paradoxus. Collected in 1802 by Brown and Bauer from Gulf of Carpentaria, northern Australia. It is uncertain whether it was described from a painting of Bauer's or samples he provided to them.

as a water source. The species *B. megaphyllum* is used as a calendar plant in the Northern Territory (Franklin) as the appearance of its large red flowers coincides with when sharks are fat and ready for hunting!

The term *Brachychiton* was first used by the Austrian botanists Heinrich Schott and Stephen Endlicher in 1832 to describe *B. paradoxus*. The name is derived from the Greek 'brachys' meaning short and 'chiton' meaning tunic, referring to the loose seed coat. In that same publication Schott and Endlicher described two other plants in monotypic genera that have now been included as *Brachychiton*, *Trichosiphum australe* (*B. australis*) and *Poecilodermis populnea* (*B. populneus*), their generic names used as section names by Guymer in 1988.

Prior to the publication of Schott and Endlicher, *Brachychiton* samples had been collected over the preceding three decades. Robert Brown, the Scottish botanist, arrived in Australia aboard the *Investigator* in 1801 under the command of Matthew Flinders. With Brown was the great botanical artist Ferdinand Bauer and together, as the *Investigator* circumnavigated the continent in 1802–03, they collected botanic samples. Brown and Bauer's stay was extended in Sydney after the *Investigator* was temporarily condemned, before they returned to London (without Flinders) in 1805. During the circumnavigation, samples of *Brachychiton paradoxus*, *B. australis* and *B. diversifolius* were collected and, while in Sydney between 1803 and 1804, *B. populneus*. Some of those samples were provided to and described by Schott and Endlicher (1832). Bauer's illustrations of *B. paradoxus* are now in the British Museum and adorn merchandise such as cards, tote bags and games.

Two years earlier in 1830, species that are now included in *Brachychiton* were first described in the closely related genus, *Sterculia*. A number of botanists continued to classify future *Brachychiton* species into the genus *Sterculia* for many decades. Allan Cunningham (one of Australia's greatest botanists/early explorers) arrived in late 1816 and collected specimens of the species.

Brief descriptions of those samples (noted as being collected in 1824) were included in Loudon's 1830 *Hortus Britannicus* as: *Sterculia acerifolia*, the maple-leaved sterculia (now *B. acerifolius*) and *Sterculia diversifolia* (G. Don) or *Sterculia heterophylla* (A. Cunn.), the various-leaved sterculia (now *B. populneus*). The species were also included in Don's rivetingly titled *A general history of dichlamydeous plants*, published in 1831. When and where exactly they were collected is unknown as from the moment Cunningham arrived in Australia, (or New Holland as it was known then), he travelled, explored and collected widely. He completed three circumnavigations of the continent as the botanist accompanying Phillip Parker King and extensively explored eastern Australia from near where Canberra is today to southern Queensland until he returned briefly to England in 1831. Unfortunately documentation was not his forte, though it is known that he collected samples of *B. diversifolius* from northwest Australia whilst the boat he was on was being repaired in October 1820. Also in September 1824, Cunningham accompanied John Oxley on his exploration of the Brisbane River. The river at that time was bounded by a dense rainforest including *Eucalyptus* species but both *B. acerifolius* and *B. populneus* still grow in the area today.

Endlicher in 1840 moved his three genera to subgenera of *Sterculia*. The genus *Brachychiton*, however, was soon reinstated by Robert Brown in 1844 for reasons we will discuss shortly which was supported by Endlicher in 1850.

In the meantime another future *Brachychiton* was described this time under the genus name *Delabechea*. It was first seen by Major Thomas Mitchell in 1846, on his fourth expedition covering the inland areas of northern New South Wales and southern Queensland, in the vicinity of the current town of Roma. The following is an extract from his journal published in 1848.

'In hopes of obtaining an elevated view over the country to the westward, I endeavoured to ascend the northern summit of Mount Abundance, but although the surface to near the top was tolerably smooth, and the bush open, I was met there by rugged rocks, and a scrub of thorny bushes so formidable as to tear leathern overalls, and even my nose. After various attempts, I found I was working round a rocky hollow, somewhat resembling a crater, although the rock did not appear to be volcanic. The trees and bushes there were different from others in the immediate vicinity, and, to me, seemed chiefly new. It is, indeed, rather a curious circumstance, but by no means uncommon, that the vegetation on such isolated summits in Australia, is peculiar and different from that of the country around them. Trees of a very droll form chiefly drew my attention here. The trunk bulged out in the middle like a barrel, to nearly twice the diameter at the ground, or of that at the first springing of the branches above. These were small in proportion to their great girth, and the whole tree looked very odd.'

Botanic samples of the droll tree were sent to England to be examined by John Lindley who was professor of botany at University College, London and his description appeared as a subscript in Mitchell's journal. Lindley felt that it had some similarities to both *Sterculia* and *Brachychiton* but should be in its own genus. The 'bottle tree' as they called it was therefore initially named *Delabechea rupestris* at Mitchell's request after H. T. De la Beche with *rupestris* signifying 'living on cliffs or rocks'. A more 'droll' tree is hard to imagine.

In his publications between 1858 and 1889, Ferdinand von Mueller maintained the separation of *Brachychiton* from *Sterculia*, but George Benthham treated them as a section of *Sterculia* in both his *Genera Plantarum* and *Flora Australiensis* (1862, 1863). By 1889 Mueller had listed ten species from Australia (including transferring *Delabechea*), one from Papua New Guinea and the first hybrid (*B. populneo-acerifolius*).

In 1897, a revision of the genus by Terracciano reduced the number of species by half (e.g., *B. acerifolius* and *B. gregorii* became subspecies of *B. acerifolius*),



The 'bottle tree' drawn by E. Kennedy as it appeared on page 154 in Mitchell's 1848 journal.

because he assumed their differences just reflected leaf polymorphism. A few years later some new species were added in 1899 by Bailey and 1906 and 1918 by Fitzgerald (all as *Sterculia*) but a thorough, detailed revision of the genus would wait until Gordon Guymer's review in 1988. Guymer catalogued the botanic differences between *Brachychiton* and *Sterculia*, the botanic features of the genus *Brachychiton*, the species differences, and the botanic relationships between members. Guymer also separated the genus into five sections of related species using the names, *Pocilodermis*, *Trichosiphon* and *Brachychiton* that had been used by Endlicher (1850), *Delabechea*, the original genus name for the bottle tree and he added *Oxystele* for *B. acerifolius* and its related species.

Guymer moved five species from *Sterculia* to *Brachychiton*, (Bailey, Fitzgerald) and described fourteen new species, two new subspecies and eight naturally occurring hybrids which in effect doubled the genus overnight.

There has been some confusion as to the correct gender of the genus. Although Schott and Endlicher assigned a neuter gender (*B. paradoxum*), as was followed by Brown and initially by Mueller, by 1889 Mueller was using the masculine gender (e.g. *B. paradoxus*) that has continued to now. This was formalised with recommendation 75A.2 of the 1983 International Code of Botanical Nomenclature.

The distinction between *Sterculia* and *Brachychiton*

Though *Brachychiton* and *Sterculia* are closely related, they have a number of seed and follicle differences. Brown in 1844 was the first to draw attention to the crucial position of the seed radicle with respect to the hilum. In *Brachychiton* it is adjacent to the hilum but in *Sterculia* it is remote; also in *Brachychiton* the seed exotestas (outer seed coat) is covered at least over the lower half with stellate trichomes (hairs), but smooth and glabrous in *Sterculia*.

The fruit of both genera are follicles that split longitudinally. The pink, scarlet or vermilion mature follicles of *Sterculia* are usually glabrous or rarely

pubescent on the inside. In contrast the outside of *Brachychiton* follicles is dark brown to black if glabrous, or pale yellow to light brown if covered with indumentum, but the inside of the pericarp is covered with hairs (stellate or simple). The interlocking of these hairs on the inside of the pericarp with the exotestas retain the seed inside the follicle even though the seed abscises (separates) before follicle dehiscence. With *Sterculia*, in contrast, the follicle dehisces before abscission. With the seed still attached by their funicles and without the hairs to hold them in, the seed can hang down from the follicles, falling later after abscission. After the seed abscises, the exotestas of the *Sterculia* seed dries and peels leaving, temporarily, a white oily or pithy layer over the tough, inner part of the seed coat, the tegmen. In *Brachychiton* at maturity, the exotestas which is more lignified and crisp, separates from the inner seed coating. Whilst retained in the split follicle, the upper portion of the exotestas exposed to the effects of weathering or animals is detached allowing the pale yellow of or orange coated seed to fall free. The lower portion of the exotestas remains in the follicle. The differences are summarised in Table 2.

Table 2 Key differences between *Brachychiton* and *Sterculia*

	Distribution	Mature follicle colour	Follicle inside surface	Exotestas	Radicle position
<i>Brachychiton</i>	Australia (30 species) Papua New Guinea (2 species)	Dark brown to black if glabrous. Yellow to light brown if covered with indumentum	Hirsute	Hirsute at least lower half, remains in follicle	Adjacent to hilum
<i>Sterculia</i>	Trans-tropics (91 species)	Pink, orange red or vermilion	Glabrous, rarely pubescent	Glabrous, remains attached to seed	Remote from hilum



Far left, *Brachychiton bidwillii* seed showing radicle adjacent to hilum at bottom.

Left, *Sterculia quadrifida* seed showing sprouting radicle remote from hilum.



Far left, *Brachychiton bidwillii* seed retained in the follicle after dehiscence, after exotestas has been removed (top) and soaking in hot water (bottom).

Left, *Sterculia quadrifida* with bright vermilion follicles and seed hanging before abscission.

Brachychiton sections

In his 1988 article, Guymer separated the related *Brachychiton* species into five sections based on differences in pollen morphology (which are not discussed here), wood anatomy, germination type, as well as floral and seed characteristics. Tables (3, 4) summarise the key differences between sections. Much of the information that follows is based on Guymer's work where greater botanic detail can be found.

Table 3 Differences between *Brachychiton* Sections

Section	Type Species	Habit	Nectaries	Leaves	Germination
<i>Oxystele</i>	<i>B. acerifolius</i>	Trees to 45 m Trunk slightly bulbous or cylindrical	Absent	Usually glabrous	Phanerocotylar [†]
<i>Poecilodermis</i>	<i>B. populneus</i>	Trees to 20 m Trunk slightly bulbous or cylindrical	Absent	Glabrous	Phanerocotylar
<i>Delabechea</i> *	<i>B. rupestris</i>	Trees to 25 m Trunk distinctly bulbous	Absent	Glabrous	Phanerocotylar
<i>Trichosiphon</i>	<i>B. australis</i>	Trees to 25 m Trunk columnar	Absent	Glabrous	Phanerocotylar
<i>Brachychiton</i>	<i>B. paradoxus</i>	Shrubs or some trees 35 m	Present	Usually tomentose	Cryptocotylar [†]

* The wood of section *Delabechea* is unique in having extensive mucilage cavities.

† Phanerocotylar = cotyledons above the ground. Cryptocotylar = cotyledons remain in seed coat.

Selected *Brachychiton* species

The following species are some of those most likely to be encountered. They are generally more frost tolerant though none are suitable for the wetter, colder areas of northern Europe and the USA unless grown with the protection of a wall and in free draining soil. Because of their drought tolerance, several have been popular around the Mediterranean and California for many years.

Section *Oxystele*

Section *Oxystele* contains just two species, *B. acerifolius* from the east coast of Australia and *B. carruthersii* from Papua New Guinea. Both are trees with red campanulate flowers grouped predominantly in axillary compound paniculate inflorescences. The flowers lack nectaries.

Brachychiton acerifolius Common names—flame tree, Illawarra flame tree, lacebark. A tree growing to 45 m in height; when it is in flower it is a most impressive sight, covered in large panicles of bright red flowers, made all the

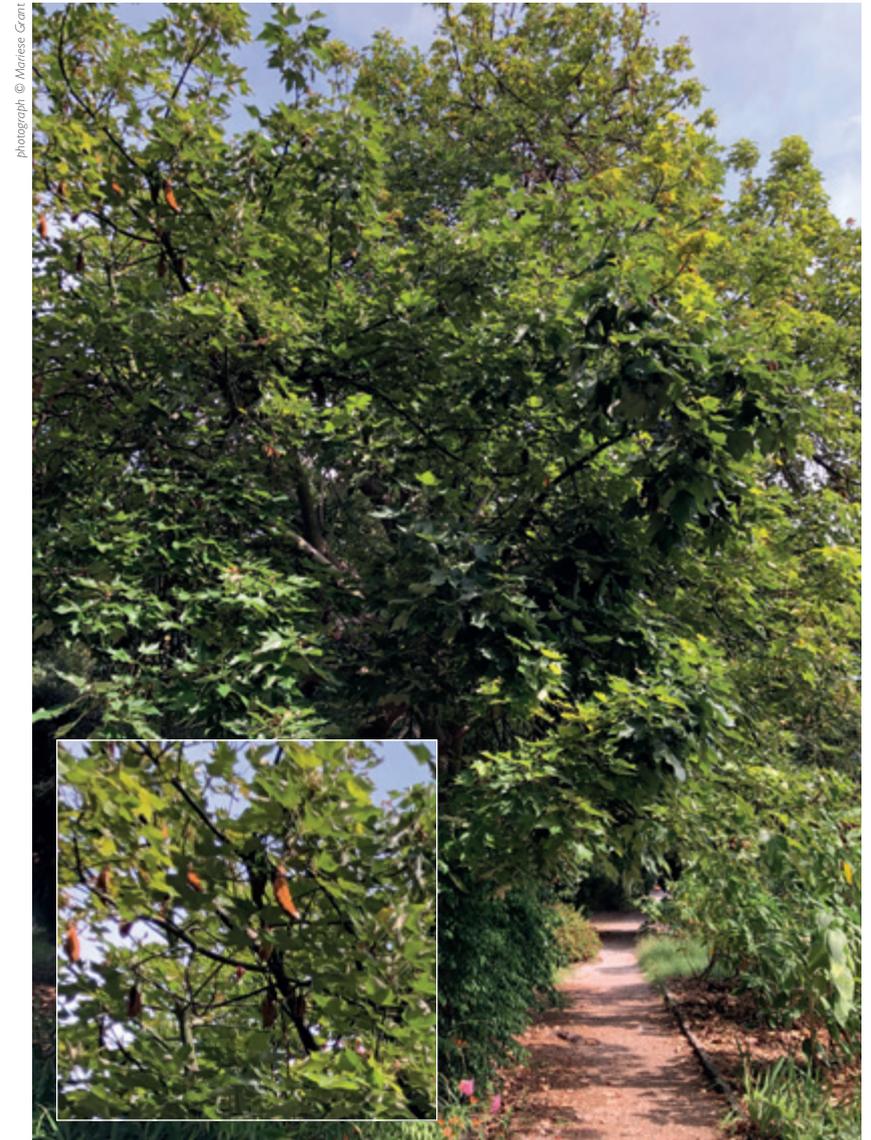
Table 4 Floral differences between Sections

Section	Inflorescence	Perianth colour	Perianth shape	Example
<i>Oxystele</i>	Ramal, axillary. Compound paniculate,	Red	Campanulate, 5-lobed above middle, margin induplicate, cylindrical	 <i>Brachychiton acerifolius</i>
<i>Poecilodermis</i>	Axillary. Panicles or triads, dichasia	Pale green, blotched or stippled red inside	Campanulate, 5 or 6-lobed above middle, tube cupular	 <i>Brachychiton diversifolius</i>
<i>Delabechea</i>	Axillary. Panicles, triads, dichasia occasional metabotryoids	White or cream blotched or stippled red inside	Compressed-campanulate, 5-lobed below middle, tube cupular	 <i>Brachychiton rupestris</i>
<i>Trichosiphon</i>	Ramal, axillary. Condensed, compound paniculate	White or cream, not blotched with red	Tubular-campanulate,	 <i>Brachychiton australis</i>
<i>Brachychiton</i>	Ramal, axillary or terminal. Botryoidal, metabotryoidal, triads, panicles	Red, orange-red or pink	Campanulate or tubular-campanulate 5 (6)-lobed for 0.1–0.4 length	 <i>Brachychiton spectabilis</i>



Opposite, *Brachychiton populneus* growing at Mt Annan Botanic Garden, Sydney.

Below, *Brachychiton discolor* growing in Giardini Botanici Hanbury, (La Mortola) Ventimiglia, Italy. Note the cinnamon-coloured follicles top left.



more conspicuous as it drops its leaves just before flowering in late spring/early summer.

The cylindrical to slightly bulbous trunks are 15–30 m tall with dark grey bark that is finely fissured and tessellated. Deciduous or semi-deciduous when flowering, its leaves are 3–5 lobed, 12 to 20 cm long and 5–18 cm wide. The margins are entire. They are glabrous and coriaceous.

The 15–40 cm long inflorescences are branched and compound paniculate with 100 to 200 campanulate flowers. The red flowers are 20–30 mm long and 16–22 mm in diameter. The perianth made of five fused sepals is lobed for 0.25–0.5 of its length. Nectaries are absent.

The follicles are glabrous outside, narrowly ellipsoid in shape and measure 8–12 cm long by 3.5–4 cm wide. They contain 12–26 seeds that are 10–12 mm long and 5–7 mm wide.

It has an extensive but disjunct distribution from just south of Sydney



Brachychiton populneus subspecies: **Left**, *B. populneus* subsp. *populneus* has entire leaves and **right**, *B. populneus* subsp. *trilobus* has lobed leaves; both trees are growing at Mt Annan Botanic Garden in Sydney.

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along the coast to the far north of Queensland. That includes the Illawarra region south of Sydney after which it gets one of its common names. It is found on lowlands up to an elevation of 840 m in NSW and 1,000 m in Queensland, growing in complex notophyll vine forests (intermediate leaf-size, subtropical rainforests) south of the Tropic of Capricorn and to its north in complex mesophyll vine forests (very wet, large-leaf tropical rainforests). It is also found in drier and/or more seasonal forests at their edges such as in semi-deciduous mesophyll vine forests (< 2,000 mm annual rainfall) and the semi-evergreen notophyll vine forests. Despite its origins it has been found hardy in a range of soils and climatic conditions coping with mild frosts to perhaps -3 °C once established.

Naturally-occurring hybrids with *B. discolor* (*B. × vinicolor*) and in cultivation with *B. populneus* subsp. *populneus* (*B. × roseus*) have been described.

Brachychiton carruthersii from eastern Papua New Guinea is similar and grows to 18–35 m in height. It has larger follicles (13–19 × 7–9 cm) that are more thickly walled, and stellate pubescent outside. They contain 80–140 larger seed. The leaves also differ in that they are finely hirsute below. The 8–15 cm long inflorescences contain 30–80 individual flowers. The flowers are red-brown outside and dark red inside. Though grouped with *B. acerifolius* in *Oxystele* and having similar floral characteristics, the different follicle

appearances, the presence of hairs on the leaves and some pollen differences suggest the two species are not that closely related.

Section *Poecilodermis*

Three closely related species are included in section *Poecilodermis*: *B. populneus* from eastern Australia, *B. diversifolius* from tropical Australia north of 18°30'S, and *B. gregorii* from central Australia.

Members of this section are generally medium-sized trees growing in eucalypt woodlands and open forests. The main distinction from the other sections is by their flowers which are pale green, blotched or stippled red inside. The perianth composed of 5 (–6) fused sepals is campanulate with the base cup-shaped and 5 (–6) lobes above the middle. Nectaries are absent. Related to section *Delabechea*, the shape of their perianths and the absence of extensive wood cavities in the vertical wood, distinguishes them from that section.

Brachychiton populneus Common name—kurrajong

Brachychiton populneus grows to 8–20 m. Usually evergreen except in extreme conditions, it can be used as fodder in droughts. The trunk is cylindrical to slightly bulbous, grey to dark brown, shallowly fissured and tessellated. The leaf blades are shiny above, paler or glaucescent below. Two subspecies are now recognised.

Brachychiton populneus subsp. *populneus* has entire, lanceolate or ovate-lanceolate leaves (poplar-like) or with one or two short triangular lobes up to

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Brachychiton populneus subsp. *populneus*, a street tree in glorious profusion.

1 cm long. The leaves are generally 6–12 cm long and 2–5 cm wide. Specimens east of the Great Dividing Range have entire leaves with the lobes becoming more prominent further west.

Brachychiton populneus subsp. *trilobus* has 3 (–5) lobes narrowly triangular with the central lobe 5–12 cm long and the lateral lobes 1–8 cm long. Juvenile leaves are 3 (–5) lobed, rarely entire. The inflorescences are axillary and in panicles with 10–60 flowers. The flowers on ultimate branches are often in triads. The flowers are cream or pale green outside, pale green and blotched or speckled with red inside, rarely red. The perianth is 5 (–6) lobed, the tube 6–12 mm long and 7–13 mm in diameter with recurved triangular to broadly deltate lobes 6–9 mm long. It flowers between throughout the summer.

The glabrous surfaced follicles of *B. populneus* subsp. *populneus* are 4–7 cm long containing six to 22 seed (each seed 6.5–8 × 4.5–5 mm) whereas the follicles of *B. populneus* subsp. *trilobus* are smaller at 2–5 cm long containing three to 11 seed.

The natural distribution of *B. populneus* subsp. *populneus* tends to be more southerly, easterly and from wetter areas than *B. populneus* subsp. *trilobus*. Though extending to Victoria, it is confined to the far north-east of that state around the Snowy River. In NSW its distribution is extensive ranging from the coast to the tablelands up to 1,000 m and through to the western slopes. In Queensland it is restricted to the southeast in the Moreton, Darling Downs, Wide Bay and Burnett districts. It grows as single trees in eucalypt forests though it has been recorded from the edges of microphyll and notophyll vine forests. They grow in various well-drained soils amongst rocks of granite or limestone. *Brachychiton populneus* subsp. *trilobus* is confined to the western districts of NSW where the rainfall is only 250–500 mm per year, extending in central Queensland from the NSW border to Ravenshoe inland just south of Cairns. This subspecies occurs in eucalyptus woodlands in well-drained soils.

Natural hybrids between *B. populneus* subsp. *populneus* with *B. discolor* (*B.* × *incarnatus*) and *B. rupestris* are known to occur (*B.* × *turgidulus*).

Brachychiton diversifolius is the tropical form of *B. populneus* with an extensive distribution covering the northern parts of Western Australia, Northern Territory and Queensland. It is most closely related to *B. populneus* subsp. *populneus* with similar shaped, entire leaves (slightly longer and wider on average), rarely with short lateral lobes, but their flowers only have ten stamens and stamens (18–20 of each in *B. populneus*). Also the outside of the perianth is densely pubescent while glabrous or at most sparsely pubescent in *B. populneus*. It grows to 5–18 m in height and commonly occurs in open eucalyptus woodlands and open forests. Two subspecies have been described, *B. diversifolius* subsp. *diversifolius* from northern WA and NT and *B. diversifolius* subsp. *orientalis* from northern Queensland. The former

subspecies is said to have thicker hairs on the outside of the perianth and narrower leaves.

Brachychiton gregorii, on the other hand, has its closest affinity to *B. populneus* subsp. *trilobus*. There are similarities in their leaves and follicles. The outside of the perianth of *B. gregorii*, like *B. diversifolius*, is densely pubescent. However it has 25 staminodes and stamens. The deeply lobed leaves have three to five lobes and are slightly larger (central lobes 8–20 cm long). The follicles are small at 1.5–3.5 cm in length and 1–3 cm in width and only contain two to eight seed on average. The seeds are about 7 × 4 mm in size.

The species has an extensive distribution in arid central Australia in Western Australia, Northern Territory and South Australia where there is an average rainfall of less than 250 mm per year. It occurs on undulating sand dune country on rocky ridges and slopes growing in sandy loams to skeletal soils derived from granite, ironstone and quartzite. It usually grows as a single tree 4–12 m in height in low eucalyptus woodland or acacia scrub.

Section *Delabechea*

No discussion on *Brachychiton* would be complete without covering this section, the bottle trees. Developing markedly bulbous trunks reaching 3.5 m, they are most unusually shaped trees.

Their mature leaves are glabrous and entire. Juvenile leaves which may persist for 25 years in contrast are can be deeply lobed and markedly different in shape. The flowers are white or cream, stippled or blotched red on the inside of the perianth. The 5 (–6) sepals are fused to form the valvate perianth but the fusion finishes well below the middle of their length creating a compressed campanulate shape with a cupular tube and relatively longer lobes above. Nectaries are absent.

Trees in this section are most closely related to section *Poecilodermis* with similarities in floral morphology and pollen. What separates this section from the other sections however is in the unique wood anatomy. Extensive mucilage- (a mixture of glycoproteins and polysaccharides) filled axial cavities occur in the vertical wood parenchyma not seen in any other species of the genus or other *Sterculioideae*.

Two species, *B. rupestris* and *B. compactus* are now recognised as members of this section though a third species now known as *Brachychiton* sp. Ormeau has been proposed.

Brachychiton rupestris Common name—narrow-leaved bottle tree.

As noted above this species when described was first separated from *Brachychiton* by John Lindley. This was on the incorrect assumption of the radicle being remote from the hilum, a mistake later corrected by Mueller. It is a deciduous or semi-deciduous tree that grows to 10–25 m with trunks



4–10 m. The bark is dark grey, deeply fissured and shallowly tessellated. The leaf blades are shiny above, linear-lanceolate to lanceolate measuring 5–11 cm long and 0.8–2 cm wide. Juvenile leaves are digitally compound or very deeply lobed with the lobes sessile usually linear to lanceolate, 6–14 cm long and 0.3–1 cm wide.

The inflorescences are axillary, 3–8 cm long panicles of 30–40 flowers or

Brachychiton rupestris

A young *Brachychiton rupestris* (opposite) growing at the Australian National Botanic Gardens in Canberra—the inset photo showing its lanceolate leaves. **Below left**, a mature specimen near Roma, Queensland which is included on the National Register of Big Trees. **Below right**, are the flowers and **bottom right** are the deeply-divided and spidery juvenile leaves.



occasionally in metabotyroids or triads. The flowers are 5–10 mm long and 13–18 mm in diameter. It flowers in September to November.

Follicles are glabrous outside, ellipsoid in shape and 1.5–3.5 cm long and 1.5–2.5 cm wide. They contain 4–12 seeds that are about 6.5 × 4 mm in size.

It is endemic to Queensland occurring in the south east quarter in areas with above 500 mm of annual rainfall extending from just north of the New



Brachychiton × *turgidulus* has intermediate features of its parents.

South Wales border to Clermont west of Rockhampton.

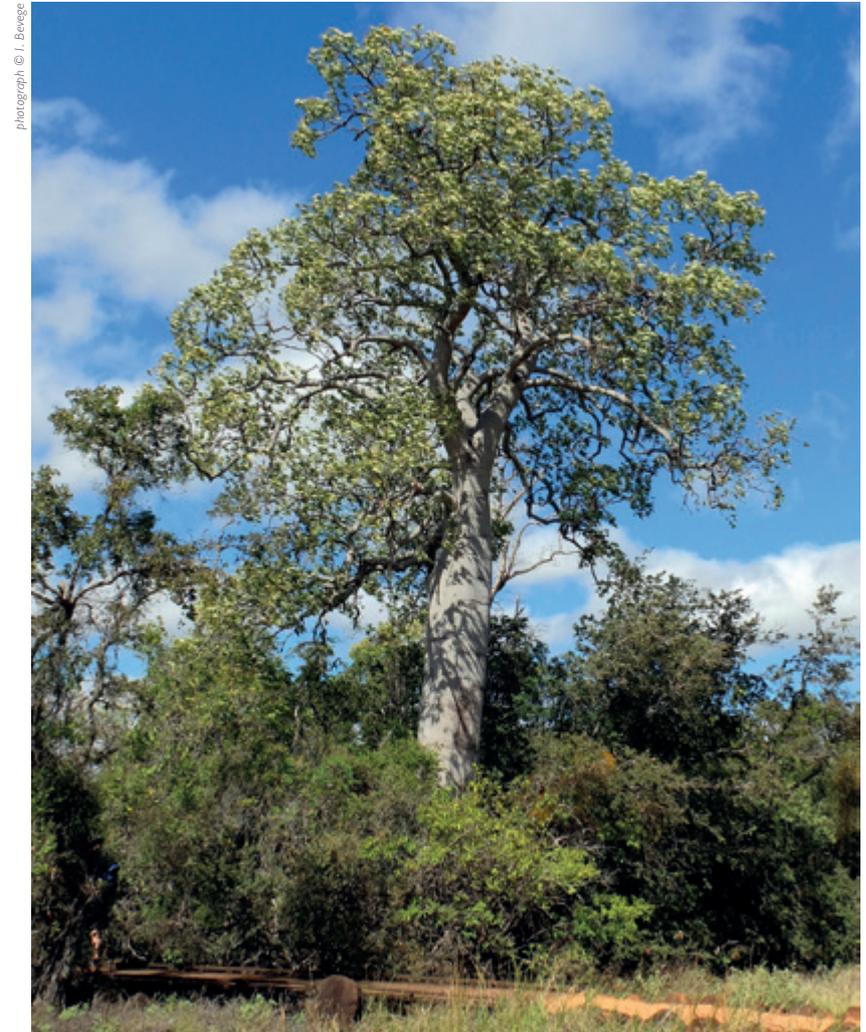
It occurs from near sea-level to about 600 m altitude in gently undulating country to ridges and rocky hilltops. It grows in skeletal soils to clay loams derived from shales basalts and other volcanic rocks. It is an emergent dominant species in semi-evergreen or semi-deciduous microphyll vine forests and in forests dominated by brigalow (*Acacia harpophylla*) and hoop-pine (*Araucaria cunninghamii*) and remains a common remnant in land cleared for crops or livestock.

96 *Brachychiton* × *turgidulus*, the natural hybrid with *Brachychiton populneus* subsp. *populneus* occurs where the two species co-exist, occasionally even locally dominant or co-dominant with *B. rupestris*. It develops a slightly bulbous trunk and has intermediate leaf blade shape and flower characteristics.

Brachychiton compactus is the other official member of section *Delabechea*. A semi-deciduous tree growing to 8–15 m tall, it has a restricted distribution on the central coast of Queensland around Proserpine. Closely related to *B. rupestris* it can be distinguished by its mature leaf blades that are ovate to ovate-lanceolate and 6–12 cm long and 2.5–5 cm wide. Also the inflorescences are shorter and more compact at 1–2.5 cm containing 30–80 flowers. The closely related *Brachychiton* sp. Ormeau has been proposed as a new species. It comes from drier rainforests further south near Ormeau in the Gold Coast hinterland. It grows to 30 m and is deciduous but is otherwise similar to *B. compactus*. It is popular amongst collectors but specimens in cultivation generally still have juvenile foliage (5–9 deep lobes) as they persist for over 25 years.

Section *Trichosiphon*

The four species in this section are considered not to have any close affinities with any of the species in the other sections. Deciduous trees with columnar or slightly bottle-shaped trunks, they have glabrous 5–7 (–9)-lobed leaves. The most notable differences are in the flowers. They are white or cream and



Brachychiton australis in the Undara Volcanic National Park, northern Queensland.

tubular campanulate. Nectaries are absent. They come from north of 26°S in either Queensland or northwest Western Australia.

97 *Brachychiton australis* Common name—Broad-leaved bottle tree. This species is a deciduous tree growing to 8–25 m in height with a grey or grey-green smooth or shallowly fissured trunk that is 4–15 m. The leaves are six to seven lobed with the lobes to about the middle. The lobe margins are

Brachychiton australis

Below are the tubular campanulate flowers, right are the cordate juvenile leaves; opposite page, left are the intermediate form leaves and right, the distinctly-lobed adult leaves.



Photograph © K. Rathie



Photograph © Simon Grant

entire. Juvenile leaves are initially heart shaped gradually developing shallow lobes over successive leaf generations.

The 3–8 cm long inflorescences are ramal and condensed, compound paniculate with 30–60 flowers. The perianth of each flower is made up of (4–) 5 (–6) sepals fused to about half its length, its tube subcylindrical or infundibular with the lobes above recurved. The perianths are 15–25 mm long and 18–33 mm in diameter. It flowers from June to September.

The ellipsoid follicles are 7–11 cm long, 3–4 cm wide and contain 30–50 seed. Each seed is 7.5–10 mm long and 5–6 mm in diameter.

It is endemic to eastern Queensland from just north of Cairns south to 26° extending to the west where the rainfall is above 600 mm annually. It grows in skeletal soils derived from granite, limestone or recent volcanic activity as well as light to medium brown clay loams. It is a dominant emergent species in low semi-deciduous notophyll vine forests or deciduous microphyll vine thickets in the north of its range, further south it is a conspicuous component of *Araucaria cunninghamii* vine forests and is co-dominant with *Brachychiton rupestris* where the two coexist. The leaf lobes tend to be deeper and more pointed in lower rainfall areas.

Because of the lack of affinity with other species in different sections, hybrids were thought not to occur but in 2002 a hybrid with *B. acerifolius* was found near Rockhampton and more recently another with *B. chillagoensis*.

Two other members of section *Trichosiphon* were previously identified as *B. australis*. Separated by Guymmer on floral differences, both *Brachychiton collinus* from northwest Queensland and *Brachychiton acuminatus* from the Fortescue district of northwest Western Australia have flowers that are much



Photographs © Simon Grant



smaller (10–15 mm long and 12–18 mm in diameter), though similar in overall shape. Also the inside of the perianth lobes are densely white tomentose whereas only the margins are in *B. australis*. They both have fewer flowers per panicle (10–40) but those of *B. acuminatus* are longer and more open measuring up to 15 cm in length.

The fourth species, *Brachychiton obtusilobus*, is closely related to the preceding two having similar smaller flowers with densely tomentose covering the inside of the lobes. It is distinguished by its leaves that are shallowly lobed with rounded apices and condensed short panicles only 2–3 cm in length. It comes from the North West Cape Peninsula of WA.

All three grow in fairly harsh environments with thin skeletal soils on rock outcrops in low open woodlands of eucalyptus and acacia scrub. As a consequence they only reach 10 m in height.

Section *Brachychiton*

This is by far the largest of the sections with 20 species and a few new ones still to be ratified. They grow as trees with cylindrical trunks or more often as shrubs. The leaves usually have tomentum, are entire or three to five-lobed. The flowers are red, orange-red or pink but unlike section *Oxystele*, they have nectaries. The perianths are campanulate or tubular-campanulate. The seed has cryptocotylar germination with the cotyledons remaining in the seed coat.

Brachychiton discolor Common names—lacebark tree, brush kurrajong
The largest species in section *Brachychiton*, *B. discolor* can grow to 35 m in height. The trunks are cylindrical or narrowly obclavate. The straw-coloured bark is



irregularly fissured or lace-like but can be smooth. Adult leaves are shiny and glabrous or glabrescent above, white star-like hairs below, interspersed with brown hairs. Usually 5-lobed with the lobes extending to about the middle, they are 10–22 cm long and 10–20 cm wide. The margins are entire. The juvenile leaves which can persist for a decade are so different from the mature forms that a different species (*B. luridum*) was initially described (Mueller, 1858). They are deeply 5–7 lobed, dull with sparse hairs above and hirtellous below. A 10 m, 30-year-old tree here in Mittagong, New South Wales, still has predominantly juvenile foliage.

The inflorescences of three to ten flowers are usually bunched, grape-like and 6–8 cm long. The shortly-lobed, campanulate flowers are pink, darker red inside and measure up to 56 mm long and 60 mm wide. There are two distinct nectaries opposite each of the five lobes of the perianth near the base of the tube. It flowers November to January.

The densely brown follicles are stellate hirsute outside, ellipsoid in shape, 10–13 cm in length and 3.5–4.5 cm wide containing 30 to 50 seed. The seed are 9–10 mm long and 5–7 mm in diameter.

Brachychiton discolor occurs naturally from just north of Newcastle in coastal New South Wales to Mackay in Queensland in dry rainforest communities classified as notophyll vine forests. In higher rainfall areas it is of secondary importance dominated by either *Araucaria* or *Flindersia* species. It grows from near sea level to 600 m and to 1,000 m in Queensland and its range extends to 160 km inland to the Bunya Mountains. The soils are often skeletal and derived from basalt, shales or slates.

Brachychiton discolor

Opposite page, far left, a young tree showing the deeply-lobed juvenile foliage and right, a more mature specimen showing the lace bark pattern—the green areas of the trunk contribute to photosynthesis.



Right, the campanulate flowers of *Brachychiton discolor*, here on the tree at the Giardini Hanbury, La Mortola (see also photo page 89.)

Three natural hybrids with *Brachychiton discolor* have been described; with *B. acerifolius* (*B.* × *vinicolor*), with *B. bidwillii* (*B.* × *excellens*) and with *B. populneus* subsp. *populneus* (*B.* × *incarnatus*).

One thousand kilometres further north in the north-eastern region of the Cape York Peninsula is the closely related *B. velutinosus*. It also is native to Papua New Guinea. It grows to 20 m, its adult leaves have very short lobes, and the flower colour is darker pink.

Brachychiton bidwillii Common name—little Kurrajong

This species however is one of the shortest growing of the genus, often a multi-stemmed shrub 1–4 m high with pale brown or grey bark which is smooth or finely fissured.

The leaves are dull and usually hairy above especially along primary veins. The lower surface is densely brown hirtellous-velutinous with stellate hairs. The usually deeply lobed leaves are 6–16 cm long and 6–17 cm wide. There three to five (or seven) lobes with entire margins. Juvenile leaves are stellate hairy above and below and also deeply lobed with five to seven lobes.

The ramal inflorescences are usually in botryoids with triads on ultimate branches. They are 3–5 cm in length and have seven to 35 flowers. Occasionally axillary or cauliferous inflorescences develop. The tubular-campanulate flowers are orange-red to pink outside, browner at the base and red or pink inside. They are 35–45 mm long and 20–30 mm wide. The perianth is shortly lobed with five (or six) lobes and two distinct nectaries are inside the tube opposite the base of each lobe. It flowers August to November.



Brachychiton bidwillii

Opposite page, a young *Brachychiton bidwillii* shrub with its characteristic tubular-campanulate flowers (inset) and right, the hairy, khaki-coloured follicles.



rocks. The soils are generally gravelly or stony with rock outcrops. It occurs in vine thickets or vine forest transition into eucalypt open forest or woodland.

Naturally occurring hybrids with *B. discolor* (*B. × excellens*) occur.

The remaining species in this section are all tropical and space does not permit detailing the subtle differences between them. They come from northern Queensland: *Brachychiton albidus*, *B. chillagoensis*, *B. garrawayae*, *B. grandiflorus*, *B. muellerianus* and *B. vitifolius*; the Kimberley region of Western Australia: *Brachychiton fitzgeraldianus*, *B. incanus*, *B. tridentatus*, *B. tuberculatus*, *B. viridiflorus*, *B. viscidulus* and *B. xanthophyllus*; and the Northern Territory: *Brachychiton megaphyllus*, *B. multicaulis* and *B. spectabilis*. *Brachychiton paradoxus* comes from both central Northern Territory and western Queensland. Some of them as well as sectional hybrids are becoming available for cultivation.

Hybrids

With the exception of members of section *Trichosiphon*, hybridisation between species of *Brachychiton* is not uncommon. The leaf characteristics are in general a blend of both parents, the trait of cryptocotylar germination (the cotyledons remain in the seed coat) is recessive and glabrous follicles dominant.

Brachychiton × roseus (*B. acerifolius* × *B. populneus* subsp. *populneus*)

Mueller reported the first cultivated hybrid in 1884, between *B. acerifolius* and *B. populneus*. He recorded that 'It arose in Dr Cox's brother's garden' though the details were sketchy, and it was later said to have occurred as a seedling in the Jerilderie school giving the cultivar its name, 'Jerilderie Red'. *Brachychiton populneus* grows naturally in Jerilderie, a town near the New South Wales/Victoria border, whereas the *B. acerifolius* was a cultivated specimen. Since then a number of similar hybrids have arisen from the same parents.

They are evergreen trees growing to 20 m in height, frost tolerant and

The follicle is rough to touch, light brown, ellipsoid and 5–11 cm long and 3–3.5 cm wide. They contain ten to 29 seeds that are 10–11.5 mm long and 7 mm in diameter.

Brachychiton bidwillii is endemic to eastern central and southern Queensland with an isolated population on Magnetic Island in the southern part of north-eastern Queensland. Its southern limit is Boonah near the New South Wales border and Bowen in the north. It grows on moderate slopes, ridges and hilltops, frequently in thin soils derived from basalt, granite and sedimentary



Two *Brachychiton* cultivars from different crosses: *B. × roseus* 'Belladonna' (above left) is similar to *B. 'Jerilderie Red'* and *B. × vinicolor* 'Clarabelle' (right) was discovered in the Gold Coast hinterland.

drought resistant. Their leaves are entire but occasionally three-lobed, ovate-acuminate and 8–15 cm long. The axillary 10–25 cm long compound paniculate inflorescences of 30–100 red flowers occur in November to January. Special selections are maintained by grafting onto *B. populneus* or *B. acerifolius* as are other selected hybrids.

Brachychiton × vinicolor (*B. acerifolius* × *B. discolor*)

Natural hybrids of this semi-deciduous tree have arisen around the New South Wales/Queensland border region. It grows to 20 m and has 5-lobed, usually glabrous leaves. The ramal inflorescences of 25–60 dark red flowers are 9–12 cm long. Nectaries are absent. *B. 'Clarabelle'* is a popular example.

Conservation status

There is little information on conservation status of most species of *Brachychiton* since Guymer's studies over 30 years ago. Many species have extensive ranges and are likely to be categorised as species of least-concern though isolated communities may be under threat. He did however note even then that 17 species were considered at risk because of rarity and restricted distribution. Of those he considered the following species are vulnerable: *B. carruthersii*, *B. grandiflorus*, *B. incanus*, *B. obtusilobus*, *B. spectabilis*, *B. velutinosus* and *B. vitifolius*. He also considered *B. tuberculatus* to be endangered. The recently proposed species, *B. sp. Ormeau* is considered critically endangered.

Cultivation of *Brachychiton*

Whilst cultivation of *Brachychiton* is relatively simple as they are drought tolerant and can cope with a range of soil types, their often tropic origins restrict their usefulness to regions with only mild frosts at most i.e. hardiness zone 9 or above. Even the young plants may need some protection. The most frost tolerant species are *B. acerifolius*, *B. discolor*, *B. populneus*, *B. rupestris* and the



Brachychiton sp. Ormeau, a proposed species in section Delabechea, is critically endangered. Though it can grow to 30 m, most plants in cultivation are considerably smaller and still have deeply lobed juvenile leaves. Inset, a few adult leaves can be seen near the pale green flowers.

shrub *B. bidwillii* and its hybrids. Unlike many Australian genera such as many Proteaceae, they are also not adversely affected by normal levels of phosphorus in fertilisers.

Seed germinates readily though care is needed, and gloves should be worn when removing the seed from follicles because of the numerous irritating hairs. The germination can be sped up by soaking large seeds in near boiling water for 30 to 60 seconds and then lukewarm water overnight, though I have not found it helpful for smaller seeded varieties.

Members of the genus have already proved to be valuable plants for cultivation around the world, in particular those regions with a Mediterranean climate. Let us hope that more of the recently described species become more widely available.

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Brachychiton rupestris in a private garden known for its succulents, Melbourne, Victoria.

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