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Eucalyptus Study Group Newsletter

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Contents

Thankyou for contributors of this issue;, Steve Harries, Rod Kent, David and Barbara Pye and Brian Walters.

Eucalypts in the Melton Botanic Garden

By David and Barbara Pye

The Melton Botanic Garden is Melbourne's newest Botanic garden. The garden occupies 24 hectares and is based in the driest part of the Melbourne region. Annual rainfall is 450-500 mm long term, but in recent times has often been around 300 mm. Soils are generally moist in winter and dry in summer. The garden is well suited to growing plants from dryland regions.

The garden is being developed by the Friends of the Melton Botanic Garden (FMBG) with support from Melton Shire Council, Matchworks and various other community groups. It houses a collection of dryland Eucalypts which includes more than 100 species, most of which are suitable for suburban and town gardens.

Six years ago, we set out to plant a Eucalyptus arboretum with dryland species (ie from less than 450 mm rainfall zones). Many of these established quickly and have flowered several times. Because of their relatively small size and masses of colourful flowers they have proved popular with the ever increasing number of visitors to the garden. In general, the Eucalypts were planted in groups of 3-5 plants, with an understorey of various colourful shrubs, including Eremophilas and local everlasting daisies (Chrysocephalum and Xerochrysum species).

Most of the trees were grown from seed by the FMBG members, while a few species were donated or purchased. Seed was sourced from Nindethana and elsewhere. Most resulting trees were later identified as correct, although a few turned out to be hybrids or a different but related species. While hybrids with good horticultural value are usually kept, those with limited horticultural value are being removed, especially large growing ones. The majority of species planted remain healthy and have thrived, but some losses have occurred, mostly due to wind damage, but some due to frost. We are planting further species, but due to shortage of space, preference is given to rare species. . As we develop the West Australian and South Australian gardens, more Eucalypt species are being planted.

A guide to the Eucalypts in the arboretum has been compiled for the use of tour guides and visitors to the garden, and is available on the FMBG website (fmbg.org.au) as a pdf document. It is planned to update this guide as more photos become available and to expand it to include all dryland Eucalypts in Melton Botanic Garden.

The garden contains a number of species which are rare in the wild and many that are rare in cultivation. Some of these species include:

Eucalyptus erythronema Red-flowered mallee
Mallee or tree to 6 m tall. Forms a lignotuber.
Smooth bark, dark satiny pink-brown to dark red, shedding to reveal powdery creamy-white trunk, glossy olive green leaves. Flowers showy, red or yellow.
Distribution: Western Australia

Eucalyptus formanii Die Hardy mallee
Tree or mallee to 10 m tall. Forms a lignotuber.
Rough bark on the trunk extending to base of large limbs, smooth bark on branches, cream brown to pinkish grey. White flowers, glossy green leaves.
Distribution: Western Australia

Eucalyptus gardneri Blue mallet
Mallet to 6 m tall, rarely a small tree to 8 m. No lignotuber

Smooth bark generally, sometimes with some rough bark on lower part of larger stems, smooth bark white, cream, pink or grey. Branchlets usually glaucous, grey green or blue grey leaves, Pale yellow flowers.
Distribution: Western Australia

Eucalyptus gillii Silver mallee
Mallee to 6 m tall, rarely a small tree to 8 m. Forming a lignotuber.
Bark smooth throughout or with some rough, flaky or box-type grey or brown bark on lower 2 m of larger stems, the flakes shed imperfectly giving a curly appearance; smooth bark white, cream, pink or grey. Flowers pale yellow.
Distribution: South Australia, New South Wales

Eucalyptus incerata Mount Day mallee
Mallee to 5 m tall. Forming a lignotuber.
Bark smooth throughout, light grey-brown over orange. Buds long and narrow. Flowers yellow.
Distribution: Western Australia

Eucalyptus macrocarpa Mottlecah
Mallee shrub to 3 m tall, often sprawling. Forms a lignotuber.
Bark smooth, shiny yellowish brown and grey-brown, large glaucous grey leaves, large showy red flowers, large nuts.
Distribution: Western Australia

Eucalyptus megacornuta Warted yate, Photo 1
Mallet to 15m tall – no lignotuber.
Smooth bark throughout. Large warty buds, flowers yellowish green.
Distribution: Western Australia

Photo 1, ***Eucalyptus megacornuta***

Eucalyptus pimpiniana Pimpin mallee
Mallee's to 2 m tall and often wider. Forms a lignotuber.
Bark smooth throughout, sometimes powdery, mottled salmon, pink, white, pale grey and brown. Yellow flowers and blue-grey foliage.
Distribution: Western Australia, South Australia

Eucalyptus pleurocarpa Tallerack
Mallee to 5 m tall, usually with many long, thin, erect stems. Forms a lignotuber.
Smooth bark, grey to grey-brown. Crown consists only of juvenile leaves which are grey and glaucous, leaves. Whitish flowers. Often incorrectly named as E. tetragona.
Distribution: Western Australia

Eucalyptus synandra Jingymia mallee, Photo 2
Mallee to 4 m tall. Forming a lignotuber.
Smooth bark, white, reddish and pale grey, sometimes powdery. White or pink flowers, dull green leaves.
Distribution: Western Australia

Photo 2, ***Eucalyptus synandra***

Eucalyptus talyuberlup
No generally accepted common name.
Mallee to 4m tall. Forms a lignotuber.
Smooth bark, pale brown-grey and whitish, green leaves. Flowers large yellow-green clusters.
Distribution:Western Australia

Eucalyptus woodwardii
Lemon-flowered gum, Photo 3
Mallet to 10m tall. No lignotuber
Branches pendulous, the tips brushing the ground. Bark smooth, white over salmon to pink, grey-green leaves.
Showy bright yellow flowers.
Distribution: Western Australia

Photo 3, *Eucalyptus woodwardii*

Eucalyptus wyolensis Wyola mallee
Mallee to 7 m tall. Forming a lignotuber.
Bark usually rough over most of the lower stem, sometimes extending to the larger branches, fibrous, light grey to brown; upper stem mostly smooth-barked, smooth bark grey to brown to cream. Flowers yellow.
Distribution: South Australia

Eucalyptus youngiana Yarldarlba
Photo 4
Mallee to 8 m tall, sometimes trees to about 10 m. Forms a lignotuber.
Rough bark over part or all of trunk, smooth above, whitish grey over yellowish or salmon pink, dull light green leaves, Large red, pink or bright yellow flowers, large distinctive fruits.
Distribution: Western Australia, South Australia

Photo 4, *Eucalyptus youngiana*

The garden also contains a number of remnant indigenous trees including *Eucalyptus microcarpa* (Grey Box), *E. melliodora* (Yellow Box) and *E. camaldulensis* (River red gum). There are some particularly fine specimens of *E. camaldulensis*.

When we began constructing the garden 6 years ago, we inherited a number of Eucalypts planted 30-40 years ago, and which included a few larger growing species such as Corymbia maculata and a few smaller growing species. Many of the larger species line the main path through the Garden and provide valuable shade, while a number of smaller growing dryland species are located within the arboretum and include *E. talyuberlup*, *E. stoatii*, *E. dolichorrhynca* and *E. stricklandii*.

For those who would like to visit, the garden is open at all times. Many conducted tours take place throughout the year.

ABSTRACT
Designing food and habitat trees for urban koalas: identifying short ecotypes of Corymbia intermedia

Stephen J. Trueman A B , Tracey V. McMahon A , Elektra L. Grant A , David A. Walton A , Brittany B. Elliott Aand Helen M. Wallace A

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The eucalypt trees eaten by koalas are generally tall, but urban landholders prefer to plant shorter trees that pose less danger of limbs falling from a great height or damaging powerlines. Our aim was to develop shorter eucalypt trees to provide food and shelter for koalas and other fauna in urban areas. We identified short ecotypes of Corymbia intermedia (R.T.Baker) K.D.Hill & L.A.S.Johnson growing naturally on exposed coastal headlands, and tested whether their seedlings were shorter than the seedlings of nearby tall ecotypes when planted in cultivation. Trees raised from the short ecotypes were 22–43% shorter than trees raised from the tall ecotypes, being around 5–7 m tall rather than 8–12 m tall after 8 years. This demonstrated that there was a genetic basis for the short stature of C. intermedia trees on coastal headlands. These shorter C. intermedia trees could be valuable food and habitat trees for urban koalas and other fauna.

Additional keywords: Corymbia, Eucalyptus, koala, Phascolarctos cinereus, street trees, tree height, urban fauna.

ABSTRACT
Genetic structuring in the spotted gum complex (genus *Corymbia*, section Politaria)

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Spotted gums (genus Corymbia, section Politaria) occur as a species replacement series along the eastern seaboard of Australia, their distributions marked by regions of disjunction and sympatry. Their taxonomy remains controversial, with species assignment often challenging and reliant on knowledge of geographic origin as well as subtle morphological or leaf-oil variation. In the present paper, we explore a classification for spotted gums, without assuming predefined geographic or taxonomic groups but instead using genetic structure at microsatellite marker loci (n = 9) and a Bayesian model-based clustering approach implemented in STRUCTURE software. The C. torellianaoutgroup (n = 21; section Cadagaria) formed a well resolved cluster (minimum pairwise Fst = 0.19). Four populations were evident within the spotted gums (n = 93) but structure was weak (pairwise Fstrange 0.13–0.05). Geographic distance, topography and distribution disjunction were major determinants of structure, with migration among populations approximating a linear stepping-stone model. Corymbia maculata was resolved as a taxon and had the greatest genetic distance from any other population (minimum pairwise Fst 0.08). Three clusters were evident within the northern taxa but alignment with taxonomic groupings was poor. C. citriodora material from north of a major disjunction in central Queensland formed a Northern population. C. citriodora, C. variegata and C. henryi material south of this disjunction but north of the Border Range, formed a Central population, whereas a Southern population comprised C. variegata and C. henryi from predominately south of the Border Range.

Deciphering the underground chemical dialogues between *Eucalytus grandis* and fungi

By Johanna Wong
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I am a PhD candidate of the Hawkesbury Institute for the Environment of Western Sydney University, under the supervision of Dr. Jonathan Plett and Prof. Ian Anderson. As a molecular biologist, my research focuses on the chemical signals eucalypts use to communicate with root associated fungi. The soil-borne fungal community is one of the most widely-recognized and versatile members of the soil biota that impose substantial impacts on the growth and sustainability of eucalypt forests and plantations globally. Fungi are an inherent part of any forest and they serve crucial roles in nutrient and water cycling, toxin sequestration and degradation, as well as acting as a conduit for communication between different organisms. However, due to their hidden nature, the fungal consortia are often overlooked among eucalypt studies.

Why are fungi important to eucalypts?

The health of *Eucalyptus* seedlings and trees is greatly influenced by two groups of fungi that exhibit very different lifestyles: pathogenic fungi and mycorrhizal fungi. While the former is responsible for disease and mortality of trees, the latter is beneficial towards nutrient acquisition of eucalypts. Mycorrhizal fungi form symbiotic association with the roots of eucalypts and facilitate plants' nutrient acquisition. In exchange, plant host provide organic carbon resources for mycorrhizal fungi. The ability to distinguish the nature of their fungal partner and respond correspondingly is crucial for the survival of eucalypts.

How do trees communicate with soil-borne fungi?

While trees appear to be sessile and passive, they communicate with neighbouring soil-borne fungi through the exchange of chemical signals. Tree roots exude a mixture of chemical signals including primary and secondary metabolites, enzymes, mucilage, ions and small peptides etc. These chemical signals may attract or deter their neighbouring fungi. In response, to trees root exudate, fungi also release chemicals which affect the tree's physiology. As a whole, these underground chemical dialogues mediate interaction between various fungi and trees.

How do trees distinguish between mycorrhizal fungi and pathogenic fungi?

Although mycorrhizal fungi and pathogenic fungi affect the fitness of eucalypts in a contrasting manner, there is insufficient research on the way trees distinguish between one and another. I postulate that root exudates of eucalypt contain specific chemical signals towards which pathogenic fungi and ectomycorrhizal fungi would respond differentially. In my research, I am comparing the chemical composition of eucalypt roots when the tree is exposed to mycorrhizal fungi and pathogenic fungi, and hopefully I will be able to identify the specific chemical signals which help the tree to distinguish between the "good" and "bad" fungi.

Why is this important?

Not only can this research project advance human knowledge on the "tree language", this project also have potential in application to forest management and conservation. Currently, we rely heavily on the visible detection for signals of tree diseases, such as crown thinning and rotten root. My research would help in developing a new approach for early detection of eucalypt disease. It is possible to use metabolite present in the soil around eucalypt roots as a feasible approach to detect fungal disease before visible signs of disease above-ground or before spread to other individuals.

To know more about my research, please check on this profile page:
https://www.westernsydney.edu.au/hie/people/postgraduate_students/current_postgraduate_students/johanna_wong

ABSTRACT
Phylogenomics of the green ash eucalypts (Myrtaceae): a tale of reticulate evolution and misidentification

Susan Rutherford A B C , Peter G. Wilson B , Maurizio Rossetto B and Stephen P. Bonser A

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Eucalyptus is a genus that occurs in a range of habitats in Australia, Papua New Guinea, Timor, Sulawesi and the Philippines, with several species being used as sources of timber and fibre. However, despite its ecological and commercial significance, understanding its evolutionary history remains a challenge. The focus of the present study is the green ashes (subgenus Eucalyptus section Eucalyptus). Although previous studies, based primarily on morphology, suggest that the green ashes form a monophyletic group, there has been disagreement concerning the divergence of taxa. The present study aims to estimate the phylogeny of the green ashes and closely related eucalypts (37 taxa from over 50 locations in south-eastern Australia), using genome-wide analyses based on Diversity Arrays Technology (DArT). Results of analyses were similar in topology and consistent with previous phylogenies based on sequence data. Many of the relationships supported those proposed by earlier workers. However, other relationships, particularly of taxa within the Sydney region and Blue Mountains, were not consistent with previous classifications. These findings raise important questions concerning how we define species and discern relationships in Eucalyptus and may have implications for other plant species, particularly those with a complex evolutionary history where hybridisation and recombination have occurred.

Additional keywords: Australia, DArT, Diversity Arrays Technology, Eucalyptus, hybridisation, phylogenetics, recombination.

Eucalyptus oil distilling a major local industry by 1890s; Part 1

Source: Archives of Berrima District Historical & Family History Society, Bowral Rd, Mittagong
cited in the Highland News; 6 June, 2016

By Philip Morton

Eucalyptus oil was one of the unexpected discoveries made by colonial settlers in NSW. Distilling plants were set up and by the 1890s enterprising businessmen in the Berrima District were participants in this 'dinkum oil' industry.

Within a few weeks of the First Fleet arriving in 1788, settlers discovered the wonders of the eucalyptus tree, first found growing on the shores of Port Jackson. Surgeon-General John White noted that the distilled oil was more efficacious than that of English peppermint, being less pungent and more aromatic.

The eucalypt belongs to the Myrtaceae family. The genus was named Eucalyptus by the Frenchman L'Heretier in 1788.

The word came from the Greek eu 'well' and kalypto 'I cover' and refers to the cap that covers the flower buds until the buds mature and force the cap open.

The properties of the oil were already well known and put to use by local Aboriginal communities at the time.

Eucalyptus oil was amongst the first natural raw products exported from the colony.

Identified early on in the Southern Highlands was a scarce species, Eucalyptus Smithii, which rendered a higher yield of oil than many other species.

Found at Hill Top and through to Wingello, it is a tall tree, up to 45 metres in height, with a 150cm diameter. One of the earliest mentions of the local industry was in the Scrutineer on 26 August 1892: "Eucalyptus oil-making appears to be all the rage now.

We have no less than three factories at Wingello, viz, Mr R Curry, Langshaw and Bond, and Mr J Simmonds, and the oil manufactured is first class.

"In visiting Mr Curry's establishment the other day we were informed by that gentleman that he intends sending a sample of his oil to the Chicago Exhibition. Mr Curry is exporting half a ton of oil to England next week."

In November that year the paper reported that the cultivation of the eucalyptus had been declared a purpose for which to reserve land under the 90th section of the Crown Lands Act of 1883. As well, in a report from Wingello the sad news was conveyed that Thomas Barrett, employed cutting leaves for the eucalyptus factory, met with a very nasty accident.

Instead of cutting the leaves he cut off the end of his finger. The paper "hoped that in a few days he would be OK again".

The Bowral Free Press reported on 15 March 1893 that Frank Hook lost his Eucalyptus factory in the flood at Mittagong. Over 40 pounds worth went. A fishing party afterwards found two tins of oil about three miles down the creek only slightly damaged, which were returned to the owner.

At Hill Top, Daniel Chalker established a distillery in the 1890s using Smithii leaves from trees that still grow today on land he originally owned. Daniel gained a prominent mention in the first edition of A Research on the Eucalypts and their Essential Oils, a 1902 publication by the Technological Museum of NSW.

Only eucalyptus leaves and terminal branchlets were required by the distiller, so large trees were naturally a disadvantage, the material having to be collected either by lopping off the branches or by felling the trees.

Lopping was dangerous and more easy collection of the leaves was obtained from the 'coppice' growth which springs rapidly and abundantly from the short remaining stems of felled trees.

The leaves and bark were carted by wagon to the distilleries where the freshly cut material was dumped into vertical iron digesters set into the ground below wagon level for easy filling. After steam had distilled the volatile oil the spent leaves and stick were hoisted out by derrick and dumped on the fire. The rising column of pungent smoke was a constant landmark.

Back in the 1880s this work was often carried out by indigenous workers and by former miners as the goldfields rush petered out.

The old distilleries were somehow kept going by pieces of wire, bits of tin, lumps of clay and the resourcefulness of the true bushman whose ramshackle buildings were made of hand-hewn posts and roofed with branches of nearby trees.

The business was at the mercy of international markets. The Scrutineer of 12 April 1893 noted: "For the sake of our local eucalyptus factories we regret the late news from the London market that eucalyptus oil has dropped to 9 pence per lb and that a further decline is expected."

This proved to be a temporary setback as the industry was soon flourishing again

Highlands History: Eucalyptus oil industry; Part 2

Source: Archives of Berrima District Historical & Family History Society, Bowral Rd, Mittagong
cited in the Highland News; 13 June, 2016

By Philip Morton

COLONIAL settlers in 1788 were amazed by the efficacious properties of oil distilled from the leaves of the native Eucalyptus tree.

A distilling industry developed.

It was found that a rare, high-yielding species Eucalyptus Smithii grew abundantly in the Southern Highlands.

By the early 1890s first-class oil was being produced locally in numerous distilleries at Hill Top, Mittagong and Wingello.

The Scrutineer of 23 May 1894 reported that: "Mr Langshaw's eucalyptus factory at Wingello, which has been idle during the past two months, will commence operations this week, when a large quantity of eucalyptus oil will be manufactured for the colonial and foreign markets.

This enterprising gentleman intends to start manufacturing perfumes in conjunction with his eucalyptus works.

He has got all the necessary plants to start the perfumery growing in his garden."

Under the heading 'A New Industry' the Bowral Free Press of 26 November 1898 informed readers that: "The Australian Eucalyptus Oil Company is under the management of Mr Easson, brother to the chief at Joadja.

He is a resident of Bowral, but the works are at Moss Vale, a large estate having been secured there for the gathering of leaves; some six men are now engaged in felling and collecting, and the works are capable of indefinite extension, as the world better appreciates the properties of Australian eucalyptus."

The paper also outlined the distilling process and the product. Extracts follow here:

"The leaf and fine twigs of the eucalyptus yield a volatile oil, which has a good commercial value both in a crude and refined state.

Each variety of gum tree has an oil distinctive to itself, but the difference is chiefly perceptible in a laboratory, so slight is it.

The usual procedure in an oil distillery is to fell the trees both small and great, and collect the tender twigs and leaves.

These are chopped fine and placed with water in a closed boiler.
The steam and vapour come away and are condensed in a coiled copper tube immersed in cold water.

This first distillate is allowed to settle in a vessel with numerous taps, so all the floating oil is drawn off, whilst the mixed residue of water and oil is collected in other vessels until enough is accumulated for redistillation.

The crude oil is purchased by the wholesale druggists and through them finds its way in a refined state into all the chemist shops.

It is purchased wholesale on analysis."

In April 1899 the Goulburn Evening Penny Post advised that, amongst the visitors to Goulburn at that time was Mr R T Baker, Curator of Sydney Technological Museum.

He had been visiting the eucalyptus oil stills of Wingello and Bundanoon. In conjunction with Mr H G Smith, the museum's chemist, Baker had done much to bring before the world the value of eucalyptus oil bearing trees of NSW.

The above report makes it clear that the Southern Highlands ranked highly in regard to eucalyptus oil production.

From it we also learn that a still had opened at Bundanoon.

Over following years more were set up, including one at Bowral in 1903.

BY the 1920s, eucalyptus oil was a major Australian export.

Back in 1852 Joseph Bosisto, an emigrant pharmacist from England, had been encouraged by Baron Ferdinand von Mueller, the famous government botanist of Victoria, to begin commercial production of the oil.

He obtained high-quality oil from a mallee-type tree that only grew near Bendigo in Victoria and at West Wyalong in NSW.

The Bosisto Company continued to expand, establishing a eucalyptus factory locally at Mandemar in 1925.

Other local manufacturers included William Quigg who distilled a special eucalyptus oil called Germinoll at his Paddy's River property, with sole manufacturing rights from Fauldings.

A factory operated at Macdonald's Flat in the Joadja Creek area and oil was produced on the Mereworth property near Berrima from 1935 for export to Japan.

Australia dominated the world eucalyptus oil market for 80 years from the 1860s to the mid-1940s.

It's market share then declined, and production in the local district ceased.

Australia wide, after World War II labour costs rose and the strong demand for wheat meant that drastic destruction of stands of high quality eucalyptus species occurred.

Wheat growing was viewed as more profitable than eucalyptus oil production.

Australian oil could not compete with Spanish eucalyptus oil on international markets.

Recently this downward trend has reversed, at least for medicinal purposes. Today, for air vaporisers, body and household cleaning, many people wouldn't be without a bottle of the 'dinkum oil'.

ABSTRACT
Floral morphology of *Eucalyptus leucoxylon* (Myrtaceae) facilitates pollination by lorikeet (Aves: Psittacidae) tongues

Joseph P. Zilko A B , Susan E. Hoebee A and Trevor J. Edwards A

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Bird pollination is particularly common and widespread in the southern regions of Australia. Despite some eucalypts being heavily frequented by birds, they are usually considered to have a generalist pollination system because of their apparently unspecialised floral morphology. A few species possess protandrous anthers that dehisce within a tightly furled dome of filaments. We hypothesised that this facilitates pollen transport via the brush tongues of lorikeets. Using Eucalyptus leucoxylonF.Muell. and five captive rainbow lorikeets (Trichoglossus hematodus) as a model, we demonstrated that lorikeets remove significant quantities of pollen from flowers with inflexed filaments in a short time (30 min), compared with bagged control flowers (Mann–Whitney U test, $Z = 165.4$, d.f. = 29, $P = 0.008$). Some of this pollen is deposited on stigmas by the tongue, which is the organ that most regularly and reliably contacts stigmas. The mean number of pollen grains deposited on stigmas by each bird was as high as 121.2. Adhesive tape contacted by the tongue during foraging removed up to 2104 pollen grains, which was significantly greater than for uncontacted control tape (Mann–Whitney U test, $Z = 110$, d.f. = 21, $P < 0.001$). Scanning electron micrograph imaging of a lorikeet tongue showed many pollen grains that had been transferred onto its keratin papillae, which is likely to have contributed to high carryover rates by retaining pollen for a substantial amount of time. Minimal pollen is available for generalist pollination once the filaments unfurl. It appears highly unlikely that insects are able to access pollen from these male-phase flowers and inflexed filaments may therefore fulfil an exclusionary role.

Eucalyptus leucoxylon buds and flowers
Source: Plantfinder; http://www.gardensonline.com.au

Eucalyptus leucoxylon capsules
Source: Urban Forestry Ecosystem Institute
http://www.selectree.calpoly.edu

The curious relationship between the Cadaghi tree and native stingless bees

By Tim Heard

Source: http://www.qnc.org.au/Papers/The%20curious%20relationship%20between%20native%20bees%20and%20cadaghi.htm

This article is extracted from Tim Heard's upcoming book on Australian Native Bees

Stingless bee keepers in Australia are daily reminded of the intimate relationship between their bees and a eucalypt tree called Cadaghi or *Corymbia torelliana*. From a distance, seedlings of this tree are often seen germinating below the hive entrance. Close up, red objects about 2.5 mm in diameter, the seeds of the Cadaghi, are often seen around the entrance. Massive numbers of seeds appear at the entrance in December to February when fruit (gumnuts) of this tree are mature. Inside the hive, lots of seeds are also seen usually in combination with a resin that resembles mozzarella cheese in colour and stringiness. What on earth is going on?

Seedlings of the cadagi tree below the entrance of *T. carbonaria* hive, Image: Tim Heard

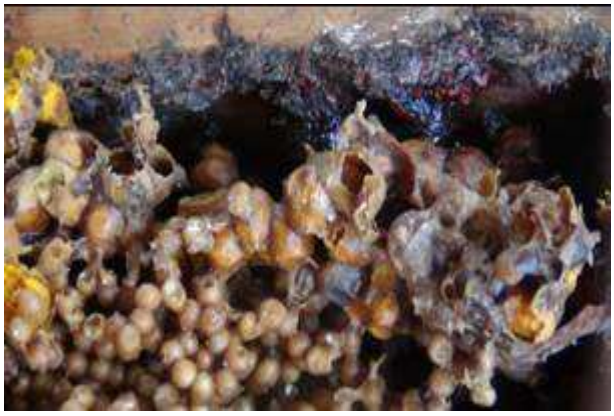
Seeds of the cadagi tree around the entrance of *T. carbonaria* hive, Image: Tim Heard

Careful work by Helen Wallace revealed the mystery. Helen first identified the seeds as belonging to *Corymbia torelliana*. She then found the trees and opened the gumnuts (hard hollow fruits) when mature. She saw resin glands producing sticky droplets inside. She observed that stingless bees were attracted to the resin, they entered the gumnuts to collect it and in the process many got seeds stuck on their body. They then flew to their nests. But the weight of a seed (about half that of the bee itself) is such that they struggle to carry it. So before, during and after the flight they try to remove the seeds, dispersing them as they go. A mutually beneficial relationship has evolved between the bees and the trees. The bees provide long distance dispersal of seeds and are rewarded with a viable source of nest-building resin.

A Cadaghi fruit (gumnut) opened to show seeds and resin droplets inside (Image: Helen Wallace).

A *T. carbonaria* bee with a seed of the Cadagi stuck to its leg inside (Image: Helen Wallace).

The Cadaghi resin collecting season typically lasts 2-3 months starting with fruiting in December and ending when the bees have removed the resin from the fruits. Only a small proportion of the foraging bees will be returning with resin and only a few of these will also be carrying a seed. These figures are variable; occasionally in the peak season of Cadaghi fruiting, a larger proportion of the bees will be collecting resin. The bee stockpile the resin in the hive to later combine with wax to make propolis for nest building. The seeds can be incorporated into the nest structures but many are also removed and dumped outside. In the case of *T. carbonaria*, the seeds are deposited on the outside of the entrance and remain there. *T. hockingsi* removes the seeds well away from the entrance and does not allow them to accumulate there.



Even *Austroplebeia* stingless bees, which normally do not collect or use much propolis in the nest, collect the resin of Cadaghi, note the red cadagi seeds in this *A. australis* nest. Image Tim Heard

The resin of Cadaghi has been the subject of much discussion and angst. Although native to Far North Qld, this tree has been planted as far south as Newcastle in NSW. It is abundant in many areas where stingless bees are kept and certainly the resin of this plant can accumulate in large deposits in the hive. Many stingless bee keepers warn about the dangers of this resin to the health of the hive. Some claim that the resin melts in hot weather leading to blocking of the entrance and collapse of nest structures. Others believe that poisonous fumes are released.

Seeds and resin of the cadagi tree inside a *T. carbonaria* hive, it appears the bees have used this material to close a gap, Image: Tim Heard

I now doubt that Cadaghi is a serious threat to hives of stingless bees. Claims about resin melting do not seem to stand up to scrutiny. Giorgio Venturieri placed some cadagi hive structures in a container with adults of the stingless bee *T. carbonaria*. He placed it in a controlled temperature cabinet and slowly increased the temperature. At around 44°C, the bees died but the resin was still firm and showing no sign of collapse. At higher temperatures the resin melted. Note that the bees died before the resin melted. Beekeepers who open a hive after it has died observe dead bees and melted Cadaghi resin. They attribute the death to the resin, but it appears the heat may be a primary reason the colony died and the resin melted later. There also does not seem to be any evidence that the fumes of this resin harms colonies of stingless bees.

Whether or not this plant poses is threat to hive, it is certainly another fascinating aspect of the biology of these bees.

ABSTRACT
Designing food and habitat trees for urban koalas: tree height, foliage palatability and clonal propagation of *Eucalyptus kabiana*

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Highlights

- Koala populations are vulnerable because of habitat fragmentation and inbreeding.
- Urban planners and landowners often do not like to plant tall Eucalyptus trees.
- We have developed shorter koala-food Eucalyptus trees for planting in urban areas.
- *Eucalyptus kabiana* is short, palatable to koalas, and easy to propagate.
- *E. kabiana* trees are now planted in wildlife corridors, parks, schools and gardens.

Koalas are iconic Australian tree-dwelling marsupials that are classified as vulnerable because of threatening processes that include urban development, habitat fragmentation and inbreeding. Koalas eat the leaves of specific eucalypt trees but urban planners and landowners often prefer to plant smaller

trees that pose less risk from falling limbs. We have conducted a long-term project to develop shorter koala-food trees for planting in parklands, schools, streets and gardens. We identified a little-known and geographically-confined species, Eucalyptus kabiana, that had potential for urban plantings. We assessed the height of *E. kabiana* trees in cultivation, determined whether their foliage was palatable to koalas, and compared the amenability to vegetative propagation of *E. kabiana* with that of an extensively-propagated related species, *E. tereticornis*. Cultivated *E. kabiana* trees were short, reaching around 3–5 m height after 6 years. Their foliage was highly palatable to koalas, and their cuttings proved to be amenable to propagation. Average rooting percentages for *E. kabiana* cuttings were 31–46%, similar to values obtained with *E. tereticornis* cuttings. Over 600 *E. kabiana* trees have thus far been distributed for planting in wildlife corridors, parklands, schools and gardens. The planting of more koala-food trees will help to alleviate the risks of inbreeding faced by koala populations in fragmented urban landscapes. School plantings also provide opportunities for students to learn about and interact with organisms such as koalas that inhabit the Eucalyptus trees.

Species profile: *Eucalyptus kabiana*; Mt Beerwah Mallee

Source: *Euclid*

Description

A mallee to 5 m, rarely a small tree to 10 m tall. Forming a lignotuber.

Bark normally smooth throughout, white to light grey to pink; sometimes with short stocking of grey fibrous rough bark on the larger plants.

Juvenile growth (coppice or field seedlings to 50 cm): stem usually square in cross-section; juvenile leaves always petiolate, alternate, lanceolate to broadly lanceolate, 6–8 cm long, 2–3 cm wide, dull, grey-green.

Adult leaves alternate, petiole (1.1)1.3–2.5 cm long; blade narrowly lanceolate to lanceolate to falcate, 6–15 cm long, 1–2.3 cm wide, base tapering to petiole, concolorous, dull or glossy, green, side-veins normally greater than 45° to midrib, moderately reticulate, intramarginal vein present, oil glands mostly island.

Inflorescences (see photo) axillary unbranched, peduncles (0.5)0.7–1.4 cm long; buds 7, 9 or 11 per umbel, pedicellate (pedicels 0.3–0.5 cm long). Mature buds elongated-ovoid (0.9–1.2 cm long, 0.3–0.5 cm wide), the hypanthium short, green to creamy, scar present, operculum conical to horn-shaped (0.7–0.9 cm long), stamens erect, anthers cuboid to oblong, versatile, dorsifixed, dehiscing by longitudinal slits (non-confluent), style long, stigma tapered, locules 4, the placentae each with 6 vertical ovule rows. Flowers white.

Fruit (see photo) pedicellate (pedicels 0.3–0.4 cm long), hemispherical, 0.3 cm long, 0.5–0.7 cm wide, disc broad and steeply ascending, convex to oblique, valves 4 or 5, strongly exserted.

Seed usually black, 0.8–1 mm long, pyramidal or cuboid, edge with small teeth, hilum terminal.

Cultivated seedlings (measured at ca node 10): not grown at time of publication.

Notes A mallee presently known only from one locality just north of Brisbane in south-east Queensland, viz. Mt Beerwah in the Glasshouse Mountains. In the original description of this taxon, it was also reported to grow at Mt Coolum near Yaroombah Beach, just south of Coolum on the Sunshine Coast. All recent efforts to find *E. kabiana* on Mt Coolum have failed and it is now regarded as no longer growing there (fide Tony Bean). *E. kabiana* is usually found in low woodland or mallee-heath on the steep sides of the mountain. It is characterised by its mallee habit, its smooth bark, its long acute operculum, often swollen near the base, its hemispherical fruit with strongly exserted valves and its lanceolate juvenile leaves.

Eucalyptus kabiana belongs to the group of red gums which is distinguished by having buds with the stamens mostly erect, fruit where the disc is united to the ovary roof and by the black, toothed, cuboid to pyramidal single-coated seed. There are 15 species belonging to this group. They are *E. amplifolia, E. blakelyi, E. chloroclada, E. dealbata, E. dwyeri, E. flindersii, E. gilleniI, E. glaucina, E. infera, E. kabiana, E. nandewarica, E. nudicaulis, E. tereticornis, E. terrica and E. vicina*.

Within the series, *E. kabiana* is very close to *E. tereticornis* and can only be separated by its mallee habit (*E. tereticornis* is normally a large well formed tree) and its lanceolate juvenile leaves (ovate in *E. tereticornis*). With its mallee habit, its smooth bark, its pedicellate buds and its long narrow horn-shaped operculum, often swollen near the base, *E. kabiana* should not be confused with any other red gum.

Eucalyptus kabiana is listed as "Vulnerable" under the Australian Government Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Further information may be found at this web address: http://www.deh.gov.au/cgi-bin/sprat/public/sprat.pl

Flowering Time: Flowering has been recorded in October.

Origin of Name: *Eucalyptus kabiana*: commemorates the Kabi Aboriginal people, who originally inhabited the Glasshouse Mountains.

Occurrence: (see photo) Queensland: lower N slope of Mt Beerwah, 26° 54' S, 152° 53' E, K.D.Hill 1247, L.A.S.Johnson & A.Bean, 26 Aug 1984; holo: NSW; iso: BRI, CANB, MEL

In search of Australia's biggest tree: How you can help identify giant plants

By Tim Entwisle for Blueprint for Living

Source: http://www.abc.net.au/news/2017-08-05/search-for-australias-giants-where-is-our-biggest-tree/8766292

Photo: The title of world's tallest tree is highly disputed. (Flickr. com: liquidcrash, CC-BY-2.0)

Where is the biggest tree in Australia, and just how big is it?

That's what Derek McIntosh is hoping to find out through his aptly named National Register of Big Trees.

Mr McIntosh wants to locate and document all our largest trees, and he's calling on the public to help by nominating trees based on their circumference, height, and crown spread.

Those taking part might even discover the tallest tree in the world. The title is much disputed, particularly for historical specimens.

At least with a living tree you can measure its height and girth, but tales abound of giant trees that are no longer standing, and there is simmering debate about whether Australia or the United States holds the record for height.

Giants of North America

In 2005 the world's tallest measured living tree was a 112.7-metre-high coast redwood growing in Humboldt Redwoods National Park, California.

It is still considered the tallest — presumably plus or minus a metre or two now — and is a relative of the giant redwood, which grows just a few hundred kilometres to the north.

Photo: Trunk circumference is not the only thing being measured, but it's important. (Supplied: Tim Entwisle)

For the botanical record, the coast or Californian redwood (*Sequoia sempervirens*) and the giant redwood (*Sequoiadendron giganteum*) are each the only species in their genera.

Despite its name, the giant redwood doesn't grow quite as tall as the coast redwood, but it achieves more bulk — the volume of its trunk is the largest in the world.

The Montezuma cypress (*Taxodium mucronatum*) in Mexico actually has the largest girth at over 15 metres in diameter. The tallest tree in the Royal Botanic Gardens, Victoria, is one of these.

And even though both the redwood species frequently top 100 metres in height, the tallest conifer ever recorded was a 126-metre Douglas fir (*Pseudotsuga menziesii*).

Gums can grow tall too

All these record holders are what we call conifers; that is, they produce cones. Of course, flowering trees like our gums also grow very tall.

Although there are claims of mountain ash (*Eucalyptus regnans*) in southern Australia growing to over 120 metres, the tallest ever officially measured was 107 metres.

Today the tallest living known specimen is a 97-metre-high tree called Icarus Dream in the Styx Valley, Tasmania.

It's quite possible this tree will reach the 100 metre mark over the next few decades.

But no matter how long they live, we don't expect any tree — conifer or gum — to reach 130 metres.

The limit on their height comes down to a plumbing problem: how do you get water from the ground to a leaf fluttering 100 or so metres above?

The battle against gravity

Water is drawn up a tree — what we call transpiration — in a continuous column as it evaporates from leaves into the atmosphere.

A few years ago, scientists from Northern Arizona University climbed the world's tallest trees to measure their water potential and photosynthesis in the highest branches, and analysed leaves taken back to the laboratory.

They found that gravity starts to win out against water cohesion at around 110 metres.

Photo: Australia's gum trees can grow very tall: one has been measured at 107m. (Flickr.com: Alpha, CC-BY-2.0)

The leaves most distant from the base of a gigantic redwood are under extreme water stress, and their small size and low photosynthetic rates may be due to the plant closing some of its breathing pores, known as stomata.

This would not only retain precious water, but also slow down the rate of water transport through the plant, reducing the possibility of air bubbles being formed, which would mean death for a lofty limb.

They also found that to keep one of these big trees alive and transpiring healthily, the surrounding forest must remain intact, which maintains high moisture levels and buffers the trees against storm damage.

So if we want to see tall trees in Australia, we've got to look after the forests that surround them.

Recent droughts have put some of these big trees under additional stress, so doing what we can to reduce the severity and impact of climate change will also help our botanical giants survive.

A point system for the biggest and bulkiest

Mr McIntosh's citizen science project is an endeavour to get more Australians interested in and caring for our trees.

The idea came from a similar project he encountered in his time living in the US during the 1970s.

Though there are some lists of important trees in Australia already, he wants to tap into the excitement and competitive element that comes with trying to find the biggest of anything.

Contributors to his National Register of Big Trees use a points system originally used in the United States, which totals up the circumference of the trunk (in inches), the height (in feet) and the average crown spread (also in feet — although the register records both metric and imperial statistics).

Photo: If we want to see tall trees, we've got to look after the forests that surround them. (Flickr.com: Ryan, CC-BY-2.0)

The largest tree in the register is a mountain ash called Kermandie Queen, growing near Geeveston, Tasmania.

At 77 metres high, with a trunk that is 22 metres in circumference and a crown spreading some 25 metres, it scored a total of 1,125 points.

Brett Mifsud, the nominator of this mighty specimen, estimates it was 500 years old when he took the measurements in 2013.

Assuming we care for the forest around it, the Kermandie Queen has the potential to improve on all its vital measurements.

Who knows, it may even become the tallest tree in Australia, or even the world.

Eucalyptus forrestiana, Common name: Fuchsia Gum, Forrest's Mallee or Forrest's Marlock, A mallet endemic to Western Australia, of restricted subcoastal distribution north of Esperance extending from the Cascades area east to near Mt Ney and Mt Beaumont. (*Euclid*)

Source: http://melbournedaily.blogspot.com.au/2014/02/

Eucalyptus torquate Common name: Coral Gum. A small tree endemic to Western Australia, restricted to the central and southern goldfields, from Coolgardie to east of Kalgoorlie and south to Norseman (*Euclid*)

Source: http://www.pacifichorticulture.org/wp-content/uploads/2009/04/Ritter.09.torq_.jpg

Articles, requests and questions are needed
Please send all correspondence to my;
email address; tallowwood@hotmail.com
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