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Eucalyptus Study Group Newsletter

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How our native giants shrug off heatwaves

Sources: University of Western Sydney, University of Sydney[1], published: 12 November 2012

New research has unearthed an unknown resilience to extreme heat waves in tall trees, providing useful insights for catchment management.

In addition to obvious threats to trees from fire, scientists worldwide are concerned about trees and whole forests dying during increasingly frequent drought and heatwaves.

In a new study published in *Oecologia*, researchers recorded the effects of the 2009 Victorian heatwave – which brought temperatures of up to 49°C – from within Mountain Ash forest at Britannia Creek, near Warburton.

Results show that the forest giants survived due to their incredible ability to store, use and refill water in their stems.

'Current theory would suggest that many Mountain Ash trees that were not affected by the fires should have died of severe water stress on Black Saturday, but they did not,' says co-author Dr Sebastian Pfautsch from the University of Western Sydney.

[1] http://www.ecosmagazine.com/paper/EC12480.htm

‘The remarkable ability of this species to grow quickly and reach tremendous heights, yet survive extreme droughts and heatwaves, is very heartening as we enter a period of history which is predicted to see increasing numbers of extreme weather events.

‘There’s been much concern [that] Australia’s tall trees could succumb to higher temperatures and less rainfall, but our study shows they’re far more resilient than expected,’ says Dr Pfautsch.

‘This research is a key step in predicting how they will respond and their capacity to support the ecosystem through services such as carbon sequestration and water yield.’

The ability to survive owes much to the capacity of the trees to use stored water that will be mobilized when water in the soil becomes limiting. This feature is emphasized by the researchers’ recording of substantial water uptake by the trees at night.

‘Wood of these remarkable trees can act like a sponge, being squeezed dry during the day and recharged during the night,’ explains Dr Pfautsch.

It had been widely assumed that water uptake at night was a minor process, but the researchers found that the Mountain Ash trees ‘recharged’ their internal storage at night at rates of up to 30 percent of daytime levels.

Dr Pfautsch’s co-investigator, Professor Mark Adams from the University of Sydney, says that water use by Mountain Ash is critical to determining water yield for the City of Melbourne.

‘Understanding how and how much the trees use water under extreme conditions, and understanding how extreme conditions affect the trees, is therefore vital to future catchment management.’

But more research is needed to ensure we fully understand the complex ecosystems of our forests. ‘Many questions remain before we can accurately predict their future in a warming world,’ Dr Pfautsch says.

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Abstract
Consequences of *Corymbia* (Myrtaceae) hybridisation on leaf-oil profiles

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The present study examines patterns of heritability of plant secondary metabolites following hybridisation among three genetically homogeneous taxa of spotted gum (*Corymbia henryi* (S.T.Blake) K.D.Hill & L.A.S.Johnson, *C. citriodora* subsp. *variegata* (F.Muell.) K.D.Hill & L.A.S.Johnson and *C. citriodora* (Hook.) K.D.Hill & L.A.S.Johnson subsp. *citriodora* (section *Maculatae*), and their congener *C. torelliana* (F.Muell.) K.D. Hill & L.A.S.Johnson (section *Torellianae*)). Hexane extracts of leaves of all four parent taxa were statistically distinguishable (ANOSIM: *global* $R = 0.976$, $P = 0.008$). Hybridisation patterns varied among the taxa studied, with the hybrid formed with *C. citriodora* subsp. *variegata* showing an intermediate extractive profile between its parents, whereas the profiles of the other two hybrids were dominated by that of *C. torelliana*. These different patterns in plant secondary-metabolite inheritance may have implications for a range of plant–insect interactions.

Retirees find link between ‘bush graffiti’ and Gondwana

By Chris McKay[2] Published: 28 November 2012

A team of retired scientists working at CSIRO has completed a remarkable investigation into the iconic ‘scribbles’ found on smooth-barked eucalypts throughout southeastern Australia. Their work took them deep into the little known world of Australia’s scribbly gum moths.

Nutritious tree cells consumed by *Ogmograptis racemosa* scribbly gum caterpillars in the final stage of their ‘scribbling’ allow them to rapidly mature and turn into the adult moth seen here. Scientists have just recently linked this species to scribble tracks on gum trees.
Credit: Natalie Barnett, CSIRO

The distinctive ‘scribbles’ on scribbly gum eucalypts have long been an Australian icon. They inspired Australian poet Judith Wright’s 1955 poem ‘Scribbly-Gum’, and May Gibbs made them a feature of her classic series of children’s books, *Snugglepot and Cuddlepie*.

But, for as long as they’ve been iconic, they’ve also been an enigma. The scribbles were first thought to be caused by beetle larvae and, although an English school teacher discovered in 1934 that moth larvae were the real culprits, the misconception has endured.

Now, new research facilitated by CSIRO – involving a collaboration between some of Australia’s most respected entomologists – has finally verified the identity of these ‘bush graffiti’ artists.

The respected entomologists are former CSIRO scientists, well into their retirement but able to continue pursuing the science they love through CSIRO’s Honorary Fellowship program.

Marianne Horak, Ted Edwards AM (Member of the Order of Australia) and 96-year-old Max Day AO (Officer of the Order of Australia) donate their time and passion for insects at CSIRO’s Australian National Insect Collection in Canberra. Another team member, Celia Barlow, on whose property much of the work was done, added the botanical knowledge.

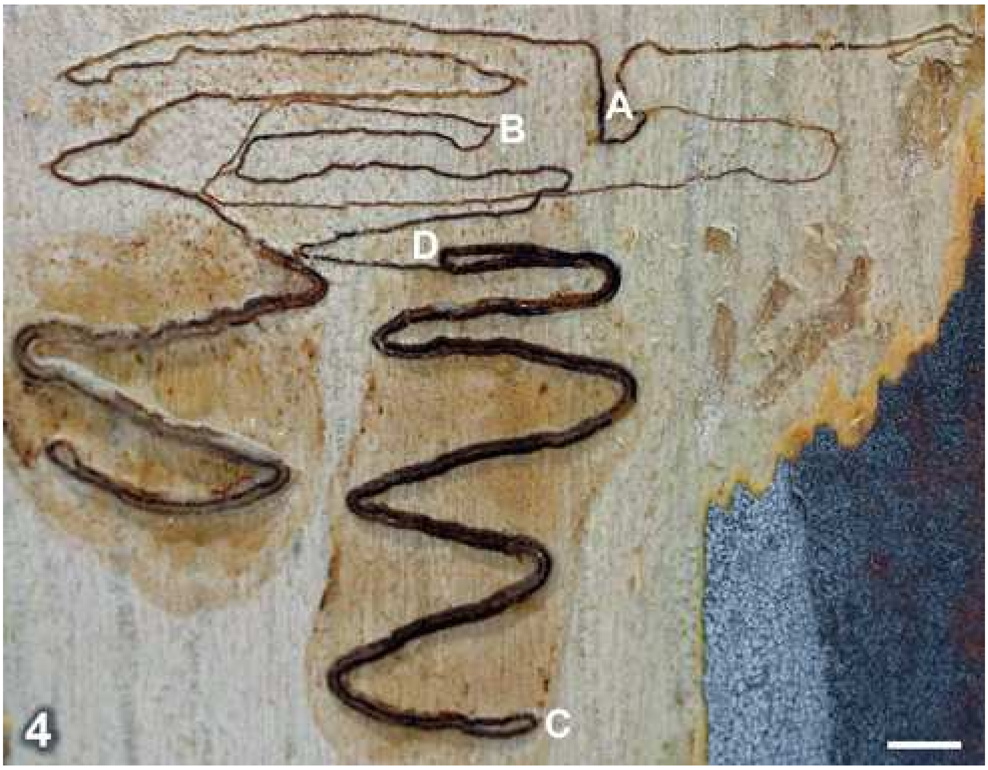
The researchers began the detective work after schoolgirl, Julia Cooke – with the help of Ted Edwards – discovered different and unique ‘dialects’ present in different scribbles, indicating that a range of species was likely to be responsible. Julia and Ted published their work in 2007.[1]

To find out more about the scribble ‘dialects’, the researchers conducted detailed studies into the biology and systematics of the scribbly gum moths. Collaborating researchers at CSIRO and Queensland University of Technology provided DNA and carried out microscopic analyses to help confirm the findings.

[2] C/- http://www.ecosmagazine.com/paper/EC12497.htm

What the team discovered was remarkable. Eleven new species of moths have been described, several of which turned out to be behind the scribbles, in addition to the original species of scribbly gum moth described in 1934 – *Ogmograptis scribula*. The new species that do not appear to make 'scribbles' on smooth-barked eucalypts are thought to feed hidden in rough-barked eucalypts and are therefore not as visible.[2]

The team also pieced together the mechanism by which the moth larvae make the distinctive scribbles and in the process have uncovered a unique ecological interaction that occurs between tree and moth (see the image and caption below).

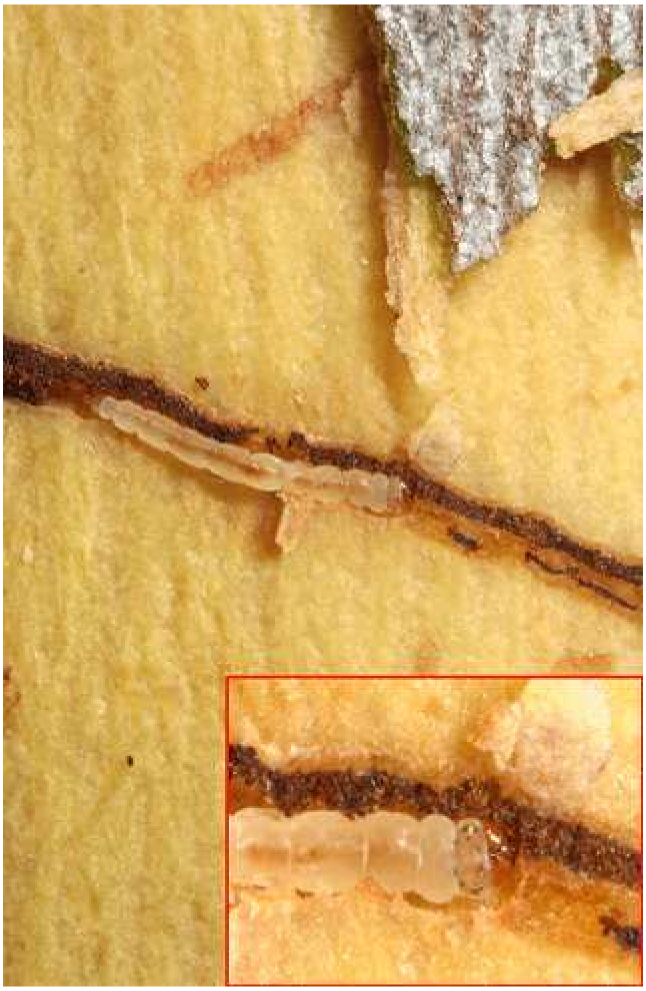


The life cycle of scribbly gum moths can be seen in their tracks. **Point A**: Larva chews through underside of egg and through outer bark to reach the bark layer where the future cork cambium will form. There it turns to bore along this layer, possibly moulting to its 2nd life stage. **Track A–B**: Track is narrow, irregular, often meandering and occasionally crossing itself. Larva feeds on bark tissue, apparently moulting to its next stage part-way between A and B. **Point B:** Beginning of series of regular track zig-zags; larva moults near point B. **Track B–C**: First pass of doubled zig-zags which don't cross each other; larva feeds on bark tissue. **Point C**: First turning loop of doubled track. **Track C–D**: Return track of doubled zig-zags, either closely parallel in separate track (*O. scribula*) or joining and enlarging initial track (*O. racemosa*); larva feeds on bark tissue. **Point D**: Second turning loop; larva (after turning) moults at point D to its final stage and now has legs. **Track D–E**: Larva returns along the way it came towards point C along the doubled track. It now feeds on the highly nutritious callus tissue that has filled the track, as well as the incorporated frass from the earlier passage(s). **Point E**: Emergence hole where mature larva bores to the surface somewhere between points D and C (not visible after outer bark has abscised). The caterpillar spins a cocoon at the base of the tree and turns into a moth. (Adapted from Horak *et al.* 2012)[3]

Not only has this team described eleven new species and solved the mystery of how the scribbles are made, but they have also helped redraw the moth family tree.

The researchers have expanded the *Ogmograptis* genus, to which the scribbly gum moths belong, from three species to fourteen named species – with many more known to exist but with too little material for a description – and have confirmed that it belongs to the enigmatic family Bucculatricidae.

This work, for the first time, links *Ogmograptis* to the Australian *Tritymba*, whose larvae make the so-called 'ghost scribbles' on eucalypts, and the African *Leucoedemia*. It also indicates all three genera have a common ancestor from Gondwana.



Caught in the act: one of the graffiti artists has been revealed for the first time by CSIRO scientists as *Ogmograptis racemosa*, seen here in its mature caterpillar form.
Credit: You Ning Su, CSIRO

'Discovering that there are at least fourteen species of moths associated with the scribbles was certainly an exciting find,' said Dr Marianne Horak, lead author on the paper that was published in *Invertebrate Systematics*.

'We also found these moths have a link with the ancient supercontinent Gondwana.'

With any luck, this wonderful tale of discovery will inspire the next generation of scientists to pick up where this team has left off.

'This study of an apparently well-known phenomenon like the eucalypt "scribbles" demonstrates just how much there is yet to discover about the insect life in this country,' said Dr Horak.

'I'd love to see some younger scientists come along and make the next big discovery.'

[1] Cooke J and Edwards T (2007) The behaviour of scribbly gum moth larvae *Ogmograptis* sp. *Meyrick* (Lepidoptera: Bucculatricidae) in the ACT. *Australian Journal of Entomology*, 46: 269–275. doi: 10.1111/j.1440-6055.2007.00606.x
[2] Whitten M (2012) Deciphering nature's message stick. *Meanjin*, 71, 30-38.
[3] Horak M, Day MF, Barlow C, Edwards ED, Su YN and Cameron SL (2012) Systematics and biology of the iconic Australian scribbly gum moths *Ogmograptis Meyrick* (Lepidoptera : Bucculatricidae) and their unique insect–plant interaction. *Inverterbrate Systematics*, Volume 26 (4)

Eucalypt genome to be sequenced

Source: Stephen Pincock; ABC, 5 July 2007

An international project to decode the eucalyptus genome could one day lead to new methods for producing biofuels and help predict how gum trees will respond to climate change, scientists say.

Researchers from institutions in the US, South Africa, Brazil and Australia say they are going to sequence the genome of the species *Eucalyptus grandis*, commonly known as the flood, flooded or rose gum.

The Eucalyptus Genome Network hopes to make the results publicly available online.

Hidden within the tree's DNA sequence will be genes that govern its growth and development, says Australian researcher Associate Professor René Vaillancourt from the University of Tasmania.

Understanding those genes could eventually allow scientists to breed new varieties that yield more pulp for paper making, or produce high levels of ethanol as an alternative to fossil fuels.

These applications are likely to be years away. But the possibilities are exciting, says Vaillancourt.

"It's a tremendous tool," he says. "Having the genome sequence will allow us to do all kinds of research."

US scientists, for example, are particularly interested in finding ways to make eucalypts more cold-resistant, so they could be grown in the US for producing biofuels.

In Brazil, home to the world's biggest eucalyptus plantations, researchers also hope to be able to increase the ability of the species to remove carbon dioxide for the atmosphere to combat climate change.

Vaillancourt would like to understand better the drought- and salt-tolerance of eucalyptus species.

"Climate change is happening so fast," he says. "The genome sequence will allow us to predict how they will adapt."

Major funding for the project comes from the US government. Private companies are also providing genetic data that will help make sense of the genome sequence.

There are more than 700 eucalypt species worldwide, almost all of which have their origins in Australia, says Professor Brad Potts from the University of Tasmania.

Since the 1900s, they have been introduced into many countries worldwide and he says they're now grown on virtually every continent.

So far, only one other tree species has been genetically sequenced.

The black cottonwood, an American hardwood species, had its genome published in the journal *Science* last year.

Unusual eucalypt a genetic engineering pioneer

By Bob Beale - ABC Science Online; Thursday, 12 December 2002

Eucalyptus occidentalis: a candidate for genetic engineering

New genetically engineered species of eucalyptus trees that produce better wood fibre and grow faster - but are less attractive to native animals - are on the drawing boards for Australian forestry plantations, researchers said.

Dr Simon Southerton of CSIRO Forestry and Forest Products, a specialist division of the Commonwealth Scientific & Industrial Research Organisation, said the new trees would be based on an unusual early-flowering eucalyptus species from Western Australia.

Known as *Eucalyptus occidentalis*, it was selected as a potential workhorse for genetic engineering after screening 11 families of eucalypts species from around the country.

CSIRO scientists hope to use the tree to develop new gum tree species with desirable traits - such as superior wood fibres, the ability to grow rapidly and a resistance to insects and herbicide - for the nation's rapidly expanding native forest plantations.

The plant, also known as flat-topped yate, is native to the south-west of Western Australia. As with most forest trees, gums often take years to form their first flowers and seeds. Selective breeding of the best strains for forestry has been hampered by long breeding cycles.

But if the flat-topped yate is given optimum light, temperature and nutrients, its flowers start to form within just 13 weeks of germination, the researchers found. By about seven months, its floral buds have matured and begun opening.

Such rapid maturation could drastically shorten the time needed to learn whether a desired gene modification will be passed on to a tree's progeny.

Research into transgenic gums is still at early stages and such trees in Australia can only be grown in special containment glasshouses approved by the Office of the Gene Technology Regulator, a federal statutory authority.

CSIRO scientists have so far achieved successful single-gene transfers into eucalypts using a special 'reporter gene' that lets them confirm the newly inserted transgene is active.

The transfers were achieved by piggybacking the reporter gene into *E. occidentalis* utilising the crown gall bacterium, commonly used in laboratories globally to add new genes material to plants.

Southerton said some transgenic gums may need to be rendered sterile, to prevent their transgenes from escaping into native forests and causing potential and unforeseen ecological disruption. The obvious way of doing this is to insert genes that prevent flowering, stopping transgenic plantation gums from cross-pollinating with trees in the wild.

Genes that control flowering in eucalypts have been isolated, and work is under way to try to engineer sterile trees by disrupting them. The flat-topped yate will play an important role in this research: "It means we will be able to test very quickly whether the sterility genes are working," said Southerton, who is working with John Watson at CSIRO Plant Industry on the project.

Because eucalypts invest large amounts of energy in flowering and producing nectar and pollen, sterile trees would probably divert the saved energy into growing more wood.

Non-flowering plantations would be less attractive to native mammals, birds and insects that feed on nectar and pollen, potentially reducing the toll on these species when the plantations are logged, the researchers believe.

Other genes could be added to deter defoliating pests like Christmas beetles, sawfly larvae and other insects, which reduce tree vigour and productivity.

Scientists in Brazil - which has the world's largest eucalypt plantations - are also working to develop transgenic gums using a tropical hybrid of *E. grandis* and *E. urophylla*, widely used in reforestation programs in South America.

The first transgenic plant to express a foreign gene was tobacco in 1983. Since then, more than 90 different species have been genetically modified, including forest trees such as poplar and walnut.

Abstract
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R. Andrew Hayes [A D], Helen F. Nahrung [A B] and David J. Lee [B C]

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Additional keywords: eucalypt, foliar chemistry, gas chromatography–mass spectrometry.

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BOOK: Atlas of Leaf Venation and Oil Gland Patterns in the Eucalypts

Authors: Ian Brooker — Plant Industry, CSIRO
Dean Nicolle — Currency Creek Arboretum

Atlas of Leaf Venation and Oil Gland Patterns in the Eucalypts is an aid to the identification of eucalypts in the field and a confirmation of the natural affinities between species and higher-level taxa on the basis of their comparative morphology. Its purpose is to standardise leaf venation and oil gland terminology and to demonstrate the taxonomic value of leaf venation and oil gland patterns within the eucalypts.

The work discusses the visible features of the adult leaves of eucalypts as seen with reflected and transmitted light. Because venation and oil glands become obscure in dried specimens this work relies entirely on the comprehensive sampling and observation of fresh leaves.

High quality, scaled, leaf venation images of vouchered specimens are used to compare all taxonomic groups in the eucalypts. All genera, sections, series and subseries are represented.

Published, June 2013
Book orders are available via the following link- http://www.publish.csiro.au/nid/18/pid/7083.]

Eucalyptus Facebook Page

By Phil Hempill

Phil Hempill has set up a community Facebook site for anyone that wishes to post photos, comments, questions etc. on Eucalyptus trees. Surprisingly, the site is called ***Eucalyptus Trees***. However to get the site more visible, it needs more “likes” and content, so please feel free to visit this site and add any comments, enquiries or photos of Eucalypts that you like to share.

The site link is listed below.

http://www.facebook.com/pages/Eucalyptus-Trees/124249007754284?ref=hl

Urgent attention members
Vacancy required to be filled

Our membership officer, Sue Guymer is retiring from this position. Sue has provided a wonderful job in this roll over the years, initially standing in temporarily. Sue has always been relentlessly punctual in providing feedback and registration of membership, and tending to the financial records. As well as providing advice to me with the group based upon her long standing experience within the Australian Plants Society and study groups. You have been the backbone of this group, and will be certainly missed. I appreciate your assistance and your time with running the Eucalyptus Study Group, and hope to catch up with you at future APS events.

Could any members interested in filling the position of the 'membership officer' please contact either Warwick or Sue. This position will be required to be filled so that the group can continue functioning.

On another note……….

Articles, requests and questions are ~~most welcomed (actually they are~~ wanted).
Please send all correspondence to my;
email address; tallowwood@hotmail.com
or postal; PO Box 456, WOLLONGONG 2520

Membership

New members wishing to subscribe to the *Eucalyptus Study Group*, please fill out the following application and forward to Sue Guymer at;
Email: aitchguy@gmail.com
Postal: No. 13 Conos Court, DONVALE, VICTORIA. 3111

Annual membership costs are;

- $A 10 per year national members, newsletter mailed (black and white).
- $A 20 per year international members, newsletter mailed (black and white).
- $A 5 per year, national and international, newsletter emailed, full colour PDF.

All subscriptions can be mailed via a cheque (made out to the *Eucalyptus Study Group*) or payment made via direct deposit into the account listed below. For payments made via direct deposit, please add your name as reference.

Post address; Eucalyptus Study Group c/- 13 Conos Court, DONVALE, VICTORIA 3111

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Account name: **ASAGP Euc. Study Group**

Application for membership to the *Eucalyptus Study Group*

Date: ....

Name:..

Postal address: .... Post code..........

Contact Phone number:....................................

Email: ....

Payment method: Cheque ☐ Direct Deposit ☐