Anti-feed chemicals may provide new mallee benefits

ABOVE: Concentrations of sideroxylonal are strongly correlated both phenotypically and genetically. (Photo: W Foley)

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JVAP

Most of us see the wood and the leaves. But if you were an insect or possum looking at York Gum (*Eucalyptus loxophleba* spp *lissophloia*) leaves you might also detect sideroxylonal, a bioactive leaf compound. And chances are that you won't eat many of those leaves.

Sideroxylonal is a formylated phloroglucinol – is a group of chemicals that deters feeding on eucalypts by mammals and some insects – it promotes nausea in feeding mammals; serving as a highly effective antifeedant.

Aside from their properties as antifeedants, these compounds have many other activities including antibacterial agents, antifouling agents and as inhibitors of enzymes involved in disease. However to date they have been available only in small quantities and so cannot be widely tested for biomedical and industrial uses.

The FFI CRC's *FloraSearch* project recognised the potential economic importance of sideroxylonal as a co-product of the large volume biomass feedstocks from the oil mallee industry.

A neat fit with Eucalyptus oil

Research by Professor Bill Foley at the Australian National University (ANU), has found that York Gum has extraordinarily high concentrations of sideroxylonals, up to 15 per cent of the dry weight of the leaf, making it an ideal target for work to extract large amounts of the compound for testing and market evaluation.

Furthermore, Professor Foley has found that concentrations of sideroxylonal and 1,8 cineole (Eucalyptus oil) are strongly correlated both phenotypically and genetically (see Figure 1). So selection aimed at improving the concentration and yield of cineole in oil mallee plantations, will coincidentally select for greater concentrations of sideroxylonals as well – a classic win-win situation.

"Before sideroxylonal can become a product, we need a cheap and environmentally benign method to extract it," Professor Foley said.

"We need a procedure that can be part of the integrated wood processing system planned for the oil mallee industry in WA.

"Most methods for extracting natural products from plant tissue rely on hazardous and flammable organic solvents, such as methanol, petroleum spirit and acetone. An increasing awareness of the environmental problems associated with organic waste, together with the industrial need for cleaner processes, has highlighted the need for research and development into alternative 'green' processing and synthesis methods.

"In our work, 'green' extraction methods showed considerable promise but overall yields were low.

"A hot water method compatible with the industrial processing currently envisaged in WA also produced large amounts of unwanted material."

The ANU team extracted large quantities of pure (95 per cent) sideroxylonal using organic solvents and work is underway to find a more benign extraction processes.

Another card in the oil mallee hand

The viability of low rainfall forestry hinges on utilising all of the resulting biomass, therefore targeting multiple products from an individual enterprise. The opportunity to exploit non-wood products and specifically the natural plant chemicals is an important part of this strategy.

The attributes of York Gum – high yields of sideroxylonal and the close genetic relationship with cineole – have resulted in this species being elevated in ranking as a *FloraSearch* development species.

So far research has not revealed new biological activities for sideroxylon. But the compounds are now available for testing in different scenarios, and given the large biomass of York Gums being planted in WA there is now a prospect that industrial uses will follow.

"Adding value to individual agroforestry enterprises is the best way to encourage their development with the added benefits of salinity control, fixing of CO_2 and possible benefits for biodiversity," Professor Foley said.

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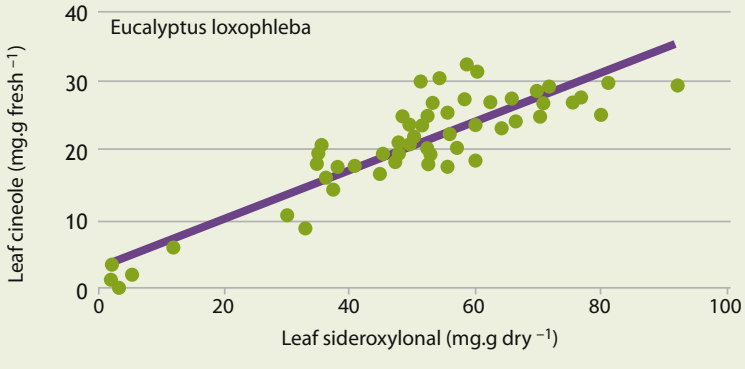
FIGURE 1. Relationship between the observed foliar sideroxylonal and predicted values based on 1,8 cineole concentrations.



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