

# Trees under attack!

Foresters and scientists are going to have to box clever to keep our trees healthy in the face of a rising tide of pests and pathogens entering our country via the booming global trade in live plants. Then there is the ability of pests and pathogens to host jump, to evolve and adapt to resistant hosts and re-infect them ...

The 26th annual meeting of the Tree Protection Co-operative Programme and the DST/NRF Centre of Excellence in Tree Health Biotechnology, was held at the University of Pretoria in May. Once again the meeting was characterized by some excellent presentations on the latest pests and diseases to arrive in Southern Africa, as well as some familiar old foes which have resurfaced with a vengeance. As always there was a lot of robust discussion among delegates, which included top tree health practitioners and researchers from around the world.

Programme Director Mike Wingfield set the tone when he said that 'resilience' is required for the forestry sector to survive the growing number of pests and diseases arriving on our shores.

"My view is that for plantations such as those that define forestry in South Africa, resilience against the growing number of pest problems that challenge us cannot lie in for example planting mixed species or clones. Indeed the trend is quite the opposite and rather towards intensive management of highly uniform genetic material. Thus resilience must lie in the availability of genetic diversity in order to offset the ravages of pests."

Another crucial layer of resilience lies in the long term sustainability of the 'human capital' needed to provide forestry with solutions to pest and disease problems. The TPCP has over the past 26 years developed a highly motivated and capable team to do just that. The TPCP team is backed up by a growing number of MSc and PhD students, as well as a network of collaborators around the world.

Finally, resilience requires the capacity to develop and deploy biological control agents for non-native invasive insect pests, which is the function of the FABI facility at the university. A number of highly effective biocontrol agents have been successfully bred at this facility and introduced into the field to counter threats from a number of invasive pests. Expansion of this facility is in the pipeline with funds contributed by Sappi, FSA and the Sector Innovation Fund of the Department of Science and Technology.

Mike also emphasized that the rapid increase in movement of plant material around the world means that keeping track of destructive pests and diseases entering the country is becoming more difficult – and unpredictable.

For instance, *Gonipterus*, the Eucalyptus snout beetle, was thought to be pretty much under control in South Africa, but has suddenly re-emerged as a destructive pest, said Mike.

The Acacia rust has "come out of the blue", and there are more surprises to come, he assured delegates.

Internationally, there have been a number of nasty surprises over the past few years. For instance, nobody could predict that *Pinus radiata* would be taken out of existence in Chile, caused by *Phytophthora pinifolia*, a serious needle blight disease. Strangely, this fungus has also been found in the gut of people who live in the Amazon jungle.

Other examples include the destruction caused by ambrosia beetles in the USA. The beetles make tunnels inside the wood of host trees and farm fungi which they carry with them. There are some 3 500 species and they each carry very specific fungi.

These beetles have wiped our Redbay trees across the US, and damaged avocado trees in Florida to such an extent that it may mean the end of the avocado industry there.

Jiri Hulcr from the University of Florida said that they have found surviving Redbay trees that have some resistance to the beetle attack, which they will use to 'resurrect' the species.

The beetles are super-efficient breeders and are capable of unleashing a wave of new tree disease epidemics across the world. Mike Wingfield concluded: "Ambrosia beetles are to be feared!"

## Sirex Control Programme

On-going work at FABI involves the selection and mass production of nematodes which are inoculated into vulnerable pines as part of a highly successful *Sirex noctilio* bio-control programme. Since 2007 some 150 000 trees have been inoculated with 13.9 billion nematodes that have been bred at FABI.

The good news, according to Bernard Slippers of the TPCP, is that the number of wasps recorded per log has been dropping steadily since the biocontrol was introduced.

He said efforts were being concentrated on getting more nematode genetic diversity, looking into the environmental factors influencing *Sirex* behaviour (in collaboration with the Canadian Forest Service), and looking at the wasp's genomics to understand the genes controlling sex determination.



TPCP Director Mike Wingfield had a novel way of announcing the start of each session during the annual TPCP meeting at the University of Pretoria. This Buddhist Gong originating from the Kingdom of Bhutan was presented by Anthony Wingfield in May 2014 to celebrate the TPCP's 25th anniversary.

## Natural tree under attack

The jury is still out on the causes of the massive die-off of *Euphorbia ingens*, a natural tree species, in Limpopo, Mpumalanga and KZN, that has been spreading since 2006. FABI researchers have found six insect species and nine fungi present in dying trees. They're also looking at climate change and changes in land management practices that could be triggering the die-off.

Johan van der Linde said that diseases and die-offs are associated with the more degraded savannah landscapes, e.g. from over-stocking and bush encroachment.

## Pitch canker and grass

Darryl Heron is doing research to determine the importance of grasses as a reservoir of *F. circinatum*. What causes this pathogen to spread from nurseries to plantations around the country has puzzled scientists since it was first reported in nurseries in the Western Cape in 1990.

Darryl said that the pathogen has been found on grasses in W. Cape and Limpopo, which indicates that the non-native pathogen has host jumped onto native grasses.

"Grass is everywhere, and it could be facilitating repeated infections," he said.

## Bio control introductions

Brett Hurley provided info on the biocontrol programmed for two destructive pests of eucalypts.

The bio-control agent for *Thaumastocoris* (the bronze bug that attacks Eucalyptus species) is the parasitoid wasp *C. noackae*, which has been released at 53 sites around the country. Brett says it is establishing itself in-field and 20-80% parasitism levels have been detected.

*S. nesei*, the bio-control agent for the gall forming wasp *Leptocybe invasa*, has been released at 509 sites around the country. The presence of this tiny wasp has been confirmed at 90% of the release sites so the TPC team is confident that it has established itself and is spreading.

On-going monitoring will hopefully confirm that the damage caused by *Leptocybe* is on the wane as the bio-control population increases.

### Gonipterus back for more

There has been a resurgence of damage to Eucalyptus species in South Africa and Brazil from the *Gonipterus* snout beetle. The TPCP team is trying to find out why. Jeff Garnas says that they now know that there are several *Gonipterus* species present in the country, and they are focusing on developing different species of the bio-control that will be more effective in controlling this pest.

### Glycaspis brimblecombei

This small sap-sucking insect causes damage to Eucalyptus species and is spreading in SA. It causes drooping leaves, drying of leading shoots, and heavy infestations can defoliate and kill trees.

Samantha Bush says that progress is being made in developing a bio-control agent for this pest.

### Breeding resistance to Wattle Rust

Julian Chan of the ICFR said work has been going on since the rust first appeared in SA in 2012 on selecting black wattle for resistance to the rust, which affects trees of all ages. Damage is greatest in trees from 0-3 years.

The rust has a negative impact on timber and bark yields, and is also affecting the seed pods.

It has been noted that trees infected with the rust do recover, but re-infection can occur. Another curious observation is that groups or rows of trees show rust symptoms or no-rust symptoms – is this a result of spore dispersal?

Julian said that it's important to find families tolerant to the rust within genetic groups which have been improved for traits of economic importance, otherwise the gains made by tree breeding over many years will be lost.

### European Root Rot *Armillaria mellea*

This pathogen was first discovered in the oak trees in the Company gardens in Cape Town in 1996. It was probably introduced with fruit trees brought from Europe into the Cape Town gardens in the 1600s to provide fresh fruit for the sailing ships calling at Cape Town.

Dr Martin Coetzee said that they thought it would be impossible for this pathogen to spread further because it was surrounded by city.

However the same pathogen was discovered killing proteas and other plants in Kirstenbosch Gardens in 2000, and in 2012 it was found in an indigenous tree



The meeting was well attended by scientists and foresters from around the world.



Jolanda Roux of TPCP (left) and Diana Six, Professor of Forest Entomology/Pathology at the University of Montana.



Dr ShuaiFei Chen (China Eucalypt Research Centre – CERC), Felix Fru (PhD student) and Gabrielle Carstensen (PhD student).



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in Table Mountain National Park.

He said that the pathogen is spread from root-to-root, and also by spores produced by the mushrooms that are dispersed by wind and infect wounded trees.

Martin said that the pathogen is a big threat to many indigenous tree species in South Africa, and could also affect commercial plantation trees anywhere in the country.

### Cut worm and white grubs beware

Birhan Abate discussed the potential of using Entomopathogenic Parasitic Nematodes (EPNs) found in soil for biological control of insect pests like white grubs and cutworm. This would reduce the need to use chemicals to control these pests.

These nematodes are present in soil and are symbiotically associated with bacteria which they carry in their intestines.

Juveniles enter the host insect from the soil, releasing the bacteria which kills the host insect. New nematodes grow in the insect cadaver, re-enter the soil and look for new hosts.

The Fabi team has collected soil samples and identified four species of EPNs, three of which are new species never identified before.

### Threats to introduced and native trees growing

Jolanda Roux said that the threats to native and introduced tree species is increasing all the time because:-

- The global trade in live plants continues to bring new pests and pathogens into the country, as well as more virulent genotypes of those already here.
- Native pests and pathogens have the ability to adapt to introduced commercial tree species, especially as these trees are in the country for longer.
- Pests and pathogens already here are able to adapt to resistant hosts over time and to re-infect those hosts.

A good example is the Myrtle rust *Puccinia psidii* which is considered to be the biggest threat to ecosystem extinctions in Australia.

The rust was originally found in South America where it was killing Eucalyptus trees. In 2013 it was reported from the South Coast of KZN, and since then has been discovered in Tzaneen and Gauteng.

Jolanda says it has been found on several native and non native hosts, but so far has not been found on Eucalyptus trees.

The pitch canker disease *F. circinatum* has recently been found on *P. gregii* in the Karkloof area.

She said that five genotypes of *F. circinatum* have been found which have not previously been reported in South Africa. The pathogen has the potential to cause a lot of damage and is a big concern for the TPCP team.

Then there is the threat to Eucalyptus species from the shell lerp psyllid (*S. plicatuloides*), which was recently found in South Africa. This is the first report of the insect outside of its native range in Australia.

Another insect pest recently discovered in South Africa is the Eucalyptus gall wasp *O. maskelli*.

Jolanda said that live plant imports is the major pathway for forest pests and pathogens, and that scientists and foresters would have to be vigilant to control the impacts on their commercial crops. ■

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**The global trade in live plants continues to bring new pests and pathogens into the country – Jolanda Roux.**



Mike Wingfield in discussion with Colin Dyer, head of the ICFR.



Ian Horrell of Sappi (centre) with Brenda Wingfield (right) of Fabi and Andrew Morris of ICFR.



Mark Barnardo of Sappi (left) and Clement Thabethe of Komatiland Forests.



Mike Wingfield hands over the 'beerslug' floating trophy to this year's winner, Kitt Payne of Mondi. The beerslug is a unique manoeuvre which involves balancing a full glass of beer on your head and then transferring it onto the ground without using your hands – and without spilling a drop. It requires flexibility, concentration and control!