FORESTRY SOUTH AFRICA
PESTS & DISEASES

FORESTRY SOUTH AFRICA™

ANNUAL REPORT 2021

2021

Forestry South Africa Pests and Diseases Annual Report 2021

FOREWORD

Our Industry remains fortunate to have world-class research capacity to support our sector. This, along with the dedicated contribution of our members, both in-house and in the various FSA structures, continues to ensure our Sector is well placed to address the continued threat posed by pests and diseases. With a significant reduction in public funding dedicated to forest protection over the last two years, we need acknowledge our members for their continued financial investment into forest protection. This has enabled the continuation of all protection platforms and consortiums and very importantly, it has ensured the continuation of some form of *Sirex* control.

Although public funding remains constrained, with Government funding commitments for the last three years still not honoured, we have at least seen some positive progress brought about by our Sector's inclusion in the Public Private Growth Initiative as well as the implementation of the Forestry Sector Masterplan. Both these initiatives have seen renewed pressure placed on officials to honour Government's commitments. All indications are that the Memorandum of Understanding between FSA and the Department of Forestry, Fisheries and the Environment (DFFE) should be signed before the end of the first Quarter of 2022 which will result in R 9 million public funding dedicated to forest protection. Even though the finalisation of this MoU is well overdue, the finalisation of this four-year process will impact immensely on the Sector's ability to address the growing threat of pests and diseases.

With regards to the volumes reported by our members, the year got off to a good start. The first six months of 2021 saw reported timber volumes on par with 2018 and annual volumes comparable to those of pre-COVID-19 were predicted. Unfortunately, no one could have forecast the insurrection or the devastating impact it had on our sector, which is clearly illustrated by the drop in timber volumes during July and August. Thankfully, our sector recovered well in the following months, and we now expect the total annual tonnage for FSA members to be between 13.2 and 13.4 million tons, which on the back of the ongoing Covid-19 challenges and additional failed insurrection pressures, is quite an achievement. This is also the first year we will experience a year-on-year increase of volumes over the last 8 years. I am of the opinion this is due to our Sector's resilience and collaborative model we apply. This is nowhere as prominent as with our efforts to address pest and diseases.

We still face significant uncertainty regarding the continued impact of the pandemic, with challenging times laying ahead. As a result, we will need to be more adaptive and resilient in our approach to manage the threat posed by pests and diseases. The establishment of the FSA Climate Modelling Platform to compliment the excellent pest and disease work we are doing is one such an example. The Industry's collective and multi-disciplinary approach, on which we have relied so much, will be increasingly important for us to weather future challenges.

I would like to thank all our members, partners, committee and working group participants for your commitment and contribution towards supporting our Sector in South Africa. Through our collective efforts, we are actively contributing to reducing the impact of pests and diseases.

Dr Ronald Heath
FSA Director: Research and Protection

New Pest and Disease Threats

Dr Ronald Heath

For the first time in a while, we unfortunately report the confirmation of four new pests. These are :

Phytophthora insolita

Phytophthora insolita was identified from samples submitted to the TPCP from a nursery. The identification was based on sequence data and confirmed with phylogenetic analysis. *Phytophthora insolita* was first described from soil in a citrus orchard in Taiwan in 1979 and it has since been reported in the USA. It is reported to cause foliar necrotic lesions and twig die-back on *Rhododendron sp.* and infects apple and cucumber when inoculated. A fact sheet can be accessed at: http://idtools.org/id/phytophthora/factsheet.php?name=7962 .

The next step will be to investigate the prevalence of this species within the specific nursery it was detected and its possible presence in other nurseries. It would also be valuable to conduct pathogenicity trials and to compare pathogenicity with that of other *Phytophthora* species associated with eucalypts (e.g. *P. alticola*).

Parvosmorbus like sp. nov.

A novel fungus in the family *Chryphonectriaceae*, associated with cankers of *Corymbia henryi, Eucalyptus grandis x urophylla* and *E. grandis* in the Mtubatuba area was recently identified. The species is most closely related to *Parvosmorbus eucalypti.* The genus *Parvosmorbus* was recently established to accommodate two new species described from cankers of *Eucalyptus urophylla* and *E. urophylla x grandis* hybrids in China. The TPCP along with FSA members will be carrying out surveys of the affected compartments, to gather information on the extent and severity of the symptoms, and to collect additional samples. The symptoms appear to be consistent with (and likely indistinguishable from) those known for *Chrysoporthe austroafricana,* with stem cankers often present at the base of trees. Trials will be set up to evaluate the pathogenicity of this fungus, to better understand the importance of this new report to our members.

Cinara pinivora (Giant conifer aphid)

This aphid species has been confirmed from the Limpopo and KwaZulu-Natal Provinces. It is suspected that this species has been present in the pine growing areas for some years already but assumed to be *Cinara cronartii* (black pine aphid), which was first reported in South Africa in 1974, and for which a successful biological control agent was released. *Cinara pinivora* is native to North America but became invasive in a number of countries including Brazil, Kenya and Malawi. It has been reported on various pine species including *Pinus taeda, P. elliotti and P. patula*.

Essigella californica (Monterey pine aphid)

This aphid was confirmed in the Mpumalanga Province. As with *C. pinivora*, it is possible that this aphid species has been present in South Africa for some years but assumed to be the grey pine needle aphid (*Eulachnus rileyi*) which was first reported in South Africa in 1980. *Essigella californica* is native to North America but is an invasive pest in many countries including Australia, New Zealand, Brazil and in Europe. It has been reported on various pine species including *P. radiata, P. elliottii* and *P. patula*.

For both the aphid species, further investigation will be required to gather information on the geographic and host distribution of these aphids in South Africa, investigate whether any natural enemies (biological control) are present, and assess the damage to the pine hosts.

Eucalyptus Pest and Pathogen Working Group

Mission statement

The *Eucalyptus* Pest and Pathogen Working Group (EPPWG) seeks to develop risk mitigation strategies by establishing a national network of pest and disease monitoring, identification, research and management projects across the *Eucalyptus*-growing areas of the country. It also aims to develop and maintain pest and disease expertise through partnerships between academic institutions and industry.

Focus areas

- **A multi-layered system for monitoring plantation forest health at a national scale.** The system follows a three-tiered approach, which includes:
  1. Multi-scale remote sensing for detecting and monitoring plantation forest health over space and time;
  2. Ground-based surveys for identification of pests and diseases associated with damage; and
  3. Quantification of site risks associated with drought, frost and fire events, as well as ad hoc intensive site monitoring for understanding cause and effect relationships.
- **Industry disease screening** to develop and apply disease screening protocols of eucalypt, acacia and pine species over the next three years, servicing all industry partners.
- **Management of pest and disease monitoring data** through a fully integrated, spatially-enabled centralised information technology (IT) infrastructure for the storage and retrieval of information related to the presence of pests and diseases in South African plantation forests.

Summary

Each of the platforms registered with Forestry South Africa (FSA) under the EPPWG has made significant progress during the first funding phase from 2019 to 2021. Through innovative use of limited resources, students, leveraging additional support and in-kind contributions from industry partners, has ensured that the bulk of deliverables have been met. Each of the projects have evolved and aligned to both academic and industry requirements, guided by the Project Leaders and members of the EPPWG. Funding applications for the phase 2 funding cycle starting in 2022 have been submitted.

CONTACT INFORMATION:
Chairperson: **Wayne Jones**
Email Address: wayne.jones@sappi.com
Telephone: **033 3302 455 / 083 229 2843**

Funding

Primary funding - FSA

Direct and in-kind contributions - Forestry and Agriculture (GrainSA)

Direct and in-kind contributions - University of Pretoria

Government Grants - Forestry Sector Innovation Funding (FSIF)

National Forest Plantation Health Monitoring

Prof. Brett Hurley Forestry and Agricultural Biotechnology Institute (FABI) and Dr Ilaria Germishuizen Institute of Commercial Forestry Research (ICFR)

Project aims

The focus of this platform is limited to the *Eucalyptus* gall wasp (*Leptocybe invasa*) and its biological control, with these objectives:

- Monitoring damage caused by *L. invasa* in *Eucalyptus* plantations.
- Monitoring parasitism levels of *Selitrichodes neseri* and other natural biological control agents of *L. invasa*.

The quantification of damage over time and across the landscape is key to the effective management of this insect by:

- Identifying outbreaks and infestation trends.
- Evaluating biological control agent efficiencies and prioritisation of releases.
- Evaluating other means of control (e.g. selection of material planted).

Project status 2021

Monitoring of *Leptocybe invasa* continued with the support of industry members (Merensky, Mondi, NCT, Sappi and TWK) and the Spatial Technologies Platform based at the ICFR. FABI continued to take on the coordination, data analysis and reporting of the *L. invasa* monitoring component. Set protocols were established in 2020 and used during surveys in 2021. Typically, surveys consisted of 50 trees in locations which were evaluated for the presence of *L. invasa* and type of damage, following a zig-zag assessment pattern through the compartment. In stands planted to clonal varieties, the number of trees assessed was limited to 30 per location considering the uniform susceptibility of trees. The entire canopy of the tree was assessed to detect the presence of *L. invasa* and other canopy pests and diseases by walking around the tree. A total of 182 sites out of the 190 selected were surveyed, with 7 423 trees assessed. Overall, the occurrence of *L. invasa* was slightly lower than what was observed in 2020, with 42% of sites surveyed showing signs of its presence. Damage caused by *L. invasa* was more common in plots located in cool temperate (58%) and warm temperate (41%) areas, while it was only detected in 19% of plots in sub-tropical areas. *Eucalyptus grandis* and *E. grandis x E. nitens* hybrids showed overall higher susceptibility to the wasp, followed by *E. smithii* (22%) and *E. benthami* (18%). Low damage occurrence was observed in *E. grandis x E. urophylla* plots (8%). In terms of the presence of other pests, a steady increase in the presence of *Gonipterus sp.* n. 2., *Teratosphaeria destructans* and *Spondyliaspis cf. plicatuloides* was observed, while the incidence of *Glycaspis brimblecombei* was slightly lower than in 2020. For the first time, the presence of the bronze bug *Thaumastocoris peregrinus* was also detected.

Developing biological control agents and monitoring their presence at monitoring sites is key to the successful control of *Leptocybe* linages. Several parasitoids have been identified and it remains critical to understand the roles and interactions between these parasitoids in the galls. Most common are *Selithricodes neseri*, the newly found *Quadrastichus mendeli, Megastigmus pretoriensis* (indigenous) and *Megastigmus zebrinus*. The various *Leptocybe invasa* lineages A and B have spread to all the major eucalypt forestry regions. The changes in the prevalence of the lineages in the various regions has an impact on the composition of biocontrol agents, once again confirming the importance of long-term survey data. Results from the monitoring were used to identify sites where further releases of biocontrol agents were required. *Quadristichus mendeli*, a natural enemy of *L. invasa*, was released on sites where it was absent.

Work programme 2021

Project activities in 2021 included the collection of monitoring data across 190 sites for the presence of *L. invasa* and recording of damage levels on all genotypes. In addition, the following were conducted: recording presence of other eucalypt canopy pests; interpretation and analysis of the data; monitoring the distribution and prevalence of natural enemies of *L. invasa* and release of biological controls to increase parasitism levels.

Outputs

Monitored and reported changes in *L. invasa* damage over time, across the main eucalypt growing regions, and including different eucalypt varieties. Important findings from the monitoring data included identifying regions where infestation / damage was increasing and noting the higher susceptibility of *E. grandis* and its hybrids and increasing damage on *E. dunnii.*

Monitored and reported occurrence over time of other eucalypt canopy pests and pathogens across the main eucalypt growing areas. A widespread, steady increase in the occurrence of *Gonipterus sp.* n. 2 was noted during the period 2018-2021. Damage caused by *Teratosphaeria destructans* has also been increasing in most areas, while the occurrence of *Glycaspis brimblecombei*, *Spondyliaspis cf. plicatuloides* and *Thaumastocoris peregrinus* has been sporadic.

Monitored and reported the distribution and prevalence of the natural enemies of *L. invasa.* Results from the monitoring were used to identify sites where further releases of biocontrol agents were required, especially where some of the natural enemies (such as *Quadristichus mendeli*) were absent. This led to the introduction of *Q. mendeli* in those areas to increase parasitism levels and thus control of *L. invasa.*

Limits on full funding has restricted the number of sites surveyed, annually, for the presence and severity of *L. invasa* damage and other eucalypt pest and pathogens. A careful review of funding applications must be considered to ensure adequate long-term monitoring to support strategic decisions. A total of seven publications and reports were completed during the first funding phase.

Looking towards 2022

The aim of this platform is to monitor the occurrence and prevalence of natural enemies of eucalypt pests in South Africa. The project will initially focus on natural enemies of the current main eucalypt insect pests, namely *Gonipterus sp. 2* and *Leptocybe invasa*. Other pests could be included if they become more prevalent / serious, and a priority for the industry. This project builds on the previously funded 'National Forest Health Monitoring' platform, which monitored *L. invasa* associated damage and the presence and prevalence of natural enemies of *L. invasa*, with a less intense monitoring of other eucalypt pests and their natural enemies. The project will provide information on the distribution and prevalence of natural enemies of the priority eucalypt insect pests. This information will assist managers to identify and prioritize areas requiring intervention and to assess the success of implemented strategies, such as release of biological control agents and change in species choice. Project Leaders for phase 2 include Prof BP Hurley (FABI), Dr ML Schröder (FABI) and Dr I Germishuizen (ICFR).

Industry disease screening

Prof. A Hammerbacher (FABI)

Project aims

- Early screening of genotypes in environmentally controlled greenhouse structures or phytotrons. Genotypes will include hybrid clonal varieties, pure species and seeds.
- Early screening of pathogenic strains to determine virulence under varying climatic conditions.
- Correlation of susceptibility and/or tolerance with field trials established by industry.
- Training of students and capacity building, technology transfer to the industry and contribution to the existing body of knowledge and expertise.

Project status 2021

The platform was initiated with the approval of funding for three years. Prof. Hammerbacher has completed infrastructure projects and protocol development for specific eucalypt and pine disease screening.

Work programme 2021

- Complete Disease Screening facility with adequate climate control.
- Initiate and develop disease screening protocols for eucalypts and pines, specifically in relation to *Teratosphaeria destructans* and *Fusarium circinatum*, respectively.
- Initiate preliminary studies on *Phytophthora* root rot and Myrtle rust.
- Initiate first industry trials and develop future sample submission protocols and costing model.
- Appoint technician to run the facility and identify suitable students for industry projects.

Outputs

The environmentally controlled greenhouse structure on the Innovation Africa campus of the University of Pretoria has been completed. The facility consists of three individual compartments that can be separately climate-controlled via a pad-and-fan system and a screening system that is operated by a computer-integrated sensing system. Insulation curtains, the screening system and double-layered plastic with air cushion ensures maintenance of temperatures inside the structures. A misting system and irrigation system has been installed to maintain high air-humidity during inoculation experiments.

Secondly the development of screening methods has been developed for screening of eucalypts for susceptibility to *Teratosphaeria destructans*, and pines for susceptibility to *Fusarium circinatum*. Progress has been made in the development of methods for screening of eucalypts for susceptibility to *Phytophthora* root rot and myrtle rust. In addition, industry screening trials have been started with the screening facility open for FSA industry members, particularly in screening for *Eucalyptus* resistance against *T. destructans* and pine resistance against *F. circinatum*. Several trials were initiated on a no-cost basis during 2020-2021 as they were conducted as part of the method development and testing phase.

Capacity building has seen one PhD and four MSc students involved in this project as part of their degrees, specifically relating to *T. destructans* and *F. circinatum*. A new PhD student has been recruited for 2022 to assist with screening efforts of *Eucalyptus* resistance towards myrtle rust. One outcome not achieved during this funding period was the employment of a full-time technician. The reason this was not achieved, was because a suitable candidate for this position could not be identified. Instead, a Post-doctoral Fellow, Dr Tanay Bose, was recruited to assist with the screening facility (Figure 1) and to develop screening techniques for *Phytophthora* root rot of *Eucalyptus*, supported by two interns.

Looking towards 2022

The aim of this project is to develop hyperspectral sensing techniques for disease screening to service all industry partners and provide highly accurate data on the susceptibility and resistance of varieties developed by the industry. The project title will change from 'Industry Disease Screening' to 'Disease screening of forestry tree species and hybrid varieties for commercial deployment through the development and use of hyperspectral imaging techniques to quantify diseases'. While initially focused on specific diseases deemed a priority by industry partners, this project will also, in future, allow for the inclusion of pests. The key focus areas will include:

- Development of hyperspectral sensing methods for screening for resistance of *Eucalyptus* against *Teratosphaeria* leaf blight and *Phytophthora* root rot using the ASD Field Spec 4.
- Development of hyperspectral sensing methods for screening for resistance of pine against *Fusarium circinatum* (pitch canker) using the ASD Field Spec 4.
- Development of imaging techniques for automated disease assessment of T*eratosphaeria, Phytophthora* and *F. circinatum.*
- Exploration of technology transfer options for disease status of seedlings/cuttings in commercial nurseries using image technology and verification of techniques.
- Training of students, capacity building and contribution to the existing body of knowledge and expertise, both on the academic as well as the industry level.

Pest and disease monitoring platform

Prof. B Slippers (FABI), Prof. Brett Hurley (FABI) and Dr Ilaria Germishuizen (ICFR)

Project aims

- Appraise pest and disease occurrence data, currently housed at the Tree Protection Co-operative Programme (TPCP), ICFR and forestry companies (type and quality of information available, geographical referencing, storage format).
- Design, develop and implement a spatially enabled, centralised database for the storage and retrieval of records of presence of pests and diseases from TPCP, ICFR and forestry companies.
- Develop a web-based, electronic data capturing form that works across platforms to link future-collected data directly with the developed database.
- Integrate database with mobile tools used for in-field diagnosis and capture of pest and disease presence data (P&D Application or App) and with plantation management systems (e.g. Microforest).
- The IT infrastructure is envisaged as a dynamic system, which allows for expansion and addition of new functionalities as needed.

Project status 2021

Interactions and links with various groups such as FSA, GrainSA, ICFR, CropWatch Africa and others has significantly contributed to the rate of development and scope of this platform. Initiated in 2019 with limited funding, significant progress has been made by partnering with the Innovation Africa @UP Hub and the Department of Computer Science at UP. This has allowed for infrastructure, online and App-based interface developments and student capacity building. Pest and disease occurrence data has been evaluated, cleaned and uploaded. In addition, partnerships have been developed with software companies to professionalise the system as a cloud-based data warehouse with associated applications.

Work programme 2021

- Link, develop and secure human capacity for the development of the data platform and associated analysis.
- Finalisation of historical and current data appraisal, including the capturing of data currently not available in digital format, data formatting and standardisation in a central database.
- Design and develop a web-based data capturing form that works across platforms to link future-collected data directly with the developed database.
- Data integration of ICFR and TPCP databases, and GIS linkage of pest and disease records.
- Integrate database with mobile tools used for in-field diagnosis and capture of pest and disease presence data (P&D App) and with plantation management systems (e.g. Microforest).
- Development of advanced analysis tools for the collected data.

Outputs

The objective of this platform is to develop a data warehouse for all forest pest and disease data. Update for 2021 include the following outputs:

- Relational database has been completed.
- Pest and disease occurrence data, evaluated, cleaned and uploaded.
- Development of visualisation and analysis tools under the Google Cloud Platform framework basically complete with further developments in progress.
- Development of diagnostic sample submission system has been completed.

Additional developments:

- Biosecurity Africa integration, completed.
- Sensor data integration from UBI Dots platform, currently under further development.
- Image analysis for pest and disease identification, currently under further development.
- Cloud-based digital platform with visualisation and analysis capabilities for the digital collection, storage and management across sectors, (Innovation Africa Information Hub).
- Ongoing development of a cloud-based platform for the storage, analysis, and visualisation of weather data (ICFR weather database).
- Planned development of automated routine for the interpolation of weather data from point to surface at varying and temporal scales from 2022.

Capacity development during phase 1:

- Post-Doc, FABI (1)
- Hons (Computer Science), UP (1)
- B (Computer Science), UP (9)
- MIT, UP (14)

Key to the progress and developments within this platform has been the coordinating contributions by Project Leaders and team members through interactions with other groups. These include UP, FABI, FSA, ICFR, GrainSA, CropWatch Africa, DSI, DFFE and the Department of Agriculture.

Looking towards 2022

The aim of this platform is to establish the foundation for a coordinated forest pest surveillance strategy, with near real-time sharing of information for decision making, and implementation of key components of such a strategy that can be upscaled when sufficient support and funding is available. The project will demonstrate the potential for a comprehensive national forest surveillance strategy. The platform title will change from the 'Pest and Disease IT Platform' to 'Forest Pest Surveillance'.

More specifically, provide a data platform through the Innovation Africa @UP Information Hub, which originated the FSA-funded P&D Database Platform, to manage diagnostic clinic samples, data flows and user interaction, as well as the surveillance of plant pathogens and pests. A logical progression from the P&D Database Platform is to support the further development of the IA@UP Information Hub and especially its use and uptake in the forestry sector, as part of a forest pest surveillance strategy.

The IA@UP Information Hub will essentially provide the backbone for the Forest Pest Surveillance strategy providing tools for standardised data capture, data management, data integration from other data platforms, data process management, data analytics, data visualization and sharing of outputs. Appropriate data confidentiality will be built into the platform.

A key aspect missing from the early pest detection and associated diagnostic tools of forest pests in South Africa is the surveillance of new pests at potential entry points. One of the suspected points of entry of new pests, specifically of eucalypts, is the South African – Mozambique border where a series of monitoring sites would be key. A further challenge related to early pest detection is the rapid and accurate identification of new pests, which forms the foundation to an effective surveillance strategy. Diagnostic tools (often molecular) need to be developed for new and potential future pest introductions.

Seasonal monitoring of native pests, which can cause serious damage during outbreaks is a new focus area. Understanding the dynamics to develop models and predict outbreaks thus informing the timing of management responses is lacking. Pheromone-baited traps can be used on native *Lepidoptera* as a tool to monitor adult emergence and thus, together with field surveys, facilitate studies on the seasonal dynamics.

Sirex Control Consortium

Mission statement

Sirex noctilio is one of the most serious invasive insect pests of *Pinus* species globally. First detected in 1994 in Cape Town, it has spread across all pine growing regions in the country, killing pine trees as it has progressed.

At the height of *Sirex* infestations, a mortality rate of more than 30% was reported in high-risk areas. Although the impact of *S. noctilio* has been brought down significantly, the pest continues to result in financial losses due to the necessity for annual monitoring and control activities to keep its impact below economic threshold levels.

Operational activities to manage *S. noctilio* are undertaken by the South African *Sirex* Control Programme Consortium, under management of FSA's Research and Protection Director, Dr Ronald Heath with support from Programme Coordinator, Philip Croft, and the assistance of private contractors. The programme provides employment to at least 20 contractors and personnel. Research to support the sustainability of the control programme, especially the biological control agents, is conducted by the TPCP/FABI at the University of Pretoria.

The *Sirex* Control Consortium seeks to minimise the impact of the non-native pine pest, *Sirex noctilio*, in South African pine plantations and woodlots through an industry-wide collaborative control programme.

Key focus areas

Short-term objectives:

1. World class and cost-effective nematode (*Deladenus siricidicola*) production.
2. Implementing nematode release and evaluation.
3. International collections of *S. noctilio, Amylostereum areolatum* and *Deladenus spp*. for medium and long-term objectives.

Medium-term objectives:

1. Improving biological control using *Deladenus siricidicola*.
2. Screening tools.

Long-term objectives:

1. Host factors and biology.
2. Chemical ecology and behaviour.
3. Genomic tools.
4. Alternative control strategies.

Another key focus area is increasing international collaborations to support local research and management of *S. noctilio*.

Funding

Individual FSA member companies

Human capacity - FSA platforms

South African *Sirex* Control Programme (SASCP)

Sirex Steering Committee

Project aims

- Monitoring of *S. noctilio* levels in pine plantations across South Africa.
- Inoculation and release of two biological control agents, *Deladenus siricidicola* (nematode) and *Ibalia leucospoides* (parasitoid wasp) to manage *S. noctilio*.
- Awareness creation and extension activities to investigate possible outbreaks.

Project status 2021

Due to lack of Government funding, the National South African Sirex Control Programme was abolished.

A number of FSA member companies took the initiative to establish the *Sirex* Control Programme Consortium. Currently the members of the consortium are Sappi, Mondi, York, Merensky, PG Bison, MTO, Stevens Lumber Mills and Molozi Trust.

The future of the programme remains under significant threat due to lack of government funding since 2019. This resulted in significantly reduced control and monitoring activities since 2019, as the fiscal requirement to continue with national monitoring is too significant for the participating companies. The suspension of the national monitoring is of major concern as the information is vital in assisting growers of Pine in making recommendations on the level of intervention initiatives.

This year two emergence depots will be operational, one in KZN and the other in Mpumalanga.

Work programme 2020/2021

- Assessment of biological control levels for summer rainfall areas based on emergence cage depot results – January 2021.
- Assessment of biological control levels for winter rainfall areas based on emergence cage depot results – not done due to lack of funding.
- Inoculation of nematodes into trees in summer rainfall areas (February to April 2021) – funded by individual companies – completed.
- Inoculation of nematodes into trees in winter rainfall areas – was not carried out as the depot was not operational due to the lack of funding.
- National *Sirex* monitoring – no funding and not carried out.
- Log collections for biological control monitoring, trap tree plot establishment, emergence cage management and wasp submissions for parasitism evaluations at TPCP, *Ibalia* wasp releases – was implemented in 2021 with only a few companies participating.
- With the lack of government funding small growers have fallen out of the works programme.

CONTACT INFORMATION:
Chairperson: Dr Ronald Heath (May 2020)
Email Address: ronald@forestrysouthafrica.co.za
Telephone: 083 611 6946

Outputs

- A total of 392 male and 413 female (total 805) *S. noctilio* wasps were assessed for parasitism levels in November to December 2020 from the single depot that was situated in Sabie. The depot at George in the Southern Cape was not operational.
- These dissected wasps provided a parasitism of 36% male and 33% female which was spread relatively evenly across S.A.
- Nematode parasitism levels at a compartment level ranged from 0% to 100% per region.
- Parasitism levels of *Ibalia leucospoides* measured at the emergence cages was 56 % across S.A.
- A total of 1077 *Ibalia leucospoides* were collected and released back into pine plantations to augment biocontrol levels.
- Some 214 million *Deladenus siricidicola* nematodes were provided by the TPCP for inoculation into 2 200 *Sirex* infested trees. This was done by only a few companies due to the lack of DFFE funding for 2021.
- **No national *Sirex* monitoring was carried out due to the lack of funding.**
- Annual presentations/lectures to Nelson Mandela University (NMU) students by Philip Croft were carried out on a virtual Zoom platform .
- The preliminary 2021 emergence data (week 7 of the 12-week period) has indicated similar trends from both depots. The Lions River depot outside Pietermaritzburg has obtained a 44% nematode parasitism and 30.8% *Ibalia* parasitism. The male to female ratio is 1.35 male per females. Week 6 out of the seven-week period more females than males were caught.
- The depot outside Sabie at Hendriksdal, over the same period (7 weeks out of the 12-week period) has achieved a nematode parasitism of 24% and an *Ibalia* parasitism of 37.8%. The male to female ratio is 1.38 males per female which is very similar to the Lions River depot. Once again week 6 produced more females than males.
- In 2010 the sex ratio of males per female was 3.8 males per female and since then there has been a steady change over time to the figures above. This aspect deserves attention to see how the population will develop and what the impact could be on tree mortality. A more comprehensive analysis will take place when the wasps have stopped emerging and the final dissection data has been received.

Looking towards 2022

The Consortium continues to play a critical role in the control and monitoring of *Sirex*. The commitment by a few FSA members to continue the Consortium into 2022 is invaluable and ensures some level of biological control of *Sirex* in our pine growing areas. We were optimistic to see some additional corporates join the Consortium in 2021 but this unfortunately did not materialize. The Consortium will continue to establish Trap Tree Plots, inoculate these and incubate logs in emergence cages in 2022 to continue the monitoring of *Sirex* and the efficacy of the various biological control organisms.

Wattle Rust Working Group

Mission statement

The wattle plantation sector is being severely affected by a rust disease. The pathogen has been identified by the TPCP as *Uromycladium acaciae* and mainly affects *Acacia mearnsii* (black wattle).

The long-term aim is to develop an integrated management strategy to limit the economic impact of the pathogen on the wattle industry. The wattle plantation sector is being severely affected by this disease which was identified by the TPCP as ***Uromycladium*** *acaciae* in 2013. It mainly affects *Acacia mearnsii* (black wattle).

A Wattle Rust Steering Committee was formed in 2013 to identify and support various research initiatives.

Key focus areas

- **Biology and epidemiology** – to better understand the life cycle and impacts
- **Spatial technologies** - for monitoring and predicting outbreaks
- **Tree breeding** – to select for tolerance (main focus of current research)
- **Impact assessment** – to understand the economic impact and triggers for outbreaks
- **Chemical management** – to develop best operating practices for chemical control

Funding:

Projects are currently funded equitably by:

- NCT Forestry Agricultural Co-operative Ltd
- NTE Company Ltd
- TWK Agri Ltd
- UCL Company Ltd

CONTACT INFORMATION:

Chairperson: Craig Norris
Email Address: craig@nctforest.com
Telephone: 033 897 8500 / 082 806 7013

Selection of Rust Tolerant wattle for cutting production

Iain Thompson (NCT Forestry Agricultural Co-operative Limited).

Project aims	Project status 2021
To select and screen genotypes from the *A. mearnsii* (wattle) population that show a higher tolerance to damage caused by *Uromycladium acacia* (wattle rust).	Initiated in 2015, the project has now selected material from in-field as well as the ICFR breeding population. Coppice from selections are rooted in a research nursery facility and are bulked-up to produce hedges for cutting production. Rooted cuttings are then planted in-field trials for selection based on various traits, including rust tolerance.

Work programme 2021

- Management of hedges to produce cuttings for field trials
- Block trials are planted to test best performing clones from clonal trials
- Measurement and analysis of field trials.

Outputs

- Two commercially available rust clones – SP 644 and AF01
- Continue to test other promising selections showing potential for commercialisation.

Looking towards 2022

The project will continue to screen material from the ICFR wattle breeding programme, as it becomes available. Green x black wattle hybrids will also be screened for performance as they become available.

Breeding for tolerance to the wattle rust disease

Dr Julian Chan (ICFR)

Project aims

The ICFR wattle breeding programme has focused on identifying genetic variation and resistance to the wattle rust disease in the existing breeding population. The breeding strategy seeks to develop both seed orchards and clones resistant to the rust and superior growth.

Project status 2021

The wattle breeding population has been screened for rust tolerance. From the best current families, 33 selections were made in 2017/2018 for clonal testing (CL series) and other 35 selections were used for establishment of two clonal seed orchards (CSOs 4-5) in 2019. It is anticipated that these orchards will start producing seed from 2025. A further orchard (CSO 6) will be established in 2022.

A new wide-scale seed introduced from Australia commenced in 2019 and will carry through 2022. The plan is to collect seed from 623 trees of *A. mearnsii* and 225 trees of *A. decurrens* from specific areas/provenances in Australia.

In addition, in 2018 the programme commenced the development of hybrids between black (*Acacia mearnsii*) and green (*Acacia decurrens*) wattle. Green wattle is more resistant to the wattle rust disease and the view is to develop hybrids with increased rust resistance, acceptable tannin quality as well as growth and stem form. Crosses of frost tolerant selected trees of black with green wattle could potentially produce frost hardy and rust resistant hybrid varieties.

Outputs

- Fraser S., McTaggart A.R., Moreno C.J., Nxumalo T., Shuey L.S., Wingfield M.J. & Roux J. (2018). An artificial inoculation protocol for *Uromycladium acaciae*, cause of a serious disease of *Acacia mearnsii* in southern Africa. *Southern Forests*. doi: 10.2989/20702620.2018.1468985
- Isik F., & Moreno C.J. (2017). Genetic Analysis of Wattle Rust and Growth Data. Technical report for the wattle funding companies. September 2017. *ICFR Confidential report - contact ICFR for access.*
- Moreno C.J. & Isik F. (2019). Genetic variation in resistance to *Uromycladium acaciae* fungus, growth, gummosis and stem form in *Acacia mearnsii* Populations. *Tree Genetics and Genomes*. 15:1-13. DOI 10.1007/s11295-019-1341-x.
- Julian Moreno Chan, and Fikret Isik, Genetic Variation in Frost Tolerance, *Uromycladium acaciae* Rust Resistance, and Growth in an *Acacia mearnsii* Population. Forest Science, 2021, 67(5) p574-586

Looking towards 2022

Continue with the work plan set out by the Wattle Funding Consortium for 2021-2024.

TIPWG Timber Industry Pesticide Working Group

Make sure you visit the TIPWG WEBSITE
www.tipwg.co.za

Funding:

TIPWG's Industry Partners include:

- Hans Merensky
- Mondi
- NCT Forestry Agricultural Co-operative Ltd
- SAFCOL
- Sappi
- Shiselweni
- TWK Agri Ltd
- Usutu
- York

Mission statement

TIPWG, an FSA initiative, exists to promote responsible and effective use of pesticides in South African commercial timber plantations. This is achieved through the provision of four main functions:

1. Technical support
2. Industry collaboration
3. Compliance
4. Provision of guidelines

TIPWG provides guidance to FSA, its environmental committee, and the Forestry Industry as a whole, on:

- The adoption of new pesticides and the removal of older, less effective formulations and active ingredients.
- Co-ordinating and facilitating collaboration of industry pesticide research and integrated pest management (IPM) practices.
- The endorsement of new pesticides for regulatory approval.
- Industry compliance with local legislation, international conventions and standards such as Forest Stewardship Council® (FSC®), the Programme for the Endorsement of Forest Certification (PEFC)/South African Forestry Assurance Scheme (SAFAS) and International Standards Organisation (ISO).

Key focus areas

- **Chemical usage data** – obtaining, collating and analysing chemical-use data for informed decision-making International collaboration - to solve common global forest chemical issues.
- **IPM strategies** - the use and incorporation of past research for the development of integrated management strategies.
- **Development of business-critical chemicals** - the active development of current chemicals where their use is business-critical.

CONTACT INFORMATION:
Chairperson: **Roger Poole (NCT Forestry)**
Website: www.tipwg.co.za
Email Address: chairman@tipwg.co.za
Telephone: **082 804 8300**

Dessicants for fire-break management

Prof. Keith Little (NMU)

Funding: FSA and Industry partners.

Project aims

Paraquat dichloride is a rain-fast, quick-acting, non-systemic, contact herbicide* which is used for the preparation of tracer lines as part of a broader fire management strategy. However, it has been banned for use on Forest Stewardship Council® FSC®-certified plantations. A replacement for paraquat must be sought; either from new innovative technologies and systems or through the testing and use of existing contact/ defoliation herbicides that would comply with current and future FSC regulations.

(*allows regeneration from root portion)

Project status 2021

Initial pelargonic acid trials pre-2019 looked favourable. However, a formulation change brought about by the original pelargonic acid supplier being bought out by a multi-national, meant bridging trials are required to determine the efficacy of the newly formulated product against the original product used for the testing.

The original bridging trials had to be repeated, because the manufacturer supplied incorrect application rates. This was only realised once the trial had been done and results showed no impact at even the highest formulation. Repeat bridging trials with the correct application rates confirmed the new formulation still did not to work to the levels found with the previous formulation, so a new pelargonic acid supplier was sought.

Work programme 2021

A European pelargonic acid manufacturer came on board supplying a small amount for preliminary testing of a pelargonic acid formulation registered in Europe for industrial and home and garden markets.

Testing of these were found to be on par with the initial samples tested. An agreement with the manufacturer was made to get enough product to conduct proper trials for registration purposes. The first trials were done in Autumn 2021, in Ingwe and Mpumalanga, on a commercial scale. 14-days later the teams went in and burnt the tracers, the burns were extremely favourable, and TIPWG is now assisting with the product registration process.

Outputs

Screening for alternatives to paraquat:

- Little, K. & Nadel, R. (2014). Testing pelargonic acid and pyraflufen-ethyl with glyphosate as alternatives to paraquat dichloride for the preparation of fire-break tracer lines, Underberg (South Africa). Southern Forests 76(2): 67-73.
- Little, K. & Roberts, J.C. (2017). Desiccant herbicides tested for the preparation of fire-break tracer lines, South Africa. South African Journal of Plant and Soil 34(4): 319-322.

Testing pelargonic acid against paraquat:

- Results from the commercial trials have show the product to be very favourable and currently TIPWG is working with Government to apply for an emergency product registration to ensure the industry has a product for the coming fire season.

Looking towards 2022

TIPWG will continue to work with Government on the emergency registration.

The development of an integrated pesticide risk model for plantation forests in South Africa

Jonathan Roberts and Prof. Keith Little (NMU), Dr Carol Rolando (Scion)

Funding: FP&M SETA, FSA and Industry partners.

Project aims

- Quantifying herbicide use within the Forestry Industry in South Africa
- Linking herbicide use treatments and/or alternative practices to forest productivity (survival, uniformity, and growth [yield])
- Economic risk model related to herbicide use

Project status 2021

- Published paper (Estimated herbicide use within the commercial forestry sector in South Africa).
- Completed all chapters and including the risk model to be used in the industry.
- Aim to submit thesis 3rd of December 2021.

Outputs 2021

Conferences attended related to the thesis

- Presented at the Combined Congress 2020 (January 2020) held at the University of the Free State, Bloemfontein (Topic presented: Herbicide use within the commercial forestry sector in South Africa).

Published paper

- Roberts JC, Little KM and Rolando CA. 2021. Estimated herbicide use within the commercial forestry sector in South Africa. Australian Forestry 84 (3): 108-121. DOI: 10.1080/00049158.2021.1935127

Papers to be submitted for publication in 2022

- Roberts JC, Little KM and Rolando CA. 2021. Linking eucalypt rotation end data to vegetation management treatments and herbicide use: results from 7 pulpwood trials, South Africa.
- Roberts JC, Little KM and Rolando CA. 2021. Linking pine performance to vegetation management treatments and herbicide use: results from 12 pulpwood trials, South Africa.
- Roberts JC, Little KM and Rolando CA. 2021. Linking pulpwood tree growth and financial performances to different methods of vegetation management within commercial forestry South Africa.

PROJECT CONCLUDED

The environmental fate (soil/water) of pesticides used operationally within South African commercial plantations

Noxolo Ndlovu and Prof. Keith Little (NMU), Dr Carol Rolando, Dr Brenda Baillie (Scion)

Funding: FP&M SETA, NCT Forestry Agricultural Co-operative, FSA and Industry partners.

Project aims

- Evaluation of environmental behaviour, fate and risk of key pesticides used in South African forest plantations
- Soil fate (persistence and leaching potential) of pesticides used operationally within South African forestry plantations: a humic soil-based compartment study
- Water fate (concentration in water and persistence in sediment) of pesticides used operationally within South African forestry plantations: a sub-quaternary catchment level study
- Develop an environmental risk model framework, for generic pesticide use, that will underpin risk models and/or decision support systems

Project status 2021

- Trial work/data collection completed.
- Completed write up of Chapters 1, 2 and 3.
- Currently writing up the results and discussion soil and water environmental fate chapters (Chapter 4 and 5).

Looking towards 2022

- Completing chapter 6 (Developing an environmental risk model framework that will underpin risk models and/or decision support systems).
- Thesis completion.

Pesticide-use within South African forestry nurseries and the testing of non-hazardous products for pest and disease control

Ilke Opperman and Prof. Keith Little (NMU), Mrs Jacqui Meyer (TIPWG), Prof. Jolanda Roux (Sappi)

Funding: Sector Innovation Fund, FSA, Seedling Growers Association of South Africa (SGASA), NCT Forestry Agricultural Co-operative and NMU.

Project aims

The project is composed of three focus areas, with the main aim being to Identify ecologically-sound pesticides for insect and disease control in forest nurseries.

Focus area 1 – Survey of forestry nurseries regarding the most prevalent insect pests and pathogens and the pesticide use within these nurseries to prevent or eradicate these pests.

Focus area 2 – Identification of ecologically-sound pesticides for screening of insect and disease control in forestry nurseries.

Focus area 3 – Screening trials of the ecologically sound pesticides for the control of insect and disease control in forestry nurseries.

Project status 2021

Focus area 1:
Complete.

Focus area 2:
Final review stage.

Focus area 3:
In progress.

Work programme 2021

Focus area 1:
The focus area has been written up completely and supervisors are doing the last revisions.

Focus area 2:
This focus area has been written up completely. There are minor changes being made after which supervisors will do revisions.

Focus area 3:
This chapter is 50% complete and is set out to be completed by November 2021 after which it will be reviewed by supervisors.The insecticides have not been tested due to Covid-19 and the student receiving a job opportunity. This section is thus still outstanding.

Looking towards 2022

Ilke will be submitting her thesis in 2022 and partners will be identified for the completion of the insecticides component of the project.

FORESTRY SOUTH AFRICA™

Produced by: Forestry South Africa

Johannesburg Head Office: 011 268 1104
Pietermaritzburg Regional Office: 033 346 0344

www.forestrysouthafrica.co.za