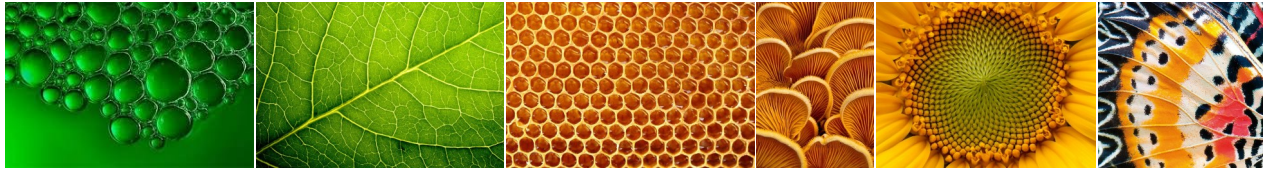


# PLANT PROTECTION NEWS



AGRICULTURAL RESEARCH COUNCIL - PLANT PROTECTION RESEARCH

*In this issue*

Winter 2021

No 117

**NEW**

Seed Health testing  
now available



***Release of the moth, Evippe sp. #1, for the control of invasive Prosopis species; the first mesquite biocontrol agent not limited to seed destruction in Africa***

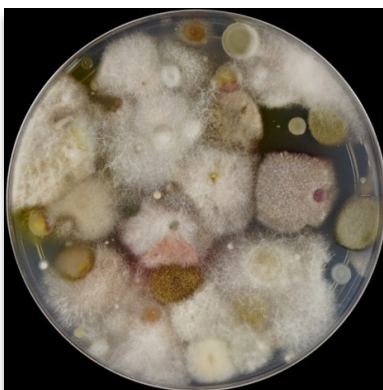


**Natural Science  
Collections Facility**  
SOUTH AFRICA

Standardized preservation and management of National Public Goods Assets

A new biocontrol agent, a leaf feeding moth, *Evippe* sp.#1, was released into South Africa for the control of invasive *Prosopis* species (mesquite), at the Meerkat Reserve at the Square Kilometre Array (SKA) on 24 February 2021. At the SKA, where any activity such as the use of vehicles and chain saws causes signal interference, biological control is probably the only viable solution for the management of the mesquite. Additional releases took place during autumn and we now wait to see if the *Evippe* sp. can successfully overwinter in diapause and emerge again in spring. If we can prove overwintering survival and establishment in the field, then this biocontrol agent will be released further throughout the range of mesquite in South Africa in the coming years.

Though introduced into South Africa from the Americas many years ago for its usefulness as a shade and fodder tree, mesquite has proved to have increasingly adverse effects on the environment. It is considered to be a powerful ecosystem 'transformer' with a huge negative impact on ecosystem function, reducing native plant species density and diversity, as well as on the diversity of the native fauna in the invaded areas. Other negative impacts are reduced soil quality, grazing availability and especially water resources in the arid areas. These impacts are set to increase, as mesquite expands its range and densifies.



Is your soil healthy?

## Editorial Committee

Almie van den Berg (ed.) • Ian Millar  
• Robin Lyle • Petro Marais • Elsa  
van Niekerk • Marika van der Merwe

## General enquiries

Plant Health and Protection,  
Private Bag X134, Queenswood,  
0121 South Africa

e-mail: [infoppr@arc.agric.za](mailto:infoppr@arc.agric.za) • web-  
site: <http://www.arc.agric.za>

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*Evippe* sp adult moth



*Prosopis* stand with seedling recruitment (F. Heystek – ARC)

To help contain its rapid expansion, seed-feeding bruchid beetle species were the first natural enemies of mesquite introduced from their countries of origin, following research conducted under the biological control programme of mesquite at the ARC-PHP. Despite suppressing the viable seed load, mesquite invasion is continuing to expand and it is now considered to be the most serious weed threat in arid areas. Estimates from 1998 reported it to occur over 1 800 000 ha, with approximately 55% of this area in the Northern Cape Province. By 2010, models by van den Berg estimated the area infested in the Northern Cape alone to be around 1 500 000 ha, with an estimate of at least a further 5 million ha suitable for future invasion in this Province. Significant expenditure on mechanical and chemical control measures by government departments and by landowners are already being made to manage this weed.

A new biocontrol candidate, an undescribed species of gelechiid moth, belonging to the genus *Evippe*, originally from Argentina, was investigated for its suitability as biocontrol agent of mesquite in South Africa. *Evippe* sp. #1 was found safe for release in Australia and introduced there in 1998. It proved to be their most successful biocontrol agent, causing a significant reduction in *Prosopis* growth and reproduction, and projected in models to reduce *Prosopis* infestations at population level in the longer term.

The ARC, with generous funding provided by the Department of Forestry, Fisheries and Environment's Natural Management Resource Programmes (DFFE: NRMP), focused on studying the safety of a potential introduction of *Evippe* sp. #1 into Africa. The South African source consignment of *Evippe* sp. #1 was imported from Australia during December 2014. The moth was then evaluated in quarantine at ARC-PHP, where indigenous related species, including *Prosopis* species indigenous to and grown in Africa, were tested for their ability to support development of *Evippe* sp. #1. Laboratory trials in both Australia and South Africa, evaluating 86 unique related plant species, found that complete larval development was restricted to *Prosopis* species belonging to the New World (mesquite), whilst Old World *Prosopis* species or other related non-target species tested, did not support complete larval development. The fact that *Evippe* sp. #1 was only able to develop to adulthood on the invasive alien *Prosopis* species and their hybrids, along with the reduction of fitness in mesquite from damage caused by larval feeding, meant that it would be safe and to the benefit of our biodiversity to release *Evippe* sp. #1 as a biocontrol agent of mesquite in South Africa. On grounds of these results, following advice from an independent scientific committee including international reviewers, the DALRR granted permission for the release of *Evippe* sp. #1 as biocontrol agent of mesquite on 21 December 2020.



Adult *Evippe* sp # 1 under microscope stacked (R. Lyle – ARC)

The feeding of the developing immature stages of the moth causes damage to the mesquite. A female moth lay about 75 eggs on the trees throughout her two- to three-week lifespan. The first instar larva of *Evippe* sp. #1 mines within the pinnae of a mesquite leaf, whilst larger larvae feed externally in a shelter created by tying a few pinnae of a leaf together, using silk threads. These can be easily observed on the trees. Entire stands of mesquite may be repeatedly defoliated, which reduce its fitness and invasiveness. The moths entire lifecycle can be completed in less than 45 days and it can complete several generations in a year, to build up to high numbers before entering diapause in winter.

*Evippe* sp. #1 is anticipated to establish widely in Africa, based on experience in Australia, where it is encountered from the north west of Australia to parts of New South Wales in the southeast of Australia. Similarly, mesquite invaded these latitudes in southern Africa.

However, it is extremely unlikely that biological control will eradicate the mesquite invader from the environment, but we hope that the *Evippe sp.* agent will cause a reduction in plant densities in the field. This may add economic value to the plants in the field as it may cause sparser plant densities and larger individual trees from which greater biomass value could be derived. In addition, it was estimated that by 2036, the total absence of mesquite from South Africa would be more beneficial than the value it provides, due to expansion of the invasion and the associated control costs. A reduction in invasive *Prosopis* populations would thus only result in a net benefit. It is thus clearly beneficial to use effective biological control as an integrated tool in the management strategy of mesquite in Africa. We anticipate the establishment of *Evippe sp. #1* to have a significant impact on invasive *Prosopis* species in southern Africa, and to make the greatest biocontrol contribution of all established biocontrol agents on mesquite in South Africa. Furthermore, biological control is the most cost effective and environmentally friendly means to control invasive alien plant species.

### Acknowledgements

- DFFE: NRMP and ARC for funding to conduct research on biological control of invasive alien plants.
- Commonwealth Scientific and Industrial Research Organisation, Australia: for providing a study culture and advice.
- Centre for Agriculture and Bioscience International, Africa: providing some African test plant species.
- SKA, and South African National Parks: for providing access to the Meerkat National Park for the release and study plot.
- Personnel at the ARC-PHP quarantine laboratory Roodeplaat for undertaking various aspects of the research and technical work.

Contact: Fritz Heystek at [HeystekF@arc.agric.za](mailto:HeystekF@arc.agric.za)

## Commercialization of strains from the National Collection of fungi

A request from BASF was received in November 2013 regarding the purchase of a *Beauveria bassiana* strain (PPRI 5339) from the National Collections. The fungal strain in question was isolated from beetle larvae in 1994. No determinant was indicated on the database and the culture had not been reserved for exclusive use by the collector. Therefore, it was considered to be a good candidate strain for commercialization following the process as set out in Chapter 6 of National Environment Management: Biodiversity Act (NEMBA), that includes negotiations pertaining to benefit sharing as set out by the Nagoya protocol of the Convention on Biological Diversity (CBD). Developmental work for the registration of the product was done by ARC-Tropical and Subtropical Crops. Finally, in October 2020, accumulated royalties from the licensing agro-chemical company, BASF, via DFFE, to the value of R1.1 million were received by the ARC. As per agreement, a certain portion of the funds has been used for the purchase of capital items to capacitate the screening capabilities of the mycology laboratory. The search for strains that can be commercialized in different applications continues. This kind of passive income from the National Collection supports both the Bio-economy strategy as well as the SDG and NDG of South Africa, and is hope to provide increased financial sustainability of the National Collections. However, it is important to note that the development and commercialization of these strains can take up to 3-5 years before any substantial benefit is realized.

Contact: Dr Riana Jacobs-Venter at [JacobsR@arc.agric.za](mailto:JacobsR@arc.agric.za)



Broadband registration label

## Developing soil health management strategies for black commercial farmers

A project is currently being conducted to determine the soilborne diseases of grain crops in cropping systems in the summer grain production areas, with special emphasis on the development of management strategies including crop rotation/cover crops and seed treatment for black commercial farmers. Surveys are being conducted in production areas in the Eastern Cape, Free State, Gauteng, KwaZulu-Natal, North West and Mpumalanga. Results showed that crown and root rot were present in all the fields that were sampled. Major progress has been made with the identification of disease complexes in the different production areas. The study highlighted the differences in the soilborne disease complexes in maize, soybean and sunflower in the different provinces, and the effect on the different crops. The correct identification of the disease complexes has significant implications for the management strategies that will have to be developed during the second phase of this project. Due to interaction with farmers during sampling, as well as the discussion and sharing of results of the previous surveys, an awareness was created of the importance of soilborne diseases such as crown and root rot in reducing yields of their crops. The farmers are very positive about future research to develop management strategies. This is important to improve sustainable crop production and yield of summer grain crops.

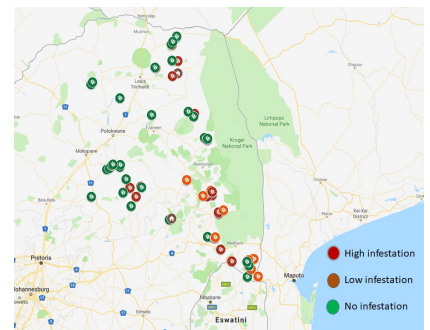
Contact: Sandra Lampbrecht at [LampbrechtS@arc.agric.za](mailto:LampbrechtS@arc.agric.za)



Discussing root rot symptoms with a farmer (S Lampbrecht – ARC)

## Overwintering sites of Fall Armyworm (FAW) mapped

The Fall Armyworm (FAW), *Spodoptera frugiperda*, is an exotic invasive lepidopteran pest from the Americas that was first reported in West Africa in 2016 and which invaded southern Africa in early 2017. In a project funded by DALRRD, the ARC-PHP surveyed the overwintering sites of the FAW and found viable populations throughout the winter of 2017-2020 in numerous field sites in smallholder farming areas in the warmer lowveld areas of Limpopo, Mpumalanga and northern KZN Provinces. The FAW populations die out in the Highveld maize production areas during winter due to the cold temperatures. However, the FAW is now considered to be an endemic pest problem in these lowveld smallholder farming areas and is no longer regarded as a sporadic invasive pest. Many smallholder farmers grow small areas of conventional (non-GMO) maize and sweetcorn in a continuous succession throughout winter under irrigation and in moist drainage areas in the frost-free areas of the country. These sites now provide refugia sites for FAW populations during winter, which then act as foci for population expansion. When the rains fall, FAW moth invasions occur into the rain-fed commercial maize cultivation areas, which are the food basket of the country.



FAW hot spots

The FAW has become a serious pest problem in smallholder farming areas and exerts a high pest pressure, with a number of farmers reportedly having to abandon maize cultivation due to the economic losses sustained. The FAW will also become a more persistent problem for commercial maize farmers in future who will be subject to home-grown invasions from the lowveld. A detailed study of the development rates of the FAW at different temperatures shows that populations can readily survive the lowveld winters and are able to rapidly exploit the onset of the warmer rain season to infest a large part of the maize production region. The survey also exposed the desperate control measures that some smallholder farmers now employ to control their FAW infestations, with misuse of insecticides that poses a threat to human health and the local environment.

Contact: Tebogo Mailula at [MailulaT@arc.agric.za](mailto:MailulaT@arc.agric.za)

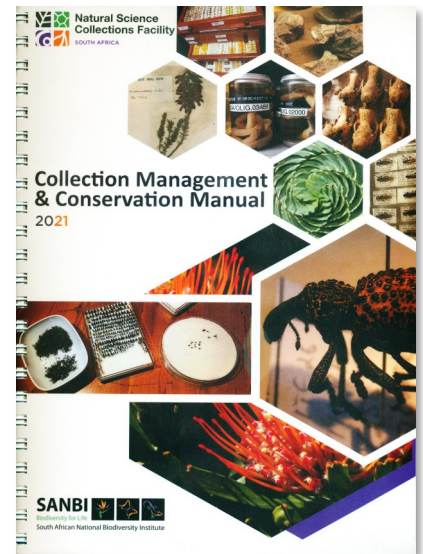
## ARC-PHP Biosystematics receives the NSCF Collection Management & Conservation Manual

During 2009-2011 the National Research Foundation (NRF) commissioned an assessment of natural science collections in South Africa. Some of the main shortcomings of institutions housing collections were highlighted as the lack of policies, procedures and standards documents. This meant that there was no common approach to collection management and curation in South Africa and in some cases even within institutions. Another shortcoming highlighted by the NRF report was the lack of formal training available in the curation of natural science collections. After many years of lobbying by the natural science collections and broader research community for recognition of collections as being critical for scientific research, as well as for capacity development and biodiversity conservation, government responded and the Natural Science Collections Facility (NSCF), which is a national Research Infrastructure Roadmap (SARIR) project, was established.

Through the NSCF, staff members from 16 participating institutions were afforded the opportunity to work collaboratively to pool their knowledge and experience on collection management and conservation, as representatives on the Collection Management and Conservation Working Group. Over a period of more than three years the NSCF Collection Management & Conservation Manual was developed through discussions and extensive reviews of global standards and institutional documents at a series of meetings of the Collection Management and Conservation Working Group. Petro Marais and Maggie Manyatsa represented ARC-PHP at these meetings. Dr. Riana Jacobs-Venter contributed by writing a chapter in the manual. During the final stages of developing the manual there were small group reviews of each chapter in which both Petro Marais and Dr. Riana Jacobs-Venter participated. Elsa van Niekerk provided photographs for the manual.

The NSCF Collection Management & Conservation Manual will serve as a national guideline for a standardized approach to collection management in South Africa. On Friday 5 March 2021 the printed NSCF Manual was delivered by representatives of the NSCF Hub Team to ARC-PHP Biosystematics staff. This manual can now be used by the collection personnel to achieve individual, institutional and national goals for the collections. The manual consists of ten chapters that address daily activities performed in collections. The aim of the manual is to guide collection staff in establishing carefully drafted policies, standards and procedures for these activities to ensure that they will be done in a systematic, defensible, and globally accepted way. This will ensure that the collections will survive and serve society, not only in the present but also far into the future, and are valued as critical research infrastructure.

Contact: Petro Marais at [MaraisP@arc.agric.za](mailto:MaraisP@arc.agric.za)



Collection Management & Conservation Manual



Watch video about the Value of the National Assets in PHP—

<https://www.youtube.com/watch?v=jpg0AcR1J4A&t=8s>

## Importation of a flower-feeding moth as a biocontrol agent against pompom weed

The pink blanket of flowering pompom weed has unfortunately become a common sight during late summer throughout the Highveld grasslands. The pompom weed has now become the most important invasive alien plant in the grassland biome in Gauteng, North West and Mpumalanga Provinces. Pompom has the potential to greatly expand its range throughout the grassland biome in South Africa, where it out-competes native plants to negatively impact both biodiversity as well as stock grazing capacity. The ARC has already released a stem and flower deforming thrips, *Liothrips tractabilis*, as an effective biocontrol agent and has previously evaluated and obtained permission for the release of a second insect agent, the flower-feeding moth *Cochylis campuloclinium*.



Pompom with the flower-feeding moth *C. campuloclinium*

However, after seven years of delay due to problems in obtaining biodiversity export permits from Argentina, a new culture of the *C. campuloclinium* flower-feeding moth was finally imported in February 2021 and is currently being reared in the ARC-PHP Roodeplaat quarantine facility. This is a major milestone for the biological control of pompom weed. This initial consignment consisted of 236 adult moths and 60 larvae that survived the trip from Argentina were transferred onto fresh bouquets of pompom flowers and the culture was screened for parasitoids. Specimens of the moth were also lodged with ARC-Biosystematics in order to confirm its identity. The culture will be nurtured through the diapause period during winter 2021 before releases can be considered in the late spring and summer season of 2021-2022. With no competitive interactions expected between *C. campuloclinium* and *L. tractabilis*, the two biocontrol agents should perform a complementary role of reducing pompom flowering (by *L. tractabilis*) and seed production (by *C. campuloclinium*).

Contact: Liame van der Westhuizen at [VDWesthuizenI@arc.agric.za](mailto:VDWesthuizenI@arc.agric.za)

## OIE approved laboratory confirms Bacteriology AFB results

American foulbrood disease (AFB), which is caused by the bacterium *Paenibacillus larvae*, is a lethal disease of honeybees which causes the death of the hive colonies. AFB was first reported in South Africa in 2009, being the only affected country in sub-Saharan Africa. The disease is incurable and often leads to complete colony losses, which proves to be a massive economic loss to beekeepers impacted by AFB. Some countries incinerate the honeybees that are infected with the disease, including all the equipment that was used during that period. In 2020, the ARC-PHP tested imported wholesale honey from Zambia for the presence of AFB on behalf of the Department of Agriculture, Land Reform and Rural Development and other relevant stakeholders. *Paenibacillus larvae* was detected in several Zambian honey samples. Zambian authorities questioned the results, as the clinical symptoms of AFB disease were not observed in honeybee colonies in the country. A number of samples, both positive and negative were sent for confirmation of results to the OIE-World Organisation for Animal Health approved laboratory at the Friedrich-Loeffler-Institute in Germany. The results obtained by the OIE confirmed the results obtained by the ARC-PHP laboratory. It must be noted that *Paenibacillus larvae* can be detected in symptomless colonies worldwide. The theory is that some bees might possibly be either resistant to AFB, or colonies contain microorganisms that inhibit toxicity of *Paenibacillus larvae*. This could be the situation in Zambia and requires further investigation.



Examination of a bee hive. Photo E. Lundall-Magnuson

Contact: Dr Teresa Goszczynska at [GoszczynskaT@arc.agric.za](mailto:GoszczynskaT@arc.agric.za)

## Report, detection and survey of *Phytophthora palmivora* Butler on *Carica papaya* L. from production regions in Mpumalanga Province

*Phytophthora palmivora* has been isolated from various ornamental nurseries in Mpumalanga Province since 2006. Infections did not spread for several years until December 2019, when it was detected in ornamental nurseries in the Witrivier, Komatipoort and Malelane regions. However, in February 2021 several papaya growers from Low's Creek, Malelane and Tzaneen reported collapsed papaya trees with symptoms of severe root and crown rot. Isolates from infected tissues revealed the presence of *Phytophthora palmivora*, a regulated quarantine pathogen with a wide host range and capable of destroying trees and seedlings of numerous subtropical crops. Subsequently, a virtual meeting was held with the DALRRD Manager of Plant Health Early Warnings, tasked with the monitoring, surveying, awareness and control of *P. palmivora* on subtropical crops in Mpumalanga. A thorough background was

provided of the disease incidence and several sub committees were formed. These committees were tasked with various responsibilities for the implementation of national monitoring, grower awareness and drafting of control programs.

In particular, a task team of six members was formed to be responsible for designing, drafting and implementing a sampling and diagnostic protocol. This protocol will be used by the members in their respective regions to sample soil from orchards of various subtropical crops in the vicinity of the infected papaya orchards. In addition, monitoring the possible spread of *P. palmivora* to neighbouring citrus orchards will receive high priority during the sampling process. High value crops such as macadamia and avocado may also be susceptible to infection and will receive special attention during the survey. Dr. W.J. Botha (ARC-PHP) was tasked to draft and circulate a sampling and diagnostic protocol for *P. palmivora* in the field and orchard soils. This protocol was sent to the members of the task team for review. It was approved and sent to the Early Warning System steering committee chairperson. Two more isolates of *P. palmivora* were received from Low's Creek, Mpumalanga in February, 2021. The disease is active and present in the same papaya orchards where the symptoms of crown rot and collapsed trees occurred in December 2019. It is therefore essential to commence the survey and sampling of orchards in the vicinity of affected papaya orchards as soon as possible. The survey should commence no later than October 2021, when soil and air temperatures will start to rise.

*Contact: Dr Wilhelm Botha at BothaW@arc.agric.za*

## ***ARC hosts national training event on five transboundary pests and diseases for DALRRD***

ARC-PHP recently presented a week long training event, the National Training Workshop Regional Agricultural Policy (RAP) EDF 11. It was attended by DALRRD members representing the provinces of South Africa, and FAO representatives. The workshop covered the Fall army worm, *Tuta absoluta*, Oriental fruit fly, Maize lethal Necrosis Disease and *Fusarium* tropical race 4. These five important transboundary pests and diseases are a serious threat to food security within the SADC region as they affect fruit and maize production. These crops are staple food sources for millions of people in the region. The abovementioned pests and diseases also have a detrimental effect on the production volumes and quality of produce required to achieve and maintain market access for export programs. This workshop coincided with the national celebrations of the International Year of Plant Health (IYPH).



Group photo of attendees

The aim of the training was to transfer technology to the delegates regarding the correct surveillance, detection, sampling and identification of these transboundary pests and diseases. The delegates gained an understanding of the biology of each pest and the disease vector, and learnt how to develop integrated strategies to control and manage them. The workshop also focussed on the concept of pest risk analysis and how the effects of pests should be mitigated within the international trade scenario. International standards for phytosanitary matter (ISPMs) played a crucial role, forming the background for training provided. The outcome of this training event was to develop capacity within provinces for increased pest surveillance, awareness and detection. Communication channels are also developed through central contact points (i.e. a referral center for diagnostics and identification at the ARC-PHP) managed through the ARC Training Centre of Excellence and through Plant Health Early Warnings at DALRRD. Suggested ways forward for dealing with these pests and diseases include increasing awareness and surveillance through provincial contact points, ensuring increased diagnostic capacity for their identification, and proper reporting channels.

*Contact: Robin Lyle at LyleR@arc.agric.za*

# *IUCN Red List of South African spiders included in the Species Environmental Assessment Guidelines*

Over the past few years, members of the Arachnology unit, under the guidance of Dr Ansie Dippenaar, have been working closely with the South African National Biodiversity Institute's (SANBI) Threatened Species Unit to evaluate all the South African spider species for possible placement on the IUCN Red List. This project was a massive undertaking with more than 2200 species being individually assessed according to the IUCN Red List Categories and Criteria. The ARC and SANBI worked with a number of arachnid specialists from various institutions to evaluate and assess each species according to this international standard. In order to do these assessments, data associated with the National Collection of Arachnida database and the published spider records in the SANSa database were used. This data comes from the National Collection of Arachnida, which is one of the national assets housed at ARC-PHP.

Based on the assessments of the South African spiders, 3% are considered Threatened, 32% are Data Deficient, 3% are Near Threatened or Rare and the remaining 62% are considered of Least Concern, meaning they have wider distributions with little or no known threats.

As part of this exercise, the South African spiders species that are of concern according to the IUCN Categories and Criteria have been included in the Species Environmental Assessment Guideline. This document is the guideline for the implementation of the terrestrial fauna and terrestrial flora species protocols for environmental impact assessments (EIAs) in South Africa. This means that the spider biodiversity in a given area needs to be included in every EIA that is done. This document was produced for the Department of Forestry, Fisheries and Environment, by the South African National Biodiversity Institute and BirdLife South Africa.

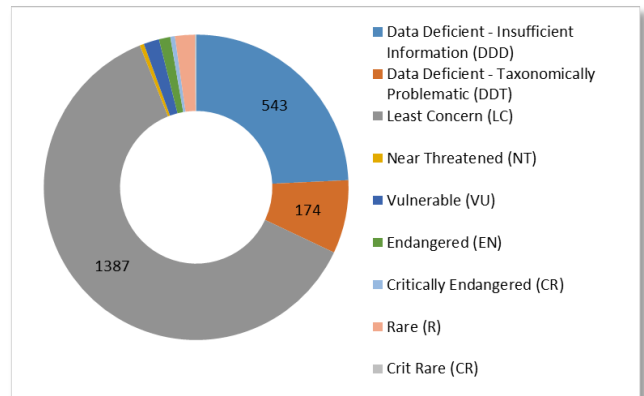
Furthermore, the spider assessments are also included in the National Screening that is used by EIA practitioners. It is a web-based Environmental Screening Tool that is a geographically based and web-enabled application which allows a proponent to submit an application for environmental authorisation in terms of EIA Regulations 2014. This tool is amended to screen their proposed site for any environmental sensitivity. This screening tool can be accessed at <https://screening.environment.gov.za/screeningtool/#/pages/welcome>.

The Screening Tool also provides site or locality specific EIA process and review information, e.g. the Screening Tool may identify whether an industrial development zone, minimum information is requirement, Environmental Management Framework or bio-regional plan applies to a specific area.

## Reference

South African National Biodiversity Institute (SANBI). 2020. *Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa*. South African National Biodiversity Institute, Pretoria. Version 1.2020.

Contact: Robin Lyle at [LyleR@arc.agric.za](mailto:LyleR@arc.agric.za)



A graphic representation of the South African spiders Red List species



## ARC-PHP Weeds Research Division: Progress Report 2018-2021

The Weeds Research Division recently released its latest progress report on the ongoing research done for the Department of Forestry, Fisheries and the Environment: Natural Resources Management Programmes (DFFE: NRMP) into the biological control of invasive alien plants in South Africa. The 32-page report briefly summarizes work completed between April 2018 and March 2021, and highlights the main progress made on the biological control programmes targeting some 21 invasive weed species. This research encompasses both the evaluation and risk assessment of new biocontrol agents still in quarantine, as well as the monitoring and implementation of agents already approved for release in the country. The ARC is grateful for the generous funding received from DFFE: NRMP for these research projects.

**The Report can be downloaded using the following link:**

[http://www.arc.agric.za/arc-ppri/weeds/Documents/ARC-PHP%20Progress%20Report%202018-2021\\_Hi-Res.pdf](http://www.arc.agric.za/arc-ppri/weeds/Documents/ARC-PHP%20Progress%20Report%202018-2021_Hi-Res.pdf)

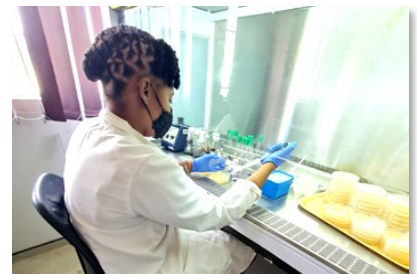
Contact: *Liamé van der Westhuizen at*



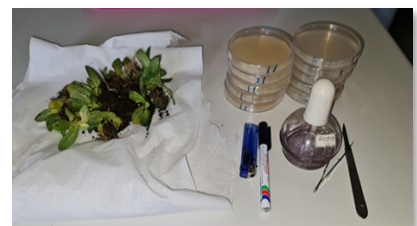
## Mycology Diagnostics supports agriculture by characterising important plant pathogenic strains

The Mycology Unit worked through 901 samples for agricultural related industries during the past year. This volume of samples demonstrates a significant increase in the need for specialist mycology diagnostic services and is the greatest expansion in the request for diagnostic services for the past five financial years. The samples originated from all regions of South Africa, and covered a wide range of sample types (e.g. soil, plant material, water, animal feed and air). Apart from providing the diagnostic services, 162 agricultural important plant pathogenic strains were isolated from the samples and deposited into the National Collection of Fungi (NCF) living collection. The cultures were barcoded and the sequences compared against the GenBank sequence database at the National Centre for Biotechnology Information (NCBI, Genbank) using the nBLAST algorithm. Accessioning new strains in the NCF, with edited DNA sequences, provides accurate and extended documentation of South African fungal biodiversity. The NCF as a national asset has to comply with South African legislation and international treaties, and provide accurate identified reference strains to the broader South African scientific and farming community. Currently the NCF live fungal collection at ARC-PHP houses 29 000 strains.

In addition, 170 samples were tested for quarantine organisms, e.g., *Ustilago maydis*, *Glomerella graminicola*; *Stenocarpella maydis*; *Cochliobolus carbonum*, and *Tilletia indica*-Karnal Bunt. *Fusarium* strains identified included; *Fusarium equiseti-incarnatum* from fodder. This represent a threat to animal health as genetic entities in this species complex have been linked to kikuyu poisoning of cattle in the East Cape Province (Botha et al., 2014, Jacobs et al., 2018). A sample was tested for the presence of *F. euwallaceae*, the *Fusarium* species associated with avocados and the polyphagous shot hole borer.



Processing of diagnostic samples in aseptic conditions



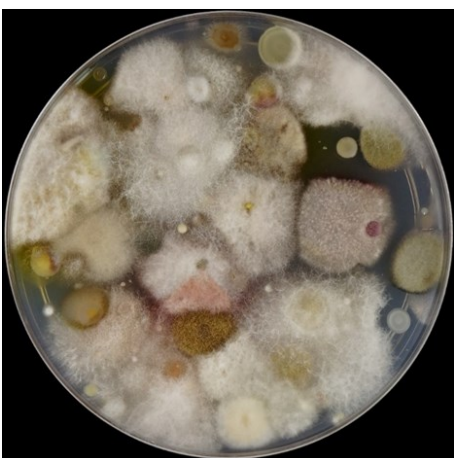
Processing of material for diagnosis



Processing of material for diagnosis



Different diseased samples received through the diagnostic services



Some mixed fungal colonies from a soil sample

*Fusarium oxysporum* was also isolated from grapevine and was associated with grapevine decline in Egypt (Ziedan et al., 2011) and Australia (Hight and Nair, 1995). *Fusarium oxysporum f.sp. lini* was isolated from tomato although previously associated with *Fusarium* wilt of flax. *Fusarium chlamydosporum* was isolated from wheat and is one of six species associated with head blight of wheat globally. It was reported in South Africa in 1998 and is the species associated with 3% of head blight infections (Boshoff et al., 1998). Furthermore, *Fusarium scirpi* was isolated from alfalfa and was reported on plant debris and wheat stubble in South Africa. The species forms part of the *Fusarium incarnatum-equiseti* species complex and was reported as a weak pathogen on Alfalfa.

*Neopestalotiopsis clavispora* was isolated from blueberry, and cause twig dieback and canker of blueberries. *N. clavispora* was recorded from Korea, Spain and Uruguay (Mondino et al., 2012 and Lee et al., 2019). *Neopestalotiopsis clavispora* and *Pestalotiopsis microspora* were isolated from macadamia flower buds and is known to cause Pestalotiopsis leaf spots of macadamia in Australia (Prasannath et al., 2020) and Brazil (Santos et al., 2019). *Sclerotinia sclerotiorum* was isolated from lettuce seedlings and is a severe threat to lettuce seedling cultivation. *Sclerotinia* cause lettuce drop (Van Beneden et al., 2010) in Belgium and disease symptoms on lettuce seedlings in England (Budge & Whipps 1991).

*Macrophomina phaseolina* was isolated from grapevine soils and cause trunk and cordon canker disease of grapevine in the United States of America (Nouri et al., 2018). *Macrophomina* may also cause extensive root rot when present in the rhizosphere of grape vines with general decline and leaf necrosis symptoms. *Didymella exigua* was isolated from several leafy vegetables and was previously known under many taxa classified in the genus *Phoma* and related taxa (Chen et al., 2015). This species was isolated from leaves of Eucalyptus sp., Alfalfa sp. and Chrysanthemum sp. submitted through the diagnostic service. *Bipolaris zeicola*, the causal agent of brown spots on *Zea mays* (maize) worldwide (Manamgoda et al., 2014), was detected on Alfalfa.

With regard to *Alternaria* spp., *Alternaria alternata* and *Alternaria arborescens* were frequently isolated from leafy vegetables submitted through the diagnostics service. *Alternaria alternata* was isolated from Alfalfa, Pepper, Tomato, Macadamia, Brassicae, carrot and other leafy vegetables. *Alternaria* spp. cause early leaf blight and late blight of various crops causing extensive leaf defoliation (Rotem 1994, Simmons 1999).

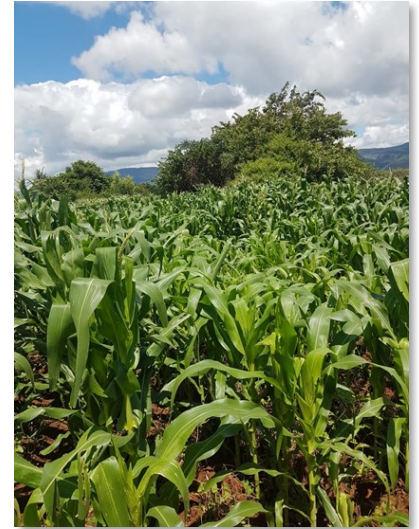
The *Rhizoctonia solani* complex has been isolated from cabbage, bean, chickpea and soybean and is a broad-spectrum pathogen with a wide host range. According to the list of Alfalfa diseases (Pervaiz et al., 2018), *Rhizoctonia* is listed as a serious pathogen. Sanger sequencing of the rDNA-ITS region showed that the binucleate isolate belonged to anastomosis group AG 2-2. Most *Rhizoctonia solani* anastomosis groups are important plant pathogens associated with seed rot, damping-off, seedling blight, stem rot and/or root rot of numerous field crops, (Melzer et al., 2016).

*Pythium aphanidermatum* and *Rhizoctonia* sp. complex were isolated from soils and roots of most received samples. Both *Rhizoctonia* and *P. aphanidermatum* may cause root rot on grape vine cultivars (Walker, 1997). *Rhizoctonia* and *Pythium aphanidermatum* may cause extensive root rot when present in the rhizosphere.

Contact: Ms Thando Bhiya at [Bhiyat@arc.agric.za](mailto:Bhiyat@arc.agric.za), Dr Riana Jacobs-Venter at [Jacobsr@arc.agric.za](mailto:Jacobsr@arc.agric.za) and Dr Wilhelm Botha at [Bothaw@arc.agric.za](mailto:Bothaw@arc.agric.za)

## Progress on the FAO FAW Farmer Field School

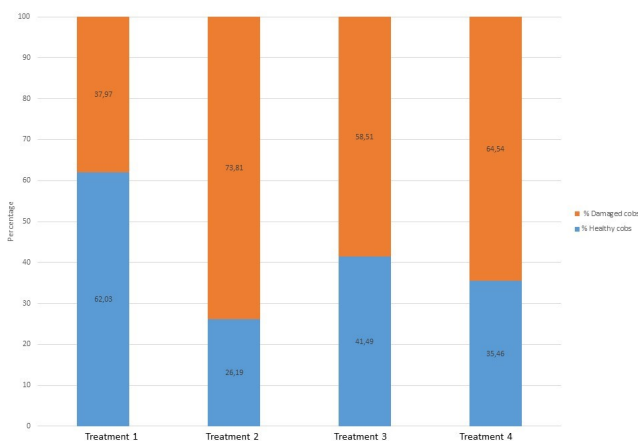
Through the funding provided by the Food and Agricultural Organisation of the United Nations (FAO) and with the support of the South African Department of Agricultural, Land Reform and Rural Development, technology transfer activities on Fall Armyworm (FAW) were able to be up-scaled in South Africa. This was done through a FAO FAW Farmer Field School project for female and youth smallholder farmers. Two sites were selected to roll out the field school project. Each of the sites was selected according to their proximity to the country's borders and their possibility of being a FAW outbreak hotspot. The first site is in the Mpumalanga Province, in the Nkomazi district, Magogeni Village. The second site is in Limpopo Province, near the town of Thohoyandou. At each site, 20 women and youth trainees were selected to participate. Formal AgriSETA training was provided to the trainees at both sites before the experimental planting trial was done. For each planted site, four treatment options were selected for application.



A recent photograph of the maize in the Tshiombo planting site, Limpopo

The treatments were as follows:

- Treatment 1 = GM Maize (Bt)
- Treatment 2 = Conventional maize
- Treatment 3 = Conventional maize with cultural control
- Treatment 4 = Conventional maize with chemical control



Preliminary findings that the cultural control which is the application of ash to the growing point reduces damage to the maize cobs

The layout at each site differed, depending on the physical space available for planting. The trainees with the ARC team planted the experimental layout by hand and the cutworm treatment was applied after planting. Currently, the maize is growing well after receiving good rainfall and the different treatments are being applied by the trainees. The aim of the trials was to show how different control methods can be used against FAW. To determine the effectiveness, data was collected during the harvesting process with the two communities.

Some of the primary findings have shown that the cultural application, which involves applying ash to the growing point of the maize plant, proved to reduce damage to maize cobs.

Contact: Robin Lyle at [LyleR@arc.agric.za](mailto:LyleR@arc.agric.za)

## A quarantine nematode found on “String of pearls”

Dr Antoinette Swart (Nematology Unit, Biosystematics) found ten female and three male nematode specimens of the genus *Aphelenchoides* in a sample from the Inspection Services of DALRRD (Stellenbosch). Both females and males were conspecific with the quarantine nematode, *Aphelenchoides ritzemabosi*. *Aphelenchoides ritzemabosi* is generally known as the “Chrysanthemum leaf nematode”, being a major pest on that plant. However, it is a polyphagous ecto- and endoparasite, and attacks the above-ground parts of at least two hundred plants, such as ornamental plants and fruit crops (e.g. strawberry and blackcurrant). Its feeding activities result in growth retardation, distortion and leaf blotches which turn brown and then black. The nematode can survive in a cryptobiotic state for three years or more, mostly as later

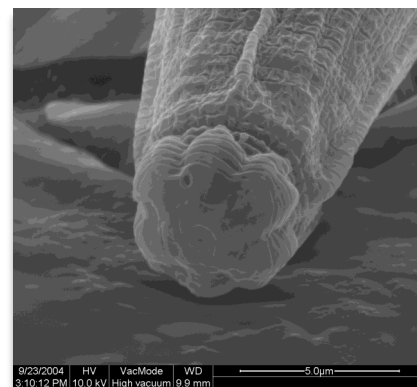


String of pearls showing disease symptoms

stage juveniles and adults. *Aphelenchoides ritzemabosi* is associated with bacterium *Corynebacterium fasciens* to form “cauliflower disease” of strawberry. This nematode is on the South Africa DALRRD list of prohibited pests on imported pests.

The host plant of the nematode was *Curio herreanus* Dinter (syn. *Senecio herreianus*), an endemic from southwestern Namibia and northwestern South Africa (Great Namaqualand). This member of the daisy family Asteraceae, called “String of pearls”, “String-of-beads”, “Gooseberry Senecio” and “String of Tears”, is a tender perennial succulent desired for its creeping stems and attractive, tear-shaped foliage. This nematode has been reported from other species of the genus *Senecio* (*S. petasitis* and *S. vulgaris*) from New Zealand, but never before on the genus *Curio*.

*Contact: Antoinette Swart at SwartA@arc.agric.za*



Scanning electronic microscope image of *Aphelenchoides nerine*

## Bacterial diseases unit seed testing services

The Bacterial Diseases Unit specializes in detection and identification of plant pathogenic bacteria in agricultural crops, including seed. Protocols used are based on IST/ISHI recommended protocols as well as our experience in seed testing. It must be noted that ISTA/ISHI protocols are available for a limited number of seed-borne bacterial pathogens.

Methods comprise the following:

- Dilution plating on selective media
- Morphological and biochemical tests
- Confirmation by pathogenicity tests in a greenhouse
- Molecular techniques:
- Polymerase chain reaction with primers specific for particular pathogens (if available)
- Identification of pathogens by gene sequence analyses

We offer seed testing for the presence of a variety of seed-borne bacterial pathogens. The laboratory is registered with DALRRD as the Test Lab for Plants, registration number: 72030001.

### BEANS

*BROWN SPOT - Pseudomonas syringae* pv. *syringae*

*HALO BLIGHT - Pseudomonas savastanoi* pv. *phaseolicola*

*COMMON BLIGHT - Xanthomonas axonopodis* pv. *phaseoli* and *Xanthomonas axonopodis* pv. *phaseoli* var. *fuscans*

### ONION AND LEEK

*LEEF AND SEED STALK BLIGHT - Pseudomonas syringae* pv. *porri* and pv. *allii* *Xanthomonas axonopodis* pv. *allii*

*CENTER ROT - Pantoea ananatis* and *P. allii*

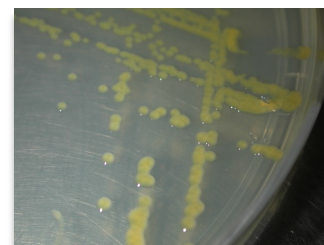
*LEAF AND SEED STALK NECROSIS - Pantoea agglomerans*

### CUCURBITS

*ANGULAR LEAF SPOT AND FRUIT ROT - Pseudomonas syringae* pv. *lachrymans* and pv. *syringae*

*LEAF AND FRUIT BLIGHT - Xanthomonas cucurbitae*

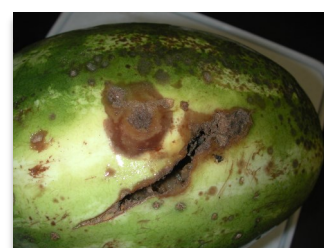
*BACTERIAL FRUIT BLOTCH - Acidovorax citrulli*



Bacterial colonies



Cabbage



Watermelon



Squash

## CRUCIFERS (CABBAGE, CAULIFLOWER, BRUSSEL SPROUT)

*LEAF BLIGHT* - *Pseudomonas syringae* pv. *maculicola* and pv. *syringae*

*BLACK ROT* - *Xanthomonas campestris* pv. *campestris*



## CARROTS

*LEAF BLIGHT* - *Xanthomonas hortorum* pv. *carotae*

## WHEAT

*LEAF BLIGHT, GUMMY DISEASE* - *Xanthomonas translucens/undulosa* (

## TOMATO

*BACTERIAL CANKER* - *Clavibacter michiganensis* subsp. *michiganensis*

*BACTERIAL SPOT* - *Xanthomonas vesicatoria*, *Xanthomonas perforans*, *Xanthomonas euvesicatoria* and *Xanthomonas gardneri*

*BACTERIAL SPECK* - *Pseudomonas syringae* pv. *tomato*



Tomato leaves

## MAIZE

*BACTERIAL LEAF STREAK OF MAIZE AND GUMMING DISEASE* - *Xanthomonas vasicola* pv. *vasculorum*



Tomato

## BRING ANY KIND OF SEED

If infested by any seed-borne bacterial pathogen we isolate and identify it.

## APPROXIMATE TIME TO PROCESS A BATCH OF SEED

Usual time for diagnosis from seed including pathogenicity tests – 8-30 days.

*Contact: Dr Teresa Goszczynska at GoszczynskaT@arc.agric.za*

## *Thanks to Ian Millar for his contribution to the Plant Protection Newsletter*

Ian Millar, who was a long standing member of the ARC-PHP Publication Committee, has recently retired after 40 years of service with the Biosystematics Division (first with the PPRI and then the ARC-PHP). He has made a valuable contribution to the advancement of the taxonomy of the Sternorrhyncha through his research and as curator of the Hemiptera collection, while at the same time serving on the ARC-PHP Publication Committee. His sharp editing pen helped to ensure that the Plant Protection Newsletter and other ARC-PHP outputs maintained a high standard.

*We would like thank Ian for his valuable contribution.*



Ian Millar

### SCIENTIFIC PUBLICATIONS

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## **MASTERS THESES**

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