

PLANT PROTECTION NEWS



In this issue

AGRICULTURAL RESEARCH COUNCIL - PLANT HEALTH AND PROTECTION

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Find out about our recent first reports of pest & diseases



Biosystematics collections were visited by external moderators



What did this cork-lid spider do?

The ARC-PHP Biosystematics National Public Good Assets are in good hands

The Natural Science Collections Facility (NSCF) is one of 13 projects implemented by the Department of Science & Technology as part of the South African Research Infrastructure Roadmap (SARIR) project. The NSCF is a network of South African museums, universities and research institutes that hold natural science collections and as a community work towards achieving a common set of objectives. These include using the collections for nationally and globally relevant research and for identification of biological material, making data from specimens accessible for use in research and decision-making, and using collections for education and citizen science to promote understanding of South Africa's biodiversity assets.

The ARC and NSCF have a collaboration agreement to achieve the NSCF's common set of objectives. Some of these objectives are to ensuring accessibility to collections, both physically and virtually, for research and to mobilizing data from the collections for research and decision making. The ARC is also represented on the NSCF's coordinating and steering committees.

During the NSCF's Annual Forum held in October 2022 the Iqoqwana Initiative was launched. *Iqoqwana* means "a small group" in isiZulu and isiXhosa, and is derived from the word *Iqoqo* which means "group" or "collection". The initiative signifies the coming together of small groups of people from different collections and institutions, working together for a common purpose: conducting assessments of the collections that forms part of the NSCF network with the purpose of learning and improving the state of the collections.

The assessments started with an Orientation workshop held at SANBI, Pretoria National Botanical Garden on the 8th March 2023. The NSCF Hub team drafted a questionnaire which the participating institutions then used to self-assess their collections against the standards set by the NSCF in their Collection Management & Conservation Manual. PHP had four National Public Goods Assets (NPGAs) or collections complete and submitted the questionnaire by 30 April 2023. The NPGAs assessed were the National Collections of Arachnida, Entomology, Mycology and Nematology.

During May 2023 each of the four collections were moderated on their submitted self-assessments. The moderations were done in person by a moderator from the NSCF Hub as well as an observer from another participating institution. During the moderation sessions, which lasted a day for each collection, a visual inspection of the collection was done, hard copy documentation and databases were moderated and finally the self-

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assessment were reviewed and responses were updated if needed. Data from the final assessments will be processed after all the moderations throughout South Africa is finalized by the middle of July 2023. This may take up to two months where after each collection as well as PHP will receive a report.

Initial verbal responses from the moderators were that these unique collections within PHP are well organized, have good workflow processes and are curated by a group of highly dedicated staff. Some aspects in the collections that need intervention or additional investment were also identified.

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From right to left: the Research Team Manager of Biosystematics, Dr Isabel Rong, with curator of the National Collection of Fungi, Dr Riana Jacobs-Venter, the ARC NSCF coordinator, Petro Marais and the head of the NSCF, Dr Michelle Hamer.

The biocontrol agent, the flowering gall mite, *Aceria lantanae*, and the lawn effect it causes



Fig. 1 Lantana mature flower- and seed-heads on the right versus flower galls induced by the mite *Aceria*

The invasive alien plant of Central to South American origin, *Lantana camara* (Verbenaceae), remains a persisting menace to ecosystem services throughout its introduced range, including South Africa. *Lantana camara*, hereafter referred to as lantana, is toxic to livestock, poses a threat to indigenous vegetation, reduces grazing land through encroachment, and contributes to the loss in water resources. Farmers, land owners and nature reserve conservancies are continuously bemoaning the presence of lantana and its deleterious effects. This plant is better controlled in an integrated fashion, combining manual clearing, herbicide application and biological control.

Biological control is a crucial component in the management of lantana, not only because it is cost effective but also because it is environmentally friendly. Between 1986 and 2009, over a dozen arthropods (insects and mites) and a leaf spot fungus have been

released on lantana, with varying levels of control. In 2008, the flower galling mite, *Aceria lantanae* (Acari: Trombidiformes: Eriophyidae), was introduced into South Africa from a biotype obtained from Florida in the United State of America. Research shows that *A. lantanae* (hereafter referred to as *Aceria*) is significantly reducing seed production of susceptible lantana varieties occurring in the country (about 30 % of all known varieties). In addition to reducing the reproductive capacity of the plant (Figure 1), field observations show that *Aceria* appears to also be attacking the vegetative re-growth of previously cut lantana plants, thus creating a stunted horizontal growth at ground level, which looks like a mowed lawn (Figure 2).

The implication of the *Aceria*-induced lawn effect is that land owners and invasive alien plant management teams may not find it necessary to undertake follow up herbicide applications and/or clearings after cutting down heavily galled lantana plants (*Aceria* attacked plants) as the vegetative re-growth of such plants will be significantly held back or retarded by *Aceria*. Not only will these plants not re-grow to their initial height, they will bare less fruits as a result of flower galling, which will massively contribute to the reduction of subsequent recruitment (by seeds). The lawn effect is indicative of the ability of *Aceria* to readily re-colonize lantana coppices keeping their growth at bay.

In addition to its ability to curb the spread of lantana, *Aceria* will save weed management on operational cost by significantly reducing the frequency of follow-up herbicide applications, and this will contribute to the preservation of the environment through cutting down on the harmful effects of herbicides on non-target vegetation.

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Fig. 2 *Aceria* induced horizontal re-growth of previously cleared lantana creating the lawn effect

News on first reports of pests and disease for South African biosecurity

Through the activities of the work done at the ARC-PHP Department of Agricultural, Land Reform and Rural Development accredited labs, a number of first reports of pest and diseases found in South Africa have been reported. We are excited to share these findings with the agricultural community.

New virus reported on Cannabis



The Alfalfa mosaic virus belong to the family Bromoviridae was reported on Cannabaceae, *Cannabis sativa*.

Additional hosts of the virus are alfalfa, potato, peppers, tomato, hemp/cannabis, soybean and many ornamental plants and weeds.

Further work is being under taken by ARC-PHP researcher, Tendekai Mahlanza.

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New pest reported on peppers and chilli

The new pest reported on peppers and chilli is *Asphondylia gennadi* of the family Cecidomyiidae. They are also referred to as gall midges. The larvae of these insects feed within the plant tissue, creating abnormal plant growths. These growths are referred to as galls.

The symptoms of the disease are dried, misformed young fruit, often with emergence holes and pupals castings visible. The host range of the pest or the extent of the crop loss is currently unknown.

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New fungus reported on blueberries

The blueberry industry is one of the successful and expanding agricultural cropping systems in South Africa. As a result of this growth, research into identifying plant disease agents has become increasingly important, yet there are relatively few scientific reports published on the subject in the country. The aim of this study was to identify the causal agents of stunting and leaf scorch on blueberry plants and evaluate their virulence. Therefore ten samples were collected from a commercial blueberry in Gauteng, South Africa. The resulting isolates were identified based on DNA sequence data from the rDNA-ITS. Three *Pythiaceae* were identified including *Globisporangium ultimum* var. *sporangiiferum*, *G. splendens* and *Pythium aphanidermatum*. Results of pathogenicity trials showed the isolated species were able to cause disease on 40% of the plants. This is the first official report for *G. ultimum* var. *sporangiiferum* in South Africa and the first report of *G. ultimum* var. *sporangiiferum* and *P. aphanidermatum* from blueberry plants.



Blueberry plant showing infections of the *Globisporangium ultimum* var. *sporangiiferum*

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Second report on Pepper Ringspot virus on potato

Pepper Ringspot virus (PepRSV) on potato has been reported for the second time in South Africa.

It was found in plant material and tuber that show no visible symptoms. The extent of the PepRSV is not known within South Africa. There was a first report in October 2020 but the locality was not given.



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Understanding the cork-lid trapdoor spider diversity leads to a doctoral degree being awarded

Dr Shannon Brandt has recently been awarded her doctoral thesis with the title: 'Under the trapdoor - Resolving the taxonomy and phylogeography of the trapdoor spider of the genus *Stasimopus* (Mygalomorphae: Stasimopidae) of the Karoo. Dr Brandt was co-supervised by ARC-PHP staff member, Robin Lyle. Her main supervisor was Dr Catherine Sole from the Department of Zoology and Entomology at the University of Pretoria. This project started as an Honours project through the Karoo BioGap project (<https://www.sanbi.org/karoo-biogaps-project/>) and after much work in at Masters level, it was eventually upgraded to a PhD study. Material collected through the work has been deposited in the National Collection of Arachnida at the ARC-PHP.

Stasimopus is a genus of cork-lid trapdoor spider under the infra-order Mygalomorphae. The genus is endemic to southern Africa, but is largely understudied. This study was undertaken to understand the true species diversity and history of this genus in the Karoo region of South Africa. The Karoo is a semi-arid, unique and sensitive ecosystem which is facing pressure for development due to economic incentives. This area has long been neglected, with few studies investigating the fauna and their phylogeographic history. Part of the project was finding new methods to aid in species identification. Various diagnostic methods were tested against the morphological identifications and monophyletic groupings. The study found that the diversity of the genus is significantly higher than previously believed including the description of



Shannon Brandt on the day of her graduation with her supervisors Robin Lyle (ARC, on the left) and Dr Catherine Sole (UP, on the right)

nine new species. The final data chapter unravelled the phylogeographic patterns of the genus in the Karoo. The study highlights the large number of short-range endemics present in the Karoo, which are of great conservation concern.

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Lady beetle (*Mada polluta*) demolishing yellow bells (*Tecoma stans*) in East London



Fig. 1 *Mada polluta* adult

A leaf-feeding lady beetle, *Mada polluta* (Coleoptera: Coccinellidae) (Fig 1) was initially released at East London in November 2016 against *Tecoma stans*, commonly known as yellow bells because of its yellow flowers. Its origin is in Gurerro province in Mexico with rainfall throughout the year and the climate range from tropical to temperate. Releases of 200 and 400 of the lady beetle were conducted in seven *Tecoma stans* L. (Bignoniaceae) sites to determine the optimal release size. The optimal release size at East London was 200 and the agents were establishing, damaging, dispersing and causing a severe impact on *T. stans* populations. Since February 2018, the lady beetle has been found establishing at some of the sites and currently has dispersed beyond the release points. Severe damage (Fig 2) caused by the beetle can be seen along the R72, N2, N6 (close to East London), Nahoon and along the old Transkei road.

It has defoliated yellow bells up to 100% in some of the sites like Nahoon, Nahoon valley, Old Selbornian club and surrounding communities. The beetle continues to extend its range around East London and is having an

impact on the reproductive output of yellow bells population. Both larvae and adults feed on the leaves and cause significant damage to yellow bells.

The significant beetle population increase and spread in other regions invaded by yellow bells is likely to result in the overall reduction in the vegetative and reproductive output of the invader.

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Fig. 2 Severe damage caused by *Mada polluta*

Work Integrated Learning (WIL) students' activities in the National Collection of Fungi

The Mycology Unit at the ARC-PHP plays a major role in educating and training students from several universities at different graduate levels including PhD, MSc, BTech, internships and WIL programs. The aim of the WIL program is to ensure that students have the ability to integrate academic learning with work related activities and be able to become a graduate. The unit has provided the WIL program to more than 20 students since the beginning of 2001. Seven of the trained students are employed by the ARC.

The Mycology Unit currently has three WIL students from Vaal University of Technology. They joined the unit on 1 November 2022. During a five month period the group was involved in many activities such as preparing growth media, buffer and other solutions including sterile water in McCartney bottles; sub-culturing and transferring fungal cultures for clients, collection, research and BBSA. Further activities included molecular activities (DNA extractions PCR outputs and sequence analyses) for the verification of fungal species; preserving cultures using different methods and verification of ultra-low freezing tubes as part of GRAP 27 activities. Other participation included the screening of strains for amylase and protease production for research purposes.

They are very dedicated in their work and they play a major role in assisting the unit to meet all project targets on time. These range in a number of projects both research and diagnostics while at the same time contributing to the National Collection of Fungi activities.

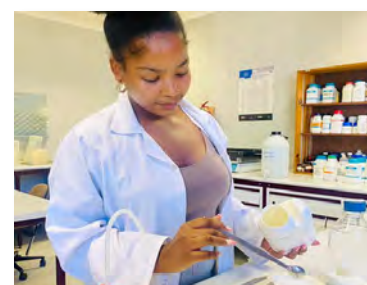
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Meladi Simelane transferring fungal cultures aseptically



Thuso Tshipani extracting DNA from fungal cultures



Sibongile Nqashe preparing media for fungal isolation

To test or not to test your seed – that is the question!

Asked by many in various ways, this question can be a determining factor of a successful or unsuccessful planting season. Imagine planting more than 20 hectares with seeds infested by plant parasitic nematodes and seed borne pathogens? “Scary” thought because this situation will only result in poor seed germination and high plant disease

pressures. As a result, a farmer will have higher input costs due to compact spraying programmes trying to combat these plant diseases. At this point, two questions will be asked: Firstly, was the seed worth planting? Secondly, is it worth it for the farmer to continue with these compact and costly spraying programmes?



The first question was most probably answered during the Agricultural Research Council – Plant Health Protection’s YourSeed™ online webinar. Themed “Let us test it for you if it is worth planting”, this webinar was held on the 18th of November 2022. Attended by ARC specialists as well as companies from the seed industry, this platform was utilized to discuss the importance of seed health testing. Seed vigour and germination are influenced by many factors including amongst others, fertilizer applications and irrigation schedules during seed production, humidity and temperature during seed storage. Seed health is influenced by many factors ranging from microorganisms to plant parasitic nematodes and insects. These interesting talks were initiated by the presentations offered by Emil von Maltitz (ARC-PHP researcher), Dr Kulani Machaba (Corteva Agriscience™), Dr Magdaleen Cilliers (South African National Seed Organisation) and Dr Brigitte Hamman.

While it is easier to maintain conducive conditions for seed viability, it is not the case when it comes to seed health since there are other external factors influencing seed health status of the seed. These external factors include temperatures that may be conducive for disease development from pathogen inoculum that are either mixed in with seeds, adhering to the seed coat, inside

the seed or deep-seated within the seed. Even though they never seem to cause diseases at times, these microorganisms have been reported to reduce seed quality, seed and seedling viability, affect plant growth and crop yield.

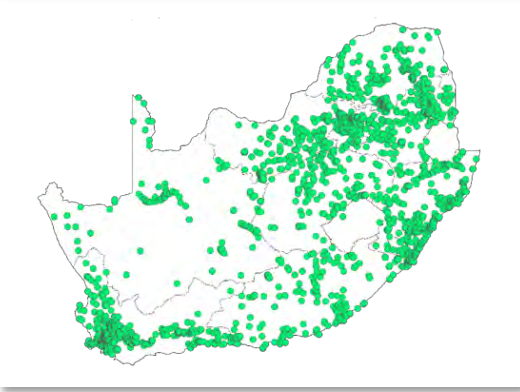
To prevent all this, it will then make economical sense to test your seed to determine if it is worth planting, prior to planting. Launched recently, YourSeed™ is an ARC-PHP’s seed diagnostics package designed to offer fast, accurate diagnostics of seed-borne pathogens and pests for all agricultural crops. Using standard protocols recommended by International Seed Health Initiative (ISHI) and International Seed Testing Association (ISTA), the ARC-PHP’s diagnostic team is determined to offer seed health testing and ensure that each and every seed planted is indeed worth planting. Therefore, get your seed tested before planting it – you will pick the fruit of your efforts!

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The Nematology Unit — Serving the agricultural sector for more than 50 decades



Locality records from the SAPPNS database from 1952 to 1989

Nematodes are microscopic organisms, also known as roundworms or eelworms, that can be found in every ecosystem type and every continent of the globe. These organisms are the most abundant and diverse group of animals on the planet. The Nematology unit at Biosystematics is one of the leading nematology laboratories in South Africa with work that ranges from daily diagnostics to intense research on nematodes in both agricultural and natural ecosystems.

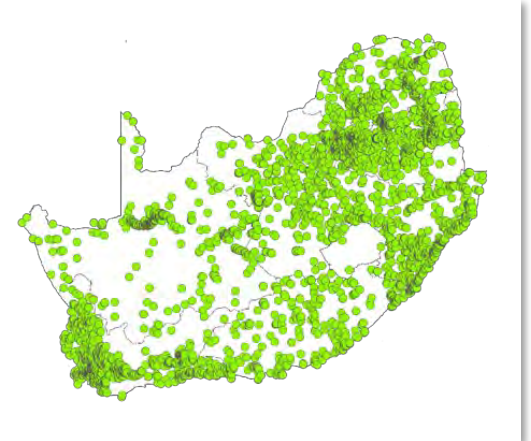
The unit houses the National Collection of Nematodes (NCN) which is currently the largest reference collection in Africa and houses nematode species from various countries in the world. This is a working collection and specimens are added to the collection on a regular basis. Currently there are only a selected few people able to

identify plant-parasitic nematode species in South Africa and these experts are based in the National Collection of Nematodes housed at Biosystematics, ARC-Plant-Health and Protection.

In 1987 the Nematology Unit founded the South African Plant-Parasitic Nematodes Survey (SAPPNS), to make a comprehensive assessment of the nematode biodiversity resources of South Africa with various objectives namely:

- to make an inventory of all the plant-parasitic nematodes of South Africa
- to study the biogeography of these plant-parasitic nematodes
- to establish an electronic database of these plant-parasitic nematodes at the NCN
- to compile distribution maps.

As part of the South African Plant-Parasitic Nematode Survey (SAPPNS) programme systematic surveys were conducted in various parts of South Africa, especially in areas where little information was available on the plant nematodes of the region, and to record nematode–plant associations. In 1996, ten years into the SAPPNS programme the personnel of the Nematology Unit was able to publish "*Plant nematodes in South Africa*" drawing together the knowledge on the occurrence of plant nematode species (51 genera) occurring in South Africa". In 2006 the SAPPNS database was transferred into a module of the web-based relational Nematode System and thus the second phase of the SAPPNS was launched in 2006 when digitising of the specimens deposited in the National Collection of Nematodes was started.



Locality records from the SAPPNS database from 2000 to 2023

Datasets from SAPPNS were part of the 2017 publication *Nematology in South Africa: a view from the 21st Century*. The SAPPNS has grown to include more than 9200 localities with distribution and host information on South African nematode, including 530 plant-parasitic nematodes of which more than 200 species are reported to be endemic to South Africa.

The Nematology unit, a team of nematologists with a passion for not only nematodes but also for improving sustainable agriculture, has been and continues to be a centre of excellence in nematode diagnostics and research.

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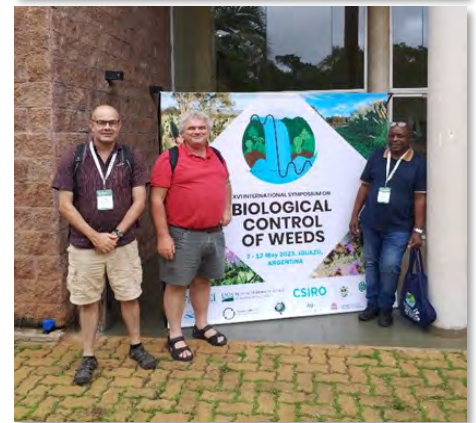
ARC-PHP Biocontrol researchers attend the 16th International Symposium On Biocontrol of Weeds

The 16th International Symposium on Biological Control of Weeds (XVI ISBCW) was held in the town of Puerto Iguazú, Argentina, from 7-12 May 2023. ARC-PHP was represented by three researchers, Dr David Simelane (Specialist Scientist, Roodeplaat), Dr Alan Wood (Specialist Scientist, Vredenburg) and Dr Costas Zachariades (Senior Researcher, Cedara). Each of the researchers gave an oral and a poster presentation, and several other posters including ARC-PHP staff as authors were presented by other attendees.

ISBCW is held once every four years, and is the core international meeting for weed biocontrollers. International collaboration is especially important for the science of weed biocontrol, because of the need to source biocontrol agents from the region of origin of weeds ('invasive alien plants' - IAPs) invading South Africa – the region of origin usually being on a different continent. This is the first time that ISBCW has been held in South America. This is significant both because South America has been the source of many IAPs worldwide (e.g. lantana, water hyacinth, cacti) and thus has considerable expertise in conducting surveys for potential biocontrol agents for other countries; and because countries in South America are being increasingly impacted by IAPs from other parts of the world (including South Africa), and would like to start biocontrol programmes of their own. A further issue is that with Access and Benefit Sharing legislation (e.g. Nagoya Protocol) coming into effect, South American governments have become increasingly cautious in providing their biodiversity to other countries. By holding ISBCW on the continent, South American weed biocontrol practitioners hoped to highlight the discipline and the potential it holds for solving some of the IAP problems they are facing.

About 160 delegates from 20 countries attended the symposium, including a strong delegation from South Africa. Seventy-five oral presentations were made over four days (no parallel sessions), while 100 posters were displayed. A wide range of topics was covered: genetics of both IAPs and their natural enemies; surveys for and host-range testing of potential biocontrol agents; ecology and evolution; climate change; legislation; mass-rearing; the interface between communities, implementers and biocontrollers; post-biocontrol restoration of ecosystems; the potential for improvements to weed biocontrol; and the future. A special session was held on weed biocontrol in South America. Judging from the high proportion of millennial scientists, the future of weed biocontrol is in good hands. There is a drive to reduce the use of herbicides worldwide, and weed biocontrol is one of the tools that can be used to achieve this. New genetic technologies such as gene drives and gene silencing may well have application in this. The ever-increasing power of computing systems allows for the analysis of large and complex datasets, an extremely useful tool in the complex trophic systems we are manipulating through the use of biocontrol. There is also increasing adoption of weed biocontrol by countries in Europe, where it was previously viewed with caution.

Apart from catching up on new research, technologies and approaches, the XVI ISBCW afforded the ARC-PHP delegates the opportunity to network with practitioners worldwide. Dr Simelane was able to make important progress in arrangements for the identification of insects collected as potential biocontrol agents from weeds being surveyed in Argentina and Brazil, and to discuss the possibilities for surveys of the weed *Xanthium strumarium* in Texas, USA. Dr Wood was approached by researchers from several countries about collaboration possibilities on rust fungi being used very successfully against invasive Australian *Acacia* species in South Africa. Dr Zachariades convened a meeting to discuss the future direction of the biocontrol project on *Arundo donax* in South Africa, and made contacts for work on biocontrol of invasive *Rubus* species.



From right to left: Dr Alan Wood, Dr Costas Zachariades and Dr David Simelane



Dr Alan Wood (right) talking to the Chair of the Organising Committee, Dr Guillermo Cabrera Walsh (FuEDEI, Argentina, left)



Dr David Simelane in action presenting his work

Oral Presentations

Ramabulana, E. & **Wood, A.R.** (2023). Diversity of fungi associated with dieback and stem canker of *Prosopis* tree species in South Africa. (Presented Sunday 7/5/2023 at International Bioherbicide Group workshop).

Simelane D.O., Mawela, K.V. & Katembo, N. (2023). Ten years after the release of the balloon vine weevil *Cissoanthonomus tuberculipennis* (Coleoptera: Curculionidae) in South Africa: an emerging success.

Wood, A.R. (2023). Impact of the gall-forming rust fungus *Uromycladium morrisii* on the invasive tree *Acacia saligna* in South Africa: 30 years of monitoring.

Zachariades, C., Moran V. C., Hoffmann, J. H. & Hill, M. P. (2023). Assessing the outcome of biological control on weed populations.

Posters

Caister, R.E., **Strathie, L.W.** & Olckers, T. (2023). Biology and field performance of the seed-feeding weevil *Smicronyx lutulentus* (Coleoptera: Curculionidae), a biological control agent of *Parthenium hysterophorus* (Asteraceae: Heliantheae) in South Africa.

Lehavana, A., Hill, M.P., **Zachariades, C.** & Birkinshaw, C. (2023). Biological control using *Cyrtobagous salviniae* as a potential strategy for managing the invasion of *Salvinia molesta* in Madagascar.

Simelane, D.O., Mawela, K. & Katembo, N. (2023). The leaf-mining flea beetle *Epitrix* sp. is suitable for release as biological Control for *Cestrum* spp. (Solanaceae) in South Africa.

Wood, A.R. (2023). Establishment of the gall-forming rust fungus *Uromycladium woodii* on *Paraserianthes lophantha* in South Africa.

Zachariades, C., Martin, G.D., Sochor, M., Mason, B. & Widrechner M.P. (2023). Towards biological control of invasive North American *Rubus* species in South Africa: species identities, genetic diversity and origins.

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