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Plant Protection Research Institute

PLANT PROTECTION NEWS

Newsletter of the Plant Protection Research Institute (PPRI), an institute in the Natural Resources and Engineering Division of the Agricultural Research Council (ARC)

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General enquiries

Plant Protection Research Institute
Private Bag X134
Queenswood
0121
South Africa

e-mail: infoppri@arc.agric.za
website:
http://www.arc.agric.za

Lantana flower gall mite: established, spreading, and making an impact

The lantana flower gall mite, *Aceria lantanae* (Cook) (Eriophyidae) (Fig. 1), which is native to the Caribbean area, feeds on the undifferentiated inflorescence bud of lantana, and induces it to develop into a microphyllous gall (Fig. 2) instead of a flower-head and fruit-head, thus reducing seed production. The mite breeds inside the flower gall (Fig. 3). Galling also stunts vegetative growth (Fig. 4). By reducing the rate of growth and reproduction of lantana, the budmite has the potential to reduce the rate of densification and spread of the weed. This will reduce the rate of loss of natural pasturage and biodiversity, and the frequency and cost of mechanical-plus-chemical control of lantana.

This candidate biocontrol agent was imported into ARC-PPRI's quarantine facility in Pretoria. Host-specificity testing over a number of years demonstrated that *A. lantanae* is specific to *Lantana* section *Camara*, to which the weedy lantana entities (*Lantana camara* hort.) belong, and that it poses no threat to any economic or indigenous African plants. Authorization to release the mite was granted, and it is now established on mite-susceptible lantana varieties at a number of humid, frost-free sites in South Africa, where it reduces seeding by up to at least 85% (Fig. 5). The budmite is dispersed by wind and by phoresy on flower-visiting insects (Fig. 6), and has been recovered at distances of up to 50 km from the closest release sites, within two years of release.

ARC-PPRI would be happy to supply starter cultures of *A. lantanae* to official organizations in other countries. Tests conducted in quarantine by ARC-PPRI for the State of Queensland demonstrated that *A. lantanae* is suitably host specific for release in Australia. Consequently, a pure starter culture of *A. lantanae* was recently prepared at ARC-PPRI for Biosecurity Queensland. We hope that the lantana flower gall mite will help to reduce the scourge of lantana in Africa, southern Asia, Australasia and the Pacific Islands.

Contact: Alan Urban at UrbanA@arc.agric.za, Stefan Neser at NeserS@arc.agric.za* and *Phillimon Mpedi at MpediP@arc.agric.za

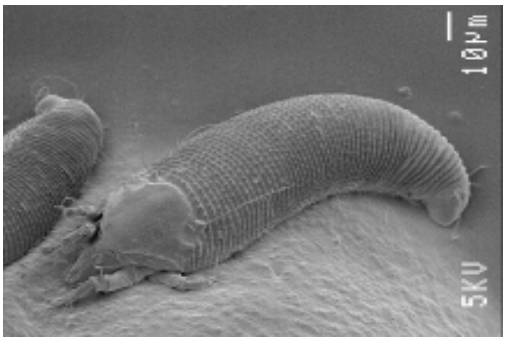


Fig. 1. Scanning electron micrograph of adult lantana flower gall mite, *Aceria lantanae*. Photo: C. Craemer (ARC-PPRI) & A. Hall (University of Pretoria).

Fig. 2. Microphyllous galls induced by *Aceria lantanae* in place of inflorescences on *Lantana camara* in Florida, USA. Photo: S. Neser.

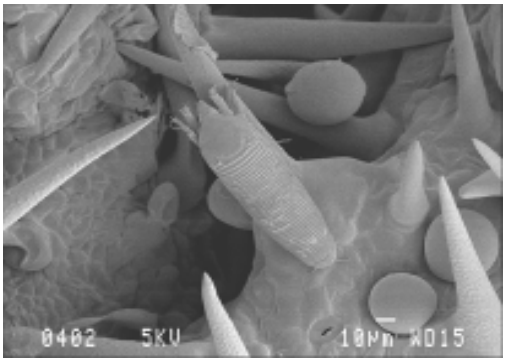


Fig. 3. Scanning electron micrograph of eggs and nymph of *Aceria lantanae* among the leaf trichomes inside a lantana flower gall. Photo: C. Craemer (ARC-PPRI) & A. Hall (UP).

Lantana flower gall mite (continued)

Fig. 4. Galling by *Aceria lantanae* stunts vegetative growth of lantana

Fig. 5. Flower galling by *Aceria lantanae* can reduce seeding of lantana by more than 85%

Fig. 6. *Aceria lantanae* is spread by wind and flower-visiting insects

Biosystematics

Workshop on biopesticides: from development to commercial opportunities

Drs Mariette Truter (Biosystematics, Mycology) and Ahmed Idris Hassen (Microbiology and Plant Pathology) attended a biopesticide workshop entitled: "Future focus: biopesticide development trends and commercial opportunities" held at Pure Joy Guest Lodge, Kameeldrift, Pretoria from 22 to 23 November 2010.

The purpose of the Workshop was to create a platform for more effective communication between interested researchers and biopesticide and biofertilizer companies with government. Biopesticides are broadly described as any living organisms that are applied to control other organisms, e.g. phytopathogens. Biofertilizers are, on the other hand, applied to improve plant nutrient acquisition, thereby promoting growth. The workshop focussed on the most recent and innovative developments, trends and innovations in biopesticides with an emphasis on novel technologies and formulations. Aspects dealing with product registration and commercialisation were discussed, and a "biopesticide to business" overview of industry potential and constraints was provided. Talks were divided into three main themes, e.g. Novel technologies in biopesticide science, Biopesticide company overview and commercialisation challenges, and Biopesticide regulations. At the end of the workshop a round table discussion was held to specifically discuss the various regulations surrounding biopesticides.

A constant concern raised by speakers and participants, was on quality control of biopesticide products. Most people feel that there are not sufficient accredited laboratories in South Africa to test biopesiticides on a routine basis to ensure quality. Independent laboratories are required to test the various products as part of the production quality assurance, and as a service to clients/farmers who need to verify the quality of the products purchased.

About 60 people attended the two day workshop, including researchers, students, government, industry and professionals involved in research, development, registration, production, storage, trade, marketing, pest control, and commercialisation.

Contact: Dr. M Truter at TruterM@arc.agric.za and Dr. A Hassen at HassenA@arc.agric.za

Delegates who attended the Biopesticide workshop

Biosystematics (continued)

Burundi takes a stand to conserve bee biodiversity

Burundi is a small country in the middle of Africa. Being in the transition zone between the East African savannah and the West African tropical forests, one would anticipate that it has a large and interesting biodiversity. A survey of the bee biodiversity in Burundi is currently underway.

The person responsible for biodiversity research is Benoît Nzigidahera, and he is a remarkable scientist. He first studied plants and mushrooms, and knows the entire Burundi flora. He then progressed to spiders, which remains his passion, but has his research team working on bees because they are the most important pollinator group, and the conservation of pollinator biodiversity is a priority in the Convention for the Conservation of Biological Diversity's Agro-biodiversity Programme. Dr. Connal Eardley was recently invited to Burundi to teach Benoît's team how to collect, curate, and identify bees. This trip was supported by the Belgian Development Corporation. It was highly successful, but much work is still needed because learning to identify bees requires a lot of practice and mentorship.

In Africa historical data on bees is mostly scant, there are insufficient taxonomists, and there is little expertise in bee abundance and diversity. Therefore, the assessment of change in bee populations in time and space is difficult. However, a lot of evidence on the decline in bee numbers is coming to the fore in other parts of the world, and there is no reason to believe that the same is not happening in Africa. Large collections of bees from Burundi's west and east neighbours, namely the eastern Democratic Republic of the Congo and western Kenya, exist in Tervuren (Belgium), Nairobi, and London.

These can help us understand the historic bee diversity in Burundi, and the current survey can help us understand the changes that are taking place. Burundi should, therefore, be applauded for its approach to biodiversity science, and we trust that the partnership between Burundi, Belgium, and South Africa will be a long-standing one.

Contact: Connal Eardley at EardleyC@arc.agric.za

Benoît Nzigidahera and his research team

DIAMOND ROUTE RESEARCH CONFERENCE

The **1st Annual Diamond Route Research Conference** was held at De Beers' Johannesburg Campus from Tuesday 9th to Wednesday 10th November 2010. This meeting was hosted by De Beers Consolidated Mines, and E. Oppenheimer & Son. All parties that have conducted research on any of the Diamond Route properties (Venetia Limpopo Nature Reserve, Ezemvelo Nature Reserve, Rooipoort Nature Reserve, Tswalu Kalahari, Benfontein, Dronfield, Brenthurst Garden, Namaqualand, and the Kimberley Big Hole) and other sites within the De Beers Family of Companies, and E Oppenheimer & Son were invited to attend the conference.

The objectives of this conference are to provide a platform for researchers to:

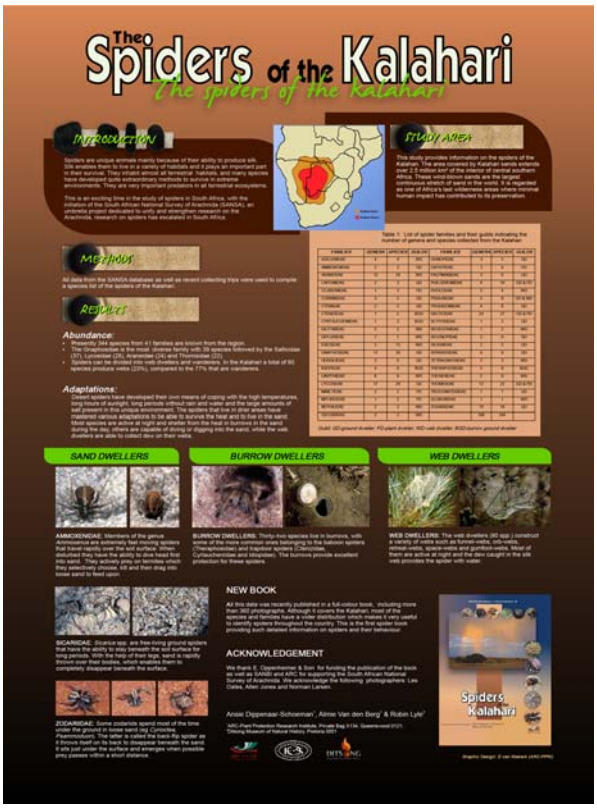
- share the outcomes of the range of research projects that have taken place across the Diamond Route properties and other sites within the De Beers Family of Companies, and E Oppenheimer & Son;
- provide a networking opportunity for the site managers and researchers working across these sites;
- guide future research and post-graduate opportunities across the properties.

Ansie Dippenaar and Robin Lyle attended the conference, and presented the following poster and paper:

DIPPENAAR-SCHOEMAN, A.S., VAN DEN BERG, A.M. & LYLE R. The spiders of the Kalahari [poster].

DIPPENAAR-SCHOEMAN, A.S. & LYLE R. Spider jewels of the Diamond Route [paper]

Contact: A. Dippenaar at DippenaarA@arc.agric.za



Poster presented at the conference. Designed by Elsa v Niekerk

Biosystematics (continued)

A training workshop in nematology

Plant parasitic nematodes are major pests of cultivated plants. They interact with pathogenic micro-organisms in disease complexes, and are also the main cause of damage to plants. In agriculture, the resulting losses are experienced as reduced yields, downgrading and unmarketability of produce, and restrictions on local and international trade in plants and plant products. An initial step in nematode management is establishing their presence through collection and relation with symptoms and, with expert help, accurately identifying the species involved. Workshops on collecting, extracting and detecting nematodes are, therefore, imperative initial steps for assessing plant parasitic nematode problems.

Twenty-seven extension officers from the Gauteng Department of Agriculture and Rural Development (GDARD) attended a Nematology Workshop, which was held at the facilities of ARC-API and ARC-PPRI, Roodeplaat on 30 November 2010. The Workshop was organised by Ms Nancy Ntidi (Nematology Unit, Plant Protection Section, ARC-GCI), and Drs. Antoinette Swart and Mariette Marais (Nematology Unit, Biosystematics Programme, ARC-PPRI). The extension officers received training in the following subjects: the importance of plant parasitic nematodes (Lecturer: Nancy Ntidi), collecting nematodes (Lecturer: Antoinette Swart), importance of record keeping (Lecturer: Mariette Marais) and the control and management of plant parasitic nematodes (Lecturer: Prof. Driekie Fourie, Environmental Sciences and Management, North West University). The practicals (extraction and detection of nematodes) were conducted by Dr. Antoinette Swart, Ms Elsie Ringane (Nematology Unit, Programme, ARC-PPRI) and Ms R. Jantjies (ARC-GCI). At the end of the day, a vote of thanks was given by Mr. Netshifhefhe, Assistant Director: Crop Production, GDARD) after which the extension officers were presented with attendance certificates. A special session for feedback was organised and the overall response from the officers was positive. Thanks are due to Ms Nancy Ntidi who acted as convener, and whose enthusiasm added greatly to the success of the day.

Contact: Drs Antionette Swart at SwartA@arc.agric.za* and *Mariette Marais at MaraisM@arc.agric.za

Ms Elsie Ringane demonstrating nematode extraction methods from soil

Extension officers from the Gauteng Department of Agriculture and Rural Development who attended the Nematology Workshop

Extension officers examining live nematodes

Microbiology and Plant Pathology

Developments in the South African Rhizobium Culture Collection (SARCC)

Legumes inoculated with effective strains of *Rhizobia* form root nodules and fix atmospheric nitrogen in return for energy supplied by the plant. When a good symbiotic relationship is formed, no additional nitrogen needs to be applied. Inorganic and organic nitrogen supplements, or high levels of nitrogen in the soil suppress this symbiotic relationship.

The Biological Nitrogen Fixation (BNF) Unit at ARC-PPRI, Roodeplaat, has been the curator of the South African Rhizobium Culture Collection (SARCC) since the 1960s, and currently holds more than 600 rhizobial strains. The SARCC is one of the cornerstones of the legume industry in South Africa. It supplies the industry with well tested atmospheric nitrogen fixing *Rhizobium* and *Bradyrhizobium* strains for all important legume crops cultivated in South Africa.

Over the last 50 years, the BNF Unit has selected and screened rhizobial strains for efficacy under glasshouse and field conditions. Subsequently 15 highly effective strains have been released, and are currently available from a number of inoculant manufacturers. Strains like WB74 (soybean), XS21 (groundnut), UD5 (bean), TJ14 (pea), RF14 (lucern), and VK10 (lupin) are highly effective in fixing nitrogen.

Until recently, the rhizobial strains in the SARCC have been identified according to their morphological and growth characteristics. To improve the identification process of rhizobial strains, we have subsequently started to generate 16S r RNA sequence profiles for many of the strains in our culture collections, including the commercial strains. Based on the 16S r RNA profiles, the selected strains grouped with genera such as *Mesorhizobium*, *Sinorhizobium*, *Rhizobium*, *Bradyrhizobium,* and the β-proteobacteria group containing *Burkholderia* and *Herbasprillum*, indicating that the morphological identifications were inaccurate.

We envisage extending the molecular identification and characterization of the whole collection. This information is important in strain selection to release effective strains into agriculture. To fulfil this vision, both government and industry have to invest in the maintenance and extension of this valuable collection.

Contact: Dr Ahmed Idris Hassen at HassenA@arc.agric.za and Mrs Francina Lebogang Bopape at PhalaneF@arc.agric.za

Effective nodules of *Lupinus albus* formed by rhizobial strain VK10 look pinkish red, a simple indication of nitrogen fixation efficiency. Non fixing nodules are white

Repeated screening of rhizobial strains for nodulation and nitrogen fixation is done using a Leonard jar experiment in the greenhouse at the nitrogen fixation unit at ARC-PPRI-Roodeplaat

Commercial rhizobial strain VK10 forms effective nodules on the roots of lupin (*Lupinus albus*). The plants appear green and well developed (a & b) when compared with uninoculated plants which have yellow leaves and no nodules (c)

The benefits of rhizobia to agricultural production

Francina Bopape presented a paper at the International Symposium on Biological Nitrogen Fixation in Africa. The symposium was held at the University of Cape Town with about 60 participants from Africa and overseas. The title of her paper was:

- *Screening of effective rhizobial strains for the propagation of indigenous legumes*

The leguminous plants form symbiotic associations with rhizobia. The rhizobia absorb nitrogen from the air, and convert it into a useable form in the root nodules of the plant. This process stimulates plant growth, improves plant yield, and creates highly fertile soil. Soils in Africa are often very poor in nutrients. The use of biotechnological approaches such as the exploitation of the legume-root nodule bacteria symbiosis, can provide biological nitrogen for improving soil fertility which increases crop yields. This is of great benefit to food security, and improves the quality of human life on the African continent.

Microbiology and Plant Pathology (continued)

The benefits of rhizobia (continued)

The South African Rhizobium Culture Collection (SARCC) is stationed at ARC-PPRI, and consists of more than 2000 rhizobia strains. This collection is registered with the World Federation of Culture Collections. Most of the strains were previously isolated from indigenous legumes. These strains are consistently tested for effective nodulation and nitrogen fixation on various legumes under controlled glasshouse conditions. The most effective strains are identified, and recommended for inoculant production for suitable host plants. The SARCC also supplies experimental strains and inoculants to clients. In addition, ARC-PPRI offers a quality control service to companies that produce commercial inoculants.

Contact: Francina Bopape at PhalaneF@arc.agric.za

Screening rhizobial strains for nodulation and nitrogen fixation is done using a Leonard jar experiment in the greenhouse

Francina Bopape, analysing legume plants for effective nodulation and nitrogen fixation

Good nodulation formed on roots of an indigenous legume inoculated with rhizobial strain XBU3, compared to the control

Microbiology and Plant Pathology (continued)

Mushrooms in China

During October 2010, Dr Susan Koch visited the People's Republic of China as part of a South African delegation to investigate cooperation between South African and Chinese researchers. The Hebei Normal University, Hebei Agricultural University, as well as three Institutes of the Hebei Academy for Agriculture and Forestry Sciences (HAAFS) were visited. The HAAFS Institutes were the Genetics and Physiology Research Institute in Shijiazhuang, the Plant Protection Institute in Baoding, and the Dryland Farming Institute in Hengshui.

The emphasis of this study tour was on the production of edible mushrooms, in particular oyster and winter mushrooms. China is currently the largest producer of mushrooms in the world, and mushrooms form a daily part of their diet. Most of the mushrooms are produced on a medium to large scale. Since it is an age-old industry in China, we quickly realized that we have much to learn. We were involved in hands-on training regarding substrate preparation which is the most important part in mushroom production. The second most important step is the production of quality spawn. We were also introduced to the production of spawn at the farm.

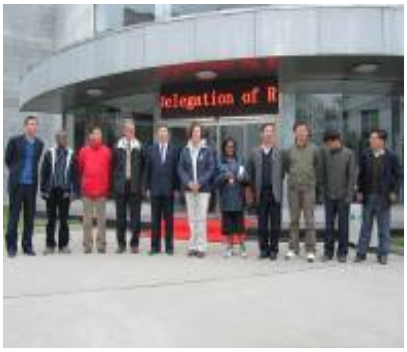
We visited a number of production houses, and were impressed by the scale and the low level of technology used to produce mushrooms. The methodologies we mastered will soon be implemented at two community sites around Gauteng.

Contact: Dr Susan Koch at kochs@arc.agric.za

Hands-on training

Open-air fermentation

Bagging of substrate



SA delegation in China

Variety of mushrooms in the market

Oyster mushroom growth house

Preparing winter mushrooms for the market

Winter mushrooms

Mushrooms for a Chinese hot pot

Pesticide Science

ARC-PPRI ATTENDS CONGRESS IN CHILE

Ms Lianda Lotter was invited to attend and present a poster at the 16th Congress of the International Soil Conservation Organization (ISCO) – Soil and Water Conservation, held from 7-12 November 2010 in Santiago, Chile. The poster was based on results obtained from the National LADA Participatory Expert Assessment (PEA) Workshops

The purpose of this Congress was to advocate the sustainable, productive, and efficient use of water and soil resources through an improved understanding of natural resources management issues, and enhanced communication with various organizations with similar concerns and commitments.

South Africa is one of six pilot countries participating in the Global Environmental Facility (GEF)-funded Land Degradation Assessment in Drylands (LADA) project, executed by the UN Food and Agriculture Organization (FAO). In South Africa, the LADA project is coordinated by DAFF and implemented by ARC-ISCW. The LADA project is in its final stages, and will be completed by the end of December 2010.

The LADA Regional Training Workshop on various resource degradation assessment methods was held in Pretoria from 2 -6 August 2010. During the Workshop, methods were discussed of implementing the different LADA tools in the five Southern Africa Development Community (SADC) countries (Botswana, Zimbabwe, Mozambique, Swaziland, and Lesotho) which attended and received training at the Workshop. The Workshop formed part of the wrapping-up process which will ensure the proper finalization of the various assessments, and completion of the methodologies that were developed in the process. Additional tools, which may optimize the application of the LADA data collected during the project, were also discussed

The need for LADA National Assessments followed by detailed LADA Local Assessments, especially on wetland and other water bodies, was prominent in the discussions. As part of her PhD, Ms Lianda Lotter will be involved in the Water Resource Assessments. The data obtained on wetlands and other water bodies will add value to the LADA National Assessments in South Africa, and in the SADC countries. Botswana, Swaziland, and Zimbabwe indicated that they require assistance to assess the status of the different water resources.

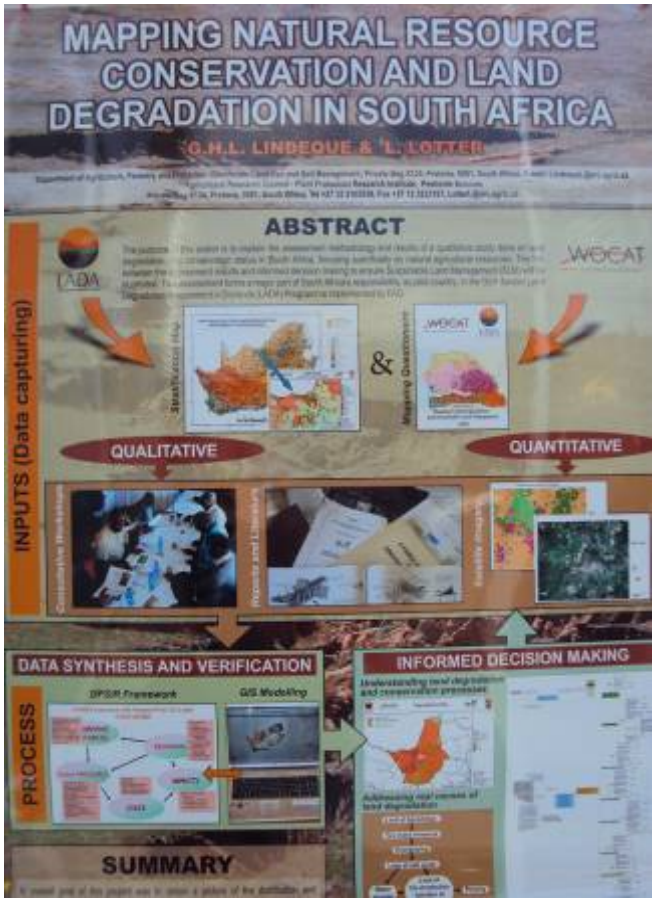
Funding remains a serious stumbling block for most countries. As part of the continuation of the LADA Project, the SADC countries will request funding directly from their respective GEF focal points, using a combined, regional proposal.

Prior to the Congress, Ms Lianda Lotter attended a meeting in Windhoek, Namibia. Here, Dr Lindiwe Sibanda, CEO of FANRPAN, and Dr Marapara, CEO of the Agricultural Research Council in Zimbabwe, invited her and Mr Lehman Lindeque (DAFF) to attend the FANRPAN High Level Regional Policy Dialogue to promote the LADA Project, and to help initiate future collaboration of the SADC countries on land degradation and natural resources. Ms Lotter was invited to assist and co-facilitate a short presentation in the session titled: “Introduction of New Partnerships”. This focused on the LADA National Assessments, but also on how to manage moving data on land degradation and soil and land management (SLM), to informed decision-making. Following the brief presentation, a break-away meeting was held for interested countries. At this meeting, more information on the LADA project and aims, as well as the outlines for a proposal to GEF for the continuation of LADA, were discussed. This was to facilitate the compilation of a strong regional proposal for Land Degradation and SLM Assessment in the SADC Region. South Africa (ARC and DAFF), together with the FAO and other role players, will play a crucial role in capacity building on the LADA methodologies.

The 16th ISCO Congress in Chile complemented the FANRPAN meeting.

Attending the 16th ISCO Congress enabled the ARC to strengthen its partnership with the various organizations (such as the FAO, GTZ, GEF, SADC) and other countries, and provided an opportunity to showcase its achievements in the LADA project. The ARC provided valuable inputs in the finalization and capacity building of the LADA assessment methodologies, especially the National, and Local Level Assessments.

Contact: L Lotter at LotterL@arc.agric.za



Poster by G.H.L. Lindeque & L. Lotter presented at the conference

Weed Research

Stem-galling wasp, *Tetramesa romana*, a host-specific natural enemy of the invasive giant reed, *Arundo donax*, found to be widespread and parasitized in South Africa

Giant reed, *Arundo donax* Linnaeus (Poaceae), is a perennial grass from Mediterranean Europe that has become invasive in many parts of the world, including North America (notably Texas and California), and South Africa (RSA). The reed forms dense infestations along a 960-km stretch of the Lower Rio Grande River on the Texan/ Mexican border (Fig. 1a). Giant reed is a major threat to riparian areas, where it displaces native riverbank vegetation and increases siltation, thus reducing water flow. It also affects agriculture by invading rangeland (Fig. 1b), and dense stands present a wildfire threat.

Fig. 1. (A) Dr John Goolsby and giant reed, *Arundo donax,* on an irrigation canal in Weslaco, Texas, and (B) an *A. donax* infestation in rangeland in South Africa.

Arundo donax is a CARA Category 1 weed in RSA, where it competitively excludes native sedges along riverbanks, and invades disturbed areas such as roadsides (Fig. 1b). It was originally introduced as vegetative material (rhizomes with shoots) for ceiling material and screening in about 1652, and is currently used in traditional reed dances where Zulu and Swazi maidens are presented to their kings. However, giant reed has become naturalized and widely distributed (Fig. 2), and a serious threat to all South African biomes.

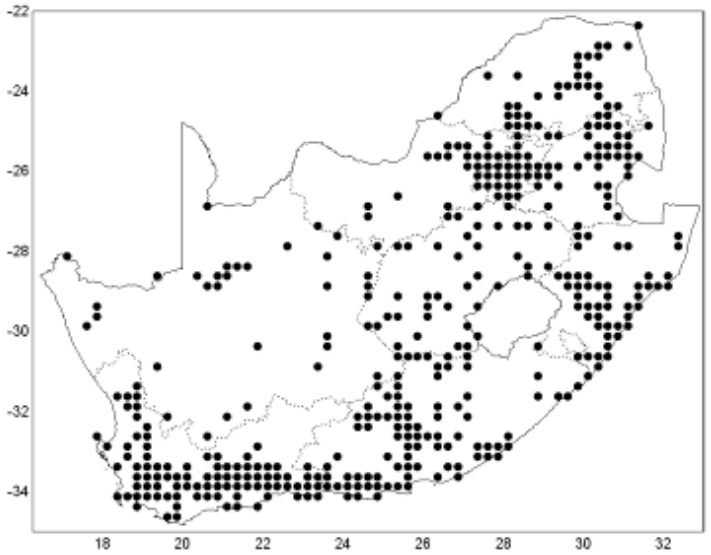


Fig. 2. Distribution of *Arundo donax* in South Africa. (Drawn by L. Henderson: data source: SAPIA database, ARC-PPRI, Pretoria)

The development of a biological control programme against *A. donax* by the United States Department of Agriculture's Agricultural Research Service (USDA-ARS) provides us with an opportunity to initiate biocontrol of the weed in RSA, with guidance and assistance from the USDA-ARS team (Drs John Goolsby, Patrick Moran and Alex Racelis). The *A. donax* project, based in Weslaco, Texas, was visited in September 2010 to learn of their progress. Five genotypes of the host-specific, stem-galling, eurytomid wasp, *Tetramesa romana* Walker, were the first Arundo biocontrol agent released in the USA early in 2010. In addition, a release application for a root-attacking diaspidid scale, *Rhizaspidiotus donacis*, is being processed by the USA authorities, and a cecidomyiid (*Lasioptera donacis*) and a chloropid fly (*Cryptonevra* sp.) are currently under evaluation in quarantine in Texas.

It was also learnt that Dr Alan Kirk of USDA-ARS, who did the survey work for the programme, had found a population of *T. romana* established at Alexandria Forest in the Eastern Cape province in 2001. The wasp and evidence of its damage have since been found by biocontrol researchers in various parts of the country. Iain Patterson of Rhodes University was the first to find *T. romana* on *A. donax* at Kenton-on-Sea (Eastern Cape). Other collections of the wasp were made in Pretoria (Gauteng) (Drs Stefan Neser and Alan Urban), Cape Town, Stellenbosch and Paarl (Western Cape) (Prof. John Hoffmann (UCT) and Dr Neser) as well as in Durban (KwaZulu-Natal). Specimens of the wasp were determined as *T. romana* by Dr Janine Kelly of the South African National Collection of Insects (ARC-PPRI Biosystematics Division), who compared local specimens with named reference specimens from Texas, and originally Spain, which were deposited at ARC-PPRI by Dr Goolsby of USDA-ARS.

The stem-galling wasp, *Tetramesa romana*, is native to Europe and North Africa. Based on host range studies conducted in the USA, the wasp is specific to the genus *Arundo*, with a preference for *A. donax*. Females insert eggs into the young stems and side-shoots of *A. donax* (Fig. 3). This induces gall formation (Fig.4), thus stunting plant growth and development. The galling wasp reproduces by thelytokous parthenogenesis, which is the production of females from unfertilized eggs. Male wasps are rare, and are believed to be sterile. The progeny emerge close to the site of oviposition (Fig. 5).

The precise origin of the population of *T. romana* in RSA is currently unknown. Preserved specimens of both *A. donax* and *T. romana* have been sent to the USA for DNA analysis. Customized microsatellite markers will be used to compare the adventive population of the wasp in RSA to European populations collected for the American biocontrol programme. This may pinpoint the origin of the South African *T. romana* genotype, which may provide some

Weed Research (continued)

Stem-galling wasp (continued)

clues to how it arrived in the country. The wide distribution in RSA indicates that it has been here for some time – possibly since the original introduction of the host plant over 350 years ago.

The presence of an *A. donax* biocontrol agent in RSA may be significant for the management and control of this species. However, the Arundo gall wasp has also been found to have a suite of parasitoids in RSA, probably from native species of *Tetramesa* in grasses, which could be suppressing their abundance and impact significantly. Five species of parasitoids in four families were reared from *T. romana* collected in Pretoria, and have been tentatively identified by Dr Gerhard Prinsloo (recently retired from ARC-PPRI). Additional agents are definitely required for biocontrol of giant reed in RSA.

Financial assistance from the KwaZulu-Natal Department of Agriculture, Environmental Affairs and Rural Development, which made the visit to Texas possible, is gratefully acknowledged.

Contact: Dr Angela Bownes of the Weed Research Programme, Cedara: **BownesA@arc.agric.za**

Fig. 3. Adult *Tetramesa romana* ovipositing into a young shoot of *Arundo donax.* Photo: John Goolsby, USDA-ARS

Fig. 4. Galling of an *Arundo donax* shoot by *Tetramesa romana*

Fig. 5. *Tetramesa romana* emergence holes on side-shoots of *Arundo donax*

First Annual South African Young Scientists Conference

From 12 to 13 October, Ms Lulama "Lulu" Madire participated in the first annual South African Young Scientists Conference. Lulama is manager of the biological control project against yellow bells, *Tecoma stans*, using insects, at the ARC-PPRI Weeds Laboratory at Rietondale, Pretoria.

The conference, which was held at the 'Diep in die Berg' Functions and Conference Centre outside Pretoria, was hosted by Academy of Science of South Africa (ASSAf), in partnership with the Department of Science and Technology (DST) and the National Research Foundation (NRF).

The theme of the conference was "Biodiversity in focus - exploring the opportunities for South Africa". More than 80 delegates from different provinces, universities, and research organisations attended. The objectives of the conference were:

- to provide an opportunity for young scientists to showcase their work and to share information on their research fields;
- to provide an opportunity for networking among young scientists;
- to enhance the implementation of the activities of the Academy of Science for the Developing World (TWAS), and the Organization for Women in Science for the Developing World (OWSDW) National chapters;
- to provide a platform for young scientists to discuss issues related to the establishment of a framework for collaboration and representation within the science system in the country, and
- to provide an opportunity for young scientists to engage with DST, ASSAf, and other key stakeholders.

Lulama's paper titled, "Biological control of the invasive alien plant, *Tecoma stans* (Bignoniaceae) in South Africa", co-authored by Dr Alan Wood (plant pathologist at ARC-PPRI, Stellenbosch), under

Weed Research (continued)

South African Young Scientists Conference (continued)

the sub-theme: Biodiversity Conservation and Management, was one among 28 papers and 8 posters presented during the Conference.

The Conference was fully funded by ASSAf, DST, NRF, TWAS, and OWSDW.

Contact: Lulama Gracious Madire at MadireL@ arc.agric.za

Participants in the ASSAf-DST-NRF first annual Young Scientists Conference. ARC-PPRI's Lulama Madire is in the front row, second from right

The use of herbicides as a tool in managing parthenium

The savanna biome is an important region for agriculture, the conservation of wildlife, game farming, and tourism, yet the production potential of this biome is seriously hampered by the invasion of the annual weed, *Parthenium hysterophorus*. No selective herbicides are currently registered for the control of parthenium, and chemical control with broad-spectrum herbicides would create serious damage to the grass layer, thus reducing the carrying capacity even further.

In 2007, a trial was undertaken to identify suitable, selective herbicides against parthenium. The trial was carried out in the Hluhluwe-iMfolozi Park in plots 5 m x 5m in open woodland heavily disturbed by game. Three selective herbicides, viz. 2,4-D amine 480 g/l, metsulfuron methyl 600 g/l and picloram 240 g/l were applied to parthenium plots by knapsack sprayer at three concentrations each. Manual methods of control were also tested, viz. hoeing and pulling out plants by hand, since these methods are commonly used by subsistence farmers. All treatments were compared against the untreated control. The trial had a randomised block design with three replicates per treatment. Parthenium plants were counted individually, but all other species were appraised according to an abundance rating of 1 (rare, <5% cover) to 5 (abundant, >75% cover).

Parthenium was effectively controlled (>80% kill rate) by Brush-Off® (metsulfuron methyl) and Access® (picloram). Parthenium less than 0.5 m in height were killed at lower rates of Brush-Off® at 10 g / 100 ℓ and Access® at 0.375%. Plants larger than 0.5 m were killed at 15 g / 100 ℓ and 0.5% concentrations of Brush-Off® and Access® respectively.

Both manual control methods (hoeing and pulling out) were equivalent to the herbicide treatments in efficacy, but these methods were labour intensive. Herbicide accounts for less than 10% of the cost of control on a per hectare basis, with labour costs followed by transportation making up the bulk of the expenses. Given that parthenium causes serious allergic reactions in people coming into contact with it, manual control is not recommended from both a cost ,and a health perspective.

Herbicide treatment resulted in plots becoming dominated by in-

Weed Research (continued)

The use of herbicides as a tool in managing parthenium (continued)

digenous grasses, but forbs were as severely affected as the parthenium at all dose rates. However, this was regarded as a short term effect, since most of the herbs were pioneer species that colonise disturbed ground.

Flora in the manual treatments became dominated by other broadleaf alien species because only the parthenium was targeted for control. This is the likely scenario under conditions where only selected weeds are targeted.

Parthenium became more dominant in the untreated control plots and native species declined.

The use of selective herbicides is, therefore, an essential tool towards the integrated control of parthenium in South Africa.

The KZN Department of Agriculture subsequently launched a campaign to control parthenium north of Richards Bay in 2009. Parthenium has been drastically reduced along roadside in Zululand using Access® at a 0.5% concentration, incurring an average herbicide and labour bill of 0.5 ℓ and 3.25 person days per hectare respectively. It is easy to kill parthenium, but the greatest challenge is reducing the soil-seed reserve.

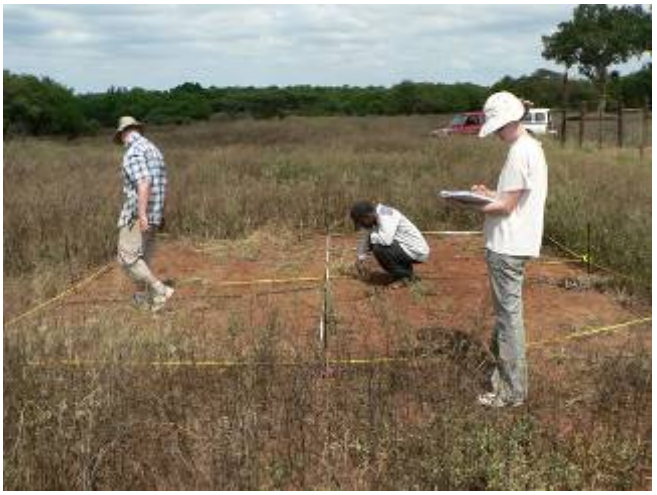
Reference: Goodall J., Braack M., de Klerk J. & Keen C. 2010. Study on the early effects of several weed-control methods on *Parthenium hysterophorus* L. *African Journal of Range & Forage Science* 27: 95–99.

Contact: Jeremy Goodall at GoodallJ@arc.agric.za.

A dense stand of parthenium before control

The application of herbicides to parthenium plants

Manual control of parthenium by hoeing



Vegetation assessments in plots

Weed Research (continued)

New biological control agent released against cat's claw creeper

Cat's claw creeper, *Macfadyena unguis-cati,* remains a significant threat to local biodiversity in a number of regions around South Africa. This 'structural parasite' overwhelms other vegetation, and has become particularly troublesome in cultivated orchards and plantations (Fig. 1), riparian corridors, natural forest remnants, and disturbed areas such as roadsides and abandoned urban spaces. The weed is capable of forming dense infestations which compete for light with mature trees, and precluding indigenous understory growth. In the absence of climbing support, the vine will readily grow along the ground, resulting in a dense ground cover and the formation of an extensive subterranean tuber bank. This vigorous growth, coupled with resilient tubers, makes the weed very difficult to manage. Both mechanical and chemical control options are costly and largely ineffective, and biological control has been prioritised as the only cost effective and sustainable means of control in the long term.

Fig 1: A plantation infested with cat's claw creeper

Initiated in 1996, the biological control programme against cat's claw creeper has released four insect natural enemies against the weed, all of which are leaf feeders. The first of these, released in 1999, was the golden-spotted tortoise beetle, *Charidotis auroguttata*. Unfortunately, although it was widely distributed and has become established in a number of areas, the beetle has had only a limited impact on established infestations. Due to this lack of success, additional natural enemies were developed, ultimately leading to the release of two leaf-sucking tingids, *Carvalhotingis hollandi* and *C. visenda*, and the leaf-mining buprestid, *Hylaeogena jureceki,* in early 2008. In November 2010, the leaf-tying moth, *Hypocosmia pyrochroma*, became the fifth biological control agent to be released against *Macfadyena unguis-cati* in South Africa.

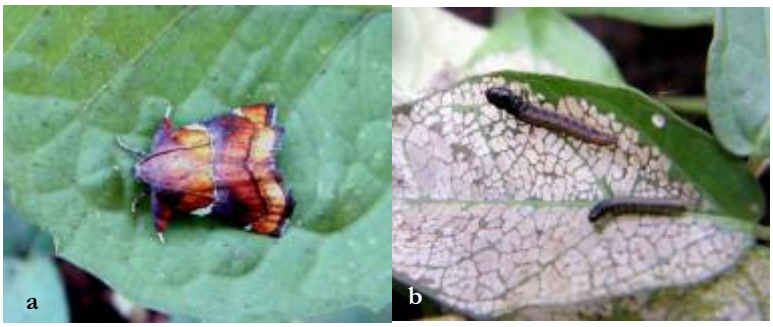


Fig 2: *Hypocosmia pyrochroma* (a) adult moth and (b) larvae

Adult *H. pyrochroma* moths (Fig. 2a) are highly fecund, and emerging larvae (Fig. 2b) are particularly voracious. The larvae are exclusively foliar feeders, and use silk to tie leaves together for concealment. Larvae are able to consume large quantities of leaf tissue which leads to distinct see-through windows and, in some cases, leaf skeletonisation (Fig. 3). Larval feeding significantly reduces the amount of leaf area available to the plant for photosynthesis and, at high insect population densities, leaves drop prematurely and eventually the stem growth-points die back.

To manage established cat's claw creeper infestations successfully, it is essential to limit the growth rate and vegetative reproduction of the plant, as well as to reduce the tuber bank. Work done in Australia has shown that only sustained and severe defoliation is able to negatively affect the accumulation of tuber biomass. From laboratory studies, it is evident that *H. pyrochroma* is very damaging and able to sustain defoliation levels high enough to affect tuber growth negatively.

To date, although the moth has only been released at two localities in South Africa, it has persisted well and been able to cause small localised patches of defoliation. If levels of defoliation similar to those recorded under laboratory conditions can be achieved in the field, *H. pyrochroma* is expected to make a valuable contribution to the biological control of cat's claw creeper.

Contact: Anthony King at KingA@arc.agric.za

Fig. 3: Larval feeding damage

Weed Research (continued)

Combined IOBC workshops on invasive alien plants held in Kenya

Two international workshops under the auspices of the International Organization for Biological Control (IOBC) were held in combination in Nairobi, Kenya from 1-5 November 2010. They were the **Eighth IOBC Workshop on Biological Control and Management of *Chromolaena odorata* and other Eupatorieae,** and the **First IOBC Workshop on Biological Control and Management of *Parthenium hysterophorus.*** The IOBC Chromolaena workshops were started in 1988 and have since been held every 3-4 years, while this was the first IOBC parthenium workshop to be held since the inception of the IOBC Parthenium Working Group in 2009.

As Convenor of the IOBC's Working Group on *Chromolaena odorata*, Costas Zachariades, together with colleagues Lorraine Strathie and Andrew McConnachie from ARC-PPRI, organized the bulk of the workshops— in collaboration with former ARC-PPRI Weeds Programme Manager, Arne Witt, and his team at Centre for Agriculture and Biosciences International (CABI) Africa in Nairobi. Both *C. odorata* and *P. hysterophorus* have invaded East Africa, so it was hoped that by holding the workshop in Kenya, it would encourage early awareness and mitigating action in the region. Additionally, by holding the workshop in Kenya, the workshop on parthenium could be held in conjunction with an annual meeting of project partners of the Integrated Pest Management Collaborative Research Support Program (IPM CRSP) project on parthenium in East Africa, funded by the United States Agency for International Development (USAID).

The workshops were attended by a total of 45 participants from 16 countries (Australia, Bangladesh, Ethiopia, Ghana, India, Jamaica, Kenya, Mauritius, Nigeria, Pakistan, Papua New Guinea, South Africa, Tanzania, Thailand, Uganda and USA). A keynote address by Arne Witt focused on invasive alien plants in Africa and prospects for their control. During the first workshop, aspects such as the distribution, spread, impacts, ecology, and control of *C. odorata* and the related weeds, *Mikania micrantha*, *Ageratina adenophora* and *Campuloclinium macrocephalum,* were presented for discussion. The following workshop on parthenium, which addressed similar topics, was held from 4-5 November. The four ARC delegates who attended the workshops presented nine oral contributions on four invasive plant species, in addition to chairing several of the sessions.

On the day between the two workshops, delegates visited Nairobi National Park to view encroaching invasive alien plants. It was evident that parthenium is a rapidly increasing threat to East African savannah habitats.

Technical recommendations were promulgated at the end of each workshop. Some of the main recommendations from the chromolaena and other Eupatorieae workshop were that governments and agencies be made aware of the imminent threat of chromolaena to East Africa, and encouraged to take action to contain it; that the introduction of the biocontrol agents *Pareuchaetes pseudoinsulata* and *Cecidochares connexa*, where they are not present, be encouraged; that the distribution and efficacy of these two agents in West Africa be assessed; and that introduction of the rust fungus, *Puccinia speggazzinii,* as a biocontrol agent against *M. micrantha* be considered. The workshop also recommended that impacts of invasive Eupatorieae on biodiversity and socio-economics be studied further.

In summary, the parthenium workshop recommended that, in addition to *Zygogramma bicolorata*, several agents which have been successful in Australia be considered for release in other countries; that increased coordination between the various international projects and workshops on parthenium be considered; that countries where parthenium has not yet been recorded but which are at risk (particularly in West Africa, Indochina and the Pacific) be on the lookout for it, while countries in which it has recently arrived take up strong management strategies, including possibly biocontrol, to contain it; and that development agencies that may inadvertently be spreading parthenium take appropriate remedial actions to prevent further spread.

Holding these two IOBC working groups in combination was successful from both logistical and technical aspects. In the home countries of many delegates, more than one of the species is either present or a potential invader, and many issues were common to both workshops. Thus, when appropriate, the intention is to consider combination of these workshops in the future.

Apart from ARC and CABI Africa, we would like to thank the International Union for Conservation of Nature (IUCN), and Global Invasive Species Programme (GISP) groups based in Nairobi who also contributed substantially to the organization and sponsorship of these workshops. Thanks are also due to USAID - IPM CRSP for sponsorship of participants involved in the IPM CRSP project, and to the IOBC, Centre Technique de Coopération Agricole et Rurale (CTA), and Australian Agency for International Development (AusAID) for sponsorship of several other participants.

Contact: Costas Zachariades and Lorraine Strathie at ZachariadesC@arc.agric.za

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Welcome to our new co-editor!

Dr Mariette Truter from the Mycology Unit, has jointed the editorial committee of the Plant Protection News as co-editor.