



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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Biosystematics to join the world in barcoding initiative

Knowing the species to which an animal or plant belongs is the core issue in biological science. However, most species are difficult to identify and only a tiny percentage of the vast numbers of different kinds of living things can be recognized by anybody other than a specialist. Until now, we have relied mainly on morphological features to identify specimens. But morphological methods aren't always adequate, and as a result there has recently been a great deal of investigation into novel ways of diagnosing species. Researchers have been testing the idea that all biological species can be identified using a short gene sequence from a standard position in the genome - a "DNA barcode", analogous to the black stripes that are used to distinguish commercial products in shops. Research to date has shown that DNA barcoding is proving effective in:

- Assigning specimens to species.
- Discovering new variation within species.
- Documenting poorly known groups.

This has led to researchers around the world joining together to form the Barcode of Life Initiative. These are people who have adapted DNA barcoding as a everyday tool in research.

At ARC-PPRI, several units in the Biosystematics Division are now participating in this new technology. A project for barcoding the Southern African Arachnida and the Southern Africa Parasitic Hymenoptera have been registered in collaboration with the University of Johannesburg.



The first analyses for the Arachnida project, will look at the different species within the family Thomisidae (genus *Thomisus*) where sexual dimorphism between the sexes make placement difficult. Photo: female with small male on body

The Parasitic Hymenoptera project aims to obtain as many barcodes of identified material as possible. This will serve the dual purpose of enriching the collection material with this new information and to allow the taxonomic studies of some of the more important groups to be enhanced.

The Scale Insect Barcoding Initiative project started in 2008 and is being funded by the Department of Agriculture for three years. This project aims to produce DNA barcodes that can be used to identify the economically important scale insects that occur in South Africa, as well as a number of other scale species of quarantine importance that don't occur here yet but which pose a risk in our international agricultural trade.

The fungal kingdom is poorly sampled and although the known phenotypes are available from herbaria and culture collections it is not always observed in nature. This emphasises the need for additional molecular tools to assist in the correct identification of fungal species and DNA Barcoding is one of these methodologies. The Mycology Unit's bar-coding project will focus on developing DNA Bar-codes for the fungal strains in the living PPRI collection. The strains will be selected based on their economic importance and taxonomic ambiguity. The project will be registered late 2010.



Drawing of a chalcid wasp

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Biosystematics

Field trip with bee specialist

Professor Laurence Packer, from York University in Toronto, Canada, joined Connal Eardley on a field trip to the Eastern Cape Province during February and March. Laurence is a bee taxonomist (as is Connal), and he started an international project called BeeBOL, which aims to produce DNA barcodes which can be used to identify the bee species of the world. This project is part of the International Barcode of Life initiative, iBOL. The field trip, which started in pouring rain in the drought-stricken Eastern Cape Province, provided a lot of opportunity to discuss ARC-PPRI participation in BeeBOL, and to collect bees for barcoding (after the first few days the weather improved and was good for bee collecting). About 2000 bee specimens were collected, including some rarely-found species. Many of these will become voucher specimens of the DNA barcodes produced, and they will be deposited in the ARC's National Collection of Insects.

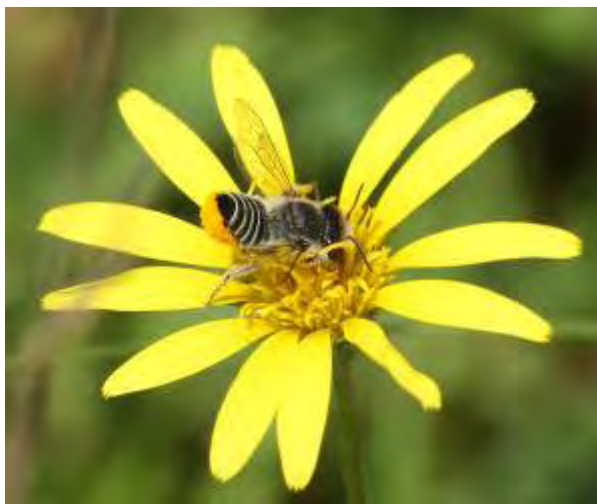
Another interesting, and unexpected accomplishment was to discover that Laurence had collected several specimens of a "cuckoo bee", called *Ammobatoides braunsi*, in the Western Cape when he visited the country about 20 years ago. This bee was previously only known from one female specimen that was found at Willowmore in the Eastern Cape. We now have a better idea of its distribution and the time of the year when it is active, and will know where to search for more specimens, and the male of this species, in forthcoming seasons.

Such collaboration is extremely important for progress in science in our country.

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Laurence Packer photographing a bee host plants



Megachile sp. collecting pollen, and pollinating a flower

SABI Forum meeting

The South African Biosystematics Initiative (SABI) held its annual meeting, the SABI Forum, in Port Elizabeth on 25 February 2010. The aim of SABI is to promote biosystematic research (taxonomy) in South Africa. The meeting was attended by about 100 students and professions biosystematists. Five presentations were delivered by accomplished taxonomists (Nigel Barker, Mervyn Mansell, Basil Brooke, Martin Villet and Mandy Cadman) from organizations such as local universities and museums. Afterwards, the three 2009 SABI prize winning students (Taryn Ralph, Leigh Richards and Fourie Rene) delivered presentations on their SABI supported overseas trips to study with the leading specialists in their fields.

During the afternoon, the SABI Business Meeting was held. This was the time for the taxonomists to discuss SABI's accomplishments and its future. Clearly SABI, as a platform for South African biosystematics, has fulfilled its objectives with distinction and has strengthened biosystematic endeavours in our country. Dr Connal Eardley represented the ARC at this Meeting. The ARC is the largest centre of invertebrate and micro-organism biosystematic research in South Africa.

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Audit of National Collections

Concerns expressed by local and foreign researchers about the security, perceived state of decline and long-term future of our Natural History Collections (NHC) in South African Institutions resulted in a joined audit organized by the National Research Foundation (NRF) and the South African Biodiversity Institute (SANBI). Prof. Michelle Hamer, the Director of Zoological Systematics at SANBI, was appointed to access all the Zoological Collections in the country. The purpose of this assessment was to identify problems and to look for solutions in the interest of the long-term wellbeing of the NHC.

Prof. Hamer spent three days at ARC-PPRI to access the large arachnid, insect and nematode collections in the National Collections - one of the National Assets of the ARC. Thanks to active collecting, good curation and databasing and the design of the new building, these collections are in a good state.



The Nematode specialists Antoinette Swart and Mariette Marais working with Prof. Hamer through the questionnaire

Biosystematics (continued)

First lists of Endemic Arachnida species

To identify priority areas for species/habitat conservation evaluation of the narrow range or endemic species are very important. Collation of all the known species data from published papers and national collections into the SANSA database enabled us to produce the first species lists for six arachnid orders as well as the first endemic species lists for South Africa.

This database (about 5000 records) was made available to the South African National Biodiversity Institute who are busy with the National Spatial Biodiversity Assessment (NSBA) for 2010. They use a range of species data (for threatened and endemics taxa) to identify areas of species richness within South Africa. The last assessment was done in 2004 but it contains very little invertebrate data.



Peter Webb

Garden orb-weaver spider



Martie Rheeder

Ladybird spider

Spiders (Araneae)

Presently 2000 spider species are known from South Africa (Dippenaar-Schoeman & Haddad, unpublished report) but the number are increasing annually seen in the > 60 new species that were described the last three years. Of the known 2000 spp. 1040 (52%) are endemic to the region. This represent about 4% of the world fauna.



Les Oates

Sunspiders

Sunspiders (Solifugae)

Presently 150 sunspider species (Dippenaar-Schoeman *et al* 2006) are known from South Africa. Nobody in South Africa are presently working on the group but in collaborating in a global project specimens from the National Collection of Arachnida (NCA) are made available for research and more species might be added in the near future. Of the known species, 92 (61%) are endemic to South Africa and this represent about 15 % of the world fauna.

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False scorpion



False scorpions (Pseudoscorpiones)

Presently 135 false scorpion species (Dippenaar-Schoeman & Harvey, 2000) are known from South Africa. Nobody in South Africa are presently working on them. Of the 135 known species, 72% are endemic and this represent about 7% of the world fauna.



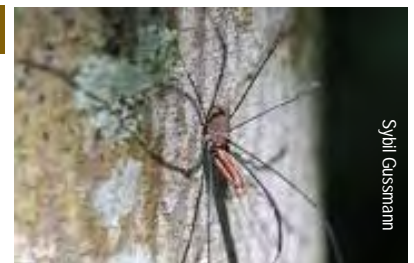
Aart Louw

Whipspider

Whipspider (Amblypygi)

Presently only three whip spiders (Dippenaar-Schoeman, 2000) are known from South Africa. Of the 3 known species, 2 (67%) are endemic and this represent this represent about 3% of the world fauna.

Harvestmen



Sybil Gussmann

Harvestmen (Opiliones)

Presently 218 species (Lotz, 2009) are known from Southern Africa and 217 of the known species are endemic and this represent about 3.4% of the world fauna.

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Biosystematics (continued)

SABIF handover event

The South African Biodiversity Information Facility (SABIF) held their first Data Handover Event of 2008 data on the 24th March 2010 at Kirstenbosch. SABIF is part of the South African National Biodiversity Institute (SANBI) and Dr Ansie Dippenaar-Schoeman and Janine Kelly were invited to attend the breakfast held in celebration of this event. Dr Tanya Abrahamse, the CEO of South African National Biodiversity Institute (SANBI) who is also the 2nd Vice Chair of the Global Biodiversity Information Facility (GBIF) Science Committee welcome the researchers and Ms Majorie Pyoos the DDG of the Department of Science and Technology and the South Africa's Head of Delegation to the GBIF Governing Board gave the opening address.

The SABIF Initiative has been well supported by the ARC and the Biosystematics Programme of PPRI has become increasing more involved with this Initiative over the years and the bee and arachnid data (44 000 records) formed part of the handover ceremony. Information on this projects was also displayed in two posters on display at the event.

Ansie was also one of the invited speakers and she gave an overview of the national arachnid survey and demonstrated the wealth of information made available to the research community through databasing and the important role SABIF played in the process as they have already funded the project for three years.

This was a considerable milestone in the progress made in the digitisation of biological information in South Africa as more than 6 million records are now available through SABIF. Their new user friendly webpage was also demonstrated.

Collaboration with SABIF continues as four project of the Biosystematics Programme have received funding for the coming year.

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Dr Tanya Abrahamse, the CEO of South African National Biodiversity Institute (SANBI)



The SABIF team

Visitor to National Collection of Nematodes

Ms Henda Landman, an M.Sc. student at the University of the Free State, visited Dr Mariette Marais at the National Collection of Nematodes during the first week of January this year. Mariette is the co-supervisor of Ms Landman, who is working on a revision of the nematode genus *Histotylenchus* Siddiqi, 1971 in South Africa. *Histotylenchus* is a small genus of ectoparasitic nematodes belonging to the family Belonolaimidae, which is only found in Africa and India. The genus is represented by six species, and three of these occur in South Africa, namely *Histotylenchus mohalei* Kleynhans, 1992, *Histotylenchus hedys* Kleynhans, 1975 and *Histotylenchus histoides* Siddiqi, 1971. *Histotylenchus* is reported from all the South African plant biomes, except for the forest biome.



Henda Landman

Lecture series at the University of Pretoria

A three-lecture series was presented to about 200 second years students at the University of Pretoria as part of the Invertebrate Biology block. The lectures dealt with the Arachnida that are of medical, veterinary and agricultural importance. During the 3 hour practical the students learn to distinguish between the different species.



The most venomous scorpion in South Africa
Parabuthus granulatus

Biosystematics (continued)

Spider collecting in Northern Cape

As part of the South African National Survey of Arachnida a collecting trip was undertaken from 14 February to 7 March to the Northern Cape Province. The 3-man team included Robin Lyle from the Transvaal Museum and Petro Marais (ARC-PPRI) and Luther Seshothela (DST Intern working at ARC-PPRI).

During the first week collecting took place on the guest farm Soetvlakte of Louis and Dorette Hauman. The farm is situated off the R380 to McCarthy's Rest, the border post between South Africa and Botswana. The next stop was Tswalu Kalahari Reserve the largest private game reserve in South Africa, covering an area of over 100, 000 hectares and owned by the Oppenheimer family. In between the collecting there was time to visit with a habituated family of Meerkats. The last collecting sites was at Noup in the West Coast Namaqualand. This quaint little place used to be the homes of the diamond divers of the Beguela Concessions in the mid-eighties and provides an opportunity to collect arachnids from vastly different vegetation types than the previous two locations. Robin Lyle was especially pleased with the first record for ? at Noup. Although the Northern Cape is renowned for its scorching heat this time of year it was quite forgiving towards us. This made collecting so much easier and a large number of arachnids was collected.

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Sweeping at Tswalu Game Reserve



Putting out pitraps at Noup

New intern at the spider unit



Luther Seshothela

Luther Seshothela started his internship at the Spider Unit from the 1 April 2010. He studied the University of Limpopo (Turfloop Campus) where he completed his B.Sc (Physiology and Zoology) degree in 2008, and B.Sc Honours degree (Aquaculture) in 2009. He started at ARC-PPRI as casual worker while waiting to be appointed as an intern through the DST and NRF programme. His highlight during that first period was a three week field work as part of the SANSA project to the Northern Cape with Petro Marais and Robin Lyle. It was a dream coming true for him as he has always wanted to do field work since starting with his studies. He is passionate about nature and enjoy touring places of natural interest such as botanical gardens, game reserves, zoos etc. - places that bring him in touch with the countries rich biodiversity. During his internship he will learn to sort, identify and database spiders and other arachnids collected in the Cedarberg over a four year period.

Invitation to attend the annual Biological congress of the "SA Akademie van Wetenskap en Kuns"

"Biodiversity is Life"

This is the theme of the annual Biological Congress of the "Suid-Afrikaanse Akademie van Wetenskap en Kuns" that will be held at the ARC-Plant Protection Research Institute Roodeplaat West campus on the 1 October 2010. The congress is open to everybody — so come and participate in this event. Papers and posters can be presented in both languages.

For more information contact Ansie Dippenaar-Schoeman (DippenaarA@arc.agric.za), Antoinette Swart (SwartA@arc.agric.za) or Mariette Marais (MaraisM@arc.agric.za)

Biosystematics (continued)

Visit by Czech beetle fundis

It is said that, *per capita* of the national population, there are more entomologists in the Czech Republic than any other country. This may well be true; numerous Czech taxonomists have in the past studied aspects of our insects. The Czech entomologists to engage most recently with the South African National Collection of Insects (SANC) are Jiří Janák of Rtyň nad Bílinou and Petr Bulirsch of Prague. They were the first non-South African visitors to the Coleoptera (beetle) Unit at “Nuwe Vredehuis”, the new facilities of the Biosystematics Division at Roodeplaat, northeast of Pretoria.

These two beetle aficionados visited South Africa in late 2009 on their second of a series of planned research collecting expeditions. Both gentlemen are specialists of rather inconspicuous, rather small, and very poorly known beetles that in South Africa mostly occur on the moister, eastern side of the country, frequently in forests. Petr's study group is small ground beetles (family Carabidae, subfamily Scaritinae, mainly tribes Clivinini and Dyschiriini), many of which are eyeless animals. Jiří studies various unusual kinds of rove beetles (family Staphylinidae), also including some small, blind forms. Both Petr and Jiří have already published a first round of papers on these peculiar creatures from South Africa, a most welcome addition to the knowledge of our remarkable beetle fauna.

On a balmy evening, the two Czech collaborators managed to fit time into their travelling schedule to examine their groups of interest in the SANC. Not very many specimens that fancied their interest were found, but they tell that this frequently is the case in museum collections. After all, the objects of their interest are small, obscure, and apparently uncommon. Their visit to the Collection was not without success, however, both men locating specimens that did excite them. Quietly, these specimens have, after being collected, been waiting for attention for many years, even decades. These specimens have all been carefully sent to the Czech Republic for detailed investigation. When they are returned they will carry names. Most probably some of these names will be new, then belonging to species previously undetected.

Contact: Riaan Stals at StalsR@arc.agric.za



Jiří Janák and Petr Bulirsch, Czech beetle specialists

Nature combating the unwelcome 'harlequin' invader



The main colour variations of adult harlequin beetles
Photo by Lambert Smith

Previously, *Plant Protection News* (Nos 77 and 75 of 2008, and No. 81 of 2009) discussed the arrival in, and rapid spread through, South Africa of the 'harlequin lady beetle', *Harmonia axyridis*. This noxious insect is considered the most harmful invasive arthropod species of our decade. It originated in eastern Asia, and it is presently causing great alarm in North America and Western Europe, where its invasion is being studied very well. It is also known from South America, and it is spreading through southern Africa. It potentially can cause complex ecological effects involving changes in invaded communities, besides impacting on agriculture and human health, and being a noteworthy household nuisance.

Researchers in the Northern Hemisphere are scrambling to discover a way of combating this invasive insect. As the use of pesticides is not a viable option, all hope is on the discovery of a biological control agent to fight the 'harlequin invasion'. Lady beetles have surprisingly few natural enemies. Birds and reptiles would very seldom try to eat lady beetles, as they are foul or even poisonous prey, as is advertised by their warning colours, typical combinations of black, yellow, orange and white. A modest number of microorganisms, fungi, mites, nematodes, wasps and flies are, however, known to be parasitic on, or pathogenic of, certain lady beetles. Researchers are looking at some of these as potential biological control agents against the harlequin lady beetle.

Two exciting, albeit fortuitous, photographs of natural enemies attacking adults of the harlequin lady beetle were submitted to the Biosystematics Division recently. Mr Wolf Anvi, who lives on a farm in the southern Drakensberg, is a regular contributor to the South African National Survey of Arachnida (SANSA). He photographed, in the Giant's Cup Wilderness Reserve, a golden orb-web spider (*Nephila fenestrata*, family Nephilidae), clearly feeding on a harlequin lady beetle in her web. This is a fascinating and unusual observation, but unfortunately it is unlikely that these spiders will have any noticeable effect on the population dynamics of the invasive beetle.

The second photograph is more difficult to interpret. It was contributed by Mr Francis Bakos, who made this discovery inside his office building in Johannesburg. The photograph shows a suffering harlequin lady beetle with the cocoon of a parasitic wasp between its legs. A parasitic wasp had here completed its larval development inside the adult lady beetle, emerged from the still living body, and spun this silky cocoon to pupate in.

Biosystematics (continued)

Nature combating (cont.)

Unfortunately the specimen was discarded before Mr Bakos learnt from us how valuable it would have been for scientific research. The parasitic wasp which is the most likely culprit is called *Dinocampus coccinellae*, belonging to the family Braconidae. This species has a virtually cosmopolitan distribution and attacks a number of different lady beetle species. In the National Collection of Insects there are specimens of this wasp that had been reared from a couple of other lady beetle species. Mr Bakos's photo is the first proof of this parasitic wasp attacking the harlequin lady beetle in South Africa. Ideally, some wasp specimens themselves should be obtained and sent for critical examination to a specialist. Dr Gavin Broad of The Natural History Museum, London, is such specialist, among others of these very wasps. According to him there is a remote possibility that these wasps in South Africa represent an undescribed species of *Dinocampus*, and need not necessarily be *Dinocampus coccinellae*. However, Dr Broad remarked to Riaan Stals of the National Collection of Insects that the harlequin lady beetle stands a chance of surviving an attack by a *Dinocampus* parasite anyway, as the beetle is a comparatively large host.

Anybody who encounters harlequin lady beetles, no matter where they are, no matter what they are doing, and no matter what they may be experiencing, is strongly encouraged to contact Riaan Stals of the National Collection of Insects. He continues to study the spread of this potentially dangerous alien invader through southern Africa, and appreciates every single contribution in this regard. Citizen science is being utilised. These lady beetles are, of course, highly variable in colour and in the number and size of their spots, as described in those previous issues of *Plant Protection News* and shown in the accompanying photograph. They can, however, easily be distinguished from all other South African lady beetle species by the white neck shield (pronotum) that carries a black 'M' (or 'W' if you look from the other side).

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Harlequin beetle with the cocoon of a *Dinocampus* parasitic wasp. Photo by Francis Bakos



Illustration of the parasitic wasp *Dinocampus coccinellae* © Victor Fursov, National Ukrainian Academy of Sciences, Kiev



Golden orb-web spider feeding on harlequin lady beetle. Photo by Wolf Anvi

Launch of new Spider book



The new spider book *Spiders of the Kalahari* was launched in Pretoria on 20 April 2010. During the ceremony the photographers each received a copy in acknowledgement of their photographs used. Photo: Ansie Dippenaar-Schoeman and Almie van den Berg (authors of the book) with Dr Rami Kfir Research Manager of ARC-PPRI.

Biosystematics (continued)

Two ladies retire at Biosystematics

Elmé Breytenbach

Dr Gerhard Prinsloo accurately portrayed Elmé Breytenbach in a few words during her farewell tea, as: "a person who was always willing to do anything she was asked to". During the 12 years she spent working at the South African National Collection of Insects (SANC), Elmé made her mark in many areas. Her great passion is beetles, having been mentored by the late Dr Endrody-Younga at the Transvaal Museum at the beginning of her career as an entomological technician, and surviving the rigours and pleasures of several extensive collecting trips with him to the arid areas of South Africa and Namibia. Elmé was instrumental in reorganizing the fruit chafer beetles (Scarabaeidae: Certoniinae) in the SANC beetle collection, making this group one of the best curated sections of the Coleoptera collection. She was also a very enthusiastic communicator and organised several large interactive displays as part of WITS University's Yebbo Gogga, and Durban Museum's Kwa Nunu, exhibitions. Besides this, she was sought after as a speaker, giving talks to primary schools on an annual basis. Elmé was very proactive in safety and health, and largely responsible for keeping the Vredenhuis campus habitable until the new building at the Roodeplaat campus was completed.

During the Biosystematics Division's great move out to Roodeplaat, Elmé took charge of receiving all the removal loads at the new building, directing the movers to the correct location for offloading. She did an amazing job, making sure that the careful trip out to the new building ended in an extremely orderly manner, thereby ensuring minimal disruption of biosystematics research and the services provided by the division.

We all know Elmé as a highly enthusiastic and dedicated worker, with definite ideas on how things should be done. She is very caring, and readily gives good advice on many topics including health - her fundamental training having been as a nursing sister. We wish Elmé an entomologically interesting and happy retirement.



Elmé showing off her farewell gift - a painting of a bushveld charaxes by the Rev. Anthony Watsham

Naomi Buckley



Naomi Buckley received a beautiful watch as retirement gift

Naomi Helena Buckley began her career in Nematology as a technical assistant on 1 January 1981 and retired on 28 February 2010. Through the years she became so proficient in her work, that we came to see her as our very own specialist technician.

Naomi matriculated from the Sedaven High School, Heidelberg during November 1962. She received her Teachers' Training Diploma at Helderberg College, Somerset West with Child Psychology, Educational Psychology, Biblical Studies and Pedagogy as major subjects.

At the Nematology Unit Naomi was involved with the collection (field work), extraction, fixation and mounting of nematodes on Cobb slides. She could identify the plant parasitic nematodes to genus level and was responsible for the labelling of all nematode slides in the National Collection of Nematodes. Naomi also did the updating and adding of all publications into the literature collection of the Nematology. In later years Naomi was responsible for capturing specimen data from slides and accession register in web based Nematode System.

Some of Naomi's many responsibilities were obtaining quotations for all required equipment, filling out requisition forms, receiving and acceptance of all ordered equipment and goods, procurement of stationery and other office supplies from the stores office and arrange for all equipment to be serviced and maintained. She was presenter or co-presenter of five Nematology courses, co-authored two books, was co-author of eight peer-reviewed and semi-scientific articles and was presenter or co-presenter of six papers and posters at various national symposia and conferences.

In her "free" time Naomi still had time for her hobbies: gardening, knitting, reading and sewing.

We will always remember Naomi as a wonderful colleague and friend and will never forget the enthusiasm and dedication with which she approached her work and her exceptional contribution to the National Collection of Nematodes and the Nematology Unit in its entirety.

Pesticide Science

Hosting meeting on pesticidal plants (botanical pesticides)

ARC-PPRI hosted the inception meeting of the African Dryland Alliance for Pesticidal-Plant Technologies (ADAPPT), an ACP Science and Technology Programme-funded project at the ARC Central Office conference centre in Pretoria from 25 – 29 January 2010.

At the inception workshop, 17 participants from ten countries, representing 14 institutions, met as project management, work-package leaders, country co-ordinators and external advisors, to discuss the execution of the projects goals.

On the External Advisors Board, two world authorities on botanical pesticides, namely, Prof. Murray B. Isman from University of Columbia (Canada) and Dr. Opendra Koul from the Koul Research Foundation in India presented their views and strongly supported the ADAPPT Programme.

The overall objective of the project is to strengthen the scientific and technological capacity of African nations to exploit pesticidal plants (or botanical pesticides) and optimise their use for poor farmers by establishing a pesticidal plant network of scientists and agricultural technicians from NGOs, agricultural institutes and universities. The network will facilitate the development and optimisation of appropriate, cost effective, and environmentally benign agricultural technologies that are based on indigenous pesticidal plant materials for insect pest management in field crops and stored product, and ectoparasite control in livestock in the small-scale farming sector across African drylands. The network will provide a platform on which old and new knowledge can be better consolidated, expanded and disseminated. Ultimately this project aims to reduce the high level of rural poverty in sub-Saharan African countries by making agriculture and animal husbandry more competitive, increasing food security and raising poor farmers' incomes by cost effectively increasing crop yields, reducing storage loss and protecting livestock.

Pesticidal plants can be a source of marketable products for farmers and small businesses or cooperatives and their commercialisation will provide both an additional income stream to poor farming communities and a major uptake pathway for business-driven promotion of this proven and effective pest management technology.

The specific objectives in Africa are to;

1. Establish, consolidate and expand a regional network to research the use of pesticidal plants.
2. Provide a forum for an raising awareness about pesticidal plant use.
3. Create an environment for cross-training and skill-transfer.
4. Develop policy guidelines to ensure validated marketing and promotion of safe and effective plant-based pesticides in compliance with the Convention on Biological Diversity while promoting the conservation of habitat diversity across the region.

The project is linked to the current Southern African Pesticidal-Plants (SAPP) research project, to optimise the indigenous use of pesticidal plants in Caesalpinoid woodlands of southern Africa.

For more information on the two project, see
<http://www.nri.org/projects/adappt>
<http://www.nri.org/projects/sapp>

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Some delegates at the ADAPPT Inception Meeting



Pesticidal plant—*Ambrosia artemisoides*



Pesticidal plant—*Strychnos spinosa*

Pesticide Science (continued)

ECORAT—final workshop



The 'ECORAT' research team from Tanzania, Namibia, Swaziland, South Africa and United Kingdom

The final, EU-funded, 'ECORAT' project workshop took place in November 2009 at Okaukuejo, Namibia. Messrs Frikkie Kirsten, Phanual Malebana and Emil von Maltitz presented the final research results obtained in Tanzania, Namibia and Swaziland on rodent management by small-scale farming communities and their impact on those communities.

Over the past three years, the ECORAT project carried out research on rodent ecology (with the emphasis on population dynamics and habitat utilisation); rodent biology; rodent-human interactions regarding disease risk and special proximity; rodent impact on people's livelihoods, and most importantly, community-based rodent management. The work showed that rodent population dynamics can be extremely complex as a result of a mosaic of different ecological habitats, with different rodent species, within rural agricultural communities.

Results from the community-based intensive trapping showed that this method significantly reduces the rat population, is cost-effective and sustainable when employed over a large enough area, with good commitment from the farming community.

The concluding remark in the final report bears some significance and insight into the ECORAT project: "In the case of rural farming communities in southern Africa, the ECORAT project has shown us implementation is not without its challenges, requiring significant community organisation and education,

along with knowledge of the rodent species present and the habitat complexity.

We believe delivering ECORAT-style rodent management to all subsistence farmers in Africa is possible, but will require concerted efforts to raise the awareness of policy makers about the problems rats cause to people's livelihoods and how rats can be sustainably and cost-effectively controlled". The final technical report is available on the ECORAT website <http://www.nri.org/ecorat>.

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Weed Research

Biocontrol of Hydrilla verticillata at Pongolapoort Dam by an immigrant moth, Parapoynx diminutalis

An aquatic plant moth, *Parapoynx diminutalis* (Lepidoptera: Crambidae), indigenous to Asia, Australia and possibly east Africa, is contributing to control of an invasive aquatic weed in South Africa, *Hydrilla verticillata* (Hydrocharitaceae), despite not having been introduced deliberately.

The moth was first discovered in low numbers on hydrilla plants collected, as part of a biocontrol research project, from Pongolapoort Dam in northern KwaZulu-Natal in July 2008 (the only known infestation of the weed in South Africa). However, it only became of interest when it occurred at such high densities on hydrilla taken back to the laboratory that it interfered with rearing of two of the candidate biological control agents in quarantine (two leaf-mining fly species). The aquatic moth larvae are leaf-cutters and, by removing large portions of leaves and even whole leaves, they destroy the food source for fly larvae which develop inside the leaf tissue.

Subsequent to discovering high numbers of moth larvae on hydrilla, the infestation in Pongolapoort Dam was monitored to determine whether the moths were negatively impacting the plants in the dam. The first visible signs of moth damage in the field were noted in January 2009, when dense mats of hydrilla were heavily defoliated in an area of approximately 1 ha. By April 2009, extensive areas of the hydrilla infestation (covering approximately 600 ha surface area; mapped in 2006 from GPS records and aerial photographs by Michael Braack – KZN DAERD Invasive Alien Species Programme) were defoliated. Hydrilla plants that had been heavily damaged in January had died back completely by then, and the indigenous broad-leaved pondweed, *Potamogeton schweinfurthii* (Potamogetonaceae), had replaced the hydrilla. At this time, the occurrence of the moth on hydrilla was noted as an important discovery, particularly in terms of its potential to contribute to control of hydrilla in South Africa.

Although re-growth of hydrilla from seeds and vegetative structures (tubers and turions) was inevitable, the damage caused by the moth at Pongolapoort Dam in the summer of 2008/2009 does appear to have had an effect on the development of hydrilla in the following growing season. Dense surface mats of hydrilla were only visible by late summer (Jan/Feb) in 2010 whereas in previous years, dense surface mats were widespread by late spring (Oct/Nov). Complete defoliation and die-back of mats in some areas similar to that seen in the previous year was again observed; a month later, the hydrilla in that area had disappeared.



Healthy, leafy shoots of *Hydrilla verticillata* submerged in Pongolapoort Dam



Hydrilla verticillata damaged by larvae of *P. diminutalis* in April 2009



An adult of the leaf-cutting moth, *Parapoynx diminutalis*, on healthy *Hydrilla verticillata*



Hydrilla verticillata defoliated by larvae of *Parapoynx diminutalis* in December 2009

Weed Research (continued)

Biocontrol of *Hydrilla verticillata* (cont.)

Both *P. diminutalis* and hydrilla are native to Asia where hydrilla is one of the moth's preferred hosts. For this reason, the moth is often referred to in the literature as the 'Asian hydrilla moth'. The U.S.A. was interested in introducing *P. diminutalis* as a potential biocontrol agent for hydrilla, which is one of their worst invasive aquatic weeds. Host range studies were conducted in India for this purpose, but the moth was found to be polyphagous, having too broad a host range to be considered for release. Ironically, three years later the moth was discovered in hydrilla cultures at a research station in Fort Lauderdale, Florida. It is assumed that it was accidentally introduced through the aquarium industry in its immature stages on Asian aquarium plants that were imported into the country.

The aquarium industry is also believed to be the likely cause of its occurrence in southern Africa (A.J. Urban, pers comm.) as other host plants of the moth are common aquarium plants. Collection records of *P. diminutalis* indicate that it has been present in South Africa for as long as a century. Earlier collection records from KZN were provided by Dr Martin Krüger of the Transvaal Museum, NFI, who also confirmed the identification (although the specimens from Pongolapoort Dam have not been compared with the type specimen). There are 15 collection records for KZN, including the agricultural area below Pongolapoort Dam, the Makhatini Flats, in 2001. Although it is possible that the moths on hydrilla in the dam could have been introduced along with the plant, the fact that *P. diminutalis* was already present in the area suggests that the moth most likely colonised hydrilla after the plant established in the dam.

Although hydrilla is the moth's main host plant in the U.S.A., it has failed to make a significant contribution to the biocontrol of the weed there. Outbreaks and the associated damage have been observed on a large scale in Panama, but in Florida, extensive defoliation is sporadic and localized (Grodowitz, pers comm.). Low temperatures and reductions in hydrilla biomass during the winter months are believed to be responsible for its limited success in Florida.

Only time will tell if *P. diminutalis* will be a successful biocontrol agent for hydrilla in South Africa. However, if the trend continues in the long-term, a reduction in healthy shoot-tip fragments and turions (which give rise to new plants and new infestations) through sustained herbivory, should contribute to a reduction in the risk of spread and the invasiveness of the weed in South Africa.

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National initiative aims to halt further expansion of pompom weed

Pompom weed continues to expand its range in South Africa, but a new national initiative aims to put the brakes on this expansion.

Pompom weed (*Campuloclinium macrocephalum*), an invasive, Asteraceous, perennial herb from South and Central America, was first recorded in South Africa in the Fountain's Valley, Pretoria in the early 1960s. During the 1970s and 1980s it showed a slow expansion in the Pretoria area and spread to parts of Limpopo and KwaZulu-Natal. In the 1990s and 2000s there was a dramatic, exponential expansion phase, with vast tracts of land invaded in Gauteng, and parts of Limpopo, North West Province and Mpumalanga.



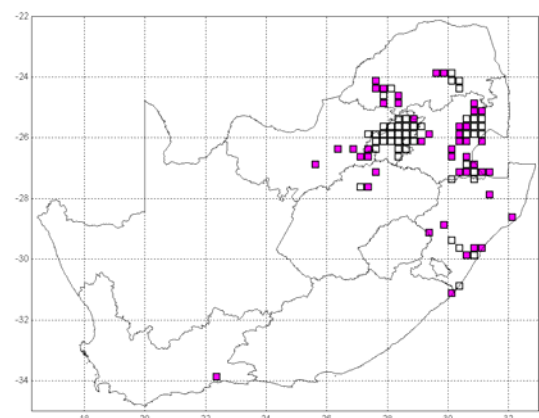
Pompom weed, *Campuloclinium macrocephalum*

In the past five years the Southern African Plant Invaders Atlas (SAPIA) project has noted an almost doubling in the number of ¼ degree squares in which it is present, from 48 known ¼ degree squares in March 2005 to 93 known ¼ degree squares in March 2010 (see map).

The dramatic expansion of pompom weed over the past five years is a testament to the lack of a co-ordinated national control programme. The only regionally co-ordinated effort over the past three years has been in KZN by the Department of Agriculture and Environment, under the leadership of Michael Braack. Pompom weed has been chemically treated at all known sites in this province in a magnificent effort to pompom weed out of KZN. The single known site in the W Cape near George was treated in 2008 by Cape Nature Conservation.

In 2009 SANBI's newly formed Early Detection and Rapid Response (ED & RR) programme established a national steering committee for pompom weed management. This committee, under the leadership of Phetole Manyama, will assist in the development, planning, implementation and evaluation of a rapid response approach to restrict the spread of pompom weed prior to the release of appropriate biocontrol agents. Considerable progress has already been made to develop clearing teams. The few sites in the Free State were treated for the first time in 2009 and control programmes in North West, Limpopo and Mpumalanga were co-ordinated for the first time in the 2009/2010 season.

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All known ¼ degree squares where pompom weed has been recorded up to March 2010. Squares recorded from April 2005 to March 2010 are shown in pink. The map does not indicate which areas have been cleared.

Weed Research (continued)

Survey for biocontrol agents against eastern Australian acacias

Pearl acacia (*Acacia podalyriifolia*), Bailey's wattle (*A. baileyana*) and pepper tree wattle (*A. elata*) are native to eastern Australia and are all declared (category 3) invader species in South Africa. All three of these species were introduced into South Africa for ornamental purposes, and although not as abundant as some of their Australian acacia counterparts, their current distribution in several provinces of South Africa, and potential spread as weeds, makes them good target species for biological control.



Pearl acacia, *Acacia podalyriifolia*



Bailey's wattle, *Acacia baileyana*.

Two biotypes of a seed-weevil, *Melanterius maculatus*, have been collected from Australia and released against *A. baileyana* and *A. podalyriifolia*, respectively, in 2004 and 2008. However, the weevils cannot be mass-reared in a laboratory, and the collected weevils only allowed one release to be made against *A. baileyana* and three against *A. podalyriifolia*. The weevils have recently been confirmed to have established on *A. baileyana*, but since the population is still small, weevils cannot yet be collected here for redistribution to other potential release sites. As a result, further collections of this weevil from Australia were required. As yet establishment of *M. maculatus* on *A. podalyriifolia* has not been confirmed.



Pepper tree wattle, *Acacia elata* (photograph C. Meiring)

Between the 1st and 24th October 2009, Judy Post and Fiona Impson, from the Weeds Division in Stellenbosch, travelled to Australia to collect adult *M. maculatus* weevils for further releases against *A. baileyana* and *A. podalyriifolia*. They also carried out a survey for potential control agents to use against *A. elata*. Approximately 2000 weevils were collected in southern Queensland from *A. podalyriifolia* and a further 1800 from *A. baileyana* in New South Wales for shipment to South Africa. Although quite high mortality of the weevils was experienced during transit and quarantine, a single large release was made on *A. podalyriifolia* and a further five on *A. baileyana* – all in the Western Cape.

Unfortunately the survey for potential agents against *A. elata* was less successful. Despite finding several populations of the plant in its native range (New South Wales), there was no evidence of damage to the plant by seed-feeding weevils or gall forming pteromalid wasps or cecidomyiid flies (all of which are usually host-specific). Extensive damage by cerambycid beetle larvae (which tunnel in the branches and trunks of the trees) was commonly noted; however, the specificity of these stem borers is uncertain and they are possibly generalist borers on many of the Australian *Acacia* species. In addition to this, a gall rust fungus (*Uromycladium notabile*) was abundant, although it appeared not to be particularly damaging, and most of the die-back observed was due to the cerambycid activity. The potential for a biological control programme against *A. elata* thus remains uncertain, and for the time being it has been decided not to investigate this weed further.

The Working for Water Programme and the Drakenstein Trust are gratefully acknowledged for their funding of this collecting trip.

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Judy Post collecting weevils in Australia

Weed Research (continued)

Lantana herringbone leafminer now in Madagascar

The lantana herringbone leafmining fly, *Ophiomyia camarae* (Diptera: Agromyzidae), was released in South Africa in 2001 by David Simelane, for the biocontrol of the invasive alien lantana (*Lantana camara* hort. (Verbenaceae)). Its populations exploded on lantana infestations growing under the hot and humid conditions along the coast of KwaZulu-Natal, and the small fly dispersed rapidly to neighbouring countries, including Mozambique, Swaziland and Zimbabwe. During a bilateral mission to Madagascar in December 2007, David Simelane found no herringbone mines on lantana during brief surveys around the capital of Antananarivo. However, in October 2009, colleague Lorraine Strathie discovered it to be well established on lantana near the village of Ambatozavavy near Lokobe Nature Reserve on Nosy Be Island, just off the Western coast of Madagascar.

We are not aware of any deliberate introduction of the lantana herringbone miner into Madagascar. The lantana lace bug, *Teleonemia scrupulosa*, is the only lantana biocontrol agent that was recorded as introduced deliberately into Madagascar; it was introduced during 1961 from Mauritius, where it was recorded as early as 1952. *Ophiomyia camarae* may have been blown across at least 380 km of ocean from Mozambique - trans-oceanic aerial dispersal of insects and mites in fast-moving, high-altitude jet-streams is a well known phenomenon.

Other symptoms on lantana plants in Madagascar indicate that other lantana biocontrol agents may have also dispersed naturally from Africa to Madagascar. These include two other agromyzid flies: the lantana blotch leafminer, *Calycomyza lantanae*, and the lantana fruit miner, *Ophiomyia lantanae*. The lantana blotch leafminer was released in RSA in 1982 and dispersed from RSA to the equator in less than 14 years, and over the sea from Australia to the East Indies and SE Asia, while the lantana fruit miner was present in Kenya before 1958 and had arrived in Madagascar by 1968. Leaf damage typical of the noctuid moth, *Hypana laceratalis* (lantana leaf window maker), which is indigenous to African *Lantana* and *Lippia* spp., was also noticed in Madagascar.

Lantana is widespread and often dense in Madagascar, and it is hoped that the arrival of the lantana herringbone leafminer will make a valuable contribution to suppressing the weed there, as it has done in South Africa.

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Lantana camara



Herringbone symptoms of *Ophiomyia camarae* larval mine (adult fly shown separately) on a common variety of *Lantana camara* in Madagascar. Photographs: LW Strathie & DO Simelane

Congratulations



Well done, to Lulu Madire of Rietondale's Weeds Division who was recently awarded an MSc from the University of Fort Hare. The title of her thesis is "Suitability of the leaf-mining fly, *Pseudonapomyza* sp. (Diptera: Agromyzidae), for biological control of *Tecoma stans* L. (Bignoniaceae) in South Africa. Lulu's supervisor at Fort-Hare was Prof. Samuel Waladde, and her co-supervisor at ARC-PPRI was Dr. David Simelane, also from Rietondale's Weeds Division.

Insect Ecology

Beekeeping in Vhembe, Limpopo Province

The Agricultural Research Council (ARC) has been involved in a beekeeping development project in Vhembe, Limpopo Province, since June 2008. The community beekeeping project was funded by the European Union and the ARC. The organisation of the community project and the selection of farmers that could form part of the project was undertaken with the assistance of the Agricultural Extension Services of the Limpopo Department of Agriculture and Forestry. The first beekeeping training sessions targeted extension officers in a 'train the trainers' approach, to give them background information and hands-on knowledge so that they could then assist with the preparation of the beekeeping training programme. The intensive training of the Vembe community beekeepers then took place over a period of 12 months and the beekeepers each received bee hives, protective clothing and all the specialist equipment needed for beekeeping.

There has been speculation that a long history of traditional beekeeping existed among the Venda people. During the training in Vhembe, one of the most interesting discoveries was of a traditional home-made clay pot hive still used by one of the rural beekeepers and proving that traditional beekeeping is still being practised. This was our first direct evidence of traditional clay-pot hives still being used.

One of the co-ordinators for beekeeping from the Limpopo Department of Agriculture and Forestry is Mr Thomas Ramatsindela from the Thulamela Municipality. His dedication as an extension officer was very evident in the long overtime hours he spent using his own private transport to help farmers to get to the beekeeping training sessions in Vembe. His own department also saw his potential and on the 11 th of February 2010 he was awarded a certificate by the MEC of Agriculture and Forestry for his dedication as an extension officer and special mention was made of his involvement in beekeeping.

There is still a lot of work required to ensure that this beekeeping development initiative flourishes and becomes sustainable. A total of 105 farmers participated in the initial beekeeping training, while there are at least another 195 people already identified that are interested in beekeeping. The prospects for a thriving beekeeping enterprise in the Vhembe district look very good.

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A traditional home-made clay pot hive used by rural beekeepers

Did you know?

In 2009/21010 various different samples were received in the Insect Quarantine facilities at ARC-PPRI. These included stable fly parasitoids for which quality and percentage parasitism were determined, insects imported for the pet food trade, biological control organisms for which identification where confirmed and surveys of natural enemies in other countries. The Insect Quarantine Service is rendered under a mandate from the Department of Agriculture, Fisheries and Forestry in terms of the Agricultural Pests Act (Act 36 of 1983). All insects that are imported, whether for the biological control of insect pests, for scientific study or other beneficial purposes, have to pass through quarantine before being released back to the importing agency. They are reared for at least one generation in quarantine to ensure that the culture is pure and of the right identity, and that it conforms to the host specificity requirements set by the Department.

The quarantine facility, situated at the Rietondale campus in Pretoria, is available to any person or institution in possession of a valid import permit issued by DAFF.

For further information contact the Quarantine Officer: **Almie van den Berg** at vdbergam@arc.agric.za



Stable fly parasitoid emerging from fly pupa
(www.bugsforbugs.co.au)

Plant Pathology and Microbiology

Soil microbiology: Linking Conservation Agriculture with the underground

"The condition of our soils ultimately determines human health by serving as a major medium for food and fibre production and a primary interface with the environment, influencing the quality of the air we breathe and water we drink. Thus, there is a clear linkage between soil quality and human and environmental health. As such, the health of our soil resources is a primary indicator of the sustainability of our land management practices." - Acton and Gregorich, 1995

What is Conservation Agriculture (CA)?

CA is a holistic approach to crop production, which encompasses "conservation tillage" or tillage practices specifically intended to reduce soil disturbances during seedbed preparation, the establishment of a permanent soil cover and the practice of crop rotation. The aim is the improvement of soil structure and stability, as well as preservation of biodiversity in terms of both micro- and macro-flora and fauna.

Why CA?

Conservation agriculture is beneficial for the soil, since soils will be preserved in semi-natural conditions. Soil moisture is preserved and soil structure does not degrade, while drainage, porosity, adsorption capacity, and structural stability is improved. The effects of CA practices are not only localized, but also influence the environment. CA in the long term, impacts energy consumption, carbon sequestration and harmful gas emissions, resulting in reduced air pollution and the promotion of carbon sequestration in soils. Through these processes, soil biodiversity and bioactivity are preserved since excellent food and habitats are provided for microorganisms, earthworms and insects.

Where does Soil Microbiology fit in?

Baseline data for the impact of agricultural management practices (AMP) on soil microbial populations is limited for South African soils. As a result, an unsaturated demand to quantify the impact of various AMP on soil physicochemical and biological properties exists. This information is essential to ensure that accurate recommendations are provided to farmers on AMP to sustain soil health and quality, in order to maximize profitability. While agricultural practices (e.g. tillage, cropping sequence, fertilization inputs, and irrigation) are known to have significant effects on the physical and chemical properties of soil, less is known about the associated effects on the biological aspects of the soil. Microbial community biodiversity, on the other hand, is a facet that is often neglected, despite the integral part it plays in soil quality and maintenance of ecosystem functioning.

How is soil microbial community diversity and activity measured?

Biogeochemical cycling of nutrients such as carbon, nitrogen, and phosphorus, is a fundamental soil function in which microorganisms, especially bacteria, play a very important role. In this context, microbial community level physiological profiles (CLPP) and enzymatic activity assays are often analysed to determine the functional diversity of soil microbial populations (PPNews no.76: Soil microbiology). In both types of analyses, the ability of soil microbial populations to utilise a specific substrate is measured. Substrate availability is the main factor that influences both size and activity of microbial communities. Enzyme activities, known to be influenced by soil type and soil organic matter, are early indicators of ecosystem stress. It can therefore act as biological indicators of soil degradation, compared to classical and slowly changing soil properties such as organic matter. Enzyme assays are used to evaluate soil fertility and to describe the functioning of a soil ecosystem, providing useful information on the presence and activity of microbial populations in soil with the capacity to obtain carbon, nitrogen or phosphorous.



A small portion of the Conservation Agriculture trial at Zee-koegat, Roodeplaat, illustrating types of implemented cropping systems



The Soil Microbiology Laboratory at ARC-PPRI, Roodeplaat, applying the most recognized methodologies to study soil microbial dynamics

The Soil Microbiology Laboratory at ARC-PPRI, Roodeplaat, currently applies some of the most recognized methodologies to study the effects that CA practices have on soil microbial diversity and activity. The aim of this Soil Microbiology Laboratory is to compile functional profiles of soil microbial populations present in various soils in order to correlate it to the actual or potential activities of microorganisms that contribute to ecosystem dynamics.

The future of soil microbiology at ARC-PPRI

Thus far, a limited number of studies regarding the dynamics of micro-organisms in South African agricultural soils have been conducted. It is the vision of this Soil Microbiology Laboratory at ARC-PPRI to increase the number of techniques that are independent of cell culturability, in the near future. This will enable us to serve the agricultural community better and ultimately contribute to farming profitability.

Services offered

We are currently offering services to clients where long-term effects of soil management practices are determined on soil biological properties.

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Plant Pathology and Microbiology (continued)

Conservation Agriculture Information Day at Zeekoegat, Pretoria

Researchers within the ARC are currently involved in a number of Conservation Agriculture (CA) projects throughout the country. The need arose for a multidisciplinary investigation to quantify the beneficial effect of CA under South African conditions, together with the compulsion to optimize methodologies to be used in the quantification of these beneficial effects under reliable experimental conditions. As a result, an on-station research strategy was initiated by ARC-ISCW in collaboration with the ARC-PPRI and ARC-API at the ARC-Roodeplaas (Zeekoegat) Experimental Farm outside Pretoria. This venture is financially supported by the Maize Trust and the ARC.

During an information day that was held on 24 February 2010 at Zeekoegat, near Pretoria, Johan Habig presented his soil microbial population dynamics results obtained over a period of two years in the above mentioned trial.

The applied techniques were briefly outlined on p.16. The data obtained during October 2008 is accepted as the baseline for further comparison in the evaluation of the influences of various CA practices on soil microbial population dynamics.

Differences in soil bacterial functional diversity (i.e., the amount and types of carbon sources utilised) were found between pre-planting soil samples for October 2008 and October 2009. Profiles from 2009 soil samples clustered together (are similar), whereas 2008 soil samples clustered together as shown in Fig. 1. This clearly indicates a shift (change) in functional diversity resulting from the previous season's agricultural practice.

In Fig. 2 the influence of cropping systems and tillage practices on soil microbial communities is illustrated. As indicated, the maize/legume rotations clustered together on the left-hand side of the dendrogram (Block a, b), while maize monoculture and maize/delayed intercropping treatments cluster together on right-hand side of the dendrogram (Block c). The composition of plant root exudates is mainly responsible for these differences since the difference in composition attract different microbial species within a microbial population that are especially well adapted to utilise the specific compounds very rapidly.

The over-all influence of tillage, cropping sequence and fertilizer input on enzyme activities can be clearly observed for β -glucosidase and alkaline phosphatase activity. Although no clear trend can yet be established, results indicate that reduced tillage (RT) positively influence β -glucosidase, alkaline phosphatase, and urease activities at the end of season 2, compared to conventional tillage (CT). Increased microbial enzyme activity is an indicator of improved nutrient recycling (Fig. 3).

After only two planting seasons, it is difficult to determine which CA practice has the most beneficial or detrimental effect on soil microbial populations. It might take up to seven years for soils to stabilise when conventional tillage practices are converted to Conservation Agriculture practices.

For further information, contact: Johan Habig at HabigJ@arc.agric.za



Johan Habig presenting his results on soil microbial dynamics at the Information Day at Zeekoegat.

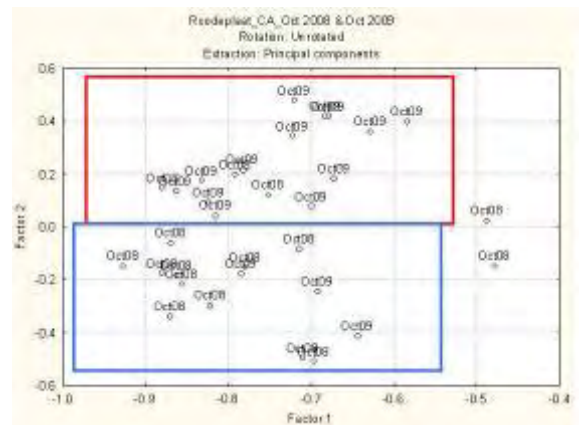


Fig. 1. Principal Component Analysis (PCA) ordination plot illustrating the differences in pre-plant carbon source utilisation patterns for the October 2008 and October 2009 seasons.

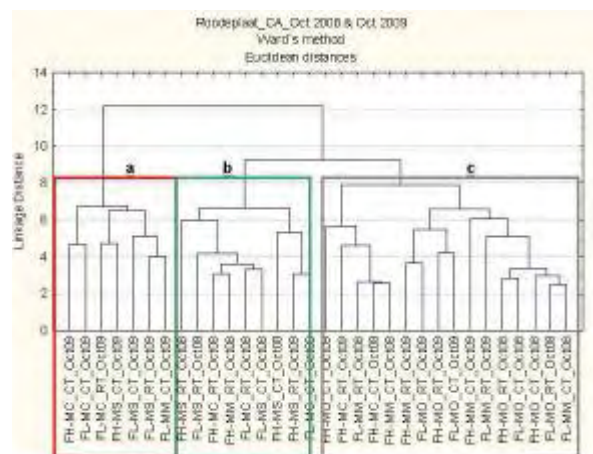


Fig. 2. Cluster analyses illustrating the differences in pre-plant carbon source utilisation patterns for the October 2008 and October 2009 seasons.

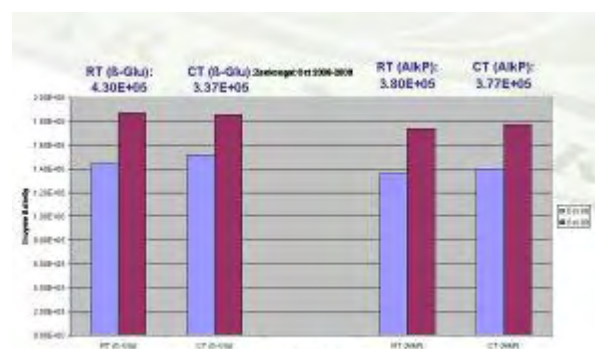


Fig. 3. β -Glucosidase and alkaline phosphatase activity (reduced data) in pre-plant Zeekoegat soils for the October 2008 and October 2009 seasons.

Plant Pathology and Microbiology (continued)

Corky bark (CB) disease of grapevines

The common viticultural practice of grafting grapevine cultivars to rootstocks is the reason that corky bark (CB) disease, which affects graft unions, is one of the most destructive grapevine diseases worldwide. The disease is known for more than 56 years. It was first reported from California, USA, in 1954. In 1959 Hewitt and his team (University of California, USA) discovered that the interspecies hybrid LN33 (Courderc 1613 x Thompson Seedless) grapevine reacts to CB infection by exhibiting severe internodal swelling of canes.

These symptoms are the result of abnormal activity in the cambium of affected plants, which leads to modified wood and enlarged phloem tissues. As there is no cork cambium, true cork is not produced. A spongy, thick, cork-like layer observed later in the growing season accumulates from dead secondary phloem cells. Grafting of grapevine buds to LN33 plants has been adopted by grapevine industries worldwide as a reliable method for detecting CB. Grafted LN33 plants are monitored for development of symptoms of the disease for 2-3 years.

The clear-cut association of a *Vitivirus*, Grapevine virus B (GVB) with symptomatic LN33 hybrid, strongly suggests that this virus causes CB. Grapevine virus B (GVB) is the type member of the *Vitivirus* genus. Its genome of 7599 nt, excluding the poly A tail at the 3' terminus, is organized into five open reading frames (ORF1-5). The virus is transmitted between grapevines by pseudococcid mealybugs (*Pseudococcus* spp. and *Planococcus* spp.). It can be transmitted from grapevines to *Nicotiana* species by insect vectors or mechanically. Molecular analysis of GVB from various grapevines has revealed that the virus is extensively variable.

In our laboratory we isolated GVB variant that is not pathogenic to LN33 hybrid grapevine. The variant was fully sequenced. Comparative analysis of the genome of this variant and GenBank full genome sequence data for two other variants of the virus led to the identification of short, divergent regions encoding amino acid sequences with significant amino acid substitutions, possibly characteristic for pathogenic and non-pathogenic strains of the virus.

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Cane of LN33 hybrid grapevine affected with Corky bark (CB) disease

Wealth in Rhizobium collection

Nitrogen is one of the most important elements in agriculture and without it optimal plant growth can not be obtained. It is also a scarce resource. Conventional agriculture depends on expensive inorganic nitrogen that contributes to environment pollution such as water systems.

Biological fixed nitrogen, on the other hand, is a more cost-effective environmentally friendly option. It is the result of a beneficial symbiotic relationship between a bacterium, namely rhizobium and leguminous plants. These bacteria fix atmospheric nitrogen and make it available to the plant and follow-up crops such as maize. Soybeans inoculated with rhizobia for example can fix between 26 and 188 kg N/ha.

Plant Protection Research Institute is the custodian of the South African Rhizobium Culture Collection (SARCC). Currently the collection consists of 2670 strains which are regularly tested for viability and efficacy. From this collection 15 strains have been released for commercial application. Crops that benefit from these are for example soybeans, *Medicago* spp., groundnuts, cowpeas, lupins, root crops and honey bush tea.

New indigenous strains are constantly collected, identified and added to the collection. These strains are further tested under controlled and field conditions for their ability to form nodules and fix nitrogen. The contribution to protein content in crops is also determined.

The SARCC supply experimental strains and inoculants on demand. The Institute also offers a quality control service for commercial inoculants.

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Nitrogen fixing nodules produce by rhizobia on cowpea roots



Dr Hassen busy testing rhizobium strains in the glasshouse

Plant Pathology and Microbiology (continued)

Morphological and phylogenetic analyses of *Pythium* species in South Africa

The genus *Pythium* is a water and soil-borne pathogen of many commercial crops, and an important phytopathogen from an agricultural viewpoint. Many species are serious pathogens causing root and crown rot, as well as seedling collapse of many food crops. Because of the universal occurrence of *Pythium* species in South African agricultural and hydroponic systems, a study was initiated to determine the biodiversity of *Pythium* populations in these systems. Isolates obtained between 1991 and 2008 were included. This study was undertaken in collaboration with University of Stellenbosch, Dept. Plant Pathology.

The study focused on and concluded:

- i) the variability and overlapping of cultural morphological characters
- ii) the confusion in taxonomic literature with regard to the descriptions of synonymous species
- iii) imprecise and incomplete original species descriptions that require revision
- iv) the need to update current dichotomous keys
- v) Genbank sequence submissions under incorrect specie names
- vi) heterogeneity in ITS gene sequence in some species groups
- vii) ITS gene sequence similarity between related or non-related species
- viii) the requirement for extensive multi-gene sequence data to resolve phylogenies
- ix) different species concepts should be revised to resolve specie boundaries and
- x) the establishment and expansion of an online database for *Pythium* species, with sequence data of multi-gene regions and
- xi) rapid and precise specie identifications, and resolving the phylogeny of the genus using this database.

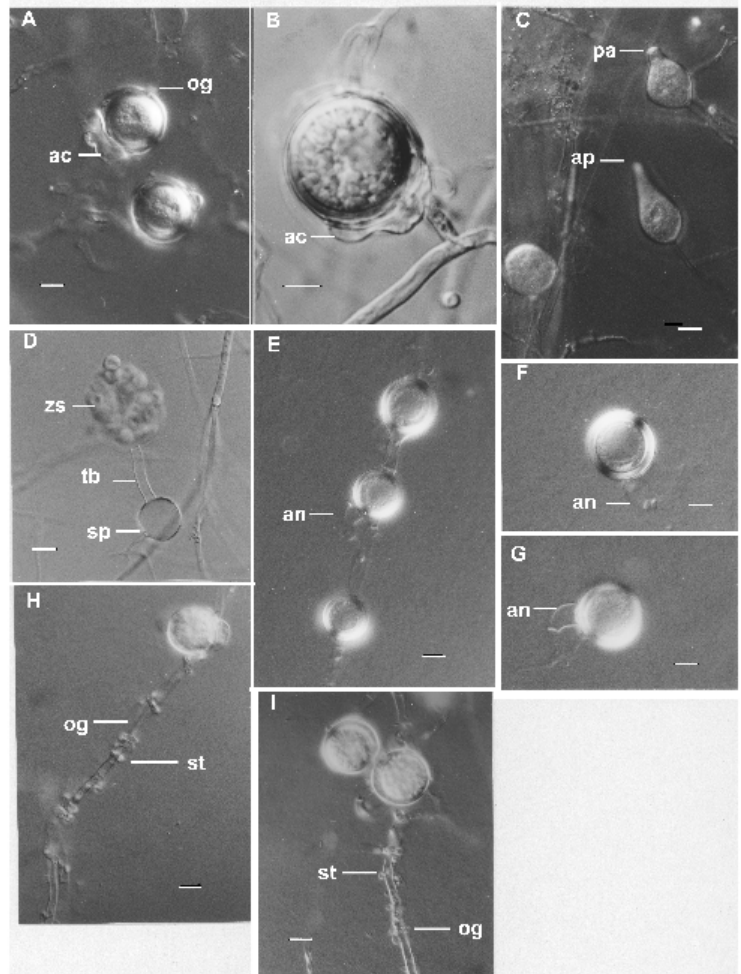
This study will make an important contribution to such a public database of Southern African *Pythium* species and populations. International connections with *Pythium* researchers have been established for the exchange of isolates and multi-gene sequence data. A paper was published on this work.

Read more:

McLeod, A., Botha, W.J., Metz, J.C., Spies, C.F.J., Tewoldemedhin, Y.T. & Mostert, L. 2009. Morphological and phylogenetic analyses of *Pythium* species in South Africa. *Mycological Research* **113**: 933-951.

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

Morphological structures of *Pythium* spp. (scale bar 10 µm)



- A: Terminal, aplerotic oogonia of *P. cucurbitacearum* showing large, lobed antheridial cells (ac) attached lateral to oogonium (og).
- B: Oogonium of *P. vexans* illustrating large, lobed antheridial cell (ac) with undulating contour.
- C: Papillate sporangia of *P. vexans* before the onset of proliferation showing papilla (pa) and extended apex (ap).
- D: Release of zoospores (zs) through discharge tube (tb) from vesicle after discharge from empty sporangium (sp).
- E: Intercalary, plerotic oogonia of *P. rostratum* with attached closely monoclinal antherida (an).
- F, G: Terminal plerotic oogonia of *P. rostratum* with closely monoclinal antherida (an).
- H, I: Antheridial stalks (st) coiling around oogonial stalks (og) of terminal oogonia of *P. volutum*.

Technology Transfer

Scientific publications

GROBBELAAR, E. 2010. Morphology of the adult and immature stages, biology, and phylogenetic placement of *Donaciasta goeckei* Monros, 1958 (Chrysomelidae: Donaciinae: Donaciini). Jolivet, P., Santiago-Blay, J. & Schmitt, M. (Eds). *Research on Chrysomelidae* 2: 153–176, 270 & 271 (Plate 33). Koninklijke Brill, Leiden.

JOVANOVIĆ, N.Z., BUGAN, R.D.H., VAN DER WALT, E. Pesticide Non-Point Source Pollution From Agriculture: A Modeling Approach, Water Research Commission, Gezina Pretoria, ISBN K5/1516, 2010, 110 pp.

NJOBE, P.B., DUTTON, M.F., KOCH, S.H., CHUTURGOON, A., STOEV, S.D. & MOSONIK, J.S. 2010. Simultaneous occurrence of mycotoxins in human food commodities from Cameroon. *Mycotoxin Research* 26:47-57.

PIETERSEN, G., ARREBOLA, E, BREYTENBACH., J.H.J., KORSTEN, L., LE ROUX H.F., LA GRANGE H., LOPES, S.A., MEYER J.B., PRETORIUS, M.C., SCHWERDTFEGER, M., VAN VUUREN, S.P., AND P. YAMAMOTO, 2010. A Survey for "Candidatus" *Liberibacter* species in South Africa confirms the presence of only *Ca. L. africanus* in commercial Citrus. *Plant Disease* 94:244-249.

UECKERMANN, E.A., JALAEIAN, M., SABOORI, A. & SEYEDOLESLAMI, H. 2009. Re-description of *Typhlodromus (Anthoseius) khosrovensis* Arutunjan, first record for Iran (Acari: Phytoseiidae). *Acarologia* 49 (1-2): 23-27.

VAN DEN BERG, E., SUBBOTIN S.A. & TIEDT L.R. 2010. Morphological and molecular characterisation of *Hemicycliophora lutosa* Loof & Heyns, 1969 ad *H. typica* de Man, 1921 from South Africa (Nematoda: Hemicycliophoridae). *Nematology*, 12 (2): 303-308.

New Books

COUTINHO, T.A., **GOSZCZYNSKA, T., LENNOX, C., and VENTER, S.N.** 2009. *Bacterial Diseases of Plants in South Africa*. Briza Publications. South Africa. ISBN: 978-1-920146-02-3, Format: A4, soft cover in full colour, 119 full colour photographs, 128 pp.

DIPPENAAR-SCHOEMAN, A.S. & VAN DEN BERG, A.M. *Spiders of the Kalahari*. Plant Protection Research Institute Handbook No. 18, Agricultural Research Council, Pretoria, 120 pp.

Semi-scientific papers

DIPPENAAR-SCHOEMAN A.S. 2010. Do you want to know more about spiders? *Pest News, Summer Issue* 10: 8.

DIPPENAAR-SCHOEMAN A.S. 2010. New building for the arachnids. *SANSA Newsletter* 10: 1-2.

DIPPENAAR-SCHOEMAN A.S. 2010. First record of *Crosopriza lyoni* (Blackwall, 1867) from South Africa. *SANSA Newsletter* 10: 14.

VAN DEN BERG A. & DIPPENAAR-SCHOEMAN A.S. First report on Nematodes parasitizing spiders in South Africa. *SANSA Newsletter* 10: 15.

Scientific meetings

DIPPENAAR-SCHOEMAN, A.S. 2010. South African National Survey of Arachnida. Invited talk at the SABIF handover event at Kirstenbosch.

DIPPENAAR-SCHOEMAN A.S., 2010. Mites of medical, veterinary and agricultural importance. Second year Zoology/Entomology course. University of Pretoria.

DIPPENAAR-SCHOEMAN A.S. 2010. Scorpions of medical importance. Second year Zoology/Entomology students. University of Pretoria.

DIPPENAAR-SCHOEMAN A.S. 2010. Spiders of medical and agricultural importance. Second year Zoology/ Entomology students. University of Pretoria.

DOUGLAS-SMIT, N., **PIETERSEN, G. & KRÜGER, K.** 2010 Transmission of Aster yellows to grapevine by *Mgenia fuscovaria* (Stål) (Hemiptera, Cicadellidae): Poster presented by K. Kruger at science meeting in Sitges, Spain.

HABIG, J. 2010. Soil microbial diversity and enzymatic activity in the Roodeplaat conservation Agriculture trail. ARC-ISCW Conservation Agriculture Information Day, Zeekoegat, Pretoria, 24 February 2010.

KOCH, S.H. & SEKGOTA, M.W. 2010. Soil-borne fungal pathogens under conventional and reduced agricultural practices. ARC-ISCW Conservation Agriculture Information Day, Zeekoegat, Pretoria, 24 February 2010.

LUBBE, A. Powerpoint presentation titled "Peste en plaë van Canola in die Overberg. Wat het ons gevind?" given at the SKOG meeting at Langgewens, Mooresburg District, Swartland on 11 March 2010.

MOLOTO, M.V. and GOSZCZYNSKA, T. 2009. Characterisation of the South African *Agrobacterium* strains from the Plant Pathogenic and Plant Protecting Bacteria Culture Collection. 46th Congress of the SASPP, 25-29 January 2009, Gordon's Bay, South Africa.

SEKGOTA, M.W. & KOCH, S.H. 2010. Arbuscular mycorrhiza fungi as indicators of soil health under conventional and conservation agricultural practices in South Africa. ARC-ISCW Conservation Agriculture Information Day, Zeekoegat, Pretoria, 24 February 2010.

SERFONTEIN, J.J. & **GOSZCZYNSKA, T.** 2009. First report of bacterial apical necrosis of mango caused by *Pseudomonas syringae* pv. *syringae* in South Africa. 46th Congress of the SASPP, 25-29 January 2009, Gordon's Bay, South Africa.

Newsletters

DIPPENAAR-SCHOEMAN, A.S. & HADDAD, C. 2010. SANSA Newsletter no 10.

HENDERSON, L. 2010. SAPIA News No. 14, January 2010.

Radio

DIPPENAAR-SCHOEMAN, A.S. RSG Monitor –live broadcast on the Barcode of Life project on spiders; 10 live broadcasts on Radio Laeveld about spiders.

STALS, R. *Radio Sonder Grense*, programme Ekoforum (SABC). Interview about taxonomy in general, and in particular about the activities of the Biosystematics Division of ARC-Plant Protection Research Institute.