Plant Protection Research Institute

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No 67

PLANT PROTECTION NEWS

Newsletter of the Plant Protection Research Institute (PPRI), an institute in the Public Support Services Division of the Agricultural Research Council (ARC) of South Africa.

Inside this issue:

General inquiries

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New book releases by PPRI

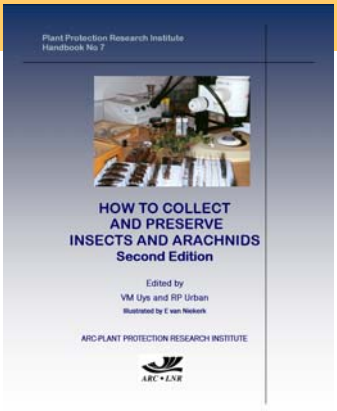
How to Collect and Preserve Insects and Arachnids second edition

The continued demand for an easily accessible general handbook for collecting and preserving insects and arachnids, with a southern African slant, prompted the production of a second edition of this handbook.
This edition has received a complete update giving it a modern, contemporary look. Photographs are included wherever possible. In addition to students and amateur naturalists, this publication should prove indispensable to workers in the fields of: crop protection; natural resource management and medical and veterinary science.
Editors: Vivienne Uys and Ros Urban

This book costs R100-00 (VAT included) and may be ordered from:
ARC-PPRI Publications
Attention: Ms Eunice Kewane
E-mail: KewaneE@arc.agric.za

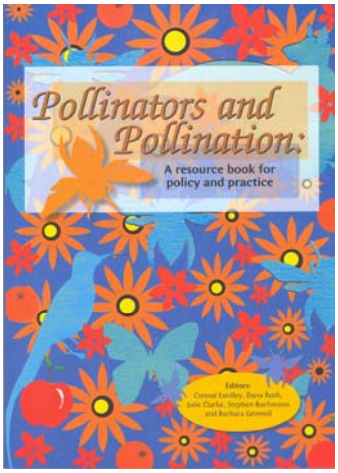
The content of this edition is similar to the first and includes:

- *Outline of the higher classification of insects and arachnids*
- *Descriptions and keys to the orders*
- *Collecting methods*
- *Killing and temporary storage*
- *Preservation*
- *Labelling, accessioning and dispatching*

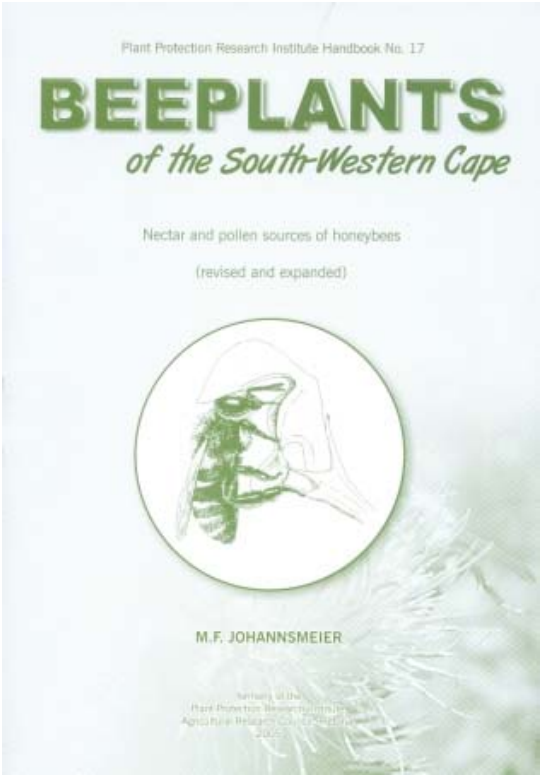


Pollinators and Pollination: a resource book for policy and practice

The conservation of pollinator biodiversity is a priority in the Convention on Biological Diversity's (CBD) agro-biodiversity programme. It has received a lot of attention from a number of international organizations, such as the United Nation's Food and Agriculture Organization (FAO), DIVERSITAS and the Global Biodiversity Information Facility (GBIF), but there was growing concern whether pollinators were actually reaping the benefit. In 2003, the Plant Protection Research Institute therefore hosted an International Workshop, financed by the US State Department, to discuss ways to help implement the International Pollinator Initiative at 'farm gate' and 'game reserve' level. The result of this Workshop is a small book called "*Pollinators and Pollination: a resource book for policy and practice*" edited by C. Eardley , Dana Roth, Steve Buchmann, Julie Clarke and Barbara Gemmill, and published by the African Pollinator Initiative (API).
Available from Connal Eardley at EardleyC@arc.agric.za for a free copy.



Beeplants of the South-Western Cape: Nectar and pollen sources of honeybees



This second updated edition of "Beeplants of the South-Western Cape – Nectar and pollen sources of honeybees" includes 154 new plant entries. Information was obtained from pollen trap surveys, scale hive records, pollen analysis of honey samples and published data from other authors.

Botanically and apiculturally the South-Western Cape is unique, being the centre of the fynbos vegetation, as well as the focal point of beekeeping with the indigenous Cape honeybee. Honeybees and many plant species are interdependent, the bees obtaining nectar and pollen as sources of food, while plants benefit from bee pollination.

Information is listed for the beekeeper, botanist and other interest groups under the following headings: botanical name, common name, beeplant value, flowering time and other remarks regarding the different plants. The plants are divided into nine plant groups: creepers and semi-climbers, annuals and biennials, bulbous plants, ground covers, crop plants, Eucalypts, other trees, shrubs (including aquatic plants, perennial herbs, shrublets and succulents) and weeds.

The book will be distributed to the registered beekeepers in the South-Western Cape, and will be obtainable from :
ARC-PPRI Publications
Attention: Ms Eunice Kewane
E-mail: KewaneE@arc.agric.za

New PPRI Technical Report 2004-2005

Following the establishment of the Agricultural Research Council (ARC) in 1992, the Plant Protection Research Institute (PPRI) reported its technical and other achievements in a series of Biennial Reports, the last of which reviewed the calendar years 2000 and 2001. PPRI's management then decided to discontinue the Biennial Report and replace it with an annual Research & Technology Report. This first report for the 2004-2005 financial year provides a link to the previous reports by including the Institute's scientific publications since 2002.
Despite the fact that 17 staff members resigned or retired during the 2004-2005 reporting year and 55% of the Parliamentary Grant was ring-fenced for the maintenance of the Institute's Public Good Assets, PPRI succeeded in achieving its targeted external income. During the reporting year, the external income generated (R19.3 million) amounted to 46% of the institute's total income.

Since the previous report in 2001 the Institute also successfully maintained an excellent scientific output. A total of 135 refereed publications, 3 books, 59 chapters in books, 84 non-refereed articles, 38 contributions for course manuals and 58 technical reports were published, as well as the production of 6 CDs and 8 wall posters. A total of 260 congress contributions were made. The Institute is strongly involved in training and skills development and 440 talks and lectures were presented over the three years to a diverse audience. The media was also used to market research and PPRI was involved in 33 radio talks and 14 TV presentations.

This publication is available from:
ARC-PPRI Publications
Attention: Ms Eunice Kewane
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Weeds Researchers excel

Liamé van der Westhuizen and Fritz Heystek

Laboratory and field host utilization by established biological control agents of Lantana camara *L. in South Africa*

Several varieties of *Lantana camara* (lantana) have become invasive weeds in many countries, including South Africa, where they mostly invade the sub-tropical eastern and northern regions. Mechanical and chemical control options are expensive and ineffective, with the result that a biocontrol programme was initiated in South Africa in 1961. To date, 22 insect species and a fungus have been introduced, with only 10 insect species and the fungus having established. Three indigenous lepidopteran species and an exotic generalist pest mealybug are also associated with the weed.

The variable success of some of the agents released on *L. camara* worldwide has been ascribed to a few factors. One important aspect is the large range of lantana varieties encountered in the field. Laboratory trials on five of the established agents showed clear varietal preferences. In the field, most of the biocontrol agents had limited geographic ranges, linked to altitudinal conditions, with higher populations recorded in low-lying, warm, summer rainfall areas. A pink flower corolla lobe and orange throat colour combination, and plants with few to medium leaf hairs, were most abundant. Most of the agent species had individual preferences towards different flower colour combinations, as the agents built up different population levels on varieties in the field, within the suitable geographic region for the insect species. Eight agents preferred smooth-leaved varieties, while three preferred hairy leaves, and three had no specific preference to leaf hairiness. Varietal preferences thus did play a significant role in agent populations and the associated impact achieved in the field.

Fritz Heystek and Liamé van der Westhuizen, both from the Weeds Research Division, recently submitted their Masters theses to Rhodes University in Grahamstown. According to their supervisor, Prof. Martin Hill, both theses received extremely favourable reviews from all examiners.

In fact, Fritz was awarded MSc cum laude for his work on lantana, while Liamé just missed out on a first class pass for her study on a potential biocontrol agent for Madeira vine. The two theses are summarised here.

New candidate agents need to be proven specific under quarantine conditions and the results extrapolated to predict specificity in the field, while avoiding potential non-target effects. Many authors have questioned the validity of laboratory host specificity trials. The conventional wisdom is that insects portray a far wider host range in the laboratory than they would do in the field. In other words, laboratory studies measure the physiological host range of an agent and are conservative and usually don't reflect the ecological host range of agents in the field. To avoid unnecessary rejections of biocontrol agents, this study has made a retrospective study of the host specificity of agents already established in the field. Their laboratory and field host ranges were compared and it was found that virtually all the agents reflect non-target effects in the field similar to, or less than, predicted during multiple choice trials. Of the 14 agents, only one introduced species, *Teleonemia scrupulosa*, and two indigenous species, *Hypena laceratalis* and *Aristea onychote*, were able to sustain populations on non-target species in the field in the absence of *L. camara*. Insect populations on non-target species were greatly reduced compared to those on *L. camara*. Furthermore, non-target effects were only recorded on plant species closely related to the target weed. The multiple choice trials therefore predict field non-target effects accurately. (It might be noted that species such as *T. scrupulosa* would possibly not be released today, but in 1961 this species was released based on trial results that included a limited number of species from the family Verbenaceae.)

Lantana camara infestation in Amatikulu Reserve, KZN.

It was concluded that non-target effects of candidate agents can be accurately predicted by laboratory studies, in terms of species likely to be affected, and to what extent. One field that needs further study, though, is the impact of agents on non-target species.

Contact: Fritz Heystek at HeystekF@arc.agric.za

Weeds Researchers excel (continued)

The evaluation of cf. Phenrica *sp. 2 (Coleoptera: Chrysomelidae: Alticinae), as a possible biological control agent for Madeira vine,* Anredera cordifolia *(Ten.) Steenis in South Africa*

Anredera cordifolia (Basellaceae), commonly known as Madeira vine, is a perennial, semi- succulent climber native to South America, from Paraguay to southern Brazil and northern Argentina. It has a history of weediness and difficulty of control once established. In South Africa, Madeira vine has a wide distribution range with altitudes ranging from 10-1800 m above sea level. Described as a transformer species, its sheer weight is capable of breaking branches off
trees, causing the potential collapse of forest canopies. Chemical and mechanical control methods are expensive and labour intensive, and may provide only temporary relief, which is why a biological control programme was initiated in 2003.

The South American fleabeetle, *cf Phenrica* sp. 2 (Coleoptera: Chrysomelidae: Alticinae) has a total developmental time for a generation from egg to egg that ranges from 7 to 8 weeks. Biological traits that favour the flea beetle as a possible biological control agent include long-lived adults (up to 5 months) and multiple generations during the summer period. Both adults and larvae feed extensively on leaves and stems and although developmental rates will slow down during the winter period, no indication of a definite diapause was found under the prevailing laboratory conditions.

After completing the larval no-choice trials using 26 plant species from 14 plant families, *Phenrica* sp. 2 proved to be adequately host specific, as larval development was only supported by 3 Basellaceae species (including the target weed *A. cordifolia*) and one Portulacaceae species, all of them introduced species tending to be weedy in South Africa. The only indigenous *Basella* species in South Africa could not be tested, as it has a very marginal distribution, and because of its inconspicuous nature, it is seldom seen or collected. Adult multi-choice trials were restricted to species that could sustain larval development to give some indication of the acceptability of these species for adult feeding and oviposition. Although the adults fed mainly on *B. alba*, the females oviposited on *A. cordifolia* only.

An adult flea beetle

In order to quantify the impact of *Phenrica* sp. 2 on plant biomass and to assess the incidence and intensity of foliar damage, a pair of adults was confined to the host plant, for 2 generations, with different levels of larval densities. The results indicated that the host plant, due to both larval and adult feeding, suffered leaf losses of up to 55%. *Anredera cordifolia* was however still capable of enlarging its root mass despite suffering these huge leaf losses. This would imply that *A. cordifolia* has an effective re-growth capacity and it will only be vulnerable to attack of the storage organs that enable re-growth, or to repeated attack of other plant parts until its reserves are exhausted. Unfortunately the period of exposure (24 days) was too short to prove that *Phenrica* sp. 2 impacts on the below-ground dry mass, but should the plant be completely defoliated, as was observed in the field in South America, the host plant would be forced to deplete stored resources. *Phenrica* sp.2 has shown to be very host specific and it has a definite impact on leaf production, rendering it an ideal candidate for controlling *A. cordifolia*. In order to make an informed decision with regards to its release it would be in the best interest of biological control to include adult multi-choice trials in a walk-in cage as well as multi-generation trials, which will include all test plant species that supported larval development. A further consideration is the additional agent, *Plectonycha correntina* Lac. (Coleoptera: Chrysomelidae), that is also being reared in quarantine. It would be essential to establish if only one or both agents should be released against *A. cordifolia,* and what impact competition would have on establishment and control, should both agents be approved for release.

Contact: Liamé van der Westhuizen at
VDWesthuizenL@arc.agric.za

Madeira vine smothering vegetation

New Appointments

New appointments

Welcome to Julie Coetzee

PPRI's Weeds Research Division recently acquired the services of a second researcher on its Aquatic Weeds project following the appointment of Angela Bownes at the end of last year. Julie Coetzee completed her PhD in 2003 in the School of Animal, Plant and Environmental Sciences at Wits University. Her research, which focused on the suitability of a mirid biocontrol agent of water hyacinth in South Africa, made her a regular visitor to PPRI. After graduating, she coordinated and taught on an undergraduate Semester Abroad programme, run by the Organization for Tropical Studies, in Kruger National Park for 2 years, where the emphasis was on savanna ecology, conservation and management. Julie has been employed by PPRI as of March of this year, where she is the Aquatic Weeds project leader. We wish her a happy and successful career in weed biocontrol, and are expecting remarkable results from the two-woman aquatic weeds team!

Welcome to Zama Mbele

Zama Mbele was appointed as a technician at the Bacterial Diseases Unit in February 2006. Zama obtained her National Diploma in Biotechnology last year at the Vaal University of Technology. She is working towards the B. Tech. degree.

Welcome to Mildred Zulu

The new Senior Research Technician that was appointed on the 1st March at the Pesticides Analysis Laboratory at Roodeplaat. She obtained her diploma in Analytical Chemistry through the Tshwane University of Technology and is presently studying towards a B.Tech degree in Chemistry. She formerly worked for six years at CSIR-Bioscience, as an Analyst in the Biocatalysis group, Fine Chemicals and the Environmental analysis, as well as for AECI-Research and Development Department for two years which also included her internship.

Recognition at last!

Congratulations to Dr Sandra Lamprecht, Specialist Scientist at the Soilborne Plant Diseases Unit in Stellenbosch, who received the "Applied Plant Pathology Award" from the Southern African Society for Plant Pathology in recognition of her research. She was presented the award at the 44th Congress of the Society that was held at the Magalies Park Country Club, Hartebeespoortdam on 25 January 2006.

Research grants

Three grants from the Department of Science and Technology to the amount of R 100 000 each were awarded to researchers at PPRI. Dr Elna van der Linde of the Biosystematics: Mycology Unit received a grant to do further research after completing her PhD study on *Claviceps* of nut sedge (causing bovine ergotism resulting in a serious drop in milk production as well as reproduction problems in dairy cattle) in 2005. Elize Lundall-Magnuson of Insect Ecology received one of the grants to complete her MSc study and David Simelane of Weeds Research received the third grant to complete his PhD.

Long service (Jan-March 2006)

Congratulations to the following PPRI'ers who qualified for long-term awards during the first three months of this year:

The 30-years group includes:
Hildegard Klein of Weeds Research; Dr Eddie Ueckermann and Flip van der Merwe of the Biosystematics Division.

The 20-years group includes:
Mariette Marais, Beth Grobbelaar and Charnie Craemer, all three of the Biosystematics Division.

Congratulations

Dr Rami Kfir was appointed to the Editorial Board of *the International Journal of Tropical Insect Science* which is published by CABI.

Plant Protection Research Institute Initiatives

PPRI is well-know for the leading role it plays in various research fields in South Africa. Several National and International initiatives have been initiated at PPRI and are being coordinated by PPRI researchers. In this issue we look at the South African Plant-Parasitic Nematode Survey (SAPPNS).

South African Plant-Parasitic Nematode Survey (SAPPNS)

South Africa has a rich nematode fauna with more than 500 of the 4000 plant-parasitic nematode species described worldwide occurring in the country. A worldwide survey revealed that global crop losses attributable to nematode parasitism were in the order of US$ 78 000 million per year. There is no plant species, cultivated or uncultivated, that is not known to be a host of one or more plant-parasitic nematode species.

The Nematology Unit of PPRI founded the South African Plant-Parasitic Nematode Survey (SAPPNS) in 1987. The aim was to make a comprehensive assessment of the nematode fauna of South Africa. The main objectives of the programme are:

- to make an inventory of all the plant-parasitic nematodes of South Africa;
- to study their biogeography;
- to establish an electronic database at the Nematology Unit to compile distribution maps for each economically important plant-parasitic nematode species.

A database has been developed to incorporate all the data gathered during systematic surveys of various areas and also all previously published data. The database presently consists of 7000 records. Some of the interesting information contained in the database:

- A number of the nematodes in the Fynbos and Forest Biomes are endemic
- Eight of the nine *Trichodorus* species are endemic
- Most of the nematodes that cause problems in other parts of the world such as the cyst nematodes (*Heterodera* spp. and *Globodera* spp.) and root-knot nematodes (*Meloidogyne* spp.) are also found in South Africa
- The pine wilt nematode (*Bursaphelenchus xylophilus*) has not yet been reported from South Africa but *Bursaphelenchus leoni* is already known from the Western Cape Province
- Two quarantine species of the genus *Ditylenchus* [*D. dipsaci* (stunt bulb nematode) and *D. destructor potato rot nematode*)] occur in South Africa
- The root-knot nematodes *Meloidogyne chitwoodi* is only found at a few localities.

The nematode fauna of vast areas of all eight biomes are still unknown. The systematic collecting in biomes and agro-ecosystems for the SAPPNS is the ideal vehicle to meet our obligations with regard to the Biodiversity Act of 2004.

Contact: Mariette Marais at MaraisM@arc.agric.za

Examples of publications and presentations using the data of the SAPPNS database:

Book:

- Plant nematodes in South Africa

CD:

- Key to Plant Parasitic Nematode Genera of Southern Africa

Papers:

- A check list of plant nematodes from the Fynbos Biome, with a description of *Helicotylenchus curatus* sp.n.
- A first list of plant-parasitic nematodes from the Wilderness National Park, with a description of *Ogma sekgwaum*.
- Plant nematodes from the Gouekrans area of the Swartberg Nature Reserve, with descriptions of one new and one known Hemicycliophorinae (Nemata)
- Plant nematodes in the Bergplaas Plantation, Western Cape Province with a description of a new *Criconema* species and notes on two known species of Criconematidae
- Plant nematodes in the Lottering Plantation, Eastern Cape Province
- Plant nematodes of the Tzaneen area, Limpopo Province
- Plant-parasitic nematodes of the Lower Orange River irrigation area, South Africa
- Plant nematodes of the Modimolle area, Limpopo Province
- *Zygotylenchus natalensis* (Nemata: Pratylenchidae) from a potato field in South Africa

Presentations:

- Nematodes associated with forest trees in South Africa
- The South African Plant-parasitic Nematode Survey

Posters:

- Plant nematodes of the Afromontane Forest veld type
- Ring nematodes of the Nama and Succulent Karoo Biomes
- Plant nematodes of the Swartberg Nature Reserve

Potatoes infested with root-knot nematodes

New Publications

Refereed publications

DIETEMANN V., LUBBE A., & CREWE R.M. 2006. Human factors facilitating the spread of a parasitic honey bee in South Africa. *Journal of Economic Entomology* 99: 7-13.
DIPPENAAR-SCHOEMAN A.S. & HARRIS R., 2005. Food storage by a wandering ground spider (Araneae, Ammoxenidae, *Ammoxenus*). *Journal of Arachnology* 33: 850-851.

EARDLEY C.D., DAVIES G. & BROTHERS D.J., 2005. Eight new species of *Scrapter* (Hymenoptera: Apoidea: Colletidae), with descriptions of *S. albifumus* and *S. amplispinatus* females and a major range extension of the genus. *African Invertebrates* 46: 141-179.

EHARA S. & UECKERMANN E.A., 2006. A new genus of Stigmaeidae (Acari: Prostigmata) from Okinawa Island. *Zootaxa* 1160: 29-36.

FARAJI F. & UECKERMANN E.A., 2006. A new species of *Mediolata canestrini* from Spain (Acari: Stigmaeidae), re-description of *M. chanti* and a key to the known species of *Mediolata*. *Zootaxa* 1151: 27-39.

FOORD S.H. & DIPPENAAR-SCHOEMAN A.S., 2005. First records of the genus *Neotama* Baehr & Baehr (Araneae: Hersiliidae) from the Afrotropical Region. *African Invertebrates*, 46: 125-132.

GOSCZYNSKA T., VENTER S.N. & COUTINHO T.A. 2006. PA 20, a semi-selective medium for isolation and enumeration of *Pantoea ananatis*. *Journal of Microbiological methods* 64: 225-231.

LUBBE, C.M., DENMAN, S., LAMPRECHT, S.C. & CROUS, P.W. 2006. Pathogenicity of *Collectotrichum* species to *Protea* cultivars. *Australasian Plant Pathology* 35: 37-41.

Other publications and reports

EARDLEY C.D., 2006. Pollinator biodiversity conservation in Africa stimulates interest in bee taxonomy. *In:* Success Stories in Implementation of the Programmes of Work on Dry and Sub-humid Lands and the Global Taxonomy Initiative.

EARDLEY C.D., ROTH D, BUCHMANN S. ,CLARKE J . & GEMMILL B. 2006. Pollinators and Pollination: a resource book for policy and practice. Published by the African Pollinator Initiative 77pp.

KIRSTEN J.F. & VON MALTITZ E.F., 2006. Final Technical Report. Extension of ecologically-based rodent management.

STRATHIE L.W., WOOD A.R., VAN ROOI C. & McCONACHIE A.J., 2005. *Parthenium hysterophorus* (Asteraceae) in southern Africa, and initiation of biological control against it in South Africa. *In:* Proceedings of the Second International Conference on Parthenium Management.

Media

Radio talks and TV presentations

Members of PPRI are frequently asked to participate in radio talks and TV presentations on a variety of topics. During the period January – March 2006 a total of 14 radio talks were broadcast on research done at PPRI.

- Dr Ansie Dippenaar-Schoeman of the Spider Research Centre continued with her weekly live broadcasts that are transmitted every Wednesdays over *Radio Laeveld*. As part of the RSG "Hoe verklaar jy dit?" series three programmes were broadcast from January to March.
- Dr Sandra Lamprecht of the Soilborne Plant Diseases Unit in Stellenbosch was interviewed for the agriculture programme on Radio 2 in Zambia on her views with regard to plant disease problems in conservation farming systems practiced by smallholder farmers in Zambia.
- Margaret Kieser discussed a possible commando worm outbreak in South Africa over Radio Pretoria.

TV presentations

Dr Ansie Dippenaar-Schoeman was interviewed for Semaka 50/50 on TV2. She also participated in a children's programme "Bush Radar" for TV 2.

Other media releases

A two-part series on spiders as biocontrol agents in crops appeared in Farmer's Weekly in February 2006. It provides information on what spiders prey on and how producers can effectively use them as bio-predators to control problem pests and sustain agricultural systems. All the data in the second series "Orchard soldiers" were based on research undertaken in South Africa at PPRI.

On 16 February, the *Cape Argus* published a report titled *Aussie weevils unleashed against hakea*. It dealt with Tony Gordon's recent collecting trip to Australia to import a culture of the flowerbud-feeding weevil *Dicomada rufa*, which is expected to reduce the number of viable seeds produced by silky hakea in the Western and Eastern Cape Provinces.

The *Environmental Management* of January/February 2006 featured an article, based on an interview with David Simelane, on the control of lantana by the herringbone leafminer, *Ophiomyia camarae.*

A letter by Angela Bownes was published in the *Farmer's Weekly* of 17 March 2006 in which she pointed out the dangers of water hyacinth, and provided reasons why it is unacceptable to farm with this declared weed species. This was in response to an article that appeared in the same magazine on 3 February, where water hyacinth was promoted as a profitable farming crop.

Courses

Ansie Dippenaar-Schoeman presented a three lecture course to the second year students of the Department of Zoology and Entomology of the University of Pretoria. The course "Arachnida of medically, veterinary and agricultural importance in South Africa" is supplemented by a 40-page course manual.

Congress contributions

44th Congress of the Southern African Society for Plant pathology

The 44th Congress of the Southern African Society for Plant pathology of the Southern African Society for Plant Pathology was held at the Magalies Park Country Club, Hartebeespoortdam, 22-25 January 2006. The following contributions were made by researchers of PPRI:

COUTINHO T.A., GOSZCZYNSKA T., & VENTER S.N. 2006. [TALK]. Current status of phytobacteriology in South Africa.

GOSZCZYNSKA T., MOLOTO M.V. & COUTINHO T.A. [TALK]. 2006. Bacterial blights of leek and onion caused by *Pseudomonas syringae*.

MOLOTO M.V. & GOSZCZYNSKA T. 2006. [TALK]. Fist report of watermelon soft rot caused by *Pectobacterium carotovorum* subsp. *carotovorum* in South Africa.

THOSAGO M.P., RETIEF E. & VAN ROOI C. 2006. [TALK] Host-specificity testing of rust fungus, *Puccinia conoclinii*, on *Campuloclinium macrocephalum*.

VAN COLLER G J., DENMAN S., GROENEWALD J Z., LAMPRECHT S.C. & CROUS P.W. 2006. [POSTER]. Characterisation and pathogenicity of *Cylindrocladiella* spp. associated with root and cutting rot symptoms of grapevines in nurseries.

WOOD A.R., 2006. [TALK]. The gall rust, *Uromycladium tepperianum*, is successfully controlling *Acacia saligna* in the Western Cape Province, South Africa.

6th International Hymenoptera Congress

The International Society of Hymenopterists held its Sixth Congress at Sun City in South Africa, from 22-27 January 2006. This was the Society's first Congress to be held in Africa. The Congress comprised 59 talks, 27 posters and a Workshop, and was attended by 85 people. It provided many opportunities for hymenopterists to discuss their research, and to have some fun, which included a game drive at the Pilanesberg Game Reserve. The three hymenopterists at the Plant Protection Research Institute, namely Ottilie Neser, Gerhard Prinsloo and Connal Eardley, attended and helped organize the Congress, in partnership with Prof. Denis Brothers of the University of KwaZulu-Natal.

Among the many delegates who visited the National Collection of Insects before and after the conference to study the Hymenoptera collections were colleagues from as far afield as the USA, Canada, Britain, Denmark, Sweden, Hungary, the Netherlands and Russia.

The following posters and papers were presented by PPRI at the 6th International Hymenoptera Congress:

PRINSLOO G.L. & NESER O.C. [POSTER]. *Trichilogaster signiventris* (Hymenoptera: Pteromalidae): a name for a bud-galling biocontrol agent of *Acacia pycnantha* in South Africa.

NESER O.C. & PRINSLOO G.L. [POSTER]. The chalcidoid (Hymenoptera) collection of the Plant Protection Research Institute, Pretoria.

NESER S., NESER O.C. & KLEIN H. [POSTER]. More Eucalyptus insects - for Africa.

EARDLEY C. [TALK]. The African Pollinator Initiative tackling bee taxonomy.

MELIKA G., KFIR, R., MIKO, I., MOSIANE, S.W., BECHTOLD, M. & ACS Z. 2006. *Plutella xylostella* (Lepidoptera: Plutellidae) and its parasitoids in South Africa and Hungary.

32nd Congress of the South African Association of Botanists

GAREEB M., PAMMENTER N.W. & BOWER J.P., 2006. Waterlogging and oxygen deficiency: possible factors influencing die-back of potted *Chromolaena odorata* plants at Cedara in the KZN midlands. 32nd Congress of the South African Association of Botanists.

Talks at other meetings

ALLSOPP M.H., 2006. Bees & Beekeeping in South Africa. Travato Garden Club.

BLOEM J.F. 2006. Biological nitrogen fixation in crop rotation. Meeting at Golden Valley Agricultural Trust in Zambia.

DIPPENAAR-SCHOEMAN A.S. 2006. Common garden spiders. Marble Hall Garden Club.

GORDON J.A., 2006. Biological control of *Hakea sericea, H. gibbosa* and *Leptospermum laevigatum*: current situation and future prospects. CapeNature Quarterly Ecological Meeting. CapeNature.

LAMPRECHT S.C., 2006. Managing soilborne diseases in conservation tillage systems with crop rotation. Meeting at Golden Valley Agricultural Trust in Zambia.

JEZILE Y.P., 2006. Mushroom Workshop. Training. Department of Agriculture, KwaZulu-Natal.

KLEIN H., 2006. Wetlands, alien plants and biological control. Information session for primary school teachers. JNF Walter Sisulu Environmental education Centre, Mamelodi.

VAN DEN BERG A. 2006. Wonder world of spiders. International Primary School in Arcadia.

Workshop

In 2004, the *Morogo* Research Program (MRP) of the School of Environmental Sciences and Development, North West University, Potchefstroom, invited research groups of other African countries to participate in the "Initiative for the Development of Indigenous Food-plants of Africa" (IDIFA). IDIFA research will contribute invaluable information to a general database on different health-related and cultivation aspects of traditional African vegetables.

A 3-day workshop on the genus *Fusarium*, a well known plant pathogenic fungus and mycotoxin producer, was presented at the University of the North West by Riana Jacobs and Elna van der Linde of the Mycology Unit, Biosystematics Division. Six post graduate Microbiology students of the School of Environmental Sciences and Development attended the workshop. The purpose of the initiative was to educate them in the isolation and identification of *Fusarium* species pathogenic on the indigenous vegetable, "*morogo*" from various localities in the country. It forms part of the IDIFA project to investigate the role of *Fusarium* species producing the mycotoxin fumonisin B which may further weaken the immune systems of immuno-compromised individuals.

The workshop included a presentation to illustrate the different species concepts; the morphology of, and differences between sixteen species was treated, as well as morphologically related genera which may be confused with *Fusarium*. Afterwards, students were provided with live cultures of the species which were examined by them during extensive practical sessions. They were also assisted with cultures that they had isolated from *morogo*.

News from the Divisions

Biosystematics Division

Kenyan bee taxonomist visits the National Collection of Insects

Mary Gikungu, from the Kenya National Museums, Nairobi, after attending the Sixth International Conference of Hymenopterists, spent a week at the National Collection of Insects studying bees. Bees are the most important pollinators of agricultural crops and wild plants. Without them we would have very few crops and hardly any fruit and vegetables, and the little Karoo's insect pollinated pasture plants would disappear. Pollination, as an essential ecosystem service, is high on the agenda of the Convention on Biological Diversity's agro-biodiversity programme. Many other groups of organisms collectively provide essential ecosystem services, e.g. all woody plants sequestrate carbon and all green plants photosynthesize. However, pollinator/plant relationships are unique in that one or a few closely related pollinator species visit a specific plant. Thus knowing the identity of the pollinators and the plants they visit is essential for protecting pollination, and thus our food supply. Therefore bee taxonomists play an important role in the future of sustainable agriculture in Africa.

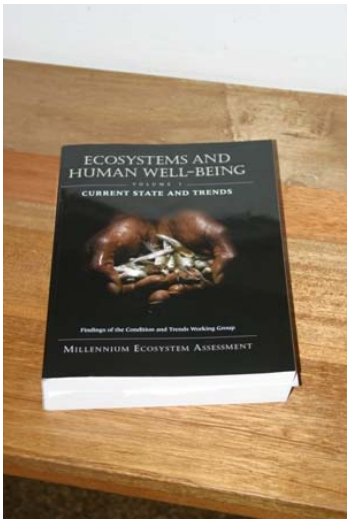
Mary is the first Kenyan bee taxonomist, and busy with her PhD through the German BIOTA project. Several future projects were discussed with Dr Connal Eardley.

Wasp expert visits National Collection of Insects

Dr Frank Koch, of the Museum Naturkunde für Humboldt -Universität, Berlin, Germany, visited the National Collection of Insects on 14 February and 22 March 2006. Frank has been researching wasp biodiversity in montane areas and sawfly taxonomy in South Africa for many years. This research has resulted in the revision of many of our sawfly genera and the description of several new species. For about the past decade he has visited South Africa at least once a year, and has always spent some time at the National Collection of Insects. This year his research took him beyond our borders to Namibia and Botswana.

Ecosystems and Human Well-Being. Volume 1. Current State and Trends

The UN Secretary General called for an assessment of the consequences of ecosystem change for human well-being. The Millennium Assessment undertook the challenge and provided the largest ever assessment on this topic. The results of this assessment are of extreme importance to every country in the world, and within every country to all agricultural research organization. The first volume has been published, and includes an article on Biodiversity Regulation of Ecosystem Services. Pollinators provide an essential ecosystems service that depends heavily on specific insect pollinator/ host plant relations. South Africa alone has over 1000 bee species, each contributing uniquely to the maintenance of South Africa's agricultural production and natural biodiversity. Pollinator taxonomy is an important science that contributes to South Africa's 'human well-being'.



Connal Eardley, PPRI's bee taxonomist, was a contributing author to the chapter on Biodiversity Regulation of Ecosystem Services. This volume is available on the Internet at www.MAweb.org.

Scale insect scientist visits the National Collection of Insects

Dr. Penny Gullan, who teaches entomology at the University of California (UC Davis), spent five days at the National Collection of Insects from 12-16 December last year. Penny is a prominent specialist in the systematics of scale insects (Coccoidea), and she currently has several projects on the taxonomy and biology of some unique gall-forming mealybugs and scales that are indigenous to South Africa. She was hosted by Ian Millar, who curates and studies Coccoidea at the National Collection. Penny spent her time studying specimens housed in the extensive scale insect collection at PPRI, and also kindly shared her expertise whilst discussing scales with Ian. Another aspect that Penny and her lab members at UC Davis are working on concerns the molecular phylogeny of Coccoidea. She took several samples of South African species back to California for DNA analysis, in order to work out their relationships with scale species from other parts of the world.

Interesting identification

The Identification and Information Services at PPRI provide all kinds of information to the public and research community. One of the most interesting samples that was identified recently was 55 spiders collected from the stomachs of the Nile crocodile. The sample contained five different spider species but the most abundant was that of the fish-eating spider of the family Pisauridae.

Biosystematics (continued)

Top scientist from Israel visits the National Collection of Mites

Dr. Eric Palevsky of Newe-Ya'ar Research Center, Agricultural Research Organization, Israel, visited the Mite Unit from 14-24 March 2006 to finish a project started last year during his first visit. A paper on species of the predatory mite family Phytoseiidae occurring in date palm orchards was completed. Future cooperation on other predatory mite families associated with date palm is also being considered. He also approached Drs. Ueckermann and S. Neser to be part of a EUROTOMITE project for which a proposal will be submitted early next year. The aim of this project is to search for predators of mite pests of tomatoes world-wide and to develop rearing techniques for the potential control agents.

Charnie Craemer (PPRI) Eddie Ueckermann (PPRI), Eric Palevsky and Tshidi Makutoane (PPRI)

Spiders a problem on export grapes

Spiders are found in and around grape vineyards. They prey on insect pests that are found associated with grapes. However, several spider species construct silk retreats in the stems of the grapes. When the grapes are harvested the spiders are inadvertently packed with the grapes. The grapes are chilled prior to being transported. The chilling causes spiders to become dormant and immobile, making their way to retailers and consumers' homes.

Live spiders that are exported with grapes cause great concern when they emerge alive from containers on arrival in overseas countries. The Spider Unit has received several queries regarding spiders collected from exported grapes. During a recent survey undertaken by APHIS on the border of Namibia and South Africa a total of 107 spiders represented by four families and five species were identified with the dominant species *Cheiracanthium furculatum* (sac spider) and *Latrodectus geometricus (brown* button spider). This is important new information as both species are recognized as of medically importance in Southern Africa.

Brown button **Sac spider**

Spider Unit to participate in the Greater St Lucia Wetland Park project

Dr Ansie Dippenaar-Schoeman of the Spider Unit was invited to act as mentor scientist for the spider taxon in the Greater St Lucia Wetland Park (GSLWP) – Rare, Threatened and Endemic Species Project. It is a joint initiative of Ezemvelo KZN Wildlife, The Wildlands Conservation Trust, and the GSLWP Authority within the context of the Lake St Lucia Living Lakes program. A list of 227 spider species that are known from the GSLWP was compiled from the National Collection of Arachnida database.

Nematologist from Benin visits Nematology Unit at Rietondale

Biamey Hugues from the International Institute of Tropical Agriculture, Cotonou, Benin, visited the Nematology Section from 8 February to 24 March.

In January he finished his PhD at the University of Pretoria on *Scutellonema bradys* which is the most economically important nematode affecting yam (*Dioscorea* spp.) in West Africa. A survey was conducted in the yam growing areas in Benin to assess the relative distribution and incidence of *S. bradys* and the extent of the nematode problem on marketed yam during the main storage period of tubers.

His main aim was to get more experience in the extraction and detection of nematodes in soil, root and tuber samples. He was also keen to learn how to distinguish the various genera better. He learnt most of these techniques while at the same time working through about three hundred extracted samples from a vegetable survey, which he brought with him. This survey was done just before he arrived, in vegetable areas around Cotonou and further into the country. Another survey on cassava is being planned for this year.

Arachnids receive research funding

Charnie Craemer of the Mite Unit received funding from the Technical Centre for Agricultural and Rural Cooperation (CTA) in the Netherlands to attend the 12th International Acarology Congress in Amsterdam, in August 2006.

Ansie Dippenaar-Schoeman of the Spider Unit received R50 000 from SABIF for the capturing of primary data.

Insect Ecology Division

Research on Mantophasmatodea, the new insect order

In 2002 a new insect order, Mantophasmatodea, was described. The oldest known specimen of this newly described insect was encased in a 40 million year old piece of Baltic amber. Living populations were later discovered in Namibia and in the western and northern Cape in South Africa. In May 2002, staff from the National Museum of Namibia went on a field expedition in the Paresis Mountain (Otjiwarongo district) and successfully collected live specimens of *Sclerophasma paresisensis* (wrongly thought to be *Mantophasma zephyra*).

Eight specimens—two males and six females - were sent to Leoni Pretorius, a senior technician in charge of the Quarantine facilities at the Rietondale Research Station of the ARC-PPRI, for biological observations.

Over a period of three weeks all six females were successfully mated with the two males. Eggs were laid in egg pods that look like clumps of soil at different depths in the soil. The egg pods differed in size and shape and were extremely tough. Between one and ten egg pods were laid by each female with 6-12 eggs per pod. After five months, one egg from one pod hatched. Egg pods were then moistened from time to time and another egg, from the same pod, hatched after about seven months, as well as eight eggs from another pod. The rest seemed to be in diapause.

In 2004, two and a half years after the eggs had been laid, an attempt was made to break the diapause. Some pods were moistened and others were placed in a cold room, at a temperature of 5°-10° C, before they were moistened. Five eggs from a pod with the cold treatment hatched. In 2005, three pods were kept in the cold room for eight weeks and then removed to a culture room where they were kept moist all the time. Five to six weeks after moistening, eggs from two pods hatched. Eggs from the same pods hatched a week apart. These eggs have been in diapause for 3-5 years.

At another expedition in May 2003 to the Brandberg a second species *Praedatorphasma maraisi* was collected and sent to Rietondale. In this case there were eight nymphs of which only one male and two females developed into adults. The male mated with one of the females but was then eaten. The female laid five egg pods 6-25mm deep over a period of six weeks. These pods were all pea-shaped and more or less of equal size. In 2005, two pods were treated in the same way as *S. paresisensis*. Eggs from both pods hatched: one egg from one pod, two weeks after moistening, and eight eggs from the other pod after six weeks. (See photo). The nymphs that emerged are currently being reared at Rietondale and will hopefully mate and lay eggs again.

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Sub-Saharan Africa Challenge Programme (SSACP)

Elize Lundall-Magnuson of the Insect Ecology Division has been involved in the SSACP since 2004. The SSACP is one of the programmes under the Forum for Agricultural Research in Africa (FARA). This programme targets research and development at three Pilot Learning Sites (PLS) in Africa using the Integrated Agricultural Research for Development approach (IAR4D). These pilot learning sites are in Zimbabwe, Mozambique and Malawi (ZMM), at Lake Kivu (Uganda, Rwanda and DR Congo) and at Kano, Katsina and Maradi (KKM) in Nigeria and Niger.

The ARC forms part of the Facilitation and Mentoring Services for the SSACP with the lead institution being NR International. Elize delivered consultancy services to the F & M services for the validation of entry points for research in the Zimbabwe, Mozambique and Malawi and the Lake Kivu pilot learning sites. She spent 28 days driving through Zimbabwe, Malawi and Mozambique and 24 days driving through Uganda, Rwanda and DR Congo for the validation and identification of entry points that would be used in the calls for proposals.

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Elize was further involved in training of Participatory Research Approaches and Extension (PREA) and Integrated Agricultural Research for Development (IAR4D) during the proposal development workshops in all three pilot learning sites. These training events took place in Kano (Nigeria), Mangochi (Malawi), and Kampala (Uganda).

Participants at the workshop in Kano, Nigeria

Weeds Research Division

Additional biocontrol agent introduced against golden wattle

Acacia pycnantha, commonly known as golden wattle, is a small shrub or tree which is native to the temperate regions of South Australia and Victoria. This plant, like many of the other Australian *Acacia* species, has become an invasive weed in South Africa. However, as a result of the beneficial uses of a few of the species, biological control of this group of plants has been somewhat limited, and for the most part only insects that reduce the reproductive potential of the plant have been used.

The gall-forming wasp, *Trichilogaster signiventris*, was the first biocontrol agent to be released against *A. pycnantha*, and has spread to most of the *A. pycnantha* infestations in the country. Studies have demonstrated that galling by the wasp has drastically reduced pod production by the plant.

In a related project, where another gall-forming wasp, *Trichilogaster acaciaelongifoliae*, was released against *Acacia longifolia* (long-leaved wattle), the wasps showed tremendous potential in limiting seed production of their host plants, but the trees were nevertheless able to produce significant numbers of pods in certain situations. This has now also been shown to be the case with golden wattle.

In the case of long-leaved wattle, a seed-feeding weevil, *Melanterius ventralis*, was introduced in 1985 to supplement the activity of its gall wasp. *Melanterius ventralis* has excellent host searching abilities and has caused high levels of damage to the remaining seeds. Together these two agents have brought long-leaved wattle under excellent biological control. In view of the success achieved using both the gall-former and seed-feeder against long-leaved wattle, it was believed that the additional use of a seed-feeding agent against golden wattle should be the way forward to obtain complete biological control of the plant.

In November 2005, a trip was therefore made to Australia (Victoria and South Australia) to survey and search for potential seed-feeding agents to introduce against golden wattle. A weevil of the genus *Melanterius* was found and collected from a number of different localities, and was later identified as *M. maculatus* by Rolf Oberprieler, CSIRO Entomology. *Melanterius maculatus* has previously been collected and introduced into South Africa for biological control programmes against *Acacia mearnsii* (black wattle), *Acacia dealbata* (silver wattle) and *Acacia decurrens* (green wattle). Taxonomic and DNA studies have demonstrated that they are all one species. Despite this, collections of *M. maculatus* were always made from the target weed (in this case golden wattle), as it is thought that there may be host-specific strains of the species.

Damage to the seeds of the target weed by these insects is twofold, since firstly the adult weevils feed on the green ripening seeds, and secondly there is oviposition and subsequent larval development within the seeds.

The weevil, *Melanterius maculatus*, (above), which was released to damage the seeds of golden wattle (left)

South Africa has had a long and successful history of utilizing *Melanterius* weevils against various invasive Australian *Acacia* species, and it is anticipated that these weevils will follow suit, and play an important role in the biological control of golden wattle.

The first release of *M. maculatus* collected from golden wattle was made in December 2005 at a locality in De Hoop Nature Reserve in the Western Cape. It will be a number of years before the insects can be collected from this site for redistribution and as a result further collections in Australia are planned for later this year.

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Weeds Division a key role-player in international collaborative project on management of parthenium in Africa

A grant was awarded in 2005 under the global theme programmes of the Integrated Pest Management Collaborative Research Support Program (IPM CRSP), funded by the United States Agency for International Development (USAID), for a project proposal entitled 'Management of the Weed Parthenium (*Parthenium hysterophorus* L.) in Eastern and Southern Africa using Integrated Cultural and Biological Control Measures'.

This project, coordinated by Virginia State University and administered by Virginia Tech, was one of 12 four-year projects to be awarded a grant. The project aims to develop an integrated management system for parthenium in the regions of eastern and southern Africa to reduce the adverse impacts of this invasive plant on humans, crops, livestock and plant biodiversity. Ethiopia and South Africa are the key African host countries in the project, due to the severity of parthenium infestations in their sub-regions and because of their expertise relevant to the project. PPRI is one of the main contributing partner institutions, and the only South African institution to participate in the project, which extends from October 2005-September 2009. Uganda, Botswana and Swaziland are also participants, and organisations such as CAB International (CABI), the World Conservation Union (IUCN), the International Institute of Tropical Agriculture (IITA), and CIMMYT have contributing roles in the project.

Parthenium hysterophorus (parthenium, feverfew) is considered to be one of the 10 worst weeds of the world. Originating from Central and South America, it is present and spreading in the southern regions of Africa and is also particularly severe in east Africa. Parthenium impacts on biodiversity and agriculture, affecting land used for conservation, grazing and cropping. High economic losses have been attributed to parthenium infestations in countries such as Australia, India and Ethiopia. Parthenium is toxic to humans and animals, and causes severe respiratory and skin allergic reactions. A recent survey conducted by PPRI as part of the IPM CRSP project indicated the presence of parthenium in a much wider area of southern Africa than previously known, with dense infestations in much of the eastern regions of South Africa as well as throughout Swaziland. Parthenium is also abundant in parts of Mozambique and has been recorded in Zimbabwe. Infestations occur particularly along roadsides, drainage lines and in abandoned or fallow fields, as well as around many rural dwellings.

Mechanical removal and herbicides can be used to control this plant, but the financial, environmental and health costs are high; biological control is recognised as the most feasible, sustainable solution to manage this weed. The Department of Water Affairs and Forestry's *Working for Water* Programme has provided funding since 2003 for PPRI to conduct research on biological control of parthenium. The IPM

Weeds Research Division (continued)

CRSP project builds on this existing research project and encourages collaboration, technology transfer and the development of management expertise for the control of parthenium among developing countries within the African continent.

Australia has a well-established and successful biological control programme on parthenium, using nine insect species and two pathogens, that PPRI has been able to utilise to select several pathogens and insect species suited to the South African environment.

At present, the stem-boring curculionid weevil, *Listronotus setosipennis*, from Argentina, and the leaf-feeding chrysomelid beetle, *Zygogramma bicolorata*, imported from Australia but originally from Mexico, are being investigated in the quarantine laboratory at Cedara. Results of host range tests on economically important and indigenous South African plant species thus far indicate a high degree of host-specificity of the agents. The stem-galling tortricid moth, *Epiblema strenuana*, will be imported and further investigated within the next year. The leaf spot rust, *Puccinia abrupta* var. *partheniicola*, was found to be present in Brits in the North-West province in the 1990's, its method of introduction into South Africa unknown, but it is mainly a phenomenon of drier areas. Plant pathologists at the PPRI Weeds Division at Stellenbosch are currently conducting research on the related pathogen *Puccinia melampodii*, imported from Australia, as this agent is better suited to humid lowland and coastal regions where parthenium is also problematic.

The first meeting of all participants of the IPM CRSP parthenium project was held in Addis Ababa, Ethiopia in December 2005, and Ms Lorraine Strathie and Dr Andrew McConnachie of PPRI at Cedara attended the workshop for planning, training and development of project methodologies. About 30 scientists from the USA, Australia, India, Ethiopia, Benin, Kenya, and Botswana participated in the workshop. Ms Strathie and Dr McConnachie reported on research on parthenium in South Africa and provided training to project participants on parthenium distribution survey techniques and methodologies for predictive modeling of distribution, as well as training on methodologies for rearing and evaluation of insect biocontrol agents for parthenium.

Parthenium infestations were visited in the field. Facilities at the Ethiopian Agricultural Research Institute (EARI) at Ambo, about 100 km west of Addis Ababa, were inspected and recommendations made for the upgrade of glasshouses to a quarantine facility capable of handling the breeding and evaluation of insects as biocontrol agents for invasive plant species.

Adults of the leaf-feeding chrysomelid beetle, *Zygogramma bicolorata*

PPRI is a key role-player in the biological control component of the IPM CRSP parthenium project, and is advising and training other African entomologists and weed scientists. PPRI will supply parthenium biocontrol agents to other countries, particularly Ethiopia, during the project period, as well as conduct research on biological control of the weed. Entomologists from EARI, Ethiopia, are to visit South Africa in 2006 for further training on biological control techniques at PPRI. Participation by PPRI in this project enables the transfer of technology for improved management of parthenium on the African continent.

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Emerging weeds survey uncovers Hydrilla *in KwaZulu-Natal*

An alarming discovery of a 'new' submerged invasive aquatic plant, *Hydrilla verticillata,* was made at the Pongolapoort Dam in the Pongola North Reserve in February 2006. This discovery was made by Lesley Henderson during a collaborative survey with KZN Wildlife on emerging weeds in Zululand protected areas which included Ndumo, Thembe, Pongola North, Ithala, Vryheid Hills and Opathe/Emakhosini.

This is not the first record of Hydrilla in South Africa as an examination of herbarium specimens in the Pretoria National Herbarium revealed that it was first recorded, but misidentified as *Egeria densa*, in South Africa in 1963 when it was reported as a problem in a fish pond at the Tongaat Sugar Estates. The first record of Hydrilla in southern Africa is from the Nkomati River near Maputo (formerly Lourenco Marques) in Mozambique in 1961.

Hydrilla is a submerged aquatic plant, probably with its centre of origin in tropical Asia. It has been described as the perfect aquatic weed in the USA where it has become a huge problem, causing economic hardships, interfering with various water uses, displacing native aquatic plant communities and adversely impacting on freshwater habitats. Apart from its ability to reproduce from seed and stem fragmentation, it can reproduce from two kinds of specialised buds (turions), namely floating turions and underground turions. Turions can survive ingestion and regurgitation by water fowl and remain viable for several years in undisturbed sediment. Hydrilla is a potentially very serious invasive plant in South Africa and steps are already in place to determine how widespread it is in KZN, to create an awareness campaign and minimise its spread from the Pongolapoort Dam eg. by boat trailers, and to investigate the possibility of biocontrol. Caution must be exercised not to cause any harm to the indigenous *Lagarosiphon* spp. that are very similar to Hydrilla and occupy the same habitats.

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Plant Pathology and Microbiology Division

New disease on cucurbits discovered

A new bacterial disease on cucurbits caused by *Xanthomonas* spp. in South Africa was discovered by Teresa Goszczynska.

Small water-soaked spots appear on the lower side of the leaf, and are later visible on the upper side of the leaf as diffuse yellow spots. Lesions become round to elongated and angular, tan to brown in color, and surrounded by a yellow border of varying intensity. Initial spots on leaves are easy to overlook because of their small size (1 mm in diameter). Spots are light tan and surrounded by a yellow border. Spots usually appear water-soaked on the lower leaf surface. Where spots merge, large areas of yellowing may develop.

Fruit spots are tan, initially small (1-2 mm), circular, slightly sunken, usually with a dark brown, greasy border. Spots often enlarge to over 2 cm in diameter, crack, and extend deep into the rind. Severely affected fruit may collapse in the field or become prematurely soft after harvest.

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Plant Pathology and Microbiology Division (continued)

Visit to the Golden Valley Agricultural Trust in Zambia

Jacomiena Bloem and Dr Sandra Lamprecht visited the Golden Valley Agricultural Trust (GART) in Zambia beginning of 2006. Research conducted by GART is very relevant and contributes significantly towards the improvement of household food security and financial independence of smallholder farmers in Zambia. The following is a summary of impressions on the status of information on plant diseases, the use of legume crops and nitrogen fixation in conservation farming systems used by smallholder farmers in Zambia, as well as potential research topics:

Information on plant diseases of crops used in conservation farming in Zambia is almost non-existent. The only information on plant pathology research that could be obtained was that collaborative research on grey leaf spot of maize is being conducted between GART and companies such as Omnia, Du Pont and Pioneer, and different compounds are being evaluated for treatment of cotton seed at the Cotton Development Trust.

Crop rotation is one of the most important agricultural practices to manage plant diseases. This is especially true for soilborne diseases. It was therefore impressive to note that all the smallholder farmers visited practice crop rotation and are aware of the importance of conservation farming to improve the condition of the soil. Crops mostly used in rotations by smallholder farmers in Zambia are cotton, cowpea, guar, maize, soyabean, sunhemp, sweet sorghum and velvet bean. Rotation crops are chosen for their function as food, feed, fiber and/or to improve soil fertility. Broadleaf crops are unfortunately sometimes rotated with other broadleaf crops such as sunhemp with soyabean or cotton with cowpeas.

Intercropping maize with legumes is actively pursued by researchers at GART. Residues of both crops are therefore maintained on the soil surface after harvest. From a plant pathological perspective, intercropping could result in more disease problems than when crops are rotated. A high incidence of a foliage disease was observed on cowpea intercropped with maize for two years, and according to the farmer the problem was more severe in the second compared to the first year. This is a particularly wet season and the high humidity and limited movement of air between intercropped plants could definitely have aggravated the incidence of foliage diseases. The use of resistant varieties may be considered.

Conservation farming can increase problems with crop establishment due to seedling diseases caused by a complex of fungal pathogens (*Fusarium*, *Pythium* and *Rhizoctonia* spp.) and insect pests. Seed treatments are currently evaluated by the Cotton Development Trust. They visited a trial that demonstrated the benefits of seed treatment. Although they could not establish what the seeds were treated with, there was a clear improvement in establishment of plants from treated seed.

Cotton production is currently being increased in Zambia, but the planting of genetically modified cotton is not allowed. There are also no breeding programmes against diseases of cotton. According to staff at the Cotton Development Trust, the two major diseases of cotton viz., *Fusarium* and *Verticillium* wilt are not a problem at present. However, they are aware of the negative impact that these diseases can have on cotton production.

Smallholder farmers in Zambia do not currently use any biological nitrogen fixation-enhancing legume inoculants. Legumes such as cowpea, guar, sunhemp, and velvet bean should be able to nodulate with the established indigenous rhizobia. However, it is essential to ensure that effective rhizobia nodulate these legumes, because a good competitor for nodulation is not always that effective in fixing atmospheric nitrogen. Soybeans on smallholders' plots showed clear nitrogen deficiencies, but the soyabean planted at GART's experimental farm in Chisamba were inoculated with the Soygro inoculant and showed no nitrogen deficiencies.

A large number of legume crops are evaluated by GART for inclusion in crop rotation or intercropping with maize. This includes thorn-less *Acacia* spp., *Cassia*, *Centrosema*, *Crotalaria*, *Desmodium* (silverleaf), *Dolichos* (lablab), *Glyciridia, Macroptilium* (siratro) and *Stylosanthes*. This allows for a broader range of crops from which to select for the different agro-ecological regions. Except for the efforts of ARC-RFI in Landcare projects on the Eastern Seaboard, there are no full-scale evaluations or a similar concerted approach in South Africa to benefit any farmers.

Problems with rodents and fungi on stored grain were mentioned as pre- and post-harvest problems. Rodents could carry diseases, and fungi on maize cobs are potential mycotoxin producers. Proper grain storage facilities could address both these problems. The ARC-PPRI currently has several programmes in rural areas to train farmers on the building and maintenance of grain storage facilities. The detection of both mycotoxin-producing fungi and mycotoxin levels in maize are also being addressed.

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Bacterial blights of leek and onion caused by Pseudomonas syringae

During 2001 until 2004 growing season, a new and damaging disease of leak and onion was observed on nursery produced and field grown plants in South Africa. Symptoms on leek were water-soaked lesions on leaves, which expanded down the length of the leaf and resulted in brown, elongated strips with yellow margins. Lesions on onion leaves and seed stalks were irregular oval spots, 4-10 cm long with a necrotic center and a dirty yellow or water-soaked margin. Small water-soaked lesions were also observed. Blue fluorescent pseudomonads were consistently recovered from lesions on King's B, KBC and MT media. In LOPAT tests, isolates were negative for oxidase, arginine dihydrolase and ability to rot potatoes and positive for production of levan from sucrose and hypersensitive reaction on tobacco leaves. This indicated that they were *P. syringae*.

In pathogenicity tests, five representative strains, two from leek and three from onion, induced disease symptoms in leek and onion similar to those observed in the nurseries and field. The isolates were identified as *P. syringae* based on carbon source utilization (Biolog GN2 micro-plates) and comparison with the Microlog 4.2 database (Biolog Inc., Hayward, CA). Biolog did not provide a clear pathovar designation. A BLAST search of the EMBL/GenBank database conducted with 16S rDNA sequences revealed a high degree of sequence identity (99%) with a previously determined sequence of *P.* s. pv. *atropurpurea* (accession number AB001440), belonging to genomspecies 4 of *P. syringae*. However, the sequences of the spacer region between 16S and 23 rDNA genes (ITS), clearly divided leek and onion isolates into separate groups. The ITS sequences of the two South African leek isolates and P. s. pv. porri (AF098251 and AF098252) were identical. The ITS sequences of three onion strains were identical to each other, but only 94.7% homologous to leek stains sequences. Phylogenetic relationship derived from a neighbour-joining analysis of the pairwise comparison among the ITS sequences of isolates from this study and sequences of described pathovars of *P. syringae* confirmed this division. Leek strains sequences grouped

Plant Pathology and Microbiology Division (continued)

with *P.* s. pv. *porri, garcae, papulans* and *coronafaciens*, belonging to genomspecies 4. Onion strains sequences formed a separate cluster most similar to P. s. pv. *atrofaciens, phaseolicola, syringae* and *pisi* (97.1%), belonging to the genomspecies 1 of *P. syringae*. The results indicate that the leek and onion diseases are caused by two different pathovars of *P. syringae*; leek blight by *P.* s. pv. *porri* and onion blight by an undescribed pathovar.

These pathogens were recovered from commercial seed lots, which suggests that they are seed-borne. Assaying seed lots for *P. syringae* and seed treatments to reduce or eradicate seed contamination would be practical measures for managing these diseases.

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First report of watermelon soft rot caused by Pectobacterium carotovorum *subsp.* carotovorum *in South Africa*

Symptoms induced by *P. c. carotovorum* on watermelon fruits in pathogenicity tests

In 2002 and 2003, a watermelon fruit disease was observed in commercial fields of watermelon in Gauteng and KwaZulu-Natal. Initial symptoms consisted of water-soaked, oval, 3-5 cm lesions on the surface of fruits of 50-80% of the crop. The lesions enlarged in later stages of infection, resulting in severe soft rot. Bacterial streaming from the edges of freshly cut young lesions was clearly visible in a droplet of water under x100 magnification.

Isolations were made from small sections of tissue cut aseptically from the margins of lesions. Plant extract was streaked on the following agar media: King's B, Milk-Tween and CVP, and plates were incubated at 26°C for five days. From all lesions, non-fluorescent, non-pigmented, pectolytic bacteria were isolated. Six representative isolates were purified and characterised. All were gram negative rods, oxidase and indole negative, strongly fermentative, produced acetoin and H_2S from cysteine, liquefied gelatin and caused soft rot of potato.

The isolates were identified *as P.c. carotovorum* based on carbon source utilization (Biolog GN2 micro-plates) and comparison with the Microlog 4.2 database (Biolog Inc., Hayward, CA). Similarity indices ranged from 0.89 to 0.96. Pathogenicity was confirmed on mature, healthy watermelon fruits (cv. Miki Lee). For each isolate, a single fruit was injected subepidermally with 0.1 ml of bacterial suspension (10^7 CFU/ml in sterile distilled water). Two control fruits were injected with sterile distilled water. Inoculated fruits were placed in a humidity chamber at 26°C and inspected daily for development of symptoms. Water-soaking, soft, expanding lesions appeared after three days on fruits inoculated with the bacterial isolates. After five days, soft rot developed in all six fruits. The symptoms were identical to those found in the field. No symptoms were observed in control fruits. Bacteria re-isolated from inoculated fruits were identical to the original isolates. This confirmed that *P.c. carotovorum* was responsible for soft rot of watermelon observed in South Africa.

Watermelon is widely grown in South Africa by both commercial and subsistence farmers. Early diagnosis of bacterial soft rot may prevent spread of the disease by introduction of resistant cultivars and correct control measures.

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