



Bio-Protection

Bioprotection science for New Zealand



NEWSLETTER | June 2011

Trans-Tasman Research Excellence



Award winning science team: Dr Karen Armstrong, Team Leader Assoc Prof Tony Clarke, Queensland University of Technology and Dr Deborah Hailstones, Industry & Investment NSW.

The trans-Tasman research team involving the Centre's Dr Karen Armstrong and Laura Boykin has won the Science Excellence Award at the Australian Co-operative Research Centre for National Plant Biosecurity's (CRC NPB) Annual Science Exchange.

The project 'Resolving the *Bactrocera dorsalis* complex' is funded by the CRC and the Centre and is seeking novel methods for identifying individual species within fruit fly species complexes. Species complexes are groups of closely related and recently evolved species which are difficult to distinguish morphologically (by their physical characteristics) or by standard molecular diagnostic tests such as DNA barcoding. The aspect led by Dr Armstrong is looking for novel gene regions within the *B. dorsalis* (oriental fruit fly) complex which may provide new clues as to the species-status of these flies in Asia and be of use in this identification process.

The judges commented that in scoping their project, the group had "recognised the need to address a complex but fundamental problem in biosecurity with a multi-disciplinary approach. As a result the project brings together elements of molecular, morphological and behavioural biology to address species distinctions in the *dorsalis* complex - this is a strongly and genuinely collaborative project."

"Prime evidence of science excellence is the independent and international validation of the approach taken. The model used by this project has been adopted as the project structure

for a multinational, IAEA Collaborative Research Programme (CRP) project to look at resolving cryptic species complexes in insects to overcome constraints to SIT (sterile insect technique) application and international trade."

The oriental fruit fly (*dorsalis*) complex is a focus of activity in that programme, being the largest of three projects, and is led by Karen Armstrong with members from Australia, Italy, Greece, Thailand and China.

The 2011 CRC Awards Dinner was held at the Langmeil Winery in the Barossa Valley and attended by over 150 delegates including researchers, students, staff, Board members and industry and government representatives.

CRC Chair visits Lincoln

Prof John Lovett, Chair of the Board, CRC National Plant Biosecurity visited Lincoln in April. He met with Prof Alison Stewart, Dr Mike Dunbier, Prof Philip Hulme, and Assoc Prof Susan Worner to discuss current research projects and ongoing collaboration between the Centre and the CRC.

For more information:

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From the Director



Earthquake disruption aside, 2011 has started well for the Bio-Protection Research Centre with confirmation from the Tertiary Education

Commission that our mid-term review proposal has been positively reviewed. This result endorses the calibre of research carried out at the Centre over the last eight years as well as our plans for future research and capability development. Most importantly, it ensures funding for the Centre through until the middle of 2014.

To make sure that we are constantly evolving our research activities to deliver results of international significance, we will be running our normal three yearly cycle of internal rebidding for TEC research funds. This will provide Centre researchers with the opportunity to bring new ideas and collaborations to the table.

The key item on the Centre's calendar this year is our 1st Bio-Protection Symposium. This event, focussing on microbial products and biocontrol, will be held at Lincoln University at the end of August. The organising committee is pleased to have attracted several well known international speakers who will present alongside Centre researchers and New Zealand experts on a diverse range of topics. The level of industry support for the Symposium has been outstanding and we are pleased to be able to name AGMARDT as our Gold Sponsor.

Many of you will already be aware that I intend to step down as Director at the end of 2011. I have signalled this early to the Board and to our host institute, in order to provide plenty of time to find a suitable replacement so that there is a smooth transition of leadership at the end of the year.

Alison Stewart

Bio-Protection Symposium

managing pests: the future of biocontrol

Registrations are now open for the 1st Bio-Protection Symposium, Managing pests: The future of biocontrol, which will be held at Lincoln University, on Wednesday 31 August 2011.

The Symposium will be divided into four sessions featuring formal presentations from internationally recognised speakers. They will outline the current global situation surrounding non-pesticide methods for management of pests, diseases and weeds and highlight some of the problems and successes associated with the development of effective biological control methods. Future, or new generation, options for effective biological control using micro-organisms will also be explored.

Head of the organising committee Prof Richard Falloon says the Symposium will be of interest to grower groups, primary industry leaders, exporters and representatives from groups with interests in environmental issues, sustainability, bioprotection science and consumer wellbeing.

"The importance of this issue, nationally and internationally is reflected in the calibre of speakers appearing on the day, and in the level of sponsorship support the Symposium has attracted. Our Gold Sponsor for the event is AGMARDT. Silver Sponsors are Lincoln and Massey Universities, Plant & Food Research, Dairy NZ, Nufarm NZ Ltd and AgResearch. Bronze Sponsors are AERU, PGG Wrightson Seeds, Crop Solutions Ltd, Ballance Agri-Nutrients, Zelam Ltd and Lallemand Inc."

For a complete programme and to register for the Symposium, look for the link at www.bioprotection.org.nz or contact Anna Heslop anna.heslop@lincoln.ac.nz.

Seed research feeds economic growth

The Lincoln University Seed Research Centre's new Seed Laboratory was officially opened by Dr Garth Carnaby, Chair of the Centre's Industry Advisory Board in May.

In his speech, Dr Carnaby told assembled researchers and industry representatives that the importance of the seed industry, which contributes to more than \$200M in exports as well as feeding the \$11B dairy industry, was sometimes overlooked. He said that if the government is looking for a research intensive industry creating high value jobs, it need look no further than the seed industry which gives the whole New Zealand pastoral sector competitive technological advantage.

The Seed Research Centre, is closely linked to the seed industry by way of collaborative research programmes worth around \$2M per annum. Director Prof John Hampton says the new lab provides more space and facilities for staff to conduct the seed quality testing required for seed research, and to solve seed quality problems for industry.



Prof John Hampton, Prof Alison Stewart, Dr Garth Carnaby and Prof Roger Field at the opening of the new Seed Laboratory.

For more information:

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The complexities of biocontrol



Post graduate student Mahmoud Khalifa and Prof Se Won Yie are investigating mycoviruses of *Beauveria bassiana*.

A virus, infecting a fungus, which is a pathogen of an insect pest...this was the situation facing Prof Travis Glare, who is working on *Beauveria* spp. as potential biological control candidates for forest insect pests.

Concerned about how such a virus might impact on the efficacy of the biocontrol agent, Prof Glare contacted Centre colleague Assoc Prof Mike Pearson at the Centre for Microbial Innovation at the University of Auckland. Assoc Prof Pearson already had two Centre PhD students, Barbara Boine and Mahmoud Khalifa, investigating mycoviruses and was looking for a project for an experienced sabbatical visitor, so this new research fitted neatly into the lab.

“Mahmoud screened the initial *B. bassiana* samples late last year, confirming the presence of virus-like agents in the culture. Then, when Prof Se Won Yie arrived from Korea’s Kang Won National University, we developed a 12-month project for him. Prof Yie will concentrate on identifying and sequencing the mycoviruses found in New Zealand cultures of *B. bassiana* and *B. caledonica*, and investigate their effects on the fungus.

“So far Prof Yie and Mahmoud have discovered dsRNAs and/or virus particles in several *Beauveria* isolates, including the one provided by Prof Glare. Cloning and sequencing is underway.”

There are increasing reports of mycoviruses moderating the effects of both fungal pathogens and beneficial fungal symbionts, demonstrating that they play important roles in both natural and agricultural ecosystems.

For more information:

Assoc Prof Mike Pearson | m.pearson@auckland.ac.nz | (09) 373 7599

When natives go wild...

The enemy release hypothesis is commonly used to explain the invasiveness of introduced weeds and pests. It is based on the concept that accidentally introduced species arriving without natural enemies can multiply without natural restraints, thus increasing to damaging levels. However, this theory must be questioned when the pest in question is a native insect species.

Enter Marie-Caroline Lefort, a PhD researcher who is investigating two hypotheses around native species invasiveness. She is focusing on one of New Zealand’s most costly pasture pests, the New Zealand grass grub, *Costelytra zelandica*, and another closely related, but non-invasive native species, *Costelytra brunneum*.

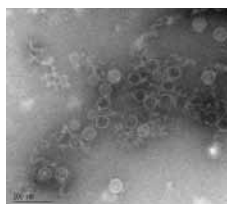
Marie-Caroline explains that the first hypothesis is looking at the pest’s ability to break through host plant defences.

“Plants which have co-evolved with insect pests produce various compounds and toxins which discourage insect feeding and reduce pest fitness. My first hypothesis is that native insect species that reach pest levels are pre-adapted to overcome these defences in their new host plants and the resulting availability of high quality, less well defended food contributes to increase their fitness performance.”

Her second hypothesis, which involves both ecological and molecular experiments, is that some pest species are more tolerant of certain environmental conditions, allowing them to better exploit the increased availability of high quality undefended food over a wide geographic area. “This results in the species quickly becoming more widespread and reaching damaging population sizes in some areas.”

Marie-Caroline’s molecular investigations are based on the *Pgi* gene, a gene controlling the production of the enzyme phosphoglucose-6-isomerase (PGI) which is required for the conversion of glucose to energy. It is thought that a high degree of polymorphism in this gene, may reflect the ability of an insect population to tolerate particular environmental conditions, especially extremes in temperature. Marie-Caroline is the first person to carry out a comparative study of *Pgi* expression involving invasive *versus* non-invasive insect species.

Nearly two years into her project, Marie-Caroline, who is supervised by Assoc Prof Sue Worner and Dr Karen Armstrong at Lincoln University, is making good progress in her aim of understanding why some native species become invasive. Her research has been recognised with two scholarships, one from the Miss EL Hellaby Indigenous Grasslands Research Trust and the second from the French Academy of Agriculture. This French grant will cover the costs of presenting her research findings at the *14th Symposium on Insect-Plant Interactions* in the Netherlands in August.



A virus from one of Prof Glare’s *Beauveria* isolates.

For more information

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Invasion Biology



Richard Duncan, Professor in Ecology at Lincoln University, has joined the Board of the South African Centre of Excellence for Invasion Biology (CIB). The appointment follows his attendance as plenary speaker at the CIB annual research meeting last year.

The CIB is an inter-institutional Centre of Excellence focused on the biodiversity consequences of biological invasions. It is based at Stellenbosch University and operates under a similar model to the Bio-Protection Research Centre. Like our Centre it places emphasis on developing research capacity through post-graduate training.

Prof Duncan's key role on the CIB board will be as a science advisor, providing feedback and advice on research quality and direction. He says there's a lot of overlap in the research carried out by the two Centres of Excellence so he hopes that as well as contributing to the direction of CIB, he will be able to initiate stronger research links between the two agencies.

For more information:

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Greening Britain?

The concepts of vineyard conservation, biodiversity and ecosystem management, familiar to those involved with the Greening Waipara research programme, are starting to resonate in the northern hemisphere.

Prof Steve Wratten, well known in New Zealand as a proponent of biological control and biodiversity, ran two wine focused training sessions in England during May.

The first, a Sustainability Forum, was specifically designed for a small group of established growers, while the second was a Masterclass for a less informed audience.

The Sustainability Forum provided training and guidance on conservation, biodiversity and ecosystem management for those wishing to grow grapes and make wine in a more sustainable way. The overall aim was to develop best practice sustainability guidelines for wine producers in the UK.

The Masterclass covered the basics of ecosystem management, including practical methods for achieving a diverse vineyard ecosystem and the benefits to be gained in terms of production costs, fruit quality and marketing.

Organiser Jo Cowdery from Plumpton College says both sessions went very well, although both would have benefited from having more time. Evaluations by delegates showed that the sessions were very highly regarded and a key outcome already is that a student has been engaged to establish Britain's first commercial-vineyard biodiversity trails.



Talks on vineyard sustainability by Prof Steve Wratten (third from right) have already produced results in the UK.

For more information:

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Achievements

Dr Amanda Black has received a Te Amorangi National Maori Academic Excellence Award in recognition of her 2010 PhD in Soil Chemistry entitled *Bioavailability of Cadmium, Copper, Nickel and Zinc in soils treated with biosolids and metal salts*. The Te Amorangi awards are held annually to acknowledge the achievements of Maori Doctoral graduates from across the country.

Honorary Centre researcher **Dr Murray Cox** has received a Massey University Early Career Research Medal and one of 10 inaugural Royal Society of New Zealand Rutherford Discovery Fellowships. Dr Cox, who was initially funded by Massey University, the Bio-Protection Research Centre and the Allan Wilson Centre for Molecular Ecology and Evolution (AWC) is now a permanent academic at Massey University.

Dr Maureen O'Callaghan has been appointed Adjunct Associate Professor in Soil Science at Lincoln University. Dr O'Callaghan is a senior research scientist at AgResearch Lincoln and a project leader with the Bio-Protection Research Centre. Her new title acknowledges an on-going contribution to funding and the joint supervision of postdoctoral fellows and PhD students in the Department of Soil and Physical Sciences.

Prof Alison Stewart has been made a Fellow of the Australasian Plant Pathology Society. The Fellowship citation recognised her work as a basic researcher, her role as the leader of a comprehensive and extremely productive research programme and the resulting creation of important knowledge on the mechanisms of action of biological control agents. It also noted her outstanding work as an applied plant pathologist and as a supervisor of numerous postgraduate students.

Collaboration on nematode control



Prof Alison Stewart will lead a trans-Tasman research programme aimed at developing a commercial biopesticide for the control of root lesion nematode, a serious pest of Australian cereal crops, especially wheat.

Microbial products experts Prof Stewart and Dr Trevor Jackson (AgResearch) will join forces with plant pathologists from Charles Sturt University and nematologists from the Department of Agriculture and Food Western Australia to form a research group with strong industry support and extensive knowledge of commercial biopesticide development.

The project has three initial research targets: the development of a *Trichoderma*-based bionematicide for cereal root lesion nematodes; the identification and evaluation of existing commercial biopesticides with potential suitability for this crop/pathogen system and the identification of indigenous strains of selected microbe groups that may have potential as bionematicides.

The four-year, A\$1.8M research project, is funded by the Australian Grains Research and Development Corporation and begins in July.

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Microbial products: art, science and alchemy



Dr Trevor Jackson, Dr Stefan Jaronski and Prof Alison Stewart.

Researchers, students and industry representatives involved in microbial products research and development met at Lincoln earlier this year for a mid-contract review of the MSI funded AgResearch/Bio-Protection Research Centre Microbial Products programme.

Dr Stefan Jaronski from the U.S. Department of Agriculture's scientific research arm, the Agricultural Research Service, attended as invited external reviewer for the programme. Dr Jaronski has 30 years experience in biocontrol product development in academia, industry and government research. Dr Jaronski praised the depth of knowledge and innovation of the research team, but also gave excellent advice for prioritisation within the programme to meet the objectives for development of successful products and support of a viable local biocontrol industry.

Programme leader Dr Trevor Jackson concluded that...“the two-week review was extremely useful in getting people together to analyse progress to date and identify the best opportunities for the remainder of the programme. Dr Jaronski's input as an experienced external assessor, was invaluable”.

While at Lincoln, Dr Jaronski also led a workshop on production of fungal microsclerotia, opening up new possibilities for this area of fungal biocontrol products and gave an extremely well attended seminar on the challenges involved in the commercial formulation and production of biopesticides, a process he described as equal parts art, science and alchemy!

For more information:
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East Timorese fruit flies – so which are the pests?



Prof Phil Hulme, who runs the Summer Scholars Programme, presents Hamish Patrick with his prize.

Hamish Patrick is the Centre's top Summer Scholar for 2010/2011. His project report "Identifying fruit fly (Tephritidae) larvae from Timor-Leste and Indonesia using DNA barcoding" was judged the best of the nine student reports and will be submitted to the *Australian Journal of Entomology*.

Hamish is a 3rd year BSc student from Lincoln University doing a double major in Ecology and Conservation, and Bioprotection and Biosecurity. He worked with Dr Karen Armstrong on his project which proved that, whilst it is possible to diagnose fruit flies to species level using larval DNA, identifying many from East Timor is a difficult prospect. Based on what little is known of the species in that region, Hamish's DNA analyses revealed many that did not match to 'known' species and that more survey work in the field is necessary.

Dr Armstrong was impressed by Hamish's enthusiasm. "He was very interested in the application of taxonomy to a biosecurity problem and was keen to get to grips with state of the art technology that is becoming an essential tool of the trade for modern-day taxonomists."

Hamish agrees that the highlight of his placement was learning new DNA techniques (courtesy of PhD student Ana Chomic). Hamish is already putting the skills he learned over the summer to good use in a research placement in the University's Faculty of Agriculture and Life Sciences.

For more information:

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Postgraduate scholarship

Ben Hancock has received a \$10,000 scholarship from Freemasons New Zealand to help further his PhD studies at Lincoln University. Ben, whose PhD project is investigating the Ecosystem Services of Spiders in Viticulture, received his award from running legend, Sir John Walker.

Student profiles

Nga Bui Thi

Title: Bacterial pathogens of *Plutella xylostella*.

Nga joined the Centre from Can Tho University, Vietnam. She has an MSc in Entomology from Tokyo University of Agriculture and Technology, where she investigated the interaction between a Granulovirus (SpltGV) and a Nucleopolydnavirus (SpltNPV) in *Spodoptera litura* larvae. Nga's PhD will focus on identifying potential biological control agents for the agricultural pest diamondback moth.

Supervisor: Prof Travis Glare (Lincoln University)

Associate supervisor: Prof John Hampton (Lincoln University)



Bradley Case

Title: The detection, spatial characterisation and multi-scale modelling of New Zealand alpine trees.

Brad's PhD is using hierarchical Bayes modelling to integrate and quantify the relative influences of multiple environmental drivers on New Zealand tree lines. The development and use of remote sensing imagery and image processing techniques makes up a large component of his work.

Supervisor: Prof Richard Duncan (Lincoln University)

Associate supervisor: Dr Roddy Hale (Lincoln University)



Lisa Hsu

Title: The determination of genes involved in bacterial phosphate solubilisation and their expression in the rhizosphere.

Lisa gained both her BSc and MSc from Canterbury University. She is based at AgResearch Lincoln where her PhD is investigating strategies for improving the utilisation of soil and fertiliser phosphorus (P) in soil-plant systems.

Supervisor: Prof Leo Condron (Lincoln University)

Associate supervisors: Prof Tim Clough (Lincoln University) and Adjunct Assoc Prof Maureen O'Callaghan (Lincoln University/AgResearch)



Claudia Lange

Title: Two genetically similar *Trichoderma atroviride* strains with high phenotypic divergence: Exploring the basis of biocontrol.

Claudia has an MSc in Biotechnology from the University of Applied Sciences in Jena, Germany. Before starting her PhD studies she worked as a technician in the Centre. Her PhD will investigate why two genetically similar *Trichoderma* isolates provide very different levels of biological control. She is hoping her results will help to understand biocontrol potency and ultimately to develop better microbial products.

Supervisor: Prof Alison Stewart (Lincoln University)

Co-supervisors: Dr Johanna Steyaert (Lincoln University), Dr Richard Weld (Lincoln Ventures Ltd)



Ross Meffin

Title: Intraspecific variation as a source of potential weeds.

Ross has an MSc from Lincoln University. His project aims to help develop more effective and efficient regulations controlling the passage of plant germplasm across international borders by better understanding which plants pose a risk as potential weeds. A specific focus is to determine whether traits assessed at the species level are the best predictors of a plant's potential weediness. Ross was recently awarded the Dan Watkins Scholarship in Weed Science for 2010/11.

Supervisor: Prof Philip Hulme (Lincoln University)

Co-supervisor: Prof Richard Duncan (Lincoln University)



Senait Senay

Title: Modelling invasive species-landscape interactions using high resolution, spatially explicit models.

Originally from Ethiopia, Senait has an MSc in Geo-information and Remote Sensing Science from Wageningen University, Netherlands and has worked as an information management analyst and GIS specialist for the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). The aim of her research is to increase the dependability and accuracy of outputs of ecological and spatio-statistical models.

Supervisor: Assoc Prof Sue Worner (Lincoln University)

Associate supervisor: Dr Michael Rostas (Lincoln University)

