



Rothamsted International

Sharing research excellence: international collaboration and capacity building for the benefit of agriculture in developing countries

Dr Natalya Buchkina Agrophysical Research Institute St. Petersburg, Russia

In June 2006, Natalya Buchkina finished her project on "Factors controlling the microbial mediation of fluxes of nitrous oxide by denitrification", which was funded through the Rothamsted International Fellowship Scheme. The work was supervised by Prof. Keith Goulding in the Agriculture and Environment Division, with assistance from Dr Penny Hirsch and Ian Clark (Plant-Pathogen Interactions Division).



Colin Webster and Natalya sampling a waterlogged soil at Rothamsted

Natalya did her PhD at the Agrophysical Research Institute working on the mechanical resistance of tundra soils. Between 2001 and 2002, she did a post-doc at Edinburgh University studying the effect of soil water table level on releases of nitrous oxide, carbon dioxide and methane from peat soils. Since then her research has included work on emissions of these greenhouse gases from agricultural soils.

Soils research is probably one of the oldest of the agricultural sciences and is crucial to crop production, farm management and landscape systems. However, very little is known about the microorganisms regulating many of the chemical processes, which in turn influence the functioning of higher trophic levels in food webs.

During her Fellowship, Natalya was interested in whether different types of soil management

affected denitrifying bacteria species responsible for nitrous oxide emissions.

Soil cores were taken from Rothamsted at the Broadbalk classical experiment (started 1843), Broadbalk wilderness (natural succession started 1882), and in Russia from agricultural soils and a mature oak forest.

Nitrous oxide emissions were measured and microbial community DNA was extracted from each soil sample. The overall diversity of the bacterial communities and of functional genes involved in denitrification were analysed using the PCR/DGGE technique. In this, DNA primers (16S, *nirS*, *nirK*, *nosZ*) bind to conserved segments of genes enabling amplification, separation and subsequent sequencing of the internal regions, leading to identification of the different bacterial species in the soil samples.

Preliminary results indicate that bacterial diversities vary with management system. It appears that Broadbalk wilderness and the Russian forest soils have more diverse populations compared with the agricultural soils.

For Natalya, the Fellowship gave her technical skills and experience in molecular biology and microbial ecology. By splitting the 12 month Fellowship into two six month placements, Natalya was able to learn soil DNA extraction techniques at Rothamsted, then extract soil DNA in Russia for analysis on her return to Rothamsted.



Natalya with Ian Clark

A lack of molecular biology equipment at Natalya's institute means she will have to get funding to continue her research on microbial ecology and greenhouse gas emissions.

Dr Maria Carolina Moraes EMBRAPA, Brazil

Maria Carolina, known as Carol, from the EMBRAPA Recurso Genéticos e Biotecnologia Institute (CENARGEN) in Brasilia, completed her Rothamsted International Fellowship in February 2006, after 12 months working with Dr Mike Birkett in the Biological Chemistry Division at Rothamsted Research. The title of her project was "Novel mass spectrometry-based approaches for investigating the impact of plant activators in induced plant defence".

The aim of Carol's project was to investigate the impact of volatile chemicals, such as (*Z*)-jasmone, that act as plant activators causing a defence reaction in recipient plants. Techniques used included novel vapour-phase extraction (VPE) and liquid-phase extraction (LPE). This allowed simultaneous analysis of targeted volatile and involatile plant secondary metabolites using coupled GC-mass spectrometry (GC-MS).



Carol was able to show that exposure of wheat seedlings, *Triticum aestivum*, to (*Z*)-jasmone, led to significant increases in the levels of certain compounds which protected the seedlings against a range of pests. The compounds included the hydroxamic acids 2,4-dihydroxy-7-methoxy-2*H*,1,4-benzoxanin-3(4*H*)-one, or DIMBOA, and 2,4-dihydroxy-2*H*-1,4-benzoxain-3(4*H*)-one, or HBOA, along with the phenolic acids *trans-p*-coumaric acid and syringic acid.

Studies were extended to other crop plants, such as broad bean, *Vicia faba*, and barley, *Hordeum vulgare*. Exposure to (*Z*)-jasmone led to the production of both volatile and involatile secondary metabolites involved in plant defence in these plants.

The Fellowship provided Carol with the opportunity to learn new skills for working in this area of plant sciences, such as plant tissue extraction, developing and applying novel extraction methods and working with magnetic sector mass spectrometers. These analytical skills are necessary for studying induced plant defence, and are already being applied to her work at EMBRAPA, as part of its programme, led by Dr Miguel Borges, on establishing new sustainable agricultural practices that reduce the impact of broad-spectrum insecticides.

In addition to her work on plant activators, Carol also investigated the chemical ecology of a number of insect pests important to Brazilian agriculture. A male-produced sex pheromone for the rice stalk stink bug, *Tibraca limbativentris*, a major pest of paddy rice in Brazil, Argentina and Uruguay, has been identified, and the sex pheromones for *Ceratoma arcuata* and *Diabrotica speciosa* are currently being investigated. It is anticipated that the plant activator and sex pheromone work will lead to at least two peer-reviewed scientific publications.

Carol and Mike are now continuing this new and exciting collaboration between Rothamsted and EMBRAPA-Brasilia. The main focus of the work will be to study the impact of (*Z*)-jasmone in tritrophic interaction involving soybean, one of the most important economic crops in Brazil, the brown stink bug, (*Eustichus heros*), and the egg parasitoid, *Telenomus podisi*. The second target insect pest to be studied will be the brown root stink bug, *Scaptocoris castanea*.

Country update: Brazil

Dr Mike Birkett has obtained a BBSRC ISIS grant for collaboration with the Federal University of Ceara, Fortaleza, in north east Brazil. The funding will enable him to study induced defence in cotton and cowpea crops, with the aim of devising novel crop protection strategies. The first Brazil-UK visit took place from April to May 2006, with Professor Ervino Bleicher and Janser Nobre Oliveira visiting Rothamsted for periods of two and six weeks, respectively. This stay provided an opportunity for the Brazilian scientists to learn new techniques for studying insect behaviour both in the laboratory, and in field-based studies. These skills will be used in experiments on insect-crop interactions with (*Z*)-jasmone treatment. As part of the ISIS grant, Mike will be visiting Fortaleza in Autumn 2006, and further exchange visits are planned for 2007.

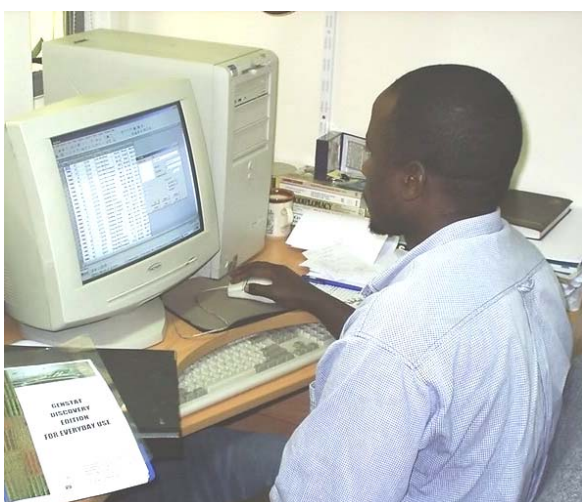
China update: Nanyang collaboration

In 2004, a joint laboratory was formed between the Biological Chemistry Division and Nanyang Normal University, focusing on novel methods for insect control. In 2006, a grant for about £827,00 was awarded to Nanyang by the Chinese regional government to purchase equipment at the university. In addition, Dr Liping Ban and Dr Li Du, both from Nanyang, have been carrying out research projects with Dr Jing-Jiang Zhou at Rothamsted.

VSNI and Rothamsted International

VSN International (VSNI) are the developers of the GenStat statistical programme. Since 2002, VSNI have been distributing a free version, called GenStat Discovery Edition, for scientists and researchers throughout the developing world.

By offering Discovery free of charge, VSNI hopes to spread awareness of the programme's capabilities, and to help scientists in the accurate design and analysis of laboratory and field experiments. The Discovery programme has been endorsed by Sir David King, Scientific Adviser to the Prime Minister, and it now has over 3000 registered users in 85 countries, including distributors in 20 African countries.



From 2006, VSNI and Rothamsted International will be working together to promote the distribution and use of Discovery version 2 through collaborators especially in Africa and South Asia. More information about The GenStat Discovery Edition can be found at www.discovery.genstat.co.uk.

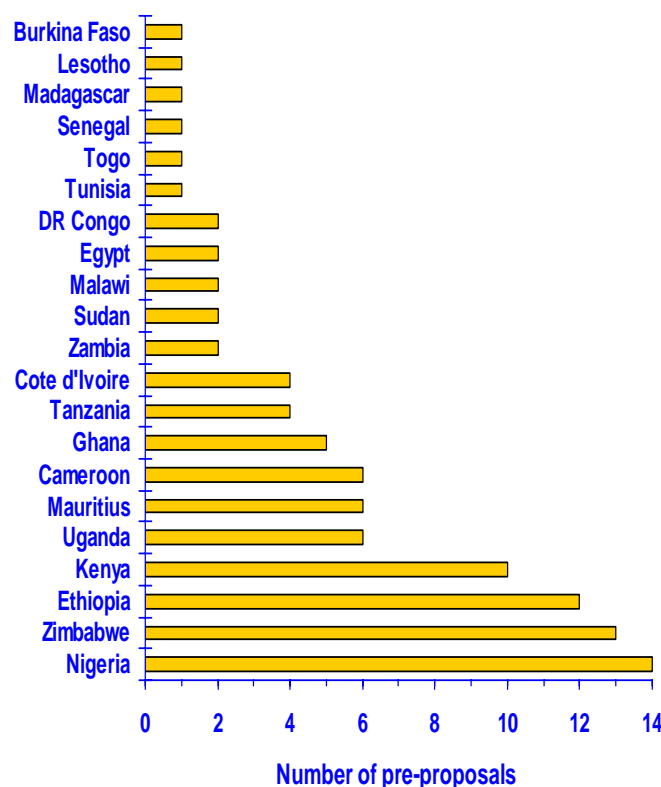
African Fellows Programme

Fourth Round of pre-proposals

In March 2006, we received 96 applications from African scientists wishing to carry out research in Europe on agriculture, livestock and fisheries projects aimed at improving food production by smallholder farmers.

An analysis of the 96 pre-proposals indicated the following;

- the median age of applicants was 38 years old (minimum 25, maximum 55)
- 19% of applications were by women
- pre-proposals were received from 21 of 54 African countries
- 51% of applications were from Nigeria, Zimbabwe, Ethiopia and Kenya



Bar chart of pre-proposals by country

Since the launch of the African Fellows Programme in July 2004 to March 2006, a total of 360 pre-proposals have been received and processed.

An important aspect for this Fellowship award is that Rothamsted International contacts appropriate European scientists who may be interested in hosting an African scientist. This is a significant first step in establishing research partnerships, which will help capacity building efforts in sub-Saharan Africa.

African Fellows appointed in 2005

Dr Achille ASSOGBADJO, Université d'Abomey-Calavi, Cotonou, Benin

Started in October 2005 for 6 months with Prof. Patrick Van Damme, Laboratory of Tropical and Subtropical Agriculture and Ethnobotany, Ghent, Belgium. Project titled "Genetic diversity assessment of the multipurpose baobab tree (*Adansonia digitata* L.) for its sustainable utilisation and management in parkland agroforestry system of Benin (West Africa)"



Achille Assogbadjo with Marie Orford from Rothamsted International

Dr Ndack Ndeye DIOP, Centre d'Etude Regional pour l'Amelioration de l'Adaptation a la Secheresse, Senegal

Started in February 2006 for 4 months with Dr Anne Repellin, LEPM, Université Paris XII, France. Project titled "Isolation and characterization of cowpea cystatin genes, involved in drought resistance"

Caroline Anne KADU, The World Agroforestry Centre (ICRAF), Nairobi, Kenya

Started in February 2006 for 12 months with Dr Joanne Russell, Scottish Crops Research Institute, Dundee, Scotland. Project titled "*Allanblackia* in agroforestry systems: developing the tools to manage a new tree crop for small-scale farmers in Africa"

Hortense DIALLO, Université Abobo-Adjame, Abidjan, Côte d'Ivoire

Started in March 2006 for five months with Prof. Phil Jones, Plant-Pathogen Interactions Division, Rothamsted Research, UK. Project titled "Viruses of papaya in Côte d'Ivoire: biological and molecular characterization"

Further details can be found at www.rothamsted-international.org/.

Donations to Rothamsted International

On March 3rd, Gill Tattersfield kindly presented Stephen James, Chief Executive of Rothamsted International, with a cheque for £1,000 on behalf of the Film Club. As Rothamsted International is a charity, we rely on donations to help pay for the Rothamsted International Fellowship Scheme.

The Fellowship scheme has been running since 1993 and over 100 scientists from developing countries have benefited from the research and training they received while at Rothamsted.

Please contact us if you would like to make a donation supporting the Rothamsted International Fellowship Scheme.

Rothamsted Open Weekend

On 30th September and 1st October, Rothamsted will be open to members of the public. This will be a great opportunity to see close-up what scientists are doing for sustainable agriculture.

Rothamsted International will have displays on our work, as well as a fruit and vegetable quiz for schoolchildren.



FEEDBACK

If you have any comments or suggestions on news which could be included, then please send an email to paresh.shah@bbsrc.ac.uk.