BSPP News

The Newsletter of the British Society for Plant Pathology

No 64 Spring 2011

Contents

Front cover: Fungi in a tropical rainforest display at the Charlotte Science Centre (North Carolina, USA) courtesy of Heiko Ziebell, Julius Kuehn Institute.

Page

Editorial

Welcome to the first Newsletter of 2011, and it's all change with this, my first issue as editor. My name is Jennifer Hodgetts and I am based at The Food and Environment Research Agency (Fera) in York, UK, where I work as a molecular biologist in an R&D team focusing mainly on plant pathogens.

I must pay massive thanks to Matt Dickinson, the previous editor, for making the newsletter so informative. Matt has now moved on to bigger and better things, as senior editor of Plant Pathology, and I am sure you will all join me in wishing him well with this new venture.

Please feel free to send in articles about what you do, where you work, or your comments and opinions on topical issues. In this issue Professor Russell has sent in a fascinating contribution discussing the numbers of authors in primary literature articles (see page 12) which is sure to spark the reader's interest.

Please send any contributions to bsppnews@bspp.org.uk, I look forward to hearing from you.

Jennifer Hodgetts

18th Triennial Conference of the European Association for Potato Research
Oulu, Finland, 24th - 29th July 2011

The EAPR2011 conference will take place close to one of the five High Grade Seed Potato Production Zones in Europe in the northernmost area of the world with intensive agricultural production.

Full details are available from the conference website www.eapr2011.com

The deadline for both early registration and abstract submission is 31st March 2011 (registration fee €360 for EAPR/PAA members, €460 for non-members, €250 for students). Late registration is available until 15th June (€460 for EAPR/ PAA members, €560 for non-members, €350 for students).

A reminder of some future meetings and conferences

2011

International Congress of Post Harvest Pathology
Lleida, Catalonia, Spain, 11th - 14th April 2011
Congress main topics include: host-pathogen-environment interactions, etiology and epidemiology, effect of preharvest treatments on postharvest disease control, molecular tools applied to postharvest pathology studies, chemical and alternative disease control strategies, production and formulation of biocontrol agents.

AAB meeting: GM Crops: From Basic Research to Application
Rothamsted Research, Harpenden, UK , 28th - 29th June 2011
Full details of this conference are available from the AAB website.

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The XV International Congress of Plant-Microbe Interactions
Kyoto, Japan, 2nd- 6th August 2011

8th International Symposium on Mycosphaerella and Stagonospora Diseases of Cereals
Mexico City, 11th - 14th September 2011
Organised by the International Maize and Wheat Improvement Center (CIMMYT)

The Second International Phytoplasma Working Group (IPWG) meeting
Neustadt an der Weinstraße, Germany, 12th - 15th September 2011

BSPP Presidential Meeting
The next BSPP Presidential Meeting will be in Cambridge in December 2011. The dates, theme and venue will be announced shortly.

2013

10th International Congress of Plant Pathology (ICPP 2013)
Beijing, China, 25th to 30th August 2013
The theme of the Congress will be "Biosecurity, Food Safety and Plant Pathology: The Role of Plant Pathology in a Globalized Economy"

Publicity report

BSPP at summer conferences
Look out for the BSPP this summer! We will have exhibition booths at the MPMI meeting in Kyoto (2nd - 6th August) and at The American Phytopathological Society meeting in Honoloulu (6th - 10th August). Come along to chat with other members of the society. If you would like to help out on the BSPP stand, please get in touch - it's a great opportunity to meet new colleagues, and tell people about your society.

Links with the American Phytopathological Society (APS)
This year, we are linking with the APS to promote scientific exchange between the continents. The BSPP will be supporting the APS session on using translational biotechnology to improve crop disease resistance. In return, the APS will be supporting a speaker to attend the Presidential meeting this year. We plan to develop this exchange programme in the future.

New promotional material
We have fliers to promote the society, and posters for specific schemes such as the summer studentships (see picture). We also have a range of materials for giving away at your conference. You can view the full range on the website where you can down load them, or hard copies of fliers and posters are available from the publicity officer.

Chris Ridout

publicity@bspp.org

Summer student funds available

BSPP undergraduate vacation bursary fund

A quick reminder to all BSPP members that the undergraduate vacation bursary is open to all BSPP members. The scheme provides modest support for work on specified research projects (£500) during the summer vacation. The objective of the bursaries of £200/week for a maximum of 10 weeks is to provide undergraduates considering a research career with some practical experience in a plant pathology laboratory and to assist supervisors to meet some specific research objectives.

Applications are invited from supervisors on behalf of an identified student. Students should be in the middle year (s) of their degree course and each BSPP member will be restricted to making a single application annually. Bursaries will be awarded on a competitive basis.

BSPP MSc project bursary fund

The M.Sc. research project bursary scheme is open to all BSPP members and will provide modest support for M.Sc. students who are unable to find other sources of funding for the research element of their course. The fund will not support research costs. The objective of the bursaries is to allow graduates to complete their research project and to provide supervisors with an additional pair of hands to undertake short research projects for which funding is increasingly difficult to find.

Applications are invited from supervisors on behalf of their M.Sc. student. Students should have performed well in the taught part of the course and proven an aptitude and enthusiasm for plant pathology research. BSPP members will be restricted to making a single application annually. Bursaries will be awarded on a competitive basis. The bursary is not transferable and students will receive a sum of £200/week to cover their living expenses with £500 in total for consumables. Bursaries will be for a maximum of 17 weeks.

The closing date for both funds is 1st April 2011

Application forms can be downloaded from the BSPP website and should be submitted as soon as possible to Dr Robert Coutts:

Dr Robert Coutts (BSPP Education Officer)
Division of Biology,
Imperial College London,
South Kensington Campus,
London, SW7 2AZ, UK.

Tel: +44(0)207 594 5364
e-mail: education@bspp.org.uk

Notification of the results of applications will be made after consideration by the Education sub-committee of BSPP Board.

BSPP T-Shirt competition

Stocks are running low of our famous BSPP T-shirts, and we need a new design. We know there's lots of creative talent out there with our members, so why not enter our T-shirt competition? You can make any design you like, large or small, simple or whacky, but especially one that our members would be proud to wear!

You can send in up to three designs in powerpoint, photoshop etc or as a PDF of a scanned image. Please send your entries to membership@bspp.org.uk before 31st May 2011. If you win, we will work with you and your design to make the next batch of T-shirts.

The winner will receive an Amazon token for **£100**, and your own T-shirt, so get your pencils out and start creating!

Some of the previous winning designs

BSPP-funded summer vacation studentship and P. H. Gregory prize-winners alumnus news

In the last issue of the BSPP Newsletter I introduced a new feature where I have attempted to track down the whereabouts and career paths of undergraduate and Masters students who had been funded through summer vacation studentships, to pursue research projects in the laboratories of BSPP members. This resulted in some very interesting correspondence which I am sure everyone enjoyed reading. I have now extended my search for further BSPP alumni to include previous winners of the P. H. Gregory prize, which is awarded for the presentation of an oral paper at the Presidential Meeting each year. Once more the response from the membership has been excellent and below I reproduce the thoughts of some awardees (one in their own words).

I feel we should be very proud of the continued success of our awardees and continue to encourage potential plant pathologists. On this point, if you have received funding from the BSPP to support an undergraduate or Masters summer vacation studentship and are in contact with that person or indeed, been the recipient of a summer vacation studentship, please get back in contact with me and supply me with a couple of paragraphs on the impact the summer vacation studentship had on them and their careers. Likewise if one of your students or post-doctoral workers has been a recipient of a P. H. Gregory prize, or you are one of those people, I would like to hear from you. I am extending the alumnus search even further to now include winners of the best PhD authored manuscripts in our prestigious journals *Plant Pathology* and *Molecular Plant Pathology* which have been awarded since 2007. So if you supervised these winners or were a winner yourself then please get in contact with career information. Full details on how to apply for summer vacation studentships (closing date 1st April 2011) and how to enter The P.H. Gregory Competition can be found on the BSPP website.

News from:-

Summer vacation awardees

Jonathan Lamb (2008)

My name is Jonathan Lamb; I received a BSPP undergraduate bursary to work at Aberystwyth University in the summer of 2008. I worked with Dr Gareth Griffith and Mrs Sandra Pierre on witches broom disease of cacao. We used tomato plants as model organisms to study infection. It was a very rewarding experience and I really learnt a lot.

Dr Gareth Griffith has since asked me to e-mail you telling you what I have done since graduating. I spent a lot of time looking for PhD's, to strengthen my candidacy I worked at Aberystwyth University studying oat genetics for a total

of six months. I am now working in the Department of Plant Sciences in Oxford University and am currently applying for D. Phil funding to start in January 2011, if all goes well. The project is looking at the evolution of leaf variation by studying inter-specific variation in the small mustard C*ardamine hirsuta.* So far I am thoroughly enjoying it and am optimistic that I will get funding. I am confident that the bursary from the BSPP has strengthened my application.

Yours Sincerely
Jonathan Lamb

Alexandra East (2010)

A photograph of Alexandra working last summer at Rothamsted Research under the supervision of Dr Jon West on 'Understanding the timing and dispersal of airborne spores of *Fusarium graminearum* and *Sclerotinia sclerotiorum'*.

And from former P.H. Gregory award winners:-

Jack Peart (2000)

Having carried out his PhD and post-doctoral work at the Sainsbury laboratories and winning his prize for his presentation on 'Identification of genes required for *N*-mediated resistance against TMV by virus-induced gene silencing' Jack is now promoting the next generation of sequencing at Illumina UK Ltd, Saffron Waldon where he is the Plant Agrigenomics Specialist.

Professor George Salmond from The University of Cambridge writes on Sarah Coulthurst (2003)

Sarah did her PhD in my group, then a postdoc before moving to University of Dundee, initially as a PDRA but then she won a prestigious, competitive Royal Society of Edinburgh Fellowship personal award and has set up her own group now (in Dundee) on a tenure track model. She is doing work on the opportunistic human and animal pathogen, *Serratia*, but she is also continuing work on plant pathogens such as *Erwinia* (Pectobacterium) and moving in to *Dickeya* spp. with Ian Toth and with me (if we can ever get any funding again in the coming punitive climate!!!!!). So Sarah is really a wonderful example of the quality of some of the former P.H. Gregory award winners who have established an independent career with a continuing investment in molecular phytopathogenesis.

Professor Jim Benyon from The University of Warwick writes on Mary Coates (2006)

Mary Coates was a PhD student of mine. She then started a postdoc in my lab on studying the role of effectors in pathogenicity. I then won a new grant that included a role for project management support (50% time). She has been carrying this out with me for the past two years. This role involves project facilitation for two large projects involving more than 40 scientists. It requires a knowledge of science to be able to liaise with researchers and writing science reports on progress within the consortia. It also requires management of meeting schedules and the organisation of workshops. Mary also aids in paper writing and editing for the group and on her own. On top of this she arranges my life and makes sure I get done what I need to! This is a good example of an excellent researcher who continues to use her scientific knowledge to great effect while balancing other demands on her time. I believe that having trained scientists in such roles is highly effective and with the increasing need to work as teams, a growing career opportunity. Mary and I have just published a review (mostly written by Mary).

Hyaloperonospora arabidopsidis as a pathogen model.
Mary E. Coates and Jim L. Beynon.
Annual Review of Phytopathology, Vol. 48: 329-345.

Professor Sarah Gurr from The University of Oxford writes on Mary Illes (2007)

Mary Illes who won her prize for her presentation on 'The role nitric oxide and nitric oxide synthases in *Magnaporthe grisea*', crafted a superb thesis but considered academia too pressured. She chose to teach Biology and Chemistry at a school in Bristol but found that too overwhelming too and is now a Tax Inspector. Clever, able and a loss to science but she wanted to follow her partner.

I urge all BSPP members to please write in with more information on our summer vacation studentships, P. H. Gregory alumni and manuscript winners.

Bob Coutts
BSPP Education Officer

Plant Pathology news

As reported in the previous issue, Plant Pathology is now in new hands.

Matt Dickinson (right) Plant Pathology's new Senior Editor with predecessor Richard Shattock

Carol Jenner (left) Plant Pathology's new Editorial Assistant, with predecessor Jenny Shattock on a winter's walk in the Cotswolds

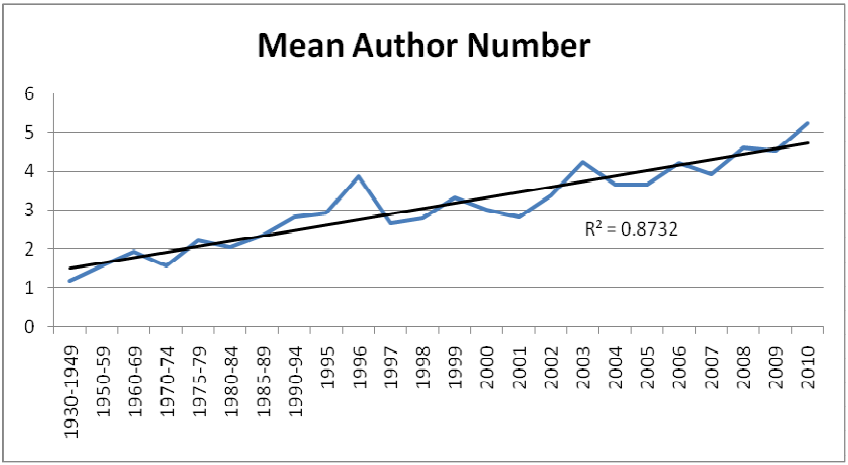
Author numbers per paper are increasing – WHY?

While reading a few articles recently I came across some where the list of authors and their addresses took up more space than the abstract to the paper. I have also recently come across Conference Proceedings where, with a space limit of two pages per contribution, the list of authors and addresses has taken up almost all of the first page.

This led me to wonder if the number of authors appearing on scientific papers was increasing, and if so, why. So I completed a short survey. The results are quite revealing.

The data were taken from a variety of sources, simply counting the number of authors per paper. I included only scientific research articles. Reviews and book chapters were excluded. The sample is biased towards Plant Pathology because that was the Journal I had most access to at home but more data came from a range of agricultural, crop protection and mycological volumes. In most cases I surveyed the 'Contents' pages of the Journals but to provide a broader sample, particularly for earlier dates, I also dipped into journals at random and surveyed the reference lists. Where sample numbers were low for any year, I combined yearly counts. This was particularly needed for the early years. Sample numbers per category varied from a low of 11 up to 45-50, the higher values being recorded for more recent years.

The key information is shown in this Figure:



Although the sampling method may not have been the most scientific I believe there was enough 'randomness' to provide a fair degree of reliability. Author numbers have increased steadily over the years from a mean of 1.18 in the period 1930-1949 up to a mean of 5.24 in 2010. There was an upward blip in the mid 1990s and possibly a slight fall in 2001, but the trend is quite clear. It may be quite accidental but in 2010 I recorded no single author paper.

Maximum author numbers also show an interesting trend (Table 1)

Table 1: Maximum author numbers per paper*

Year	Maximum number	Year	Maximum number
Up to 1974	3	2006	11
1975-1984	5	2007	8
1895-1989	6	2008	9
1990-1994	9	2009	11
1995-1999	9	2010	11
2000-2005	10		

*Clearly the minimum is 1 although the data show that the proportion of single author papers has declined over the years

The question must now be asked as to why these changes have happened. I suspect that in some cases the increased author number reflects cooperative research being conducted across several research centres; each centre thus demanding recognition when results are published, particularly if funding came from the individual centres or funding was granted to the collection of centres as a 'co-operative' grant (similar to the UK Defra-Link grants). Such situations are quite valid as they can reflect the various types of expertise found in different organisations which are required to research increasingly complex topics. Other situations could arise when the research is conducted by a dedicated 'research group' within an organisation. However, in other cases I wonder if the increase has been driven by the need for scientists to justify their existence and further their careers by presenting an extensive publications list, so even those playing a minor role demand recognition.

So how realistic are the author lists? What contribution has to be made to be a valid author? I can fully understand that for an author list of three or four authors that each author may have made a significant contribution to the research project but when you get into the realms of ten authors is it reasonable to assume that each has played a *significant* part in the research, compiling the results, analysing them and writing the paper? Personally I doubt it, even if it may not be politically correct to suggest such a thing. I can accept, but do not always approve, that at times an author's name has to appear for political reasons just to confirm the involvement of a particular research establishment but fully expect that some authors are included as authors when their involvement has been quite minor and would be better placed in the 'Acknowledgements' section.

Indeed, I have heard of one institute where every paper sent for publication had to include the name of the Director, even if the person had nothing to do with the research. I have also heard of cases where an eminent scientist has been invited to be an author even though he had no connection with the research whatsoever. I should add that in all cases I have heard of, the offer was declined. There was also a case of an author being included without his knowledge; only finding out when asked for a reprint. One can only assume that in these latter cases the extra author was included to add credence to the paper and possibly increase chances of publication.

But I digress. Surely to be accredited as an author the person should make a significant contribution to the scientific concept to be investigated (hypothesis, objectives, research plan), how the research should be conducted and data recorded and the subsequent analysis and formulation of the conclusions and future strategy. I would also like to think that authors are just that; authors. In other words they contributed to the actual writing of the paper. I do not include providing a service such as practical field help or data capture or proof reading a paper where there has been no other contribution to the research as necessarily a suitable criterion.

There is also a danger of having too many authors; it could easily considerably dilute the credit due to the lead scientists. I have heard of a scheme (or suggested scheme) whereby the involvement of each author is given a % rating. This may well help but I tend to think it is taking matters too far.

What will the future bring? Will author numbers creep up further? Will a script proof reader with no involvement in the project be designated an author? Will a part-time student helper who wielded the data capture device be considered an author?

Personally I think we need a more realistic approach to authorship or all scientists will suffer.

Professor P E Russell

MEETINGS REPORTS

American Phytopathological Society Annual Meeting, Charlotte, USA 7th-11th August 2010

Everything was looking fine in spring when I booked flights and accommodation to attend the 2010 Annual Meeting of the American Phytopathological Society in Nashville (Tennessee). I only paid little attention when the news reported in May that there was some severe rainfall in Tennessee with parts of Nashville flooded...subsequently it turned out that the conference hotel suffered some severe damage and was unable to host the meeting. The organisers were able to relocate the whole conference to Charlotte (North Carolina), an impressive achievement given the vast number of delegates and exhibitors. Luckily, rebooking of flights and hotel were not too difficult although I had to stay in a place a few miles away from the conference centre.

As this was my first time at an APS meeting, I attended the First Timer's Orientation session and was pleasantly surprised to see a few familiar faces from Cornell University and from the UK. A very nice coincidence was the recognition of Melanie Tuffen whom I had met at the BSPP Presidential Meeting in Oxford last year. It not only turned out that we stayed in the same hotel but we also shared the same hobby of geocaching...and were able to log a few caches together once the scientific sessions had finished!

I went to the meeting to present my own work in the form of a poster ("A cucumber mosaic virus mutant that induces resistance to its aphid vector in tobacco"). I was surprised by the sheer numbers of poster in the exhibition hall; it was quite easy to get lost! My abstract was also selected for a "flash and dash" session, giving me the opportunity to summarise the poster content on a few slides within five minutes. Both sessions were quite successful and generated interesting questions and good feedback.

However, I was also involved in representing the BSPP at this meeting. Chris Rideout has already written about our plans of collaboration with the APS in this publication (see page 5) so I will not repeat everything here. We both manned the BSPP booth in the exhibition hall and were able to talk to many people who were unaware of our society and the great benefits that we offer to our members. It was a great networking opportunity and I had great fun handing out carrot bugs and membership information leaflets. The BSPP booth was well received and I discovered a few photographs on the APS meeting fanpage on Facebook!

But there were also scientific sessions I was able to attend; mainly the plant virus sessions were of personal interest. The sessions were ranging from

emerging viral diseases over plant virus evolution to novel detection methods. One very interesting paper was presented by Stafford *et al*. They found that infection of plants with tomato spotted wilt virus altered the feeding behaviour of thrips, its insect vector. Viruliferous males were making more feeding and exploratory probes than non-viruliferous males. This behaviour was very similar to the behaviour of female thrips, which was unaltered by viral infection. Impressive were the video sequences showing the thrips' feeding behaviour in conjunction with electrical penetration graphs.

The BSPP booth

Another very interesting session dealt with the emerging technologies used to discover emerging viral diseases. Claude Fauquet used the example of "ViroChips", a microarray designed to detect virus sequences from every branch of the plant virus taxonomic tree. He proposed that this technology could not only be used for detection and identification but also for (re) classification of known or unknown emerging plant viruses, not at least through automated throughput and computerised interpretation of data. Neil Boonham's group at the Food and Environment Research Agency in York described a different approach: next-generation sequencing. His group was driven by the need of quick, cheap and sensitive detection methods for pathogens that might be imported into the UK through global trade of plant and seed material. By sequencing nucleic acids derived from plant material infected with an unknown pathogen they were able to describe a new cucumovirus that infected ornamental plants. Although this method still appears to be relatively expensive, Neil Boonham predicted that next-generation sequencing would allow processing a high throughput of samples in the future thus decreasing overall costs.

Overall, the trip was great on many levels: a stimulating scientific conference, great networking opportunities, the advertisement of the BSPP and meeting new and old friends.

Heiko Ziebell
Julius Kuehn Institute, Germany

European Association for Potato Research Pathology Section Meeting Carlow, Ireland 13th-16th September 2010

Two years ago, at the last Triennial Conference of the European Association for Potato Research (EAPR) in Brasov, Romania, members of the Pathology Section expressed interest in holding their next meeting in Ireland and somehow I found myself agreeing that it might be possible. However, the thought of organising the meeting in Belfast more or less single-handed (my fellow potato pathologist Roy Copeland having recently retired) was daunting and led me to 'suggest' to my colleagues at the Teagasc Oak Park Research Centre that Carlow would be an ideal venue. So an informal organising committee which included myself and colleagues Steven Kildea, Denis Griffin and Dan Milbourne from Teagasc (the Irish Agriculture & Food Development Authority) came into being.

After an alarming time in June and July when it seemed that we might have to cancel the meeting due to lack of interest, our potato friends rallied round and as a result, the meeting took place at the Seven Oaks Hotel, Carlow, Ireland, jointly hosted by Teagasc and AFBI. The theme that we chose was 'Potato Pests & Diseases: Old Enemies, New Threats' focussing on the risks to the potato crop posed by changes in pest and pathogens – changes resulting from the introduction of new organisms, from selection of new strains of already endemic species and from altered behaviour associated with factors such as climate change.

The meeting was attended by just over 50 delegates from 12 countries as far afield as the USA and Japan and for part of the time we were joined by members of the Society of Irish Plant Pathologists (SIPP) for their Autumn Scientific Meeting. We had hoped to run a student paper competition aimed at publicising the EAPR to young researchers. Despite offering free registration to student presenters (funded by the EAPR) and reduced price accommodation, disappointingly only three students registered: I suspect it may be a sign of the current economic climate and the decline in the science of plant pathology.

EAPR meeting delegates

The BSPP was publicised to delegates as a Conference Sponsor in the abstracts booklet and with a poster display - the free BSPP goodies proved very popular, particularly the pens! I found myself trying to promote the three organisations (EAPR, BSPP and SIPP) simultaneously, which was a bit confusing.

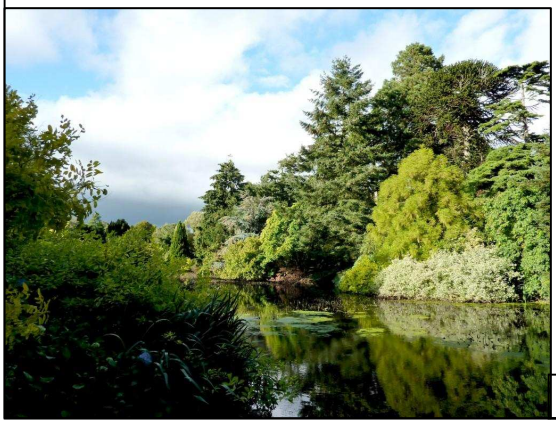
The invited speakers included Jan van der Wolf from Plant Research International in The Netherlands. Jan described how his work on new variants of bacterial pathogens is helping to show why *Dickeya* spp. are causing increasing losses from blackleg in European seed potato production. This is of great concern to countries to which seed potatoes are exported and in a subsequent talk Leah Tsror explained the risks to potato production in Israel and their monitoring programme. Another invited speaker, Colin Fleming (AFBI) explained how AFBI research is determining the reasons for increasing nematode problems, which are not only threatening potato crops, but other important things such as golf courses and football fields!

During the meeting, delegates visited the Teagasc Crop Research Centre, Oak Park, where they were welcomed by the Director Professor Gerry Boyle and heard about the range of research conducted there. After this some delegates chose to visit Altamont Gardens ("the most romantic gardens in Ireland" according to their website) which run down to a beautiful lake and river and survive as a result of the efforts of the last owner, Corona North, who restored overrun flower-beds and woodland areas with rhododendrons, azaleas and rare trees, and bequeathed the gardens to the Irish Government on her death in 1999. Other delegates chose to opt for a different venue….and Jeff Peters will tell you about that. Everyone then met up at the Sha-Roe Restaurant in the village of Clonegal for a splendid dinner of traditional Irish fare.

The papers and posters presented at the meeting can be accessed at http://www.teagasc.ie/publications/2010/20101014/index.asp and abstracts will be published in *Potato Research.*

On behalf of the organisers, I wish to thank the BSPP, the EAPR, Adgen Phytodiagnostics, BASF, Corgenix, Irish Potato Marketing and Syngenta for their generous sponsorship, without which our meeting could not have gone ahead. Our parent organisations (AFBI, Teagasc and the Irish Department of Agriculture, Fisheries and Food) also provided support and this is gratefully acknowledged.

Louise Cooke
Agri-Food & Biosciences Institute (AFBI), Belfast



Altamont Gardens, Ireland

The meeting kicked off with a presentation by Dan Milbourne (Teagasc, Carlow) who gave an overview of the work by the global Potato Genome Sequencing Consortium. Next generation sequencing has enabled the consortium to finish the sequencing of the complete 840 Mb genome of potato (approx. 40k genes). Around 480 resistance gene homologues have been identified. This offers exciting prospects for shortcutting conventional breeding programmes in providing resistance to a wide range of pests and diseases.

As this was an EAPR meeting being held in Ireland, it didn't take long before thoughts turned to potato late blight. The first morning's session was dominated by a wide variety of findings from recent research on *Phytophthora infestan*s. The population of *P. infestans* has been changing dramatically over recent years. Louise Cooke (AFBI, Belfast) presented the evidence that in Ireland genotype 13_A2 (commonly referred to as 'Blue 13') dominates the population. Blue 13 is both aggressive and resistant to the systemic phenylamide fungicides. An aggressive A1 genotype 'Pink 6' is increasing in frequency. According to Stuart Carnegie (SASA) this is a similar situation to that found in British potato crops. The concern is that with genotypes of the two mating types A1 and A2 co-existing in significant levels, there is a real danger that sexual recombination could take place allowing new variants of the pathogen to emerge.

The next session dealt with potato diseases caused by bacteria. Chief amongst these is a recently identified pathogen tentatively named '*Dickeya solani*'. Gillian Young (AFBI) described how this bacterium has emerged as a major threat to potato production in Europe. *Dickeya solani* causes a stem disease called 'blackleg' and soft rot in tubers that is similar to symptoms caused by other bacterial pathogens more commonly associated with potato disease *Pectobacterium atrosepticum* and *Dickeya dianthicola*. However, *D. solani* is a more aggressive pathogen than those other bacterial pathogens. A survey is underway to monitor for the presence of *D. solani* in Northern Ireland. John Elphinstone (the Food and Environment Research Agency, Fera) presented work that has been carried out by Fera, Cambridge University Farms and SAC on common scab (caused by *Streptomyces* species). Supplying irrigation to the potato crop during early tuber development reduces levels of the blemish disease. Parallel studies at Fera using Next Generation Sequencing to investigate the possible role of antagonists in suppressing common scab, have identified a number of bacteria that increase in number as a response to irrigation. It will be interesting to see if a direct link between irrigation, 'antagonists' and common scab control can be proved.

We then moved on to the subject of fungal diseases of potatoes. A wide range of pathogens were presented. Gary Secor (North Dakota State University) gave an overview of a *Fusarium* that is not normally thought of as a potato pathogen, *F. graminearum*. This pathogen was found in 42% of tubers showing dry rot symptoms in North Dakota and is thought to be associated with a recently introduced harvesting method, whereby vines are not killed prior to crop lifting. This talk was followed by two presentations on *Alternaria solani*, a pathogen that is fairly well established in the US but is emerging as a problem

in European crops. This was reflected in the presentations from Phil Wharton (University of Idaho) and Jan Spoelder (Hilbrands laboratory for Soil Diseases, The Netherlands). Jan's presentation focused on determining what causes alternaria-like symptoms; Phil concentrated on fungicide resistance issues emerging in American crops.

It may seem strange to some, but potatoes are increasingly being bought on the basis of their appearance. This has meant that blemish diseases, which can downgrade the value of a crop, are becoming more important as subjects for research. It was no surprise that a number of presentations covered fungal pathogens that cause blemishes. *Colletotrichum coccodes* causes an important blemish disease, black dot, on crops grown in Europe and elsewhere. However, in North America, the pathogen is also capable of producing a damaging foliar disease. Neil Gudmestad (North Dakota State University) discussed work being carried out by North Dakota University which shows that there is a high degree of genetic diversity within *C. coccodes* populations and suggests differences between US and European isolates. Glyn Harper (Sutton Bridge Crop Storage Research, UK) presented work done jointly between SBCSR and Fera on the development of real-time PCR to predict the risk of skin spot (caused by *Polyscytalum pustulans*). Thanks to a travel fund awarded by the BSPP, I was able to present the work of my team at Fera (as well as collaboration from SCRI and SAC) to show that *Rhizoctonia solani* AG3 is sparsely distributed in soil prior to planting potatoes but is found in patches of approximately 2 ha area after cultivation. This suggests that the pathogen is predominantly borne on infected planting material.

The 'alternative' cultural visit

After close of business on the second day, an excursion was arranged by the conference organisers. The delegates were split into two groups. Louise has described the excursion to the Altamont Gardens, I (and I must say many others, particularly those from the US) chose to go on the Irish cultural tour (see picture). This was a wonderful opportunity to soak up the delights that a typical Irish pub had to offer.

Jeff Peters
The Food and Environment Research Agency (Fera)

The 11th International Plant Virus Epidemiology Symposium and 3rd Workshop of the Plant Virus Ecology Network, Ithaca, New York 20th-24th June 2010

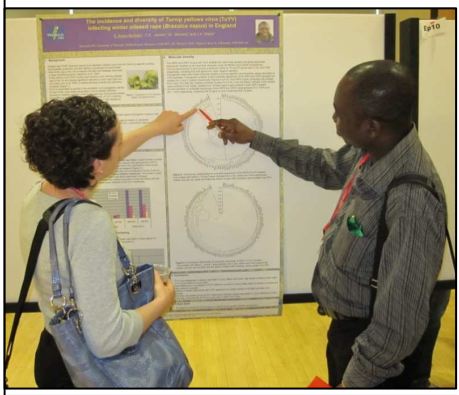
This joint international conference was at Cornell University, USA. Ithaca is a beautiful town which is the heart of the Finger Lakes Region of the New York State. The meeting brought together 173 scientists from North America, South America, Europe, Australia, Asia, and Africa working on all aspects of virus epidemiology and ecology. The objective of the meeting was to broaden the scope beyond the agricultural setting to include natural landscape and the interactions between these ecosystems that can impact plant virus disease emergence, development, diversity and maintenance.

The conference was divided into four themes, with each day beginning with a symposium that featured a keynote speaker and invited presentations in the mornings. This was followed by 15 minute oral presentations after lunch and then a short session in which selected poster authors described briefly their posters. A poster viewing session and social time then followed in the evening prior to dinner.

The first day of the conference was on plant virus epidemiology and etiology. The presentation that really caught my attention was on epidemiology of cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) in East Africa presented by James P. Legg (IITA, Tanzania). He reported that the severe CMD pandemic spread has arisen from virus recombination and inter-species synergy whilst the CBSD pandemic is a 'new encounter' situation. CMD pandemic spread has been tightly linked with the appearance of super-abundant *Bemisia tabaci* populations, in contrast to CBSD, where outbreaks have occurred 3-10 years after whitefly population increases. During the poster session, Titus Alicai (NaCRRI, Uganda) indicated that CBSD is now the most serious threat to cassava production in the entire East and Central Africa. Two virus species associated with CBSD are *Cassava brown streak virus* (CBSV) and *Cassava brown streak Uganda virus* (CBSUV) with incidences and yield loss of up to 100% reported. Maruthi M.N. Gowda's (NRI, UK) poster described two genetic groups of the virus causing CBSD in East Africa. Isolates from Tanzania and Mozambique produced the most severe symptoms and caused dieback of *Nicotiana* plants 2-3 weeks after inoculation, while the Ugandan isolates produced relatively less severe symptoms.

In the same session, I presented my PhD work which showed the widespread incidence of *Turnip yellows virus* (TuYV) infection in oilseed rape crops in England. Incidences of infections detected from oilseed rape crops between 2007-2010 in Lincolnshire, Warwickshire and Yorkshire range between 0 and 100%. Preliminary phylogenetic analyses of nucleotide sequences of both P3 and P0 genes showed the existence of more than one

genetic group of TuYV isolates infecting oilseed rape plants in each county.



Elvis describing his work

The second day theme was virus ecology and evolution. Israel Pagan (Pennsylvania State University, USA) presented an interesting topic on long-term evolution of *Luteoviridae*. Molecular clock analysis suggested that the origin of currently circulating species occurred within the last four millennia, with intra-specific genetic diversity arising within the last few hundred years. As a consequence, speciation seems to be associated with the rise and expansion of agricultural systems. Wendy Monger (Fera, UK) gave a presentation on next generation sequencing of plant viruses, an emerging powerful tool and technology which is being exploited for identification of pathogens, including viruses.

The theme for the third day symposium was vector biology / virus transmission. The talk which interested me most was on an aphid gut binding peptide which was presented by Bryony Bonning (Iowa State University, Ames, USA). A twelve-residue gut binding peptide (GBP3.1) that binds to the midgut and hindgut of the pea aphid has been identified. GBP3.1 reduced uptake of *Pea enation mosaic* virus from the pea aphid gut into the hemocoel, and also bound to the gut epithelia of the green peach aphid and the soybean aphid. These results present a novel and broad spectrum approach for the management of plant viruses.

On Wednesday evening we took a trip to the Wagner Vineyard and Micro-Brewery located on the east side of Seneca Lake, the largest and deepest of the Finger Lakes in the region. The conference dinner was held there.

The last day of the conference was on virus disease management/detection/ diagnosis. Of particular interest was the effective virus detection system developed by Maja Ravnikar (National Institute of Biology, Ljubljana) for *Pepino mosaic virus* (PepMV) that threatens tomato industry worldwide. Several sensitive one-step RT-qPCR assays have been developed for the detection of low concentrations of PepMV and for discriminating currently circulating PepMV genotypes.

Generally, it was an excellent conference where I identified future collaborators and acquired ideas knowledge. I would like to thank the University of Warwick, the British Society for Plant Pathology and the conference organisers, especially Dr Stewart Gray, for their financial support, which enabled me to attend the workshop. I would also like to thank my supervisors Dr John Walsh and Dr Carol Jenner for the opportunity to present at the conference.

Elvis Asare-Bediako
University of Warwick

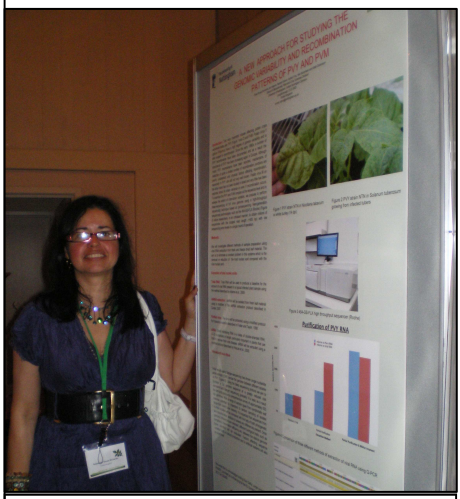
14th Triennial meeting of the Virology section of the European Association for Potato Research, Hamar, Norway 4th-9th July 2010

Although being a meeting of the European Association for Potato Research, scientists from many countries were present representing North and South America, Africa, Asia, Europe, Asia and Oceania. More than sixty potato virologists gathered together at the very charming and beautiful city of Hamar, in Norway. The conference was organized into seven sessions: resistance, virus transmission, emerging and quarantine diseases, diagnostics and detection methods, soil-borne viruses, plant-virus interactions and epidemiology and control. Lots of informal networking was done during the visits to the Aquavit Museum, a medieval cathedral and folk museum and during the conference dinner at Hotel Gard. The conference organisers planned a field trip to visit a seed potato farm in Solfr (see picture below), contractor of Strand Unikorn, Maararud crisps factory and Graminor, a plant breeding company that develops varieties of a number of agri- and horticulture species among them potatoes.

One viral species formed the core topic of this conference; Potato Virus Y (PVY) and its recombinants. Since the early 1980s, a number of PVY recombinants have been documented and studied with a new recombinant strain being presented during the conference. The presentation fuelled the on-going debate on what new variants or recombinants of PVY should be called new strains and also the nomenclature used, especially where in most cases only the sequence has been studied without the support of detailed biological characterisation. Most of studies presented were centred on how these recombinants emerge, aphid transmission efficiency, ways to minimise production losses and development of potato virus resistant cultivar. Reports from Finland, Syria, Czech Republic, Slovenia, Scotland and England highlights how common and damaging this disease is to the production of potato across the world.

The presentations involving aphid transmission attracted my attention because although *Myzus persicae* is the most efficient vector of PVY, it is not the only one able to transmit the virus. Other aphid species have also been found capable to transmit the disease. One presentation showed that the time of transmission of PVY by the vectors is variable in the field. Another showed that transmission efficiency varies in relation to which type of PVY isolates and that PVY strain O is more efficiently transmitted than PVY strain N.

Another topic present through out the conference was the development of diagnostic/detection methods for new PVY recombinants, a very important topic for me as it was the subject of my poster. The high variability present in PVY can be an indication that recombination junctions might be present anywhere alongside the genome, as a result my research is about the development of a new way to study these variability present in PVY (but also PVM) through the use of next generation sequencing. The work presented by Jan Kreuze, with deep sequence and siRNA, shows that this technology can also be used to identify known viruses present in a very low titre and new virus species without any previous knowledge of it.



Rosineide with her poster display

An excellent talk delivered by Dr R Koening showed us that recombination does not occur only in potyviruses, but also happen in tobraviruses. She showed that in the case of *Tobacco rattle virus* the recombination happens between the RNA 1 and RNA 2. The tobravirus appears to gain a number of characteristics as a result of this recombination, which appears to be in turn beneficial for their infectivity and transmission.

Although PVY was the main theme, a number of talks and posters were about different viral species and viroids causing problems in potatoes. Potato mop top virus (PMTV) vectored by powered scab (*Spongospora subterranean*) also featured. Today PMTV is one of the most important pathogens in potato production in the Nordic countries, with high incidences in the cultivar Saturna which is widely used in the potato processing industry. The results presented stress that the disease is widely spread along the potato fields and it can be transmitted with the adhering soil containing the vector and with infected tubers.

On the last day of the conference, the morning session started with a presentation by Dr Salazar on how the spread of commonly known virus vectors are modifying virus patterns in potato producing areas worldwide. The second talk of the day was presented by Dr Germundsson about how virologists from all fields can learn and how much we can gain by working together.

I would like to thank the BSPP for the financial assistance and for giving me the opportunity to present my poster at this excellent conference. This report is dedicated to the memory of Dr Lute Bos who tragically passed away at the time of the conference.

Rosineide Souza Richards
University of Nottingham and The Food and Environment Research Agency

SUMMER VACATION STUDENTSHIP REPORTS—MSc research projects

The impact of *Dothistroma* needle blight on pure and mixed stands of Corsican pine and Scots pine in Thetford Forest, East Anglia, UK

Red band needle blight (RBNB) is an economically important disease of conifers regarded as one of the most significant pine diseases in the world, known to infect over 80 different pine species in more than 60 countries. It is caused by the ascomycete fungus *Dothistroma septosporum* (Dorog.) M. Morelet, resulting in the loss of older foliage and leading to significant decreases in tree growth and, in extreme cases, tree death. The disease is characterised by red bands on the needles. The ends of the needles die back to the lowest point of infection leaving a browning colouration at the tips, while the base remains green. Eventually infected needles become necrotic and are cast.

The rapid increase in extent and severity in Britain of RBNB on the highly susceptible Corsican pine (*Pinus nigra* subsp. *laricio* (Poir.) Maire) over the last decade is of particular concern since this is one of the three main pine species grown in the country. A five-year planting moratorium of Corsican pine is currently in place on the Forestry Commission estate due to the increased impact of the disease. The pathology section of Forest Research, an agency of the Forestry Commission, based at Alice Holt Research Station, Farnham, Surrey currently conducts research on the disease in Britain. They estimate that over 80% (*ca* 11,000 ha) of the Corsican pine crop on the Forestry Commission estate in East Anglia is infected. The aim of this project, co-supervised by Dr. Anna Brown at Alice Holt Forest Research and Dr. Simon Archer at Imperial College London, was to assess the impact of RBNB on the annual growth of pure and mixed stands of Corsican pine and Scots pine (*Pinus sylvestris* L.) in Thetford Forest Park in the heart of Breckland, East Anglia, England. Scots pine is regarded as a very slightly susceptible species to the disease.

Fieldwork was conducted between May and June 2010 on two pure and one mixed 25-year-old Forestry Commission compartments in Thetford Forest. Fifteen trees per compartment and per species were visually assessed for defoliation and needle infection at branch and tree level. Disease assessments at stand level were also performed. The individual annual bolts of each tree were measured for mid-diameter (cm) and length (m) once the selected trees were felled. One random branch in each annual bolt was sampled

for future biomass assessments. In addition, 2-4 cm discs were removed from the middle of every third annual bolt for tree ring measurements using dendrometer equipment. Past annual increment of all sampled trees, namely height (m), over bark and under bark diameter (cm), and volume (m^3) were estimated from the tree ring data.

There is some evidence of a greater impact of the disease on Corsican pine than on Scots pine. Before the disease was first recorded in the region (1998) this stand grew approximately 40% more per year on average in terms of volume/ha than the pure Scots pine stand. However, during the period of disease the pure Scots pine compartment grew approximately 10% more per year than the pure Corsican pine site, while the mixed Corsican pine trees also produced on average more wood per year per hectare (≈ 2%). A similar pattern was found for mean annual height increment.

The defoliation and infection levels recorded seem to support these findings. The pure Corsican pine stand showed the highest defoliation levels (62%) and the second highest infection levels (20%), whereas the pure Scots pine compartment had the lowest defoliation and infection levels (23% and 0% respectively). In the mixed stand the Corsican pine trees were also more affected than the Scots pine trees, with defoliation levels recorded at 53% and 38% respectively.

It is generally accepted that the amount of growth and yield loss after defoliation is roughly proportional to the amount of disease severity and defoliation, as shown by several past studies of *Dothistroma* needle blight on pine trees, particularly *Pinus radiata* D. Don growing in the southern hemisphere. That is normally attributed to the loss of photosynthetic capacity and storage provided by older needles, as well as causing nutrient limitations that restrict the capacity of trees to recover. Premature senescence represents a significant loss of Nitrogen and Phosphorus which would be normally translocated to other tissue.

It has been shown that the studied Corsican pine stands in Thetford Forest are being more severely affected as a result of *Dothistroma* needle blight than the Scots pine stands. The usual practice of favouring Corsican pine stands over the native Scots pine in sandy soils in southern Britain due to faster growth may now be questionable. If the incidence of the disease does increase in the coming decades as a result of predicted changes in climate, it seems unlikely that infected Corsican pines would offer any advantage over Scots pine trees.

To the author's knowledge this was the first attempt to compare the impact of RBNB between a susceptible and a non-susceptible pine species. More research is needed in the future to validate the results obtained here, which could influence the choice of commercially grown pine crops in areas affected by the pathogen. It has been challenging to deal with such a large and diverse data set. It made me realise the importance of methodical data collection and handling. I gained much experience in dealing with statistical software and looking at different ways of analysing data. I am certain these skills will be highly needed in whichever field of study I will pursue in the future.

Fabio C G da Silva
Imperial College London

Review of plant health clinics in Karnataka, India: impacts on stakeholders

Agricultural extension introduces farmers to knowledge, information, and technologies that can improve their production, income and welfare. Extension can take the form of advice or education. The Global Plant Clinic (GPC) has promoted plant health clinics as a way around problems of inefficiency and ineffectiveness that have been identified in extension systems. The GPC is an alliance of CAB International and other institutions that offers comprehensive support and advice in disease identification and management. The GPC supports about 90 plant health clinics in developing countries, including India, and runs a diagnostic service. The clinics can be run by existing public agricultural extension services, NGO's or private companies like Bio Control Research Laboratories (BCRL).

The plant health clinics are a new concept for Bio Control Research Laboratories; they started in October 2009, are conducted free of charge for every farmer and use an integrated pest management approach. The clinics are seen to as an opportunity to provide a good and reliable advisory service to farmers and as a platform for their products. The clinics have so far have taken a flexible, learning-by-doing approach. A review of the impacts of the clinics will help to guide the clinics in a direction best suited to them.

After a chance meeting with Dr Eric Boa from the Global Plant Clinic, I was given the opportunity to undertake an assessment of Bio Control Research Laboratories run plant clinics in Bangalore India. I jumped at the chance, as the GPC was the reason that I undertook the MSc in the first place. This was my first time to work in this area of study and I have not seen any other GPC supported clinics, or similar, in action. The main objectives of the project were to A) measure selected outputs of BCRL clinics and compare them to other agricultural advisory services and B) provide feedback to BCRL to help improve the clinics.

My project lasted four months and involved a three month field visit to India. When in Bangalore I worked with BCRL at their offices developing a questionnaire and doing desk based research, spent time observing and interviewing clinic users at the plant clinics, and visited each clinic area/ village as a follow up visit where I interviewed clinic users and non-clinic users, as well as village Panchyats (administrators). Questions were asked to determine a client profile, which was looked at in comparison to other people living in the area and to clients of other advisory services. The impacts are evaluated by looking at the quality of outcomes such as the advice and service provided, and quality of documentation. Immediate outputs of the clinics such as number of farmers attending, number of times BCRL products are recommended and number of times the recommendation is followed are also used to measure impact.

The clinic clients had an average age of

38 and the average number of years in education was 7.4. Most clinic clients were marginal or small farmers and only one landless farmer and one woman were interviewed at the clinics. Advisory services available to farmers varied from village to village, but advice given by agrochemical dealers largely featured in every village. While the clinic clients did not differ greatly in profile from other farmers in the clinic area, there were some differences between the clinic clients and GKVK (Agricultural University diagnostic service) clients that particularly stood out. GKVK clients are older, more educated and spend far less money on agrochemical inputs. Unlike other GPC supported clinics, the clinic targets farmers who think progressively and have a connection with BCRL although in theory, anybody is welcome to the plant clinics. The BCRL clinics were held on public and private premises and were one-off events. Recommended products were not always available to farmers, making some advice unfeasible. Clinic documentation was always done, but to varying standards. During the five clinics I witnessed, 99 clients were registered and 131 recommendations were made. Of the clients asked later 54% followed the recommendations.

All of the clinics that I observed were well organised and well received. However, looking a little deeper, there is some room for improvement before the clinics can be called a complete triumph. If these clinics are to become a regular service, improved organisation and structure are needed. Written objectives and job roles would go towards reducing problems such as lack of ownership of the clinics. Even though BCRL have no specific aim to improve access to minority groups, improved public advertising and choosing an open public place for each clinic would make the clinics more accessible to such groups. One solution to the unfeasibility of recommending BCRL products would be to use the clinic-pharmacy model, and invite an independent input dealer to set up near the clinic or place the clinic near a dealer that supplies the inputs recommended at the clinic. Documenting plant clinics could be one of the most useful outputs. However, additional training is needed.

BCRL have given hope to farmers who have limited options for crop advice, but have a long way to go to meet its vast potential in terms of outreach, feasibility of advice, reliability and regularity. It will take dedication and hard work from all stakeholders. Luckily, BCRL have these qualities in abundance.

I would like to thank the British Society for Plant Pathology for awarding me this MSc bursary, this amazing project would not have been possible for me without it. Also, I would like to thank Dr Malvika and all of BCRL for being great hosts; I would love the opportunity to work with you again at some stage. Professor Mumford, Dr Dannie Romney, Julien Lamontagne-Godwin and Dr Jeff Bentley at CABI, thank you for all the useful advice. Finally, thanks a million to Dr Eric Boa for great advice, as well as giving me the chance to work for such a great group as the GPC, I hope I'll get the opportunity again in the future.

Hilda Dooley
Global Plant Clinic

SUMMER VACATION STUDENTSHIP REPORTS—undergraduates

Improving field diagnosis of phytoplasmas

Phytoplasmas are now known to cause disease in important crops in several parts of the world. Coconut lethal yellowing, European stone fruit yellows and witches' broom are severe diseases caused by phytoplasmas in groups 16Sr IV, X and II respectively. The economic value of the plants affected by phytoplasmas means that fast and accurate diagnosis is extremely desirable.

Culturing phytoplasmas for diagnosis is not an option as they lack the biosynthetic pathways to produce certain essential compounds. Therefore, a loop mediated isothermal amplification (LAMP) assay is being developed to give reliable results for the detection of phytoplasmas. This assay is not only able to detect the presence of phytoplasmas DNA but is also able to distinguish between the different groups of phytoplasmas. Most of the primers used are based on the 16S rRNA sequence, however at Nottingham University primers are now being designed that are based on the 23S rRNA sequence as this may differ between groups to a larger degree.

Including DNA extraction the assay currently takes around an hour to complete. The hope is that this can be cut down to as little as fifteen minutes. During my ten weeks in the lab I was given several different tasks to try and improve the efficiency of the LAMP assay. I spent some time experimenting with the ratios of primers added to the plant DNA to see if this caused the positive result to be obtained any earlier. This didn't seem to have much of an effect on the speed of the assay so the optimum ratio of primer mix is perhaps already known. Further to this I also experimented with multiplexing some of the primers. This would greatly reduce diagnosis time as one assay using primers to detect each phytoplasma group could be done on the plant sample. The theory behind multiplexing concerns the annealing step of the LAMP assay. This gives a 'melt temperature' for the products produced in the assay which will be unique to one of the phytoplasma groups. So as long as two groups do not have the same melt temperature the primers for each group can be used together in one assay. I looked at multiplexing group I and II primers and also group I and III. The assay worked well mixing these primers and gave obvious results as to which group of phytoplasma was present.

Another important area of phytoplasma diagnosis is storage of DNA extracted in the field for subsequent testing in the lab. Polyethylene glycol (PEG)/ potassium hydroxide is a very effective way of extracting DNA from plant

material for use in the LAMP assay. However, I conducted a simple experiment over five weeks which proved that storage of DNA in alkali PEG gives unreliable results. I extracted DNA from several plants and then each week used the extract in an assay to detect the presence of plant DNA. As the weeks progressed the results became unpredictable as some samples no longer gave a positive result for plant DNA and others took much longer for the positive result to come through. I would not write off this storage option completely however, as some of the samples maintained their viability throughout the five weeks. I imagine that if the volume of PEG added to the plant material could be optimised, then the DNA extracts could be stored indefinitely.

Further work to be done to improve in-field testing for phytoplasmas includes lyophilising readymade primer and enzyme mixes to be taken out into the field and used on the spot with a portable, battery powered LAMP machine. I am undertaking my final year project in the same lab so look forward to seeing the outcome of experiments using lyophilisation.

I have thoroughly enjoyed learning new lab techniques including DNA extraction, PCR and gel electrophoresis. It was great to be able to formulate theories for myself and see the testing of them through to the end. I can't thank the team in lab A58 enough for their invaluable advice and am very grateful to my supervisor Dr Matt Dickinson and BSPP for the opportunity to further my knowledge in such a practical way.

Sophie Dale
University of Nottingham

An Investigation into the role of Nitric Oxide in the pathogenicity of *Magnaporthe oryzae*

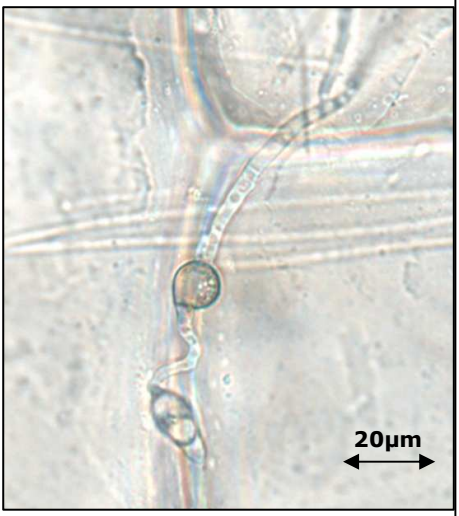
I worked for 10 weeks in the Plant Sciences Department of the University of Oxford with Professor Sarah Gurr and the two members of her lab, Dr. Marketa Samalova and Jasper Johnson. The group are researching pathogenesis in the rice blast fungus *Magnaporthe oryzae*. This is a very important area of plant pathology, as 10% to 30% of the global rice harvest is lost due to infection by *M. oryzae* every year; a highly significant percentage given that 10% is sufficient to feed 60 million people for one year (Skamnioti and Gurr, 2009).

For my project I was specifically looking at the role of nitric oxide in the pathogenicity of *M. oryzae*. The mechanism of nitric oxide synthesis in fungi is yet to be confirmed but from the study of mammals and plants it is thought that fungi may synthesise nitric oxide via two mechanisms: firstly, the nitric oxide synthase catalysed oxidation of L-arginine to L-citrulline using NAPH and molecular oxygen; alternatively NO could be synthesised from NO_2- via the enzyme nitrate reductase. Therefore, Marketa and Jasper have created two nitric oxide

synthase (Δ*nos*) mutants, a nitrate reductase (Δ*nia*) and a nitrite reductase (Δ*nii*) mutant, and various double deletion strains for study. Using 9 different genotypes of the fungus, that is wild type and knockout strains, I helped carry out several investigations in an effort to determine the phenotypic differences between the various strains.

I performed pathogenicity assays using rice and barley leaves, biomass assays, sporulation counts and onion peel inoculations (to assess penetration peg formation as a prelude to host invasion). For the pathogenicity assays we used detached leaves laid on water agar plates and inoculated them with spore solution using an artist's airbrush. We tried various assays to reduce error due to variation between the leaves and assessed the results by visual scoring of lesions and by using a semi-automated scoring algorithm, which assessed counts as well as lesion area. Additionally, I generated a large amount of strain growth biomass data. As I write this report I am still analysing data and repeating various assays; but I have learned much. This project has shown me that planning, precision and replication are paramount for a successful experiment and if at first you don't succeed try, try again!

I found my time in the Plant Sciences Department extremely interesting and enjoyed having an insight into the world of plant pathology. It will certainly help me in my final degree year at the University of Oxford and has prompted me to consider seriously applying for further study in plant pathology.



Wild-type strain germlings at 24hpi on onion showing the 3 celled conidia, germ tube, melanised appressoria and infection hypha

I would like to thank Sarah, Marketa and Jasper for their help and guidance during my project and also the BSPP, as I would not have been able to take advantage of this exciting opportunity without this financial support.

Emma Houghton-Brown
University of Oxford

Effects of *Mycoshpaerella graminicola* on infection of wheat by *Blumeria graminis*

Blumeria graminis f.sp. *tritici* is the causative agent of powdery mildew on wheat, while Septoria tritici blotch is caused by *Mycosphaerella graminicola*. Both are important diseases of wheat crops throughout Europe. During the summer, I had the good fortune to work in the Disease and Stress Biology Department of the John Innes Centre on a project hosted by Prof. James Brown. The aim of my project was to investigate the effects of *M. graminicola* on infection by *B. graminis*.

For this project, we used two varieties of wheat that were either susceptible or resistant to an isolate of *M. graminicola*, while both were susceptible to powdery mildew. A third wheat variety was used as a susceptible control for powdery mildew inoculation. Leaves were first inoculated with an *M. graminicola* isolate, then a little later with the virulent *B. graminis* isolate. Leaves were sampled at various time points after inoculation by powdery mildew and the chlorophyll cleared from the leaves. I then examined them by light microscopy to assess development of the *B. graminis* spores. On each leaf, 30 spores were counted and their stages of development were determined, including the development of primary germ tubes, appressoria, haustoria and elongating secondary hyphae. These spores had to be undamaged, isolated and each infecting a different epidermal cell**.** Powdery mildew colonies were also counted with a magnifying lens and their numbers compared between leaves which had or had not been infected by *M. graminicola*.

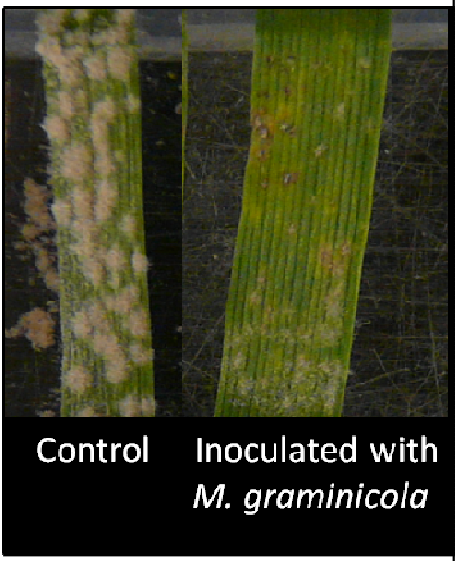


Fig. 1: Development of powdery mildew colonies on wheat after inoculation with *M. graminicola*

The macroscopic development of mildew clearly differed between treatments, with fewer colonies on leaves which had been infected previously by *M. graminicola* than on those which were not (Fig. 1). Mildew colonies sporulated more profusely on leaves inoculated with *B. graminis* soon after inoculation with *M. graminicola* than on those for which the interval between inoculation with the two fungal species was longer. By contrast, there was no statistically significant difference between the microscopic development of *B. graminis* on leaves with or without

prior infection by *M. graminicola*, implying that Septoria infection appears to have no discernable effect on the early development of the powdery mildew pathogen.

The contrast between the macroscopic and microscopic results allow us to conclude that infection of wheat by *M. graminicola* has an effect on subsequent infection by *B. graminis* but that this effect is not visible at early stages of powdery mildew development. As a result, we predict that there are differences in the later stages of the development of mildew on leaves with or without prior infection by Septoria. This result provides a new hypothesis for the lab and the later stages of mildew development are now being investigated.

This internship has given me the opportunity to participate in research activities and acquire a lot of new knowledge of lab techniques and plant pathology. I have also gained some experience of QPCR, DNA and RNA extraction. This laboratory experience developed my practical skills and enhanced my enjoyment and my knowledge of plant pathology. I also participated in field scoring. It allowed me to spend time in the field and see the impact of varieties on disease development. Ten weeks in the John Innes Centre allowed me to live in a different country, with another language and culture. I would like to thank the BSPP for providing me with financial support for this placement. I would like to extend my thanks to my tutor James Brown, to my supervisor Elizabeth Orton for her help and her kindness. Also thanks to Margaret Corbitt, Henry Creissen, Laëtitia Chartrain and Fran Lopez Ruiz, who made me feel welcome.

Mathilde Cailliau
Ecole Nationale Supérieure Agronomique de Toulouse (ENSAT), France

Understanding the timing and dispersal of airborne spores of *Fusarium graminearum* and *Sclerotinia sclerotiorum*

This summer I spent 10 weeks working in Jon West's lab working on an independent project that it was hoped would add value to other projects related to this area of crop disease and its links to climate change. My goals were to test DNA from air samples in order to quantify airborne spores to understand possible variable factors; to extract DNA from rotating-arm traps, operated in a transect, spanning positions upwind and downwind of sclerotia buried in an oil-seed rape (OSR) field at Rothamsted; and finally to quantify the amount of *S. sclerotiorum* spores by qPCR to assess gradients of spore concentrations around this expected strong local point-source.

We first undertook to survey diseased plants (identified by their white stems) in an OSR field to gain statistics on the prevalence of infection this year, and to

see if there were any disease gradients around sites where sclerotia (which release spores) had been buried the previous autumn. The results of this showed that there were higher levels of disease downwind of the buried sclerotia for over 30m but also a low background level of infection over the whole field.

Air samples had been taken during the spring at a variety of locations in the UK and France but to quantify the numbers of pathogen spores present, it was necessary to extract DNA and apply a quantitative PCR diagnostic method. I extracted DNA from spores collected on wax-coated tapes, using a phenol-chloroform method, an activity which greatly improved my confidence in the lab.

The final part of my project involved the most technical problems, but proved perhaps the most interesting as we attempted to resolve them, and provided the most striking results. We ran a number of qPCR plates using a protocol that- inexplicably- did not work. Changing a variety of variables- the primers, the company making them, the concentration of DNA, the thermal profile of the run, the standards used- led to a working protocol. This was used to quantify Sclerotinia spores released over nine weeks in one of the Rothamsted fields, and this data was then correlated with local weather data. Preliminary statistical analysis showed that rainfall encourages the fungus to release spores, and therefore it may be possible to predict outbreaks of the disease based on weather.

As well as working on my specific project, I broadened my experience in a number of ways- such as using the NanoDrop, helping with potting and misting OSR plants (which gave me a chance to see other facilities on-site), and culturing two *Fusarium* species, improving my aseptic technique in the process. I also counted spores on microscope slides that I made (see picture on page 9), in order to compare the efficiency of new and old rotorod traps- preliminary analysis implies that the new traps catch up to twice as many spores as the old type. I also, of course, improved my computing skills whilst analysing the data obtained.

I would like to thank the BSPP for awarding me the bursary that made this beneficial experience possible. I would also like to thank everyone at Rothamsted, particularly Dr. Jon West, Dr. Bruce Fitt, Julia Halder and Kevin King for their kindness and extensive guidance with my project.

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The role of annexin 1 in plant defence against pathogens

Annexins are small (32-36 kDa) soluble proteins that are found in many locations within the cell. Annexins have been widely studied in animals but are not as well understood in plants. Nevertheless, *Arabidopsis* has 8 annexins of which annexin 1 (Ann1) is the most highly expressed. Plant

annexins have been found to act as calcium channels, to possess phosphodiesterase activity, to bind actin, and could relocate in response to changes in cytosolic Ca^{2+}.

I was working under the joint supervision of Dr John Carr and Dr Julia Davies, both of the Plant Sciences Department, University of Cambridge. My project linked the Davies Lab's work on annexins with the Carr Lab's work on pathogens, aiming to determine if the annexin 1 protein (Ann1) is involved in the pathogen defence response.

Two approaches were taken. Firstly, existing microarray data was surveyed to see if expression of the *Ann1* gene was altered in response to pathogen infection. Secondly, the susceptibility to pathogens of an *Arabidopsis* line deficient in Ann1 (*ann1* mutant plants) was compared to that of wild-type plants, *NahG*-transgenic plants (which are depleted in the defence signal salicylic acid and served as controls), and plants of the line CS (a transgenic control line that should not be compromised in resistance). Susceptibility to the bacterial plant pathogen, *Pseudomonas syringae* pathovar *tomato* (Pst) strain DC3000 was determined by plating out extracts of leaves and counting the number of colony forming units per leaf at two days post-inoculation. Susceptibility to a viral pathogen, cucumber mosaic virus (CMV), was investigated by using Western blotting with antibody specific for viral coat protein.

The microarray data did not show any very large changes (most were less than 2-fold) in *Ann1* expression after inoculation with pathogens, although it was more often down-regulated than up-regulated. This suggested that *Ann1* expression is not responsive to pathogen infection. There were some problems with the *Pst* experiments so the number of repeats was limited. However, the results obtained showed that whereas wild-type and CS plants were similarly susceptible to bacterial infection, the *ann1* mutant plants appeared to be slightly more resistant to infection. These experiments are being repeated to obtain definitive, statistically significant results. In terms of susceptibility to CMV, 3 out of 5 *ann1* plants appeared to show a stronger signal in the Western blot than the wild-type control (the other two had a similar signal to the wild-type plants). This may indicate a greater titre of virus, and so a greater susceptibility, but again more repeats will be needed to authenticate these findings.

I thoroughly enjoyed my time in the department. I feel as if I have learned a lot, not only about the area of study but also about the execution of a project. It especially reinforced the importance of forward planning before and problem solving during an investigation and the skills I have learnt will serve as excellent preparation for my final year. I am very grateful to Dr Carr, Dr Davies and everyone in the lab for helping me throughout the project and to the BSPP for providing me with financial support.

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