BSPP News

The Newsletter of the British Society for Plant Pathology

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Pictures courtesy of Phil Jennings

Front cover: top left sporangia of Phytopthora ramorum and clockwise symptoms on Rhododendron.
See pages 29-31 for more on this pathogen.

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Editorial

Nowadays we seem to have a morbid fascination with the number of emails that hit the Inbox each day. But I'm not truly convinced that all those claims of despair aren't secretly a badge of pride. After all, such a bulging list of messages must indicate that we're indispensable and important!

I had expected that taking on the editorship of the Newsletter would bring me an avalanche of fascinating emails: chance at last to claim a prodigious list of mail demanding my attention. Now I would be able swagger down the corridor and join the Champions League of email banter. And that proved to be the case, sort of. The inbox has certainly filled-up.

Unfortunately, instead of the education in plant pathology that I had expected, the world community have decided to bombard me with offers to improve my lot in life. Obviously a plant pathologist needs all the financial help they can get – and rest assured I've been offered plenty of opportunity to make my fortune. More disquietingly however, membership of the profession also appears indicative of tragic loneliness; presumably exacerbated by the debilitating health problems and dysfunctional interests that are taken for granted!

So I must hang my head in shame. Ruinously marked as financially inept, pathologically deviant and in need of a smorgasbord of medical potions. Ecotoxicologists, biochemists and, god help me, even the entomologists pour scorn on my pitiful inbox. I've told them that the appearance of an email address in a website makes it fair game for all the world's nutters, rogues and criminals. They nod sympathetically, but their scepticism is obvious. All I can do now is beg your indulgence. Write me some articles – before I succumb and reply in desperation to one of those charming ladies who seem so keen to make contact with an aging plant pathologist.

At this point I hope there is a group of indignant members bashing out emails to me: something along the lines of 'cheeky beggar – you didn't even publish my last gem'. And, to all of you, my sincere apologies. My previous Internet provider introduced a brilliant anti-spam filter. Sadly, so brilliant it was able to detect the fact that you belong to the dubious profession of plant pathology. A couple of the articles in this latest issue certainly suffered that fate. If you have sent me anything via bsppnews.org.uk that's not appeared, please send it to me again. Rest assured that the problem is now fixed – Melody and her chums are back in touch!

Steve Parker

Plant Pathology in decline?

I recently represented BSPP at a Plant Health Strategy one day Stakeholder Workshop at CSL. The purpose of the workshop was to discuss how 'Plant Health' could be developed for England in order to provide an even better service than it currently provides.

It was very interesting to note that one key element during the discussions centred on training, particularly the training appropriate for people wishing to enter the 'Plant Health' services as a career. This training need was identified as being across all relevant disciplines but I will restrict my comments to those related to plant pathology.

For many years I have been concerned that, unless there is a radical change in the training given at undergraduate and at post graduate level, then in not too many years time there is going to be a lack of young people with the necessary expertise to begin careers in many branches of the crop protection or plant health industries. It is not difficult to appreciate why. Over the past decade we have seen a major change in plant pathology science with the rise in molecular biology studies. Research projects have flourished in order to capitalise on the opportunities presented while at the same time teaching courses have altered to incorporate the new technology. This has all happened at a time when teaching basic field skills in agriculture and agronomy has been in decline, taking with them a lack of teaching of plant pathology at the field level. How many plant pathology / crop protection courses exist now compared with 20 years ago? How many courses offer wide experience of disease symptomology and an opportunity to view diseases in the field (or even on relevant plants in the laboratory)? How many courses require students to be able to identify agricultural crops? I suggest the answer is very few. Speaking to many potential employers in the public and private sectors, it is clear they are finding it more difficult to find suitably trained young people to join their sectors. Finding experts with molecular biology training, including at PhD level, is not a problem, but finding field pathologists is.

This may sound as if I am denigrating the molecular biologists. But I am not ... their contribution to plant pathology is a very valuable one and will remain so. But somewhere over the years the balance between the basic elements of plant pathology and the new technology has become unbalanced. And this is not just in the UK. I have raised the issue in discussions with colleagues in France, Germany and South Africa. Their feelings are the same.

What can be done to redress the balance? I really wish I knew! Everyone I have spoken to agrees that something needs to be done. It was even officially recognised in a report from the National Audit Office 'Protecting England and Wales from plant pests and diseases', Report by the Comptroller and Auditor General, HC 1186, 29 October 2003. But recognising the problem is not really good enough. What is being done? I guess nothing. I have certainly tried to find out who could take action but have failed miserably to find who is responsible. I suspect that no one has overall responsibility and that any changes to training programmes would have to be made at individual University / College level rather than as part of a national policy. In education up to age 18, they have various standard requirements defined by the National Curriculum. Maybe now is the time to implement a 'Standard Curriculum' for plant science courses in universities and colleges.

Another way of looking at the problem, particularly from the more field experienced readership (= those likely to retire in the not too distant future!) is to ask yourself the simple question: 'How easy will it be to find my successor?' or maybe more to the point

When I retire or leave, will I be replaced?' I suspect that a survey would show that succession planning is difficult and that for many research institutes, university and college posts, the position of the experienced pathologist who concentrates on the plant and disease in the field is somewhat threatened and likely to be replaced with a person with 'more appropriate' new technology expertise.

I suspect some of these views may appear to you as controversial. I am pleased if they are, because I believe that the basic discipline of plant pathology is under serious threat. Some time ago the then President of BSPP asked the question 'If asked, what profession do you say you belong to?' I always say 'Plant Pathologist'. What do you describe yourself as?

If any of you have facts and figures to illustrate the decline in teaching basic crop protection / plant pathology at your workplace, I would be delighted to receive them.

Kind regards to all

Phil Russell

Biotrophy and Research

We are all taught at school that plants are the primary producers that harness the energy of sunlight to convert inorganic molecules into organic food and photoassimilates that are then used by other living organisms. And amongst these other organisms are the plant pathogens – microbes that kill plant material to obtain their food (necrotrophs), or tap into living plant cells and utilise the nutrients for their own growth and development (biotrophs and hemibiotrophs).

So if we move on to think about the scientific community, who are the primary producers here? That's right; it's us, the scientific researchers who assimilate ideas and research expertise to produce new data, technologies and scientific innovations, publications etc. And just like plants, we have our own pathogens, the bureaucracies, research assessment activities and other cottage industries that have built up around research over the years. Of course not all of these are bad. Just as mycorrhizal fungi are often seen as mutualistic organisms because of the benefits that plants can derive from their presence, so some bureaucracy and research-associated activities can be mutually beneficial. But in too many cases the bureaucracy works like a classic biotroph or hemibiotroph. The initial infection doesn't seem too bad – just a bit of an irritation tapping into a few cells. But gradually they grow, and eventually take over so that the research is weakened, and all too often withers and dies.

So what can we do as plant pathologists? We can all do the diagnostics and identify the problem, but how can we control it? Can we use approaches equivalent to pesticides and try to eradicate all these pathogens. Maybe, but too often the blanket approaches are untargeted and kill off the mutualistic organisms as well as the pathogens. And public acceptance of such approaches may also be problematic and research needs to be publicly accountable. So can we breed resistance into research programmes instead? Well perhaps some research groups have. They have worked out how to resist the pressures and have thrived. There has been an increasing tendency toward fewer more concentrated research groupings, fewer institutes, and elite research departments, the equivalents of crop monocultures. But beware the boom and bust cycle. Whilst your research may be booming at the moment, pathogens are adaptable and constantly evolving, and all too often resistance genes are overcome as new strains of pathogens evolve and the bust ensues. We've all witnessed the development of superbugs in medicine – where practices have resulted in the prevalence of organisms that are virtually impossible to control.

So what is the solution? Some may argue for varietal diversification, lots of small groups all doing their own thing. But perhaps we should be looking for some more integrated and durable control strategy. Just as the Universities have grouped together to form Universities UK, and the research councils have grouped to form Research Councils UK, perhaps it is time we as scientists form an equivalent body – Scientists UK – designed to integrate all available methods and expertise to combat the creeping bureaucracies that are tapping into research and diverting the resources for their own good.

Matt Dickinson

Cites for Sore-eyes

Because Senior Editors spend hours at a time sitting reading manuscripts at various stages of the process from submission, through the review procedures and at the proof stage prior to publication, two outcomes are likely, firstly, sore-eyes from too much reading, and secondly a lack of fitness from a sedentary occupation. Good spectacles deal with the first problem, and in my case, regular cycling in and around Snowdonia sorts out the second.

The Society's two hard-copy journals performed well in the recently published ISI Journal Citation Reports for 2004. Based upon cites of published papers Plant Pathology increased its Impact Factor for the 5th year running and stands at 1.467, whilst *Molecular Plant Pathology* entered the charts spectacularly with an impressive score of 2.838‼ In the case of *Plant Pathology* some of its closest competitor journals stumbled somewhat in the latest ratings. Consequently, they are not only in PP's cites, but also in its sights‼

Plant Pathology may seem to be a standardised product since 2000, but there have been many changes, all offering author/user-orientated extras delivered by Blackwell Publishing e.g. e-proofing, pdf reprints, Synergy and OnlineEarly with the latter permitting citing of publications prior to hardcopy publication. Typesetting and printing/dispatch, once UK-based, are now done in Hong Kong and Singapore respectively.

Publishing information and its access by the consumer as hard or digital copy is a changing and challenging arena. Learned societies with journals as an income stream cannot afford to be passive spectators, but have to participate actively in the debate.

As part of the digital evolution *Plant Pathology* adopted a 'hard launch' approach to electronic manuscript submission and processing in September 2004 via ManuscriptCentral [http://mc.manuscriptcentral.com/pp]. Authors seem to like the system as submissions have increased substantially. Electronic submission and editing mean that instead of the 'phlap' of hard copy through the letter box, arrival of new manuscripts is announced by a 'pling' on the computer. The latest to arrive is a rust paper with nice colour pictures of diseased leaves and that can only mean one thing, 'sites for sori'‼"

Richard Shattock
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Gift for former Senior Editor

In recognition of her efforts as the former senior editor of *New Disease Reports* (NDR), the BSPP thanked Claire Sansford by presenting her with a book 'Heligan: a Portrait of the Lost Gardens'. Colleague and current NDR senior editor, Rick Mumford presented the book to her. Claire was one of the founders of NDR and was at the helm for three years from its start in 2000. Conceived to complement the BSPP's two mainstream journals, *Plant Pathology* and *Molecular Plant Pathology*, NDR has rapidly become established as a leading source of new disease records and has become an invaluable resource for many plant pathologists around the world. Five years after it began, the journal has continued to grow year-on-year; 131 submissions were received in 2004 compared with 24 submissions in the first year. Last year, 89 papers were published both online and subsequently in *Plant Pathology.*

For more information on NDR please go to the website (www.bspp.org.uk/ndr

Neal Evans

Neal Evans has recently taken up the role of membership secretary for the BSPP. Neal's interest in crop science and subsequently plant pathology began with regular child-hood visits to his Grandparents farm in his native Leicestershire. This interest continued to develop during a BSc Applied Biology degree from Liverpool Polytechnic which included a one year sandwich placement as a field trials assistant with Schering Agriculture. Following 15 months working on barley powdery mildew fungicide insensitivity at the Cambridge Lab - JIC, Neal moved north to Scotland where he studied for his PhD at SAC-Auchincruive/ University of Glasgow working on interactions between Alternaria linicola and linseed. After a two year Postdoc on diseases of pistachio at UC Davis, Neal returned back to the UK to work in the oilseeds research group at what was then IACR – Rothamsted. Current work at Rothamsted Research sees Neal working on the development of decision support systems for the main UK oilseed rape pathogens, Pyrenopeziza brassicae and Leptosphaeria maculans. He also co-ordinates the EU-funded SECURE project which aims to use innovative molecular and modelling techniques to develop strategies to increase the durability of resistance to the stem canker pathogen (*L. maculans*).

Membership matters!

The question

The past-President Stuart Wale posed the question "who are the members of the society?" The question was asked as part of a general discussion on membership and the "global" profile of the society. Was there the opportunity to raise the profile of the society in central and eastern Europe and in so doing, to increase membership from this region? It became clear that no-one had looked at the "demographics" of the membership of the society for some time (if ever?). With details of all past and current members stored on the society's database, one would think that researching and distilling such information should be a simple task. However, having wrestled with various updated versions of the database over the past four weeks or so, it appears to me that the emphasis of the last sentence remains with "should"! I suppose that the real problem is that, as with any medium to large size organisation, there is a degree of "fluidity" in membership and this makes it particularly difficult to take a "representative" snap-shot. This is compounded by a Direct Debit system which, regrettably, has caused problems in the past. However I expect that the combined efforts of Diane Brown, the Membership Database Administrator, Roger Plumb, the new Treasurer and me will resolve these problems before the renewal process begins in 2006. However, an additional problem is that even though renewal notice reminders were sent out in April, renewals are still trickling in. One reason for this is that, even with airmail, there is a lag in time between membership reminders being sent out to some of the more exotic global locations where members reside and the completed renewal documents finding their way back to Diane in Hockering. Obviously, there is not much we can do to rectify this, but it does cause a delay in the process. This means that the total figure given for 2005 below may not be the final number of members for this year.

Demographics

Total number of members

Unfortunately, some data for the 1980s and 1990s do not record exactly when members joined the society. From Plant Pathology 31 (1) March 1982, the first volume of the journal printed following the transfer of editorial responsibilities from what was then the Ministry of Agriculture, Fisheries and Food to the BSPP, we know that there were 89 "founder members". Forty-seven founder members are still members. I think this reflects the intense passion the founder members had for plant pathology as a science. It is not unreasonable to suggest that their passion is still felt throughout the Society today. For the 1990s, Diane and I have both looked at an old table that remains in the database and appears to concern subscriptions. If we extract the number of paid members out of this, the figures that we both get seem plausible (Table 1), but should be treated with caution (was membership really so low in the early 1990s?). Even if the figures are only approximately correct they show a steady rise in membership year on year to the end of the '90s. We know that data since 2000 are reliable as the then incumbent Membership Secretary, Kevin O'Donnell, totally revamped the database and checked all details of the members at that time. Membership continued to increase into the new millennium to 658 members in 2003 and seems to have reached a plateau at about the 620 mark.

Journal subscriptions

Of the currently recorded 610 members, 358 take Plant Pathology, 173 Molecular Plant Pathology and 57 take both journals in paper form. In addition, 66 members who have re-newed for 2005 pay a personal Synergy subscription for electronic access to the journals. Obviously, many members do not need this additional service, as access to Synergy is provided by their employer through a site-wide license.

Table 1. Annual records of the total number of members of the British Society for Plant Pathology.

Year	No. of members
1993*	306
1994*	323
1995*	341
1996*	365
1997*	407
1998*	482
1999*	534
2000	449
2001	513
2002	559
2003	658
2004	624
2005	610+

* Treat data for these years with caution.

+ Membership renewals are still arriving, so figure is probably not final for the year.

Geographical location

The current 610 members who have renewed for 2005 reside in 54 different countries. Of these, the main countries are: UK 364 members, USA 43, Germany 23, Australia 21, Spain 11, Greece 11, New Zealand 9, France 9, Canada 9, South Africa 8, Netherlands 8, India 7, Japan 6, Ireland 5, Belgium 5. All other countries have <5 members. Figure 1 gives a breakdown of membership for different world regions. From these data, it is pretty obvious that the "British Society for Plant Pathology" is truly international and the Society has an important role and voice in Plant Pathology worldwide. However there is clearly scope to increase the profile of the society and attract new members from many regions but perhaps especially from central/eastern Europe.

Retention of members

As members are not asked for details of their birth date when they join, we are unable to look at the age structure of the Society. However, we can reliably consider membership numbers and the retention of those members since 2000. Many members joined during 2000 but it is not easy to see why unless prospective members had been "holding back" their subscription during 1999 under the false assumption that the civilised world would effectively end at exactly 00.01 on 1 January 2000? Whatever happened, these cautious folk obviously value the benefits of membership, as we still retain 78% of them. One of the many benefits of membership of the Society is access to the travel bursary fund and membership often swells considerably before large international congresses. This is what happened in early 2003 when a large number of members joined just prior to the 8th International Congress of Plant Pathology in Christchurch, NZ. However, some of them seem to have taken the money and run, as we only managed to retain 52% in 2005, or it may represent a difficult employment climate for Plant Pathologists. The number of members who joined last year remained high and obviously we would hope to retain the vast majority each year. All new members receive a "welcome" pack which contains a letter of welcome from the current President, recent past issues of the newsletter, BSPP pens, multicolour highlighter and post-its and details of benefits for members (including the offer of a free T-shirt!).

The future

With the fall in individual library subscriptions to both of the Society's journals due to the uptake of the online versions through Synergy, the Society faces a real financial challenge in coming years. Increasing membership of the Society could help alleviate matters although the board realise that there is a need to maintain a balanced approach in terms of subscription costs. I believe that there are a

number of ways forward to enhance the profile of the Society and attract new members and in conjunction with the publicity team (Dawn Arnold and Roger Williams), I hope we can achieve this over the short to medium term. If you are reading this you already value your membership of BSPP and know its advantages, why not point out these advantages to others!

Real progress, with respect to membership issues, began a few years ago with the appointment of Diane as Membership Database Administrator. Diane looks after renewals, direct debits and the Blackwell lists (lists of which members should be sent which journal), which frees up considerable time for the Membership Secretary to answer initial membership enquiries and answer the concerns of current members. In many respects, I am indebted to the outgoing Membership Secretary, Tijs Gilles. In conjunction with Diane, Tijs has done a fantastic job and on behalf of the board, I would like to pass on our thanks to Tijs for all of his hard work and dedication to the Society.

Figure 1. Breakdown of current 2005 British Society for Plant Pathology membership by geographical region

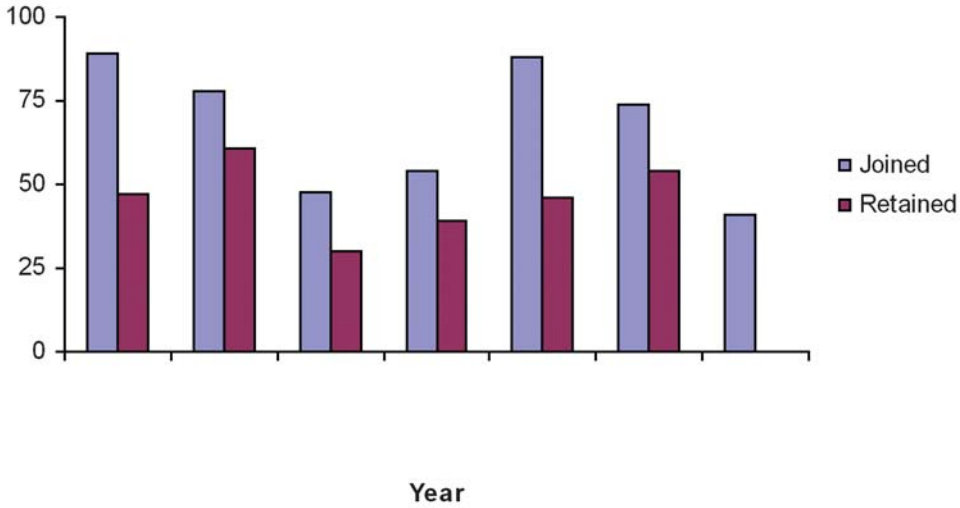

Figure 2. Number of British Society for Plant Pathology members who joined in a specific year retained to 2005. Eighty-nine "Founder members" founded the Society in September 1981.

How Are Honorary Members Elected?

Honorary Membership of BSPP is the highest Honour the Society can confer on a person and lasts the lifetime of the recipient. Election to this position is a matter taken very seriously by your Board and the purpose of this short note is to outline the procedures taken in granting the Honour.

Who is eligible? Technically anyone could be considered but in practice Honorary members are normally distinguished plant pathologists who have made a significant contribution to the art or science of plant pathology. Defining 'significant contribution' is not easy but is best thought of as a sustained scientific, internationally recognised contribution over a period of time. The total contribution could comprise elements from one or more areas such as education, research, advisory/extension work but must set the incumbent above others in terms of personal achievement. The Honorary Member does not have to be a member of BSPP before election.

The election of Honorary Members is a Board function and, as such, there is no 'call for nominees' via the general membership, although general members are able to suggest names for consideration for nomination by a Board member. Suitable people are then nominated by a Board Member or group of Board Members and considered for Honorary Membership by the Board. It is expected that nominees are unaware of their nomination.

Nominations are usually considered at the autumn (September) Board meeting each year, but this is not a rule. Nominations are sent to the Secretary in writing, enclosing a case setting out why the person nominated should be granted Honorary status. This case is distributed to all Board Members in advance of the meeting and treated in strictest confidence. Nominations are then considered by the Board with all Board Members present being free to add comments and pose questions. Should a Board Member or Members be absent from the meeting, a procedure exists for them to make their opinions known to other Members of the Board.

There is no limit on the number of Honorary Members elected at any one time and no requirement to elect an Honorary Member at any time if no nominee is deemed suitable. There is no limit on the number of Honorary Members the Society may have at any one time.

Once a decision is reached to grant the Honour, the President will contact the person(s) to inform him/her of the Honour with, normally, an invitation to formally accept the award from the President at the Presidential Meeting. Once accepted, the Honour is made public via Plant Pathology.

Phil Russell

Regional Meetings

South/South West Universities

On February 7 2005, groups from the Universities of Exeter, Bristol, West of England (UWE), Southampton, Oxford and Bath braved the fog and descended on the University of Bath for a one-day meeting. It was gratifying that this first gathering attracted 46 researchers, suggesting that the field is alive and well. In reality we all know that funding is notoriously fickle and patchy. Which is a good reason to go regional and collaborate.

Each group offered representative aspects of current work. In some cases this was done by the PI providing an overview, other groups encouraged (delegated?) to post docs and post grads. The range and quality was excellent in my view.

In brief, speakers and topics were:
Research at UWE included Richard Amey's (working with Peter Spencer-Philips) description of proteomics and pea downy mildew with a hope to find early disease biomarkers (with applicability to other diseases), then Dawn Arnold described her work on bacterial genomic islands and pathogenicity; race changes of *Pseudomonas syringae* pv *phaseolicola* induced by selection pressure in resistant varieties was especially striking.

Mark Dixon from Southampton then described resistance gene structure and considered the engineering of R genes; Mark Barber showed a system for *Arabidopsis* lignification mutants, which had taken some time to develop, as *Arabidopsis* apparently does not readily produce wound-induced lignin. *Magnaporthe grisea* research from Nick Talbot's lab at Exeter covered secretion (Martin Gilbert) including mutants with much reduced secretion of amylase yet normal production of wall-degrading enzymes; oxidative burst (Martin Egan) revealing the need for reactive oxygen as part of appressorium formation and the phylogeny and role in pathogenicity of *nox* genes, and MAPK (Zac Cartright) deletion of which has profound effects on aerial morphology, conidiation and wall structure.
To illustrate recent work here at Bath on attack and defence I gave snapshots of our findings on bacterial polymers in defence suppression, fungal depolymerases in saprotrophic and parasitic fungi, and resistance to vascular pathogens, including upregulated genes and localised accumulation of elemental sulphur in some species. Robert Rees also from Bath covered biological control of *Ganoderma* of oil palm, which added a tropical feel to this winter's day. However, he did not need to add to this effect by showing an image of his freely perspiring, red-faced supervisor sawing at a palm in Sumatra.

From Oxford, a wide range of work on fungal pathogens was described by Sarah Gurr,ranging from cutinases and catalases of powdery mildews, to keratin-degrading *Trichophyton* the causal agent of athletes' foot (did we need to see its gory consequences?), to a laccase-driven biofuel cell. Gail Preston using full cartoon imagery then focussed on plant-associated pseudomonads; why do they have hrp genes and are type III secreted products there to interact with other plant-associated organisms such as nematodes?
Bristol's contribution from Gary Foster's and Andy Bailey's groups was Lisa Gow on exotically named strains of PVY such as stipple streak, and Risha Patel on gene silencing in *Botrytis cinerea* to identify new antifungal targets; although not mainline plant pathology, we allowed Patrick Collopy to reveal the devastation that *Verticillium fungicola* can cause to commercial mushroom production, some of its potential pathogenicity genes and transformation with *Agrobacterium*; also *Agaricus* and *Coprinus*

developing molecular technologies were outlined by Mary Heneghan.

Clearly one aim of regional meetings such as this is to encourage collaboration, and sharing of techniques and equipment when driving times are short. In future meetings (and there was clear support for this) perhaps we will programme more time for discussion. This time we were all perhaps understandably keen to relay our interests and achievements.

For those without car journeys (Bath, Bristol, UWE) the evening continued at local hostelries and restaurant; enough said.

We are grateful for the encouragement and financial support of BSPP for this meeting.

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Yorkshire joins the Midlands – eventually!'

In 2004, whilst President of BSPP, Stuart Wale proposed that we should try to hold more regional meetings to help foster links amongst the plant pathology community. So a year on, Yorkshire joined the Midlands (despite our best efforts to block the border on the M1 south of Sheffield) and the Midlands / Yorkshire BSPP community held a one day meeting at the Sutton Bonington Campus of the University of Nottingham on 28th June 2005. With about 50 participants from Warwick HRI, Harper Adams, CSL York and Nottingham, and apologies from Birmingham, Sheffield, ADAS Drayton and Nottingham Trent, the meeting covered all aspects of plant pathology and showed that research in the region remains vibrant and cutting edge.

Warwick HRI single-handedly covered virology (John Walsh), mushroom pathology (Peter Mills), biological and integrated control (John Whipps), oomycetes (Jim Beynon) and resistance genes / avirulence determinants (Jim Beynon and John Walsh). The technologies being used ranged from molecular diagnostics, through analysis of gene expression to epidemiological studies, and highlighted the impressive expertise and dynamism of the research staff at Wellesbourne. Simon Edwards from Harper Adams was similarly able to show how the research there was combining molecular diagnostics with agronomic practices in studies on mycotoxin contamination in cereals caused by *Fusarium spp*. and on *Rhizoctonia* on potatoes. Work on *Fusarium* was also highlighted at Nottingham (Steve Rossall), where microencapsulation of fungicides was being tested as a means of targeting their application, whilst other work highlighted at Nottingham included the analysis of mating-type genes in eyespot and *Aspergillus spp*. (Paul Dyer), and analysis of gene expression in the cereal rust fungi (Matt Dickinson). Molecular diagnostics was also being used at Nottingham both for phytoplasma diagnostics (Matt Dickinson) and for analysis of microbial contamination of salad vegetables (Matt Dickinson and Steve Rossall). The popularity of plant pathology teaching at Nottingham was also noted – undergraduate student numbers currently exceed 100 on our second year pathology module, and range between 40 and 90 on our three third year modules. Development and implementation of diagnostics was the main theme of the presentations from CSL (along with the problems of travelling down the M1 which delayed their arrival by an hour). Rick Mumford gave a clear overview of the

extent of plant pathology expertise at CSL, Belinda Phillipson discussed the importance of consultancy work both in import and export of plant material and in development of plant health policy. Giles Budge talked about the development of DNA and monoclonal antibody-based diagnostic techniques, including the infamous potato 'chip' for identifying a range of potato pathogens, Steve Parker discussed the development and uptake of user-friendly decision support systems, including the 'cropmonitor' system, and Nicola Spence discussed the importance of international development, especially in training personnel in Africa and eastern Europe in diagnostic and crop protection techniques.

Then it was time to discuss a follow-up meeting in 2006, pose for the obligatory group photo (below), and the journeys home. The general consensus was that the meeting was a great success. It was particularly good to hear that so much is going on in the Midlands / Yorkshire area, and that there is such a dedicated and relatively youthful group of people with similar interests and complementary expertise. From an organisers perspective, I just wish it could be made as easy and straightforward for us all to get the research money we crave as it is to organise such an enthusiastic and well-motivated group of researchers to talk about their work.

Matt Dickinson

Under-graduate bursary report

An Investigation into the Effect of the Avirulence Gene avrPpiG on Plant Cell Signalling in Bean and Arabidopsis.

For my project I worked with the Molecular Genetics Group in the Faculty of Applied Sciences at the University of the West of England. Along with Natalie Gray, another second year summer project student, we carried on and expanded the research that was on going in the lab. Work in the lab is centred on molecular genetics and involves plant pathogenic bacteria. Our project aimed to investigate the activation and inactivation of MAPK in bean and Arabidopsis via the use of in-gel MAPK assays after infiltration of the leaves with *Pseudomonas syringae* pathovars with and without *avrPpiG* expressed in them.

When pathogenic bacteria are introduced into plant leaves they secrete proteins encoded by virulence and avirulence genes, some of which alert the cell to the pathogens presence. The aviruence gene *avrPpiG* was isolated from *Pseudomonas syringae pv. pisi* by Dr Dawn Arnold, my supervisor. It produces a hypersensitive response (HR) in bean pods and leaves when conjugated with *Pseudomonas syringae pv. phaseolicola (Pph)* strains 1448A and RW60. The HR is a programmed cell death that results in localised tissue necrosis and forms part of the plants defence mechanism.

When homology searches were conducted AvrPpiG was shown to be very similar to YopP and YopJ, proteins present in animal pathogens such as *Yersinis pestis* and also to AvrBsT and AvrRxv which are encoded by avirulence genes in *Xanthomonas campestris* and elicit HR on tomato plants. All five have three highly conserved amino acids which are present in their protein sequences. These consist of a histidine glutamine and cytosine and in YopP these three form the catalytic triad or active site.

As YopP and YopJ inhibit their host's immune response by preventing activation via the phosphorylation of the MAPK pathway, it is thought that *avrPpiG* may work in the same way, due to its strong homology. However preliminary in-gel MAPK assays failed to show any difference in MAPK activity between the gene *avrPpiG* and the vector pBBR1MCS (containing no gene) tested. An MgCl2 control was used and this showed similar although fainter bands on the autoradiograph film suggesting the MAPK activity observed may be partly due to a wounding effect, caused upon inoculation. Timescale may also be a factor, the longest period of time leaf material was harvested after inoculation was thirty minutes. Longer periods of time may be necessary for MAPK activity to be visible.

Previously, three site-directed mutants of the *avrPpiG* gene had been generated, each with one amino acid (from the catalytic triad) substituted for an alanine. I'm currently in the process of cloning the *avrPpiG* gene His-Ala mutant out of a narrow host range vector into a broad host range vector, pBBR1MCS. This can then be tested on plants to see if changing the histadine to an alanine renders the *avrPpiG* gene unable to elicit a HR in plants. MAPK assays could then be conducted to test this as well, if differences are observed.I also showed that the HR was apparent when four ecotypes of Arabidopsis were inoculated with *Pph* strain 1448A with *avrPpiG*. However the Pph strain without *avrPpiG* induces a strong disease response. This discovery means in-gel MAPK assays could be conducted using Arabidopsis to further investigate the reaction.

This project has proved to be very valuable in finding out more about the *avrPpiG* gene, and has provided a starting point for much further research into the subject. For me it was a tremendous experience, enabling me to work alongside accomplished researchers, develop my existing skills and knowledge as well as learn a great deal. I have thoroughly enjoyed the experience and hope to pursue a career in research following a PhD. Thank you BSPP for giving me this opportunity.

Helen Lovell
University of the West of England, Bristol

Fellowship report

In 2003, I had been first Head of the Department of Agricultural Botany, then Director of Research for the School of Plant Sciences for five years, and teaching at Reading for 13 years. I needed intellectual invigoration and the University agreed to grant me a year off teaching and administration, provided it didn't cost them anything. I needed to break my old habits, and I needed to learn something of the new molecular techniques I was increasingly "advising" my students on, from a delightfully, if near-criminally, ignorant point of view. John Lucas and Bart Fraaije of Rothamsted Research agreed to host me on a short attachment, and the BSPP fellowship committee agreed to fund me to do so. So I spent about 3-4 days a week at Rothamsted between October 2003 and January 2004, courtesy of BSPP. This is now some time ago, but the advantage of that is that I can see more clearly what I gained from the generosity of our membership (and the libraries which through *Plant Pathology* provide most of the society's funding!).

The scientific outcomes were somewhat different from those I originally proposed to the fellowship committee. I had suggested two projects, each with a different reason why it was inappropriate. One of the projects essentially duplicated work already under way – so I just dropped it; the other was over-ambitious and of lower priority than experiments to strengthen an existing collaborative project.

In all I did, I was completely dependent on the help and guidance of Dr Fraaije and colleagues, but for simplicity I will say that once, here.

What did I do? I extracted DNA from the complete series of Broadbalk seed sampled from the archive by Dr Bearchell and her helpers, and standardised it to a common concentration in each year. I showed that the most recent samples had high concentrations of high molecular weight DNA, but that this could not be seen in agarose gels of samples more than about ten years old. I amplified, cloned and sequenced the chloroplast ATPase gene from a representative sample of the wheat varieties used, in order to design real-time PCR primers and a probe which would detect wheat DNA throughout the series. I then used this to quantify the amplifiable DNA in Dr Bearchell's leaf/stem extracts and the seed extracts.

What did I find out? Only around 1% of the DNA present in the leaf/stem samples was of amplifiable quality, with no discernable trend over time and a range of variation between years of about 100-fold. By contrast the seed DNA – which was, as expected, much better preserved – had a strong and significant temporal trend. In the recent seed samples, about 70% of the DNA present was of amplifiable quality; this declined by about 1% per year in a fairly steady fashion. This work contributed to a collaborative paper in PNAS. Bart Fraaije has now quantified the *Phaeosphaeria nodorum* in these seed samples; they vary with time in more or less the same way as in the leaf samples analysed by Sarah Bearchell; we are preparing another, hopefully high profile, paper on the data.

The fellowship was immensely valuable. I learnt enough to comment on and discuss with some understanding colleagues' and students' work in real-time PCR and in molecular methods applied to population problems. Although the scientific results are worthwhile, I certainly gained more from observing work in another institution, still more from being back in the position of an active practical scientist, and most from intangibles such as

discovering what it is like to be in a new lab and completely helpless because you know neither how to do anything nor where anything is. In a curious way the three weeks spent hitting plastic bags of wheat seed laid on an engineering brick with a 2 kg lump hammer were very restful: no-one interrupted me, I went to no departmental meetings, I was asked to make no impossible decisions. I hope I can learn too from the subtle and thoughtful way in which Bart Fraaije suggested work which was worthwhile yet simple enough for me to acquire a sense of achievement. I hope my supervisory and management practice will be improved by reflection on this, but I am not sure: maybe I should simply be grateful!

A year and more on, I am more than ever convinced of the immense value of this period. I learnt more than I realised about the use of molecular techniques and the culture they are embedded in. There is a synergy in learning, or at least in my learning, so that nothing becomes real until it can be related to a physical manipulation. When I read a PCR protocol now, I can feel what it means, in the same way as I can if I read a measurement of disease severity. This practical element is being eroded everywhere in our educational system, in the name of efficiency, but at least I have a personal experience with which to reinforce arguments against yet further erosion of the soil of real understanding. There is also a relevance to career structures: in a scientific career of 40 years or more, there have to be periods of real physical research work throughout the career if a worker is to retain their creativity.

So, in summary, I am very grateful indeed to the society for its support and the simplicity of its procedures. I know of no other body which would support this kind of tangential, capacity-building work. Thanks to BSPP and thanks again to Rothamsted Research and all those there who contributed so much to make my time enjoyable as well as valuable!

Michael Shaw
University of Reading

Discovery, Development and Delivery in Plant Pathology: 7th Conference of the European Foundation for Plant Pathology & British Society for Plant Pathology Presidential Meeting,

5-10 September 2004, Aberdeen.

Plant Pathology research at UWE covers both fundamental biology (eg proteomic analysis of downy mildew of peas and metabolic profiling of bacterial diseases of potatoes) as well as more applied aspects (such as development of biosensors and 'electronic noses' for early detection of infection in the field). Thus a meeting that drew together discovery, development and delivery was particularly welcome. Some aspects were of greater relevance to our specific interests, and so we focus in this report on biotrophic infections, pathogen detection and potato pathology.

Presentations in the 'discovery' session started with the *Hyaloperonospora parasitica/Arabidopsis* downy mildew pathosystem. Jim Beynon showed how analysis of pathogen genes can provide fundamental information on mechanisms of pathogenicity and host defence. He focussed on 'pathogenicity effector molecules', which include proteins likely to suppress defence mechanisms, alter host metabolism and modulate gene transcription. Three approaches were described: map-based cloning to identify avirulence genes; suppressive subtractive hybridisation to detect genes encoding proteins likely to be exported from pathogen cells and thus be candidate pathogenicity effectors; genomics, where recently released *Phytophthora* sequences provide exciting opportunities for comparative genomics of oomycetes. These libraries will also help those of us using a proteomics approach to identify proteins that are differentially regulated during infection. An example of the value of functional genomics was given by Sophien Kamoun for *Phytophthora infestans*. Data mining of sequence databases identified 18 extracellular protease inhibitor genes that appear to be deployed by the pathogen to suppress host defence responses. This provided an intriguing insight into the complexity of even just this single aspect of host-pathogen interaction, with a cascade of inhibitors matching a cascade of host proteases.

Proteomics has been applied by the Aberdeen Oomycete Group to identify proteins produced by appressoria and other pre-invasion structures formed by *P. infestans*. Proteins key to successful infection include those involved in amino acid and cellulose biosynthesis. The specific aim of a proteomic analysis of downy mildew infected peas, described in our first presentation, was to identify biomarkers that could be used in biosensor devices for pre-symptomatic diagnosis of infection in the field. This demonstrated a role for proteomics beyond the gleaning of fundamental information about host-pathogen interactions, bridging the gap between discovery and delivery.

cDNA-AFLP isolation of gene fragments from compatible interactions in leaf rust of wheat, caused by *Puccinia triticina*, was shown by Matt Dickinson to have enabled a variety of techniques to identify host and pathogen genes expressed at specific times during the infection process. The largest group of fungal genes had a metabolic function, whilst the plant genes typically had stress functions. Of the fungal genes, about 30% had no significant homology in databases. A similar situation was reported by David Collinge for barley powdery mildew, where a differential display mRNA approach

had identified some 36 genes up-regulated in infected epidermal cells. Whilst 5 and 9 transcripts were identified as plant and fungal respectively, a further 22 were unidentified. This is a common problem in research at the gene and protein levels, as these 'unknowns' may include the key effectors of compatibility and resistance. The focus for wheat rust is now on further functional analysis and localisation of expression in *planta*, whilst proteomics will be applied to screen for key proteins in the barley powdery mildew interaction.

The 'development' session was launched by Gerry Saddler's overview of potato brown rot caused by *Ralstonia solanacearum*. He used two very different case studies to illustrate approaches to control. In Kenya, where brown rot is well established and now present in 71% of fields causing a 50% yield loss, biocontrol using avirulent mutants will be incorporated into integrated pest management schemes. Brown rot has been present in the UK since 1995, but out of about 10,000 samples of tubers tested, only 5 ware stocks have proved positive for the infection. Eradication of the indigenous alternate host *(Solanum dulcamara)* from the River Tay has eliminated what appears to have been one single introduction of the pathogen. Thus in the UK, exclusion and eradication are the main control strategies. This requires development of rigorous and reliable methods for detection, for example using an array of molecular diagnostics as reviewed by Rick Mumford. An alternative approach, using electronic sensors to detect finger-print volatile organic compounds for brown rot and ring rot within bulk quantities of imported potato tubers, was explored in our second contribution.

Serious concerns about fungicide resistance, not least to the relatively new strobilurins, means that reliance on fungicides for disease control is not sustainable. Although this message from Simon Oxley was not new, the stark reality is that often there is not much else in place to help control pathogenic fungi. The need for a shift away from fungicides and towards greater emphasis on host resistance was emphasised again by Peter Gladders in the 'delivery' session. With cultivars of crops generally selected for agronomic (yield) reasons instead of resistance to pathogens (explored by Didier Andrivon for potatoes and *P. infestans* in France), it was refreshing to learn of the co-ordinated, pre-emptive breeding programmes for resistance to cereal rust in Australia. Robert Park described how these have been used to incorporate resistance to rusts not yet present there, as well as for targeting endemic diseases by anticipating changes in the pathogen population. He estimated that this approach had saved the Australian grain industry some AUS$100 million. By comparison, it cost AUS$40 million in chemicals to control wheat stripe rust in 2003 following its appearance a year before, whilst US$184 million over 8-10 years is needed to develop just one new fungicide (Karl Kuck, Bayer CropScience).

In many parts of the world, safe and effective fungicides are beyond the reach of those farmers who may live on little more that one US$ a day. The problems of 'delivery' (ie converting R&D into practical messages) in resource-poor developing countries were addressed by Rebecca Nelson. Central issues were the choice of communication strategy, for example through setting up 'farmer field schools' and the use of mass media, as well as awareness of the social and cultural context within which any new pest management approaches should be implemented. The latter was illustrated by Solveig Danielson in relation to seed quality as a prerequisite for successful crop production of potato in Uganda and rice in Bangladesh. Eric Boa introduced 'ethnopathology', the study of local farmers' knowledge about the diseases affecting their crops. This has very practical applications for those providing advice on plant health in developing

countries. For example, aphids on peach, peach leaf curl and smut on maize are all known by the same name in Bolivia, but clearly need very different control strategies.

Aberdeen had greeted us with the sea and sky matching its grey granite buildings, perhaps reflecting the serious nature of the challenge facing plant pathologists as their work contributes to food production. But the sun then shone from a clear blue sky for the rest of the conference, providing an appropriate back-drop for a meeting that broadened horizons and illuminated the many facets of our discipline. We thank the BSPP for providing travel grants, and the organisers of both the scientific and social programmes for their excellent planning and delivery. Finally, a special thanks to Steve Woodward and Janice Brodie for the post-meeting foray to a pine forest and whisky distillery... some of us never tire in our pursuit of fungi and their products!

Richard Amey & Peter Spencer-Phillips
University of the West of England, Bristol

Steve Woodward (in red) leading the post-meeting foray

European Whitefly Symposium, Cavtat, Croatia

In October 2004 I attended the 2nd European Whitefly Symposium, held in Cavtat, Croatia. This second symposium followed the inaugural symposium held three years earlier in Ragusa, Sicily and followed on from its success. The conference, which lasted for four days, attracted over 150 delegates from far and wide and we welcomed many from the Far East and the Americas to join us under the European banner of the meeting. The conference itself was held in the beautiful coastal resort of Cavtat, which was almost as close to the airport as I live from Heathrow, but without the accompanying 36 second interval plane arrivals. Delegates were mainly accommodated in two hotels, the larger of which, The Hotel Croatia, was the venue for the symposium. With almost two days free before a Tuesday start to the meeting many of the delegates got themselves into a relaxed mood for the upcoming presentations and renewal of friendships and collaborations.

Because of the nature of the subject matter of the meeting the overall theme was naturally multi-disciplinary covering everything whitefly-related including faunistics, systematics and ecology, chemical and physical controls, integrated pest management and biological control, whitefly-natural enemies and whitefly-transmitted viruses and epidemiology. The latter is my specialist topic but this did not prevent my attendance or interest in a wide-ranging programme of talks on these topics.

The symposium began with an official opening ceremony that included short speeches from representatives of regional government (the county of Dubrovnik & Neretva and the Konavli region) and the Croatian Ministry of Agriculture, Forestry and Water Management. Once the formalities of the opening ceremonies and welcome to Croatia by our fine hosts from the Institute for Adriatic Crops and Karst Reclamation headed by Dr Katja Zanic were behind us it was full-speed ahead to three full days of scientific presentations, including over 30 oral presentations and some excellent posters. The enormous diversity of whiteflies and their global movement, assisted by man, air travel and climate change together with their impact on plants either as pests or vectors of virus disease set an ideal backdrop as to what was to follow on all of the above aspects.

In terms of whitefly-transmitted viruses the presentations fell squarely down the middle and concerned the DNA-containing Geminiviruses, which contain one of the smallest plant virus genomes, and the RNA-containing Criniviruses, which are members of the closterovirus family and contain the largest plant virus genomes. There are a number of other viruses that are whitefly-transmitted but these were not mentioned in detail. An excellent review by Stephan Winter from Germany of the worldwide distribution and agricultural impact of all whitefly-transmitted viruses, together with known details of their biology, molecular biology and epidemiology set the scene for the day's proceedings. The current status of cassava Begomoviruses, the most serious constraint to the production of cassava, a major staple food crop in sub-Saharan Africa, was reviewed in relation to their distribution, effects, aetiology, and epidemiology. The dynamics of the exquisite relationship between the whitefly vectors and the viruses they transmitted was the theme for several of the talks which illustrated that a subtle balance existed to determine which whitefly vector species, whether it be *Trialeurodes vaporariorum* or *Bemisia tabaci* of differing biotypes, predominated in any one particular geographical location. Subsequent virus infection could then be transient and managed by the introduction of better phyto-hygenic practice or resistant/tolerant cultivars, as

illustrated by Herve Lecoq in France and in California or variable in terms of the predominant whitefly species, as shown by several laboratories in Almeria, Spain where the displacement of *Trialeurodes vaporariorum* and its replacement by *Bemisia tabaci* meant the elimination of one virus, *Beet pseudo-yellows* virus and the appearance of another, *Cucurbit yellow stunting disorder virus*, which in turn has been replaced by another virus, *Cucumber vein yellowing virus* which is transmitted by a different biotype of *Bemisia tabaci.*

Geminiviruses then moved centre stage and new descriptions of the potential movement of Old World and New World types in both directions only confirmed just how mobile these diseases and their whitefly vectors are.
The enormous variety and number of geminivirus isolates described only served to illustrate that if you look hard enough there are many more viruses than you thought and the possibilities of synergism and silencing in multiply-infected plants, emphasised by more than one speaker, illustrated the dramatic effects that may ensue.
The contribution of the DNA beta satellite molecules to the pathogenicity of unipartite Begomoviruses was excellently described in talks from John Stanley and Rob Briddon. Here results on the biology of this intriguing phenomenon ranged from field observations to sophisticated molecular analysis.

As is normal for any meetings involving virologists and epidemiologists the week would not be complete without the mandatory visit to view infected plants in a field situation and this symposium was no exception. However this was no ordinary field trip as it involved visiting a massive valley devoted in October and through until Christmas to the production of mandarin orange. We saw the whole process through from field to supermarket and then experienced at first hand how most of the oranges reached the processing area via river and sampan. Following a 30 minute journey when I anticipated meeting Charlie Sheen at any moment we reached our lunch venue where we feasted on frogs legs and eels, well some of you did! But prior visits to screen houses growing a variety of salad crops illustrated the importance of this agriculture to the growing Croatian economy. Despite many of the delegates searching both crops and indigenous weeds, we only found very low numbers of whiteflies during the day. However, their presence, especially Bemisia tabaci, which is the vector of so many plant viruses, should be noted and carefully monitored. The situation experienced in southern Spain over the past decade demonstrates how rapidly this whitefly species can become a serious agricultural problem.

Following the final days session which culminated in a visit to the future by Henryk Czosnek, who invited all of us to join him and Judy Brown to collaborate and push forward the genomics of *Bemisia tabaci* in an effort to understand more of its biology and virus-transmission capabilities, we repaired to the walled city of Dubrovnik for the conference dinner which was as fine affair as were all of the other social functions throughout the meeting.

Many congratulations to Ian Bedford, Liz Robertson and David Oliver and their Croatian counterparts for organising an excellent meeting. They will be a hard act to follow in wheresoever the next meeting occurs in 2007. At the end of the meeting numerous enticing possibilities were offered to host the next symposium encouraging further global gallivanting.
I am indebted to the BSPP travel fund for financially supporting my attendance in Croatia.

Bob Coutts
Imperial College London

The 2nd International Symposium on Fusarium Head Blight

Orlando, Florida, USA. 11-15th December 2004

For the uninitiated, Fusarium head blight (FHB) is a disease of wheat and other cereals that is caused by *Fusarium* species, predominantly *F. graminearum* and *F. culmorum.* The disease is also known as Fusarium ear blight or scab and is of particular significance because trichothecene mycotoxins, produced by the fungus during colonisation, are harmful to human and animal consumers. The most prevalent of these mycotoxins are deoxynivalenol (DON) and nivalenol (NIV) although other, more toxic compounds, are produced by some of the Fusarium species associated with FHB.

The First International Symposium had taken place in Suzhou, China in 2000. The choice of venue had been most appropriate as this was the origin of the wheat variety Sumai3, which is the source of FHB resistance most utilised in plant breeding programmes around the world. The venue of the 2nd International Symposium could boast no similar claim, but did provide an excellent environment and facilities for the 320 delegates who descended upon Orlando for this meeting. The symposium brought together, from across the globe, scientists who have significant research interests in FHB. It provided a unique opportunity to hear, first hand, from those working in diverse areas relating to this disease. The breadth of the conference provided a holistic view of FHB, from incidence, effects and control, through to forecasting and food safety, including political considerations related to consumer risks. Attendance at this symposium provided an opportunity to present our FHB work to a global audience and to stimulate dialogue and collaboration with researchers who may have been known previously only as names on scientific publications. Most importantly, the symposium brought together scientists from Europe, USA and elsewhere and enabled them to identify areas for potential collaboration as well as aspects that require concerted effort if this disease is to be effectively controlled.

The conference opened with a presentation by Richard Emerson of Busch Agricultural Resources, USA who described the impact of this disease on the USA malting and brewing industry. As FHB took hold in the USA, affected regions became unsuitable for producing malting barley and malting houses also relocated to minimise the length of transport chains. The industry does not accept any detectable DON in grain used for malting and brewing. It appears that the brewing industry wishes to have only a single toxin in its product!

This reminder of the impact of this disease on one part of the food and feed chain was followed by the Plenary Session, consisting of three presentations. Bikram Gill of Kansas State University began with a talk centring upon the cereal hosts. This presentation described the genetic similarities between cereals, including conservation of synteny across rice, wheat, barley and other cereal crops. These similarities have been exploited in the generation of genetic maps and the use of comparative genetics. Within wheat, cytogenetic stocks have been used extensively to identify the location of genes. Currently, expressed sequence tags (ESTs) are being mapped onto lines carrying known deletions on specific chromosomes which allows the ESTs to be assigned to 'bins' that correspond to particular parts of chromosomes. Thus, where mapping indicates that genes for resistance are located in particular regions, candidate resistance genes can immediately be identified from within the relevant 'bin'. Other resources that have been developed will aid efforts to clone genes from wheat, including those

responsible for resistance to FHB. Large insert-size DNA (bacterial artificial chromosome (BAC)) libraries have been produced to enable map-based cloning approaches to be undertaken. The recently released Affymetrix GeneChip for wheat will permit the expression of 1000's of genes to be monitored in response to infection by Fusarium species to identify those associated with resistance/susceptibility. These resources should contribute greatly to understanding the basis of resistance/susceptibility of wheat and other cereals to FHB.

The second talk centred upon genomics of *F. graminearum* and was given by Corby Kistler of USDA-ARS. He described the production of the recently assembled first-draft of the genome sequence of this fungus. Annotation is being improved by reference to *F. graminearum* ESTs identified by researchers world-wide. An Affymetrix Gene-Chip has also been produced for this fungus and this tool will enable in-depth investigation of gene regulation within *F. graminearum* during colonisation of hosts and during the saprophytic phase of the life-cycle of this fungus. He also described research to produce mutants within *F. graminearum* with which to identify genes associated with pathogenicity and virulence of this fungus.

The final talk of this session was presented by Paul Nicholson, who brought together the partners involved in this disease and gave an overview of the current state of knowledge of the host-pathogen interaction and, perhaps more importantly, what is not known. This presentation also highlighted aspects of pathogen-pathogen interactions in FHB. In those regions where toxin-producing and non-toxin producing species form disease complexes the competitive interactions between pathogens has important consequences for disease and subsequent risks to consumers associated with the consumption of mycotoxin contaminated cereals or their products. While genomics and molecular diagnostic tools are beginning to shed light on some of the host-pathogen and pathogen-pathogen interactions much remains to be learned. Further insights into the study of FHB and progress towards controlling this disease were forthcoming in subsequent sessions.

The second session focussed on host plant resistance and variety development. Durable natural resistance in host cereals is the most cost effective and appealing disease control strategy for FHB. Keeping this in consideration and the fact that variety development in the United States is carried out primarily by research labs at universities and USDA stations, this research session was allocated the most time for talks and poster presentations. A plenary talk by Maarten van Ginkel from CIMMYT, Mexico and Tomohiro Ban from CIMMYT-JIRCAS kicked off the proceedings. Their talk centred on global progress in identifying and deploying resistance genes against FHB. They stressed that FHB resistance is a polygenic trait and several QTLs have been identified that contribute to resistance. Maarten van Ginkel highlighted a range of factors that needed to be considered while developing FHB resistance varieties such as multiple alleles, linkage disequilibrium, pleitropy and epistatic gene effects. Tomohiro Ban continued the talk summarising key QTLs associated with different components of the host plant's defence arsenal against FHB.

Jim Anderson from the University of Minnesota presented an update on the quest to clone the gene or genes responsible for the best FHB resistance characterised so far, residing on the short arm of chromosome 3 (3BS). He stressed that the main strategy for elucidating the molecular genetics of FHB resistance was to locate molecular markers that segregated closely or were linked to the resistance gene of interest. His results showed that the QTL was thought to lie in an interval spanning

0.5cM and the group were developing markers to clone and identify the gene. Hermann Buerstmayr from IFA-Tulln, Austria and Hirokazu Honda from the National Institute of Agrobiological Sciences, Japan both gave stimulating talks about the progress on mapping FHB resistance QTLs, giving a European and South Asian perspective respectively. Daryl Somers from Agri-Food Canada presented similar progress in Canada and highlighted strategies to introgress resistance QTLs in breeding lines. Six other talks were included in this session covering resistance to the mycotoxin deoxynivalenol, FHB resistance in European wheat breeding programs, utilisation of alien translocation lines to introgress novel QTLs, and progress in identifying FHB resistance QTLs in barley.

The third session focussed on genetic engineering. There were six talks in this session arguing the case for transgenic control of FHB with interesting strategies. Stephen Baenziger from the University of Nebraska got the ball rolling with a plenary talk on wheat transformation. He highlighted the relative difficulty in transforming a hexaploid genome of over 16000mb, but argued that Agrobacterium mediated transformation could be employed to increase the frequency of gene integration events, and presented work on incorporating anti-fungal proteins and inhibitors of programmed cell death to enhance FHB resistance. Ron Skadsen from the USDA labs in California gave an interesting talk on the use of host tissue specific promoters that could be designed to target anti-fungal gene expression during the short window of Fusarium infection. Jyoti Shah from Kansas State University discussed the successful incorporation of an arabidopsis resistance gene in wheat that increased FHB resistance. Other talks in this session further highlighted transgenic approaches to combat FHB.

Session four focused on the use of chemical, cultural and biological control for reducing the effects of FHB. The main point to come from this session, one emphasised by all speakers, was that an integrated control strategy was the one most likely to be succeed. The session opened with Friedrich Kerz-Möhlendick (Bayer CropSciences Ag) describing the control achieved using DMI (demethylation inhibitors) fungicides, in particular the new active prothioconazole. Philip Jennings (Central Science Laboratory, UK) continued on the fungicide theme by looking at the effect of timing and application rate on fungicide efficacy. He indicated that optimum control could be achieved if an appropriate product was used at the manufacturers recommended rate and applied during crop flowering within 2-3 days of inoculum arriving at the ear (this presentation was cut tragically short due to a lack of blood to the brain[1]). The third presentation on fungicides was given by Gary Van Ee (Michigan State University, USA) who showed how greater chemical deposition on the ear could be achieved using two flat fan nozzles one angled forward and the other backwards, especially when the nozzles were angle at 60∞ from the vertical. Ruth Dill-Macky (University of Minnesota, USA) and Wilfred Hermann (University of Hohenheim, Germany) both looked at how cultural practices could reduce levels of FHB. They highlighted that the principle factors to consider were previous crop (try not to grow wheat following maize), tillage (minimum or no till gave highest disease levels) and use of fertilisers/green manures to help increase residue decomposition. The final two presentations in this session examined the role of biological control. Gary Bergstrom (Cornell University, USA) set the scene and was followed by Jeannie Gilbert (Agriculture and Agri-food Canada) who showed results from three projects which examined the usefulness of *Cochliobolus sativus,*

[1] Phil & I have a long-standing disagreement about whether FEB or septoria is the most interesting disease of wheat. He continues to claim, despite any plausible medical explanation to the contrary, that his faint was not associated with the soporific effect of fusarium! Ed.

Pseudomonas chloraphis, Bacillus amyloliquefaciens, B. subtilis and *Trichoderma harzianum* in the control of *F. graminearum.*

The fifth session was a short one dealing with food safety. Hans van Egmond started by detailing the worldwide regulations for fusarium mycotoxins as determined by a FAO investigation in 2003. Jim Pestka then covered the known adverse health affects of trichothecene mycotoxins and Antonio Logrieco detailed the occurrence of beauvericin and enniatins within European cereals.

The sixth session covered pathogenesis, epidemiology and disease forecasting. This session had two presentations detailing the US and Canadian forecasting systems which aid fungicide spray decisions and predict mycotoxin contamination at harvest by Larry Madden and Art Schaafsma respectively. Naresh Magan presented results from in *vitro* and in *vivo* interaction studies which should how other grain mycoflora can affect the growth and mycotoxin production of *Fusarium* species. Other presentations covered ultrastructural studies of the infection process, the use of real-time PCR to study epidemiology and the use of mycotoxin-negative mutants to determine the role of mycotoxins as pathogenicity factors.

The seventh and final session detailed taxonomy, population genetics and genomics. This session almost solely covered *Fusarium graminearum*. Overall the session indicated that with the aid of the genome sequence and microarrays there is an opportunity for a rapid advance in the understanding of this species complex.

Overall the 2nd International Symposium on Fusarium Head Blight was a great success. The venue, facilities and organisation were excellent. The main benefit was the opportunity to meet researchers from the around the world, in particular the large contingent of US and Canadian scientists present. One unusual feature of this International Symposium was the attendance by a number of farmers. The discussions greatly benefited from their feedback as to what results were useful to them, what questions they needed answering and what anecdotal evidence they had which supported, or otherwise, the scientific evidence. Over 320 scientists, growers, and industry representatives from 27 different countries participated in this Symposium. It was the largest gathering to date of scientists and stakeholders working on combating this disease.

Finally, a date for your diaries. The next International Fusarium Head Blight Symposium is due to take place in Szeged, Hungary in August 2008, timed to link with the Torino ICPP congress.

Paul Nicholson
John Innes Centre, Norwich

Phil Jennings
CSL, York

Simon Edwards
Harper Adams University College, Shropshire

Arsalan Daudi
Rothamsted Research, Harpenden

Selected highlights of the Sudden Oak Death Second Science Symposium

January 18-21 2005, Monterey, California, USA

In California in 1995 the highly damaging tree disease Sudden Oak Death (SOD) was first noticed and in 2002 the causal agent was shown to be *Phytophthora ramorum*. *P. ramorum* is now found to be causing significant damage to trees and a range of native and ornamental plants in California, Oregon and a number of European countries, including the UK. Thanks to funding from BSPP and Forest Research UK I was able to attend the SOD second science symposium in January this year, and present a paper on the distribution and etiology of aerial stem infections of *P. ramorum* and *P. kernoviae* (another newly identified Phytophthora species) in the UK. The aim of the meeting was to provide an update on the current status of research being carried out on *P. ramorum* in the USA and Europe. Approximately 300 people were in attendance from 11 countries. The initial sessions concentrated regulatory issues with particular reference to the nursery trade whilst the remaining sessions focussed on the biology (including fungal diversity, etiology, epidemiology and ecology), genetics (particularly diagnostics) and disease management, including eradication. Some of the key areas are covered below.

Biology

One issue that arose in a number of the talks was the variation among and between the European and American populations of *P. ramorum* and the potential for sexual recombination. Several studies show European isolates to be predominately of A1 and American isolates of A2 sexual compatibility (or mating) type. In terms of phenotypic characteristics, the European and the American groups can be discriminated, European isolates having faster growth rates on agar over a narrow range and also producing larger mean lesion areas (i.e. having greater aggressiveness) when wound inoculations on tree stems are carried out. In addition, the colony morphologies of the European isolates tend to be uniform, whilst the American isolates are morphologically more variable and unstable. In contrast, other studies using microsatellites and AFLP analysis showed less neutral DNA variation in the Californian/Oregon population than in the European population. Several laboratories have successfully mated isolates of the European A1 and American A2 population types. However, gametangial production is very sparse, and high abortion rates of oospores (60-70%) have been found. To date there has only been one finding of an A2 sexual compatibility type in Europe. This isolate displayed typical European phenotypic characteristics. In America, there have been reports of isolates of the A1 mating type and European phenotype in several nurseries in Oregon, and in one nursery in Washington, alongside American A2 types. In addition an isolate has been found that contains unique microsatellite alleles as well as alleles exclusive to both the European and American population types. This is believed to be a new and unique genotype resulting from a further introduction into America.

Evidence that *P. ramorum* can occur in the xylem of trees was reported in several papers, a finding which has implications for control and risk analysis. One of the studies used magnetic resonance imaging and found that lesion development could extend up to 5cm into the xylem of *Quercus agrifolia* (coast live oak). In addition, the ray cells were shown to connect laterally between the inner xylem and outer periderm, and appeared to have *P. ramorum* hyphae growing through them. These ray cells also exhibited high water concentrations, which was also a feature of the damaged tissues of the lesion area.

Interestingly, as a result of the *P. ramorum* surveys being carried out in the UK, California and Oregon, a large number of other *Phytophthora* species are being isolated from streams, soil foliar and bark samples. Although some of these species are considered to be endemic to the areas involved (e.g. *P. citricola, P. cambivora* and *P. gonapodyides*), they are "acting differently", causing aerial stem lesions opposed to collar or root or shoot lesions. In addition, previously undescribed species are being found which appear to be additional recent invasive causing significant stem lesions and tree mortality such as *P. kernoviae* sp. nov. in the UK, and endemics causing lower levels of damage, such as *P. nemorosa* sp. nov. in the US.

Diagnostics

A lot of effort is being put into the development of DNA-based diagnostic systems including the field based TaqMan® real time PCR methods, single strand conformational polymorphism (SSCP) and microsatellites. Although all the methods discussed have potential for use in diagnostics, most also have their own particular limitations.

Completion of the genome sequence of *P. ramorum* was reported. Its possible implications for use was discussed in general terms. One such application was the possible identification of improved genetic markers, such as noval microsatellite markers for diagnostics.

Management

In California, where the disease is widespread north and south of the San Francisco bay area, the emphasis appears to be on containment and management of *P. ramorum* opposed to eradication. However in Oregon, where the disease is confined to a relatively small area in the south-west (Brookings), an intensive eradication programme was established after the initial discovery of *P. ramorum* in July 2001. Initially the approach used was to fell and burn every potential host within 20m of a diseased plant, with all the litter being raked and burnt. Post-eradication surveys found that *P. ramorum* had survived on sprouts associated with the cut stumps of tan oak (*Lithocarpus densiflorus*) and other hosts. These are now treated with 10% glyphosate, a herbicide, at the time of felling. Although the number of disease sites has increased since the eradication programme began, with 7 sites still undergoing treatment, the number of infected trees is decreasing. However, even where the eradication of *P. ramorum* on plant hosts appears to have been successful, the fungus is still detectable in the soil and in the streams.

In the UK the vast majority of *P. ramorum* infections have been found in nurseries and retail premises (c. 320). Around 75% of these have now been eradicated. However, outside nurseries, on managed and unmanaged land, only 11 of the 60 outbreaks have been eradicated to date.

After the meeting a number of delegates took part in a series of informal field trips to the Big Sur outbreak area to the south of Monterey. I also had the opportunity to visit ecologically distinct outbreak areas in central and Northern California and the eradication sites in south-west Oregon. In addition a visit was made to Oregon State University, Corvallis to see research in progress on SOD and to US Forest Service, Medford, Oregon to see control of *Phytophthora lateralis* on Port-Orford Cedar *(Chamaecyparis lawsoniana).*

Dr Anna Brown
Forest Research, Alice Holt Lodge

P. ramorum lesions on tan oak

Report on the 2nd Joint Conference of The International Working Groups on Legume and Vegetable Viruses

Fort Lauderdale, Florida, 10-14th April 2005

This stimulating international conference was held on April 10-14th in the Riverside Hotel in Fort Lauderdale, Florida. It was the Second Joint Conference of the International Working Groups on Legume and Vegetable Viruses. It marked the last stage in the merger of the two groups to form the new International Working Group on Legume and Vegetable Viruses (IWGLVV), this merger being ratified by a vote at the conference. The conference was attended by 45 participants from 15 different countries from five continents. There were 17 talks on vegetable viruses, nine on legume viruses and one that addressed both. There were also 17 posters on legume or vegetable virus topics. Presentations ranged from basic and molecular to ecological and applied, and there was a major emphasis on new and emerging plant viruses.

The programme commenced on Sunday 10th April with registration and a welcoming reception in the poolside area of the hotel, and on Monday 4th April with introductory comments by the principal symposium organiser, Gail Wisler, Chairperson of the Plant Pathology Department, University of Florida, Gainsville. Scientific papers were presented on Monday 4th April, Tuesday 5th April and Thursday 7th April, with sessions on virus detection, molecular genomics, new and emerging viruses, and virus resistance. Wednesday 6th April was devoted to a full day excursion.

There were three general presentations. Piero Caciagli (Italy) provided a short history of the International Working Group on Vegetable Viruses, and Roger Jones (Australia) did the same for the

International Working Group on Legume Viruses. The third general talk by Andrew Schuerger (USA) reflected the proximity to the Cape Canaveral Space Centre! He spoke on "Cross contamination of microbes between earth and Mars – is there a risk". Highlights of the conference included the following contributions:

1) Two papers from Joe Vettens' group at Braunschweig (Germany) on emerging legume viruses in Africa. Using monoclonal antibodies and sequencing to differentiate them from *Faba bean necrotic yellows virus*, two new Nanovirus species tentatively named *Faba bean necrotic stunt virus* and *Faba bean yellows virus* were reported. Both new viruses occur in Ethiopia and the first of them also in Morocco. A new Polerovirus, *Chickpea stunt virus*, was found infecting cool season legume crops. It was transmitted by *Aphis craccivora*, distantly related serologically to *Beet western yellows virus* (BWYV) and had 70-78% sequence homology with BWYV and *Groundnut assistor virus*. It existed in two clades, clade I found so far in Ethiopia and Sudan, and clade II in Syria, Egypt and Morocco. These findings are undubtedly just the 'tip of the iceberg' as regards presence of additional nanoviruses and luteoviruses in Africa and elsewhere.

2) Papers by Rene Van Der Vlugt (The Netherlands) and Kai-shu Ling (USA) comparing the sequences of numerous *Pepino mosaic virus* isolates from Europe and the Americas. This damaging virus on tomato spread recently throughout the Americas and Europe through movement of contamination of tomato seed between different countries, becoming a significant concern for quarantine authorities worldwide. Two groups of isolates from Chile and the USA have CP sequences that are most divergent not only from each other but also from the European ones which are all very similar.

3) Two papers on emerging Begomoviruses of cucurbits by Judith Brown (USA) and Yeheskel Antignus (Israel). Antignus described the diseases caused by two Begomoviruses from cucurbits, *Squash leaf curl virus* (SLCV) and *Watermelon necrotic stunt virus*. Both are damaging new world (bipartite) Begomoviruses that have now spread outside the Americas. Brown described the properties of four new world Begomoviruses in the SLCV clade, SLCV itself, *Squash mild leaf curl virus*, *Cucurbit leaf curl virus* and *Melon chlorotic leaf curl virus*. They all infect Cucurbitaceae and Phaseolus vulgaris. SLCV seems to be the ancestor of the clade.

4) An interesting study on cucurbit viruses in the Sudan, the centre of origin of melon and watermelon presented by Herve Lecoq (France). Ten years of surveys revealed five viruses to be common, *Watermelon chlorotic stunt virus* (a Begomovirus), *Cucurbit aphid-borne yellows virus* (a Polerovirus), *Squash mosaic virus* (a Comovirus), and the Potyviruses *Zucchini yellow mosaic virus* and *Moroccan watermelon mosaic virus*. Four other viruses that often infect cucurbits elsewhere were found at lower incidences. In addition, an ancestral melon species contained a new Sobemovirus, *Snake melon asteroid mosaic virus*, which had 71% amino acid sequence identity with *Rice yellow mottle virus*. This virus infected melon and watermelon but did not systemically infect pumpkin, squash and zucchini, which originated elsewhere in the world. Interestingly, another common cucurbit virus, *Watermelon mosaic virus*, was not found in the centre of origin of watermelon (the Sudan). In another paper, Lecoq provide evidence that this cucurbit Potyvirus actually arose by recombination between two legume-infecting Potyviruses, *Bean common mosaic virus* and *Soybean mosaic virus.*

5) Several papers and posters by John Walsh (UK), Christian Obermeier (UK) and Rainer Kramer (Germany) that described recent progress with virus

diseases of Brassicas. Obermeier described investigations on the genomics of plant virus co-evolution in wild *Brassica oleracea* and *B. rapa* populations. Competition experiments suggested that local *Turnip mosaic virus* isolates have greater fitness in their original wild hosts than non-local ones. Walsh discussed mapping resistance genes to TuMV in the *Brassica genome* and identifying viral determinants of virulence. To date, eight TuMV resistance genes have been mapped and determinants of virulence for six Brassica resistance genes identified. Cross protection was being investigated as a TuMV control strategy in cabbage. Effects of TuMV, BWYV and *Cauliflower mosaic virus* (CaMV) on stored cabbage were described. BWYV induced leaf tip burn and TuMV induced cigar burn (internal necrosis). Mixed infection with CaMV and storage both exacerbated the symptoms caused by the other two viruses. Kramer used intergeneric somatic hybridization between *B. oleraceus* and *B. sativus* to transfer TuMV resistance into *Raphanobrassica* hybrids to show that it was possible to generate new donors with durable resistance to different TuMV pathotypes in vegetable Brassicas.

The Scientific Excursion on Wednesday 13th April was very informative. It included visits to commercial fields of tomato devastated by multiple infection with different Begomoviruses, seeing naturally-infected weed hosts with bright yellow symptoms caused by Begomoviruses, inspection of an impressive field trial on control of Begomviruses in *Phaseolus vulgaris* using host resistance, and a guided tour demonstrating virus research underway at a cyclone-damaged field station. The research station improves tropical crops grown in the southernmost part of Florida. Its research included impressive plantations of papaya with transgenic resistance to *Papaya ringspot virus*. Picnic lunch even included delicious transgenic papaya! The excursion passed by pristine areas of the Florida everglades, and finished with a tour of an extensive botanical garden full of tropical plants from around the world.

On Tuesday 12th April, participants enjoyed a "Jungle Queen Dinner Cruise" along the Fort Lauderdale canal system, which is lined by some of the most opulent mansions and seagoing pleasure cruisers and yachts to be seen anywhere in the world.

At the end of the final oral session, it was announced that the next conference, the first of the newly combined Working group, would be in Ljubljana, Slovenia in September 2008 at the time of the next International Congress of Plant Pathology in Italy. Membership of the five-person transitional steering committee of the merged Group was also agreed, with Piero Caciagli (Italy) as the president and Ko Verhoeven (the Netherlands) the secretary. Presentations were made to Gail Wisler to thank her for all her hard work in organising such a successful symposium.

I thank the British Society for Plant Pathology for providing a travel grant that helped me attend this most enjoyable and informative conference.

Roger Jones

Report on the IXth International Planr Virus Epidemiology Symposium - Applying Epidemiological Research to improve Virus Disease Management

Lima, Peru, 3-7 April 2005

This successful and stimulating international symposium was held on April 3-7 in the attractive Hacienda style "El Pueblo" Hotel, just inland from Lima, the capital of Peru, located on the countries' central Pacific Coast. The symposium was attended by 104 participants from 26 different countries from five continents. It was the ninth in the series of international symposia held every three years under the auspices of the Plant Virus Epidemiology (IPVE) Committee of the International Society for Plant Pathology. It was also the first symposium in this series to be held in a developing country. The programme started on Sunday 3rd April with registration and a welcoming reception in the outdoor restaurant area of the hotel hosted by Dr Pamela Anderson, the new Director General of the International Potato Centre (CIP), which is headquartered in Lima.

On Monday 4th April the opening session started with introductory presentations by Pamela Anderson, the principal symposium organiser, and Roger Jones (Australia), Chairman of the IPVE Committee. Dr Anderson emphasised the importance of locating one of the epidemiology symposia in a developing country for the first time. She also briefly explained the history and changing role of CIP as an International Agricultural Research Centre focussed on tuber and root crops, initially concentrating on potato and, more recently, also on sweetpotato. Dr Jones outlined the activities of the IPVE group in the 3 years since the eighth Symposium held in Aschersleben, Germany. The main activity was a successful 1 day meeting organised by John Fletcher (New Zealand) held in Christchurch, New Zealand before the International Congress of Plant Pathology in February 2003.

The opening introductory presentations were followed by the Chairmans' address in which Roger Jones spoke on the topic "Developing effective integrated virus management (IDM) strategies – the way forward". He emphasised the need to use generic control measures in devising interim IDM approaches where insufficient information on epidemiology and control measures is available for a pathosytem, and the need to validate such interim approaches thoroughly afterwards. He also emphasised that optimum control is achieved by including control measures of low and high selectivity, and ones acting against internal and external virus sources, and against early and late virus spread. He gave examples from diverse pathosystems illustrating IDM validation and individual control measures of these different types. Success in devising effective IDM's in the future will depend on intelligent, innovative and flexible use of available experience, information and new technology. Within the current environment of skills erosion, lack of focus and diminishing research funding, the challenge for the virus epidemiologist is to apply new technologies to greatest effect, while still ensuring adequate epidemiological studies and field validation of control measures and IDM tactics.

The morning session that followed started with a contribution on "Defining conditions favouring spread of *Tomato spotted wilt virus*" by Alan Clift (Australia). Ten years of records of TSWV incidence in different vegetable and ornamental crops were analysed by the Netica program. This identified which factors were important in suppressing virus spread, and quantified their impacts for a diverse range of scenarios. Jerome Kubiriba (Uganda) then spoke on "Spread of *Banana streak virus* in Uganda". The pattern of virus spread in initially healthy plots of banana located within infected fields at different sites suggested that both primary and secondary

virus spread was occurring, but clustering of infected plants was limited. Isolation is of pivotal importance as a control measure. Next, Lava Kumar (ICRISAT, India) spoke on "Epidemiology and management of *Pigeonpea sterility mosaic virus*". The virus and its mite vector depend on pigeonpea and its wild relatives. Early infection causes greatest yield losses and volunteer plants and neighbouring crops are the main sources of infection. Control is achieved through virus resistant cultivars and phytosanitary measures. Carl Spetz (Norway) then contributed on "Potato mop-top virus in Nordic countries". This virus is one of the biggest problems that potato industries in Nordic countries are facing. More than one virus strain seems present. Soils in limited areas still remain free of infestation with the virus. Next, Giovanna Muller (CIP, Peru) discussed "Alternative hosts of *Potato yellow vein virus*". The virus, which is transmitted in the field by the glasshouse whitefly, was first introduced to Peru in 1990 and spread rapidly subsequently. Volunteer potatoes and weeds belonging to several different plant families, especially Polygonaceae, act as infection reservoirs. Overuse of insecticides greatly increased populations of its vector and infection was dispersed widely by planting infected seed potato stocks.

The afternoon session started with a special topic presented by Forest Nutter (USA) on "The role of plant virus epidemiology in risk assessment and risk mitigation". The potential for introduction of damaging plant viruses and their vectors to new countries remains a serious threat to crop biosecurity worldwide. The risk of an epidemic is dependent on quantitative knowledge concerning the host, vector and virus population, and how the environment influences the risk of disease development. In the *Tobacco etch virus* – bell pepper pathosystem in south east USA, perennial horsenettle and groundcherry are the key alternative hosts. Relative source efficiency depends on virus concentration and receptivity to the particular aphid vector species present. Early infection is critical but reducing rate of virus spread by half (using partial resistance or reflective mulch) means that yield loss is much decreased.

Dirk Janssen (Spain) followed with an interesting presentation on "Viruses diseases in horticultural crops in Almeria, Spain". Over 28,000 hectares of plastic houses are used to grow vegetables all-year-round at Almeria. This high concentration at one location makes the system vulnerable to introduction of new viruses. During the past 5 years, several serious diseases caused by contact, seed and/or fungus transmitted viruses arrived. Phytosanitary and cultural control measures worked well against them, but control of newly arriving arthropod-transmitted viruses, especially ones spread by thrips and whitefly, has been less successful. A rural hygiene plan and physical protection against whitefly vectors assisted greatly in diminishing virus-induced losses. Keith Perry (USA) then spoke on "Strains of *Potato virus Y* in seed potatoes in Maine, USA". Both the ordinary and tobacco veinal necrosis strains of the virus occur. One isolate caused potato tuber necrotic ringspot disease, and others may represent different strain recombinants. Differentiation of strains relied on monoclonal antibodies and micro-arrays but not inoculation of cultivar differentials with hypersensitivity genes to different strains of the virus. Next, Joseph Ndunguru (Tanzania) spoke on "*Papaya ringspot virus* in East Africa". The crop is mostly grown in small plots for subsistence and local markets, and the incidence of infection is so high that production of papaya is severely diminished. Monoclonal antibodies to the virus were ineffective at detecting some local virus isolates. Herve Lecoq (France) then presented on "Molecular epidemiology of *Watermelon mosaic virus* in cucurbits: from simple to complex patterns". The approach used involved monitoring the spread of a newly introduced and an indigenous strain of the virus within plots of squash over several years. Samples from all plants were

tested weekly by ELISA and PCR to follow the spatial and temporal progress of the epidemics of the two strains. The new strain spread earlier each year but the ratios of the two strains and their rates of spread varied greatly. Complex interactions and mixed infections between strains influenced the epidemics and patterns of spread found. Next, Paul Guy (New Zealand) spoke on "Plant virus records for New Zealand". A comprehensive review of the 170 plant virus records in New Zealand was made; 30 new virus species records were added since 1989. However, no records were for viruses native to the country. This contrasts with nearby Australia where there are several despite its shorter history of crop introduction and cultivation. Some introduced viruses have invaded the native flora causing damaging disease outbreaks in New Zealand native plants. Roland Sigvald (Sweden) then spoke on "Epidemiological studies on *Potato virus Y* and *Barley yellow dwarf virus*". A revision of his predictive simulation model for epidemics of PVY in potato in Sweden was presented. The proportion of tubers infected are now included in the predictions. The model was validated with data from 500 potato fields with good agreement between predicted and observed values. With BYDV, key factors to use in risk assessment were identified.

Tuesday 5th April commenced with an important keynote address by Pamela Anderson (CIP, Peru) entitled "Ecological epidemiology: review, synthesis and application of models for insect-transmitted viruses". She reviewed the types of mathematical models used for epidemics of insect-transmitted viruses. She then presented the generic model 'Epivirus' which has broad application in different plant virus-crop pathosystems. She used epidemics of the whitefly-transmitted Bean golden mosaic disease complex in common bean to illustrate how this and other models are used to identify gaps in current knowledge and to advise on the intervention strategies and virus control measures most appropriate to deploy. The generic 'Epivirus' model will soon be made available on the world-wide-web for use by others.

Juan Alvarez (USA) followed with a presentation on "The epidemiology of *Potato leaf roll virus* in Idaho, USA". He emphasised the importance of hairy nightshade as a reservoir host of the virus for epidemics. Infected plants of this species were introduced into potato plots and disease progress followed using ELISA to test samples. Next, Enrique Moriones (Spain) spoke on "Virus resistance breakdown in tomato associated with mixed infection between *Tomato chlorosis virus* and *Tomato spotted wilt virus*". A marked synergism was observed when the two viruses were inoculated simultaneously to susceptible tomato, killing the plants. Presence of both in plants carrying TSWV resistance gene Sw-5 broke this resistance. Forest Nutter (USA) then spoke on "Spread of *Soybean mosaic virus* in transgenic soybeans". Soybeans transformed with the CP of the virus were evaluated for epidemic rate-reducing resistance by quantifying the temporal and spatial spread of the virus from point sources in field plots. Two transformed lines had low infection rates, less clustering of infected plants and greater yields than untransformed controls. Alberto Fereres (Spain) then presented on "Temporal and spatial spread of *Lettuce mosaic virus* in Spain". In lettuce nursery and field epidemics, the primary inoculum source was seed-infected lettuce plants and spread was by non-colonising winged aphids. The Gompertz model described disease progress best. Clustering of infected plants was followed using the SADIE program and contour maps. Next, John Randles (Australia) spoke on "Mundella yellows disease in eucalypts". The spatial distribution of this lethal dieback disease in tree plantings is patchy. Because small RNA's are present along with virus-like inclusions, virus-like agents seem a possible cause of the disease which is not associated with phytoplasma. Brendan Rodoni (Australia) then described "The first detection of *Potato virus Y* NTN

strain in Australia". Potato tubers showing the typical necrotic rings caused by this PVY strain were shown to contain it using PCR, sequencing and by inoculation to potato cultivar differentials. The sequences found indicated introduction from Europe.

The afternoon session started with a special topic presented by Mike Irwin (USA) concerning "Aerial dispersal of aphids and its implications for IPM". He emphasised that the whole concept of IPM first started when DDT-resistant pests appeared in cotton in the nearby coastal Canete Valley in Peru. Using the *Soybean mosaic virus*-soybean pathosystem as an example, he stressed the need to always consider vector movement in IPM approaches, with long distance and short distance movement of vectors both being important. In general, non-persistently aphid-borne viruses are best managed at their source while persistently aphid-borne viruses can also be addressed at their sink (ie. in the infected crop).

Steve Castle (USA) followed with a presentation on "Monitoring Pierces disease of grapevine in glassy-sharpshooter populations in California, USA". The proportion of the vector population that is infective and the concentration of the pathogen in them were determined. Both factors were important in establishing the upper threshold numbers of the insect vector for decisions on use of chemical control measures. Next, Jorg Schubert (Germany) spoke on "Sequence variations in *Potato virus Y* strains". Several isolates from Germany and Poland were sequenced fully, and the sequences compared with those of other already published isolates from Europe and North America. This comparison revealed several recombination points where new variants are likely to arise. Next, Paul Guy (New Zealand) spoke on "Plant viruses in wild plants". Contrary to generally accepted views, there are a number of examples from different parts of the world of wild populations of plants suffering high virus incidences and severe viral symptoms (damage). This is so whether these viruses are endemic to the wild plants or biological invaders coming from introduced cultivated plants. Examples of diverse pathosystems where this occurs in native plants in Australia, USA and the UK were provided. Forest Nutter (USA) then talked on "Post-introduction mapping of plant virus spread with GPS and GIS technologies". He described the USA National Plant Diagnostic Network, which provides a plant disease biosecurity system now operating from five hubs in the USA. Gathering temporally and geo-spatially referenced diagnostic data is one of its roles. GIS is proving a powerful tool to provide maps that identify production areas with different degrees of risk for specific plant virus pathosytems. Next, Gerhard Pietersen (South Africa) spoke on "Spatial and temporal patterns of spread of grapevine leaf roll disease in South Africa". Grapevine leaf roll is the most important virus disease affecting grapevine in South Africa. Most spread occurred along rows and there was secondary spread by mealybugs. The main infection sources were nearby infected grapevine plantings and use of contaminated rootstocks. Then, Martin Verbeek (the Netherlands) talked about "Epidemiological developments with *Potato virus Y*". The O, C and N strains of the virus are all present in seed and ware potato crops in the Netherlands, with increasing incidences of the virus found despite decreasing numbers of Myzus persicae. Based on molecular data, recombination between strains occurs often in the field. Next, Rene Van Der Vlught (the Netherlands) described "Natural variation in *Pepino mosaic virus*". Since 1990, a new strain of this contact-transmitted virus became widespread in tomatoes in European countries. The genetic diversity of >60 Dutch isolates was compared with those published from other countries. Two isolates from the USA grouped separately from the European ones.

This session ended with an open meeting that elected three new regional representatives to the IPVE Committee of the ISPP (Lava Kumar - Asia,

Joseph Ndunguru - Africa and Stewart Gray – North America) and discussed the possible location of the next symposium sponsored by the Committee. Provisional offers to host the next symposium were received from India and Uganda, and, following their confirmation, it was left to the IPVE Committee to decide which offer to accept.

Wednesday 6th April commenced with an interesting keynote address by Tim Chancellor (UK) entitled "Spatio-temporal virus disease dynamics: the case of rice Tungro in the Philippines". The spatio-temporal dynamics of virus spread over four cropping cycles was analysed in a continuous 150 hectare block of fields that contained rice crops at varying stages of maturity. There was marked clustering of infected plants. Infection of newly-planted fields depended on proximity to older infected fields, relative abundance of leafhopper vectors and the susceptibility of the rice cultivar planted. A spatial simulation model predicted the effectiveness of different control tactics: virus resistant cultivars and fallow periods were more effective than roguing or application of insecticide.

Nilsa Bosque-Perez (USA) contributed next on "The effect of transgenic resistance to *Barley yellow dwarf virus* on aphids in wheat". Although its *Rhopalosiphum padi* vector normally grows better on infected than healthy plants, it had diminished population growth on transgenic plants infected with the virus. Also, it was less attracted to and less efficient at acquiring virus from them. Deploying transgenic partial resistance in wheat crops is therefore likely to decrease virus spread. Then, Wilmer Cuellar (Finland) talked on "RNA silencing suppression controlled by *Sweetpotato chlorotic stunt virus*". Infection with SPCSV suppresses the natural RNA silencing in the upper leaves of sweetpotato explaining why 'sweet potato virus disease' (SPVD) results from mixed infection of SPCSV with potyviruses. SPVD is the most economically important disease of this crop. A combination of RNase3 and the protein p22 was shown to block the RNA silencing, paving the way to understanding the suppression mechanism. Stewart Gray (USA) contributed next on "Transmission of two viruses that cause Barley yellow dwarf disease is controlled by different loci in the aphid *Schizaphis graminum*". Two genotypes of the aphid that differ in their abilities to transmit *Barley yellow dwarf virus* and *Cereal yellow dwarf virus* were crossed and the transmission efficiencies of their F1 progenies determined. There was no genetic correlation between transmission of the two viruses, indicating that more than one locus is involved. Liezel Herselman (South Africa) then spoke on "Molecular markers for a resistance gene to the aphid vector involved in groundnut rosette disease". This is the most destructive disease of groundnut (peanut) in Africa, and the causal viruses are transmitted by *Aphis craccivora*. Development and application of molecular markers for use in breeding aphid-resistant groundnut was described.

A Scientific Excursion to CIP followed where a comprehensive oversight of the organisations diverse programs was provided, along with a guided tour of the extensive Laboratory and Glasshouse facilities, and an explanation of the potato and sweetpotato virus projects currently underway. Delegates were then treated to a traditional Andean Pachamanca lunch: the delicious food was cooked in an underground oven heated by hot stones, and dug up in front of them following a brief traditional "blessing" ceremony. The day finished with a guided city tour of Lima which included a visit to the impressive archaeological museum, sightseeing and a visit to a large market selling traditional Peruvian handicrafts.

Thursday 7th April commenced with a stimulating keynote address by Mike Jegger (UK) entitled "Evolutionary epidemiology of plant viruses". The drivers of evolutionary change in plant virus population structure include mutation rates, relative

fitness, selection pressures, genetic drift, host dynamics and vector interactions. Re-assortment allows deleterious mutations to be eliminated. Information on the likely contribution of altered cropping practices and crop protection measures such as pesticide use, host resistance and cultural control to emerging plant virus disease problems can be obtained from retrospective analysis of historical epidemics. This applies especially to situations involving new virus or vector variants or novel virus-vector-host combinations. New approaches that augment a population dynamic model with varying fitness traits and the derivation of evolutionary stable states can offer new insights into the strategic management of plant virus diseases.

Claudia Martins (Brazil) contributed next on "Grapevine leafroll-associated virus 3 genetic variability in Brazil". Sequenced viral polymerase and CP genes showed that isolates from north-east Brazil were similar to North American isolates, but with some minor amino acid sequence differences. Keith Perry (USA) then spoke on "Structural determinants in virions for non-persistent aphid vector transmission". A surface charge or structure in the virion seems necessary for successful non-persistent transmission of *Cucumber mosaic virus* by aphids. Dynamic properties of the virions may play a role in their ability to bind to or release from aphid mouthparts. Benny Raccah (Israel) then presented on "The role of helper component (HC) in binding to aphid cuticular proteins and to capsid proteins". HC serves as a bridge between virion and aphid stylet. To evaluate the role of HC in transmission, the N-terminal of *Turnip mosaic virus* CP was exchanged with the respective fragment of *Zucchini mosaic virus* CP creating a chimeric virus. This exchange allowed the TuMV HC to transmit the chimeric virus but not the wild type ZYMV.

Several presentations on sweetpotato viruses followed. Setumba Mussaka (Uganda) spoke on "Sweetpotato virus disease complexes in sweetpotato in Uganda". *Sweetpotato feathery mottle virus* (SPFMV), *Sweetpotato mild mottle virus* (SPMMV), *Sweetpotato chlorotic fleck virus* (SPCFV) and *Sweetpotato chlorotic stunt virus* (SPCSV) were found singly and in combination. SPCSV, SPFMV and SPMMV were detected in 90% of plants found showing viral symptoms. Although the vector of SPMMV is not known, regression analysis suggested that it and SPCSV are transmitted either by different biotypes of whitefly or by entirely different vectors. Emmanuel Byamukama (IITA, Uganda) talked on "Sweetpotato virus disease (SPVD) in Rwanda". SPCSV, SPFMV, SPMMV and SPCFV were present. Incidence of the SPVD complex was generally low, except in a highland province where the crop is grown continuously. Segundo Fuentes (CIP, Peru) presented on "Sweetpotato virus disease in Peru and its control". High incidences of SPVD caused by co-infection with SPFMV and SPCSV were found in the costal Canete Valley. SPFMV alone did not diminish yield, but SPCSV alone did so while a combination of the two viruses (ie. SPVD) caused much greater yield losses. A healthy stock program that employs propagation by cuttings under screenhouse conditions, roguing and insecticide application against vectors provides local farmers with healthy planting materials. This healthy stock triples the yields they obtain. Arthur Tugume (Uganda) spoke on "Viruses infecting wild *Ipomoea* in Uganda". About 90 wild Ipomoea species occur in East Africa. More than 1,500 wild plants were surveyed in 22 districts of Uganda: 36% of plants tested positive to viral antibodies, with SPCSV, SPFMV, SPMMV and SPCFV all detected. Multiple infections were common in perennial wild Ipomoea species. Peter Sseruwagi (South Africa) contributed on "Diversity of *Bemisia tabaci* in Uganda". Phylogenetic analysis revealed eight distinct genotype clusters of this whitefly species in Uganda. Both the B and Q biotypes that are important vectors elsewhere were found and the host ranges of the Uganda1 and Uganda8 types were expanded.

These findings have important implications over the ease of spread of whitely-transmitted viruses locally.

The final afternoon session was on Begomoviruses. It started with an interesting special topic presented by Frank van den Bosch (UK) concerning "The effect of cropping practices on Begomovirus evolution." Plant disease management tactics introduce selection pressures that can actually make things worse by selecting for evolutionary changes that enable viruses to get round them. Such evolutionary responses nullify the beneficial effects of deploying the management tactics so ones that put minimal pressure on the system and so avoid provoking such responses are preferable. Mathematical models were used to simulate how tactics such as roguing, selection of cuttings and deployment of virus-resistant cultivars affect virus virulence. Roguing diminished virus titre but most other tactics increased it. Not taking virus evolution into account can lead to incorrect control measures being deployed so 'evolutionary stable approaches' are preferable.

Yeheskel Antignus (Israel) then contributed with an important paper on "Light manipulation by soil mulches to protect crops from spread of Begomoviruses". Begomovirus diseases are so damaging to tomato in Israel that all tomato crops are now grown in protected houses. However, cucurbit crops are still grown outside and are suffering severe yield losses from Begomoviruses. In field experiments, deploying yellow plastic mulches delayed epidemics of *Squash leaf curl virus* in zucchini more than other plastic mulches providing the greatest yield benefit. Whitefly vector landing rates were seven times lower with yellow as opposed to no mulch. The yellow colour diminishes the contrast between the background (mulch) and the target (plants). The IDM strategy now recommended involves yellow mulch, limited insecticide sprays and virus-tolerant zucchini cultivars. Richard Gibson (UK) spoke on "Farming practices that delay selection of virus-resistant land races of vegetatively propagated crops". Crop seedlings are rare in subsistence farmers' fields and tend to be hoed out. With sweetpotato in East Africa, only 1% of farmers had ever grown crops from seedlings and the findings for cassava, another vegetatively propagated crop, were similar. Evolution of new land races was speeded up successfully when they were encouraged to select superior accessions from seedlings. James Legg (IIATA, Uganda) presented on "A continent-wide perspective on the epidemiology of cassava mosaic viruses in Africa". The current cassava mosaic disease pandemic in East Africa is expanding both westwards and eastwards to include Tanzania, Rwanda, Burundi and eastern Congo. This expansion is propelled by short distance migration of super abundant *B. tabaci* vector populations, synergistic interactions in susceptible cassava cultivars, and the greater virulence of recombinants between *East African cassava mosaic virus* (EACMV) and *African cassava mosaic virus* (ACMV). Deploying virus-resistant cassava germplasm is helping to manage the pandemic. Joseph Ndunguru (Tanzania) spoke on "Molecular epidemiology of *Cassava mosaic viruses in Tanzania*". Sequence analysis revealed a higher genetic variability among isolates of EACMV than of ACMV. This has important implications in providing a source of diversity and evolutionary change in the virus. Gowda Maruthi (UK) then spoke on "Molecular epidemiology of tomato leaf curl viruses in the Indian sub-continent". CP sequencing and phylogenetic analysis revealed at least six viral clusters, each with <85% sequence identity. Two clusters represented previously undescribed viruses. Tobacco, cotton and weed species were infected, and mixed infections were common. The B biotype of *B. tabaci* was found for the first time in the region. Next, Nilima Prabhaker (USA) talked about "The impact of neonicotinoid insecticides on the natural enemies of *Bemisia tabac*i". Before deploying chemical control, it is important to determine the effects of the chemicals used against

valuable biological control agents. Although neotnicotinoid insecticides, such as thimethoxam and imidacloprid, were effective in suppressing whitefly vector populations, they killed beneficial parasitoids, such as *Encarsia* and *Eretmocerus spp*. Renato Resende (Brazil) contributed next on "Resistance to monopartite and bipartite tomato leaf curl disease-inducing Begomoviruses in tomato". Eight different TLCD-inducing Begomoviruses occur in tomato in Brazil including both monopartite and bipartite virus species. Tomato breeding line TX468-RG has good resistance to the bipartite Begomoviruses, which is controlled by recessive gene tcm-1. Three other tomato lines are resistant to the monopartite Begomoviruses, the resistance again being controlled by a single recessive resistance gene. Breeding of tomatoes with both resistance genes is underway. Aldo Rojas (Nicaragua) spoke next on "A complex of Begomoviruses affecting tomato". Phylogenetic analysis revealed that the indigenous Begomoviruses of the Americas belong to three major clades and to another intermediate grouping. *Tomato severe leaf curl virus* was subdivided into two strains which fitted in different clades due to past recombination of one of them with another Begomovirus. Mixed infections are common providing a high risk of evolution of new strains and species by recombination. Gration Rwegasira (Tanzania) presented the final talk which was on "The effect of vectors and environment on incidence and severity of sweetpotato virus disease in Tanzania". Data on the effect of insect vectors, different virus inoculum levels and climate variability on the incidence and severity of SPVD was collected from farmers' fields at six different locations in the Great Lakes region of East Africa. The findings were used to guide decision making over which control measures to recommend against SPVD.

One of the important features of the symposium not mentioned above was the large number of interesting posters, more than 35 in total on a very diverse array of topics. The four poster sessions were held after the afternoon sessions and provided a good opportunity to engage in further discussions.

At the end of the final oral session, presentations were made to Pamela Anderson, Francisco Morales and Luis Salazar to thank them for all their hard work in organising such a successful symposium and to Martha Huanes and her team for their invaluable conference support. At the conference dinner that followed, participants were treated to a delicious multiple course meal + the local "Pisco sour" drink and a choice of wines, followed by a most entertaining display of typical folk dancing from different regions of Peru including audience participation. An excellent evenings' entertainment was had by all.

This ninth in the series of triennial International Symposia on Plant Virus Epidemiology was not only scientifically stimulating but also very well organised. It successfully maintained the high standards set by past meetings of the IPVE. The attractive setting of the "El Pueblo" Hotel with its well maintained lawns and garden, extensive sports facilities, and delightful café + outdoor restaurant secluded within a its surrounding 'horseshoe of hills' all helped to provide an ideal 'backdrop' to the event. The Director General of CIP and her staff are to be congratulated warmly over a job well done.

I thank the British Society for Plant Pathology for their support towards my travel expenses to attend this symposium.

Roger Jones

Awards

Congratulations to Stuart Wale, our President in 2004 and to our current Secretary, Bill Rennie who have been awarded Associateship of Royal Agricultural Societies (ARAgS) for their contributions to agriculture in Scotland over many years.

Stuart Wale currently leads Crop Services at the Scottish Agricultural Colleges, based at the SAC Aberdeen Campus: where he is responsible for developing consultancy and R&D across SAC in crops. Stuart is particularly interested in advisory and consultancy plant pathology, across a wide range of crops, but especially potatoes. He is active in applied research to support these activities. Stuart is also a member of UK Pesticide Forum and Scottish seed potato consultative committee.

Bill Rennie is a founder member of BSPP and was local organiser for ICPP98 in Edinburgh. He retired recently from his post with the Scottish Agricultural Science Agency, where he was responsible for the Agency's work on seed potatoes; including plant health, variety testing and registration, and seed certification. He is currently manager of Scottish Potato Technology Ltd, a partnership of 6 companies and organisations that aims to market Scottish seed potatoes, and potato technology, in China and other developing countries.

BSPP

Obituary

S C Melville

S.C. (Stan) Melville, an advisory plant pathologist for nearly 40 years, died in Exeter on 18 February. He joined the National Agricultural Advisory Service (later ADAS, Agricultural Development and Advisory Service) as an assistant to T. Whitehead, a pioneer in the study of crop virus diseases and in advisory plant pathology, at Bangor. After only a few years he moved to Starcross (Exeter) where he spent the rest of his career working on crops in the Devon, Cornwall and Isles of Scilly, part of the South West Region, and retiring in 1987. It is interesting to note that the careers of these two people (Whitehead and Melville) span virtually the whole period when an organised state service provided free advice and development in plant pathology to farmers and growers.

The far south west is not the most prominent area for agricultural or horticultural crops but it has a wide range of crops grown at commercial levels and a climate that is often more favourable for disease development than in the traditional arable areas. It was therefore a good place to be a plant pathologist and Stan Melville took full advantage of that. He saw the first records of soil borne virus in cereals and of nematode transmitted virus (in soft fruits). This was the region where A. Beaumont attempted to devise a forecast method for potato blight, later used nationally by E.C.Large from the Plant Pathology Lab (PPL) at Harpenden. Stan had a particular interest in potato blight and continued to supply information from his plot experiments in the disease prone area of east Cornwall.

In the 1960's the rapid increase of the cereal acreage, especially of spring barley, also occurred in the more pastoral areas of Devon and Cornwall. A serious attack of Rhynchosporium on a newly introduced cv. Cambrinus in the region brought cereal leaf diseases to prominence for the first time. The Department at Starcross initiated plot experiments in collaboration with the local NIAB and using frequent sprays of a dithiocarbamate fungicide – the best then available for control – showed the effect on yield to be appreciable. Then in collaboration with Clive James of PPL a survey of the incidence and severity of Rhynchosporium and other leaf diseases of spring barley was initiated in the southwest and organised by Stan and extended to the whole of England and Wales (1967). The survey showed that powdery mildew was the most important disease and even more damaging than had been suspected. The results came at a time fortuitous for some of chemical companies who were about to release fungicides for the first time aimed specifically at the control of cereal leaf diseases, in this case mildew in spring barley (tridemorph, as a spray, (Calixin), and ethirimol, as a seed treatment, (Milstem). The surveys were so successful that they have continued for barley and wheat with largely the same methods to the present (now from the CSL, York).

Stan Melville was a quiet, loyal and private man with a lovely sense of humour. He had the opportunity to move to a more senior job in a prominent region but for purely personal reasons chose to stay at Starcross – much to the satisfaction of the local farmers. He enjoyed sport and played tennis until stopped in his retirement by a sudden and acute attack of arthritis. He was also involved for many years with the administration of the game as the secretary of the Devon Lawn Tennis Association and was rewarded by a Meritorious Service Award from the LTA in 1999. His latter years were blighted by the severe disabling arthritis that he bore with remarkable fortitude and to the admiration of his friends.

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