

GCRI trust, Travel Grant Report

Title: Golden Jubilee Conference of the Society for Invertebrate Pathology, University of California San Diego, USA / 2nd Ag Innovations Conference: Microbial Control

Date of Travel: 12th – 20th August 2017

Name of GCRI Travel Grant Recipient: Dr David Chandler

Headline bullet points::

- The State of California is the USA's biggest producer of horticultural crops, and on its own represents one of the biggest markets in the world. The ornamentals sector alone is worth > \$1.5 billion p.a., for example.
- Because of its size and dominance, developments in both policy and technology occurring now in California are very likely to filter over to the UK in due course.
- There is a big drive underway in California to promote biopesticides as alternatives to synthetic chemical pesticides for reduced risk pest management, and the California Department of Pesticide Regulations sees them as replacing the majority of conventional pesticide use in the future.
- A range of new biopesticides products are being launched on the Californian market. Most of these are novel for the UK although a small number, such as insect pathogenic nematodes, have been used in the UK prior to being marketed in the USA.
- The development of new microbial bio-insecticides is underpinned by research on the biology of entomopathogens and their use in Integrated Pest Management. A range of new research findings have occurred in recent years that are likely to impact on the protected crops and ornamentals sectors in due course.

Background:

I attended the Society for Invertebrate Pathology conference to give a paper on our AHDB-sponsored research project ('AMBER') on biopesticides. In addition, I supported 4 of my PhD students who also attended the meeting, 3 giving oral papers and one presenting a poster. I also attended a 1 day 'ag-innovation' workshop the day before the meeting. This consisted of a wide range of companies presenting information on new biopesticide products that were being launched and used in California, predominantly for use in the horticultural sector. The talks included presentations on pesticides policy in California. There is a big drive to promote biopesticides as alternative to synthetic chemical pesticides for reduced risk pest management, and the California Department of Pesticide Regulations sees them as replacing the majority of conventional pesticide use in the future. This is important, as California has one of the most valuable agricultural sectors in the world (worth some (\$50 billion p.a.), and hence developments in both policy and technology occurring now in California are very likely to filter over to the UK in due course.

Travel Findings:

The travel to California enabled me to attend 2 meetings at the same location in San Diego: an Ag-innovation conference on the use of microbial control agents in Integrated Pest Management systems, followed by attendance at the 50th anniversary conference of the Society for Invertebrate Pathology. The SIP conference is mainly about basic research on entomopathogens to provide underpinning knowledge for their use as microbial biopesticides in IPM systems (note that microbial biopesticides are still used predominantly in horticultural crops although they are breaking onto broad scale agriculture in some countries such as Brazil). The Ag-Innovation conference was probably of more immediate relevance to UK growers of protected crops and outdoor ornamentals as it focused on some of the new microbial biopesticides that are coming onto the US market and which are likely to trickle down to the UK in due course.

It was appropriate that the meetings were held in California: the state is the USA's biggest producer of horticultural crops, and on its own represents one of the biggest markets in the world. California has its own Department of Food and Agriculture which operates separately to the US Department of Agriculture and gives it a large amount of autonomy from the rest of the USA in respect to the way its food and agricultural systems are regulated. The Californian horticulture sector is certainly ahead of the UK in terms of its access to new biopesticides and there are a number of drivers for this:

- 1) The USA has a government-sponsored system that helps finance the development and registration of biopesticides.
- 2) The large size of the horticulture market in California means that biopesticide companies are more likely to launch products there before looking to the rest of the USA and to countries such as the UK. It is telling that Bayer has an R&D facility specialising in biopesticide development based in California.
- 3) California is undergoing a shift in consumer and legislator attitudes to the use of conventional chemical pesticides that occurred in the UK / EU some years ago. My understanding is that California currently has a softer approach to pesticide MRL's (maximum residue limits) than is the case in Europe but this is changing, which will create further drive to adopt biopesticides in order to cope with increasingly strict legislation on MRLs (most biopesticides are residue exempt which makes them increasingly attractive to use).
- 4) Horticultural production in California really falls into three different categories: production of conventional crops for consumption in the USA; production of conventional crops for export to markets such as the EU and Japan, which has much stricter regulation on MRLs; and production of organic crops. The organics sector is undergoing rapid expansion, associated with consumer concerns about pesticides, and is more profitable than the conventional sector. As a result, Californian production is predicted to shifting radically in the coming years to focus predominantly on production of organic crops and crops for export, while conventional production for the US market would be done in Mexico. The expansion of the organics sector in California is felt to be a major driver for the development of biopesticides in the USA.

Because of its size and dominance in the world horticultural market, developments in biopesticides technology occurring now in California and the rest of the USA are very likely to filter over to the UK in due course. Some of the main points to come out of the Ag Innovations conference and the SIP conferences were as follows:

- 1) The California Department of Food and Agriculture, together with the California Department of Pesticide Regulations (CDPR), see fostering the development of reduced risk pest management as a key mission. The CPDR alone spends \$100million per annum on pesticide regulation enforcement. CPDR considers biopesticides to represent the future of crop protection in California, but there currently is a lack of knowledge about the best ways to use them in IPM systems that is seen as an impediment to product uptake and development.
- 2) The growth of the biopesticide industry currently outpaces that of the conventional chemical pesticides industry. Some of the factors behind this are the increasingly high cost of developing a new conventional pesticide active substance and a lack of new chemistry. In comparison the cost of developing a new biopesticides is about 5% of that of a conventional pesticide and can be done in about a third of the time.
- 3) The global agri-businesses, such as DuPont and Bayer, are investing considerable sums to identify new biopesticide substances, but a large amount of work in this area is also being done by sme's and biotech start-ups. The approach to biopesticide discovery of some organisations such as DuPont is to undertake large scale genomic screening of DNA extracted from agricultural soils in order to identify genes – mainly for soil based bacteria – that may produce proteins that could be used as insecticides or fungicides, either by expression in GM crops or as sprayable products. However other companies such as Marrone Bio Innovations base their strategy on screening culture-able bacteria and fungi isolated from soils and other habitats for their ability to produce metabolites with insecticidal and fungicidal properties. Biopesticide products from Marrone Bio Innovations currently sold in the USA include: Regalia, an effective fungicide derived from a plant extract; Haven, a bio-stimulant reported to reduce water stress in crops; Grandevo, a new broad spectrum insecticide based on *Chromobacterium subtsugae* and with a novel mode of action; Venerate, based on a new species in insecticidal bacterium, *Burkholderia rinojensis*, with high potency against insect pests; and Majestene, a bio-nematicide with activity against a broad spectrum of root-feeding plant parasitic nematodes. Marrone currently have three new products in the near term pipeline: a bioherbicide currently undergoing US registration, and a biofungicide and a new biofumigant, both of which will undergo a 'soft' launch in the US in 2017.
- 4) In total there are over 30 new biopesticide products currently registered and available in the US which are not yet available in the UK but which have potential to be used here.
- 5) There is increasing interest in combining different biopesticide products into the same formulation so that a single product could be used for both pest and disease control. An example of this is Leap, a biorational pesticide from Valent Biosciences based on the insect pathogenic bacterium *Bacillus thuringiensis* co-formulated with methyl salicylate and which has a dual action against pests and

diseases. Biopesticide producers and researchers are also looking increasingly at how different products may work together for improved efficacy in IPM. One example of this is combination treatments of entomopathogenic fungi with the botanical insecticide neem, which appear to be able to work together well in IPM programmes.

- 6) New biotechnology-derived biopesticides are also likely to make their way to Europe in the coming years, although some may face regulatory barriers associated with GM technology. An example of this is the product Spear from Vestaron Corporation. Spear consists of an insecticidal protein isolated from spider venom and produced by fermentation using genetically modified yeast that express the venom gene. The venom is reportedly free from mammalian toxicity, is highly active against pests such as western flower thrips, but is compatible with natural enemies and can also act in concert with other microbial biopesticides such as Bt.
- 7) Finally, it is increasingly being realised that some microbial biopesticides have a much wider range of benefits in addition to their ability to antagonise or kill crop pests and diseases. A clear example of this is evident with insect pathogenic fungi such as *Beauveria* and *Metarhizium*, which are now available as commercial biopesticides from a number of different manufacturers. In addition to their ability to kill insects, some strains of these fungi are able to grow as endophytes or within the plant root zone, and this is now known to be able to stimulate plant growth and help protect crops against periods of environmental stress such as reduced water availability.

Personal Statement: The meeting was a good opportunity for me to network and make new contacts. I held meetings with both biopesticide industry representatives and university researchers. The new information I obtained on current developments in biopesticide science, and the new products that are likely to be available in the UK in due course, is particularly relevant to the AHDB 'AMBER' research project that I manage. AMBER (application and management of biopesticides for efficacy and reliability) is a 5 year programme designed to develop management practices that can help UK growers of protected and ornamentals crops to get improved performance from biopesticides.

Contact details:

Dr Dave Chandler
Warwick Crop Centre
School of Life Sciences
University of Warwick
Wellesbourne
Warwick UK CV35 9EF
Tel +44 (0) 24 76 575 041
<http://www2.warwick.ac.uk/fac/sci/lifesci/wcc/>
<http://www2.warwick.ac.uk/fac/sci/lifesci/people/dchandler/>
Email Dave.chandler@warwick.ac.uk