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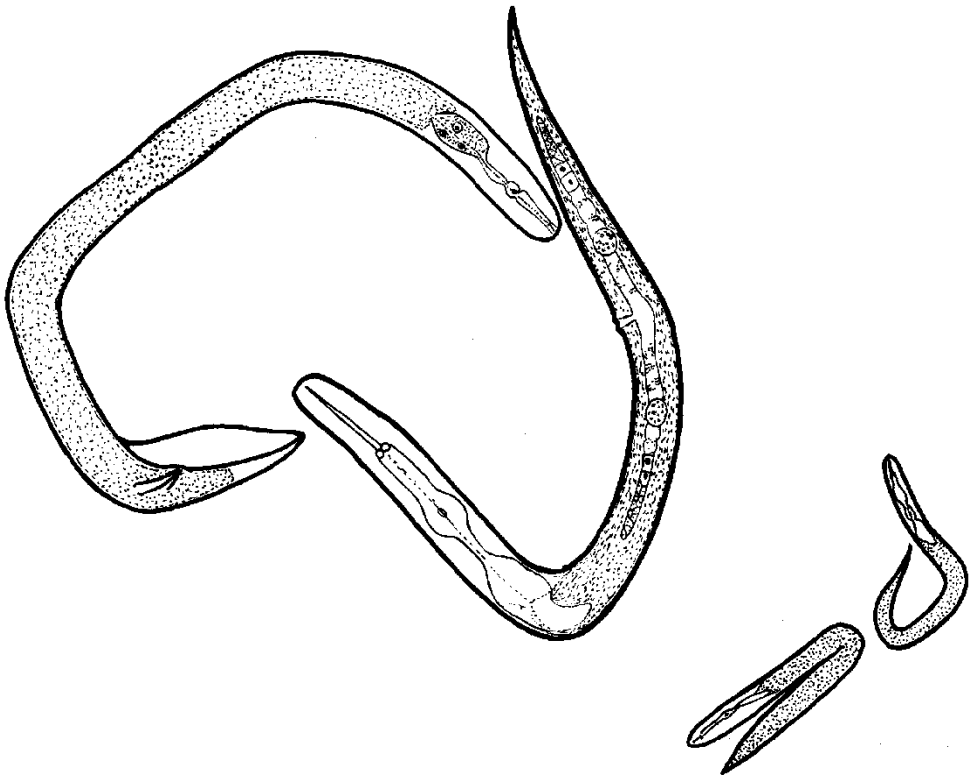
AUSTRALASIAN NEMATOLOGY NEWSLETTER



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From the Editor

Thank you to all those who made contributions to this newsletter.

WANTED – a NEW editor for the AAN Newsletter
After more than 10 years as Editor, I wish to resign. Please contact me or Mike Hodda if you would like to volunteer – it's an interesting job, and does not take much time.

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Association News

FROM THE PRESIDENT

The impending retirement of Kerrie Davies, first as editor of this esteemed publication, the Australasian Association Nematology newsletter, and then from nematology as a whole, prompts consideration of several issues. One is the role of AAN. The AAN was set up quite a while ago in response to the need for an organization to help nematologists in Australasia communicate with one another and to advocate for the discipline in the face of a perceived decline in institutional support. I don't think those core reasons for existence have changed, and that they are just as important now as in the past. It seems that unless people with similar interests work together and have some sort of shared culture, they are likely to be vulnerable in the current climate of scientific funding. That said, I think that AAN has, by and large, achieved its aims, so that support for nematology has at least stabilized even if it has not increased spectacularly as many may have hoped.

What may have changed is the demands on the nematologists. Many of us are required to complete a huge range of tasks: identification; research; publishing; teaching; extension; advisory roles; and many others. This sort of workload leaves less time for activities like AAN, with interaction with other nematologists put near the end of a long list of things to do which is never completed.

Another useful role for AAN is as a conduit to the international nematology community via the International Federation of Nematology Societies (IFNS). We get some input into the programme for the sexennial International Congresses of Nematology. Remember to send Mike any suggestions for topics or speakers you would like to see in Nice in 2020, now only 3.5 years away.

I also think the newsletter is useful in finding out about what is going on in Australasian nematology, in a short, digestible form. I think the current frequency and length are good: frequent enough to keep reasonably current, but not so frequent as to become a chore for either readers, contributors or editors.

The other issue raised by Kerrie's retirement is succession, both in nematology and AAN. University nematology is getting thin, with several older scientists (John Thompson at USQ, Mike Jones at Murdoch), and others part-time and working on other things (eg Ian Riley at Adelaide). At AAN all the current office holders have been in their positions for some time (with the exception of Sue Pederick, who is acting while Katherine is on leave). New people and ideas are probably a good idea. If AAN is still useful and needed, are there any offers? The most pressing need is for a newsletter editor to replace Kerrie, but other positions are possible, too. It looks good on a CV!

On other matters, the next APPS meeting is in Queensland. At the last few APPS meetings, we have not had a nematology workshop, unlike earlier years. But this time it looks like there will be a workshop thanks to Kirsty Owen, Rebecca Zwart and others at USQ Toowoomba (formerly QDPI). The proposed theme is cereal nematodes and/or resistance and breeding against nematodes. Please come along and support this effort. Start planning now. I am sure that Kirsty and Rebecca will appreciate any ideas and, more importantly, offers of help. Otherwise, plan to turn up. Student support is available to members of AAN.

Mike Hodda

Regional News

NEWS FROM QUEENSLAND

University of Southern Queensland

We welcomed Dr Rebecca Zwart to our Crop Nematology team in early 2016. Rebecca completed her PhD (at the University of Queensland) on the genetics of root-lesion nematode resistance in wheat, while based at the Leslie Research Facility (Queensland Department of Agriculture and Fisheries). For the past 11.5 years she has worked overseas and has held various positions investigating the genetics and nature of inheritance of genes conferring host resistance to various pathogens of wheat in Australia, Belgium and India. Rebecca presented a review of genetics of root-lesion nematode resistance in wheat at the recent 4th International Conference on Plant Genomics held in Brisbane (July14-15). Also in July, Dr Mahendar Thudi, Scientist (Chickpea Genomics), visiting from ICRISAT (India) gave a presentation at USQ titled "Reaping the benefits of advances in genomics and sequencing technologies for chickpea improvement". We are looking forward to gaining insights into the genetics of resistance to root-lesion nematode resistance in chickpea through collaboration with ICRISAT.

Roslyn Reen and Rebecca Zwart attended the annual Chickpea Innovation Lab meeting at Ege University in Izmir, Turkey in June 2016. The Chickpea Innovation Lab is an international consortium of projects focused on the improvement of traits for climate resilience and food security, with partners in the US, Ethiopia, India, Turkey, Morocco, Canada and Australia. The Australian component of the project, funded by GRDC, is being led by Dr Jens Berger and the nematode research is headed by Professor John Thompson, USQ. John's team are screening new collections of wild chickpea accessions from Turkey to identify new sources of resistance to root-lesion nematodes to be introgressed into adapted chickpea varieties.

Several members of our team have started post graduate study and we welcome two new students too.
Jason Sheedy, (PhD): "Introgression of A-genome resistance to the root-lesion nematode (*Pratylenchus thornei*) from wild *Triticum* spp. into wheat (*Triticum aestivum*)".
Neil Robinson, (Master of Science): "Use of normalised difference vegetation index to assess tolerance of cereal cultivars to root-lesion nematodes (*Pratylenchus thornei*).
Ros Reen (Master of Science): "Resistance of wild relatives (*Cicer reticulatum* and *C. echinospermum*) of chickpea (*C. arietinum*) to root-lesion nematodes (*Pratylenchus thornei* and *P. neglectus*).
Iman Elmore (PhD): "Characterisation of quantitative trait loci for resistance to two species of root-lesion nematode (*Pratylenchus thornei* and *P. neglectus*) on chromosome 2BS in wheat"
Motiur Rahaman (PhD): "Understanding of nematode defence mechanisms in wheat".

Dr Rebecca Zwart (left) and Roslyn Reen (centre) from the University of Southern Queensland with Dr Jens Berger CSIRO Western Australia inspecting chickpea at the Aegean Agriculture Research Institute, Izmir, Turkey.

Recent publications:

Thompson JP (2015) Modelling population densities of root-lesion nematode (*Pratylenchus thornei*) from soil profile temperatures to choose an optimum sowing date for wheat in a subtropical region. *Field Crops Research* **183**, 50-55.

Thompson JP, Clewett TG, O'Reilly (2015) Temperature response of root-lesion nematode (*Pratylenchus thornei*) reproduction on wheat cultivars has implications for resistance screening and wheat production. *Annals of Applied Biology* 167, 1–10, doi:10.1111/aab.12187

Thompson JP, Clewett TG, O'Reilly (2015) Optimising initial population density, growth time and nitrogen nutrition for assessing resistance of wheat cultivars to root-lesion nematode (*Pratylenchus thornei*). *Australasian Plant Pathology* **44**, 133–147.

Rodda MS, Hobson KB, Forknall CR, Daniel RP, Fanning JP, Pounsett DD, Simpfendorfer S, Moore KJ, Owen KJ, Sheedy JG, Thompson JP, Hollaway GJ, Slater AT (2016) Highly heritable resistance to root-lesion nematode (*Pratylenchus thornei*) in Australian chickpea germplasm observed using an optimised glasshouse method and multi-environment trial analysis. *Australasian Plant Pathology* **45**, 309–320

Elif Yavuzaslanoglu, I. Halil Elekcioglu, Julie M. Nicol, Jason G. Sheedy (2016) Resistance of Iranian landrace wheat to the cereal cyst nematode, *Heterodera filipjevi*. *Australasian Plant Pathology*, **45**, 411–414.

Kirsty Owen recently tested the resistance of northern grain region weeds to *P. thornei* and *P. neglectus* in a small project funded by the Northern Grower Alliance (NGA) and GRDC. A summary of the results is included in this newsletter.

And finally a plug for the field trips at the 2017 "Science Protecting Plant Health" conference (Brisbane 26-28th September 2017). Kirsty Owen and Ros Reen are organising field trips to the grain production region of the Darling Downs and northern NSW horticultural production areas as pre- and post-conference tours. We look forward to showing you the many delights of warm, sunny Queensland.

Kirsty Owen

NEWS FROM SOUTH AUSTRALIA

The University of Adelaide

I spent last August/September working with Robin Giblin-Davis in his lab. at the University of Florida Research Station in Fort Lauderdale. As always, it was great to be working with him, and catching up with other colleagues on the Station. Robin and I were finalising the papers describing new species of *Ficophagus* from Pharmacosycea and Americana figs respectively, all from Central America. This was a project begun about 15 years ago, and (having submitted the two papers), it is good to think (hope!) that that particular aspect of it is 'completed'. I also visited the USDA in Baltimore, where I worked on another paper with Sonja Scheffer, and chatted with people including David Chitwood, Lynn Carta, Zafar Handoo and Andrea Skantar.

Back in South Australia, with ABRS funding 'Fred' Bartholomaeus and I are describing 5 new species of *Fergusobia*. This will be the last work that I do with these beautiful chubby little nematodes. After more than 20 years, 25 papers, two book chapters and three reviews, it will be a wrench to say 'good-bye' to them, but the time is ripe to hang up my nematological boots.

It will probably take me 2 – 3 years to finish (publish) work that should have been done X years ago, and I am grateful to the University of Adelaide for giving me the opportunity to actually do this. I also need to prepare the Waite Institute Nematode Collection for its planned transfer to ANIC. It's a strange feeling planning for the end of a career, but the time has come, and nothing lasts forever. Except that you can safely bet that nematodes will inherit the earth, and there is plenty of fun nematology left for younger and more energetic biologists to tackle.

Kerrie Davies

SARDI

Our talented AAN committee member and nematologist Katherine Linsell is on maternity leave. Katherine gave birth to 'James Andrew' a little earlier than expected on the 3rd of October 2016. Congratulations to Katherine and Jason, and we wish the family all the very best with their new addition. We will see Katherine back for the second half of 2017.


Katherine and James at the end of a Christmas function in 2016, both looking healthy and happy and he is so grown up already.

Sue Pederick

NEWS FROM VICTORIA

Horsham

In collaboration with Katherine Linsell and Marg Evans from SARDI, Joshua organised a field tour of nematology and crown rot trials in South Australia and Victoria. The tour started in Adelaide on the Tuesday visiting trials in Kingsford, Pinery, Tarlee, Hart and finishing in Clare overnight. Wednesday we made the journey to Horsham via the Nhill Birchip Cropping Group site. On Thursday we visited AgVic trials at Horsham, Longerenong, Banyena, Rupanyup finishing up again in Horsham. The week was topped off with a statistics course on Friday focused on trial design.

It was a wet week. The gumboots served us well and we only got wet at a few trial sites. Discussions focussed around trial setup and management throughout the season, while also looking for disease symptoms. Due to above average rainfall differences between high and low nematode density plots were limited.

Group photo at Pinery. Left to Right; Daniel Hurbeli (DAFWA), Luise Sigel (AgVic), Jamie Fortune (SARDI), Katherine Linsell (SARDI), Ioane Vakaci (SARDI), Bev Gogel (Adelaide Uni), Joshua Fanning (AgVic), Tara Garrard (SARDI), Jordan McDonald (AgVic), Marg Evans (SARDI), Carla Wilkinson (DAFWA), Alan McKay (SARDI), Clayton Forknall (DAFQ) and Johanna Couchman (AgVic).

Joshua presented a paper on nematode resistance at the Soilborne Disease Symposium in New Zealand with the venue moved from Hamner Springs to Lincoln following an earth quake. The earthquake added an interesting dimension to the trip, and resulted in minimal travel from Christchurch.

In terms of the nematode program at Horsham, it was a bumper season with wheat and barley yields often above 5 and 6 ton per hectare. The trials have only just been harvested with a late finish to the season and data analysis has just begun.

Joshua Fanning and Grant Hollaway

NEWS FROM WESTERN AUSTRALIA

Murdoch University

The Plant Nematology group currently comprises: Prof Mike Jones, Dr John Fosu-Nyarko, and Dr Sadia Iqbal. PhD students are: Ms Silvee Rhaman, Mr Sameer Knot, Ms Jebin Ahkbar, Ms Fareeha Naz, Ms Maria Maqsood, Mr M Adeel, Ms Farhana Begum, and Ms Malathy Rathinasamy.

Three PhD projects were completed:

Sadia Iqbal (2016). Effect of knockdown of genes involved in the RNAi pathway on root-knot nematodes

Vineeta Bilgi (2016). Effects of silencing green peach aphid (*Myzus persicae*) genes *via* RNA interference

Harshini Herath (2016). Comparative and functional analysis of the spliceosome units of cyst and root lesion nematodes.

Two Honours projects were completed:
Rhys Copeland: Identification and characterisation of putative parasitism genes of the root lesion nematode *Pratylenchus neglectus*.
Ryan McCracken*:* Molecular analysis of transgenic *Nicotiana tabacum* developed for pest resistance, through gene silencing technology**.**

The Plant Nematology section of the Plant Biotechnology Research group at Murdoch University continues to be very active. In addition to work on plant parasitic nematodes research was extended to aphid control, as another group of plant pests which feed from cells contents. The focus is on developing synthetic resistance to plant parasitic nematodes using gene silencing technology *via* transgenic plants, for both sedentary and migratory endoparasites. We are interested both in genes vital for nematode survival and effectors that are required for nematode parasitism. The work includes Next Generation Sequencing of root lesion nematode transcriptomes and genomes, and analysis of how they function.

One highlight was an invitation to write a review for the Annual Reviews of Phytopathology on *'Advances in understanding the molecular mechanisms of root lesion nematode host interactions'* – our analysis of nematode effectors shows that those effectors present in endoparasites involved in migration through plant tissues and evading or avoiding host plant defences are common, but not surprisingly effectors thought to be involved in feeding cell formation (giant cells or syncytia) are not present in root lesion nematodes.

In expanding our work into control of aphids using RNAi, we have also found evidence that nematodes and aphids may have some common effectors.

Although we strongly support the development of GM crops, we recognise issues of deployment, and also have work on spray delivery of dsRNA for nematode control, which makes use of the fundamental work we do with transgenic plants, and then applies this knowledge to pest control in a non-transgenic manner.

We have continued our international collaboration with Dr Uma Rao at the Indian Agricultural Research Institute (IARI) in New Delhi, supported by an Australia-India Strategic Research Fund grant, and contributed to a number of international meetings.

Mike attended a Bill and Melinda Gates Foundation Workshop in Nairobi in relation to controlling root lesion nematodes in yams in West Africa, but the Leeds group (Howard Atkinson and Peter Urwin) seem to be in control of any possible funding support! It was great to meet up with a former PhD student, Dr Rose Njeru who is now CEO of a biotech company.

Mike was also a keynote speaker at Forman Christian College (FCC) in Lahore, Pakistan as guest of Professor Kauser Malik – after some visa issues he finally made it to the meeting and gave 3 talks (after arriving at 3.00am). FCC is the former home of three of our students (Fareeha, Maria and Adeel), and about half the cabinet in Pakistan under a former President attended this college. A highlight of the visit was a trip to the border between Pakistan and India (at Wagah), where the

flag lowering ceremony has been held every day for 70 years, and the border closed, amid much patriotic fervour on both sides of the border.
Mike, Fareeha and Farhana presented papers at the European Society of Nematologists meeting at Braga in Portugal, which was well worth attending. There are many advances in plant nematology and host-pathogen interactions at the moment – too many to list here!

We co-organised a Workshop on 'Regulation of New Breeding Technologies' with the University of Malaya, Kuala Lumpur, as part of a link between the Innovative Research Universities (IRU, includes Murdoch University) and the Malaysian Research Universities Network (MRUN). New technologies such as RNAi and Genome Editing show great promise for crop improvement, but we need to determine how best to use genome editing for delivering resistance to nematodes and other crop pests.

In a non- nematode project, the group works on an ARC Linkage grant on genome editing of potato to reduce its glycaemic index, with a Dutch potato company and the Potato Marketing Corporation of WA (now transferred to the potato Growers Association of WA).
The Plant Virology Section of the Group, led by Dr Steve Wylie has also been active, and published 4 papers in 2016.

Invitations (including presentations) in 2016 included:

- Taylor's University Malaysia Mini-symposium, invited speaker, '50 shades of GMOs' (MJ)
- Chief Guest, Kakatiya University, Warangal, India, International Congress on Emerging Biotechnologies (Feb 2016)(MJ)
- Lectures at IARI, New Delhi and KIIT University at Bhubaneshwar, Odisha (Feb 2016).
- Keynote lectures at Forman Christian College, Lahore, Pakistan (Mar 2016)(MJ)
- 3rd Plant Genomics Asia Conference, Keynote talk 'New approaches for crop pest control' Kuala Lumpur, (April 2016)(MJ)
- Organiser and MC, Ausbiotech Biobriefing Workshop on 'Innovation in Ag & Food Biotechnology: Outcomes for Human Health', Innovation Centre, Perth, WA , (28 April 2016) (MJ)
- European Society of Nematologists meeting Braga, Portugal, (Sept 2016).
    - Michael G K Jones, Jo-Anne Tan, Sameer Khot and John Fosu-Nyarko 'Effectors of root lesion nematodes'
    - Fareeha Naz 'Improving the effectiveness and delivery of gene silencing triggers to control plant nematode pests'
    - Farhana Begum, John Fosu-Nyarko, Shashi B. Sharma, Bill Macleod and Michael G. K. Jones. 'ITS sequences reveal genetic variation within populations of *Pratylenchus quasitereoides* and between Pratylenchus species in Australia'
- Invited to be an external expert assessor of the Kuwait Foundation for the Advancement of Sciences (KFAS) on the Evaluation Committee for the 'Kuwait Prize of 2016: Food and Agriculture' (Prize value US$40,000) (MJ).
- Ausbiotech Ag & Foodtech Symposium 2-3rd Aug 2016, Brisbane, Invited Speaker, 'Advances in plant biotechnology: the future of plant agriculture' (MJ).
- Global Entrepreneurship Community 2016 'Reimagine the Future of Entrepreneurs' Kuala Lumpur Convention Centre, Malaysia, 8-9 December 2016: invited speaker (MJ).

Recent publications

- Fosu-Nyarko, J and Jones, MGK (2015). Application of biotechnology for nematode control in crop plants. Chapter 14 in 'Advances in Botanical Research: Plant nematode interactions', Academic Press, Edited by C. Escobar and C. Fenoll, 73, 339-376.
- Fosu-Nyarko J, Gill R, Agrez VG, Tan J-ACH, Rao U, Jones MGK (2016). *De novo* analysis of the transcriptome of *Pratylenchus zeae* to identify structural, sensory, locomotion and parasitism genes. *Molecular Plant Pathology*, 17, 532–552, DOI: 10.1111/mpp.12301
- Fosu-Nyarko J, Nicol P, Naz F, Gill R and, Jones MGK. (2016). Analysis of the transcriptome of the infective stage of the beet cyst nematode, *H. schachtii*. *PloS One*: DOI: 10.1371/journal.pone.0147511.
- Jones MGK, Iqbal, S and Fosu-Nyarko, J (2016). Chapter 9: Belowground defense strategies against migratory nematodes, in 'Belowground defense strategies in plants', Eds Vos, C, Kazan, K, Springer International,pp. 253-278.
- Iqbal, S and Jones, MGK (2016). Encyclopedia of Applied Plant Sciences 2nd Edition, Eds Thomas B, Murphy D and Murray, B., Ms 61. Nematodes, Elsevier, in press.
- Fosu-Nyarko J and Jones MGK. (2016). Advances in understanding the molecular mechanisms of root lesion nematode host interactions. *Annual Reviews of Phytopathology* 54:11.1–11.26.
- Iqbal, S, Fosu-Nyarko, J and Jones MGK (2016). Genomes of parasitic nematodes (*Meloidogyne hapla*, *Meloidogyne incognita*, *Ascaris suum* and *Brugia malayi)* have a reduced complement of small RNA interference pathway genes: knockdown can reduce host infectivity of *M. incognita*. *Functional and Integrative Genomics*, DOI: 10.1007/s10142-016-0495-y
- Bilgi, V, Fosu-Nyarko, J and Jones, MGK (2017). Using vital dyes to trace uptake of dsRNA by green peach aphid allows effective assessment of target gene knockdown. *International Journal of Molecular Sciences 18, 80; doi:10.3390/ijms18010080*
- Harikrishna JA, Othman RY, Mispan MS, Iqbal S, Han Y and Jones MGK (2017) Mini review: Biosafety of RNA silencing and genome editing technologies in crop plants: Malaysian and Australian research perspectives *Asia Pacific Journal of Molecular Biology & Biotechnology* (in press)
- Smiley RW…Iqbal,S, Jones MGK.. et al (2017). Cereal Cyst Nematodes: A Complex and Destructive Group of *Heterodera* Species. In press.
- Tan, MHN, Perera MR, and Jones MGK (2017). (Submitted). Protein profiling of four species of Plant Cyst Nematodes using Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry.

Some pictures follow:

With Dr Uma Rao and the Nematology Department at IARI New Delhi.

At KIIT University Bhubaneshwar, where they look after 25,000 tribal children on site, serving 25,000 meals three times a day – here are children waiting for the next dinner sitting – the dining hall serves 10,000 children per sitting.

With 10 Murdoch students at KIIT, plus the Vice Chancellor of the University (centre) – I don't think he had ever met a group of students like this before!

At ESN meeting Braga – L. Fareeha gives her first conference talks; R. Murdoch contingent at ESN meeting (Mike, Fareeha and Farhana).

Mike Jones

RESEARCH REPORT

RESISTANCE OF WEEDS IN THE NORTHERN GRAIN REGION TO THE ROOT-LESION NEMATODES, *PRATYLENCHUS THORNEI* AND *P. NEGLECTUS*

Currently there is no information about the resistance/ susceptibility of common weed species in the northern grain region to the root-lesion nematodes, *P. thornei* and *P. neglectus*. We tested 10 weed species collected from the region in glasshouse experiments (including *Sisymbrium thellungii; Echinochloa colona; Hibiscus trionum; Fallopia convolvulus; Chloris virgata; Conyza bonariensis; Urochloa panicoides; Sonchus oleraceus; Avena* spp.*;* and *Chloris truncata*). For *P. thornei,* most of the grass weeds tested were rated as resistant (R) to moderately-resistant (MR) in both experiments. However Awnless barnyard grass was rated as moderately-susceptible (MS), and Wild oats as MS-S in the second experiment. African turnip weed and Climbing buckwheat were rated as MS and MS-S to *P. thornei* respectively and Bladder ketmia as MR but these treatments had limited numbers of replicates. Weed species inoculated with *P. neglectus* were rated as R to MR. However, Liverseed grass was the exception and was rated as moderately resistant-moderately susceptible (MR-MS) in the first experiment, but MR in a second experiment with *P. neglectus*. Repeating the experiments and understanding the role of planting time and seasonal effects on the rate and timing of germination and plant growth is recommended in future. Further experiments with weeds collected from different areas within the northern grain region and with more weed species is also recommended. Targeted control, particularly of susceptible weed species, will support management of root-lesion nematodes and will contribute to better understanding of changes in populations of root-lesion nematodes when weed populations are poorly controlled.

The full report can be accessed at the following link:
http://us2.campaign-archive2.com/?u=27b6b0083e10356895c90c4c7&id=b9c806484f

Kirsty Owen and John Thompson

Centre for Crop Health, University of Southern Queensland, Toowoomba.

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Short Course 2017

NEMATODES IN CROPPING SYSTEMS: IDENTIFICATION & TECHNIQUES

Planning for the next course is starting now. At the moment, the proposal is to hold the course at **The University of the South Pacific, Laucala Campus, Suva, Fiji** in the first week of **December 2017.** The alternative venue is: **The University of Adelaide, Waite Campus, Adelaide, South Australia** at a similar time of year.

The intention is to follow the format of previous courses: that is starting with the draft timetable below, and then modifying the content and particular nematodes discussed to suit any particular interests of participants expressed either before the course or that arise during the course. If the course proceeds in Suva, there will be some initial emphasis on tropical nematodes.

Participants are encouraged to bring specimens or material (subject to local quarantine restrictions) for study and discussion during the course.

The presenters will be:

Dr Mike Hodda, CSIRO
Dr Kerrie Davies, University of Adelaide
Dr Sunil Singh, University of The South Pacific (to be confirmed)

The cost of the course is AUD2100 (including GST).

The course costs cover all materials (microscope slides etc), plus a manual, and morning and afternoon teas, but not breakfast, lunch or dinner, accommodation or meals. Some local transport MAY be available by arrangement with local participants. International participants can be met at Suva airport if desired.

The workshop requires 8 confirmed participants to proceed.

For further enquiries or to book a place, please email Mike Hodda or Sunil Singh at:

mike.hodda@csiro.au

sunil.singh@samoa.usp.ac.fj

Once confirmed, Mike will forward payment details. Payment can be by Credit card or invoice in AUD, but will be required prior to the course commencement.

No particular accommodation is suggested or recommended, but alternatives will be canvassed once the venue is decided.

Why Nematodes?

Nematodes are the most numerous multi-celled organisms on earth. Soil nematodes are of great importance to cropping systems: they can significantly reduce plant yields; they are biocontrol agents of invertebrate pests; and they recycle soil nutrients. Recent work suggests that they have potential as bio-indicators of soil health. They are frequently encountered in quarantine work.

Specialised knowledge is required to handle and identify nematodes. This course provides the skills and information needed to confidently handle nematodes in a wide variety of situations. It includes sampling, collecting and preparing nematodes for identification, using keys and other tools for identification, as well as the background information needed to deal with nematodes.

Is this Course for You?

The workshop suits researchers and professionals working in agriculture, quarantine, green-keeping, and soil biology, who need to understand the principles and practice of handling soil, plant and insect nematodes. It will provide hands-on experience in sampling, extraction, specimen preparation, culturing, diagnosis, and identification. Prior knowledge is not assumed, but it is helpful if participants have a degree which includes biology, agriculture, or soil science or have appropriate work experience. The level presented will be varied to suit participants' knowledge and experience, and less experienced participants can be supplied with recommended reading material prior to the workshop.

Course Presenters

Dr. Mike Hodda (National Research Collections Australia, CSIRO, Canberra) and Dr. Kerrie Davies (School of Agriculture, Food & Wine, The University of Adelaide) will conduct the workshop, assisted by Dr Sunil Singh (University of The South Pacific, Samoa). The presenters have almost 100 years' experience researching nematodes between them, have described numerous species, have research experience in the entire field from pure science to practical applications. They have many years teaching experience to both graduates and undergraduates, and together have studied most taxonomic groups of nematodes over much of the Asia-Pacific Region.

Course Content

- Sampling and extraction
- Preparation of specimens
- Microscopic techniques
- Ecology and physiology of nematodes
- Identification of free-living, plant parasitic and entomophilic nematodes
- Culturing (if requested)

Nematodes to be Considered

Anguina ..... Seed & Leaf Gall Nematodes
Aphelenchoides ..... Bud, Leaf & Foliar Nematodes
Bursaphelenchus ..... Pine Wilt Nematode
Ditylenchus ..... Stem & Bulb Nematodes
Globodera ..... Potato Cyst Nematodes
Helicotylenchus ..... Spiral Nematodes

Hemicycliophora ..... Sheath Nematodes
Heterodera ..... Cyst Nematodes
Heterorhabditis ..... Insect Biocontrol Nematodes
Meloidogyne ..... Root Knot Nematodes
Morulaimus ..... Australian Sting Nematodes
Paratrichodorus ..... Stubby-Root Nematode
Pratylenchus ..... Root Lesion Nematodes
Radopholus ..... Burrowing Nematodes
Scutellonema ..... Spiral Nematodes
Steinernema ..... Insect Biocontrol Nematodes
Tylenchorhynchus ..... Stunt Nematodes
Tylenchulus ..... Citrus Nematode
Tylodorus .....
Xiphinema ..... Dagger Nematodes
Tylenchida ..... Minor Plant Parasites
Rhabditida ..... Microbial-Feeding Nematodes
Mononchida ..... Predatory Nematodes
Dorylaimida ..... Omnivorous Nematodes
Areolaimida ..... Omnivorous Nematodes
Actual list depends on participants interests.

Course Delivery and Materials

This is designed as a laboratory-based, hands-on course supported by lectures and discussion. The workshop will be held in laboratories and lecture rooms at the selected University campus. A practical manual containing outlines of topics covered, recipes for specific techniques, a key, a glossary and a bibliography of suitable references will be provided at the beginning of the course. Participants are encouraged to bring fixed material which they may wish to work on.

Course Fees

The workshop fee will be $2100 (AUD, incl GST). The fee is payable after notification that a minimum number of participants has been met. On acceptance registration, an invoice will be sent, which can be paid by Money Order, cheque payable to "CSIRO, Nematode Identification" (ABN 41687119230), credit card, or direct transfer via BPAY. The fee covers participation, the handbook and the provision of consumables such as fixatives, slides, and culture media. Tea and coffee will be provided. Travel costs, accommodation, and meals are not included in the fee. The workshop requires 8 participants to proceed.

Accommodation/Meals

Food outlets are limited around the venues: arrangements for lunches will be discussed prior to the workshop. Please indicate on the form if you require details from the workshop co-ordinator. Participants should make their own accommodation arrangements. The coordinators can supply lists of potential accommodations, off-campus.

For more information

Dr Mike Hodda mike.hodda@csiro.au

ph (02) 6246 4371

Helpful information for the organizers

It will help the organizers adjust the course to participants' interests and experience if the following information is provided:

University or other Tertiary Education: institution, degree, subjects with approx. dates?

Experience in nematology?

Main interests in particular aspects of plant, insect or soil nematology?

Other queries or preferences?