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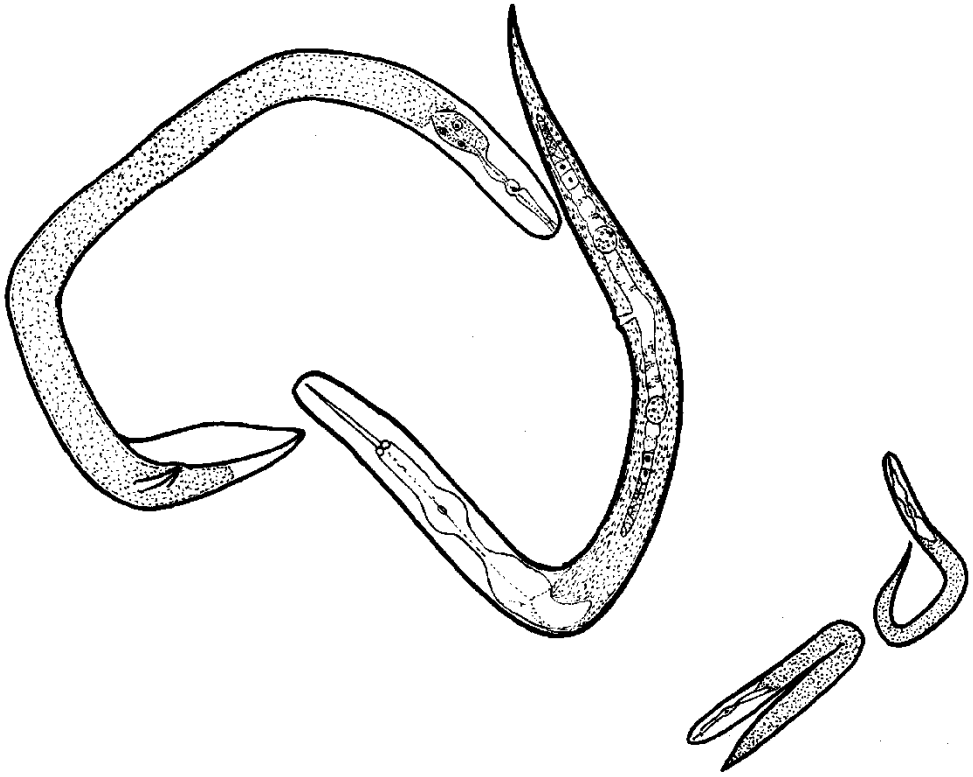
AUSTRALASIAN NEMATOLOGY NEWSLETTER



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From the Editor

Happy 2018! Thank you to everyone who has contributed to this issue of ANN. We have a bumper issue of workshop reports from the second half of 2017. It's fantastic to see the efforts in knowledge exchange and raising awareness of nematode issues through international workshops.

You may notice that a new ISSN has been assigned to this issue, as the newsletter is now published in digital format only. The AAN newsletter is accessible online through the National Library of Australia and the AAN website (http://nematologists.org.au).

I look forward to receiving your contributions for future issues. Please consider contributing to regional news and informing AAN members of your recent publications through this newsletter. Announcements of new research projects, colleagues, visitors, students etc., research reports, conference or workshop reports, abstracts of recently submitted/accepted PhD theses, conference or workshop announcements and photos are also welcome. Contributions will be accepted at any time throughout the year so please forward articles and reports to me as they occur, with the deadline for the next issue around mid-June 2018.

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Association News

FROM THE PRESIDENT

I am writing this having just farewelled a couple of undergraduate students who have been working in my team for the last 10 weeks as part of a scheme to encourage students to consider studying and then taking up careers in the areas of interest to their hosts. The students—like many we have had under this scheme—have been excellent, and so we have had considerable discussions on what would make them consider careers in nematology and science in general. The answers did not surprise me, but did get me thinking; always a dangerous proposition. And the "survey" is based on just 2 responses, and so in no way a representative sample of students in 2nd or 3rd year university.

The answers given by the students was that they would carry on with nematology if there was a very good chance of a career in it for them. Sadly of course, I could not offer that assurance.

What struck me was that I and many others in nematology did not in fact start our careers, even though it was many years ago, with the aim of becoming nematologists. Seeing the light and conversion to the discipline only came later as we were exposed to nematodes or had to deal with them in whatever other studies we were doing. Things seemed to flow from there.

So rather than schemes to lure students what might be needed more is schemes to retain those further into their careers who have been working on nematodes. I don't know what form such schemes might take, but it is worth considering and suggesting if asked.

On another matter, after the Australasian Plant Pathology Society (APPS) conference in 2017, preparations for the next Australian Soilborne Disease Symposium (ASDS) in 2018 are under way. Although there were quite a few nematologists at APPS, only a few attended the post-conference nematology workshop. Another nematology workshop is being planned around the ASDS. While frequent workshops are good, I cannot but think that concentration of AAN on one or the other of these fora would acheive a greater critical mass of attendees. I have raised this before, and received no response at all, so if there are no comments then we might have to base any decisions on an empirical comparison of the relative levels of attendance. So let me know (either by email, phone or at APPS or ASDS) if you have a strong preference for having nematology meetings at one or the other conference.

A final reminder that the programme for the 7th International Congress of Nematology (Nice, France) is under development and that as AAN is a member of the International Federation, we have a say and can make suggestions. At this stage, it is mainly organizers of sessions that are being requested, so if you are interested, let me know, so that your name can be put forward.

Mike Hodda

AAN ANNUAL MEETING

Nineteen AAN members got together to for the AAN Annual General Meeting on 27th September 2017, during the APPS Conference "Science Protecting Plant Health" in Brisbane.

AAN members enjoying breakfast at Olio Cafe & Bar at the Brisbane Convention Centre during the AAN Annual General Meeting. Photo curtosy of Kim Khuy Khun.

Regional News

NEWS FROM QUEENSLAND

University of Southern Queensland

The Crop Nematology team at University of Southern Queensland (USQ) has emerged from a very dry winter season with some interesting results for our GRDC-funded projects. The season started well with good establishment of our winter grain crops due to stored water following the heavy rain from ex-Cyclone Debbie, but there was no rain from planting until late October when plants were just about ready to harvest. Minimum tillage proved again to be fruitful by preserving precious soil moisture that our trials fully relied on throughout the season.

An experiment at Westmar (300 km west of Toowoomba) produced some exceptional yield response curves for wheat cultivars ranging from intolerant to tolerant in response to a range of *Pratylenchus thornei* population densities at planting (which were established in the previous year). Average grain yield for the most tolerant cultivar was 1.5 t/ha but for intolerant cultivars yields were as low as 0.4 t/ha and yield loss ranged from 13% to 81%. Results will be presented to grain growers in March 2018 at GRDC Update meetings by Kirsty Owen and will emphasise the value of growing tolerant wheat cultivars in our region, and also choosing crop sequences to reduce *P. thornei* populations. This experiment is part of a National GRDC-funded project (DAW00245) with the nematode component led by Dr Grant Hollaway, AgVic. Results from several, similar experiments will be collated and contribute to a new report on the economic impact of root-lesion nematodes in the northern grain region.

Other experiments at our team's dedicated *P. thornei* site at Formartin, Queensland tested the resistance and/ or tolerance of cultivars of faba bean, field pea, mungbean, wheat and barley (GRDC project codes: DAV00128, USQ00019, DAQ00188). The damaging effects of *P. thornei* didn't disappoint! A number of breeding lines developed by the USQ RLN pre-breeding program were amongst the highest yielding lines. Formartin is widely recognised as being an invaluable *P. thornei* research field site, including for Australian wheat breeders to assess their material for tolerance to *P. thornei*.

A full program of resistance experiments continued in the Toowoomba glasshouses in 2017. These included the National Variety Trials that screened for resistance to *P. thornei* and *P. neglectus* for both wheat and barley. Other crops are also screened for resistance, including methodology experiments for mungbean, field pea and barley.

The USQ Crop Nematology team hosted the post-conference workshop at the 2017 APPS "Science Protecting Plant Health" conference on 29th September 2017. See page 12 for the workshop report.

In early December 2017 John Thompson, Rebecca Zwart and Roslyn Reen visited the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad, India for an annual project meeting and presentation of results to date in regards to the wild *Cicer* collection from Turkey, collected during 2013/2014. The project has international linkages with eight countries with the research focused on identifying resistance to abiotic and biotic stresses for future incorporation into commercial chickpea. Roslyn presented a poster at the meeting. The new chickpea collection is part of Roslyn's masters research where the aim is to identify accessions with improved resistance to *P. thornei* than are currently available to Australian chickpea breeders. Prior to the project meeting Rebecca organised a workshop on Integrated Management of Root-Lesion Nematodes at the National Institute for Plant Health Management in Hyderabad. See page 16 for the workshop report.

In August, a new and very enthusiastic PhD student joined our group, Elaine Tabah. She will investigate the interaction of *P. thornei* and mycorrhiza in chickpea and mungbean.

Kirsty Owen

Recent publications

Whish JPM, Thompson JP, Clewett TG, Wood J, & Rostad H (2017) Predicting the slow decline of root lesion nematode (*Pratylenchus thornei*) during host-free fallows to improve farm management decisions. *European Journal of Agronomy*. **91**, 44-53. https://doi.org/10.1016/j.eja.2017.09.012

Thompson JP, Rostad HE, Macdonald B, & Whish JPM (2018) Elevated temperature reduces survival of peak populations of root-lesion nematodes (*Pratylenchus thornei*) after wheat growth in a vertisol. *Biology and Fertility of Soil.* **54**, 243–257. https://doi.org/10.1007/s00374-017-1256-3

Sugar Research Australia

See page 14 for a report on the recent workshop in China on sugarcane nematodes.

Shamsul Bhuiyan

Recent publications

Bhuiyan, SA, Garlick, K, Anderson JM, Wickramasinghe P & Stirling GR (2017) Biological control of root-knot nematode on sugarcane in soil naturally or artificially infested with *Pasteuria penetrans*. *Australasian Plant Pathology.* **47**, 45-52 https://doi.org/10.1007/s13313-017-0530-z

Stirling GR, Wong E & **Bhuiyan S** (2017) *Pasteuria*, a bacterial parasite of plant-parasitic nematodes: its occurrence in Australian sugarcane soils and its role as a biological control agent in naturally-infested soil. *Australasian Plant Pathology*. ***46***, 563-569. https://doi.org/10.1007/s13313-017-0522-z

Bhuiyan SA, Croft BJ, Stirling G, Jackson P, Piperidis, G & Aitkens KS (2016) Preliminary investigations on the resistance of *Saccharum spontaneum* and its backcross progenies to root-knot and root-lesion nematodes. *Proceedings of the International Society of Sugar Cane Technologists.* **29.**

Bhuiyan SA, Croft BJ, Stirling GR, Wong E, Jackson P & Cox M (2016) Assessment of resistance to root-lesion and root-knot nematodes in Australian hybrid clones of sugarcane and its wild relatives. *Australasian Plant Pathology*. ***45***, 165-173. https://doi.org/10.1007/s13313-016-0400-0

Bhuiyan, S.A, Croft BJ, Wong E, Ogden-Brown J, Turner M, Parfitt, R, Magarey R, Bull J, & Cox M (2016) Effects of pachymetra root rot and nematodes on some elite sugarcane clones in Australia. *Proceedings of the Australian Society of Sugarcane Technologists.* **38.**

NEWS FROM VICTORIA

Horsham

It was a relatively busy year for the Victorian nematology group in 2017. Grant Hollaway was invited to speak at the 6th International cereal nematode symposium held in Morocco during September. See page 10 for the workshop report.

Joshua Fanning and John Wainer both attended the APPS conference in Brisbane and the Annual AAN meeting held in Brisbane. John Wainer was co-author on two presentations and two posters at the APPS conference. Joshua Fanning presented a poster at the conference. Joshua also attended the nematology workshop and field tour of the USQ facilities and their field trials.

Jon Baker, a technician based in the group at Horsham attended the nematode identification course in Adelaide with Mike Hodda and Kerrie Davies.

Following the 2017 harvest, results are now being analysed and we are preparing for the end of the national nematology project. One experiment of note was a cereal cyst nematode trial, which had yield losses up to 23% with a number of varieties with yield losses greater than 10%. However, there were also some newer varieties that had no yield losses in this experiment. This highlights a level of tolerance in some of the more recently released varieties.

Joshua Fanning, Grant Hollaway and John Wainer.

Abstracts from conferences

Hollaway GJ, Fanning J, & McKay AC (2017) Economic importance, population dynamics and control of Pratylnechus thornie in wheat crops in southern Australia. In 'Proceedings of the Sixth International Cereal Nematodes Symposium' Agadir, Morocco, 11-15 September 2017 (eds Dadabat AA, Mokrini F and Smiley RW) p3.

Fanning J, Rodda M, Daniel R, Linsell K, Owen K, Reen R, Sheedy J, Thompson J, Moore K, McKay A & **Hollaway G** (2017) Root lesion nematode, Pratylenchus neglectus and P. thornei pulse resistance ratings: A national approach, 'Science Protecting Plant Health' Brisbane, Australia, 26-28 September 2017

Edwards J, Agarwal A, **Wainer J,** Blacket M, Tricka M & Renton M (2017) Genotyping of potato cyst nematode in Victoria, Australia, and comparison with populations from Europe and the Americas, 'Science Protecting Plant Health' Brisbane, Australia, 26-28 September 2017

Triska M, Edwards J, **Wainer J,** Powell K, Stringer L, Broughton S, Collins C, Collins S, & Renton M (2017) Optimizing the surveillance of invading organisms: Can we improve standard surveillance strategies?, 'Science Protecting Plant Health' Brisbane, Australia, 26-28 September 2017

Malipatil M, Edwards J, Blacket M, Semeraro L, **Wainer J** & Brett R (2017) Victoria's Plant Pest and Pathogen Reference Collections, 'Science Protecting Plant Health' Brisbane, Australia, 26-28 September 2017

Holmes R, Aldaoud R, Blacket M, Bottcher C, Brett R, Constable F, DeAlwis S, Dinh Q, Edwards J, Malipatil M, Mann R, Rodoni B, Salib S, Semeraro L, Skyllas C, Valenzueal & **Wainer J** (2017) The role of Crop Health Services in Victoria's General Surveillance Program: New detections 2014 -2017, 'Science Protecting Plant Health' Brisbane, Australia, 26-28 September 2017

Abstracts

Bhuiyan, SA, Garlick, K, Anderson JM, Wickramasinghe P & Stirling GR (2017) Biological control of root-knot nematode on sugarcane in soil naturally or artificially infested with *Pasteuria penetrans*. *Australasian Plant Pathology*. 47, 45-52. https://doi.org/10.1007/s13313-017-0530-z

Soil was collected from a sugarcane field where most of the second-stage juveniles of root-knot nematode (*Meloidogyne javanica*) were encumbered with endospores of *Pasteuria penetrans*. A pot experiment was established to determine whether the bacterium was present at levels capable of reducing populations of the nematode. Endospores of the bacterium were eliminated by autoclaving the soil and then eggs of *Meloidogyne javanica* were inoculated into *Pasteuria*-free and naturally-infested soil. When the experiment was harvested 19 and 37 weeks later, the root-knot nematode population was respectively 96 and 99% lower in the naturally-infested field soil, indicating that this soil was highly suppressive to the nematode. *Pasteuria penetrans* was also mass-produced on its nematode host and a further experiment was set up to determine the effect of endospore concentration in soil on multiplication of root-knot nematode. Sugarcane was grown in pasteurised sand containing 0, 6000, 12,000, 24,000 and 50,000 endospores/g soil and treatment effects were assessed after 6, 13 and 20 months. The results showed that regardless of harvest time, the severity of root galling and the number of nematode eggs produced per plant decreased as the endospore concentration increased. The lowest endospore concentration significantly reduced the number of eggs per plant at all three harvest times while the highest concentration reduced egg numbers by 96, 88 and 81% at 6, 13 and 20 months, respectively. These results suggest that when high endospore concentrations are continually maintained in the root zone, *P. penetrans* will markedly reduce populations of root-knot nematode, a particularly important pest of sugarcane.

Stirling GR, Wong E & Bhuiyan S (2017) *Pasteuria*, a bacterial parasite of plant-parasitic nematodes: its occurrence in Australian sugarcane soils and its role as a biological control agent in naturally-infested soil. *Australasian Plant Pathology*. 46, 563-569. https://doi.org/10.1007/s13313-017-0522-z

In a survey of all sugar production areas in Australia, *Pasteuria* was detected in 56% of the fields sampled. Endospores were seen on root-knot nematode (*Meloidogyne* spp.), root-lesion nematode (*Pratylenchus zeae*), stunt nematode (*Tylenchorhynchus annulatus*) and spiral nematode (*Helicotylenchus dihystera*). In most cases infestation levels were relatively low, as less than 5% of the nematodes usually had spores attached. However, the results of a bioassay with soil from a site heavily-infested with *P. penetrans* suggested that root-knot nematode was being suppressed to some extent at this site. When second-stage juveniles of *M. javanica* had to move 4 and 8 cm through the soil to reach sugarcane roots, egg production was reduced by 55 and 85%, respectively. Sugarcane had been grown at most of the surveyed sites for more than 100 years but the highest levels of spore encumbrance on root-lesion nematode were observed in two fields that were previously grass pasture and had only grown sugarcane for 18 and 22 years. Pasture and sugarcane soil from one of these sites was bioassayed by inoculating *Pratylenchus zeae* into soil that had been heated at 60 °C to kill any nematodes present. When the added nematodes were extracted 40 days later, approximately 50% were either parasitised by *Pasteuria thornei* or had endospores attached, indicating that the biocontrol agent was present at relatively high levels in both soils. Since grazed pastures are never tilled and the two sugarcane fields had been subjected to much less tillage than the other surveyed sites, research should be undertaken to determine whether the tillage practices commonly used in sugarcane are limiting the capacity of *Pasteuria thornei* to increase to high levels and provide some nematode control.

Whish JPM, Thompson JP, Clewett TG, Wood J, Rostad H (2017) Predicting the slow decline of root lesion nematode (*Pratylenchus thornei*) during host-free fallows to improve farm management decisions. *European Journal of Agronomy.* 91, 44-53. https://doi.org/10.1016/j.eja.2017.09.012

Pratylenchus thornei is a major pathogen of cereal and legume crops around the world, especially in the northern grains region of eastern Australia. The dominance of host species within the rotation has seen soil pathogen population densities increase. Long weed-free fallows combined with sorghum production (non host crop) to reduce population densities has been successful. However, little is known about the rate of population decline during the fallow or how long this non–host period should continue in order to reduce the population below an accepted damage threshold. The rate of decline from a range of initial starting populations (high, medium, low and very low) were monitored over a 30 month weed free fallow. Fallows were initiated in November (late Spring) for three consecutive years. Nematode population densities and soil moisture were measured at eight depths down the soil profile to 1.5 m and used to describe the rate of population decline over time in each soil layer. Dynamic populations of *P. thornei* existed within the upper layers (< 0.6 m) of the soil and these declined at a rate that could be described by the negative exponential model Y =ae−bt. The time taken for a population to decline was dependent on the initial population density at harvest of the previous host crop. Generally, between 300–600 days of host-free fallow was required to reduce a moderately high initial population of 80 *P. thornei*/ cm3 soil to the damage threshold of 2 *P. thornei*/cm3. The rate of decline varied between soil layers, particularly in the surface layer (0–0.15 m), but remained constant from year to year for each layer. There was no interaction between year and soil layer. Knowing the expected rate of decline of a *P. thornei* population at the start of a fallow allows better management of the crop rotation to ensure populations do not continue to rise and thus reduce the yield potential of future crops.

Thompson JP, Rostad HE, Macdonald B, & Whish JPM (2018) Elevated temperature reduces survival of peak populations of root-lesion nematodes (*Pratylenchus thornei*) after wheat growth in a vertisol. *Biology and Fertility of Soil.* 54, 243–257. https://doi.org/10.1007/s00374-017-1256-3

Elevated temperature was investigated to understand why there is a faster decline in *Pratylenchus thornei* population abundances in the topsoil than in deeper layers of vertisols after wheat matures in the subtropical grain region of eastern Australia. Soil containing a large population abundance of *P. thornei* (after wheat growth) was incubated in a replicated experiment for various periods up to 16 weeks at eight temperatures ranging from 10ºC to 45ºC in 5ºC intervals, with three moisture treatments, namely, (a) field capacity maintained during incubation, (b) field capacity allowed to dry during incubation, and (c) air-dried before incubation. After incubation, live nematodes were extracted from the soil samples by the Whitehead tray method for 2 and 7 days and *P. thornei* was counted in four life-stage categories. Temperatures ≥35ºC resulted in rapid death of *P. thornei* independent of any effects due to soil desiccation. At lower temperatures, survival over a 16-week period was better in soil maintained at field capacity than in soil allowed to dry. Death of *P. thornei* in soil that was air-dried before incubation was rapid during incubation at all temperatures tested. Elevated temperature of itself plus faster soil desiccation with increasing temperature are the likely causes of the faster decline in *P. thornei* population abundances in the topsoil than in the subsoil. These effects can contribute to soil profile distributions of *P. thornei* recorded in some fields in this subtropical grain region after clean fallow periods where greater population abundances of *P. thornei* occur in the subsoil layers than in the topsoil.

Conference Report

A SUMMARY OF MY ATTENDANCE AT THE SCIENCE PROTECTING PLANT HEALTH CONFERENCE

I would like to thank the Australasian Association of Nemtologists for offering me the Postgraduate Student Conference Bursary for attending the **Science for Protecting Plant Health (SPPH) Conference**, held in Brisbane, September 2017.

During the conference, I presented a poster titled "Characterisation of quantitative trait loci for resistance to two species of root-lesion nematode (*Pratylenchus thornei* and *P. neglectus*) on chromosome 2BS in wheat", which discusses the focus of my Ph.D. study. I also presented a short talk during the post-conference workshop held at the University of Southern Queensland, Toowoomba.

The main highlight of the conference was that it catered for a wide range of fields and interests. Conventional approaches of controlling nematodes were presented through several presentations and posters, including the pathogen referencing initiative in Victoria "Victoria's Plant Pest and Pathogen Reference Collections". The approach of the National Variety Test that allows breeders and pre-breeders to identify and use sources of resistance in their breeding programs was also presented in a poster titled: "Root lesion nematode, *Pratylenchus neglectus* and *P. thornei* pulse resistance ratings: A national approach". Furthermore, the biocontrol of nematodes was presented in various instances along with new cropping systems that can help suppressing soil borne diseases. However, it was interesting to see new approaches taken towards controlling different types of plant-parasitic nematodes using genomics. A general overview about this was presented by Prof Gavin Ash, USQ; "Use of genomics to improve biological control". The work of Prof. Michael Jones' team at Murdoch University seemed also promising. The focus of their work is to use host-induced gene silencing to control nematodes and aphids. They are also investigating the stability and heritability of the transgenic plants and nematodes they develop.

Attending the SPPH conference was a great opportunity for me to gain insights into other research fields in plant pathology and to be engaged in some useful and joyful discussions with other researchers. The pre-conference "Student Professional Development" Workshop was also informative.

In general, the venue was stunning and organisation of the event was excellent.

Iman ElMor

Workshop Report

DELEGATES GATHER IN MOROCCO TO COMBAT NEMATODES IN AGRICULTURE

AGADIR, Morocco (CIMMYT) – Eighty delegates from across the globe recently gathered at the **6th International Cereal Nematode Symposium** in Agadir, Morocco to discuss the distribution of nematodes, what strategies can be used to lessen their impact on crops and boost international collaboration on research.

Participants of the 6th International Cereal Nematode Symposium in Agadir, Morocco.

Plant–parasitic nematodes pose an enormous threat to global food security, destroying about 15 percent of global food production annually, a loss of more than $157 billion worldwide.

"Nematodes are the unseen enemy of our crops," said Ricard Sikora, professor at the University of Bonn in Germany who spoke at the symposium. "[They] attack the root of the crop…they are little worms that most people don't even know exist, but they are having a devastating effect on our ability to feed ourselves properly now and in the future."

During the opening speech of the symposium, which was held from September 11-16, the Director of Morocco's National Institute for Agricultural Research's (INRA) regional center in Agadir Abdelaziz Mimouni gave a general presentation about the different centers of INRA-Morocco as well as its research programs on cereals.

Fatih Ozdemir, director of the Bahri Dağdaş International Agricultural Research Institute and coordinator for the International Winter Wheat Improvement Program in Turkey, spoke about the importance of the soil borne diseases in Turkey and the region. Tadesse Wuletaw, wheat breeder at the International Center for Agricultural Research in Dry Areas (ICARDA), welcomed participants and spoke about the role of breeding programs to control diseases.

"We have so many common problems in each of our nations," said Richard Smiley, a professor from Oregon State University who presented on cereal nematodes in the Pacific Northwest. "Our goal is to understand and describe the biology of those nematodes, but also to determine how they can best be managed economically by our farmers."

Representing Australia as an invited speaker at the symposium was Grant Hollaway from Agriculture Victoria, Horsham. Grant noted the increased awareness of soil borne diseases, especially nematodes in

the WANA region, with many participants having participated in one of CIMMYT's Soil Borne Disease Masterclass and/or previous Nematode Symposiums. The improved understanding of the impacts of root diseases on production will increase emphasis on the development of tolerant germplasm, which will ultimately become available to Australia through the CAIGE program. Symposium participants were very keen to further develop root disease research through the development of strong collaborative links.

Abdelfattah Dababat, leader of the International Maize and Wheat Improvement Center's (CIMMYT) Soil Borne Pathogens Program, thanked CIMMYT and donors for supporting the Symposium as well as INRA for hosting this symposium. The conference was coordinated and organized by Dababat as part of the ICARDA-CIMMYT Wheat Improvement Program (ICWIP), and funded by CIMMYT, INRA, DuPont, Bisab, Labomine, Agrifuture, GRDC and Syngenta.

Turkish delegates at the 6th International Cereal Nematode Symposium.

The 7th International Cereal Nematode Symposium will be held in India in 2019. For more information, please contact Abdelfattah A. Dababat at a.dababat@cgiar.org or the local organizer for the 7th Symposium in India Umarao at umanema@gmail.com.

Watch a video summary of the 6th International Cereal Nematode Symposium in Agadir, Morocco here.

Abdelfattah Dababat and Fouad Mokrini
(http://www.cimmyt.org/delegates-gather-in-morocco-to-combat-nematodes-in-agriculture/)

Workshop Report

MANAGEMENT OF PLANT-PARASITIC NEMATODES THROUGH CROP ROTATION, PLANT BREEDING AND OTHER MEANS

On 29th September 2017, the University of Southern Queensland (USQ), Toowoomba hosted a "Science Protecting Plant Health" workshop on the management of plant-parasitic nematodes through crop rotation, plant breeding and other means.

This successful workshop hosted many researchers from around Australia and demonstrated both the work of the Crop Nematology team at USQ in the research and management of *Pratylenchus* in the northern grains region and the work of other researchers on the management of plant-parasitic nematodes in Queensland.

The workshop began in the glasshouses of the Leslie Research Facility where Jason Sheedy and Roslyn Reen talked about their research on glasshouse resistance breeding in wheat and chickpea. Jason discussed pre-breeding for resistance to root-lesion nematodes (RLN). This research establishes germplasm that can be incorporated into commercially important breeding lines and will speed up the development of varieties resistant and tolerant to *P. thornei* and *P. neglectus*. Roslyn spoke about her collaborative research in analysing sources of resistance to *P. thornei* and *P. neglectus* from genebank accessions collected from the centre of origin of chickpea in South East Turkey. Much work has been done in optimising the resistance screening protocols for these wild accessions. It is hoped that the research will identify new sources for RLN resistance suitable for Australian and Turkish breeding programmes.

Workshop partcipants inspecting glasshouse experiments at the Leslie Research Facility and field trials at Formartin in Queensland

The workshop proceeded to the field site at Formartin, a site integral to the field trials of resistance to *P. thornei* which has been kindly leased by the Gwynne family for many years. Professor John Thompson spoke about the history of the site, sequence of rotation and its crucial role in field trial research of *Pratylenchus* in the northern grains region. This site is used to establish varying populations of *P. thornei* to assess the levels of resistance in various crops commercially important in the northern grains region. Research on the survival of *P. thornei* following various rotations of non-host crops and fallows has led to important crop management systems being implemented by the growers.

Prof. John Thompson and property owner Alex Gwynne (third and second from right)

Dr Kirsty Owen presented her work in establishing varying populations of *P. thornei* in rotational strips to assess the levels of tolerance and resistance in wheat and faba bean and the quantification of the relationships between initial nematode densities and grain yields in wheat. Neil Robinson spoke about his work in optimising the Greenseeker™ or Normalised Difference Vegetation Index (NDVI) to improve the selection of breeding lines for *P. thornei*, by objective quantification. This tool will lead to high throughput phenotyping of breeding lines.

After a walk around Toowoomba's famous Japanese garden and lunch, presentations were made at USQ. Guest speakers included Dr Shamsul Bhulyan who spoke about the use of wild relatives of sugarcane and their clones to establish a source of resistance to *Pratylenchus zeae* and *Meloidogyne javanica* in sugarcane breeding programmes.

Dr Graham Stirling spoke about the role of bio-control in the management of *Pratylenchus* using the parasitic bacteria *Pasteuria* and the Mesostigmatid mite *Protogamasellsus mica*. Interestingly, *Pasteuria* were present in higher number in fields with a lower number of years of sugarcane cropping history and this suggests tillage practices may have changed the population density of the parasite. The nematophagous mite *P. mica* may play an important role in regulating populations of nematodes.

Presentations were then made by PhD students based on their research in nematology. Iman El-Mor spoke about her work on characterising QTL for dual resistance to *P. thornei* and *P. neglectus* in wheat, which will help introgressing dual resistance to the major RLN species into commercially grown wheat cultivars. Md Motuir Rahaman presented his research on elucidating the biochemical defence mechanisms employed by moderately resistant cultivars of wheat. The study will focus on various phytoalexins and phytoanticipins responsible for defence against RLN. Elaine Tabah spoke about her research on the interaction between *P. thornei* and arbuscular mycorrhizal fungi (AMF) as both organisms colonise the root cortex of chickpea and mungbean. AMF has been proposed to protect their host against plant parasitic nematodes.

All tools in the tool-kit are going to be needed in the management of plant-parasitic nematodes and it was enlightening to see the strategies adopted come to life in this workshop.

Elaine Tabah

Workshop Report

AUSTRALIAN SCIENTISTS TRAVELLED TO CHINA TO RUN A WORKSHOP ON SUGARCANE NEMATODES

A group of scientists from Sugar Research Australia (SRA) and CSIRO visited China to stage a workshop on sugarcane nematodes and gain new knowledge and insight into sugarcane research and production systems in China. In November 2017, SRA Plant Pathologists Dr Shamsul Bhuiyan and Dr Priyanka Wickramasinghe accompanied CSIRO Molecular Breeder Dr Karen Aitken for a visit to research facilities in the Yunnan province. The travel was sponsored by the Office of Overseas Training Management, Department of Human Resources and Social Security of Yunnan, China.

Situated in the country's Southwest, Yunnan shares a border with Vietnam, Laos and Myanmar and is the second largest sugarcane growing region with 300,000 ha of sugarcane under cultivation each year. Annual sugar production is around 1.8 million tonnes, with an approximate value of US$330 million. Like Australia, sugarcane nematode is one of the main constraints of sugarcane production in China. The purpose of the trip was two-fold: to meet with Chinese scientists to develop collaborative research on sugarcane nematodes; and to run a workshop on sugarcane nematodes for the Chinese. In addition, it also presented the chance to discuss sugarcane breeding and in particular introgression, a breeding technique that brings in traits from wild relatives of sugarcane into commercial varieties.

Nematode workshop at the Wenhui Hotel, Kunming, Yunnan, with workshop participants and Chinese Government Officials

The nematode workshop was divided into two sessions, presentations and hands-on practical session. The presentation session was held at the Wenhui Hotel, Kunming. Fifty trainees from the Biotechnology and Genetic Resources Institute (BGRI), Yunnan Agricultural University (YAU), the Yunnan Academy of Agricultural Science (YAAS) and the Yunnan Sugarcane Research Institute (YSRI) participated in the workshop. There were three presentations in this session, made by Dr Karen Aitken, Dr Priyanka Wickramasinghe and myself.

The highlights of our presentations are listed below:

- Plant parasitic nematodes
- Management of plant parasitic nematodes
    - Chemical, biological and cultural control
    - Resistant varieties
- Breeding for nematode resistance in Australia – introgression breeding
- Use of molecular markers for screening for disease resistance: nematodes
- RNA seq analysis

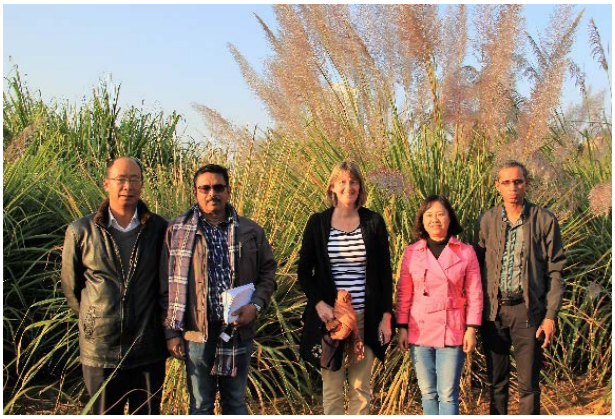
- QTL on *Erianthus* clones
- Nematode sampling from sugarcane fields
- Extraction of nematodes
- Diagnosis of sugarcane nematodes (plant parasitic and free living)

The practical session was held at the BGRI nematology laboratory, Kunming. This session involved hands-on training on: -

- collection of soil samples for nematode extraction
- setting up methods for nematode extraction,
- extraction of nematodes from sugarcane soils
- identification of plant parasitic and free-living nematodes, and assessment using a compound microscope

Part of the trip also involved the Australian scientists visiting facilities including the Biotechnology and Genetic Resources Institute (BGRI), the Yunnan Academy of Agricultural Science (YAAS), the Yunnan Sugarcane Research Institute (YSRI), and the Yunnan Agricultural University.

Practical session on nematode extraction and diagnosis at the Biotechnology and Genetic Resources Institute nematology laboratory, Kunming, Yunnan.



At the Yunnan Sugar Research Institute's Germplasm collection plot, (from left) Professor Zhan Shaosong (YAAS), Dr Shamsul Bhuiyan (SRA), Dr Karen Aitken (CSIRO), Dr Cai Qing (BGRI) and Dr Priyanka Wickramasinghe (SRA)

The visit was a valuable learning experience for Australian scientists allowed them to observe one of the most diverse collections of wild sugarcane germplasm and its associated introgression breeding programs. Introgression is playing an increasingly important role in the Australian sugarcane breeding program, so it was useful to gain valuable insights into the successes and challenges faced by our Chinese counterparts.

Nematode resistance is rare among commercial sugarcane varieties. Australian research suggested that some of the imported Chinese introgression lines possess a range in nematode resistance. Australia could tap into additional Chinese germplasm by developing a collaborative research project to explore further nematode resistant traits, and potentially other important traits, such as cold and drought tolerance, and pest and disease resistance.

Shamsul Bhuiyan

Workshop Report

USQ CONTINUES TO RAISE AWARENESS OF RLN IN INDIA

Members of the University of Southern Queensland (USQ) Crop Nematology team, John Thompson, Rebecca Zwart and Roslyn Reen, conducted a one day workshop on **Integrated Management of Root-Lesion Nematodes** on 11th December 2017 in Hyderabad, India. The workshop was hosted by Dr B.S. Sunanada at the National Institute for Plant Health Management, Hyderabad. The workshop was an outcome of networking established earlier in the year between USQ and Indian Institutes during workshops funded by the Australian Government through the Australia-India Council of the Department of Foreign Affairs and Trade.

Participants of the International Workshop on Integrated Management of Root-Lesion Nematodes

Presentations and practical sessions at the National Institute of Plant Health Management in Hyderabad

The workshop attracted 50 enthusiastic delegates (nematologists, entomologists and plant pathologists) from six different states in India (Andera Pradesh, Assam, Karnataka, Kerala, Tamil Nadu and Telangana). It consistent of presentations and practical demonstrations. During the practical sessions, the Whitehead tray extraction method and culturing of *Pratylenchus* using carrot discs were demonstrated.

Rebecca Zwart

2018 Nematology Workshop

PRACTICAL NEMATOLOGY

Presented by: Dr Mike Hodda (CSIRO) and Dr Kerrie Davis (University of Adelaide)
Date:3-4th September 2018
Venue: Waite Campus, University of Adelaide
Website: http://www.asds2018.com.au/workshops.html

The two day workshop, held in conjugation with the 10th Australasian Soilborne Diseases Symposium in Adelaide, will present skills and information on nematode ecology and physiology, sampling, extraction, specimen preparation, slide mounting, and identification. The workshop is designed as a laboratory-based, hands-on course supported by lectures and discussion.

2018 Nematology Conferences

THE SOCIETY OF NEMATOLOGISTS ANNUAL MEETING 2018

Date:22-25th July 2018
Venue: Hyatt Regency Hotel, Albuquerque, New Mexico, USA
Website: https://nematologists.org/meetings-events/son-annual-meeting/

EUROPEAN SOCIETY OF NEMATOLOGISTS CONFERENCE 2018

Date:9-13th September 2018
Venue: Ghent University, Ghent, Belgium
Website: https://www.esn-online.org/conference