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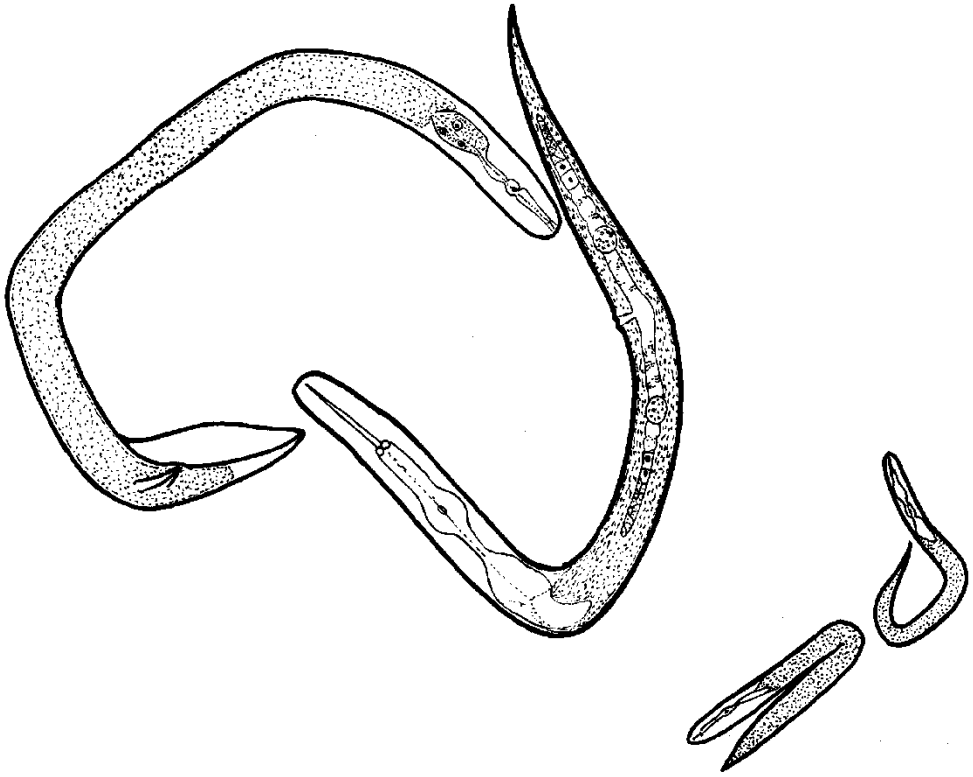

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From the Editor

A big thank you to all contributors for sharing your latest news and interesting research outcomes in this issue of the AAN Newsletter.

Articles on regional news, recent publications, 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 welcome for publication in the AAN Newsletter. 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 in November 2022.

I look forward to receiving your contributions for future issues and keeping you up to date with the regional news of our AAN members.

Rebecca Zwart

Contacts

Dr Mike Hodda
President, Australasian Association of Nematologists
CSIRO Ecosystem Science
GPO Box 1700
Canberra ACT 2601
Tel: (02) 6246 4371
Fax: (02) 6246 4000
Email: mike.hodda@csiro.au

Dr Sarah Collins
Secretary, Australasian Association of Nematologists
Department of Agriculture and Food
Locked bag 4
Bentley Delivery Centre WA 6983
Tel: (08) 9368 3333
Fax: (08) 9474 2840
Email: sarah.collins@agric.wa.gov.au

Dr Kathrine Linsell
Joint Treasurer, Australasian Association of Nematologists
SARDI Plant Health and Biosecurity
Plant Research Centre, Hartley Grove
Urrbrae SA 5064
Tel: (08) 8303 9437
Fax: (08) 8303 9393
Email: katherine.linsell@sa.gov.au

Ms Sue Pederick
Joint Treasurer, Australasian Association of Nematologists
SARDI Plant Health and Biosecurity
Plant Research Centre, Hartley Grove
Urrbrae SA 5064
Tel: (08) 8303 9585
Fax: (08) 8303 9393
Email: sue.pederick@sa.gov.au

Dr Rebecca Zwart
Editor, Australasian Nematology Newsletter
Centre for Crop Health
University of Southern Queensland
Toowoomba QLD 4350
Tel: (07) 4631 1544
Email: rebecca.zwart@usq.edu.au

Association News

FROM THE PRESIDENT

As this edition comes out, I should be in Cairns at the ASDS meeting, which will be the first in-person conference I have been to in 2 years. I am especialy looking forward to a specialist nematology workshop, the first for a while (see elsewhere in this issue for the programme). I don't know about others, but I find in-person meetings and discussions far more productive than the on-line equivalents. Research has shown that less concentration is required, meaning it is easier listening, and it's easier to discuss issues raised in talks directly with a speaker or over coffee with other audience members. And it is possible to catch up on what people have been doing outside of their professional lives.

The value of in-person meetings is shown in the conference review elsewhere in this issue. Check it out. I would have loved to be at 7ICN which was by all accounts a good meeting held in a lovely location. The next ICN will be only a few years away and the site selection will start soon. AAN has one vote of 17 for the location, so keep an eye on newsletters for the potential choices.

Also note that Sonal Channale was part-sponsored by The Olga Goss Travel Award for Nematology. This is a (hopefully) ongoing fund for supporting student members of AAN to attend conferences or other learning opportunities anywhere, overseas or locally. There are no set rules or deadlines, so applications are open any time. This fund is separate from AAN, but the AAN executive are *ex-officio* the selection commitee, so get in touch if you have any ideas.

As in-person conferences get going again, people will need to attend to make them viable. While travel restrictions, uncertainty and chaos at airports may make travel less desireable than previouly, if face-to-face meetings are to continue, then people must turn up in sufficient number to make them financially viable. Note this especially with regard to the next APPS meeting in Adelaide next year. There will definitely be a nematology workshop at this meeting. Contact myself or Sue Pederick for meore details or to offer suggestions.

While discussing meetings, for many years whether AAN should have a particular association with either, neither or both ASDS and APPS meetings has been raised numerous times, with few views being passed to the AAN executive. Given this situation, I suggest the current policy of supporting both meetings as circumstances allow continue.

While on the subject of meetings, note that several members of the AAN executive will be at ASDS, so if anyone has any issues they wish discussed, please let myself or the Secretary Sarah Collins know. In accordance with the views expressed previously by members, AAN is not a formally incorporated association, so there is no requirement to hold a formal Annual General Meeting. It appears that a limited number of AAN members will be in Cairns, so it was not porposed that a General Meeting be held there. We hope that the Adelaide APPS meeting will be better attended for a host of CoVID- and non-CoVID-related reasons, so will hold a general meeting there.

If anyone reads the proposed agenda, they will note that one of the items is thanks to the honorary Office holders. All the office holders have day jobs, so any work for AAN is additional to that and done for the love of nematodes, nematology and nematologists. If things occasionally take a while, are not updated promptly, or otherwise do not run absolutely like clockwork, then this is why. As far as I am concerned, all the Executive do a great job, and I thank them for their efforts. If you disagree then volunteer and see for yourself.

And the answer, as far as I know, to Graham Strirling's question below about "how many members have we lost through issues with payment of fees" is: "not many" because the committee have always suggested taking a flexible approach commensurate with the oft-expressed ethos of the AAN. I know this because I have been on occasion not entirely up-to-date with payments myself and am still on the mailing list.

Mike Hodda

FROM THE TREASURERS

Fees for the AAN (Australasian Association of Nematologists) are due annually 1st July through to 30th June. The $15 + GST annual fee covers newsletter articles and information regarding nematology opportunities including specialised workshops.

If you are outstanding with your fees you will be contacted shortly for the previous year.

You can no longer pay through the APPS web site when registering your membership, all now come through the AAN bank account. We have had support for many years with APPS but they are no longer able to assist with this service due to logistics.

ONLY Payment Method

ANZ
Account Name: Australasian Association of Nematologists
BSB: 012-950
Account # 5180-07506

Please include your name in the reference field so that your payment can be identified.

Looking forward to your continued support and the camaraderie the Nematology group brings.

Katherine Linsell and Sue Pederick (Joint Treasurers AAN)

Regional News

NEWS FROM QUEENSLAND

Biological Crop Protection Pty. Ltd.

Before I start, I'll explain why AAN members haven't heard from me for more than six years. In December 2015 I received an email from Katherine Linsell asking for contributions to the 2016 newsletter. I was very busy at the time and must have forgotten to pay my annual fee. That was the last I heard from AAN (no emails, no newsletters, no reminder to pay the fee).

Early this year I was talking to Rebecca Zwart and she suggested I should advertise my Master Classes through AAN. I was surprised by the comment as I presumed AAN no longer existed.

Following that conversation I paid my annual dues for 10 years, so hopefully I'll be able to communicate with the nematological community for a few more years. One question for the current management committee. How many members have we lost because a person made a mistake and forgot to pay their annual dues?

Now to move on to what I have been doing in the last 6½ years.

Sugarcane

In 2014 I commenced a three-year project that aimed to better understand the practices required to develop an active and biologically diverse soil food web capable of suppressing plant-parasitic nematodes on sugarcane. There were many findings but some of the most important are summarised below.

- On farms where growers had adopted a best-practice farming system (legume rotation crops, minimum tillage, crop residue retention and controlled traffic), the soil immediately below the trash blanket had greater root biomass, more fine roots, greater microbial activity and higher numbers of beneficial nematodes than the soil further down the profile.
- Suppressiveness to nematodes was greatest in the topsoil and declined with depth, largely because it was driven by soil carbon levels. Data from sandy loam and clay loam soils showed that increasing the carbon content by 0.5% decreased the number of *Pratylenchus zeae*/g root by 80% and 35%, respectively.
- Microarthropods were one of the suppressive agents. A diverse range of microarthropods were found in sugarcane soils and many genera were nematophagous. One predatory mite (*Protogamasellus mica*) was studied in detail and in a pot experiment it reduced numbers of *Tylenchorhynchus*, *Pratylenchus* and microbivorous nematodes by 99%, 70% and 70%, respectively.
- Research on *Pasteuria penetrans*, a host-specific parasite of root-knot nematode showed that in one sugarcane field in Bundaberg, the bacterium had multiplied to levels capable of reducing populations of the host nematode by more than 90%.
- In a survey of 126 sugarcane fields, the most widespread and damaging nematode pest of sugarcane (*Pratylenchus zeae*) was often found to be encumbered with endospores of *Pasteuria thornei*. Although levels of encumbrance were usually relatively low, there were two fields where about 50% of the nematodes were either parasitised by the bacterium or had endospores attached. Both these fields had grown grass pasture for many years and had only recently been planted to sugarcane. This suggested that *Pasteuria* increases to levels capable of reducing

populations of root-lesion nematode in situations where the host and parasite are present in a non-tilled environment for many years.

Master Classes in soil health and soil biology for the sugar industry

A total of 252 sugar growers, productivity services staff and others attended a series of Master Classes that were held at six locations in 2017 and 2018. During those classes they had the opportunity to look at some of the microscopic organisms that are found in soil and learn how sugar farming systems could be modified to improve soil biological health.

I led the classes but was supported by Dr Anthony Young (University of Queensland), Dr Jay Anderson (University of Queensland) and Mr Sebastien Garcia-Cuenca (Sugar Research Australia). However, the highlight of each class was the presentation by one of three growers: Ashley Petersen, Tony Chapman and Simon Mattsson. They explained how they were able to introduce a range of new practices into their farming system and discussed the soil health and economic benefits they had obtained.

Classes concluded with a discussion on how growers could move forward and improve the health of their soils. The process involved identifying the key soil constraints that were limiting productivity; developing an action plan to rectify the problems; modifying the farming system in some way; and then instigating a monitoring program to confirm that benefits had been obtained.

Feedback from the participants indicated that the classes were a resounding success. Comments were overwhelmingly positive and compliments such as "Excellent course: engaging and interesting", "Use of microscopes, practical application was great!" and "Continue this every year!" were received. Those who attended clearly enjoyed the classes and most indicated that they were willing to accept the challenge of implementing a soil improvement plan.

Master Classes in Soil Health and Nematode Management for the Sweetpotato industry

Four classes were held in March 2019, two in Bundaberg, one at Cudgen in northern NSW and one at Kairi in north Queensland. The objectives were to:

- Provide information on the nematode pests of sweetpotato and their management
- Improve attendees understanding of soil biology, particularly the role soil organisms play in maintaining the health of agricultural soils
- Highlight the management practices available to improve the health of soils used for sweetpotato production
- Challenge sweetpotato growers to integrate some of these practices into their farming system

The classes were held at the start of a five-year project aimed at developing sweetpotato farming systems that would improve soil health and reduce loses from nematode pests. About 20 growers and consultants attended each class and they learnt about root-knot and reniform nematodes (the main nematode pests of sweetpotato), management options to reduce losses from these nematodes, and the challenges they faced in improving the health of their soils. At the end of each class, groups of four or five growers discussed what they had learnt, considered how they might improve their farming system, and developed action plans on how they might move forward over the next few years.

Research on more sustainable sweetpotato farming systems

In a study that commenced in December 2017, I worked with a Matthew Prichard who owns one of the largest sweetpotato farms at Cudgen in northern NSW. Matthew's tillage-dominated farming system is typical of the system used by Australian growers, with nematicides being applied routinely because losses from root-knot nematode are relatively common. Matthew was willing to try an alternative approach that

I termed 'Integrated Soil Biological Management' in my 2014 book on biological control of nematodes. The basis of the concept is that a range of nematode management practices are integrated into a farming system to not only reduce pest nematode populations but also improve the physical, chemical and biological health of the soil.

An initial field trial was established to test the effects of the following practices: 1) Beds re-formed 10 months prior to planting; 2) Incorporation of large amounts of organic matter into the beds during the bed formation process; 3) Growth of two cover crops (forage sorghum followed by oats) on the re-formed beds, with residues from those crops being retained on the soil surface as mulch; 4) Sweetpotato cuttings planted into the mulched, undisturbed beds using strip tillage.

The results showed that the crop established well and yielded 93 t/ha but despite the use of an organic amendment, root-knot nematode caused severe damage. Follow-on work then showed that nematode problem could be overcome by placing the organic amendments in a V-furrow in the centre of the bed so that the swollen roots were surrounded by the amendment as they developed. Details of the experiments, the results obtained and the natural enemies that provided nematode control when organic matter is added to a V-furrow can be found in two papers and a book chapter (Stirling et al., 2020; Stirling 2021a; b).

Blueberry

Replant decline is an increasing problem in the NSW blueberry industry, as many growers are now replanting areas that have grown blueberries for 10-20 years. As replant problems in perennial horticultural crops are sometimes caused by plant-parasitic nematodes and poor soil health is often a contributing factor, a project was undertaken with the following objectives.

- Determine whether plant-parasitic nematodes are likely to be causing poor growth or replant problems in blueberry
- Assess the free-living nematode community and use the results to decide whether poor soil biological health may be reducing the productivity of blueberries.

The nematode community was assessed at 55 sites: 43 orchards where blueberries were grown in soil and 12 where they were grown in pots or containers filled with organic substrate. Three main conclusions were drawn from the survey.

- Eight plant-parasitic nematodes were present on blueberry farms but in most cases, numbers were relatively low, suggesting that nematodes were not likely to be causing major problems. *Paratrichodorus* and *Xiphinema* were occasionally observed at levels that may have been causing damage, but research is required to determine whether they are reducing yield.
- Plant-parasitic nematodes were not detected in any of the orchards where blueberries were grown in pots or containers. This was probably due to the fact that pots were placed on a plastic drainage pad that sat on a flat planting bed covered with plastic woven weed mat, and so the roots and substrate had no contact with soil. However, it is also possible that plant-parasitic nematodes were unable to move readily in the substrate due to its physical structure, or were suppressed by antagonists that were sustained by the organic materials in the substrate.
- Omnivorous and predatory nematodes were relatively uncommon in blueberry soils whereas they formed an important component of the nematode community in nearby soils under pasture and native vegetation. This suggests that blueberry soils are in poor condition from a biological perspective. Such soils lack resilience and are unlikely to suppress soilborne pests and pathogens.

Cover cropping

In subtropical dryland cropping systems, bare fallowing provides an opportunity to increase the soil moisture content prior to planting a cash crop. However, because there are no inputs of organic matter, this practice is detrimental to soil health. Dr Alwyn Williams from the University of Queensland has been looking at whether cover cropping or rotating to ley pasture for several years are options that can be used to improve or maintain soil functional attributes in such cropping systems. These practices improved several indicators of soil function in a trial on the Darling Downs and this was confirmed with nematode analyses. At a depth 0–10 cm the non-tilled ley pasture supported relatively high numbers of bacterivores, fungivores and dorylaimids and relatively low numbers of *Pratylenchus thornei*, indicating that the nematode community was relatively well-balanced and that significant amounts of N and other nutrients were being mineralised by free-living nematodes. However, the ley pasture supported many more *P. thornei* than the other systems at 10–30 cm depth, demonstrating that this practice can have both positive and negative outcomes (Williams et al. 2022).

In another a cover cropping trial in the Lockyer Valley, nematode community analyses have shown that oats, faba bean, forage rape and mixtures of these crops have significant effects on both plant-parasitic and free-living nematodes. The data are currently being analysed by Ismail Garba and a paper is being prepared for his PhD thesis. However, initial results indicate that oats and cover crop mixtures containing oats markedly increase populations of *Merlinius brevidens* whereas forage rape reduces populations of this species and is also detrimental to free-living nematodes.

Post-graduate students

Khoa Le

Khoa Le obtained his PhD from the University of Sydney in February 2020. Before moving to Australia, Khoa had experience in Vietnam's coffee industry and so his research program aimed to identify the plant-parasitic nematodes associated with coffee in Australia and investigate the pathogenicity of nematodes that were either present in coffee plantations or associated with crops growing nearby. However, the major focus of his work was to determine whether organic amendments were a useful management tool, as they are known to enhance natural mechanisms of biological control in other crops.

Six nematode genera were associated with coffee in Queensland and NSW but *Meloidogyne hapla*, *Pratylenchus brachyurus* and *Rotylenchulus reniformis* were the most damaging species. Although *Pratylenchus coffeae* and *Radopholus similis* were not found on coffee, they both occur in nearby banana plantations and in a pathogenicity test in the greenhouse they caused severe damage to seedlings of Coffea arabica cv. K7 (the main coffee cultivar in Australia).

Amending soil with organic materials produced positive changes in soil chemical and biological properties and stimulated the growth of coffee plants for up to 12 months. Evidence was obtained to indicate that a range of amendments increased numbers of nematode-trapping fungi (e.g. *Arthrobotrys musiformis* and *Arthrobotrys oligospora*) and nematode predators (mainly *Mononchus papillatus*), and this in turn enhanced natural mechanisms of suppression and reduced the population of *P. coffeae*. Sugarcane trash reduced the population of P. *coffeae* by 91% and was more effective than lucerne hay (84%), cow manure (82%) and chicken manure (74%) amendments.

Pasteuria thornei was also investigated, as this bacterium has the capacity to regulate populations of the many *Pratylenchus* species known to attack coffee. Endospores of *Pasteuria thornei* were obtained from *Pratylenchus zeae* and an in-vitro test showed that the bacterium only parasitised its original host. Other root lesion nematode species (e.g. *P. coffeae* and *P. brachyurus*) were not infected. Thus, future work on this host-specific parasite will have to focus on finding isolates capable of parasitising the *Pratylenchus* species that are economically important in various coffee-producing countries.

Peter Ruscoe

Peter Ruscoe works for SportsTurf Technology, a company in Perth that provides a range of professional services to the turfgrass industry. As southern sting nematode (Ibipora lolii) is a major problem on golf courses, sports fields and turf farms in Perth, Peter undertook a research program on the nematode and was awarded a Master's degree by the University of Queensland in 2020. Peter now provides a nematode diagnostic service for the Western Australian turf industry. A review of what is known about sting nematodes on turfgrass, and Peter's research results can be found in Ruscoe and Stirling (2020) and Ruscoe et al. (2021).

Transfer of southern sting nematode from Victoria to Queensland

In October 2020, Covid restrictions resulted in the Grand Final of the Australian Football League being played at the Brisbane Cricket Ground (the Gabba) rather than the MCG. So that players could step onto some of the "hallowed turf" as they ran onto the ground, small rolls of turf were transferred from the MCG turf nursery and placed at the Gabba prior to the game.

I was concerned about this transfer, as I was aware that the MCG was infested with southern sting nematode (*I. lolii*). As biosecurity authorities were not willing to intervene, I became involved and finished up preparing a paper on the transfer of the nematode and associated biosecurity issues (Stirling et al. 2021). The paper provides the following information.

- Results showing that Queensland was probably free of *I. lolii* in 2020
    - The nematode was never detected in 744 turfgrass samples from 160 Queensland locations that were processed by two diagnostic laboratories during the period from 2006 to 2020
    - *I. lolii* was not found at two Queensland locations that had previously been reported as being infested.
- Results showing that the turf transferred from the MCG turf nursery to the Gabba was infested with *I. lolii*
- Details of an action plan designed to eliminate *I. lolii* from the Gabba (removal and disposal of the infested turf; fumigation of the sites where the infested turf had been laid; and application of nematicides to the fumigated areas and the whole oval)
- Details of a post-treatment monitoring program that was undertaken to check whether the action plan was successful
- The paper concludes by arguing that Queensland biosecurity authorities should list *I. lolii* as one of its priority pests, establish a surveillance program for the nematode, and develop strategies to minimise the risk of *I. lolii* being transferred into and within the state.

Master Classes in nematology, soil biology and soil health

My wife (Marcelle) and I are nearing the end of our careers and so we decided to run a series of Master Classes in nematology, soil biology and soil health in 2022 and 2023. There is no fee for the classes as we are providing them as a philanthropic venture, in the hope that they will stimulate interest in important groups of soil organisms that have largely been ignored by the tertiary education sector in Australia. The first four classes were held in June 2022.

- Identification and quantification of plant-parasitic nematodes for diagnostic purposes (University of Sydney)
- Nematode pests of turfgrass (University of Melbourne)
- Improving the health of vegetable-growing soils and reducing losses from nematode pests (University of Melbourne)

- Nematodes: an important component of the soil biological community (University of Melbourne)

Each class was attended by 20-24 people and participants included plant pathologists, extension personnel, consultants, farm managers and turfgrass superintendents. The fourth class was designed primarily for post-graduate students in agricultural and biological sciences, but one encouraging sign was that several undergraduate and postgraduate students came to the other classes.

Three more classes will be held this year, all at the University of Queensland

- The soil biological community and its role in improving the health of agricultural soils (22 July 2022)
- Natural enemies of nematodes: their ecology and role as biological control agents (25 and 26 July 2022)
- Morphological and molecular identification of plant-parasitic and free-living nematodes (22-25 November 2022)

History of Australasian nematology

In 2008 I co-authored a paper on the history of plant and soil nematology in Australia and New Zealand (AuPP 37, 203-219). The paper covered the period from the 1870's to 1975 and as quite a lot has happened since then, I decided to prepare an update covering the period from 1975 to 2008. The paper is entitled "Plant and Soil Nematology in Australia and New Zealand during the period 1975 to 2008. It can be found on the APPS website: https://www.appsnet.org/History/Stirling.pdf

Publications

Books and book chapters

Stirling GR (2021a) Modifying a productive sweet potato farming system in Australia to improve soil health and reduce losses from root-knot nematode. Sikora et al. (eds.) Integrated Nematode Management: State-of-the-art and visions for the future (Eds. RA Sikora et al.) CAB International, Wallingford, Chapter 51, 368-373.

Stirling GR (2018) Managing the soil biological community to improve soil health and reduce losses from nematode pests. In: Rott P (ed.) Achieving Sustainable Cultivation of Sugarcane, Volume 2: Breeding, pests and diseases, Chapter 24. Burleigh Dodds Science Publishing.

Stirling GR, Hayden HL, Pattison AB, Stirling AM (2016) Soil Health, Soil Biology, Soilborne Diseases and Sustainable Agriculture. A guide. CSIRO Publishing, Melbourne, 275 pp.

Peer-reviewed publications

Williams A, Kay P, Stirling G, Weng X, Bell L (2022) Impacts of reducing fallows on indicators of soil function in subtropical dryland farming systems. Agriculture, Ecosystems and Environment 324, 10727

Stirling GR, Stirling AM, Eden L (2021) Plant-parasitic nematodes on turfgrass in Queensland, Australia, and biosecurity issues associated with the interstate transfer and eradication of southern sting nematode (Ibipora lolii). Australasian Plant Pathology 50, 695-704

Ruscoe PE, Aitken EAB, Stirling GR (2021) Southern sting nematode (Ibipora lolii): its distribution and population dynamics in Western Australia and an assessment of resistance and tolerance to the nematode in turf grasses. Australasian Plant Pathology 50, 559-569

Le KD, Perrine-Walker F, Stirling GR, Guest DI, Trinh PQ (2021) Pathogenicity of migratory endoparasitic nematodes on coffee seedlings (Coffea arabica cv. K7) in Australia. Australasian Plant Pathology 50, 341-348.

Stirling GR (2021b) Surrounding the swollen roots of sweetpotato with a decomposing band of an organic

amendment enhances nematode-suppressive services and reduces damage caused by root-knot nematode. Australasian Plant Pathology 50, 151-168.

Stirling GR, Stirling AM, Prichard M (2020) Sustainable sweetpotato farming systems to improve soil health and reduce losses caused by root-knot nematode. Australasian Plant Pathology 49, 591-604.

Ruscoe PE, Stirling GR (2020) Southern sting nematode (Ibipora lolii), a serious pest of turf grasses in Australia. A review of what can be learnt from research on Belonolaimus longicaudatus, a closely related pest of turfgrass and many crops in the United States. Australasian Plant Pathology 49, 493-504.

Young AJ, Wilson NL, Thomson MB, Fitzgerald S, Fitzgerald K, Baldock C, Stirling M, Stirling G (2020) Towards a molecular toolkit to assess biological health of soil. Proceedings Australian Society of Sugarcane Technologists 42, 237-244.

Stirling GR, Young AJ, Aitken RL, Beattie RN, Munro A (2018) Effects of compost and mill mud/ash on soil carbon and the nematode community in a field trial on sugarcane at Harwood, New South Wales. Proceedings Australian Society of Sugarcane Technologists 40, 41-49.

Stirling GR (2018) The impact of mill mud and compost on the biology of sugarcane soils. Proceedings Australian Society of Sugarcane Technologists 40, 50-61.

Stirling GR (2018) Deep placement of organic amendments in a dense sodic subsoils: effects on sugarcane root growth, soil carbon levels and soil biological properties. Proceedings Australian Society of Sugarcane Technologists 40, 62-70.

Stirling GR, Mattsson S (2018) Intercropping sugarcane with sunflower and mixtures of plant species: effects on the soil biological community. Proceedings Australian Society of Sugarcane Technologists 40, 86-96.

Walter DE, Stirling GR (2018) Effect of pesticides on microarthropods in sugarcane soils. Proceedings Australian Society of Sugarcane Technologists 40, 71-77.

Bull J, Stirling GR, Magarey R (2018) Plant-parasitic and free-living nematodes associated with sugarcane in north Queensland. Proceedings Australian Society of Sugarcane Technologists 40, 78-85.

Walter DE, Stirling GR (2018) Microarthropods in Australian sugarcane soils: A survey with emphasis on the Mesostigmata as potential regulators of nematode populations. Acarologia 58, 673-682.

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.

Bhuiyan S, Garlick K, Anderson J, Wickramasinghe P, Stirling GR (2018) Biological control of root-knot nematode on sugarcane in soil naturally or artificially-infested with Pasteuria penetrans. Australasian Plant Pathology 47, 45-52.

Stirling GR, Stirling AM, Walter DE (2017) The mesostigmatid mite Protogamasellus mica, an effective predator of free-living and plant-parasitic nematodes. Journal of Nematology 49, 327-333.

Stirling GR (2017) Soil carbon, root health and nematode pests in sugarcane soils. 1. Root and soil health and its relationship to soil carbon levels. Proceedings Australian Society of Sugarcane Technologists 39, 155-165.

Stirling GR (2017) Soil carbon, root health and nematode pests in sugarcane soils. 2. Factors influencing nematode-suppressive services in soils from sub-tropical Queensland. Proceedings Australian Society of Sugarcane Technologists 39, 166-174.

Bhuiyan SA., Croft BJ., Stirling GR., Wong E., Jackson P. and 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.

Graham Stirling

University of Southern Queensland (UniSQ)

The Crop Nematology team at the Centre for Crop Health, UniSQ has had a productive start to 2022. In April, 2022 John Thompson was awarded the title of Professor Emeritus at the University of Southern Queensland. Our team was thrilled to join John and his family at the ceremony and for a celebration afterwards. A very well deserved honour.

Professor Emeritus John Thompson (right) with The Chancellor, John Dornbusch, at the University of Southern Queensland.

Hannah Rostad has not only had her first baby (the lovely Amity) but has also had her Masters of Advanced Research thesis examined and accepted, and published her first paper as first author (details in the publications below).

Michelle Thompson welcomed her fourth baby, Bryn, into the world in April too. And the ultimate "nematode baby" arrived in February for recent PhD nematology graduates Drs Md Motiur Rahaman (UniSQ) and his wife Jebin Akhter (Murdoch University), a girl called Wania. Congratulations to you all.

Neil Robinson has successfully completed his Confirmation of Candidature for his PhD on "Investigation into the use of sensory platforms to phenotype wheat cultivars for tolerance to the root-lesion nematode *Pratylenchus thornei*". He has captured some amazing new data with drones of the response of wheat cultivars to *Pratylenchus thornei*.

Begita Adhikari started her PhD in early 2022 on "Genetics of Root-Lesion Nematode Pratylenchus thornei resistance in Mungbean (*Vigna radiata*)." and has made terrific progress with her first enormous experiment to phenotype the response of mungbean germplasm to P. thornei. She has a green thumb and a wonderful attitude to hard work.

Early in the 2022, Rebecca Zwart accepted a full-time teaching position in the School of Agriculture and Environmental Sciences at UniSQ. Kirsty Owen also picked-up some part-time teaching. They are both looking forward to producing some new students with a passion for the science of agriculture (and they will promise to mention nematodes as often as they can in their courses).

Kirsty Owen has recently been awarded funding by the Broadacre cropping Initiative (BACI, a research partnership between the Queensland Department of Agriculture and UniSQ) to screen promising lines of pigeon pea for their resistance/susceptibility to *P. thornei*. Queensland growers in the subtropical northern grain region currently have no resistant pulse crops to include in their crop sequences. Could pigeon pea hold the key? Following a recent Grains Research and Development Corporation project (Soilborne disease interactions in Australian Farming systems, DJP1907-002RMX), Kirsty together with Bethany Rognoni and Clayton Forknall (from the northern node of Statistics for the Australian Grains Industry, SAGI-North, project) completed an analysis of a two-year experiment in which a range of levels of *P.*

thornei and arbuscular mycorrhizal fungi (AMF) were established in year 1 by growing summer crops and then in year 2, two mungbean cultivars were each sown across the established ranges. The results showed that there was a significant effect on yield from the interaction of mungbean cultivars, *P. thornei* and AMF measured at sowing. The complexity of the interaction provides an exciting insight into what can happen in the field and how we interpret results from field experiments. Bethany will present details of the design and statistical methods used for these types of experiments at the Australasian Soilborne Diseases Symposium in August.

PhD student, Sonal Channale, has submitted her thesis for examination and is currently enjoying being very warm back at home in Mumbai, India. We hope to see her again soon. She attended the ICN and her reflections of the congress are included elsewhere in the newsletter.

Jason Sheedy has just had a paper titled 'Discovery of resistance to *Pratylenchus* neglectus among *P. thornei*-resistant Iranian landrace wheats and the introgression of both resistances into advanced breeding lines' accepted by Plant Pathology (See page 17). This paper will contribute to Jason's PhD thesis 'The identification and introgression of novel root-lesion nematode (*Pratylenchus thornei* & *P. neglectus*) resistances from Iranian landrace wheat (*Triticum aestivum*) and Einkorn (*T. monococcum*) into Australian wheat cultivars'.

Recent Publications

Gough EC, Owen KJ, Zwart RS, Thompson JP (2022) The role of nutrients underlying interactions among root-nodule bacteria (*Bradyrhizobium* sp.), arbuscular mycorrhizal fungi (*Funneliformis mosseae*) and root-lesion nematodes (*Pratylenchus thornei*) in nitrogen fixation and growth of mung bean (Vigna radiata). *Plant and Soil*, 472, 421–449, https://doi.org/10.1007/s11104-021-05254-8

Owen KJ., Clewett TG, Bell KL, Thompson JP (2022) Cereal and pulse crops with improved resistance to *Pratylenchus thornei* are needed to maximize wheat production and expand crop sequence options. Agronomy 12, no. 3: 573. https://doi.org/10.3390/agronomy12030573

Rognoni, B, Owen K, Percy C, Peitton L, Forknall C (2022) Double trouble: investigating the interaction of soilborne pathogens in wheat, using three-dimensional response surfaces. Australasian Soilborne Diseases symposium, 1–5th August 2022, Hilton Cairns.

Rostad, H.E., Reen, R.A., Mumford, M.H., Zwart, R.S. Thompson, J.P. (2022) Resistance to root-lesion nematode Pratylenchus neglectus identified in a new collection of two wild chickpea species (*Cicer reticulatum* and *C. echinospermum*) from Turkey. Plant Pathology, 71, 1205– 1219. Available from: https://doi.org/10.1111/ppa.13544

Sheedy JG, Lin J, Thompson JP (2022) Discovery of resistance to *Pratylenchus neglectus* among *P. thornei*-resistant Iranian landrace wheats and the introgression of both resistances into advanced breeding lines. Plant Pathology (accepted July 2022).

Kirsty Owen

NEWS FROM WESTERN AUSTRALIA

Murdoch University, Crop Biotechnology Research Group

PhD students (plant nematology)

Sasha Somashakaran – Spray-induced gene silencing

Supervisors Dr John Fosu-Nyarko, Dr Eddie Poinern, Prof. Michael Jones

Sasha was awarded a WA State Government's New Industries Fund (JTSI) grant and is working on the development next-generation RNAi-based biopesticides, as a possible means of controlling plant nematodes, and aphids. She has looked at a range of options of delivery of spray delivery of dsRNA taeting vital gene functions, and has generated some evidence of reduced reproduction and fecundity of Pratylenchus spp. and Myzus persicae.

Saiful Islam – Functional analysis of putative parasitism effector genes of RLNs: developing resistant potatoes using RNAi (Murdoch Postgraduate Studentship)

Supervisors: Dr Sadia Iqbal, Prof. Michael Jones, Dr Steve Milroy

After screening WA potato fields to identify nematodes present, Saiful has identified target genes in *Pratylenchus neglectus*, isolated and characterised them, and is now cloning them into vectors for production of sdRNA to silence the genes in the nematodes.

Rhys Copeland - Determining the spatial distribution of *P. quasitereiodes/P. curvicauda* in the WA wheatbelt, and understanding how they find their host roots (GRDC Postgraduate Studentship)

Supervisors Dr John Fosu-Nyarko, Dr Sarah Collins, Prof. Michael Jones

Rhys has completed his work to assess the prevalence of *P. quasitereiodes* and *P. curvicauda* in the WA wheatbelt, and has now moved on to studying how RLNs are attracted to host roots. In terms of root attraction, Rhys has developed root chemotaxis assays, and is now analysing compounds released from roots by GC-MS in order to understand how they affect RLN root interactions.

Rhys was lucky enough to attend the 7ICN meeting in Antibes. His brief report for those who were not able to attend is on page 20.

Michael Jones

Department of Primary Industries and Regional Development (DPIRD)

Nematology research at DPIRD is currently concentrated in Broadacre cropping. We have had an interesting combination of conditions for root lesion nematodes in 2021 and leading into the 2022 cropping season. 2021 was an extraordinary cropping season in WA with over 24 million tonnes of grain which is more than 30% higher than the previous record season (see https://www.giwa.org.au/wa-crop-reports). Wheat, barley, canola and oats, the main broadacre crops grown in WA, are all susceptible to root lesion nematodes so we expect nematode populations to have increased significantly. In contrast, summer in the grainbelt was the hottest on record, with dry conditions continuing through Autumn. We wait to see what 2021 good subsoil moisture across much of the broadacre growing areas, warm growing conditions and large root systems will have on RLN symptoms in 2022 crops after such a long hot summer.

Our research group, under the broader DPIRD Crop Protection portfolio, continue to work closely with WA broadacre growers and regional grower groups, with all field research trials based regionally on growers' paddocks. Additionally, we continue with six WA grower groups through the Grower Group Alliance/DPIRD/GRDC collaboration of grower demonstration trials in a National Soilborne Disease Extension project.

What's new in Research at DPIRD

Will new chickpea varieties offer another resistant crop choice to WA growers for paddocks infested with *Pratylenchus neglectus*?

Old chickpea varieties were susceptible to the common root lesion nematode species *Pratylenchus neglectus*, but newer chickpea varieties have been rated in eastern Australian soils as moderately resistant to moderately susceptible to *P. neglectus*. This means chickpeas could be a potential pest and disease break crop for WA broadacre cropping. However, crop and variety resistance to root lesion nematodes is often different in WA's soils compared to other Australian growing areas. It is important that we check the resistance of chickpeas in local conditions so we can give WA growers reliable and accurate recommendations.

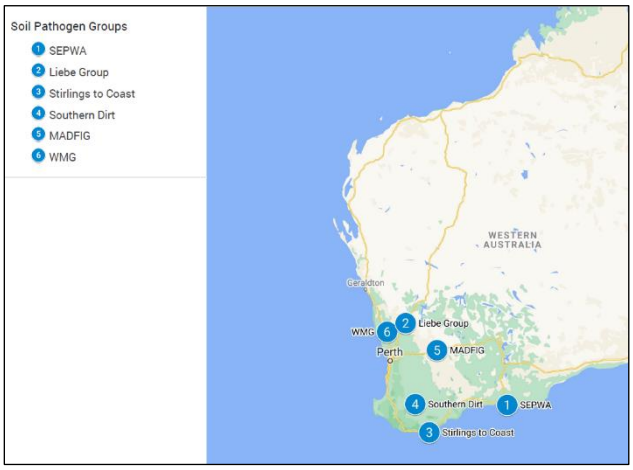
Resistance of chickpeas to root lesion nematodes has not been tested in WA since 2004, when Vivien Vanstone sampled chickpea variety trials. Vivien found that whilst chickpea varieties were more resistant to *P. neglectus* than wheat and barley they still supported a high level of nematode multiplication over a season and thus not a good break crop for this pest. However, variety trials have 2-3 reps of treatments (plots with the same variety) which is not ideal for studying root lesion nematodes as nematode distribution is patchy and low replication often results in highly variable and unreliable data.

In this small DPIRD funded project we are testing the resistance of currently grown and emerging chickpea varieties for their resistance to *P. neglectus* in a set of 3 field experiments. We will include cereal controls with a range of known resistance to *P. neglectus* to compare with chickpeas.

Carla Wilkinson assessing germination in newly sown chickpea trial in Doodlakine, WA.

Soilborne Pathogens Identification and Management Strategies for Winter Cereals Project

In 2020, a national project focused on soilborne nematode pests and pathogens in winter cereals, was established with funding by DPIRD, AgVic, NSW DPI, SARDI and GRDC. The project aims to help growers learn about the major diseases of cereals caused by soilborne pathogens and nematode pests. Typical diseases of importance in WA are rhizoctonia root rot, root lesion nematode, crown rot and take-all. This project is led by FarmLink and grower groups in WA, South Australia, Victoria, and NSW. The six participating WA grower groups (Liebe, MADFIG, Southern Dirt, Stirlings to Coast, SEPWA, and West Midlands) are supported by DPIRD and the Grower Group Alliance (GGA) to focus on extension with hands-on workshops & field walks to help growers learn about the typical symptoms of cereal root diseases and management strategies.



Locations of grower groups participating in this extension project.

a. **b.**

Growers investigating live plant samples at a) MADFIG and b) SEPWA Workshops 2021

Soil Compaction e-Book publication launched August 2021

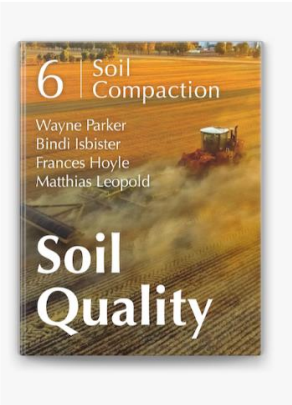
A recent ebook publication Soil Quality: 6 Soil Compaction was released in August 2021 at Dowerin Field Day authored by Wayne Parker and Bindi Isbister from DPIRD, together with Fran Hoyle (Murdoch University) and Matthias Leopold (UWA) - as well as various guest authors with specialist knowledge.

Soil compaction is highly relevant to the health and diversity of our soil biology and influences the susceptibility of a plant to soilborne disease and nematode pests. The ebook discusses the scale of the problem in Western Australia, causes and contributing factors, the impact it can have on soil properties - for example influence on plant root growth and soil biota, and how it is identified and managed. This is the sixth publication in a free Soil Quality ebook series by SoilsWest, which is a research alliance led by Murdoch University partnering with DPIRD, with collaborators at UWA, Curtin and CSIRO - and produced with co-investment from GRDC. The ebooks aim to provide students, growers, consultants and academics with information on the multifaceted role of soil and its inhabitants. It provides interactive and easy to read information on a suite of practices and amelioration strategies to target compacted soils to optimise soil production and resilience.

The Soil Quality: 6, Soil Compaction ebook, is available at no cost via Apple Books, along with the other publications in the series. Our books feature great graphics, short videos and audio from consultants, farmers and research scientists https://books.apple.com/au/book/soil-quality-6-soil-compaction/id1581017530. The other publications in the series so far:

1. Constraints to Plant Production
2. Integrated Soil Management
3. Soil Organic Matter
4. Soil Acidity
5. Soil Biology
6. Soil Compaction
7. Soil Water Repellence

They are a great resource, with three more publication on sodic and alkaline soils, crop nutrition and gravel soils in development!



Soil Quality: 6 Soil Compaction on Apple Books

The Soil Quality ebook series is a resource for farmers, agricultural professionals and students. Experts from their fields share current knowledge and best practice techniques in layers of information, allowing readers to choose the level of detail they require. Book 6 Soil Compaction explai...

books.apple.com

Recent Publications and podcast

Cereal root disease refresher SEPWA Newsletter. Edition 3, October 2021.

DPIRD's 2022 Protecting WA Crops Issue 21 Impact of liming on weed growth, rhizoctonia root rot activity and crop susceptibility to Root Lesion Nematodes (RLN).

DPIRD's 2021 Protecting WA Crops Issue 20 Impacts of mechanical soil amelioration on weeds, soilborne nematode pests and fungal pathogens.

DPIRD's Grains Convo podcast series "The effect of a green bridge on Root lesion nematodes" at Apple podcasts and Spotify or the Grower Group Alliance website.

Harries M, Flower K.C., Renton M, Collins SJ., Hüberli D (2022) Links between soilborne pathogens, plant parasitic nematodes, farm management and biophysical constraints in a southern Australian rainfed cropping system. *Crop & Pasture Science.* https://doi.org/10.1071/CP21778

Happy researching!

Sarah Collins and Carla Wilkinson

Abstract

DISCOVERY OF RESISTANCE TO PRATYLENCHUS NEGLECTUS AMONG P. THORNEI-RESISTANT IRANIAN LANDRACE WHEATS AND THE INTROGRESSION OF BOTH RESISTANCES INTO ADVANCED BREEDING LINES

Jason G. Sheedy, Jing Lin, John P. Thompson

University of Southern Queensland

Accepted for publication in *Plant Pathology* (July 2022).

Root-lesion nematodes (RLN) *Pratylenchus thornei* and *P. neglectus* are globally important pathogens of cereal and pulse crops. These RLN can occur together in farming systems and must be managed concurrently to minimise substantial yield losses in intolerant crop cultivars. Australian wheat cultivars with resistance to *P. neglectus*, have either the *Rlnn1* resistance gene, which provides a high level of resistance but is linked with yellow flour colour, a trait that reduces cultivar marketability for bread production, or *QRlnn.lrc-2B*, which provides moderate resistance. We evaluated a collection of 91 *P. thornei*-resistant Iranian landrace wheats (ILW) for their resistance to *P. neglectus* in four glasshouse experiments to 1) identify genotypes with resistance to both RLN, 2) determine if any genotypes carried *Rlnn1* and/or *QRlnn.lrc-2B* and 3) develop ILW-derived advanced breeding lines (ABL) with resistance to both RLN. A factor analytic linear mixed model (FA-1) that explained 70% of the genetic variation, where the genetic correlations between the experiments ranged from 0.54 to 0.77, was used for the combined analysis of all experiments. Seven *P. neglectus*-resistant genotypes were identified, with five that had potentially novel resistance. Subsequently, six breeding lines that were resistant to both RLN were developed by crossing six ILW with Australian cultivars and selecting for resistance in each generation. Both the ILW and ABL will be valuable genetic resources for wheat breeders to develop cultivars with dual resistance to better manage mixed RLN populations with novel *P. neglectus* resistance that potentially is not linked with yellow flour colour.

Conference Reviews

7th INTERNATIONAL CONGRESS OF NEMATOLOGY

Group photo of participants of the 7th International Congress of Nematology, Antibes, France

Below are reports from two Australian PhD students who were able to attend the congress, Sonal Channale from the University of Southern Queensland and Rhys Copeland from Murdoch University.

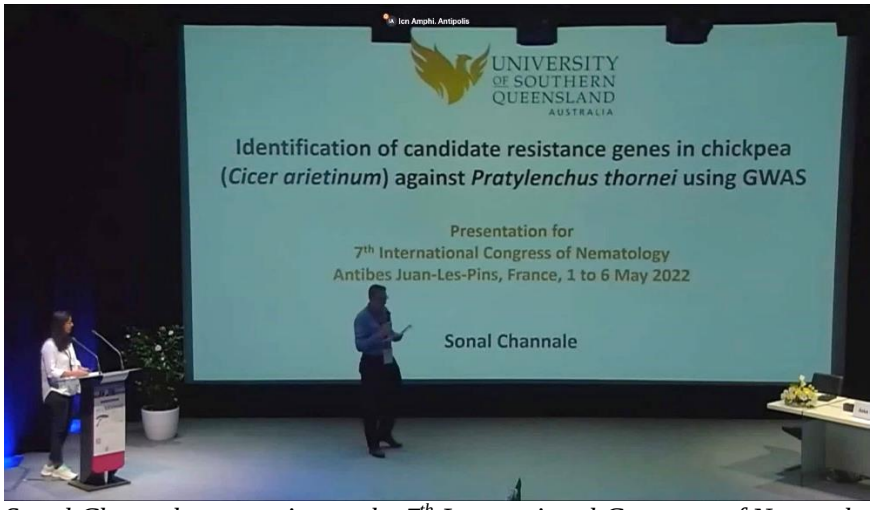
Sonal Channale, *PhD student at University of Southern Queensland.*

I attended the 7th International Congress of Nematology (7ICN) from 1st May – 6th May 2022 at Antibes, France. The conference was postponed from its original date in April 2020 due to the COVID-19 pandemic. The conference was attended by more than 600 participants from 57 countries in person and virtual too, for those unable to attend in person. The 7ICN was an enriching experience in terms of knowledge and information as it comprised of 32 concurrent sessions with 288 oral presentations, 12 workshops, 12 keynote speakers, and poster sessions with more than 500 presentations. It covered a wide and diverse range of nematology aspects - plant-nematode interaction, management, biodiversity, ecology, genetics, biocontrol, phylogeny, taxonomy and nematology education.

Day 1 – Registration and welcome

Day 2 - The conference began with plenary sessions and it was indeed very encouraging to listen to the talk on effect of microgravity on activity of entomopathogenic nematode (biocontrol agent) conducted at the International Space Station (ISS) National Laboratory (NL). Space agriculture is progressing rapidly and it's a great feat in nematology field that, entomopathogenic nematode behave equally well in space as on earth.

The oral sessions of my interests for the day were based on plant resistance and nematode virulence. The session had a majority of the talks based on different root-knot nematodes with focus on genetics, epigenetics and functional analysis of genes. The morning session concluded with three poster flash presentations among which I was also able to present part of my PhD work which was based on identification of candidate resistance in chickpea against *P. thornei* using genome wide association studies. I was happy to receive appreciation for my work from the attendees.



Sonal Channale presenting at the 7th International Congress of Nematology, Antibes, France

Among the afternoon oral sessions that I liked most was induced plant resistance-based approach for PPNs. The other talks were based on transcriptome approach for identification of target genes and defense pathways in root-knot nematodes.

Among the workshops conducted, I found the workshop on advances and challenges in CRISPER-mediated technologies in parasitic and free-living nematodes very informative. It was concluded that, the challenges one faces while adopting new technologies are very different from those of model organisms and that there is a need to build a common platform to discuss them to find better solutions.

Day 3 – Among the oral sessions I found advances in precision agriculture interesting. The highlights of the session were adoption of Normalized Difference Vegetation Index (NDVI), hyperspectral imaging, infrared spectroscopy for nematode management.

In addition, one of the talks based on chemical control of nematodes presented by Syngenta team was also interesting. The session discussed the effectiveness of new molecule known as TYMIRIUM on all types plant parasitic nematodes and yield performances of different crops were also discussed. It would be interesting to dig deep how the molecule is specific for only for nematodes while still keeping the soil microbiome intact with minimal harmful effects.

The afternoon session was regarding advances in nematode detection, identification, classification, of different nematode species through hyperspectral imaging, automated image analysis techniques, droplet digital PCR and use of machine learning approach for phenotyping of cyst nematodes. These are indeed useful techniques and could be adopted for evaluation studies which involve large number of samples to assess nematode population.

Following the oral sessions, I attended young nematologists networking program which comprised students from bachelors to early career researchers and various topics concerning difficulties of PhD students, mental health, platform for sharing future job opportunities, upcoming symposiums and conferences were discussed.

Day 4 – A free day of activities to visit France and the French Riviera.

Day 5 and 6 – I attended oral session on Future of nematology: legislation, education and training. I really liked the session on ‘Teaching nematology – what do students need to know?’ and also ‘Nematology 101 – a collection of lectures for plant nematology as slide presentations, videos and textbook chapters’. I found this session very interesting as there is vast amount of information these days through various different sources wherein one might miss out what is really important to know if they want to pursue career as nematologist. Also, it is very helpful for students from biological sciences or pathology with no formal background of nematology and wish to pursue career in nematology.

Another session was based on metabolism & physiology of nematodes and host plants. I was intrigued to know that; cyst nematode is able to modulate the plant transcriptional machinery by regulating the availability of vitamin B5 to support its continuous supply of vitamin B5 through syncytium. Vitamin B5 pathways in other host plants can be explored as target to build resistant varieties.

A session was also based on next-generation nematicides where commercially available nematicides and their efficacy were also discussed. It was also motivating to listen to learn about effector in plant parasitic nematodes. When working on plant resistance mechanism against nematodes it is also encouraging to study and collaborate with research groups focussed on effector biology to develop optimal strategies to resolve agricultural issues associated with various plant parasitic nematodes.

7ICN was indeed a great experience for me as a PhD student as it was first my international conference in person which exposed me to the wealth of knowledge from around the globe. As per my knowledge, the nematology world is progressing rapidly with its mark even in space agriculture. Expertise in and adoption of new generation technologies will help to grow nematology community in leaps and bounds and also face unforeseen challenges in future.

I was a recipient of student travel bursaries from the Australasian Association of Nematologists and International Congress of Nematology which covered accommodation and other expenses at conference.

Rhys Copeland, *PhD student at Murdoch University*

"I truly did not realise how much one can learn in the space of a week until I attended the ICN."

October 2021, I entered a three-minute thesis competition organised by the International Federation of Nematology Societies. The award was a bursary to attend the 7th International Congress of Nematology in Antibes, France. My entry reached the top nine and I was eventually awarded 2nd place.

Three competition winners (Rhys is in the middle).

Being a winner in this competition made it possible for me to attend the Congress and present a poster outlining my research progress, so I would like to begin by thanking Professor Larry Duncan (University of Florida) and Dr Eric Grenier (INRA, France), who organised the competition. The conference could not have been in a more perfect location. Antibes Juan-les-Pins is a beautiful coastal town, one I certainly hope to revisit.

Without listing the entire conference program, it would be difficult to talk about all the fascinating talks in this short communique, so I will just mention three personal highlights.

The workshop I was most excited about, “Advances and challenges in CRISPR-mediated technologies in parasitic and free-living nematodes”, was chaired by Dr Sebastian Eves-van den Akker and Dr Ralf J. Sommer. Although I do not have their permission to share, in detail, what was presented, I will say that it provided a fascinating update on the advances in utilising CRISPR techniques to study free-living and parasitic nematodes.

My second highlight was the “’Omics’ in nematology” oral session chaired by Associate Professor Adler Dillman and Dr Etienne Danchin, which covered a vast range of topics in the ‘omics’ field pertaining to nematodes, and my third the “Plant resistance and nematode virulence” oral session chaired by Dr Aska Goverse and Dr Sebastian Kiewnick.

Science aside, the organisers did a fantastic job arranging ‘extracurricular’ activities, including day trips and a gala dinner.

Rhys Copeland enjoying the 7ICN extracurricular activities

I elected to go on the day trip to Monaco, which began with a drive down the beautiful coast d'Azur. Once we arrived, we made our way to the Prince's Palace of Monaco, where Prince Albert himself was giving a talk on motor vehicles.

The rest of the day was spent admiring the beautiful city, including the Cathedral and aquarium. The gala dinner took place on the grounds of the stunning “Villa Eilenrock”, a 19th-century manor located on the coast and was an evening I’m sure most of us won’t forget.

Overall, the conference was a fantastic experience. I truly did not realise how much one can learn in the space of a week until I attended the ICN. I want to give honourable mentions to my fellow bursary recipients, Alison Coomer (University of California, Davis) and Laura Sheehy (John Moores University, Liverpool). It was fantastic to meet them both. I have definitely been bitten by the conference bug and will be looking to attend as many as possible in the future!

Workshop

CROP DISEASE, NEMATODE AND INSECT IDENTIFICATION

Department of Primary Industries and Regional Development (DPIRD), Western Australia

DPIRD has been offering an annual 'Pest and Disease Identification in broadacre crops' course for many years. The course has become an established 'rite of passage' training activity for new and young advisers / agribusiness people in WA and has been completed by 100's of attendees over time.

Workshop attended by 21 agri-industry representatives, 3 DPIRD research staff and 1 Murdoch Post graduate research student.

It is designed mainly for agronomists, growers and other grains industry representatives to improve disease, nematode and insect identification skills relevant to broadacre crop production in WA.

The course has a practical and "hands on" training approach delivered by professional and experienced DPIRD Crop protection and Entomology researchers and our senior diagnostic pathologist. Attendees also get to take home valuable resource materials.

Insect identification and integrated management will be presented on Tuesday 23rd August, followed by crop disease and nematode pest identification on Wednesday 24th and Thursday 25th August. As usual participants can register to attend either or both components.

Date: Tuesday 23 to Thursday 25 August 2022
Venue: DPIRD's South Perth office, 3 Baron-Hay Court, South Perth WA.

For further details, or to register, contact Plant pathologist Geoff Thomas, South Perth on +61 (0)428 947 287 or Entomologist Dusty Severtson, Northam on 08 9690 2160.

Conference

Focusing the Future with Plant and Soil Nematodes

'In Person' Nematology Workshop as part of the ASDS Conference
11th Australasian Soilborne Disease Symposium
Hilton Hotel, Cairns 1st - 5th August 2022

An exciting workshop to entice avid nematologists and those interested in what goes on within plant systems.

This workshop is targeted to all levels of nematode interest with experts contributing their wealth of experience from around the country.

Register early, numbers are limited!

Well worth a look into what goes on in this aspect of your industry

Date: Tuesday 2nd August
Time: 08.30 to 17:00
Place: Hilton Hotel, 34 Esplanade Cairns, QLD
Cost if attending the ASDS conference: $150 Workshops — ASDS2022 (currinda.com)

All Welcome!

Each segment will conclude with an opportunity to share in 'Show and Tell', a perfect time to hear your stories, research and experience around the topics discussed.

Topics to include:

Nematodes of the tropics

- Nematodes from the tropics Potential biosecurity threats with climate change in Australia
- Threats due to increasing range of suitable environment

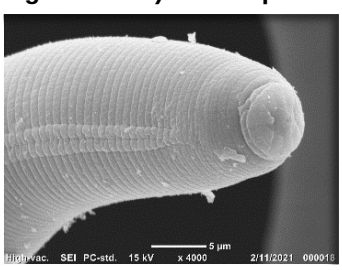
What is soil health and how can we measure?

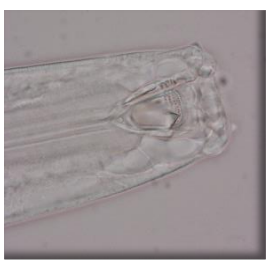
- Why is it important and methods to measure 'soil health' focus on nematode feeding groups
- Molecular testing to measure soil health

Management strategies to reduce plant parasitic impacts in crops and increase soil biodiversity and health

Case studies discussing plant parasitic nematodes that can create havoc in crops and strategies employed that reduce the issues by increasing soil biodiversity and function

Discussion session: How can broadacre growers learn from horticulture practices (bananas, sugarcane etc.) and is it practical?

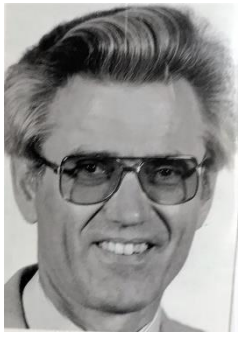




Further enquiries contact:
11th Australasian Soilborne Disease Symposium 2022 (currinda.com)
asds_program.pdf (appsnet.org)

In memoriam

Wim (Wilhelmus) M. Wouts (1935 - 2021)



Dr. Wim Wouts, former nematologist at Landcare Research in Auckland New Zealand, died in Perth, Western Australia, in December 2021. He was born in December 1935 in the Wieringermeer**, an area 60 km north of Amsterdam, the second youngest child in a family of seven. Wim's family had a small farm, on which they mostly grew potatoes. There were strong regulatory measures in place to control potato cyst nematodes (PCN) and Wim remembered visits from inspectors checking for any nematodes in mature potato plants. He was thus aware of PCN from an early age. There was no time or money for Wim to indulge in special hobbies. He did enjoy photography and singing in choirs, and he helped out on the farm. Wim's high school days were at Alkmaar, in North Holland.

After school, Wim completed two years of required military service before enrolling at the Agricultural University in Wageningen to study as an undergraduate specialising in plant pathology. In 1957, as part of his studies, he completed six months of practical work in Florida, under the supervision of Armen Tarjan, on management of the citrus nematode (Radopholus similis). He said that this confirmed his interest in nematodes, which became a lifelong passion for him. This work led to his first publication (Tarjan and Wouts, 1964). During this period, he learnt to efficiently extract sedentary cysts from soil and plant roots and took the opportunity to visit various centres of nematological research in the USA.

Wim married Alice Bartelink in 1964. She had lived in the same polder as Wim, on a farm about 10km from his parents'. They met during his last year at high school and re-connected while he was at university. Wim graduated in September 1964, at a time when there were no jobs available for nematologists in The Netherlands. Alice remembered that the only jobs were in Nigeria, Singapore or New Zealand, and as he had a brother living in the latter he chose to apply for the position there. Thus, they left for New Zealand, to take up his first professional position as a nematologist in the Entomology Division, Department of Scientific and Industrial Research (DSIR). The Entomology Division was to be moved from rural Nelson to more metropolitan Auckland, and Wim realized there was little prospect of the establishment of permanent plots for experimental nematology. He was also working with insect taxonomists, and therefore decided to work on the morphology and systematics of cyst-forming nematodes (lumped as Heteroderidae at that time), as they were insufficiently studied and economically important, and he knew PCN from his youth.

In 1967, the University of California, Riverside, one of the centres visited by Wim in 1957, offered him a scholarship to study the taxonomy of cyst-forming nematodes. He and his wife Alice and their then two children moved to California. There, supervised by Samuel 'Skip' Sher, he undertook his PhD. In the deserts of Southern California, Wim found Heteroderidae taxa that did not produce cysts and revealed the variability of the group. In his thesis, Wim showed that species of the group were more easily identified on the basis of their morphology than on their plant hosts. He proposed a phylogenetic system, based on the morphology of fully developed females, that included both cyst and non-cyst-forming categories and

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**In Australasia, where Wim lived and worked for most of his life, few of us know that the Wieringermeer was land (polder) reclaimed from the sea. In 1945, at the end of World War II, the retreating Germans ordered the destruction of the dike of the Wieringermeer and the area was inundated with fresh water. Within a year, reconstruction had begun. The Wieringermeer was one of the major seed potato producing areas of the Netherlands, and the flooding killed most of the PCN, which were largely absent in the reclaimed polder.

many known taxa for which the association with Heteroderidae had been doubtful. Species definitions were based on characteristics of the cyst and the juvenile. He established Meloidogyne, the root-knot nematodes, as a separate family (Wouts, 1973b, 1979). Until then it had been considered that they belonged to the Heteroderidae.

In 1970, Wim rejoined the DSIR research group in New Zealand, then in Auckland, and began to write up the results of his PhD work. This led to the publication of three major papers revising the taxonomy of cyst-forming nematodes. In 1972, Wim attended a conference in Italy, where he presented his work. Thus he came to the attention of German nematologists from the Institute of Nematology at Muenster, Germany, who wanted to develop a classification, based on larval characters, of the most economically important cyst-forming-nematodes of Europe. The German Government awarded Wim an Alexander von Humboldt Teaching Fellowship, to develop a system for the morphological separation of the 12 most damaging cyst-forming species in German crops. This was a highly prestigious, financially generous award, which enabled Wim to move with his family to Germany for two years, and which led to his long association with Dieter Sturhan. The award also stipulated that additional funds could be obtained for later research in Germany. This enabled Wim to organise a trip to Germany on average once every four years for the rest of his life.

On his return to New Zealand, Wim changed the direction of his research and worked on entomopathogenic nematodes, then generally known as Neoaplectana, as potential biological control agents. He established the validity of the older name Steinernema, provided an updated nomenclature for the group, clarified their life cycle (as well as the life cycle of species of the recently recognized genus Heterorhabditis), and was the first person to develop a liquid culture medium for nematodes. For some of this work, he was joined by Robin Bedding, of CSIRO, which was the start of his connection with Australia. Sadly though, a lack of funding meant his work on liquid culture of the nematodes had to be abandoned, but it is still frequently cited.

Wim maintained his excellent relations with staff at the Institute at Muenster resulting in several exchange visits. As a specialist in his field, Wim was also invited to Australia, Belgium, China, England, Fiji, the Netherlands, Russia, and the USA. In the late 1980s, he undertook training in classification of the Criconematidae at the Institute in Muenster, again made possible by generous funding from the von Humboldt Foundation. Criconematids are well represented in New Zealand, giving Wim plenty to work on from then and into his retirement., and leading to publication of his Fauna of New Zealand monograph (Wouts, 2006).

Wim's findings were communicated in ca 80 scientific publications, listed below. Of these, 13 were written in collaboration with his friend Dieter Sturhan, for whom Wim named one of his new species. Most of his papers were published in the internationally recognized journals Nematologica (and its successors through to today's Nematology) and the Journal of Nematology.

Overall, Wim described one family (Meloidogynidae), 7 genera (of which Atalodera, Bellodera and Paradolichodera are still accepted), and ca 55 new species of plant parasitic and soil nematodes. His was careful, patient and meticulous work on taxonomic issues of a broad range of nematodes. Most of these were heteroderids or criconematids. Taxonomy of the latter is still in flux, as more information on their sequences becomes available, but the great majority of Wim's species remain accepted with a few retained with recombination. Notably, he described Globodera zelandicus from the endemic New Zealand tree fuchsia, unusual for a genus typically associated with Solanaceae, and two species of Heterodera respectively from an endemic New Zealand grass and samphire. Together with his criconematid work, these descriptions illustrate the importance for New Zealand of a curious, open-minded nematologist. Wim's work on taxonomy, particularly for RKNs and the criconematids (as seen in the recent publications from Tom Powers' group on the latter), has had enduring recognition, and his work on liquid culture of nematodes continues to be recognized as seminal. In 2007, with Ian Riley and Vivien Vanstone, Wim did extensive collecting in Australia, seeking new heteroderids and RKNs, and was interested in the debate about Pratylenchus and Radopholus spp. in Western Australia. Several apparently new species were collected, and it is sad that while Wim wanted to work on these, it was not possible. He donated the material to ANIC, and the good news is that his cyst-containing soils have formed part of Mike Hodda's

current study of Heterodera. Wim was highly dedicated to the understanding of nematode evolution and phylogeny, an important process for understanding natural science.

Wim was a member of several national and international scientific societies. He travelled widely in Europe and to attend meetings of the New Zealand and Australian branches of the respective von Humboldt Associations, and particularly enjoyed one presented in Hobart, and travel in Tasmania after it. Wim was always generous of his time in editing manuscripts for European and Asian colleagues and students. He provided much encouragement and support to younger colleagues, several of whom have commented on how they miss him.

Wim was always a busy man. In addition to his work and his time with his family, he was active in many community groups. While living in Auckland, Wim was much involved in the Dutch community: initially in the Dutch Club where he served as secretary and organized a drama group, and later in the Dutch Village Trust where he served on the board and was Chairman for one year. The Trust established a retirement village, with 100 houses and a care centre, just outside Auckland, and Wim worked actively to achieve this. In 2004, he and Alice moved to Perth, Australia to be closer to family in his retirement. There Wim continued his involvement with community groups. He joined a bridge club, instigating an extension of their clubrooms; served as treasurer and president of the Probus Club; was an active member of a church choir; and even enjoyed a foray into lawn bowls. Wim and Alice where exceptionally thankful for the safe and happy life in WA, for its beauty and friendliness, and the blessing of being close to their much-loved grandchildren.

Sadly, Wim was diagnosed with bladder cancer in 2012. This was successfully treated over the following years but often painfully so, which Wim endured with good humour. This gave him nearly an extra decade of busy and happy life in Perth, some continued opportunities for travel and the great pleasure of seeing his beloved family expand and prosper. Unfortunately, pancreatic cancer was detected in late 2019, resulting in 2 years of radio- and chemotherapy. Finally, his stubborn endurance, an attribute well evidenced in his professional career, was not enough. Wim is, and will remain, sorely missed by Alice, his three boys and their families, and likewise his valued friends and nematology colleagues. Vale Wim!

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