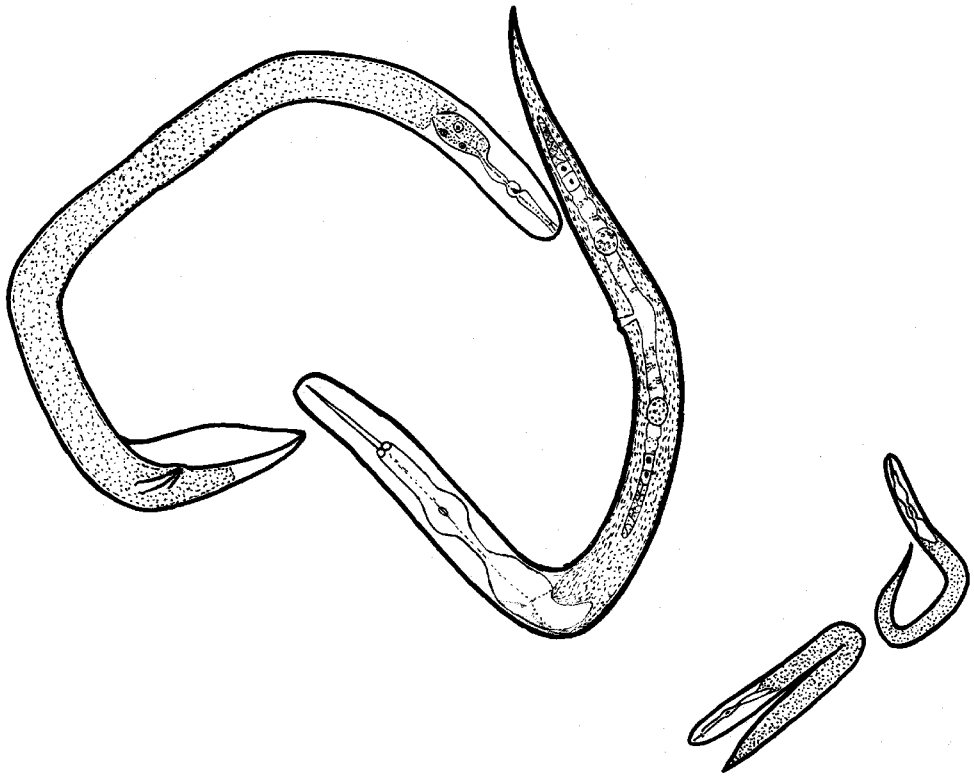
ISSN 1327-2101

AUSTRALASIAN NEMATOLOGY NEWSLETTER



Published by: **Australasian Association of Nematologists**

VOLUME 19 NO. 1 JANUARY 2008

From the Editor

Thank you to all who have made contributions to this newsletter. I particularly thank Graham Stirling for his contribution regarding the APP Nematology Feature edition. A BIG ROUND OF APPLAUSE to Graham, who has somehow motivated many of us and chivvied us into writing action. Vivien has described this as "Straight-forward motion - not nematode-like motion"!

July Issue
The deadline for the next issue will be late because of 5ICN, and because your editor will be overseas for three months after the Congress (dates unclear at present). I will notify you in advance, and please bear the newsletter in mind as you also prepare for the Congress.

Kerrie Davies

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Association News

FROM THE PRESIDENT

For this newsletter I will be doing a lot of thanking of people. This is a pleasurable position to be in, because it shows that people are willing to pitch in and co-operate to achieve some (hopefully) worthwhile goals. I think this is so important because nematologists are a relatively small community within the scientific world and working together is the only way that we as a discipline will prosper. I do not necessarily mean that projects with large teams and many different labs involved are the only way to go, but that public criticism that undermines the efforts of others ultimately doesn't help anyone. I am reminded of a saying of the late JK Galbraith (the US economist, presidential advisor, Harvard professor and a lot else besides): "When I am outside my country I never criticise it, but when I'm inside I never stop criticising, because that is the only way things will improve".

So, on with the "thank you's".

Thank you to all who participated in the nematology workshop in Adelaide. It was great to see everyone, and hopefully everyone gained from it. I certainly learned and benefited from the discussion. The organisation of the workshop was a bit more rushed than I would have liked, but all the speakers deserve a big "thank you" for sharing their experiences. I would like to thank especially David Kessell, who flew over from WA amidst a very tight schedule at short notice to give us a great perspective on *Anguina*. I also thank the locals, Ian Riley and Kerrie Davies, who did a wonderful job after being drafted in, organising the room and the restaurant for the evening and a whole host of stuff that people may not have seen, but which made the day such a great success. Thanks also to Amanda Able from the APPS conference organising committee, for keeping up with all the changes of venues and speakers etc: the morning and afternoon teas arrived exactly as scheduled.

Thank you to Jenny Cobon who took minutes of the meeting of 5ICN which followed the workshop, and thank you to Mike Jones who audited our accounts so that 5ICN can maintain its non-profit tax status.

Thank you to the officers of AAN who have kept the association going. Thanks to Kerrie Davies, the newsletter editor who has always been assiduous in hounding wayward Presidents in the kindest way for their contributions to the newsletter. The newsletter has benefited enormously from her chasing of contributions. Thank you to the outgoing Treasurer, John Lewis, who has maintained our bank account for the past 8 years. John has always been available to take people's money and has maintained our bank accounts. Big thanks also go to Ian Riley, Secretary since 1998, and before this he was newsletter editor. Ian's contribution to the AAN has been substantial, not only has he maintained our membership list, he has modernised its upkeep (ie put it in a computer file and added email addresses), and kept track of the financial status of people. Ian has maintained the AAN web site, and a host of other things. The fact that I cannot even list all the things that Ian does is testament to the way that he has just quietly and efficiently got on with doing the job. Such glowing testimonials are often reserved for those recently deceased, so I am fortunate to be able to do this for someone very much still with us, even if he may be spending some time in China in the future. Thanks Ian, you have made my job very easy.

Thank you to Vivien Vanstone and Sarah Collins for taking on the roles of Treasurer and Secretary, respectively. The Association could not continue to function without willing volunteers like them.

Thank you to Graham Stirling, who has organised a special issue of *Australasian Plant Pathology* about nematology in the region. This issue will be distributed free to everyone who registers for 5ICN, and will be a great promotion for what has gone on here over the years.

On the subject of great promotion, 5ICN should be seen as an opportunity to raise the profile of nematology in Australia. I have a couple of articles lined up with our communications section along the general lines of "world expert on X visiting, and advises on latest developments for better management" or "this is big in Y, should we be worried here". So I may be contacting several people in this regard over the next few months.

On a related issue, Keith Harrower, editor of *APP*, has asked me to remind AAN members of the availability of the rapid-publication electronic journal *Australasian Plant Disease Notes*. Keith advises that this journal is now in volume 3, has in excess of 3000 downloads per month, and might be a suitable venue for short plant-nematology papers. The papers are peer reviewed and the time from submission to actual publishing can be as little as one month.

Things are definitely hotting up around 5ICN. Session convenors have been selected for most sessions, and invitations for oral presentations should be being sent out now. Check out the web site for names and addresses (http://www.5icn.org and click on "program" on the left). There are facilities for submission of abstracts for oral papers (these will be forwarded to session convenors as suggestions for them to invite, but whether the submission is selected for an oral presentation is up to the convenor), and for posters (all submissions accepted). A reminder that early registration finishes at the end of February, so please get your registration in soon (click "register" on the left of the web page). The registration covers everything: reception, morning and afternoon teas, lunches, the dinner and field trip. I would also advise getting in soon on the accommodation as the cheapest is filling up quickly (click "accommodation" for information, "register" includes an optional facility to book accommodation).

This newsletter will be the last before 5ICN, so I look forward to seeing everyone there. It looks like a wonderful programme ranging from practical sessions on horticulture and grains, through special sessions on particular nematodes like Potato Cyst Nematodes and Root Knot Nematodes, to sessions on taxonomy, ecology, genetics and breeding, along with discussions on funding, education, problems in the developing world and much more. Encourage everyone with any interest in nematodes to come along and make it the best International Congress yet. I cannot yet announce who has been invited to speak, but check the web site shortly, because I know that many exciting speakers have been approached.

Mike Hodda

GENERAL MEETING

4.15 pm, 24 September 2007, ADELAIDE

DRAFT MINUTES

1. Apologies were received from G. Yeates.

2. Minutes of the previous meeting in Geelong 2005 presented and accepted by the meeting. There was no business arising.

3. M. Hodda presented the President's report as published in the recent newsletter. He also added comments on the success of the AAN workshop held earlier that day and thanked all who contributed. He indicated that progress on the 5ICN would be presented at the close of the meeting.

4. J. Lewis presented the Treasurer's report. The current bank account balance was $6699, a decrease from the last report mainly because of a refundable float provided to 5ICN. Although changing financial institutions was discussed at the Geelong meeting, it has not proceeded and John recommended the new committee consider this as the ANZ fees are substantial and no interest is paid.

5. I. Riley presented the Secretaries report. Membership stands at 69 an increase of 2 since the last general meeting. This consists of 44 financial members, 21 in arrears for less than one year and 4 for more than one year. Since January 2005 there has been 11 new members (2 rejoined), 1 resignation and 8 cancellations. Credit card payment through APPS was used by 29 people (including 2 new members and 6 mistaken payments) in 2007 and 19 people (including 3 new members and 1 mistaken payment) 2006.

AAN website is now hosted on DreamHost by openmonkey.com. The wiki was not reactivated when the hosting service was changed. This went unnoticed and had only received minimal interest, so it has not been reactivated.

6. Election of office bearers.

- President – M. Hodda was re-elected unopposed
- Treasurer – V. Vanstone was elected unopposed
- Secretary – S. Collins was elected unopposed
- Newsletter editor – K. Davies was re-elected unopposed

M. Hodda offered his thanks on behalf of the Association to the outgoing office bearers.

7. Other business.

K. Davies recommended that the membership help make the January 08 issue an impressive one leading into 5ICN. She also requested that abstracts of the workshop presentation be included.

V. Vanstone called for a vote of thanks to M. Hodda and everyone else that helped in making the workshop a successful event for AAN.

M. Hodda indicated that a 5ICN meeting would follow and he welcomed the contributions of those present.

The venue for the next AAN meeting and/or workshop was discussed. It was decided not to hold these at 5ICN, but rather in Sydney in conjunction with the next APPS conference. It was suggested that a workshop on entomopathogenic nematodes might be suitable.

Meeting closed at 4.45 pm.

Regional News

NEWS FROM SOUTH AUSTRALIA

The University of Adelaide

Kerrie Davies has been collecting again – with brief trips to the Cairns region in August, and to the Kimberley in October. In August, she teamed up with Dr Sonja Scheffer, ARS, USDA, who has a project examining the phylogeny of *Fergusonina* flies, associated mutualistically with *Fergusobia* nematodes. Sonja has been working at CSIRO Entomology, and this was her first 'in-depth' exposure to the fly/nematode gall system. It was a moderately successful collecting trip, including an exciting re-collection of the first tylench known from fig sycones (fruits). Sonja organised the accommodation – in a fabulous tree house near Atherton! In the Kimberley, not a single fly/nematode gall was found (giving more information on their temporal distribution), despite the presence of plenty of flower buds on eucalypts. However, three interesting collections of *Schistonchus* from *Ficus* were made.

Elise Head has made steady progress on writing up her Masters project on the ecology of *Fergusonina/Fergusobia* in a wetlands site in Adelaide, and is nearly ready to submit her thesis.

Kerrie Davies

SARDI

With the support of DEST and ATSE Crawford Fund, Ian Riley returned to China in October/November to provide training and undertake collaborative work on cereal cyst nematode. The fieldwork was done in spring wheat areas of Gansu with Li Huixia and Li Minquan and in Qinghai with Hou Shengying and Peng Deliang. It was a novel experience for Ian to be sampling almost frozen soil in snow-covered fields amongst stooks of harvested wheat. Brief visits were also made to collaborators in Beijing, Baoding, Zhengzhou and Jinan, putting the trip into the epic category.

Katherine Linsell has won a Grains Industry Research Scholarship commencing in 2008 under the supervision of Drs Klaus Oldach and Ian Riley. She will conduct her research in the SARDI molecular biology group based in the Plant Genomics Centre on the Waite Campus. The proposed project is entitled "Genetic and physiological characterisation of resistance to root lesion nematode *Pratylenchus* sp. in wheat".

Ian Riley

NEWS FROM QUEENSLAND

Department of Primary Industries

Tony Pattison (DPI) has returned from six months in Costa Rica where he completed field work for his PhD, on soils suppressive to *R. similis* in bananas. Now he has to find the time to write up his work in between all his 'real work' as he continues to lead us in projects on soil health in vegetables and bananas. Wayne O'Neill, Tony and Jenny Cobon did lots of field work in Queensland in 2007 with the vegetable project, developing the use of soil nematodes as soil health indicators to show differences in management practices within the industry.

Due to dry conditions in the southern half of the country, many farming companies are looking at new areas of production with guaranteed water supply. This has meant that some crops are being grown in areas that are not environmentally ideal for production, making them more susceptible to plant-parasitic nematodes. An example was the production of carrots on the Atherton Tablelands area of Queensland, where root-knot nematode infection meant the crop was unmarketable. Therefore, plant-parasitic nematodes continue to be an important production constraint in Queensland, especially with crops moving onto new areas.

Matthew Tan from Singapore has been in the laboratory this year. Matthew is studying at the University of Queensland and has almost completed his honours project looking at the "Phylogenetic relationships within *Radopholus similis* in Australia".

Jenny Cobon

NEWS FROM WESTERN AUSTRALIA

The WA State Agricultural Biotechnology Center (SABC), Murdoch University

Members of the Molecular Plant Nematology Group

Prof Mike Jones, Dr Modika Perera, Dr Zhaohui Wang, Dr John Fosu-Nyarko, Ms Shuie Lui, and Mr Yong Xian (Tony) Ho

Nematode diagnostics

Modika Perera has been working on an ARC Linkage grant with Mike Jones and Vivien Vanstone (DAFWA) to develop epitope specific antibodies for nematode identification. She has been using *Anguina tritici*, *A. funesta* and *Meloidogyne javanica* as models to develop the procedures. The same approach can be applied to other pathogens, eg *Diuraphis noxia* (Russian wheat aphid, RWA) biotypes 1 (an avirulent strain) and biotype 2 (a virulent strain). RWA is a quarantine pest in Australia.

Murdoch University final year Biotech/Chemistry student Yong Xian (Tony), worked with Modika for 6 months, successfully completed his undergraduate studies and has now returned to Singapore. During his time with the Group, Tony worked on novel nematode diagnostics and also produced a series of transgenic tobacco plants expressing a pathogen/wound inducible promoter – reporter gene construct. Modika is now analysing these transgenic plants for reporter gene expression after root-knot nematode infections.

Modika has also worked with Proteomics International Pty Ltd to sequence race-specific protein biomarkers identified for stem nematodes *Ditylenchus dipsaci.* These can be used to distinguish between the oat and lucerne races of this species.

Congratulations to Modika, who was awarded a GRDC Senior Fellowship Award for 2008 on "Application of recombinant antibodies for field detection of insects and pathogens". The latter includes nematode pathogens. Most of the Fellowship will be undertaken overseas as the project involves Australian quarantine pathogens, and some techniques needed for this project are not available in Australia. The study includes visiting leading laboratories to enable development of specific antibodies to priority pests of grain crops using lateral flow devices. Modika will visit:

- Kansas State University and Agriculture Research Centre-Hays, Kansas, USA
- Onderstepoort Veterinary Institute, Pretoria, Republic of South Africa
- Central Science Laboratories, York, UK.

Modika also has been invited to review two international research projects and an international award relevant to her work on diagnostics and mass spectrometry.

Understanding the molecular basis of root-knot nematode-host interaction

The project focussed on studying changes in gene expression that occur in developing giant cells at early stages of infection, using cytoplasmic contents of giant cells isolated by Laser Microdissection and Catapulting (LMC). We first demonstrated LMC as a solution to obtaining pure cytoplasmic contents of giant cells induced by nematodes 4 days after infection (Ramsay, K, Wang, Z and Jones, MGK (2004) *Using laser capture microdissection to study gene expression in early stages of giant cells induced by root-knot nematodes. Molecular Plant Pathology*, **5**, 587-592; Ramsay, K, Wang, Z and Jones, MGK (2006) *Laser capture microdissection: a novel approach to microanalysis of plant–microbe interactions***.** *Molecular Plant Pathology*, **7**, 429-435). We have since used LMC to generate expression profiles of giant cells induced by *Meloidogyne javanica* 4 and 7 days after infection, and by *in silico* functional characterisation we have identified key biological processes involved in giant cell formation.

Direct involvement of 25 genes including 7 previously known to express in mature giant cells induced by *M. javanica* in tomato roots was studied using quantitative real time PCR. Eleven of the genes were highly expressed 4 and 7 days after nematode infection. These included a Phi protein homologue and a pectinesterase, involved in cell division and cell wall morphogenesis respectively. The results indicate that the two genes are directly involved in the formation of giant cells. Other highly expressed genes include transcription factors, ribosomal protein subunits and genes involved in the electron transport chain and general metabolism. Among the 25 genes, expression levels of four including Phenylalanine ammonia lyase remained unchanged over the seven day period of monitoring the levels of expression after infection.

The identification of such giant cell specific genes not only improves current understanding of nematode-host interactions, but could also contribute to nematode control strategies. For instance, further characterisation of nematode responsive genes could provide suitable promoters for use in generating transgenic plants resistant to nematodes.

Synthetic plant resistance to nematodes

Since July 2007, Zhaohui Wang and Shuie Liu have been working on the second phase of an ARC Linkage Project on synthetic host plant resistance against root-knot nematodes. This new Linkage project 'Combinatorial controlled gene expression delivering crops resistant to nematodes', follows on from the previous Linkage project with Mike Jones and James Dale from QUT. The aim is to achieve controlled target gene expression that is restricted to nematode

feeding cells using different nematode-responsive promoters, and a replicase gene from a plant virus. Based on knowledge obtained from the previous Linkage project, a number of new nematode-responsive promoters are being tested together with a different version of the viral replicase gene, and different plant transformation strategies to improve the expression efficiency of the target gene in feeding cells. A transient expression approach has also been established to carry out fast screening of different combinations of nematode-responsive promoters and plant transformation constructs.

In July, Zhaohui Wang attended the 2007 annual meeting of the American Phytopathological Society and the Society of Nematologists in San Diego, California. He presented results from the ARC Linkage project with transgenic plants tested for root-knot nematode induced target gene expression in feeding cells. Zhaohui also discussed different aspects of synthetic plant resistance with colleagues from research institutes and private companies.

Shuie Liu has generated a number of transgenic plants carrying truncated versions of the transcription factor gene promoter from *Arabidopsis.* She has shown specific expression in nematode feeding cells, and is now screening transgenic plants with root-knot nematode infection to confirm the feeding cell specific expression, and to identify potential nematode-responsive elements in the promoter sequence.

Nematode resistance in wheat

Prof Mike Jones, together with Dr Sean Hird, has obtained support for a project to develop nematode-resistant wheat. John Fosu-Nyarko and Louise McKenzie will be working on this project, which is a new direction for plant nematology research in WA. We hope to provide more details on this exciting new venture in the next AAN Newsletter.

As the only non-EU speaker, Mike Jones was also invited to attend the EU COST ACTION 872 (Nematode Genomics) Meeting near Nice, and the Murdoch group has now been accepted as a member of this EU ACTION program. This program provides access to the R&D of leading nematode (*C. elegans* and plant parasitic nematodes) labs in Europe.

Zhaohui Wang

NEWS FROM NEW ZEALAND

Congratulations to Gregor Yeates, who was made a Fellow of the Society of Nematologists at their San Diego meeting in 2007.

NEWS FROM CANBERRA

ANIC, CSIRO

Mike Hodda went to the SON/APS meeting in San Diego in August, where he was invited to talk at a session on databases for biological material, along with speakers on databases for fungi, gene sequences, scientific expertise, and education materials (see the Abstract below). All agreed that being able to integrate data better was a priority, but, personally, Mike was disappointed that there were few new ideas on how to do this, and even fewer ideas on how to fund such worthy goals. Some sort of search engine for finding, then combining data from different sources was seen as the best way to go. Unfortunately, further developments to the ANIC contribution to this area (BIOLINK) are currently on hold.

Mike also presented a poster on his *Pratylenchus* studies (abstract below). Very interesting was the session on PCN, given the recent detection in Idaho. The amount of resources marshalled to tackle this problem was very impressive. The US is clearly taking the issue seriously and is putting in the money to do so.

In December, Mike published a review of the systematics of the entire Phylum Nematoda, down to Family level (ZOOTAXA 1668, 265-193). For those of you statistically inclined, 241 families, 89 superfamilies 52 suborders, 39 orders, 23 superorders, 9 subclasses and 5 classes were recognised. The number of families is about the same as previously, but there are more orders, superorders, subclasses and classes than in previous classifications. The position of some major groups just cannot be satisfactorily resolved by the currently available morphological, developmental or molecular evidence and so there are a number of polytomies at quite high levels. For example, Oncholaimids (marine things that look superficially a bit like Mononchids), cannot be resolved between Enoplids or Tripylids, so they have been accorded a rank equal to both.

Summer Student Janine Guy from Flinders University has been working with Mike on nematodes, particularly Aphelenchida, from the bark of urban trees. This work is complementing that of previous students who have sampled eucalypts and exotics outside Canberra city. Lots of interesting nematodes, many of which are in the problematic genus *Aphelenchoides* were found, plus *Ditylenchus*, *Laimaphelenchus* and a host of Rhabditida. At the time of writing the results were not finalised, so a full report will be presented sometime in the future.

Mike has been collaborating with Helen Jolley from the Royal Botanic Gardens, Melbourne, to describe an interesting species of *Nothanguina*, which forms tiny galls on mosses. This is a very small nematode, which manages to modify the reproductive structures of the moss to form the gall.

Abstracts of San Diego talks

Variability in morphology, genetics and biology of nematodes and evolution of new taxa

The evolution of new species, pathotypes or resistance-breaking races of plant-parasitic nematodes has major consequences for crop management and breeding, yet is little understood. A major study of hundreds of specimens and sequences from more than 30 populations of 20 species from the genus *Pratylenchus* was conducted to test the relationships between variability in morphology, genetics and biology. A range of parameters within each of these categories were measured, such as body length, diameter, various morphometric indices, different gene loci, host responses and population responses to culture conditions. The amount of variability in the different parameters was seldom correlated within putative species or populations, but there were often thresholds dividing "species". This suggests that species barriers were real, and that certain models of evolution may be operating. There were also clusters of populations with higher levels of internal overlap in many parameters than among most of the other populations studied. These may represent centers of evolutionary activity. Why these particular clusters have these properties raises important hypotheses for evolution in nematodes.

Comprehensive morphological keys to nematodes and similar invertebrates at various taxonomic resolutions using INTKEY

There are many divergent forces which need to be balanced in designing information systems for biological information: a desire for the broadest possible availability; seeking the benefits of the broadest coverage of taxa, geography and range of information; a strong interest in rapid addition of new information to databases; the needs of compilers for ease of input; the desires of users for ease of output; requirements for data of high quality; and the necessity of accommodating users with different levels of expertise or needs. To balance all these forces within realistic constraints of resources has required compromises and the acceptance that

attempts to make biological information available will always have to be regarded as incomplete and works-in-progress. This has been a central tenet of systematics for a considerable period. Despite the many innate difficulties of the task and the taxonomic complications of the Nematoda, it has been possible to design a key to nematodes and similar invertebrates that is simultaneously available, all-encompassing, flexible, and high-quality. The key is available now (http://www.ento.csiro.au/science/nematode.html) and has been attracted users from school children to experts. The properties of the program INTKEY have been important in achieving this outcome.

Research

THE ROLE OF PASTURES IN HOSTING ROOT LESION NEMATODE (*PRATYLENCHUS NEGLECTUS*)

Ali Bhatti, Ming Pei You and Vivien Vanstone

Department of Agriculture and Food, South Perth, Western Australia

(presented to the Australasian Association of Nematologists Biennial Workshop held in Adelaide, South Australia, September 2007)

Rotation using poor or non-host crops is the key to effective & sustainable nematode management. However, all Root Lesion Nematode species have wide host ranges. The role of pastures in the cereal cropping system is unclear in regard to their effect on nematode levels, and thus the influence on subsequent cereal crops.

A new generation of annual Mediterranean pastures is being introduced to Western Australia (Loi *et al.* 2005 *Australian Journal of Experimental Agriculture* 45: 289). These pastures:

- are more productive than the traditional medics & sub-clovers
- are productive and persistent under stressful growing conditions
- offer more weed control options
- increase species diversity in the farming system
- have wide adaptation
- provide greater flexibility to growers

Adoption has already occurred over 1.5 M ha of the Western Australia cereal growing area within only 5 years of release.

These new species have:

- deeper root systems
- improved water and nutrient use
- higher hard seed content
- tolerance to acid sandy soils and low rainfall
- ease of harvest with equipment used for cereals
- better tolerance to grazing
- persistence with extended cropping phases
- efficient phosphate use
- insect tolerance.

Ability of pastures to host *Pratylenchus neglectus* (the predominant Root Lesion Nematode species in Western Australia) was measured to determine their possible influence on subsequent susceptible cereal crops in the rotation. Pastures (25 cultivars representing 17 species) were grown in the glasshouse, and 10 replicates of each inoculated with 2,000 *P. neglectus*. The total number of *P. neglectus* per plant was determined 10 weeks after inoculation (Figure 1).

Pasture cultivars were classified as susceptible or resistant to *P. neglectus*, based on comparison with the susceptible control Machete wheat (*Triticum aestivum*) and resistant Tanjil lupin (*Lupinus angustifolius*). Results indicate that some of the new annual pastures (sulla, serradella, rose clover, purple clover) introduced to Western Australia are resistant to *P. neglectus*, but clover species vary, ranging from resistant to very susceptible (Table 1).

Depending on pasture species and cultivar, *P. neglectus* levels could increase during the pasture phase and become damaging to subsequent cereals.

Figure 1: Root Lesion Nematode levels extracted from 25 pasture cultivars 10 weeks after inoculation with *P. neglectus* in relation to susceptible Machete wheat (S) and resistant Tanjil lupin (R).

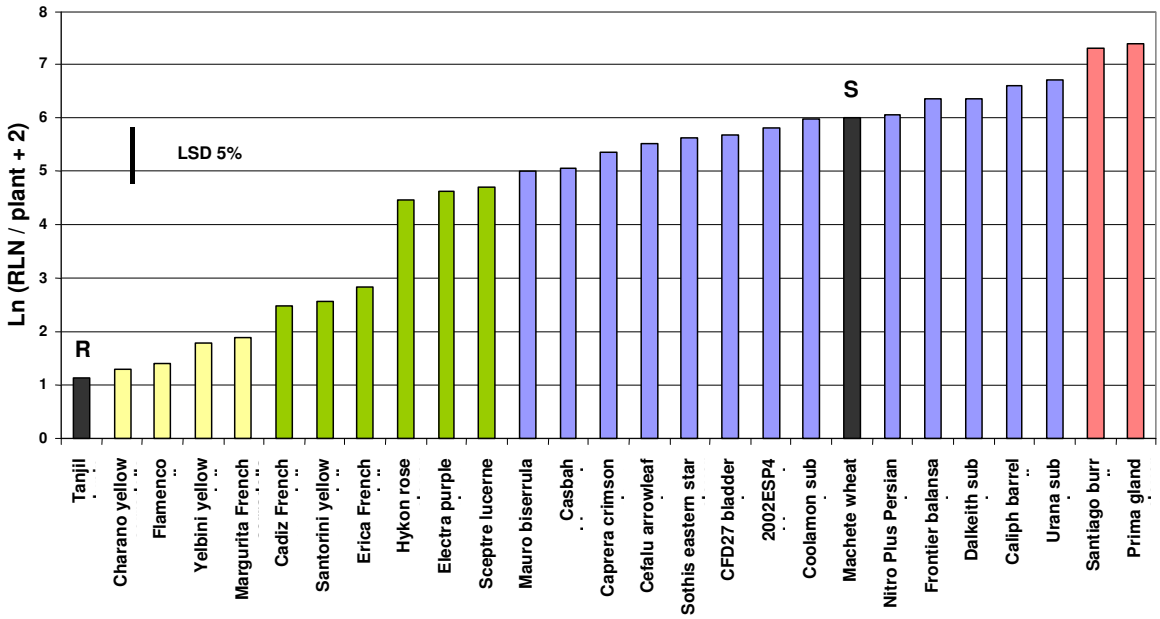


Table 1: Reaction of pasture cultivars to *Pratylenchus neglectus*. Data analysed in relation to susceptible Machete wheat and resistant Tanjil lupin.

R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible; VS = very susceptible.

Cultivar/Species	Species	Reaction to *P. neglectus*
Tanjil lupin	*Lupinus angustifolius*	R
Charano yellow serradella	*Ornithopus compressus*	R
Flamenco sulla	*Hedysarum coronarium*	R
Yelbini yellow serradella	*Ornithopus compressus*	R
Margurita French serradella	*Ornithopus sativus*	R
Cadiz French serradella	*Ornithopus sativus*	MR
Santorini yellow serradella	*Ornithopus compressus*	MR
Erica French serradella	*Ornithopus sativus*	MR
Hykon rose clover	*Trifolium hirtum*	MS
Electra purple clover	*Trifolium purpureum*	MS
Sceptre lucerne	*Medicago sativa*	MS
Mauro biserrula	*Biserrula pelecinus*	S
Casbah biserrula	*Biserrula pelecinus*	S
Caprera crimson clover	*Trifolium incarnatium*	S
Cefalu arrowleaf clover	*Trifolium vesiculosum*	S
Sothis eastern star clover	*Trifolium dasyurum*	S
CFD27 bladder clover	*Trifolium spumosum*	S
2002ESP4 biserrula	*Biserrula pelecinus*	S
Coolamon sub clover	*Trifolium subterraneum*	S
Machete wheat	*Triticum aestivum*	S
Nitro Plus Persian clover	*Trifolium resupinatum*	S
Frontier balansa clover	*Trifolium michelianum*	S
Dalkeith sub clover	*Trifolium subterraneum*	S
Caliph barrel medic	*Medicago trucatula*	S
Urana sub clover	*Trifolium subterraneum*	S
Santiago burr medic	*Medicago polymorpha*	VS
Prima gland clover	*Trifolium glanduliferum*	VS

COMPARATIVE HOST STUDIES FOR PRATYLENCHUS NEGLECTUS, P. THORNEI AND P. PENETRANS

Vivien Vanstone, Helen Hunter and Sean Kelly

Department of Agriculture and Food, South Perth, Western Australia

Diverse nematode species occur in cropping regions of Western Australia. At least 60% of paddocks are infested with one or more species of Root Lesion Nematode (RLN, *Pratylenchus* spp.). Yield limiting densities occur in 40% of these paddocks. RLN reduce cereal yields by at least 5% annually and losses as high as 15-25% have been recorded. As in the Eastern States, *P. neglectus* is the predominant RLN (detected in 40% of samples) and occurs throughout the cereal cropping zone. Unlike Eastern Australia, *P. thornei* is rare in Western Australia.

Pratylenchus teres is detected in 10% of samples, and occurs throughout the Western Australian cereal cropping zone on wheat, barley, oat and canola. *P. teres* is not found in crops in other areas of Australia.

Pratylenchus penetrans is identified from only 1% of samples, but significant impact has been observed to wheat, oat & field pea, and this nematode can reach very high levels (as many as 900,000 RLN/g dry root).

Pratylenchus neglectus, *P. thornei* and *P. penetrans* have been produced in laboratory carrot culture for use as inoculum.

Eight crop cultivars (representing 6 species) with known reactions to *P. neglectus* (Table 1) were inoculated with 2,000 *P. neglectus*, *P. penetrans* or *P. thornei* collected from WA. Each crop x nematode combination was replicated 8 times, and nematode levels in the roots were assessed 10 weeks after inoculation.

Table 1: Crops assessed for comparative testing of RLN species.

S = susceptible; MS = moderately susceptible; MR = moderately resistant; R = resistant.

Crop	Cultivar	Reaction to *P. neglectus*
Wheat	Machete	S
Wheat	Wyalkatchem	MS
Triticale	Tahara	R
Canola	Stubby	MS
Chickpea	Heera	MS
Field Pea	Kaspa	R
Lupin	Tanjil	R
Barley	Stirling	MR

There were significant differences between *P. neglectus*, *P. penetrans* and *P. thornei*, and between *P. penetrans* isolates (Figure 1). Heera chickpea, Machete and Wyalkatchem wheat, and Stirling barley were susceptible to all three RLN species. Kaspa field pea and Tanjil lupin were susceptible to *P. penetrans* but resistant to *P. neglectus* and *P. thornei*. Stubby canola was susceptible to *P. neglectus* and *P. penetrans* but resistant to *P. thornei*. Results for *P. neglectus*

and *P. thornei* are consistent with those previously reported from SA and Victoria. Canola is known to be resistant to *P. thornei* and susceptible to *P. neglectus*. Field pea in Western Australia has previously been shown to be susceptible to *P. penetrans* and resistant to *P. neglectus* (Figure 2). In a preliminary glasshouse trial using naturally infested field soil, all crops were susceptible to *P. penetrans* (Figure 3).

However, *P. penetrans* isolates were significantly different (Figure 1). Isolate "Pp Nar" was sourced from cereal trials at Narrogin Western Australia, and "Pp 642" from horticultural fields (most recently with Brassica) at Manjimup Research Station, Western Australia. The cereal isolate multiplied significantly more on field crops than did the horticultural isolate. This raises the possibility of RLN adapting to different host spectra depending on cropping history.

Figure 1: RLN levels extracted from plants 10 weeks after inoculation.

Pn = *Pratylenchus neglectus*; Pt = *P. thornei*; Pp = *P. penetrans*.

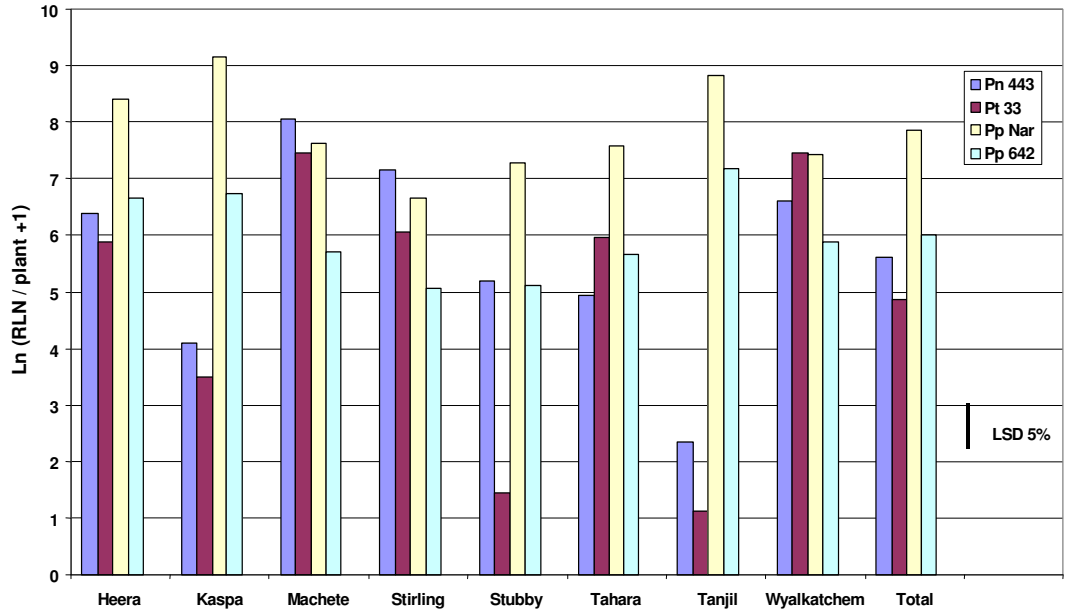


Figure 2: Comparative multiplication of *Pratylenchus penetrans* and *P. neglectus* on field pea cultivars assessed from Western Australian trials in 2004. Field pea is resistant to *P. neglectus* (multiplication rate <1) but susceptible to *P. penetrans* (multiplication rate >1).

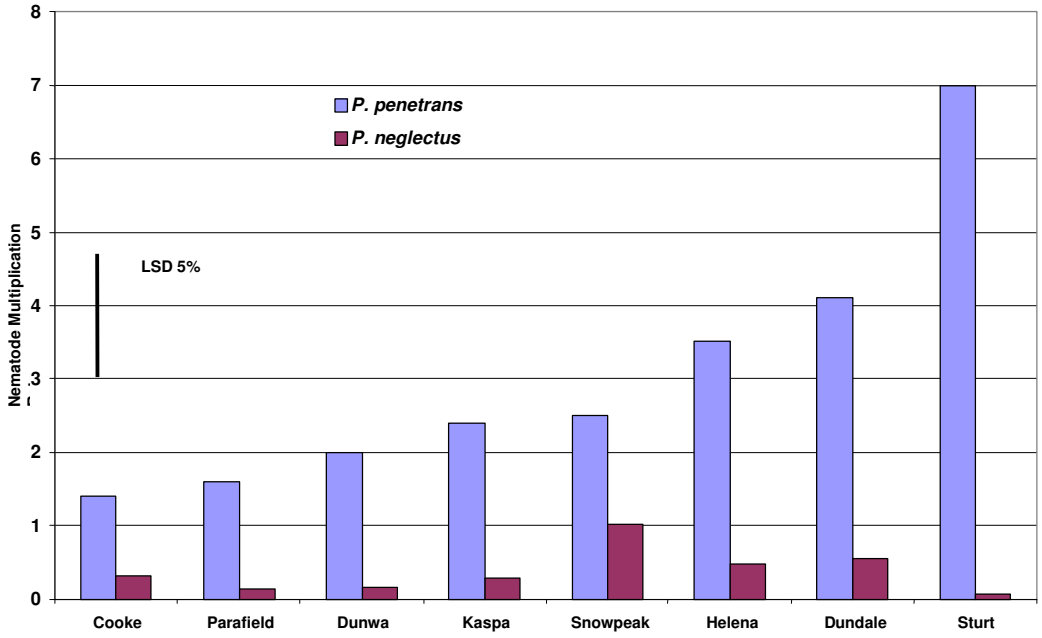
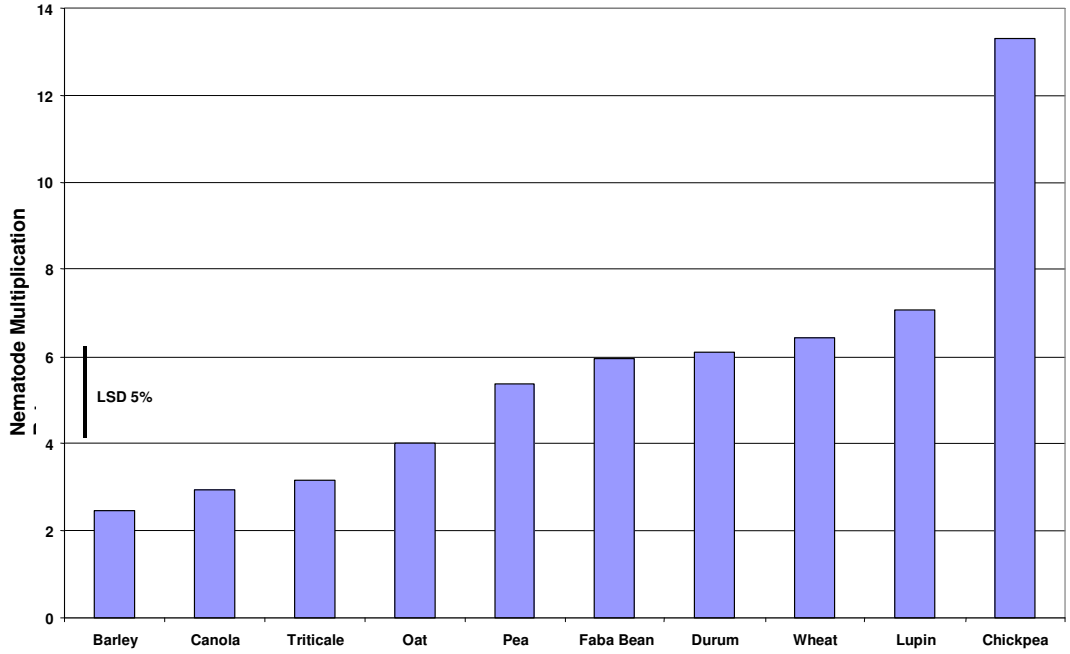


Figure 3: Preliminary glasshouse trial using field soil naturally infested with *Pratylenchus penetrans*. All crops were susceptible (multiplication rate >1)



COMPARATIVE HOST STUDIES WITH *RADOPHOLUS* SPP.

Vivien Vanstone, Helen Hunter and Sean Kelly

Department of Agriculture and Food, South Perth, Western Australia

Two species of Burrowing Nematode (*Radopholus nativus* and *R. vangundyi*) have been detected in Western Australian crops. *Radopholus nativus* was identified in 1998 (Riley and Kelly 2001 *Nematology* 3: 25) and Dr Jackie Nobbs (Nematode Taxonomist, SARDI Adelaide) has recently identified a second species (from Mingenew, Western Australia) as *R. vangundyi*. These Burrowing Nematode species have previously only been described from native vegetation in Australia and New Zealand.

Radopholus nativus is detected more frequently than *R. vangundyi*, but Burrowing Nematode is found throughout the Western Australian cropping zone, particularly in the Northern & Central Regions. *Radopholus* occur in <3% of samples, but can reach high levels & cause significant damage to wheat and barley.

Preliminary tests were conducted in the glasshouse using field soil naturally infested with either *R. nativus* or *R. vangundyi* to determine ability of crop cultivars to host Burrowing Nematode. This information is required for development of rotational recommendations for growers where these nematodes have been diagnosed at damaging levels.

A range of field crop cultivars were tested (Table 1) as hosts for the two *Radopholus* species.

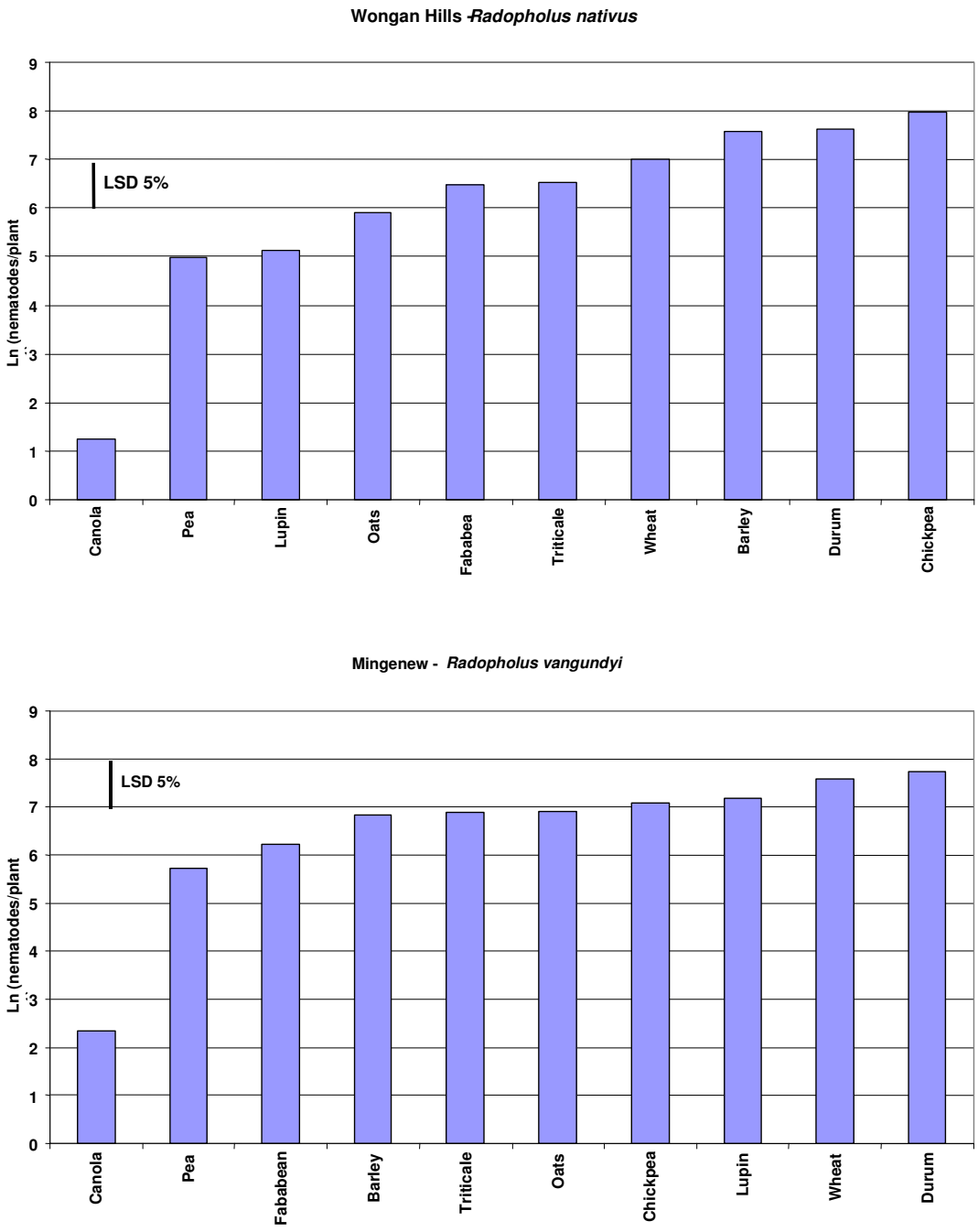
Canola was by far the least susceptible crop for both species of Burrowing Nematode (Figure 1), and this was true for all cultivars tested. All other crops were significantly more susceptible. The crops most susceptible to *R. nativus* were wheat, barley, durum and chickpea, and to *R. vangundyi* wheat and durum.

Table 1: Cultivars of crop species tested as hosts of *Radopholus nativus* and *R. vangundyi*.

Crop species	Cultivar
Barley	Baudin
	Stirling
	Schooner
	Gairdner
	Mundah
Canola	Pinnacle
	Beacon
	603CL
	Surpass 501
Chickpea	Sona
	Tyson
	Heera
	Howzat
Durum	Tamaroi
	Kamilaroi
	Kalka
	Wollaroi
Faba bean	Fiesta
	Ascot
	Fiord

Crop species	Cultivar
Field pea	Helena
	Dunwa
	Parafield
	Dundale
Lupin	Kalya
	Wonga
	Tanjil
	Merrit
	Belara
Oat	Carrolup
	Dalyup
	Pallinup
	Mortlock
Triticale	Abacus
	Tahara
Wheat	Wyalkatchem
	Westonia
	Carnamah
	Calingiri
	Machete

Figure 1: Reaction of crop species to *Radopholus nativus* and *R. vangundyi*.



Workshop Report

APPS NEMATOLOGY WORKSHOP ON NEMATODES OF PASTURES IN AUSTRALIA AND NEW ZEALAND

Organised by Mike Hodda

ANIC, CSIRO Entomology, Canberra.

September 2007

Nematodes of Pastures in WA

Vivien Vanstone, Department of Food and Agriculture, WA

See Research section in this issue.

What happens to soil nematodes in changing crops to pastures and vice versa?

Mike Hodda, ANIC CSIRO **and Emma Broos** University of Western Sydney

This talk described studies carried out a few years ago by Emma Broos, a PhD student at the University of Western Sydney, co-supervised by Mike Hodda. The nematodes and other soil biological parameters were measured over 3 years on 2 sites in the GRDC-sponsored Western Farming Systems Trial, at Nindigully in southwestern Queensland, and Cryon in central NSW, on plots continuously cultivated with wheat or converted from wheat to pasture. Soil microbial biomass was higher at both sites following conversion to pasture after 1 year, but was only higher at 1 site after 3 years. Bacterial-feeding nematode abundance 3 years after conversion to pasture was related to microbial biomass 1 year after conversion. Abundance of predatory, omnivorous, algal and substrate feeding nematodes showed no differences between plots converted to pasture and those maintained as wheat. Plant-root feeders showed differences between the sites in total abundance for many species, but *Dorylaimoides* sp. were more abundant in pasture, and *Pratylenchus* spp. were more abundant under cereal.

Survey of nematodes in temperate pastures

Graham Stirling, Biological Crop Protection, Mogill

Abstract not available.

Breeding for nematode tolerance in pastures

Nigel Bell and Richard Watson, Agresearch NZ

Selecting for resistance easier with *Heterodera trifolii* than with RKN. *Heterodera trifolii* – 7% per cycle, RKN 2.3% per cycle. Latter – resistance is multigene, promoters are involved. In New Zealand, there is a broad range of nematodes in the field in clover pastures, and resistance to *H. trifolii* has not produced the yield gains hoped for.

Pratylenchus neglectus: tolerance and resistance in medic pastures

Ross Ballard, SARDI

Work at SARDI has been focussed on the resistance and tolerance of annual medic to root lesion nematode (*Pratylenchus neglectus*).

Data from five field trials in South Australia has consistently shown that the rate of nematode multiplication under a range of medic species is similar to that under Tahara triticale, which is widely regarded as resistant. There was some minor variability between medic species, with the barrel medic cultivar Caliph proving to be most resistant.

The field tolerance of medic to *Pratylenchus neglectus* has also been quantified at two field sites on Eyre Peninsula. Medic herbage production in spring was significantly correlated with the number of *P. neglectus* in the soil at sowing. Yield loss was linear and at a rate of about 1 % per nematode (eg 30 % yield loss where 30 nematodes per g soil were present at sowing).

Efforts to improve the tolerance of annual medic is underway and most advanced for strand medic. Using a growth room bioassay, a tolerant medic line was identified and crossed with the intolerant, but widely grown, cultivar Herald. Further screening has shown that good levels of tolerance have been maintained through to the F_6 progeny. Eight families have been progressed into seed build-up with a view to testing the tolerant material in the field in 2008. A similar approach is being used to develop tolerant lines of barrel medic.

Pastures to enhance biological suppressiveness to nematodes

Graham Stirling, Biological Crop Protection, Moggill

In sugar cane, trials showed that best yields follow a pasture break (rotation).

Pasture had least impact on pathogens but the greatest effect on beneficials. Microbial biomass, C, fungi, mycorrhizae, and total numbers of free-living nematodes all increased most under pasture. *Pratylenchus zeae*, a serious pathogen of sugar cane was not necessarily reduced by the pasture break, but RKN was inhibited for up to 18 months. The longer a period of bare fallow, the more the numbers of *Pratylenchus* and other soil organisms declined. However, once cane was re-planted, the highest populations of *Pratylenchus* occurred in plots with the longest periods of bare fallow, presumably due to lack of competition. Tilling was found to kill beneficial organisms, and yields following direct drill into either grass or soybean pasture were higher than in tilled soil.

Work has also begun on control of RKN in ginger. Organic amendment with animal manure and sawdust significantly reduced numbers of RKN eggs in the soil. Trials with minimum till (direct drill into grass pastures) have begun.

Nematodes in Clover in NSW Dairy Pastures

Mike Hodda, ANIC CSIRO Canberra **and Iqbal Zahid,** The University of Sydney

This talk described studies carried out a few years ago by Iqbal Zahid, a PhD student at the University of Sydney, co-supervised by Mike Hodda. Field studies were largely carried out at Wollongbar, on the NSW north coast. *Meloidogyne trifoliophila*, *Heterodera trifolii* and *Helicotylenchus dihystera* were the most important pathogens. Species of *Pratylenchus*, *Xiphinema* and *Tylenchorhynchus* occurred widely at lower abundances. Glasshouse trials showed that *M. trifoliophila*, but not *H. dihystera*, significantly reduced root and shoot growth and nodulation of clover. The effect of all nematode species was greater when fungi were also present, although the effect differed according to the nematode and fungus species. Some common weeds were nematode hosts. Some potential rotation crops were tested, and these reduced nematode abundance, but it increased again rapidly.

Biopesticides for use against nematodes on pasture plants

Nigel Bell, Agresearch NZ

Pot trials with 1000 bacterial isolates were carried out. With these, there was a tendency for an increase in dry matter production, but no significant decline in nematode numbers. Promising strains were selected, and trials with them were carried out in large pots. Seven bacteria were used. Two showed promise, and the response increased with temperature. Within the plants, chitinase increased when exposed to both nematodes and bacteria. Glucanase increased when exposed to nematodes, but was not changed by exposure to bacteria.

Molecular tools to study soil-borne organisms

Ian T. Riley[1], Herdina[1], Diana Hartley[2], Jackie Nobbs[1] and Alan C. McKay[1],
[1]Diagnostics, Plant and Soil Health, SARDI, GPO Box 397, Adelaide SA 5001, [2]CSIRO Entomology, Black Mountain, ACT 2601

The development and delivery of quantitative molecular assay for soil-borne pathogens in cropping soils by SARDI was reviewed. This technology has been delivered as a commercial service since 1997 and is currently marketed as PreDicta B. The base technology has been refined and advanced over this period and now uses real-time PCR (TaqMan) assays. The principles and steps to development of new assays were outlined and their application to pasture soil introduced. Pastures represent a new and different challenge because they consist of mixed species, with the value of feed on offer varying throughout the year, and to understand the soil ecosystem assays for diverse pathogens, beneficials and plant roots are needed. The SARDI project under the MLA soil biology initiative has already developed and begun applying new assays for pathogenic oomycetes, fungi and nematodes, beneficial fungi (arbuscular mycorrhizal fungi) and pasture species. The existing and new tests for plant parasitic nematodes (PPN) included species of *Ditylenchus*, *Heterodera*, *Pratylenchus* and *Meloidogyne*. *Heterodera trifolii* was detected in about 10% of pastures sampled across southern mainland Australia, but the others were uncommon. It is possible other PPN tests are needed or that PPNs are not important in pasture soil ecosystems in southern Australia.

Anguina

David Kessel, Department of Food and Agriculture, WA

Anguina funesta nematodes cost Western Australia $40 million p.a. through annual ryegrass toxicity (ARGT). Of this cost, 5% is due to livestock deaths, 15% to costs of livestock monitoring, and the rest to loss of meat and wool production, loss of hay exports, and reduced fertility in male animals grazing pastures infested at low levels. Control methods include use of ryegrass herbicides, spray-topping pastures, and heavy grazing before the grass goes to head. A vaccine against the bacterial toxin has been developed by CSIRO in Victoria, but needs a commercial partner. While the ryegrass cultivar Safeguard is highly resistant to the nematode, it is expensive ($40/ha for seed) and hard to establish correctly. The biological control agent, twist fungus (*Dilophospora alopecuri*), whose spores are carried by the nematode, is having some success. Exotic non-toxigenic *Rathayibacter* have been found to grow faster than the toxic bacterial form, and could possibly be used to smother development of populations of the toxic bacterium. Field trials can begin after AQIS has evaluated quarantine research data for the non-toxigenic strains and given their approval.

Participants at the Workshop in Adelaide in September 2007.

Book Review

"PRACTICAL PLANT NEMATOLOGY. A FIELD AND LABORATORY GUIDE"

D. L. Coyne, J. M. Nicol and B. Claudius-Cole

The aim of this guide is to outline the initial steps needed to ascertain the incidence of a plant nematode infestation, and the subsequent path to preliminary identification of the probable cause. It is intended particularly for use in areas where remoteness from centres of research is a factor. Thus it covers such topics as identification of symptoms of plant disease and methods used to analyse the probable cause of the disease.

The guide is very thorough in covering the equipment and methods used for sampling, extracting and analysing soil and root samples for the presence of nematodes. It includes methods for best practice for efficient and meaningful sampling, washing, extracting and staining of any nematodes found and their initial identification.

The sections on sampling of soil, leaves and roots are well-covered and useful. Similarly, the section on extraction of the nematodes from either soil or roots is clear and helpful. The methods are clearly described and illustrated and well referenced.

In the section covering the initial identification of nematodes, one big drawback is the absence of a scale bar on any of the photographic illustrations. Even a notation in the captions on size would have been useful, and the captions could also have indicated the staining method used.

Another useful section is on the preparation of nematodes in cases where they need to be sent away for further identification. Lists of collaborating laboratories involved in this are included. In addition, scientific societies including those engaged in nematological research are mentioned, and form a very useful adjunct to this guide.

Appendix 1 has a guide to geographic distribution of nematodes according to climate type and crops and the corresponding symptoms to look for. Appendix Two gives some basic characteristics of the most common types of nematodes found. Appendix Three has score sheets for assessing crop damage.

The reference list includes most of the standard texts useful for such work.

In conclusion, it is good to have all these aspects of practical plant nematology research collected together in one guide.

Valerie N. Kempster

International Congress of Nematology

Brisbane, July 2008

Register Now!!

Early Registration Closes February 29th

Registration for the 5th International Congress of Nematology, being held in Brisbane, Australia, is now open.

On-line registration is available at http://www.5icn.org/

5th International Congress of Nematology
Where: Brisbane, Queensland, Australia
Dates: 13 – 18 July 2008

Registration and Call for Oral and Poster Presentation Abstracts are now available on the website.

Website: http://www.5icn.org/

Convenor: Dr Mike Hodda, President Australasian Association of Nematologists
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Member of Meetings & Events Australia

: what do you know about them?

Exciting changes at the MSc Nematology course at Ghent University, Belgium.

The Postgraduate International Nematology Course (PINC) at Ghent University has now been running successfully since 1992. In the past 15 years 153 students from 49 countries have obtained the degree Master of Science in Nematology. Of these, 36 have completed a PhD degree and another 37 are currently on a PhD programme. The list of publications from the students exceeds 100 and one alumnus is editor of the book on 'Freshwater nematodes: ecology and taxonomy'.

This year there are some important and exciting changes to the course, enabling it to develop and expand.

Firstly the Masters course became a **two-year course** from September 2007 onwards. This allowed the inclusion of more modules and an expansion of existing ones to provide more in-depth training. The valuable research projects, which all students must complete, can now be undertaken over a longer period.

The following modules are offered:

- *Nematology applied to Agro-ecosystems*
- *Nematology applied to Natural ecosystems*
- *Nematode systematics: taxonomy, phylogeny, biodiversity*

More information can be found at www.pinc.ugent.be

The second important change is that Ghent University is now coordinator of a consortium of universities and a research institute who are combining to provide a **European Master of Science in Nematology** through EU funding *via* the Erasmus Mundus programme. The core partners are Ghent University (Belgium, acting as host University), University of Ēvora (Portugal), University of Jaén (Spain) and University of Bielefeld (Germany). The satellite partners are University of Leuven (Belgium), University of Wageningen (The Netherlands), University of Kiel (Germany) and the Scottish Crop Research Institute (UK). Students will start their course at Ghent but will be able to select one of the core universities to attend for specialised courses. The research projects can be undertaken at any of the institutes of the core or satellite partners and, thus, can link in effectively with the research interests of the institute partner. This EU funding provides an exciting opportunity for the partners and the students to consolidate and expand the enormous teaching and research opportunities offered by the Nematology course. Moreover **students from all over the world** can apply for an EU grant and there are a few grants available for **scientists** to come to teach or cooperate in research for a period of up to 3 months. The Masters course will become a truly European one from September 2008 onwards, whilst also retaining its historical base at Ghent University.

More information can be found at www.eumaine.ugent.be. Students from developing countries can apply for a VLIR-UOS-grant; see www.vliruos.be. Students from all over the world can apply for an EM-grant; see www.eumaine.ugent.be.

We are looking forward to a continuous expansion of Nematology and hope you will help us in achieving this goal.

Maurice Moens, Wilfrida Decraemer & Nic Smol

NEMATOLOGY FEATURE IN THE JUNE 2008 ISSUE OF APP

Graham Stirling

Biological Crop Protection, Moggill

Many of our members have made a major effort over the last four months to prepare papers for a nematology feature that will occupy most of the June 2008 issue of Australasian Plant Pathology. The feature is being produced to coincide with the Fifth International Nematology Congress (5ICN) to be held in Brisbane in July 2008, and highlights much of the work on nematodes that is being done in Australia and New Zealand.

The exciting news is that CSIRO Publishing has agreed to print extra copies of the special issue at no cost to AAN. This means that we will be able to place a copy of the journal in the satchels of every delegate attending 5ICN. The feature should therefore prove to be a great way of telling our visitors what is happening in nematology in this part of the world.

The 10 papers that will appear in the feature are listed below:

TOPIC	AUTHORS
Foreword	Stirling, Yeates
The history of plant and soil nematology in Australia and New Zealand, with particular reference to the contributions of six pioneering nematologists	Stirling**,** Davies, Yeates, Hodda
Managing plant-parasitic nematodes in southern and western regions of the Australian cereal industry: continuing progress in a challenging environment.	Vanstone, Hollaway, Stirling
Lesion nematodes (*Pratylenchus thornei* and *P. neglectus*): progress in managing a significant pest of grain crops in northern Australia	Thompson, Owen, Stirling, Bell
Beyond chemical dependency for managing plant-parasitic nematodes: examples from the banana, pineapple and vegetable industries of tropical and subtropical Australia	Stirling, Pattison
Plant parasitic nematodes in Australian viticulture: key pests, current management practices and opportunities for future improvement	Walker, Stirling
Plant-parasitic nematodes on pastures in New Zealand.	Mercer, Bell, Yeates
Australian Anguinids: their agricultural impact and control	Riley, Barbetti
Development, validation and delivery of DNA-based tests for nematodes and soil borne pathogens: a review of recent progress in Australia	Ophel-Keller, McKay, Hartley, Herdina, Curran
Regional patterns among soil nematode assemblages in Australasian pastures and effects of management practices	Yeates, Stirling
The Australasian nematode fauna: what's present, what's not, and what's special about it	Hodda, Nobbs