The biology of the plant parasitic nematodes *Paratylenchus nanus* and *Paratrichodorus minor* in soil under pasture

A thesis presented in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

at

Massey University

Nigel Logan Bell

1999

ERRATA

Line numbers are counted so as to include full and part lines of text, section headings, Table headings and contents and Figure legends. For changes, additions appear in italics, deletions as strikethroughs and comments are not enclosed in quotation marks.

Page	Line	Change
2	10	"Mono*n*chida"
12	4	"by sheep *and* by cattle"
12	10	"Haplo~~u~~dand"
12	14	"Haplohum*u*lt"
19	17	Replace "Decreamer" with "Decraemer"
22	18	Replace "Decreamer" with "Decraemer"
23	5	Replace "Decreamer" with "Decraemer"
23	13	Replace "*P. minor*" with "*Paratrichodorus minor*"
24	28	"The*re* was no significant"
35	3	"explanation of ~~other~~ symbols"
39	20	"which result in change*s*"
42	12	"Haplo~~u~~dand"
43	26	"(except %~~T~~N)"
59	28	Italicise "Metatetranychus ulmi" and "Aporroectodea caliginosa"
61	1	Italicise "P. nanus"
63	28	Transpose Boag & Alphey (1988) with Blakemore *et al.* (1987)
81	11	Replace "*P. nanus*" with "*Paratylenchus nanus*"
83	17	Replace "*Rotylenchus fallorobustus"* with "*Rotylenchus robustus*"
83	20	"(Yeates, 1973a)"
86	18	Replace "*P. nanus*" with "*Paratylenchus nanus*"
86	32	Replace "*Rotylenchus robustus*" with "*Rotylenchus uniformis*"
91	15	"Revue *de* Nématologie"
96	19	"Haplo~~u~~dand"
98	14	"shoot base of *the* plant"
118	1	"Haplo~~u~~dand"
136	31	Replace "New Zealands" with "New Zealand's"
142	Fig. 2.	Bar legends should appear as in Fig. 4. (page 144)
153	25	Replace "*Rotylenchus robustus*" with "*Rotylenchus uniformis*"

MASSEY UNIVERSITY
APPLICATION FOR APPROVAL OF REQUEST TO EMBARGO A THESIS
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Name of Candidate: Nigel Bell ID Number: 08505683

Degree: PhD Dept/Institute/School: Institute of Natural Resources

Thesis Title: The biology of the plant parasitic nematodes *Paratylenchus nanus and Paratrichodorus minor* from soil under pasture.

Name of Chief Supervisor: Prof Ken Milne Telephone Extn: 5100

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Abstract

The plant parasitic nematodes *Paratylenchus nanus* and *Paratrichodorus minor* were identified from soils under grazed pasture in the Waikato region of New Zealand. Host range testing showed that all hosts of *P. nanus* were grasses, while *P. minor* hosts included both grasses and clovers.

Several variations to the Whitehead and Hemming tray extraction method were compared. The optimum variant was found to yield *ca* 75% of the total nematode fauna.

Sampling of *P. nanus* populations from 0–10 cm and 10–20 cm soil depth showed that the abundance of *P. nanus* peaked in summer. A Population Age Index, based on developmental stages, showed *P. nanus* population age increased from a minimum in spring to maximum in winter. Positive correlations occurred with soil temperature and negative correlations with soil moisture and rainfall. Accumulated temperature and rainfall (Activity Index) was correlated with *P. nanus* abundance. Evidence is presented for density-dependence in the *P. nanus* population at 0–10 cm depth. Multiple regression models were fitted and results are discussed in terms of population dynamics.

Seedlings of five grasses were inoculated with one of three rates of *P. nanus*. There was a deleterious effect of the high rate of *P. nanus* inoculum on shoot dry matter only for *Lolium perenne* infected with a selected *Neotyphodium* sp. endophytic fungus (AR37+). Sampling of soil beneath grazed pasture determined the relationship of *P. nanus* populations with mature *L. perenne* plants. For all samplings, AR37+ supported a consistently greater abundance of *P. nanus* than other plants. Dry matter production and root mass data suggest that greater root production by AR37+ was partly responsible for the greater abundance of *P. nanus* beneath these plants. Implications for field sowing of AR37+ in the presence of *P. nanus* populations are discussed.

Sampling in soil from a second grazed pasture which contained populations of both *P. minor* and *P. nanus* showed the *P. minor* population had no seasonal periodicity while *P. nanus* had distinct spring and summer peaks. *P. minor* abundance was correlated with rainfall and Activity Index. There was no evidence for competition occurring between these two nematodes at the population levels studied.

Preface

This thesis is written as a series of papers, which follow the format of the international journal *Nematology* (Koninklijke Brill NV, Leiden). Therefore, each chapter contains Summary, Keywords, Introduction, Materials and Methods, Results, Discussion and References. The General Introduction and General Discussion chapters are additional to this format.

Acknowledgements

I thank my supervisors, Mr Richard Watson (AgResearch, Hamilton), Dr Gregor Yeates (Landcare Research, Palmerston North) and Prof. Ken Milne (Massey University, Palmerston North) for their valuable contributions to all aspects of the preparation of this thesis. Richard was the 'man on the spot' who fielded practical and theoretical questions and encouraged me that what I was doing was worthwhile. He also supported my family and I in times of hardship and for this we are very grateful. Gregor has taught me much about nematodes and their ways – an education that has been valuable not only for this thesis but also for my future career. Ken has made my path through the PhD process so much smoother than it would otherwise have been and has worked hard to ensure that everything was 'on track'. Both Ken and Gregor have visited me at least twice each year and all three of my supervisors have been open and approachable throughout the course of this study.

Dr Neil Cox (AgResearch, Hamilton) answered many questions on statistical matters in a way that even I could understand. For this and his help with analyses I thank him very much. Thanks also to Frank Neville (deceased) who helped with some coring expeditions and with set-up of the damage experiment. The cheerful help and advice I received from Ken Jones (farm manager, Tokanui Research Station) was vital to site selection and maintenance and is very much appreciated. For help and advice on soil matters I thank Dr Peter Singleton (AgResearch, Hamilton). As a friend and colleague Sergio Marshall (AgResearch, Hamilton) provided expertise in endophyte detection along with his offbeat sense of humour.

I thank my wife Angela for her support and motivation and for being such a great mother to our son Jonty (born 3 November 1998, the most scary, amazing and ultimately wonderful day of my life).

This study was undertaken at the Ruakura Agricultural Research Centre, Hamilton as parts of programmes funded by the Foundation for Research Science and Technology.

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