The root lesion nematode, *Pratylenchus neglectus*, in field crops in South Australia

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Thesis submitted for the Degree of Doctor of Philosophy

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December 2000
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Summary

The root lesion nematodes *Pratylenchus neglectus* and *P. thornei* are common in agricultural fields in southern Australia. Prior to commencing this study, yield loss caused by *P. neglectus* in field crops was poorly defined. The major aims of this study were to evaluate sampling procedures, assess the extent and magnitude of yield loss caused by *P. neglectus*, assess the population dynamics of *P. neglectus* in cereals, determine whether resistance occurs in field crops and assess whether variation occurs between geographically isolated populations of *P. neglectus*. Research was also conducted on the closely related species, *P. thornei*, including population dynamics, variation between populations and the effects of this species on yield of cereals.

To evaluate sampling procedures for *P. neglectus*, the reliability and efficiency of sampling and extraction methods from plants and soil were assessed. For the extraction of *P. neglectus* from plant roots, the efficiency of staining and rinsing methods were compared, with the staining technique proving to be more labour intensive compared with rinsing. This was a significant disadvantage when processing large numbers of plants and rinsing was therefore considered a more efficient alternative. Differences were observed, however, in the rate of extraction of *P. neglectus* from roots of 6 and 16 week old wheat, chickpea, canola, faba bean and medics plants. These differences were attributed to continued multiplication of *P. neglectus* within samples in the rinsing chamber. Extraction methods were therefore affected by the suitability of different crop species to serve as hosts.

Because of the difficulty in comparing densities of *P. neglectus* both within and between crop species from plant roots, assessment of density of *P. neglectus* from field plots was undertaken from soil samples (containing root material) using the Whitehead Tray method. The investigation of limitations using this system showed sampling in soil with low moisture (< 2%) significantly reduced the number of *P. neglectus* recovered. This reduction was attributed to mechanical damage to anhydrobiotic *P. neglectus* in dry soil. Samples obtained from an undisturbed core in moist soil resulted in 39% greater recovery.
of nematodes when compared with sampling using an earth auger in dry soil. In shallow, sandy loam soils in South Australia, the majority of P. neglectus were found between 0 - 10 cm, probably related to root distribution in these soils.

To gain understanding of the population dynamics of P. neglectus, experiments were undertaken in large pots and in field trials. For the pot study, a susceptible host (Maize with corn stunt virus) was sown into infested soil (produced by the addition of infected carrot callus culture and infected wheat roots). While this experiment showed a reduction in the shoot and root dry weights of this host, inadequate differentiation was achieved between the initial densities of P. neglectus established in this experiment. As a result, no clear relationship was observed between plant growth and nematode density or nematode multiplication. In contrast, a range of initial densities of both P. neglectus and P. thornei were established in field experiments. At both sites, a linear relationship was observed between yield and initial nematode density for an intolerant cereal over-sown across these plots. In addition, an exponential relationship was observed between initial density and multiplication rate (P/P0).

Yield loss caused by P. neglectus was also shown in field sites both by correlation of P. neglectus density with yield and by comparison between aldicarb (Temik 15G) treated and untreated plots. The addition of high rates of aldicarb (12 kg a.i./ha) did not produce a phytotoxic response although some stimulatory effect on plant growth may have occurred at low rates (< 1.5 kg a.i./ha). Using either regression analysis of initial density of P. neglectus with yield or treatment of plots with aldicarb, yield responses of up to 27% were demonstrated for intolerant cereals.

Over 80 varieties from 12 crop and pasture species were evaluated for resistance to P. neglectus at field sites. Evaluation of P. neglectus from soil after harvest was assumed to relate closely to resistance (where resistance is defined as the ability to reduce or inhibit multiplication of nematodes). Variation observed in final densities and multiplication rates of P. neglectus at different field sites were attributed both to site and seasonal conditions and also possibly variation between populations of P. neglectus. This was supported by genetic differences between nine P. neglectus and four P. thornei
populations, examined in allozyme studies and phenotypic differences assessed by the rate reproduction of nematodes in cereals in growth room tests.

The results reported in this study demonstrate that *P. neglectus* is a significant pathogen in agricultural cropping regions of South Australia. The broad host range of *P. neglectus* within field crops was confirmed, but resistant and/or tolerant crops and varieties were identified which can be used within cereal cropping rotations to reduce the economic impact of this species.