Nematodes associated with hop production in Tasmania, Australia

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Introduction

The most prevalent nematode associated with hop is the hop cyst nematode (*Heterodera humuli* Filipjev 1934) which has been reported in gardens worldwide. This study aimed to characterise the abundance, temporal fluctuations, and diversity of plant parasitic nematodes associated with hop production in Tasmania.

A secondary objective was to determine the effect of nematodes on yield and levels of brewing acids of the cultivar, 'Pride of Ringwood'.

Materials and methods

The study was conducted in two commercial hop gardens ('Gunns Plains' and 'Forrester River'). At Gunns Plains, soil samples were taken from 10 plots of four plants along two adjacent rows. Soil samples were collected on 19 September, 2 October, 15 October, 26 October, 9 November, 26 November, 10 December, 25 January, 22 February, and 12 March.

At Forrester, River, soil cores were taken from 16 replicates, each consisting of four plants (arranged in a 2 x 2 lattice) on October 11, October 25, January 8, February 18 and at harvest on March 17. Three soil cores (2.5 cm diameter to a depth of 20 cm) were taken 30-50 cm from the crown of each plant in the replicate. Nematodes were extracted by the Whitehead tray technique over three days and counted at 100 x magnification.

The effect of nematodes on growth and cone yield of 'Pride of Ringwood' was assessed at Forrester River. For harvest, plants were removed and transported to a static picking machine, and weighed. Approximately 500 g of green hops was analysed for moisture and alpha acid content by the lead conductance method.

Results

Nematode diversity

The most prevalent nematode associated with hop production in Tasmania was hop cyst (*Heterodera humuli*). Other nematodes recovered from the site included *Helicotylenchus dihystera, Pratylenchus* spp. and *Meloidogyne* sp. (second stage juveniles; J_2.

Temporal fluctuations in H. humuli

High populations of *H. humuli* J_2 were present in soil in mid-October (Table 1). By late October, populations of J_2 in the soil had declined markedly. A slight increase in J_2 numbers was noted in mid-January.

Table 1. Seasonal fluctuations in *H. humuli* at Forrester River, Tasmania.

Date of sampling	No. *H. humuli* J_2/200 ml soil	
	Mean	Range
October 11	1408	406-2962
October 25	273	70-699
January 28	401	47-1467
February 18	141	7-726
March 17	124	33-236

Effect of nematodes on growth and cone yield

A significant linear relationship was found between the number of *H. humuli* J_2/200 ml soil in mid-October and the dry cone yield (Figure 1). There was a 38% reduction in cone yield/string between plants exposed to the highest population density in mid October (5040 J_2/200 ml) and the lowest population density (924 J_2/200 ml soil). Nematode numbers at other times and cone yield, or nematode numbers and alpha acid content were not significantly associated (Table 2).

Figure 1. Relationship between number of *H. humuli* J_2/200 ml soil in mid October and cone yield (kg/string) at harvest. y = 0.4457 + -3.643*10^{-5} x (P=0.0006, R^2 = 0.61)

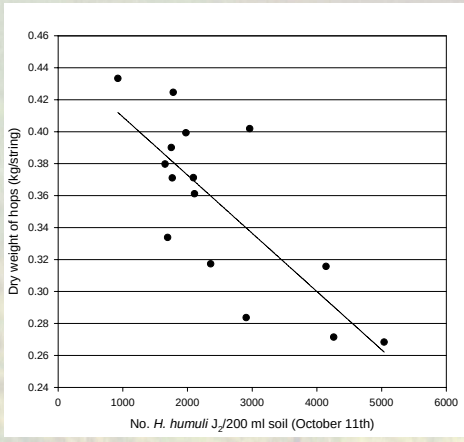

Table 2. Relationship between number of *H. humuli* J_2 over time, and cone yield (kg/string) and alpha acid content.

	Oct 11	Oct 25	Jan 28	Feb 18	Mar 17
Dry weight					
P=	0.0006	0.838	0.659	0.294	0.230
Alpha acid (%)					
P=	0.207	0.906	0.638	0.779	0.245

Discussion

Temporal fluctuations in *H. humuli* J_2 numbers suggested one peak per season, similar to that reported in the UK (von Mende and McNamara 1995).

Regression analysis suggested a significant negative relationship between the number of *H. humuli* J_2 in October and cone yield. Further work is necessary to confirm the extent of the relationship. However, control by nematicide application is unlikely to be economic or effective because of heavy clay soil production areas and large root systems, making nematicide penetration difficult. Studies in pots have also demonstrated significant negative effects from high numbers of *H. humuli* (Hafez *et al.* 1998).

References

Hafez *et al.* 1998. *Journal of Nematology* 20:89-94.

von Mende and McNamara. 1995. *Annals of Applied Biology* 126:505-516.

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