IN VITRO EFFECT OF ABAMECTIN ON THE CARROT CYST NEMATODE *HETERODERA CAROTAE*

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The effectiveness of an abamectin formulation (Vertimec® EC) for the control of the carrot cyst nematode *Heterodera carotae* Jones was investigated in an *in vitro* hatching test. Abamectin is a mixture of macrocyclic lactones produced by the actinomycete *Sptreptomyces avermitilis* especially known for its acaricidal and insecticidal activities. Cysts of the nematode were subjected for different exposure times (24, 48, 96, 192, 384 hours) to different concentrations of an aqueous solution of the abamectin formulation (0, 1.125, 2.25, 4.5, 9.0, 18.0 and 36 g/ml). Cysts were extracted by the Fenwich can. Batches of 50cysts of similar sizewere placed on 2 cm diam sieves (215 m aperture).Each sieve was put in a 3.5 cm diam Petri dish, and all dishes were arranged according to a complete randomized block design. For each treatment (exposure time x concentration) three replications were considered. Carrot root leachate was used as natural hatching agent. Three ml ofthe carrot root leachate were added to each batch of cysts, which were then incubated in a growth cabinet at 20 ± 2 °C. Emerged juveniles were counted weekly renewingthe hatching agent at the same time, over a 10week period. At the end of the hatching test cysts were crushed and unhatched eggs and juveniles were counted. Numbers of second stage juveniles emerging weekly were expressed as cumulative percentages of the total egg content of the cysts. For each exposure time the untreated cysts (0 concentration) were used as control. From percentages hatch the mortality for each treatment was assessed according to the formula% Mortality = 100 - % hatched juveniles (J_2) where% hatched J_2 = (N° hatched J_2 in treatment/N° hatched J_2 in control)*100

Percentage hatch data were statistically analyzed after transformation in arcsen root square values by ANOVA and the effects of abamectin concentrations, exposure times and their interactions were examined by 7 x 5 factorial design (Table1). On the base of total emergence data, abamectin concentrations needed to obtain 50, 60, 70, 80, 90 and 99.9% nematode mortality were also calculated using probit analysis (Software PlotIT V.3.2) (Table 2).

Results clearly demonstrate the efficacy of abamectinat all tested applied concentrations with an increaseof nematode mortality by the increase of abamectin concentration. Moreover, efficacy increased by increasing exposure time at each concentration.

Table 1

Factorial analysis of different abamectin concentrations and exposure times on percentage hatch of *Heterodera carotae* juveniles.

Abamectinconcentration (g/ml)	Exposure time (hours)				
	24	48	96	192	384
0	62.7[1] (±0.5)	53.6 (±4.3)	58.9 (±2.1)	57.1 (±5.4)	39.4 (±4.8)
1.125	47.0 (±3.6)	43.7 (±6.9)	45.1 (±7.0)	39.9 (±4.9)	32.7 (±4.6)
2.25	43.1 (±9.2)	34.3 (±4.9)	32.4 (±13.3)	30.9 (±2.2)	21.4 (±6.0)
4.5	38.2 (±5.5)	29.0 (±7.3)	34.0 (±4.5)	21.3 (±7.8)	15.7 (±4.1)
9.0	38.4 (±3.5)	25.5 (±5.6)	15.5 (±3.9)	7.6(±0.2)	11.0 (±5.7)
18.0	32.0 (±10.0)	14.5 (±6.7)	14.0 (±5.5)	5.5(±1.9)	7.8(±1.7)
36.0	11.9 (±8.4)	9.4(±3.5)	5.7(±2.8)	3.8(±2.2)	3.5(±0.5)
ANOVA F values Factor A - Abamectin concentrations 36.5** Factor B – Exposure times 11.7** A x B 0.63**					

[1]Each value is an average of three replications. Mean ± standard deviation. ** = F values significant at P=0.01.

Table 2.

Abamectin concentration sneeded to obtain 50, 60, 70, 80, 90 and 99.9% *Heterodera carotae* mortality at the different exposure times

Cyst nematode	Exposure time (hours)	Abamectin concentrations (g/ml) needed for the following % mortalities					
		50	60	70	80	90	99.9
Heterodera carotae	24	9.9	19.6	40.8	97.8	324.8	5,698.7
	48	5.7	9.4	16.3	31.1	75.6	630.7
	96	3.9	6.2	10.2	18.3	40.9	278.0
	192	2.5	3.6	5.5	9.1	17.9	90.3
	384	3.6	5.4	8.5	14.4	30.0	171.4

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