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TOXICITY OF CADMIUM AND LEAD TO *MELOIDOGYNE INCOGNITA*: IN VITRO STUDIES ON HATCHING AND MORTALITY

by

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Summary. Two heavy metal pollutants, viz. lead and cadmium were shown to be highly toxic to the root-knot nematode, *Meloidogyne incognita*. Hatching was inhibited and mortality of 2nd stage juveniles increased with increase in concentration and in exposure time. Lead was relatively more toxic to the nematode than cadmium. Acute effective toxic values (EC₅₀) were obtained for both the heavy metals.

Applications of sewage, industrial wastes, fertilizer impurities, etc. increase the concentrations of heavy metals which adversely affect the growth of plants. The effect of air pollutants on plant pathogens has been investigated (Heagle, 1973) but little attention has been given to their effect on nematodes (Alphey and Brown, 1987). Therefore, *in vitro* studies were undertaken to evaluate the effect of two heavy metals, viz. lead and cadmium on the hatching and mortality of *Meloidogyne incognita* (Kofoid *et* White) Chitw.

Materials and methods

Nitrate salts of lead (Pb) and cadmium (Cd) were prepared in distilled water at five concentrations (0, 7.5, 15, 30, 60 ppm of the metal elements). Five freshly picked egg masses of average size were placed in Petri dishes (40 mm diameter) each containing 5 ml of the concentrations of Pb and Cd (Alam, 1985) with each treatment replicated three times. The Petri

dishes were incubated at 25 °C and the total numbers of hatched juveniles in each dish were counted after five days.

In a second experiment approximately 100 freshly hatched juveniles were transferred to Petri dishes containing 5 ml of the Pb and Cd concentrations as outlined above. The number of immobile juveniles in each dish was counted after 12, 24, 48, 72 and 96 hrs. The immobile juveniles were transferred to distilled water and if they did not resume motility they were assumed to be dead.

Results and discussion

Hatching of juveniles from the eggs was greatly inhibited in the presence of Cd and Pb. The inhibition increased with concentration of the heavy metals. The effect was greater with Pb and hatching was almost totally suppressed at 60 and 30 ppm concentrations (Table I).

The mortality of juveniles also increased with concentration of the heavy metals and with ex-

TABLE I - *Effect of cadmium and lead on the hatching of Meloidogyne incognita in vitro.*

Concentration (ppm)	Cadmium		Lead	
	No. of J ₂ hatched per egg mass	% inhibition over control	No. of J ₂ hatched per egg mass	% inhibition over control
Control	580	—	580	—
7.5	148	74	30	78
15	124	79	77	87
30	65	89	25	96
60	53	91	0	100
C.D. (P=0.05)	18.9		14.6	
C.D. (P=0.01)	27.5		21.2	

TABLE II - *Effect of cadmium on the mortality of second stage juveniles of M. incognita in vitro.*

Exposure Period (hrs)	Percent mortality in different conc. of cadmium (ppm)					Regression value
	0	7.5	15	30	60	
12	0	1.6	1.8	3.6	10.9	$\hat{Y}=3.58+2.36(X-2)$
24	0	8.6	11.5	15.7	18.9	$\hat{Y}=10.94+4.49(X-2)$
48	0	24.5	26.5	29.2	32.8	$\hat{Y}=22.60+7.03(X-2)$
72	0	28.0	30.3	32.1	38.3	$\hat{Y}=25.74+8.07(X-2)$
96	0	31.1	35.3	40.0	50.0	$\hat{Y}=31.28+10.89(X-2)$
C.D. (P=0.05)		3.07	3.23	3.34	4.87	
C.D. (P=0.01)		4.46	4.70	4.87	7.08	

TABLE III - *Effect of lead on the mortality of second stage juveniles of M. incognita in vitro.*

Exposure Period (hrs)	Percent mortality in different conc. of lead (ppm)					Regression value
	0	7.5	15	30	60	
12	0	0	0	0	3.3	$\hat{Y}=0.66+0.66(X-2)$
24	0	5.0	4.3	10.2	23.7	$\hat{Y}=8.68+5.31(X-2)$
48	0	28.5	29.8	31.9	50.6	$\hat{Y}=28.16+10.46(X-2)$
72	0	30.0	36.0	40.0	50.3	$\hat{Y}=31.12+11.00(X-2)$
96	0	44.5	53.8	61.1	98.1	$\hat{Y}=51.66+21.22(X-2)$
C.D. (P=0.05)		6.94	6.66	7.24	7.50	
C.D. (P=0.01)		10.10	9.70	10.54	10.90	

posure time (Tables II and III). Calculation of regression values established that EC₅₀ value was 50.8 ppm at 96 hrs for Cd, and 13.9 ppm at 96 hrs or 53.5 ppm at 72 hrs for Pb. These values are compared with 35-40 mg/l for 48 hrs exposure to cadmium salts for a mixed population of *Panagrellus* and *Rhabditis* and 26.3 mg/l for adults of *P. silusiae* (Felmesser and Rebois, 1966).

Literature cited

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