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THE EFFICACY OF KARATE (LAMBDACYHALOTHRIN) IN CONTROLLING MELOIDOGYNE INCOGNITA (KOFOID AND WHITE) ON SOYBEANS (*Glycine max.* L. Merril.)

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ABSTRACT

The nematicidal properties of a synthetic pyrethriod (Karate) was investigated. In laboratory experiments, Karate at different concentrations (4,000ppm, 6,000ppm and 8,000pm against Meloidogyne incognita (kofoid and white) prevented egg- hatch and accentuated the death f the infective second stage juveniles. In green-house experiments, as little as 4,000ppm of Karate reduced both the number of galls and the population of juveniles in soils when compare with the control plants. However, Karate applied as soil-drench resulted in wilting of plants at all concentrations.

Key words: Lambdacyhalothrin, Meloidogyne incognita infective second stage juveniles, Glycine max. embryogenesis.

INTRODUCTION

The pyrethroid insecticides gained phenomenal support from the agricultural community because of their low costs, low rates, wide-spectrum of activity and safety in use (Watkinson, 1989). One of such synthetic pyrethroid is lambdacyhalothrin (Karate) that was introduced into Nigerian market in 1984 (ICI, 1984). Extensive laboratory screening and field trails have shown lambdacyhathrin to be highly effective in the control of insects, mites and vital diseases at very low rates. (Atiri, and Jimoh, 1990).

It has also been reported that lambdacyhalothrin is readily degraded in soil, and has no harmfull effects on soil processes (ICI, 1987). The present investigation was therefore carried out to explore the nematicidal properties of lambdacyhalothrin against the root knot nematode *M. incognita* on soybeans. The intensive cultivation of soybean has often allowed the build-up of rot knot nematode which is the most abundant nematode species in South-Western zone of Nigeria (Idowu1988).

Preliminary tests were also carried out to investigate the direct nematicidal effects of lambdacyhalthrin on eggs and juveniles of *M. incognita.* Furthermore, different rates of lambdacyhalothrin were applied as foliar sprays and soil drench on nematode infested soybean plants.

MATERIALS & METHODS

Materials

Nematode galled roots were obtained from a culture of *M. incognita* on tomato (*Lycopersicum esculentum*) collected from the National Horticultural Research Institute (NIHORT),Ibadan. The nematode eggs were extracted by a modification of centrifugal floating methods described by Whitehead and Hemming (1965). The juvenile nematodes were collected from the newly hatched eggs.

Lambdacyhalothrin (Karate 2.5. E.C.) was obtained from Chemical and Allied products Limited (Ibadan, Nigeria). The recommended rate of lambodayhlthrin on soybean is 60ml of the emulficable concentrate in 10litres of water i.e 6000ppm. Test solutions of Oppm, 4,000pm, 6,000ppm and 8,000ppm were used in this study.

Seed of soybean variety TGM-80 (Bossier) susceptible to the root-knot nematode were obtained from the International Institute of Tropical Agriculture (IITA, Ibadan). Soil for the green-house experiment was sterilized in autoclave and filled into fifteen-litre plastic pots.

Methods

i *In vitro* tests with lambdacyhalothrin on hatching of nematode eggs.

Ten freshly extracted eggs were put in glass blocks arranged on a table in the laboratory. One millilitre of the different concentrations (Opmm (control), 4,000ppm, 6,000ppm and 8,000ppm) was added to each glass block and each experiment was replicated ten times. Fresh distilled water and solutions of lambdacyhalothrin were substituted each 48 hours to avoid contamination. On the 11th day, the number of hatched and unhatched eggs were counted. All unhatched eggs were transferred to distilled water to record any hatching reactivation.

(ii) *In vitro* tests with lambdacyhalothrin on survival of *M. incognita* **juveniles.**

Ten newly hatched larvae were placed individually on labelled petri-dishes containing 10mls of the different concentrations. Each treatment was replicated ten times and the experiments was observed daily for five days. On the 5th day, the number of dead and living juveniles were recorded. Those juveniles that did not move or respond when probed with a fine needle were considered dead.

(iii) **Green-House Experiments**

The objective of these experiment was to test for the nematicidal properties of lambdacyhalrin against *M. incognita* when applied at

different concentrations as foliar sprays and when used as soil- drench on soybean plants.

Seeds were planted in plastic pots and after germination the plants were thinned down to one healthy seedling per pot. At three weeks each plant was inoculated with approximately 10,000 eggs of *M. incognita* by pouring eggs on soils at the base of the plant. A set of ten plants left as uninoculated control.

A week after inoculation, the plants were treated with the four rates of lambdacyhalothrin applied as follows:

(i) As foliar spray (after covering the pots with cellophane paper to prevent solution from dripping into the soil until run-off.

(ii) Soil-drench in which 50mls of the various concentration was used to drench the soil in the pot around the plant roots.

A hundred and ten pots were used for this experiments and pots were arranged in a completely randomized design on tables in the green-house. There were eleven treatments and each treatment was replicated ten times.

(i) Rating of root galls and estimation of nematode populating in soils.

At maturity, plants were gently uprooted and washed free of adhering soils with water. The roots were then evaluated for root-knot infestation using Daulton and Nusbaum (1961) rating scheme of 0-10. The population of *M. incognita* in soils was calculated by collecting 200ml of thoroughly mixed soil from each pot. The soils were then evaluated for root-knot nematode using the pie-pan modification of Baernan's funnel technique (Dunn, 1970).

RESULTS

Figure 1 gives the mean percentage egg-hatch at deferent concentration of lambdacyhalothrin. Egg hatch was observed in both the treated and control blocks at day 2 but the % hatch was higher in the control. Thereafter, there was no further hatch in any of the treated concentrations. For the control experiment (i.e. Oppm lambdacyhalothrin), the mean percentage egg-hatch increased progressively to 80% at day 10. There were no hatching reactivation for any of the eggs.

The mean percentages of surviving larvae are indicated in Table 1. Instant death was observed for all the larvae in petri-dishes with 8,000ppm concentration on the second day, but there were very few survival in other concentrations. The control plates had a mean larva

survival of 80% while 4,000ppm and 6,000ppm had 3% and 2% respectively on the fifth day of exposure.

It was observed that various application methods of lambdacyhalothrin as soil drench on soybeans induced very damaging phytotoxic effects at various concentrations. Wilting was also observed in plants where lambdacyhalothrin was applied as soil drench. The wilting developed from base of plants and progressed to the upper leaves.

For the foliarly treated plants, there were no wilting of the differently treated plants.

The results of the galling indices of the differently treated plants are indicated on Table 2. All plants that received lambdacyhalothrin as soil drench did not show any galling. The highest galling index was observed in the inoculated control plants. The effects of lambdacyhalothrin treatment on the number of juvenile nematodes recovered from soil are indicated on Table 3. The highest number of juvenile nematodes was recovered from the control plants while the juvenile root-knot nematodes ware not recovered from the soil-drenched plants.

DISCUSSION

There are some evidences in this study which suggest that the synthetic pyrethroid lambdacyhalothrin may be extremely active against the various life stages of *M. incognita*. The few egg hatch (5%) observed in the treated blocks on the day 2 suggest a previous development to the first stage juveniles before the chemical treatments. The fact that there were no further hatch thereafter, showed an inhibition of egg hatch and this might have resulted on the effects of the chemical on embryogenesis.

Kabde and Sharma (1982) have shown that some synthetic pyrethroids (Cypermethrin and Fenvalerate) reduced the egg hatchability of the brown plant hopper *Milparvata legens* (Stal).

Instant death of juveniles was observed at all concentrations except the control. The instant death of many juveniles supports the rapid knock-down effects of lambdacyhalothrin that was reported by Atiri and Jimoh (1990). This suggests that lambdacyhalothrin may have some direct mortality effects on the second stage juveniles of the root-knot nematode, *Meloidogyne incognita*.

In the green-house trial, application of lambdacyhalothrin as soil-drench resulted in phytotoxicity. Wilting of plants might have resulted from the direct toxic effect of lambdacyhalothrin on plant roots. As a result the translocation of water to the upper parts of the plants was probably affected. This observation supports previous reports that lambdacyhalothrin is not suitable for use as a soil incorporated pesticide (ICI, 1984, 1987). Roots of soil-drench plants were completely free of nematode galls and no nematode was extracted from

the surrounding soils. This suggests the effects of lambdacyhalocthrin on soil [illegible] applied as soil-drench.

In the foliarly treated plants there were no wilting of plants and the least galled roots were those treated with lambdacyhalothrin. The number of nematodes recovered from soil also follow a similar pattern. The improvement of plant growth and vigour caused by application of lambdacyhalothrin might make the plants less susceptible to the root-knot nematode when compared with the unsprayed plants. These treatments could have aided the plants in avoiding multiple infestations by pests.

In conclusion, the high nematicidal potency of lambdacyhalothrin on eggs and larvae could make it a promising nematicide. Lambdacyhalothrin also has some major advantages over other nematicide, because of its low-cost, low-rates, rapid-knock-down, wide spectrum of activity and safety in use. However, the dosage and method of application are important factors to be considered if lambdacyhalothrin is to be used in the control of root-knot nematode on soybeans.

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Table 1. Effect of lambdacyhalothrin concentrations on % *M. incognita* juveniles.

Days of Exposure	Percentage of survival (relative to control in different concentrations (ppm))			
	0	4,000	6,000	8,000
2	100	7	5	0
3	100	5	5	0
4	92	4	3	0
5	88	3	2	0

Table 2. Effect of different concentrations of Karate on galling of foliary treated soybeans plants.

Treatment	Mean galling indices	SEM(±)
8,000ppm	1.75a	0.49
6,000ppm	1.95ab	0.26
4,000ppm	1.52a	0.21
0ppm (inoculated)	3.6c	0.25
0ppm(uninoculated)	0.00	0.00

N.B. Means with same subscripts are not statistically different at 5% level according to DMRT.

Table 3. Effect of different concentration of Karate on number of juvenile nematodes recovered from soil.

Treatment	Mean number of Nematodes	SEM(±)
8,000ppm	922.7c	77
6,000ppm	769.5ab	66
4,000ppm	508.8a	39
0ppm(inoculated)	1336.8d	13
0ppm(uninoculated)	0.00	0.00

N.B. Means with same subscripts are not statistically different at 5% level according to DMRT.

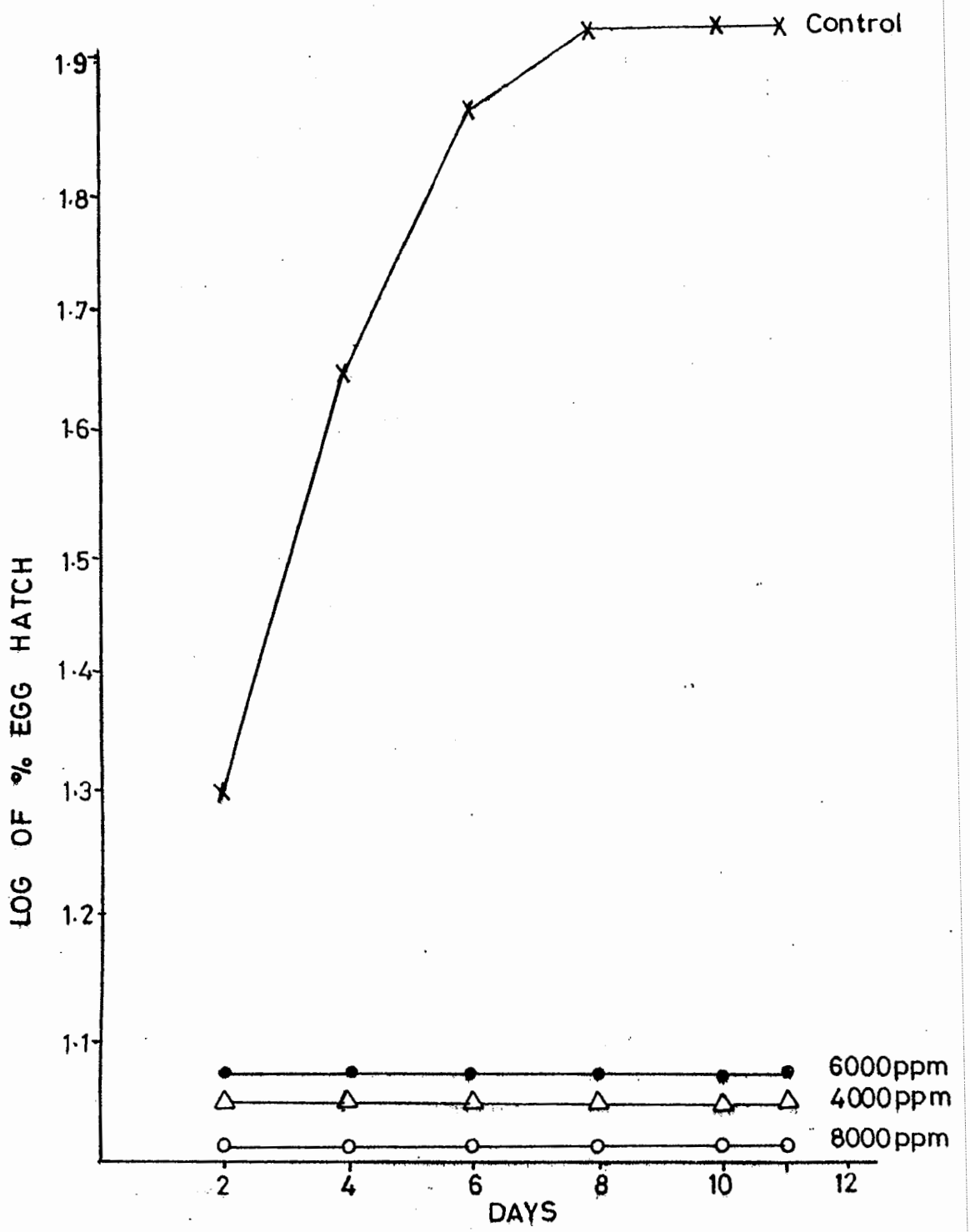

Fig. 1. Effect of different concentrations of Karate on % egg hatch.