EFFECT OF A PARASITIC NEMATODE (RHABDITIDA: STEINERNEMATIDAE) ON THE RED IMPORTED FIRE ANT (HYMENOPTERA: FORMICIDAE) APPLIED AS MOUND DRENCHE AND BROADCAST SPRAY TREATMENTS

Bastiaan M. Drees, Professor and Extension Entomologist
Richard W. Miller, Biosys, Inc.
John Wood, County Extension Agent
S. Bradleigh Vinson, Professor, Department of Entomology
Texas A&M University System

ABSTRACT Pathogenicity of infective juveniles (IJs) of selected *Steinernema* spp. on field populations of the red imported fire ant (RIFA), *Solenopsis invicta* Buren, was ascertained using mound drench and broadcast spray treatments. No statistical differences were found between treatment programs. Monitoring individually marked mounds in treated areas generally provided a higher percent reduction value in mound activity than resulted from monitoring mound per unit area (0.25-acre plot).

The red imported fire ant (RIFA), *Solenopsis invicta,* Buren, has a distribution spanning the southeastern United States and continues to spread westward through Texas. RIFA is a serious pest impacting the lives of people both in rural environments. Problems range from a nuisance pest to life threatening through their sting to people, domestic and wild animals (Lofgren 1986). Management has focused on the use of insecticides (Drees and Vinson 1989) and non-chemical solutions are few. The recent development of low-cost, large-scale production of Entomogenous nematodes of the genera *Steinernema=Neoaplectana and Heterorhabditis* (Bedding 1984) has enabled large-scale field testing with modest success against a number of turf- and soil-infesting insect pests (Kaya 1985, Poinar 1986). Several researchers have examined the susceptibility of various fire ant species to strains of *S. carpocapsae* in laboratory bioassays (Poole 1976, Laumond et al. 1979, Quattlebaum 1980). We decided to further examine the efficacy of Steinernematidae on field populations of RIFA using a program if individual mound drench and broadcast spray treatments, and the combination of these methods.

Materials and Methods

The James Northrup turf farm in Brazoria County, Texas, was selected as the site for this test. Historically, this farm had received only spot treatments for RIFA. Circular 0.5 acre (within 0.8 acre square plots) plots were established for each of 8 treatments, replicated 3 times in a randomized block design. All active RIFA mounds were marked prior to treatment and monitored. Mounds were determined to be active if numerous ants emerged from mounds when disturbed (Frankie, 1983). Treatments were as follows:

1. 1 gal. water per mound (19 April, 9 May)
2. 2.0×10^5 infective juveniles (IJ's) per mound (19 April, 9 May)
3. 1.6×10^6 dissected IJ's per mound (19 April, 9 May)
4. 8.0×10^5 IJ's per mound (19 April, 9 May)
5. 1.6×10^6 IJ's per mound (19 April, 9 May)
6. 5 tablespoons hydramethylnon (Amdro®) per mounds (19 April)
7. 2.0×10^5 IJ's per mound followed by 200 IJ's per $inch^2$ broadcast (19 April), with repeated mound drenches (9 May)
8. 1.6×10^6 IJ's per mound followed by 200 IJ's per $inch^2$ broadcast (19 April), with repeated mound drenches (9 May)

The mean number of active RIFA mounds per plot was determined for each treatment and subjected to analysis of variance using the Least Significant Difference Test (P # 0.05)(Microsoft, 1981) for each monitoring date. Percent reduction was calculated using Henderson's Formula (Henderson and Tilton 1955).

Results and Discussion

No significant differences between the number of active mound per plot were documented during this demonstration (Table1). High variability and low number of replications may have been contributing factors. Heavy rains during the course of the monitoring period resulted in excessive mound movement in some of the plots. Regardless, percent reduction was calculated using Henderson's formula (Henderson and Tilton 1955). There was a trend for all treatments to eventually reduce active RIFA mound numbers relative to untreated plots. On the 25 April and 3 June evaluation dates, percent reductions calculated from data generated by monitoring individually treated and marked mounds were consistently higher than those calculated using number of active mounds per unit area (0.25-acre plot). Establishment of satellite mounds or excessive mound movement following nematode drenches has been observed in earlier tests (Miller, Drees, Vinson, and Georgis, in press).

References Cited

Bedding, R.A. 1984. Large scale production, storage and transport of the insect-parasitic nematodes *Neoaplectana* spp. and *Heterorhabditis* spp. Ann. Appl. Biol. 104:117-120.

Frankie, O. F. 1983. Efficacy tests of single-mound treatments for control of red imported fire ant, *Solenopsis invicta* Buren. Southwestern Entomol. 8:42-45.

Henderson, C.F. and E. W. Tilton, 1955. Tests with acaricides against the brow wheat mite, J. Econ. Entomol. 48:157-161.

Kaya, M. K. 1985. Entomogenous nematodes for insect control in IPM systems. pp. 282-302. In M. A. Hoy and D. C. Herzog, [eds.], Biological control in agricultural IPM systems. Academic Press New York.

Lofgren, C. S. 1986. The economic importance and control of imported fire ants in the United States. pp. 227-256. In S. B. Vinson, [ed.], Economic impact and control of social insects. Praeger Publisher, New York.

Poinar, G. O., Jr. 1986. Entomophagous nematodes. pp.95-122, In J. M. Franz, [ed.], Biological plant and health protection. Gustav Fisher Verlag, New York.

Poole, M. A. 1976. Survey and control efficacy of endoparasites of *Solenopsis richteri* Forel and *S. invicta* Buren in Mississippi. Ph.D. dissertation, Mississippi State University, Mississippi State.

Quattlebaum, E. C. 1980. Evaluation of fungal and nematode pathogens to control the red imported fire ant, *Solenopsis invicta* Buren. Ph.D. dissertation, Clemson University, Clemson.

Table 1. Number of active red imported fire ant mounds per 0.25 acre plot and percent reduction in mound activity (Henderson and Tilton 1955) following individual mound treatments of water (drenches), hydramethylnon (Amdro®) bait or infectious juvenile (IJ) *Steinernema* spp. parasitic nematodes or mound drenches (19 April 1988 and May) or nematode mound drenches plus a broadcast application of nematodes (19 April) in a Brazos County, Texas commercial turf farm.

No. active fire ant mounds of initially marked set[1/]
(No. active mounds per 0.25 acre plot in parentheses) and percent reduction

Treatment and dose	19 Apr.	25 Apr.		9 May		3 June	
water drench	8.3a	6.3a	(7.3a)	3.7a	(9.7a)	6.3a	(9.7a)
2.0 x 10^5 IJ's drench	14.3a	7.0a 36%	(10.0a) 21%	5.7a 11%	(10.3a) 38%	3.3a 70%	(7.7a) 54%
1.6 x 10^6 desiccated IJ's drench	9.7a	2.7a 63%	(4.0a) 53%	5.0a 0%	(8.3a) 27%	3.7a 50%	(6.0a) 47%
8.0 x 10^5 IJ's drench	12.7a	3.3a 66%	(5.0a) 55%	4.7a 17%	(6.7a) 55%	3.3a 66%	(5.7a) 0 62%
1.6 x 10^6 IJ's drench	12.7a	3.3a 69%	(5.7a) 49%	5.3a 6%	(11.0a) 26%	3.7a 61%	(9.0) 39%
hydramethylnon 4 tbsp/mound	15.7a	6.3a 47%	(9.0a) 35%	3.7a 47%	(6.7a) 64%	2.3a 81%	(6.7a) 64%
2.0 x 10^5 IJ's drench + broadcast (200 IJ's per square inch)	10.0a	8.7a 0%	(10.0a) 0%	6.7a 0%	(10.3a) 12%	5.0a 33%	(7.7a) 34%
1.6 x 10^6 IJ's drench + broadcast (200 IJ's per square inch)	12.0a	3.0a 67%	(5.7a) 46%	4.0a 25%	(6.3a) 55%	4.7a 48%	(8.0a) 43%
LSD (P # 0.05)	14.83	8.233	(9.939)	6.968	(9.959)	4.641	(8.374)

[2/] Means followed by the same letter are not statistically different using the Least Significant Difference analysis of variance (P # 0.05).