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Control of Individual Fire Ant Mounds

Comparison of Two Treatment Methods and Four Insecticides for Control of Individual Fire Ant Mounds

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Abstract

Injection of insecticide into fire ant mounds was compared with surface application of insecticides to evaluate these methods for control of individual fire ant colonies in Oktibbeha County, Mississippi. Results indicate that the effectiveness of injecting insecticides is about the same as surface application under normal soil moisture conditions. However, the study indicates insecticide injection is less effective than surface application when saturated soil conditions and high water tables force the ants to congregate close to or within the top of the mound. Results indicate that Amdro provided less mound mortality than either Orthene 75S or Ambush 25W. Percent mound mortality resulting from injection of Affirm 0.011G and Amdro did not differ statistically from that of the untreated check.

Introduction

The black imported fire ant (*Solenopsis richteri* Forel) was introduced into the United States at Mobile, Alabama, around 1918, and the red imported fire ant (*S. invicta* Buren) was introduced in the 1930s (Lofgren 1986). Since that time, *S. invicta* has spread throughout the South and has become the major fire ant pest in Mississippi. According to Vinson (1997), however, a small area in northeastern Mississippi is still inhabited by *S. richteri*. Additionally, there is evidence that hybrid fire ants, resulting from the hybridization of *S. richteri* and *S. invicta* (Vander Meer 1986) have occurred, and the hybrid has been reported as being present in Mississippi (Vander Meer et al. 1985). Fire ants infest moderately undisturbed soil in turf, pasture, forest, and even some cultivated fields. They become a nuisance or a hazard in schoolyards and residential areas. Because of their ubiquitous distribution and destructive mound building, control of individual fire ant mounds has become a necessary and accepted method of control by most homeowners in Mississippi.

Recommended methods for treatment of individual fire ant mounds in Mississippi include drenches with insecticide solutions in water and surface treatment of the mound with granular bait formulations or insecticidal dust (Jarratt and Harris 1997). Other studies have evaluated injecting mounds with nematodes and fungal spores of *Beauveria bassiana* (Balsamo) that cause disease in fire ants (Drees et al. 1992; and Oi et al. 1994). Horton et al. (1982) evaluated aerosol injection of insecticide.

This study was initiated to evaluate the efficacy of injected versus surface-applied insecticides (powders or granules) for control of fire ants. Much of Oktibbeha County's soil is a heavy clay soil (15% to 35% clay) with poor internal drainage that causes a high water table during periods of high moisture. Such conditions force the ants within a colony to congregate just under the surface of the mound. During colder winter days in northern Mississippi, fire ant activity outside the mound is restricted. However, on the warmer winter days, fire ants can be very active. These factors suggest that insecticide injection may be more effective than surface application of insecticide, particularly baits, at least under some conditions. Consideration of these factors prompted the research reported in this bulletin.

Materials and Methods

Two pastures located in Oktibbeha County -- one 3 miles east of Starkville along Blackjack Road, and the second 2.5 miles west of Adaton -- were used for the studies. Studies were completed in each of the four seasons beginning in June and ending in April. Dates of application were April 11 in the spring, June 17 in the summer, Sept. 15 in the fall, and Dec. 20 in the winter (Table 1).

Each trial consisted of mounds that were treated with either an injection or surface treatment of insecticide. In addition, some control mounds were left completely undisturbed, while others were used as "untreated-injected" controls. Untreated-injected controls were poked with a clean injection tube to cause disturbance similar to that caused when mounds were injected with insecticide. Steps were taken to help insure that surface and injection treatments for an insecticide were in similar ecological locations within the test plots. To accomplish this goal, mounds for a specific insecticide were located close to each other, but they were selected randomly according to treatment method. Thus, replicates consisted of randomly arranged groups of insecticide or control treatments with methods of application randomly chosen within those groups. This process insured that injected and surface-treated mounds, treated with the same compound, were in close proximity to each other. Test mounds were selected so that all were at least 10 feet apart.

Surface mound treatments consisted of sprinkling the dry insecticide compound over the mound and the area adjacent to the mound to include approximately 4 square feet. Injection treatments were made using a specially designed square tube (1 square inch in diameter, and 4 feet long). The tube had a point welded on one end; an opening was drilled into the side near the pointed tip. This applicator was pushed into the center of a mound as far as possible by aid of a 1-foot-long cross piece welded at right angles across the upper end of the tube. Insecticide was dumped into the tube via a funnel. The tube was agitated to dislodge the insecticide through the hole near the pointed tip. Thus, most of the insecticide was deposited at or near the bottom of the fire ant mound. However, some insecticide was distributed by the tube as it was extracted from the mound. The same tube was used for all insecticide treatments. To avoid contamination of one insecticide with another, mounds were marked in advance with color-coded and labeled flags identifying the insecticide treatments and type of application. After a given insecticide had been injected into all appropriate mounds, the tube was cleaned as well as possible by briskly knocking it against the ground to dislodge any insecticide residues. Then, all the mounds to be treated with the next insecticide were injected. Surface-treated and injected mounds paired within a replicate were treated at the same time.

Efficacy of the insecticides was evaluated approximately 14 days after treatment by digging into the mound with a shovel and looking for live ants. A mound was considered live if any live ants were found. A new mound occurring within about 5 feet of the treated, dead mound was recorded as a moved mound.

Insecticides and per-mound rates used in the studies were Amdro (hydromethylnon), 75 milliliters; Orthene 75S (acephate), 10 milliliters; Ambush 25W (permethrin), 30 milliliters; and Affirm 0.011G (abamectin), 75 milliliters. Insecticide for each mound treatment was measured and placed in a paper envelope before application in the field. The insecticides were chosen from different classes of insecticides, each with a different mode of action on the insect. Orthene is an organophosphate, permethrin is a pyrethroid, abamectin is an avermectin compound, and hydramethylnon is an amidinohydrazone.

The species collected from fields for this pesticide evaluation was identified as *S. richteri*. However, the possibility exists that *S. invicta* and hybrid ants may have been present in some of these trials.

Table 1. Number of fire ant mounds treated with each compound and type of mound treatment (injected or surface treated) during each of the four trials.

Compound[1]	No. surface treated	No. injected
Spring		
Ambush	12	12
Amdro	11	11
Affirm	11	11
Orthene	11	11
Check	11	10
Summer		
Amdro	12	12
Orthene	12	12
Check	12	--
Fall		
Ambush	19	20
Amdro	20	20
Affirm	20	19
Orthene	21	20
Check	9	11
Winter		
Ambush	15	15
Amdro	15	15
Affirm	15	15
Orthene	15	15
Check	--	--

[1]Dates of application: spring, April 11; summer, June 17; fall, Sept. 15; and winter, Dec. 20.

Results

Table 1 lists the number of fire ant mounds treated with each compound during each evaluation. Figure 1 summarizes the data for percent mound mortality for surface and injection treatments of each compound within each test. There were three instances when the two treatment methods differed significantly (Chi^2; $P < 0.05$). In these instances the injection treatment resulted in significantly fewer dead mounds than the surface treatment. The percent mortality of Affirm in the fall trial was 15.8% when injected and 50% when applied to the surface. In the winter trial, Amdro (20%, injected; 80%, surface) and Orthene (53.3%, injected; 86.7%, surface) were also significantly different. In only one instance was there a significant difference between treatment methods for the movement of the colony from the treated mound to a new one. As shown in Figure 2, percent mortality of colonies for that treatment was essentially equal (60%, injected; 52.6%, surface).

When each compound was examined across all seasons, the analysis revealed no significant differences between injected and surface insecticide application methods in mound mortality (Figure 3) or colony movement (Figure 4). However, when all the insecticides were compared throughout the for seasons, results indicated a trend for the surface treatment to be marginally more effective with somewhat higher mortality (Figure 5) and slightly less colony movement (Figure 6).

Wet conditions during the winter evaluation caused 15% on the inject mounds and 21% of the surface-treated mounds to have water within a few inches of the surface. Under these conditions, the ants were congregated close to the ground-surface level or within the mound itself. Mean percent mortality of all injected mounds summarized across all insecticides for the winter trial was 50%, and that of surface-treated mounds was 76.6% (Figure 7). This might be interpreted to indicate that injection placed the insecticide below ant-contact level in wet mounds. However, based on overlap of error bars (1.96*SEM) in Figure 7, there was no statistical difference between these two methods. Figure 8 summarizes all data from the less wet spring, summer, and fall trials across insecticides, resulting in 43.8% mean percent mortality in injected mounds, and 49.9% in surface-treated mounds.

When averaged across all trials, the mean mortality of surface-applied Ambush was 53.2%; Amdro, 44.2%; Affirm, 58.5%; and Orthene, 77.4%. Check mortality was 9.3%. The percent mortality of Amdro was significantly lower than that of Orthene. All other treatments resulted in statistically similar means (F-test; $p = 0.05$).

Percent mortality of mounds injected with Ambush was 66.1%; Amdro, 30%; Affirm, 33.3%; and Orthene, 64.5%. Percent control by Amdro was significantly less than that of Ambush and Orthene (F-test; $p = 0.05$). Mound mortality by Affirm was not significantly different from any of the treatments, nor was control by Affirm or Amdro significantly different from that of the untreated mounds.

Summary

Under the conditions of these trials, there was no pesticide-efficacy advantage to the technique of injecting insecticides into fire ant mounds as compared to applying insecticides to the surface of undisturbed mounds. Additionally, the injection technique increased risk of fire ant stings during the injection process compared to the treatment of undisturbed mounds. There was no difference between the two techniques in the number of new mounds that appeared within about 5 feet of a treated mound and that were considered as moved mounds. Review of the efficacy of the four insecticides summarized across the four trials indicates that Amdro was somewhat less effective as a surface treatment than Orthene 75S and less effective as an injection than Ambush 25W or Orthene 75S.

References

Drees, B. M., R. W. Miller, S. B. Vinson and R. Georgis. 1992. Susceptibility and behavioral response of red imported fire ant (Hymenoptera: Formicidae) to selected entomogenous nematodes (Rhabditida: Steinernematidae & Heterorhabditidae). J. Econ. Entomol. 85(2): 365-370.

Horton, P. M., J. B. Kissam, S. B. Hays and G. W. Query. 1982. Chlorpyrifos aerosol mound injections for the control of the red imported fire ant *Solenopsis invicta*. J. Georgia Entomol. Soc. 17(4): 478-484.

Jarratt, J. H. and P. Harris. 1997. The imported fire ant and its control. Publication 1833, Mississippi State University Cooperative Extension Service. 3 pp.

Lofgren, C. S. 1986. History of imported fire ants in the United States. pp. 36-47. In: Fire ants and leaf-cutting ants: Biology and management. Westview Press, Boulder, CO.

Oi, D. H., R. M. Pereira, J. L. Stimac, and L. A. Wood. 1994. Field applications of *Beauveria bassiana* for control of the red imported fire ant (Hymenoptera: Formicidae). J. Enon. Entomol. 87(3): 623-630.

Vander Meer, R. K. 1986. Chemical taxonomy as a tool for separating Solenopsis spp. pp. 316-26. In: Fire ants and leaf-cutting ants: Biology and management. C. S. Lofgren, and R. K. Vander Meer eds. Boulder, CO, Westview Press, 435 pp.

Vander Meer, R. K., C. S. Lofgren, and F. M. Alvarez. 1985. Biochemical evidence for hybridization in fire ants. Fla. Entomol. 68: 501-506.

Vinson, S. B. 1997. Invasion of the red imported fire ant (Hymenoptera: Formicidae): spread, biology, and impact. Amer. Entomologist Spring, 1997 pp. 23-39.