The Effect of Heptachlor and Chlordane on the Foraging Activity of Imported Fire Ants[1]

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ABSTRACT

Studies have shown that the feeding activity of the imported fire ant, *Solenopsis saevissima richteri* Forel, on dyed baits is substantially retarded when the foraging area has been treated with granular heptachlor or chlordane. This apparent repellent effect is counteracted partially by the addition of various insecticide solvents or additives such as heavy aromatic naphtha, rosin, lubricating oil, butyl cellusolve, alkylated polystyrenes, and Piccopale (a petroleum product). There was no apparent difference in feeding activity in the presence of heptachlor or chlordane at dosage rates of $\frac{1}{16}$, $\frac{1}{8}$, and $\frac{1}{4}$ lb/acre and $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{1}{2}$ lb/acre respectively. Repellency was determined by the percentage of ants containing dye after 24 hours of foraging on 1-acre plots treated with bait applied simultaneously with the granular insecticide formulations.

Studies with baits for the control of the imported fire ant, *Solenopsis saevissima richteri* Forel, have shown that their primary disadvantage is the lack of a residual effect.

[1] Received June 26, 1963; accepted for publication November 11, 1963.

Table 1.—The effect of heptachlor and chlordane on the feeding of imported fire ants on dyed baits.

Treatment		Percentage of ants containing dye from:	
Bait	Insecticide	All mounds sampled	Mounds within the subplots
Puffed barley-soybean oil	Chlordane, ½ lb/acre	14	28
	Heptachlor, ¼ lb/acre	6	8
	None	31	69
Bran-soybean oil	Chlordane, ½ lb/acre	9	14
	Heptachlor, ¼ lb/acre	4	12
	None	19	48

Thus, fertilized queens which enter the ground just prior to, during, or after a bait treatment do not feed on the bait and are not killed. By the time the queens have reared the first workers, the bait has been consumed, lost, or become unattractive. Because of this fact, an investigation was made of the feasibility of combined bait-soil surface insecticide treatments in which a low dosage of a residual insecticide and a bait would be applied simultaneously. The purpose of the insecticide would be to provide a short residual to prevent establishment of new colonies by queens.

This paper presents a report on preliminary investigations of the effect of 2 residual insecticides, heptachlor and chlordane, on the feeding activity of imported fire ant on baits.

PROCEDURES.—In the first test, conducted in April 1961, 3 plots 300×120 ft were established, and 2 subplots 100×50 ft were located within each of the larger plots. One of the large plots was treated with 10 lb of 5% granular chlordane per acre (½ lb chlordane/acre), a second plot with 10 lb of 2.5% granular heptachlor per acre (¼ lb heptachlor/acre) and the third received no insecticide treatment. One of the subplots within each large plot was treated with a bait consisting of bran (75%) and soybean oil (25%) and the other subplots with a puffed barley grits (33%)-soybean oil (67%) bait. The oil in each bait contained 0.25% Calco oil blue dye. Twenty-four hours after application, ants were collected from all mounds in and within 25 ft of the subplots.

In the remainder of the tests, the following procedures were employed: 1-acre plots which contained 10 or more active imported fire ant mounds were established in pasture land. The plots were treated with a bait consisting of puffed milo or puffed barley grits (40%), soybean oil (59.85%), and Calco oil blue dye (0.15%) and various granular clay formulations of the insecticides. A power-take-off model Cyclone seeder mounted on a jeep was used for the bait applications and a jeep-mounted Buffalo turbine blower for the insecticide applications. The applicators were driven in tandem so that the bait and insecticide were applied almost simultaneously. Twenty-four hours after application, 100 worker ants were collected from each of 10 mounds in each test plot. The ants were examined for the presence of dye in the intestinal tract by the method outlined by Bartlett and Lofgren (1961). The effect of the insecticide on ant feeding activity was determined by comparison with the feeding of ants on bait in the absence of insecticide.

RESULTS.—The data for the first test are recorded in Table 1. It is evident that the heptachlor and chlordane formulations had a definite retarding effect on the feeding activity of the ants. Since the granular insecticides used were standard formulations containing insecticide, solvent, and deactivator, a second test was initiated to determine whether the insecticide or some other component of the formulation was causing the retardation of feeding. All plots were treated with puffed barley grits-soybean oil bait. The granular formulations evaluated and the percent of ants containing dye in the presence of each were as follows: (1) untreated attapulgite granules 71%; (2) attapulgite granules containing 10% by weight of heavy aromatic naphtha solvent 66%; (3) attapulgite granules containing 2.5% by weight of heptachlor (insecticide applied to granules in a volatile solvent and solvent evaporated) 0.2%; and (4) attapulgite granules containing 10% of heavy aromatic naphtha and 2.5% heptachlor by weight 11%; and check (no granules) 66%.

It was concluded that heptachlor was the contributing factor that resulted in a reduction of ants feeding on the bait. Since no rain occurred during the test period to release the insecticide from the granules, the apparent repellency probably was due to volatilization of heptachlor. The addition of heavy aromatic naphtha solvent evidently retarded volatilization to some extent with the result that some feeding activity took place.

A third test was initiated to determine if the apparent repellent effect of the insecticides could be alleviated. In the first series the insecticide dosages were reduced to determine if there was a dosage level within the effective killing range of heptachlor ($\frac{1}{16}$, $\frac{1}{8}$, and ¼ lb per acre) and chlordane ($\frac{1}{8}$, ¼, and ½ lb per acre) where no such repellent action occurred. The second and third series were to determine if different solvents or additives would temporarily retard the volatilization of the insecticide, thereby permitting normal ant foraging. The solvents and additives tested were lubricating oil SAE 30, butyl cellusolve, rosin, an alkylated polystyrene, and Piccopale.[2] The results are presented in Table 2.

There was no apparent difference in the feeding activity of the imported fire ants which could be attributed to the different application rates of each insecticide. There was a definite increase in the imported fire ant feeding activity on the plots treated with chlordane as compared to the plots treated with heptachlor; however, the feeding activity in the presence of chlordane was definitely less than that on the control plots without insecticide treatments. The rosin, Piccopale, alkylated polystyrene, lubricating oil SAE 30 and butyl cellusolve at the concentrations used in this test did not decrease the repellency of heptachlor or chlordane more than the heavy aromatic naphtha solvent in tests within the same series.

These experiments were not designed to prove or disprove true repellency; however, observations made dur-

[2] A petroleum raw material, essentially a hard hydrocarbon produced by the polymerization of unsaturates derived from the deep cracking of petroleum; a product of Pennsylvania Industrial Chemical Corporation, 332 South Michigan Avenue, Chicago 4, Illinois.

Table 2.—The effect of different formulations and application rates of chlordane and heptachlor on the feeding activity of imported fire ants on dyed bait.

Experimental components in attapulgite granules				Insecticide application rate (lb/acre)	Percentage of ants containing dye after 24 hours
Insecticide and conc. (%)		Solvent and conc. (%)			
			Series I		
Heptachlor	2.5	Heavy aromatic naphtha	10	$\frac{1}{4}$	15
	1.25	Heavy aromatic naphtha	10	$\frac{1}{8}$	18
	0.625	Heavy aromatic naphtha	10	$\frac{1}{16}$	17
Chlordane	5.0	Heavy aromatic naphtha	10	$\frac{1}{2}$	36
	2.5	Heavy aromatic naphtha	10	$\frac{1}{4}$	31
	1.25	Heavy aromatic naphtha	10	$\frac{1}{8}$	28
Check	—	—	—	—	83
			Series II[a]		
Heptachlor	2.5	Alkylated polystyrene	5	$\frac{1}{4}$	8
		Rosin	5	$\frac{1}{4}$	21
		Piccopale	5	$\frac{1}{4}$	14
Check	—	—	—	—	83
			Series III[b]		
Chlordane	5	Lubricating oil SAE 30	10	$\frac{1}{2}$	60
		Butyl cellusolve	10	$\frac{1}{2}$	65
		Heavy aromatic naphtha, sample 1	10	$\frac{1}{2}$	62
		Heavy aromatic naphtha, sample 2	10	$\frac{1}{2}$	59
Check	—	—	—	—	84

[a] Conducted concurrently with Series I.
[b] Each of these formulations contained 7% deactivator. Average results from 2 tests.

ing and subsequent to these tests indicated that the retardation of feeding was due primarily to this cause rather than to toxicity, or some other factor. The term "repellency" is poorly standardized at best, but is usually accepted as designating an effect which results in an avoidance reaction by an insect, as opposed to mere cessation of feeding or other normal activity. During these tests it was observed that within a few hours of application of the insecticide there was a marked absence of foraging worker ants. In some instances, dead or dying ants were noted; however, the number found was only a very small percentage of the total number of ants foraging in the area prior to treatment or on adjacent untreated land. Observations on ant control in plots treated at the dosage rates used in these tests have shown that kill of entire colonies is generally slow and it is usually several days before any appreciable number of dead ants is found around the mounds. Apparently the microclimate of the ants becomes contaminated very rapidly by insecticide vapors. By some means the foraging ants sense its presence and remain in their nests. The repellency undoubtedly also accounts for the slow kill of ant colonies obtained with soil insecticides and for the fact that short residual insecticides are not effective in controlling imported fire ants.

REFERENCE CITED

Bartlett, F. J., and C. S. Lofgren. 1961. Field studies with baits against *Solenopsis saevissima* v. *richteri*, the imported fire ant. J. Econ. Entomol. 54(1): 70–73.

Reprinted from the
JOURNAL OF ECONOMIC ENTOMOLOGY
Vol. 57, No. 2, April, 1964
pp. 235-237