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Imported Fire Ant Toxic Bait Studies: GC-1283, a Promising Toxicant¹

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The best toxicant which has been reported for use in baits for control of the imported fire ant, *Solenopsis saevissima richteri* Forel, is Kepone² (decachlorooctahydro-1,3,4-metheno-2H-cyclobuta [cd] pentalen-2-one). The effectiveness of this compound with various baits has been reported by Hays & Arant (1960), Bartlett & Lofgren (1961), Lofgren et al. (1961), and Stringer et al. (1962). Our laboratory has continued a search for better toxicants characterized by a delayed killing action, and which possess other desirable properties such as low mammalian toxicity. As a result of our studies another very promising toxicant has been found. The insecticide, an analog of Kepone, is a product of the General Chemical Division, Allied Chemical

Corporation, and has been assigned the Code Number GC-1283.³ It is a perchloro condensed ring polycyclic hydrocarbon with the chemical name: Dodecachlorooctahydro-1,3,4-metheno-2H-cyclobuta [cd] pentalene. The compound is especially interesting because its acute oral toxicity (LD-50) to male albino rats is 312 ± 88 mg./kg. and to female white rats 700 ± 88 mg. kg.; the acute oral LD-50's for Kepone are 132 ± 8 mg./kg. for male rats and 126 ± 12 mg./kg. for female rats.³ This fact plus the fact that only very small quantities of this toxicant would be applied per acre should make it possible to develop a safe bait with it for use in the eradication program against the imported fire ant. This paper presents the results of preliminary laboratory and field tests with GC-1283.

LABORATORY TESTS.—A comparison of the toxicity of GC-

¹ Accepted for publication November 27, 1961.

² U. S. Patent Reissue 24,750.

³ Toxicity data obtained from personal communication with M. M. Darley, General Chemical Division, Allied Chemical Corporation.

Table 1.—Toxicity of GC-1283 and Kepone in peanut oil baits to imported fire ant workers.*

CONCENTRATION (%)	PER CENT KNOCKDOWN AND KILL AFTER HOURS' EXPOSURE INDICATED											
	4	24	48	72	96	120	144	168	192	216	240	336
<i>GC-1283</i>												
0.005	0	0	0	0	0	0	0	15	18	35	48	83
.01	0	0	0	0	0	0	3	23	50	55	70	100
.025	0	0	3	3	8	70	83	95	100	—	—	—
.05	0	0	0	23	93	100	—	—	—	—	—	—
.1	0	0	0	70	100	—	—	—	—	—	—	—
.25	0	0	15	95	98	100	—	—	—	—	—	—
<i>Kepone</i>												
0.01	0	0	0	0	0	0	0	0	0	3	5	55
.025	0	0	0	0	0	3	3	15	40	70	75	95
.05	3	3	3	3	5	38	83	90	95	95	100	—
.1	0	0	0	0	48	63	70	85	95	98	98	100
.25	0	0	20	75	98	98	98	100	—	—	—	—
.5	0	0	48	83	100	—	—	—	—	—	—	—
<i>Untreated check</i>												
—	0	0	3	3	3	5	5	5	5	5	5	5

* Average of two tests with 20 worker ants each.

1283 and Kepone was made. The test procedure was the same as that described by Stringer et al. (1962). Essentially, it consisted of permitting *ad libitum* feeding by duplicate sets of 20 worker ants over a 14-day period on peanut oil baits containing various concentrations of the toxicants. The test chambers were small, plastic flower pots with glass lids. The temperature throughout the test period was maintained at 80° F. ± 2°. Regular observations were made for dead ants. The data are presented in table 1 and show that (1) both toxicants gave definite delayed toxicity over the range of dosages tested (2) GC-1283 was more toxic than Kepone (100% vs 55% kill after 336 hours at a concentration of 0.01%) and (3) the time interval between initial mortality and complete kill was shorter with GC-1283 than with Kepone.

BAIT ACCEPTANCE TESTS.—An investigation was made for possible repellency of GC-1283 to the ants when combined with a bait. For this evaluation the dyed food technique as described by Bartlett & Logren (1961) and Lofgren et al. (1961) was used. Puffed barley grits-soybean oil baits were prepared containing 0.03%, 0.1%, 0.25%, 0.5%, or 1.0% of GC-1283 and 0.25% Calco oil blue dye in the oil. The formulations were prepared by dissolving the toxicant in the oil, heating this solution to 150° C. and pouring it over the puffed barley grits as it was stirred with an electric mixer. At this temperature the oil penetrated the puffed barley grits readily resulting in a dry formulation. Each bait was tested against six imported fire ant colonies in the field. The bait was scattered around the mounds and after 24 hours 100 ants from each colony were examined for the presence of dye in the alimentary tract. The results as recorded in table 2 show that GC-1283 was not repellent to the ants at any of the dosages tested.

FIELD CONTROL TESTS.—Two experiments were conducted to evaluate GC-1283 when combined with baits for controlling natural infestations of imported fire ants. In the first experiment, concentrations of 0.05% and 0.1% of GC-1283 by weight of total formulations were tested in a bait composed of white flour 50%, soybean oil 47%, and monoglycerides 3%. Dosages of 0.03%, 0.06%, and 0.15% of GC-1283 by weight of total formulation were tested in the second experiment in a bait consisting of puffed barley grits 40%, soybean oil 54%, and monoglycerides 6%. The standard bait for comparison was the same as that used in experiment 1, with Kepone as the toxicant. The test plots ranged from 6 to 8 acres. Three 1-acre subplots were set up within each large plot. The borders of these subplots were at

least 50 feet from the edge of the large plot and at least 50 feet from each other. The entire test plot was treated with bait, but pre- and posttreatment counts of active imported fire ant colonies were made only within the subplots. The purpose of this type of test procedure was to minimize the feeding of ants from one treated plot to another and to delay reinfestations by ant colonies from adjacent untreated land. The flour-soybean oil baits were applied with a jeep-mounted Moyno pump bait applicator (Lofgren et al, 1961). The puffed barley grits baits were broadcast with a jeep-mounted power take-off model Cyclone seeder. A large floor model food mixer was employed in formulating the baits. The puffed barley grits-soybean oil baits were formulated by the same procedure described under the bait acceptance tests.

The results presented in table 3 definitely demonstrate the effectiveness of GC-1283 as a bait toxicant. In every test 99% to 100% control was obtained after 4 weeks. The Kepone standard was slightly less effective.

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Table 2.—Acceptability to imported fire ants of puffed barley grits-soybean oil baits containing various concentrations of GC-1283.

CONCENTRATION OF GC-1283 IN THE OIL (%)	WORKER ANTS CONTAINING DYE AFTER 24 HOURS (%)
0.05	75
.1	80 ^a
.25	83 ^a
.5	69
1.0	67
Untreated check	71 ^b

^a Average of results from five colonies, all others from six colonies.

^b The bait used for the untreated check contained the dye without GC-1283.

Table 3.—The effectiveness of GC-1283 in two different baits against imported fire ants.*

BAIT COMPONENTS (%)	TOXICANT AND CONCENTRATION (%) IN BAIT	AVERAGE PRETREATMENT COUNT OF ACTIVE COLONIES PER SUBPLOT	REDUCTION (%) IN ACTIVE COLONIES AFTER WEEKS INDICATED		
			2	4	8
<i>Experiment I</i>					
White flour 50, soybean oil 47, monoglycerides 3	GC-1283 0.05	91	93	100	100
	.1	15	100	100	100
	Kepone .25	11	96	100	98
	Check	14	13	5	5
<i>Experiment II</i>					
Puffed barley grits 40, soybean oil 54, monoglycerides 6	GC-1283 0.03	37	72	100	97
	.06	37	90	99	98
	.15	28	99	99	100
White flour 50, soybean oil 47, monoglycerides 3	Kepone 0.25	50	92	98	94
	Check	23	48	16	22

* Results are the average from three 1-acre subplots located within a 6- to 8-acre plot.

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Reprinted from the
JOURNAL OF ECONOMIC ENTOMOLOGY
Vol. 55, No. 3, June, 1962
pp. 405-407