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## TESTS WITH POISON BAITS AGAINST COCKROACHES

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Poison baits consisting of some food material with a toxicant such as phosphorus or boric acid have been used for many years for controlling the cockroaches (Mallis 1954, pp. 181-5). Recently Keller *et al.* (1956) reported that a bait consisting of cornmeal (73 percent), Coca-Cola sirup (25 percent), and Dipterex (2 percent) controlled *Periplaneta* spp. in homes for 30-60 days. This paper presents an evaluation of various poison-bait formulations against the American cockroach (*Periplaneta americana* [L.]) or mixed populations of this species with *P. brunnea* Burm. and the Australian cockroach (*P. australasiae* [F.]) and against the German cockroach (*Blattella germanica* [L.]).

### LABORATORY TESTS

A large number of food materials were tested, separately and in combination, as 2-percent Dipterex poison baits. An acetone solution of insecticide was mixed with the food material. After the acetone evaporated, the bait was placed in small plastic vial lids. Small wads of cotton were soaked in the liquid baits to facilitate feeding by the cockroaches. The baits were exposed to the cockroaches in cylindrical screen cages or plastic refrigerator dishes. The cockroaches were also supplied with dog food and water. An excess of bait was used to permit *ad libitum* feeding. Two to six tests were run with each bait, with five American cockroach nymphs or five or ten German cockroach adults per test. Knockdown and mortality counts were taken after various periods of exposure. Results of tests with baits that killed at least 90 percent after 48 hours are recorded in Table 1.

Against American cockroaches, dextrin, cornstarch, and powdered sugar, alone or in combination with each other or different food materials, were the most effective dry baits, and Coca-Cola, root beer, and vanilla sirups were the most effective liquid baits. Powdered sugar was the most effective bait against German cockroaches. With this exception, German cockroaches accepted liquid baits more readily than dry baits whereas American cockroaches showed little preference.

### TESTS IN ROOMS, HOMES, AND DAIRY BARNs

A number of bait tests were run with selected food materials in rooms, homes, or dairy barns. The baits were prepared in the same manner as for the laboratory tests but not always with the same insecticide or concentration. Cornmeal was used in most formulations to add bulk, absorb moisture, and make the baits easier to apply.

Coca-Cola sirup and a mixture of cornmeal and powdered sugar containing 1 percent of Dipterex were tested against infestations of German cockroaches in rooms. The rooms were sealed so that no roaches could escape. Approximately 67 grams of bait was divided among three stations in each room. This was sufficient to provide *ad libitum* feeding. In another

TABLE 1.—ATTRACTIVENESS TO COCKROACHES OF VARIOUS FOOD MATERIALS IN BAITS CONTAINING 2% OF DIPTEREX. LABORATORY TESTS.

Food Material (figures indicate percent)	Percent knockdown and kill after—				
	1 hour	2 hours	4 hours	24 hours	48 hours
American cockroaches					
Dextrin 50, cornmeal 50.....	0	0	70	100	100
Dextrin 50, cornstarch 50.....	0	0	60	100	100
Pepsi-Cola sirup .....	0	0	40	100	100
Powdered sugar 25, cornmeal 75..	0	13	27	100	100
Vanilla sirup .....	0	10	20	100	100
Root beer sirup .....	0	0	10	100	100
Fructose water solution .....	0	0	0	100	100
Coca-Cola sirup .....	0	0	25	95	100
Dextrin 45, dried ox blood 10, cornmeal 45 .....	0	0	15	85	100
Peanut oil .....	0	0	0	95	95
Cornstarch .....	0	0	15	90	95
Dextrin .....	0	0	27	93	93
Dextrin 50, peanut oil 50 .....	0	0	30	90	90
Brewers' yeast (dried) .....	0	0	10	90	90
Dried ox blood .....	0	0	0	90	90
Dextrin 33½, dried brewers' yeast 33½, cornstarch 33½..	0	0	0	90	90
Maltose water solution .....	0	0	0	90	90
Cherry sirup .....	0	0	10	80	90
Cornmeal 33½, dextrin 33½, dried brewers' yeast 33½.....	0	0	10	80	90
German cockroaches					
Powdered sugar .....	0	5	80	100	100
Cornmeal 75, powdered sugar 25..	0	23	56	100	100
Root beer sirup .....	0	0	60	100	100
Vanilla sirup .....	0	0	20	100	100
Orlando fly food* .....	0	5	15	100	100
Strawberry sirup .....	0	0	10	100	100
Sucrose water solution .....	0	10	10	90	100
Maltose water solution .....	0	0	0	80	100
Coca-Cola sirup .....	0	0	10	90	95
Cherry sirup .....	20	20	40	80	90
Dextrin 25, dried ox blood 10, cornmeal 25, Coca-Cola sirup 40 .....	0	0	20	80	90

\* 25% raw egg, 6% powdered milk, 34.5% honey, and 34.5% malt extract.

TABLE 2.—RESULTS OF TESTS WITH POISON BAITS CONTAINING 1% DIFTEREX AGAINST GERMAN COCKROACHES CONFINED IN ROOMS.

Bait (figures indicate percent)	Amount dispensed (grams)	Pretreat- ment count	Percentage reduction after—							
			1 day	2 days	3 days	4 days	8 days	11 days		
Stations										
Coca-Cola sirup .....	67	7,079	7	—	—	16	22	27	—	—
		10,367	7	—	—	14	19	23	—	—
		809	19	—	—	29	33	48	—	—
Dusts										
Cornmeal 74, powdered sugar 25 .....	67	2,670	3	—	—	11	20	24	—	—
		867	12	—	—	23	28	34	—	—
		989	4	—	—	7	8	12	—	—
Cornmeal 74, powdered sugar 25 .....	125	2,024	37	42	46*	56	68	74	—	—
	150	5,174	50	53	56*	69	82	87	—	—
	75	7,978	47	51	55*	66	79	84	—	—
		872	38	36	40	47	57	63	—	—

\* After this count the room was dusted again.



TABLE 3.—TESTS WITH BAITS CONTAINING 1% DIPTEREX AGAINST COCKROACH INFESTATIONS IN HOMES.—Continued

Bait (figures indicate percent)	Amount dispensed (grams)	Number of dead cockroaches/number of live cockroaches after—										
		1 day	2 days	5-6 days	8-10 days	12-13 days	15-16 days	19-20 days	22-23 days	26-27 days		
German cockroaches												
Stations												
Cornmeal 74, white Karo sirup 25.....	112	10/90	6/80	12/78	3/38	3/52	0/50	0/49	0/50	0/80	0/80	0/80
		6/85	3/66	20/45	15/50	10/20	1/39	5/40	4/30	3/60	3/60	3/60
		4/50	10/50	17/50	17/47	5/17	2/33	3/73	—	2/55	2/55	2/55
		8/30	14/40	—	5/52	3/10	0/36	0/45	0/40	0/40	0/40	0/40
Powdered sugar .....	50	0/50	0/40	4/61	—	—	—	—	—	—	—	—
		—	0/60	4/47	—	—	—	—	—	—	—	—
		0/50	2/70	0/63	—	—	—	—	—	—	—	—
Dust												
Cornmeal 74, powdered sugar 25 .....	112	10/80	—	3/50	5/40	5/55	1/69	32/50	5/55	8/47	8/47	8/47
		5/93	9/93	12/50	13/29	4/20	4/42	15/30	3/40	5/34	5/34	5/34
		2/90	6/50	0/35	2/32	2/15	2/50	0/30	2/33	1/35	1/35	1/35
Cornmeal 74, powdered sugar 25.....	225	33/120	10/115	0/117	—	0/120	0/130	—	—	—	—	—
		40/250	22/240	0/240	—	0/240	0/230	—	—	—	—	—
		12/210	0/200	0/200	—	0/175	—	—	—	—	—	—

\* Test discontinued because bait was not giving satisfactory control of German cockroaches on these premises and it was necessary to apply a residual treatment.

\*\* 0/0 after 37 days.

† 9/3 after 40 days.

‡ 0/2 after 40 days.

§ 0/0 after 54 days.

TABLE 4.—TESTS AGAINST *Periplaneta* spp. IN DAIRY BARNs WITH BAITS CONTAINING 2% OF MALATHION OR DIFTEREX.

Bait	Dairy	Dosage (grams)		Pretreat- ment count	Percent control after—					
		First treatment	Second treatment		First treatment			Second treatment		
					1 day	7 days	14 days	1 day	1 day	7 days
Dipterex plus—										
Cornmeal-Coca-Cola sirup	Arndt	834	900	57	88	29	—	—	91	93
	Brockbank	1,816	800	68	88	47	12	—	81	79
	Fennell	640	—	158	87*	—	82	—	—	—
Cornmeal-dextrin	Palm	900	—	316	87	95	75	—	—	—
	Mole	600	—	147	84	95	**	—	—	—
Malathion plus—										
Cornmeal-Coca-Cola sirup	Palm	900	900	209	60	63	—	—	—	34
	Fennell	600	—	168	6	—	—	—	—	—
Cornmeal-dextrin	Mole	600	500	153	73	63	—	—	—	4

\* Bait washed out; retreated after 1 day with 600 grams of same bait.

\*\* Dairy barn sprayed for flies.

test the cornmeal-powdered-sugar bait was applied as a dust from a small plastic catsup dispenser. In three of the rooms in this test it was necessary to replace bait that was eaten or became scattered and was swept out when mortality counts were taken.

Table 2 shows the cornmeal-sugar bait applied as a dust to be the most effective, but that at the stations the Coca-Cola bait was better.

Tests in homes were made with baits containing 1 percent of Dipterex in the following food materials: granulated sugar, powdered sugar, and mixtures of cornmeal plus white Karo sirup, powdered sugar, or Coca-Cola sirup. In one series the baits were put in small piles in out-of-the-way areas or exposed in nut cups or envelopes. The cups were set on flat surfaces and the envelopes stapled to vertical surfaces in or behind cupboards, behind sinks, refrigerators, and stoves and in other places where they would not be washed or swept away and were not readily accessible to children. In a second series of tests a mixture of finely ground cornmeal and powdered sugar plus the toxicant was applied as a dust with small plastic catsup dispensers. The treatments were evaluated by making regular inspections of the premises for dead and live roaches. The results given in Table 3 show that all the baits reduced the populations of *Periplaneta* but none were appreciably effective against the German cockroaches.

In 1955 and 1956 tests were run against large mixed populations of *Periplaneta* in several dairy barns. The baits contained 2 percent of Dipterex or malathion, 73 percent of cornmeal, and 25 percent of Coca-Cola sirup or dextrin. Small piles of the bait were placed in corners, cracks, and in other places where it would not be washed or swept away. When less than 75 percent control was obtained after one week, a second application was made.

In most of the dairies roach control was determined by taking flash pictures at night. After the barns were vacated in the evening, the cockroaches crawled from their hiding places looking for food, and a large proportion of them were located near or in the feed troughs and in the feed rooms. Control was based on the reduction in the number of cockroaches in three or four pictures before and after treatment. When low populations were present, it was possible to make an accurate visual count with the aid of a dim light. Percent control in the Fennell dairy was based on such visual counts. After two weeks most of the bait had been destroyed, and counts were discontinued. The results are presented in Table 4.

Both baits gave good control when Dipterex was used as the toxicant (75 to 95 percent after one or two treatments, based on the original pre-treatment count). When malathion was used, control ranged from 4 to 34 percent.

#### SUMMARY

Laboratory and field tests with various poison bait formulations against cockroaches are presented. In laboratory tests with 2-percent Dipterex baits, powdered sugar showed the greatest attractiveness to German cockroaches (*Blattella germanica* [L.]), and dextrin and cornstarch alone or in combinations were the most attractive to nymphs of American cockroaches (*Periplaneta americana* [L.]).

In rooms and homes none of the baits tested against German cockroaches gave satisfactory control. Baits consisting of 1 percent of Dipterex in gran-



ulated sugar or mixtures of cornmeal plus Coca-Cola sirup, powdered sugar, or white Karo sirup were effective in reducing infestations of *Periplaneta* spp. in homes. Seventy-five to 95 percent control of *Periplaneta* spp. in dairy barns was obtained with baits containing 2 percent of Dipterex in cornmeal plus dextrin or Coca-Cola sirup. When malathion was used as the toxicant, control ranged from 4 to 34 percent.

## LITERATURE CITED

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