

TESTS WITH FIVE SILICA DUSTS AGAINST GERMAN COCKROACHES

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The recent work of Wagner and Ebeling (1959) has re-emphasized the insecticidal properties of silica dusts and has created interest in this type of control, particularly with certain household pests. These compounds affect insects by causing a water loss which eventually results in death (Wigglesworth 1957, Ebeling and Wagner 1959).

The effectiveness of CAB-O-SIL, Santocel-C, Estersil-1, SG-67, and SG-68 was determined in laboratory and field tests against the German cockroach, *Blattella germanica* (L.), in the Orlando, Florida, area. Ester-sil-1, a surface-esterified amorphous silica, and SG-67, which has theoretically 4.7% of ammonium silicofluoride present as a monomolecular layer, are coated, finely divided silicas. Santocel-C and SG-68 are uncoated finely divided silicas. CAB-O-SIL is a silica smoke, produced by burning silicon tetrafluoride in a mixture of hydrogen and oxygen. The silica dusts were used at full strength and mixed with talc, individually and in combination with malathion. Malathion and Diazinon dust were used as standards.

LABORATORY TESTS

The dusts were applied to 5¼-inch-square plywood panels in a dust tower (Fig. 1). The tower consisted of a bell jar 14 inches high with an inside diameter of 8¼ inches. An inverted glass funnel was inserted from the inside of the bell jar through a one-hole stopper; the stem of the funnel projected 4 inches above the jar. A small rubber stopper tied to the out-

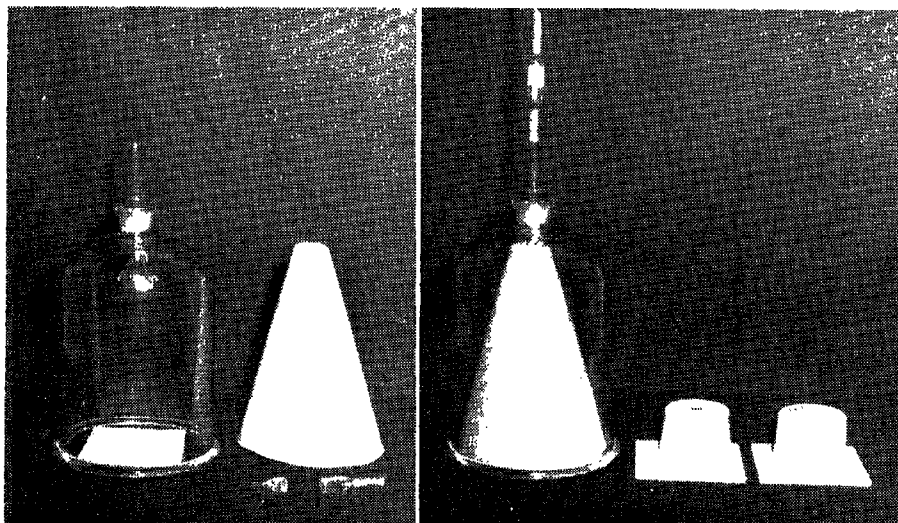


Figure 1. Unassembled and assembled components of the dust tower and the plastic dishes used for exposure of cockroaches to treated panels.

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side of the glass funnel was placed inside the cone to retain the silica dusts in the stem until ejection by compressed carbon dioxide.

A 15-ml., volumetric, transfer pipette, with both ends severed 2 cm. from the bulb, was cut across the bulb to provide two sections of unequal volume. The dust was weighed in the larger section. The two sections were rejoined with masking tape and one end was connected to the protruding funnel stem by a 1-inch piece of rubber tubing, and the other end was connected to a source of carbon dioxide under a pressure of 20 to 30 p.s.i. (gauge pressure), which was turned on for 0.4-0.6 second to expel the dust.

The interior shape of the dust chamber was modified by the addition of a glazed paper cone which extended from the funnel to the bottom perimeter of the bell jar. After ejection of the dust, the panel remained under the tower for 3 minutes, then the bell jar was cautiously removed to minimize air movement over the dusted surface. A plastic dish, 3½ inches in diameter, with a small opening in the bottom was coated with pyrophyllite and inverted over the panel (Fig. 1). The pyrophyllite coating forced the cockroaches to remain in contact with the treatment (or silica dust), since they cannot crawl on pyrophyllite-coated plastic.

Ten normal male cockroaches, which were 8 weeks old, were dropped through the dish opening onto the dusted surface. After exposure for 30 minutes, they were removed and placed in a Petri dish. Mortality counts were taken 48 hours later. The tests were conducted at 82°-86° F. and at a relative humidity of 50%-70%.

The full-strength silica dusts were tested at a range of dosages between 100 and 500 mg./sq. ft. The mortalities and dosages were plotted on log-probit paper and the LD-50's and LD-90's (mg./sq. ft.) were estimated as follows:

	LD-50	LD-90
Santocel-C	205	455
Estersil-1	175	375
CAB-O-SIL	100	240
SG-68	109	150
SG-67	104	130

At the LD-50 level CAB-O-SIL, SG-67, and SG-68 were approximately equal in effectiveness, but at the LD-90 level SG-67 and SG-68 were superior to the others.

Tests were also conducted to determine the effectiveness of talc formulations containing 2% of malathion in combination with 10% of Estersil-1, SG-67, or SG-68 in comparison with the individual materials. Since pilot tests indicated that maximum mortalities resulted when the dusts were mixed without a solvent, all the formulations were prepared in this manner. The results are given in table 1. The combinations of malathion and SG-67 or SG-68 were more effective than malathion alone, but the silica dusts alone at 10% were ineffective.

TABLE 1. SUSCEPTIBILITY OF MALE GERMAN COCKROACHES TO TALC CONTAINING SILICA DUSTS AND MALATHION, INDIVIDUALLY AND IN COMBINATION, APPLIED AT VARIOUS DOSAGES ON PLYWOOD PANELS (2 TO 8 REPLICATIONS).

Material	Dosage (mg./sq. ft.)	Percent knockdown and kill after 48 hours
Estersil-1, 10% + malathion, 2%	500	70
	1,000	100
SG-68, 10% + malathion, 2%	250	70
	500	100
	1,000	100
SG-67, 10% + malathion, 2%	250	53
	500	98
	1,000	100
Malathion, 2%	250	53
	500	87
	1,000	98
Estersil-1, 10%	500	5
	1,000	18
SG-68, 10%	250	13
	500	5
	1,000	28
SG-67, 10%	250	5
	500	3
	1,000	55

HOME TREATMENTS

Tests with Estersil-1, SG-67, and SG-68 were conducted against natural infestations of German cockroaches in homes. All treatments were made in a housing project consisting of ground-level units of five or six rooms. These units were similar in design and were constructed of concrete block. Pretreatment counts were made in the homes; all areas of cockroach infestation were noted and the percent reduction in live cockroaches was based on post-treatment counts throughout a period of 29 to 30 days.

The silica dusts and a standard dust containing 1% of Diazinon (*O,O*-diethyl *O*-(2-isopropyl-4-methyl-6-pyrimidinyl) phosphorothioate) in pyrophyllite were applied with polyethylene squeeze-bottle dusters fitted with extension nozzles. These dusters require a minimum amount of air pressure, thereby preventing excessive floating of particles. Great care must be exercised in applying the silica dusts to prevent them from diffusing into parts of the home where they would be objectionable. Normally $\frac{1}{8}$ to $\frac{1}{4}$ pound of dust was required to treat each unit. During the test period the temperature averaged 79.9° F. and the relative humidity 78.7%.

The results are shown in table 2. SG-67 was the most effective of the three silica dusts, but it was less effective than 1% Diazinon after 9-10 days.

Although the silica dusts gave some control, they were not only less effective than the Diazinon dust, but gave far less satisfactory results than oil sprays of the currently recommended organophosphorus insecticides, as tested under similar conditions by Lofgren et al. (1957).

TABLE 2. CONTROL OF GERMAN COCKROACHES IN HOMES WITH DIAZINON OR SILICA DUSTS (2 OR 3 REPLICATIONS).

Material	Pretreatment count	Percent reduction after indicated days—							
		1	2	5-6	9-10	12-13	16-17	22-23	29-30
Diazinon (1%)	463	93	92	94	95	92	97	94	91*
SG-67	82	86	94	95	86	83	87	62	69
SG-68	150	29	0	24	1	0	0	0	0
Estersil-1	283	82	80	80	78	72	80	68	60

* 77% after 90 days.

SUMMARY

Based on the LD-50's in laboratory tests, the silica dusts CAB-O-SIL, SG-67, and SG-68 were more effective than Estersil-1 or Santocel-C against male German cockroaches, *Blattella germanica* (L.). At the LD-90 level SG-67 and SG-68 were superior to the others.

Combinations of 10% of SG-67 or SG-68 and 2% malathion in talc were more effective than 2% of malathion alone, but 10% of the silica dusts alone were ineffective.

The control of German cockroaches in homes ranged from 29% to zero percent for 30 days with SG-68, from 82% to 60% with Estersil-1, from 95% to 62% with SG-67, and from 95% to 91% with 1% Diazinon.

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