

Dichlorvos Vapors: Toxicity to Larvae of the Furniture Carpet Beetle^{1,2}

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An effective and safe vapor toxicant is needed for the control of fabric pests in containers and in enclosed areas where wool is stored. Such compounds as naphthalene and *p*-dichlorobenzene require tight containers and frequent replenishing; lindane and heptachlor are effective but have high mammalian toxicity. However, dichlorvos has been reported to have effective vapor action against many species of insects. We tested the vapor toxicity of dichlorvos to larvae of the furniture carpet beetle, *Anthrenus flavipes* LeConte, when the vapors were produced by 3 static dispensers.

MATERIALS AND METHODS.—Larvae of the furniture carpet beetle were reared in the laboratory on Botany-style woolen broadcloth enriched with brewer's yeast. The concentrations of dichlorvos vapors were provided by impregnated-wax sticks (Miles et al. 1962), resinous granules, and resinous cylinders (Shell Chemicals) suspended in wire baskets 1.83 m above the floor near the rear of 42.5 m³ closed chambers. A separate chamber was used in testing each method of dispensing the compound. Concentrations, which increased with time and then decreased, were monitored by chemical analysis⁴ of air samples removed from the geometric center of each chamber with a unit developed by the U.S. Public Health Service, DHEW, Savannah,

GA, and described by Harein et al. (1970). Air samples, 113.3 or 226.6 liters each, were removed from the chambers with a 1.83 m long by 9.5 mm OD stainless steel tube.

The larvae (2-3 months old) were exposed in 20-mesh Monel wire cages 6.35 cm long by 1.9 cm diam suspended in the area from which the gas samples were taken. Enough caged larvae were introduced into each chamber to permit removal of 4 samples of 10 insects each after 4, 24, and 32 h of exposure. Check insects were similarly introduced into an untreated 42.5-m³ chamber and held for 32 h. The chambers were maintained at 26.7±1°C and 75±5% RH. After exposure, larvae were transferred to clean petri dishes and placed in a room held at 26.7±1°C and 60±5% RH so we could observe subsequent mortality. An insect that did not move or responded only feebly when stimulated with a needle was recorded as moribund. No food was provided the larvae during the holding period, 0, 14 or 28 days.

RESULTS AND DISCUSSION.—The results indicated that concentrations of dichlorvos vapor lethal to furniture carpet beetle larvae could be maintained by any of the 3 methods (Table 1). The low concentrations produced by the impregnated wax sticks caused 100% mortality among the test insects after 32 h and 14 days of holding. The maximum concentration of dichlorvos during the 32-h exposure was 0.88 µg/l of air.

Vapor concentrations produced by the impregnated resinous granules and cylinders were higher than those produced by the wax sticks and more nearly equal to each other. The granules produced 100% mortality after a 24-h exposure and 28 days of holding. The maximum concentration recorded was 2.50 µg/l of air. Vapor concentrations

¹ Coleoptera: Dermestidae.

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⁴ Savannah method Pr 2e-61 adapted from Chemical method No. 7. U.S. Public Health Service, DHEW, Savannah, GA.

Table 1.—Toxicity of dichlorvos vapors to furniture carpet beetle larvae exposed in 42.5-m³ chambers; averages from 4 cages of 10 insects each.

Source of vapors	Exposure (h)	Concn µg/l	Percentages of dead (D) and dead + moribund (D+M) larvae after postexposure (days) of —					
			0		14		28	
			D	D+M	D	D+M	D	D+M
Wax stick	4	0.46	0	0	3	3	3	3
	24	.88	3	3	85	88	88	88
	32	.60	15	41	100	100	100	100
Resinous granules	4	2.12	0	3	31	31	48	48
	24	2.50	0	85	98	100	100	100
	32	2.26	31	100	100	100	100	100
Resinous cylinders	4	1.97	0	8	81	89	89	92
	24	3.32	11	97	100	100	100	100
	32	3.18	28	100	100	100	100	100
None (check)	32	—	0	0	0	0	0	0

from the resinous cylinders produced 100% mortality after 24 h exposure and 7 days of holding; the highest concentration during the period was 3.32 $\mu\text{g}/\text{l}$. No mortality occurred among untreated check larvae.

Only the impregnated wax sticks produced concentrations of dichlorvos of less than 1 $\mu\text{g}/\text{l}$ of air, the maximum allowable concentration tentatively established for human beings (Anon. 1968).

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