Insecticide Residues in Non-Target Areas of Rooms after Two Methods of Crack and Crevice Application[1,2]

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Few data are available in the literature on the movement of insecticides after indoor application for the control of household pests. Insecticide drift from a compressed air sprayer to the person applying the insecticide was reported by ROGERS ET AL. (1973). WRIGHT and JACKSON (1971) determined the diazinon, chlordane, and propoxur residues on saucers in kitchen cabinets when the cabinets were sprayed. Insecticide residues in different areas of apartments after spraying or thermal fogging were reported also (WRIGHT and JACKSON, 1974).

This paper compares the movement of insecticides to non-target areas following application with compressed air and aerosol-type sprayers.[3]

METHODS

Vacant dormitory rooms (5.4 x 3.5 x 7.9 m) were used in the experiment. All test rooms were separated by at least 1 nontest room. The typical college dormitory rooms contained 2 single beds with hinged tops opening to an enclosed storage area beneath, 2 3-drawer chests, 2 student desks with chairs, a sink, and 2 closets (1.9 x 1.1 x 7.9 m). Furniture was arranged in a similar pattern in all rooms, with the beds parallel and 76 cm apart at a right angle to one wall. The tops of the beds were raised and the top drawers of the dressers and desks were removed and placed on top of the dressers and desks, respectively, during treatment

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[2]Use of trade names in this publication does not imply endorsement of the products named or criticism of similar one not mentioned.

[3]Aerosol-type pressurized sprayer with a liquified-gas propellent system, supplied by the Whitmire Research Laboratories, Inc., Saint Louis, Missouri 63122.

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and then returned to original positions. Closet doors were opened ca. 46 cm, windows closed, shades drawn, and transoms above the hall doors sealed with masking tape prior to insecticide application. Temperature and humidity in 1 test room were recorded continuously during the experiment with a hygrothermograph.

Aluminum pie plates (22.9 cm diam) placed in the rooms prior to insecticide application, were used to evaluate post application residues. They were located in the test rooms as follows: 1 row of 6 centered between the beds, the initial plate positioned 91 cm from the wall, with each successive plate 2.5 cm from the lip of the preceding plate; and a second row of 6 suspended 168 cm from the floor. The initial plate was positioned 91 cm out from the center of the outside wall, with each successive plate 2.5 cm from the lip of the preceding plate toward the hall door.

Diazinon and chlorpyrifos were applied as emulsion or aerosol-type sprays at the recommended and twice the recommended concentration. Water was used to dilute chlorpyrifos (E 480 g/liter) to 0.5 and 1%, and diazinon (E 480 g/liter) to 1 and 2%, emulsions. A 3.785 liter B&G compressed air sprayer was used for spraying the emulsion.[4] Crevices in the rooms were sprayed using the medium, pinpoint, spray stream produced by a multeejet nozzle.[5] Pressure in the compressed air sprayer was maintained between 3.4 and 3.2 kg/cm^2 during spraying. Aerosol-type sprays containing diazinon (1 or 2%) or chlorpyrifos (0.5 or 1%), with a pressure of 2.1 to 2.5 kg/cm^2 at the orifice, were injected into cracks and crevices with an injection tube supplied. These sprays were applied at an application rate of 1 sec of spray for each 30.5 cm of crevice. The amounts of dilute insecticide applied per room and the time required to treat rooms by both techniques were recorded. Insecticides and application methods were randomly assigned to 3 replicated rooms. One plate was selected randomly from each site at the sampling intervals of 0, 0.2, 1, 2, 4, and 8 days after treatment. The top surface of each plate was rinsed thoroughly with hexane into a glass tube for subsequent laboratory analysis. Cracks around doors were sealed with masking tape immediately after removal of the 0 day plate. The masking tape was not replaced after removal of the 0.2-day plate. Rooms were not entered between plate removal periods. Dormitory rooms employed as checks were treated with water or the insecticide-gas

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[4]B and G (3.785 liter) compressed air sprayer, manufactured by B and G Equipment Company, Plumsteadville, Pennsylvania 18949.

[5]Multeejet nozzle, no. 1/8" T-5700, manufactured by Spraying Systems Company, Bellwood, Illinois 60104.

formulation minus the insecticide by the procedures given above. There were 2 replicates.

Residues were analyzed by flame photometric gas chromatography described in a previous paper (WRIGHT and JACKSON, 1971).

Aluminum pie plates for recovery studies were prepared by pipetting diazinon or chlorpyrifos onto the plates. The solvent was evaporated and the plates were analyzed in the same manner as plates from the rooms. Recoveries with this technique averaged 89 and 100% for diazinon and chlorpyrifos, respectively.

A completely randomized analysis of variance was performed to determine significant insecticidal residues at the 1% level.[6]

RESULTS AND DISCUSSION

The temperature and relative humidity in 1 test room was 23±2°C and 50±5%, respectively, during the experiment. Total insecticide application times per room with the aerosol-type and compressed air sprayer were 6.8 min (range, 6.1 to 8.1 min) and 3.6 min (range, 3.1 to 5.0 min), respectively. The actual insecticide application time with the aerosol-type method was 1.6 min (range, 1.5 to 1.7 min), with the remainder of the 6.8 min used to locate and move to untreated crevices.

The amount of aerosol-type spray applied, determined by differences in weights of the cans before and after treatments, was 13.3 to 33.3 g, with a mean of 21.0 g. Dilute insecticide emulsion applied with the compressed air sprayer varied from 85 to 140 ml per room with a mean of 115 ml.

Table 1 shows that only 16% and 22% as much technical diazinon and chlorpyrifos, respectively, were applied by the aerosol-type sprayer as by the compressed air sprayer.

There were less insecticide residues at all time intervals (Tables 2 and 3) on the plates from the rooms treated with the aerosol-type spray. Virtually no insecticide was present on any plates removed after 0.2 days with the aerosol-type spray, while compressed air sprayer residues remained through the test period. The smaller residue obtained from the aerosol-type spray method hypothetically occurs because of a difference in formulation evaporation rates and application technique. (The aerosol spray was applied directly into the cracks and crevices, whereas the compressed air spray was directed at the cracks and crevices with part of the insecticide entering them and a portion deflecting into the atmosphere.)

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[6]Thanks are due to L. A. Nelson, Professor, Experimental Statistics, North Carolina State University, Raleigh, who made the statistical analysis.

TABLE 1

Amounts of technical insecticide applied per room.

Insecticide	Concentration (%)	Aerosol-type sprayer[a] (mg)	Compressed air sprayer[a] (mg)
Diazinon	1	178 (133-255)	1046 (796-1218)
	2	346 (334-357)	2248 (1874-2623)
Chlorpyrifos	0.5	112 (98-122)	565 (499-598)
	1.0	266 (230-333)	1163 (897-1396)

[a]Mean values are averages of 3 replicates, range in parentheses.

Plates in rooms treated with 2X insecticide concentrations contained more insecticide than those in rooms treated with 1X concentrations. Floor-positioned plates in rooms treated with chlorpyrifos contained more insecticide than ceiling-suspended plates. Insecticide residues did not differ by plate position in the diazinon treated rooms. Additional replicates may have shown significant residues on floor-positioned plates.

Chlorpyrifos and diazinon residues usually decreased at successive sampling times after application (Tables 2 and 3). Some increases observed were probably due to high insecticide residue on one plate in a replicate. The reason for the high residue is unknown.

All check plates for the chlorpyrifos treatments contained <0.15 µg/plate, the lowest detectable level. Check plates in 2 rooms at 1 day and 1 room at 2 days showed diazinon residues (Table 2). The cause for these low positive values is unknown.

The study showed significantly less movement of insecticides to non-target areas with the aerosol-type sprayer than with the compressed air sprayer.

REFERENCES

1. ROGERS, R. ET AL: Pest Control, 41, 24 (1973).
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TABLE 2

Amount of diazinon (μg/sample) present in non-target areas of dormitory rooms after crack and crevice treatment.[a,b]

	Aerosol-type sprayer						Compressed air sprayer					
	1.0%		2.0%		Check		1.0%		2.0%		Check	
Day	F[c]	C[d]	F[c]	C[d]	F[c]	C[d]	F[c]	C[d]	F[c]	C[d]	F[c]	C[d]
0	0.44	0.28	0.40	0.41	<0.10	<0.10	2.18	1.54	6.59	4.48	<0.10	<0.10
0.2	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	0.55	0.28	1.38	0.46	<0.10	<0.10
1	<0.10	<0.10	0.12	<0.10	0.30	0.10	0.51	0.27	0.38	0.69	0.52	0.15
2	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	0.45	0.22	0.54	0.27	<0.10	<0.10
4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.24	0.14	0.50	0.28	<0.10	<0.10
8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.47	0.11	0.37	0.14	<0.10	<0.10

[a]The check contained 2 replications. All other treatments had 3 replications.

[b]Significantly more diazinon on plates in rooms treated with the compressed air sprayer, at the higher concentration for each application method, and at the earlier time intervals.

[c]Plates positioned on the floor.

[d]Plates suspended from the ceiling.

TABLE 3

Amount of chlorpyrifos (µg/sample) present in non-target areas of dormitory rooms after crack and crevice treatment.[a,b]

	Aerosol-type sprayer				Compressed air sprayer			
	0.5%		1.0%		0.5%		1.0%	
Day	F[c]	C[d]	F[c]	C[d]	F[c]	C[d]	F[c]	C[d]
0	0.23	0.20	0.51	0.41	0.96	1.41	4.61	1.07
0.2	<0.15	<0.15	0.30	0.32	1.43	1.10	2.82	2.07
1	<0.15	<0.15	<0.15	<0.15	0.25	0.24	0.49	0.31
2	<0.15	<0.15	<0.15	<0.15	0.19	0.16	0.59	0.27
4	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.27	0.21
8	<0.15	<0.15	<0.15	<0.15	0.19	0.16	0.30	0.21

[a]The check contained 2 replications. All other treatments had 3 replications. All check plates contained <0.15 µg/sample.

[b]Significantly more chlorpyrifos on plates in rooms treated with the compressed air sprayer, at the higher concentration, in the floor positions, and at the earlier time intervals.

[c]Plates positioned on the floor.

[d]Plates suspended from the ceiling.