Contact Toxicity of Lindane, Landrin, and Gardona to the Mountain Pine Beetle[1,2]

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The mountain pine beetle, *Dendroctonus ponderosae* Hopkins, is the most aggressive and destructive insect enemy of ponderosa pine in the Rocky Mountain region (Keen 1952). One of the chemicals widely used for control of this insect has been lindane. Because of the recent restrictions placed on use of some chlorinated hydrocarbons, we thought it useful to compare the contact toxicity to the beetle of chemicals representing other insecticide classes. The carbamate Landrin® (3,4,5-trimethylphenyl methylcarbamate, 75%; 2,3,5-trimethylphenyl methylcarbamate, 18%) and the organophosphate Gardona® (2-chloro-1-(2,4,5-trichlorophenyl) vinyl dimethyl phosphate), were compared with lindane in topical-application tests.

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Table 1.—Percent mortality of mountain pine beetles treated with lindane, Gardona, and Landrin.[a]

Hr elapsed	Chemical	Amount applied per beetle in μg						
		1.2	0.6	0.3	0.12	0.06	0.024	Control
24	Lindane	83.2	59.9	33.1	26.4	13.0	0	
	Gardona	93.3	76.5	26.4	13.0	9.7	0	
	Landrin	33.1	33.1	13.0	0	26.4	0.3	0.3
48	Lindane	100.0	81.0	62.0	54.5	58.3	12.8	
	Gardona	100.0	92.4	39.3	16.6	9.1	16.6	
	Landrin	58.3	46.9	35.6	12.8	46.9	12.8	12.0
72	Lindane	100.0	100.0	95.1	76.1	66.6	19.0	
	Gardona	100.0	100.0	80.8	47.6	19.0	14.3	
	Landrin	95.1	61.8	57.1	57.1	61.8	42.9	30.0

[a] Mortality corrected using Abbott's formula.

MATERIALS AND METHODS.—Test beetles were obtained from naturally infested ponderosa pine trees near Ft. Collins, Colo. A sufficient number of 24- to 30-in. bolts were cut, transported to the laboratory, and placed in cyclindrical screened cages (Germain and Wygant 1967) for natural emergence to occur. Beetles of both sexes were used indiscriminately and were held under refrigeration for a short time prior to use in the tests.

Chemical application was accomplished by using a microapplicator with a 0.25-cc syringe and a 45°-angle, no. 0.26 needle. After calibrating the applicator, the 3 chemicals were diluted in acetone to concentrations of 100, 50, 25, 10, 5, and 2 ppm. Approximately 12 μliters of each dilution were applied to the ventral surface of the beetle's abdomen so that the actual amount of chemical applied per beetle was 1.2, 0.6, 0.3, 0.12, 0.06, and 0.024 μg, respectively, for each of the previously mentioned concentrations. Each drop was allowed to dry before the next was applied. The beetles were then placed in petri dishes containing moist filter paper and held at laboratory temperature.

Each dilution was replicated 3 times using 10 beetles/trial. The controls also consisted of 10 beetles/dish, but were treated with 12 μliters of acetone alone. Nine observations (6, 12, 24, 30, 36, 48, 54, 60, and 72 hr) were made after treatment.

RESULTS.—Table 1 shows that after 24 hr 1.2 μg of lindane and Gardona had killed 83.2 and 93.3% of the beetles, respectively, while Landrin caused only 33.1% mortality.

After 48 hr 100, 100, and 58.3% mortality had occurred with 1.2 μg of lindane, Gardona, and Landrin, respectively. At 24 and 48 hr Gardona gave better control than lindane at 1.2 and 0.6 μg, respectively; however at 0.3 μg and lower amounts lindane had a higher percentage of mortality. Fluctuations in mortality around 0.06 μg may have been due to preweakened beetles, the weakening caused by holding beetles too long prior to use.

Table 1 shows percent beetle mortality for each of the chemicals. Mortality was adjusted using Abbott's (1925) formula. The controls displayed 0.3, 12, and 30% mortality at 1, 2, and 3 days, respectively.

The general results of the experiment showed that lindane was most toxic to the mountain pine beetle, followed by Gardona and then Landrin.

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REFERENCES CITED

Abbott, W. S. 1925. A method of computing the effectiveness of an insecticide. J. Econ. Entomol. 18: 265–7.

Germain, C. J., and N. D. Wygant. 1967. A cylindrical screen cage for rearing bark beetles. U.S. Forest Serv. Res. Note RM 87. 4 p.

Keen, F. P. 1952. Insect enemies of western forests. USDA Misc. Publ. 273. 205 p.

Survival of Corn Rootworm[1] Larvae Under Minimum Tillage Conditions[2]

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Eggs of corn rootworms, *Diabrotica* spp., are found in the fall concentrated in the soil near the base of the corn plant. This is true for both the northern corn rootworm, *D. longicornis* (Say) (Chiang et al. 1969), and the western corn rootworm, *D. virgifera* LeConte (Kirk et al. 1968). After common tillage practices of plowing and discing, the eggs are dispersed both vertically and horizontally (Pruess et al. 1968, Chiang et al. 1969). Thus wherever the rows of the current year are situated in relation to the preceding year's rows, they are equally accessible to the larvae.

Under the minimum tillage practice which is followed by some growers in some areas, the eggs would remain concentrated at the site where they were deposited. The concentration of larvae around the corn roots was shown by Sechriest (1969) and Short (1970). While it has been shown that larvae can move up to 40 in. toward a food source (Short and Luedtke 1970, Suttle et al. 1967) it is conceivable that larval survival might be affected by the distance between the insect and the food source. Thus under the minimum tillage practice, larval survival may be affected by the location of current year's rows (food source) in relation to preceding year's rows (egg concentration). A study on this aspect was conducted at the Southwest Experiment Station, University of Minnesota at Lamberton in 1968–70.

METHODS AND MATERIALS.—A field which had been

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