Table 1.—The number of weeks of horn fly control and estimated daily doses of insecticide resulting from use of dust-charged backrubbers.

Material	Herd Number	Date Each Treatment Initiated	Weeks of Control[a]	Estimated Daily Dosage per Cow (oz. of 5% dust)
Methoxychlor 5% Dust	1	8/13	3	—
	1	9/10	5	0.02
	2	9/10	5	.03
	3	7/11	4	—
Rotenone 5% Dust	4	7/10	7	—
	4	9/2	6	.01
	3	8/13	7	.03
Malathion 4% Dust	5	7/16	1	—
Delphene 25% Dust	1	7/11	1	—

[a] An average of 10 or less flies per animal in a 10-cow sample was considered satisfactory control.

7 weeks. Methoxychlor dust gave an average of 4.2 weeks of control with a range of 3 to 5 weeks. Malathion and Delphene each gave 1 week of satisfactory fly control. Weekly averages as low as 0 to 5 flies per cow were observed during the course of each treatment lasting longer than a single week.

Estimates of the daily dosages of rotenone and methoxychlor appear in table 1. The rates of discharge for the four devices varied from 0.01 to 0.03 ounces per day, the average being 0.022.

The current recommendation for the use of rotenone for grub- and louse-control is 3 ounces of 5% dust per animal, applied from one to three times every 30 days (Entomology Research Division 1959). Jacobson and coworkers (1959), using ultraviolet spectrophotometric and paper chromatographic techniques with a sensitivity of 0.04 and 0.006 p.p.m., found no rotenone residue in milk of a cow treated with five times the normal dosage of rotenone for grub control. In view of this fact, there is not likely to be any residue problem when rotenone is applied by the dairy backrubber at the approximate rate of 0.90 ounces of 5% dust per cow every 30 days.

Methoxychlor 50% dust applied at the rate of 1 tablespoon per cow every 3 weeks is recommended for the control of horn flies on dairy cattle (Entomology Research Division 1959), an amount approximating 0.15 ounces of actual toxicant per animal. Five per cent methoxychlor dust, when applied by the dust-charged backrubber, resulted in a dosage of as much as 0.03 ounces of actual methoxychlor per animal over a period of 21 days. Though this dosage is considerably less than the recommended application rate, additional research should be conducted to determine the extent of the residue hazard in milk associated with daily exposure of cows to extremely low dosages of methoxychlor.

References Cited

Entomology Research Division. 1959. Insecticide recommendations for the control of insects attacking crops and livestock. 1959 season. U. S. Dept. Agric. Handb. 121, 129 pp. (p. 118).

Hargett, L. T., and E. C. Turner, Jr. 1958. Horn fly control by the use of insecticidal dusts in self-applicating devices. Jour. Econ. Ent. 51(6): 795–8.

Jacobson, M., J. Hornstein, and R. T. Murphy. 1959. The analysis of milk for rotenoids. Jour. Assoc. Offic. Agric. Chemists 42: 174–6.

Chemical Control of *Tetranychus marianae* McG. on Tomatoes in the Lower Rio Grande Valley[1]

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Tetranychus marianae McG. has become a very important pest of tomatoes in the Lower Rio Grande Valley of Texas. This mite was first reported there in May 1956 by Wene (1956). Since that time the mite has appeared each year in destructive numbers. Commonly recommended insecticides such as malathion and parathion have failed to give adequate control (Wene 1957, 1958). Demeton at 0.25 pound per acre gave good control (Wene 1957), but it cannot be recommended under the provisions of Public Law 518. Adequate control of *T. marianae* on tomatoes was obtained with full coverage sprays of Trithion® (*S*-(*p*-chlorophenylthio)methyl *O,O*-diethyl phosphorodithioate), Chlorobenzilate® (ethyl 4,4!-dichlorobenzilate), and Diazinon® (*O,O*-diethyl *O*-(2-isopropyl-4-methyl-6-pyrimidinyl) phosphorothioate) (Wene 1957, 1958).

Approximately only 20% of the tomato growers in the Lower Rio Grande Valley are equipped for high-volume spraying. Also, airplane applications are necessary during irrigation and after tomato plants begin to overlap in the row middles. As a result, growers have had to use several applications of available dusts against these mites, and the results have not been adequate. Consequently, a highly effective acaracidal dust is needed in the Lower Rio Grande Valley to combat the mite effectively.

Investigations during 1958 involved evaluation of newer acaracides and further evaluation of materials that had given some degree of control the previous year (Wene 1958). Results of these investigations are herein reported.

Materials and Methods.—Dust formulations of malathion, Diazinon, ethion, Kelthane® (1,1-bis(*p*-chlorophenyl)-2,2,2-trichloroethanol), Trithion, and Chlorobenzilate and emulsifiable concentrates of Trithion, ethion, and demeton were used in this investigation. Dusts were applied with a single-nozzle rotary hand duster at the rate of 30 pounds per acre. The emulsifiable concentrates, diluted with water, were applied with a tractor-powered sprayer, having three hollow cone nozzles per row, at the rate of 15 gallons per acre. Applications were made in the early morning or in the evening when the air was calm.

In each test, selected materials were included in a randomized block design with three replications. Plot sizes in the tests were approximately 1/25 acre in the dust tests and $\frac{1}{3}$ acre in the spray test. The first experiment was conducted when tomato plants were 15 to 18 inches tall. Subsequent tests were conducted when tomato plants were mature.

Pretreatment infestation counts and subsequent counts were made by selecting 20 leaflets per plot (10 from each of the two middle rows), brushing the mites from the leaflets with a mite-brushing machine which was developed by Henderson & McBurnie (1943) and trapping them in a 12% aqueous solution of a nonionic alkonolamine condensate (Emcol 5100). A portion of each plate was counted under a binocular microscope with a geometric counting disk (Morgan *et al.* 1955). Percentages of control were calculated by Abbott's formula based on the per cent alive.

The only appreciable amount of precipitation (3.5 inches) occurred on June 27 (third day of test 3). Smaller amounts of rain (light showers of less than 0.1 inch) fell on June 23 (fifth day of test 2) and July 7 (sixth day of test 4 and fifth day of test 5). The daily maximum temperature ranged from 85° to 100° F.

Results.—The results of these tests are presented in table 1. In the first test, demeton, ethion, and Trithion applied as low-volume sprays did not reduce mite populations below damaging

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Table 1.—Control of *Tetranychus marianae* on tomatoes, 1958.

TREATMENT	DOSAGE (LB./A.)	INITIAL INFESTATION	MITES PER LEAF (A) AND PER CENT CONTROL (B) ON DAYS SHOWN AFTER TREATMENT					
			Experiment 1—Spray (April 9)					
			5 days		12 days		20 days	
			A	B	A	B	A	B
Ethion	0.5	22.8	23.7	28.7	21.3	71.4	43.8	45.2
	1.0	39.7	37.2	37.4	18.6	81.3	23.6	78.8
Trithion	.5	33.0	28.1	41.9	13.7	86.3	36.4	64.9
	1.0	31.4	27.9	51.8	11.4	89.4	27.3	74.8
Demeton	.25	40.9	33.8	41.5	15.0	90.5	17.4	86.8
Check	—	14.3	25.3	—	47.2	—	65.6	—
			Experiment 2—Dust (June 17)					
			1 day		5 days		7 days	
			A	B	A	B	A	B
Trithion 2	0.6	137.5	54.3	76.2	18.4	95.8	8.8	97.3
Ethion 4	1.2	172.5	48.3	82.3	7.2	97.9	3.2	97.4
Chlorobenzilate 3	.9	112.8	54.9	70.2	34.3	89.1	48.8	64.7
Diazinon 2	.6	106.7	29.2	81.8	68.4	71.3	87.9	51.8
Check	—	91.9	153.1	—	274.0	—	143.1	—
			Experiment 3—Dust (June 24)					
			1 day		6 days			
			A	B	A	B		
Diazinon 1	0.3	152.9	52.5	81.5	40.3	75.2		
Diazinon 2	.6	165.2	36.9	82.2	11.6	95.0		
Kelthane 2.2	.7	177.1	117.1	63.6	12.8	92.3		
Chlorobenzilate 3	.9	159.1	86.3	66.8	28.0	85.3		
Check	—	93.5	163.7	—	96.3	—		
			Experiment 4—Dust (July 1)					
			1 day		3 days		7 days	
			A	B	A	B	A	B
Kelthane 2.2	0.7	70.1	34.0	32.7	29.9	73.9	8.3	74.0
Ethion 4	1.2	87.5	22.1	64.7	4.4	96.9	0.3	99.4
Trithion 2	.6	62.0	32.3	30.1	5.7	93.2	1.5	93.1
Check		64.8	45.5	—	130.7	—	55.7	—
			Experiment 5—Dust (July 2)					
			1 day		5 days		7 days	
			A	B	A	B	A	B
Malathion 5	1.5	19.6	2.7	91.0	23.9	64.9	31.9	46.7
Kelthane 2.2	.7	50.3	14.5	78.3	29.7	77.0	2.1	97.2
Diazinon 2	.6	32.4	1.6	93.9	29.5	44.7	15.7	50.7
Ethion 4	1.2	33.9	2.3	93.6	2.2	97.9	0.3	99.6
Check		25.3	33.5	—	98.2	—	74.5	—

cvels, even though each treatment controlled some mites for as ong as 20 days. These results indicated that low volume sprays did not give sufficient coverage for economic control.

Malathion, Diazinon, and Chlorobenzilate were effective in reducing mite populations, but they had poor residual effect. Ethion, Trithion, and Kelthane applied as dusts continued to reduce mite populations for 7 days, indicating residual effect. Ethion and Trithion were superior in this respect.

REFERENCES CITED

Henderson, C. F., and H. V. McBurnie. 1943. Sampling techniques for determining populations of the citrus red mite and its predators. U. S. Dept. Agric. Circ. 671.

Morgan, C. V., D. A. Chant, N. H. Anderson, and G. L. Ayre. 1955. Method for estimating orchard mite populations, especially with the mite brushing machine. The Canadian Ent. 87(5): 189–99.

Wene, George P. 1956. *Tetranychus marianae* McG. a new pest of tomatoes. Jour. Econ. Ent. 49(6): 712.

Wene, George P. 1957. Commercial control of the tropical mite on tomatoes and the two-spotted spider mite on strawberries. Rio Grande Valley Hort. Soc. Jour. 11: 108–9.

Wene, George P. 1958. Notes on the control of the tropical mite attacking tomatoes. Rio Grande Valley Hort. Soc. Jour. 12: 99–101.

Number of Fall Generations of *Oencyrtus kuwanae* (How.) in Gypsy Moth Eggs

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Oencyrtus kuwanae (How.) has been considered an effective egg parasite of the gypsy moth, *Porthetria dispar* (L.), because of the multiple generations that it can produce in the late summer and early fall. Crossman (1925) stated that probably four genera-

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