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MALATHION, NALED, FENTHION, AND BAYER 39007 THERMAL FOGS FOR CONTROL OF THE STABLE FLY (DOG FLY), *STOMOXYS CALCITRANS* (DIPTERA: MUSCIDAE)

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The stable fly, *Stomoxys calcitrans* (L.), or dog fly, as it is commonly called in northwest Florida, has been a serious nuisance in that area for many years. Blakeslee (1945) found that DDT gave effective control when it was applied as a residual spray to larval breeding areas in marine grass deposits. However, in recent years this method has not provided the degree of control necessary. As a result, large numbers of adult flies have at times seriously affected the tourist industry of northwest Florida. On the basis of our work, and that of others, with thermal fogs for mosquito control, we felt that this method might be used effectively for rapid elimination or reduction of adult stable fly populations. As a preliminary step to evaluating this method, we determined the toxicity of a large number of insecticides to stable flies in laboratory tests. From these we selected four chemicals for thermal fog tests in the field with caged stable flies: malathion, fenthion, naled, and Bayer 39007 (*o*-isopropoxyphenyl methylcarbamate). This paper presents the results of our laboratory and field tests with these compounds.

METHODS AND MATERIALS

The strain of stable flies used was established from larvae collected at a livestock farm near Panama City, Florida, and reared in our laboratory for more than a year.

In the laboratory tests, 3-7 day old adult stable flies were used. We confined 25 females or 25 males in a cylindrical screen cage, and exposed them to contact sprays in a wind tunnel 16-18 hours after they had been fed citrated beef blood. One cage of males and one of females were used per test, and three to six tests were conducted at each concentration. The sprays were kerosene solutions of various concentrations of each insecticide (selected to provide adequate dosage-mortality curves) atomized at a pressure of 1 psi and drawn through the wind tunnel at a speed of 4 mph. Knockdown counts were made 1 hour after exposure; mortality was determined after 24 hours.

In the field tests, 3-7 day old unsexed adult stable flies were used. We confined 25 flies in a 16-mesh screen wire cage and exposed them to fogs 16-18 hours after they had fed on blood. The cages (4/test) were hung 5 feet above ground on stakes placed in two rows 125 feet apart and 125 and 250 feet downwind from the line of passage of the fogging vehicle. The flies were protected from high temperatures after removal to the field (except during fogging) by holding them in insulated chests containing cans of ice. One to two hours after each series of tests the flies were returned to the laboratory and transferred to clean screen cages in a cold room (34°F) and provided 10% honey solution absorbed on cotton pads.

TABLE 1. KNOCKDOWN AND MORTALITY OF ADULT STABLE FLIES EXPOSED TO CONTACT SPRAYS OF INSECTICIDES IN A WIND TUNNEL SPRAYER (AVERAGE OF 3-6 TESTS, 25 MALES AND 25 FEMALES PER TEST).

	Percent knockdown in 1 hour at indicated concentration (%)							Percent mortality in 24 hours at indicated concentration (%)							LC_{50}	LC_{90}
Insecticide	0.5	0.25	0.1	0.05	0.025	0.01	0.005	0.5	0.25	0.1	0.05	0.025	0.01	0.005	(%)	(%)
Bayer 39007					99	95	65					100	87	53	0.005	0.01
Naled					99	90	52					100	90	55	.005	.01
Fenthion			8	1	1	0				100	99	87	37		.013	.03
Malathion	96	70	31	3				99	94	63	23				.094	.23

Knockdown counts were made 3 hours after exposure to the fogs, and mortality counts were made after 24 hours.

The fogs were applied between 9 AM and 4 PM with a Leco 120 [1] fog generator at an air field near Gainesville, Florida. The generator was calibrated to deliver 40 gallons of liquid per hour and was operated at a temperature of 850° F. Air temperatures ranged from 88 to 100° F, and averaged about 94° F. Wind speeds ranged from 2 to 12 mph and averaged about 5 mph. The vehicle was driven at a speed of 5 mph over a sufficient distance to insure that the wind carried the fog past all the cages.

Technical malathion and 14- and 8-pounds-per-gallon oil soluble concentrates of naled and fenthion, respectively, were formulated in a fog oil (molecular weight 300, specific gravity 0.92, and aniline point 145° F). For satisfactory formulation of a 1.5 pound spray concentrate of Bayer 39007, we found it necessary to add a co-solvent, heavy aromatic naphtha, at a concentration 2½ times that of the insecticide, and a sludge inhibitor (a mixed amide amine oleate from modified fatty acids and polyamines). The Bayer 39007 settled out of the formulation after about 1 hour but was easily resuspended or redissolved by proper agitation. Fog oil without insecticide was used as a check. Three or more tests were conducted with each concentration of insecticide.

Results

Table 1 presents the results of the laboratory contact spray tests. We averaged the results obtained with male and female stable flies since there were no substantial differences between the susceptibility of the sexes to the four insecticides. Naled and Bayer 39007 were the most effective compounds, with LC_{50}'s of 0.005%. Both of these insecticides gave 1-hour knockdown counts that were about equal to or slightly better than their 24-hour mortality counts. Fenthion was the next most toxic insecticide (LC_{50} of 0.013%), but produced little or no 1-hour knockdown. Malathion was the least effective, with an LC_{50} of 0.094%.

Table 2 gives the results of the field tests with the thermal fogs. Bayer 39007 was the outstanding insecticide. At concentrations of 1-4%, it caused 87-100% knockdown within 3 hours and 86-98% kill in 24 hours. The heavy aromatic naphtha solvent used with this compound may have contributed to the actual effectiveness of the compound by increasing the toxicity of the formulation or the penetration through the screen wire cages. Naled was the next most effective insecticide. It also produced a high degree of knockdown in 3 hours and killed almost as many flies in 24 hours as Bayer 39007 at concentrations of 2-4% though it was less effective than Bayer 39007 at 1%. Fenthion caused very little knockdown in 3 hours; it killed 86% of the flies in 24 hours at a concentration of 4% but only 46-58% at concentrations of 1% to 2%. Malathion caused little mortality at concentrations as high as 12% and probably would be of little value in fogs for the control of stable flies.

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[1] Mention of a trade name does not necessarily imply endorsement of this product by the U.S.D.A.

TABLE 2.—KNOCKDOWN AND MORTALITY OF CAGED STABLE FLIES AFTER EXPOSURE TO THERMAL FOGS OF MALATHION, NALED, FENTHION, AND BAYER 39007 (AVERAGE OF THREE OR MORE TESTS OF DUPLICATE CAGES, EACH CONTAINING 25 FLIES).

Insecticide	Concentration (%)	Percent knockdown in 3 hours			Percent mortality in 24 hours		
		125 ft	250 ft	Average	125 ft	250 ft	Average
Bayer 39007	4	100	100	100	100	96	98
	2	100	83	92	99	77	88
	1	99	75	87	99	73	86
Naled	4	100	90	95	100	88	94
	2	100	63	82	100	67	84
	1	61	23	42	63	31	47
Fenthion	4	13	7	10	92	80	86
	2	10	6	8	75	41	58
	1	12	8	10	56	36	46
Malathion	12	19	3	11	35	20	28
	8	11	2	7	23	14	19
	4	7	11	9	21	13	17
Check (fog oil)	—	—	—	4	—	—	11

DISCUSSION AND CONCLUSIONS

We recognize that in tests with caged insects the screen cage may interfere with passage of the particles of insecticide. However, we think that our technique was adequate to show the relative effectiveness of the insecticides. Note that these tests were conducted under daytime conditions when variable winds and thermal convection currents caused the fog to drift erratically. The effectiveness of the insecticides might be increased by application in the evening when environmental conditions are more ideal for fogging; however, stable flies are most active during the daytime, and we wanted to conduct the tests under conditions occurring then. The results definitely showed that Bayer 39007, naled, and possibly fenthion are promising insecticides for use in thermal fogs to control natural populations of stable flies, but fairly high concentrations were required. Cost of the chemicals will therefore be a determining factor in their practical use. Our results, both in the laboratory and field tests, appeared to eliminate malathion as a potential insecticide for control of adult stable flies.

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SUMMARY

Baygon (Bayer 39007; *o*-isopropoxyphenyl methylcarbamate) was the most effective of four insecticides evaluated as contact sprays in the laboratory and as thermal fogs in the field against caged stable flies [*Stomoxys calcitrans* (L.)]. As a thermal fog, Baygon caused 86% mortality at concentrations as low as 1%. Naled was the next most effective compound with an average mortality of 84% at a contration of 2%. Fenthion produced more than 80% mortality only when fogged at a 4% concentration. Malathion gave very low mortality at concentrations as high as 12%. In laboratory tests, Baygon, naled, fenthion, and malathion had LC_{50}'s of 0.005%, 0.005%, 0.013%, and 0.094%, respectively.

LITERATURE CITED

Blakeslee, E. B. 1945. DDT surface sprays for control of stable flies breeding in shore deposits of marine grass. J. Econ. Ent. 38: 548-52.

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