FIELD EVALUATION OF SEVERAL CHEMICALS AGAINST EAR-FEEDING BLACK FLY[1] PESTS OF HORSES IN VIRGINIA

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ABSTRACT. Vaseline® petroleum jelly formulations of selected insecticides: stirofos (2% A.I.); malathion (2%, 5% A.I.); crotoxyphos (5% A.I.) and methoxychlor (10% A.I.) were evaluated with a Vaseline® standard for protection of horses against ear-feeding black flies. Two wipe-on oil formulations: stirofos (1% A.I.) and Swish® Starbar Fly Repellent were compared to a refined hydrocarbon standard.

Vaseline,® applied at the rate of 5 gm per ear, afforded up to 3 days protection to the ears. The addition of selected insecticides did not enhance the protection of petroleum jelly. The oil formulations provided 2 days protection.

Horse owners in Montgomery County, Virginia have long reported severe scabbing in the ears of pastured animals. The resulting discomfort makes the horses irritable and head-shy, occasionally creating a hazardous situation when they are handled. Riders are forced to contend with nervous horses in addition to the distraction of these gnats swarming around their own faces and ears. Collections from these sites contained predominantly female *Simulium vittatum* Zetterstedt and occasional specimens of *S.* (*Phosterodoros*) prob. *jenningsi* Malloch.

S. vittatum, a multivoltine species, occurs in North America from Mexico to the Arctic (Nicholson and Mickel 1950). Females take blood meals from large animals, preferring to feed on the inner surface of the ear (Stone and Snoddy 1969). Large populations of this pest adversely affect livestock. Knowlton and Rowe (1934) cited observations of more than

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200 *S. vittatum* females per ear in collections from horses in Utah. Farming operations in the Tennessee River basin have been disrupted by black flies, particularly *S. vittatum*. In this case, farmers resorted to putting grease in the ears of work animals and tying leafy branches to bridles in an effort to protect them from attack (Snow et al. 1958).

Mechanization of agriculture has greatly reduced the use of draft animals. However, the number of horses and ponies in the U.S. is increasing because of their popularity as a leisure time activity. Owners, operating for pleasure or profit, thus are confronted with the attendant livestock pests. The increased use of horses as pets has created a demand for more effective protectants and repellents.

Conversations with owners in Virginia have indicated that the oil base wipe-on fly repellents recommended for horses (Anon. 1974) do not provide durable protection for the ears. Also, the frequent treatments require excessive expenditures of labor and time at rental stables. Many owners of horses indicated distress at the bloody appearance of the ears, but could care for their animals only on a limited basis. They were frequently unable to make sufficient applications of protectants.

Several Virginia horse owners used Vaseline ® petroleum jelly (Cheseborough Ponds, Inc., New York, New York) specifically against these ear-feeding pests and were satisfied with its performance. Therefore petroleum jelly formulations of selected insecticides have been prepared and evaluated to determine if the duration of protection could be extended beyond that offered by Vaseline ® alone.

MATERIALS AND METHODS

HORSES AND EXPERIMENTAL DESIGN. Efficacy trials of selected ear protectants were conducted during the summer of 1974 at 4 locations near Radford, Virginia. Test sites were adjacent to the New River, where livestock were subjected to black fly attack. Various breeds of horses and ponies belonging to private cooperators were used. All animals were at least 2 years old and pastured continuously.

Applications were assigned randomly at the sites. Each horse served as a replicate: one ear received the test material and the other received the standard. Untreated animals in each pasture were used to monitor daily fluctuations in black fly feeding activity. Two trials of each of the three experiments were conducted. It was not possible to transfer horses between pastures to improve experimental design.

MATERIALS USED AND APPLICATION PROCEDURES. Smear-on formulations with the exception of 2 percent stirofos (2-chloro-1-(2,4,5-trichlorophenyl) vinyl dimethyl phosphate (Shell Chemical Co., New York, New York) were prepared in the laboratory. Vaseline ® petroleum jelly was melted in an 85° C water bath and sufficient insecticide was added to obtain the desired weight-percent dosage in 200 gram lots. Methoxychlor was dissolved in Risella ® oil prior to incorporation into Vaseline ® for the 10 percent dosage.

Starbar Swish ® Fly Repellent (Thuron Industries, Dallas, Texas) containing 0.10 percent pyrethrins, 0.20 percent technical piperonyl butoxide, 0.33 percent n-octyl bicycloheptene dicarboximide, 35 percent butoxypolyropylene glycol, and 64.37 percent hydrocarbons and an experimental 1 percent stirofos oil wipe-on formulation were evaluated as representative of this type of preparation.

Nine materials were evaluated in 3 tests: Experiment A—malathion smear (2 percent A.I.), stirofos smear (2 percent A.I.), Vaseline ® standard; Experiment B—stirofos wipe (1 percent A.I.), Swish ® wipe, BPRL–7053–1 standard; Experiment C—crotoxyphos smear (5 percent A.I.), malathion smear (5 percent A.I.), methoxychlor smear (10 percent A.I.) and Vaseline ® standard.

Vaseline ® served as the standard for comparison of smears. A refined hydrocarbon (BPRL–7053–1, Exxon Chemical Co., Baytown, Texas) was used as the standard for oil wipes.

Vaseline® compounds were applied using cotton swabs. The inner ear surface was coated evenly with the formulation. By weighing the applicators, it was determined that approximately 3 gm of the material was dispensed per ear in Experiment A and 5 gm per ear in Experiment C.

Oil wipe-ons were poured on cheesecloth swabs. The swab was first primed with 6 ml, then 2 ml were added before each treatment. One ear received the standard compound; the other received the material to be evaluated.

ASSESSMENT OF BLACK FLY POPULATIONS. Black flies feeding in each ear were counted prior to treatment and at 24-hour intervals until termination of the test. Results of the 2 replicates of each experiment were combined and analyzed using the techniques of analysis of variance and Tukey's w-procedure (Sokal and Rohlf, 1969). Means for the groups were compared with an untreated control to determine the duration of protection. The protective period was considered to end when the mean for a group was not significantly different ($P<0.05$) from the control mean for that time period.

RESULTS AND DISCUSSION

Analysis of pre-treatment counts as well as previous field observations indicated that numbers of black flies in the ears of horses on the same pasture could vary considerably. Also, individual horses occasionally were absent from a field when post-treatment counts were taken. Two replications per experiment on consecutive weeks reduced this variability somewhat. Factors contributing to host selection by the flies were not examined.

EXPERIMENT A. Performance of the smear-on formulations was comparable to that of Vaseline® on day one (Table 1). After 2 days mean black fly counts in ears treated with malathion (2 percent A.I.) and the Vaseline® standard were not different from the means of untreated ears. The stirofos (2 percent A.I.) continued to provide protection 3 days after treatment. The lower viscosity of the petroleum jelly in this formulation compared to Vaseline® was considered to be a factor affecting the duration of protection.

Black flies swarmed around the horses' heads and attempted to land in the ears immediately after treatments were applied. Smear-on formulations caused the flies to drop off the ear after landing. The black flies resumed feeding in the first spots to become free of treatment as each material disappeared.

EXPERIMENT B. Swish® protected the ears for 2 days (Table 2). The effectiveness of stirofos wipe-on (1 percent A.I.) was diminished after the 1st day. Mean numbers of black flies in ears treated with the hydrocarbon standard (BPRL–7053–1) were not different from control means during the tests.

All oils dried out the skin in the ears. In several instances there was exfoliation similar to that reported by Palmer (1969). Some horses with intensely scabbed ears reacted adversely to application of the oil wipes by intermittently shaking their heads vigorously for several minutes.

Table 1. Mean pre-treatment and post-treatment black fly counts per ear. Experiment A.

Treatment	Number of ears	Days Post-Treatment				
		0	1	2	3	4
Malathion smear (2% A.I.)	7	8.1a*	0.9a	5.1ab	9.6a	12.9a
Stirofos smear (2% A.I.)	8	11.4a	0.0a	0.8b	1.4b	6.1a
Vaseline standard	15	9.2a	0.0a	4.5ab	8.1a	14.0a
Untreated control	6	6.8a	10.0b	10.5a	12.9a	19.2a

* Means within columns not showing a common letter are significantly different at the 5% level.

Table 2. Mean pre-treatment and post-treatment black fly counts per ear. Experiment B.

Treatment	Number of ears	Days Post-Treatment 0	1	2	3
Stirofos wipe (1% A.I.)	12	9.3a*	1.7ab	5.9a	5.8a
Swish wipe	8	5.4a	0.3b	0.3b	3.1a
BPRL–7053–1 standard	20	6.8a	4.0ab	7.2a	5.6a
Untreated control	9	5.1a	4.8a	5.1a	4.0a

* Level of significance (see Table 1).

EXPERIMENT C. The previous experiment indicated petroleum jelly formulations at the 2 percent A.I. dosage did not enhance the protective action of Vaseline®. Malathion, crotoxyphos and methoxychlor were selected for trial at dosages of 5 percent, 5 percent and 10 percent respectively. There was no significant difference ($P<0.05$) in the reduction of black fly numbers as a result of augmenting Vaseline® with the insecticides evaluated (Table 3). Duration of protection was 3 days in all treatment groups when applied at the 5 gm rate as compared to 2 day protection at the 3 gm rate used in Experiment A.

CONCLUSION

The addition of selected insecticides to Vaseline® petroleum jelly did not enhance the protection afforded against the attack of ear-feeding black flies attacking pastured horses. The protection period was increased from 2 days to 3 days by increasing the amount of smear-on applied from 3 gm to 5 gm.

The oil wipe-on formulations tested provided protection for 2 days but were accompanied by drying of the healing scabs and exfoliation of the skin.

On the basis of these tests, it is thus concluded that 5 gm of Vaseline® petroleum jelly applied to the ears will provide up to 3 days protection against ear-feeding black fly pests.

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Table 3. Mean pre-treatment and post-treatment black fly counts per ear. Experiment C.

Treatment	Number of ears	Days Post-Treatment 0	1	2	3	4	5	6
Crotoxyphos smear (5% A.I.)	9	12.1a*	2.1a	3.3a	3.9a	4.9a	5.3a	6.1a
Malathion smear (5% A.I.)	7	11.6a	0.0a	0.0a	3.6a	4.6a	9.4a	10.7a
Methoxychlor smear (10% A.I.)	8	20.4a	0.0a	0.0a	1.5a	4.1a	4.9a	10.6a
Vaseline standard	24	13.3a	0.0a	0.5a	1.8a	4.9a	4.5a	8.1a
Untreated control	12	11.2a	13.3b	12.5b	9.6b	8.7a	12.4a	10.8a

* Level of significance (see Table 1).

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