Alfalfa Caterpillar Control

treatment of fields by airplane application of spray advances destruction of pest

Clarence G. Thompson and Edward A. Steinhaus

Populations of the alfalfa caterpillar can be reduced successfully by airplane application of the polyhedra virus, spreading an epidemic of wilt disease—polyhedrosis—among the pest.

Preliminary field observations showed that natural outbreaks of polyhedrosis do not in general occur regularly enough to give satisfactory economic control of the caterpillar. Usually the pest occurs in the latter part of the summer after serious damage to the alfalfa has been done.

Field tests made in 1948 indicated that populations of the alfalfa caterpillar can be reliably reduced by the artificial distribution of the polyhedrosis virus. But the evidence was not considered conclusive and more extensive tests, including airplane applications, were made in 1949.

Results of Tests

Of the four 1949 tests the first, conducted on a ranch near Dos Palos, showed that the virus was still virulent after having been stored in a frozen condition for nine months. An infection of 100% was obtained in each treated plot while only a small percentage of caterpillars developed the disease naturally in the untreated plots.

In the treated plots the number of larvae dropped sharply six days after application while on the test plot they continued to increase steeply.

Larvae taken from the treated plots five days after application showed symptoms of the disease and refused to eat when placed in individual cartons with small sprigs of alfalfa. This would indicate that no appreciable damage occurred to alfalfa in the treated plots later than five days after application. At the same time, in order to save the crop, it became necessary to treat the untreated plots with an insecticide.

The second field test in 1949 was made near Oxalis. The results indicated that even the greatest dilution of virus used approximately one million virus particles per milliliter of the spray, is sufficient to give complete infection of a field population of caterpillar larvae when applied at the rate of five gallons per acre. Stronger concentrations tried in this test included up to 50 million virus particles per milliliter of spray.

Apparently as a result of the high temperatures during this test, virus-caused mortality occurred in a shorter time than in any other test yet performed. Only four to five days were required to produce a marked difference between the populations of the treated and control plots.

Airplane Application

In the third experiment, a 40-acre field near Dos Palos was sprayed with a virus suspension, applied by airplane at the rate of approximately five gallons per acre. Two acres were left untreated for control. The suspension contained about five million virus particles per milliliter. Approximately five milliliters of virus material per acre, or a total of 200 for the field, were used in preparing 200 gallons of virus suspension for the experiment.

A 450-horsepower airplane was used, carrying a suspended-boom type of airplane sprayer. In applying the spray, the airplane flew approximately six feet above the alfalfa making swaths 45 feet in width.

Daily counts of 15 samples each from the treated and control areas were made. A sample consisted of two standard net sweeps.

On the fourth day after application of the virus, considerable damage was done to the alfalfa by the caterpillar population. Some damage was also noticeable, in addition, on the fifth day. After that no additional damage was perceptible.

The alfalfa caterpillar population in the field reached a very high level during this test. Twenty caterpillar larvae per two sweeps is considered potentially economic. During this test, the population rose as high as 400 caterpillars per two sweeps.

Several conclusions could be drawn from the complete results of the test.

It demonstrated that high populations in an entire field can be greatly reduced by airplane applications of virus diluted to a concentration of five million virus particles per milliliter.

Poor timing in this particular test is indicated by the damage suffered by the crop on the fourth and fifth day after treatment. An application two days earlier would have probably prevented economic damage.

The test also demonstrated that the caterpillars stop feeding about two days before they actually die.

Approximately seven gallons of virus material were recovered from the field on the seventh day after application, merely by sweeping up the dead and dying larvae with a net. This is about a hundredfold return on the half pint used in the airplane application.

The experiment emphasized the extreme importance of proper timing of application. One day may mean the difference between economic loss and satisfactory control, especially when high populations are involved.

The fourth 1949 test was also carried out by airplane. On a ranch near Dos Palos some 20 acres were sprayed with a suspension containing five million virus particles per milliliter, another 20 acres with a suspension containing 45 million viruses per milliliter, and an area of about 40 acres was left untreated as control.

Egg laying had been heavy for a week before application but cold weather and other unfavorable climatic factors greatly reduced the hatch.

Results of the experiment indicated that in cold weather the larvae treated with the heavier concentration of virus exhibit the disease about one day earlier.

The test also showed that rapid growth of the alfalfa after application of the virus reduces the effectiveness of the treatment, especially if egg laying occurs during and after the new growth.

Economics of Virus Control

The initial supply of virus material can be built up either by infecting and rearing, in the laboratory, healthy larvae brought in from the field; or by collecting larvae dead or dying of the disease in the field.

Once an initial supply of virus has been accumulated, the least expensive and easiest way of building up an additional supply is to spray a field containing a high population of caterpillars. By collecting the infected larvae with a sweeping net on the day before they can be expected to die, large quantities of the virus can be obtained.

The cost of actual application of the virus is much the same as that of an ap-

Continued on page 16

DAIRY

Continued from page 4

again. Since over three million pounds of these agents are now used annually in sanitizing procedures, it is important to test whether or not they are bactericidal—will kill the bacteria—or merely bacteriostatic—preventing increase.

Quaternary compounds, I—alkyl-dimethyl-benzyl ammonium chloride—and II—N-pyridinium chloride—were used on the test organisms *Escherichia coli* and *Micrococcus pyogenes* var. *Aureus*. After use of the quaternary a neutralizing agent, Congo Red, was applied to attempt to reverse the action of the quaternary. Both quaternaries were found to be more active against the Micrococcus, a gram positive organism, than against the gram negative coliform organism. Quaternary I was more effective than Quaternary II. Standard plate counts made with inclusion of the neutralizing agent, Congo Red, were slightly higher than where the quaternary alone was used, but when used on dairy equipment the total plate counts were all well within the limits of recommended standards.

Studies on Rancidity

Milk fat, under certain conditions, is split into its component fatty acids some of which have distinctive flavors and odors. These lipolytic flavors, commonly called rancidity, are a source of much financial loss to the dairy industry through loss or degrading of products. Some of the most troublesome of these flavor defects occur in the winter months and are caused by the lipolytic enzyme that has been designated as naturally active. Studies on the mode of action of this enzyme show that it is present in some milks when the milk is drawn from the cow, and that when that milk is cooled the enzyme is adsorbed on the surface of the fat globule resulting in lipolysis. These studies support the idea that this naturally active enzyme is different from the lipolytic enzyme that is present in all milk which results in rancidity when raw milk is homogenized.

Solids-Not-Fat and Fat

Over 20,000 samples of milk have been collected from within California and analyzed for solids-not-fat and fat. The samples were from individual patrons collected at the dairy plant over a two-year period and selected so as to be representative of the animals and the type of dairying in the region. The analyses show that the solids-not-fat per cent of milk in California for the state as a whole can be calculated by taking the number 7.62 and adding to it 0.31 times the per cent of fat in the milk. Thus, milk of 3.8% fat content—which is about the average for the state—will have $7.62 + (0.31 \times 3.8)$, equals 8.80% solids-not-fat.

Some of the studies reported here were supported in part by funds from the California Dairy Industry Advisory Board. The study on Milk-Solids-Not-Fat was supported in part by funds from the California Department of Agriculture, Bureau of Milk Control. The study on Dry Milk in Bread was made possible by the cooperation of the California Youth Authority.

CATERPILLAR

Continued from page 8

plication of a chemical insecticide. The cost of material plus application cost by airplane in a virus treatment should be less than that of most chemical insecticide applications.

While the successful use of a polyhedrosis as a means of controlling the alfalfa caterpillar may be expected in carefully planned and executed experiments, its general use by the alfalfa growers and commercial appliers of insecticides may entail some difficulties. The timing of application may be so critical that the average grower may not be in a position to determine when the virus should be used. The most practical solution of the problem appears to be through the use of trained entomologists as is done in supervised control programs.

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