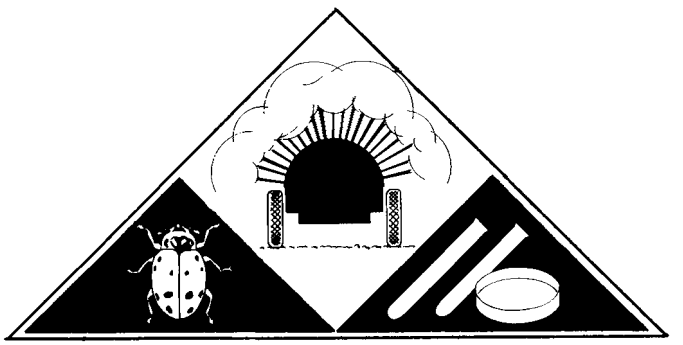
MICROBIAL INSECTICIDES for control of grape leaf folder



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Trials with the microbial insecticide Bacillus thuringiensis have been continued during the last three years to compare it with carbaryl, the standard control measure for grape leaf folder control (Desmia funeralis Hubner). Carbaryl gives excellent control of grape leaf folder but under some conditions it also produces biological upsets leading to increased spider mite and grape leafhopper populations. The overall evidence of the last three years shows that Bacillus does not increase spider mites or grape leafhoppers, and that it is usually, but not always, as effective as carbaryl. Timing of application is of critical importance with Bacillus treatments, however, whereas carbaryl applications are effective within a fairly broad range of time.

ALTHOUGH GRAPE LEAF FOLDERS have not been a serious problem in vineyards during the last three years, populations have been slowly rising, giving ample opportunity for continued testing of control methods. A randomized, complete-block design was employed in all the trials reported, with three replications of each treatment. In the spray trials, single adjacent rows of 50 to 80 vines constituted each replication except for the concentrate spray where a guard row was left on each side of the treated row. In the dust trials, each replication was always separated from the next by a guard row. The effects of the treatments were assessed in a count of all the leaf rolls after the completion of each brood. With large numbers of rolls, only portions of the rows were counted to reduce the assessment to manageable levels.

Table 1 shows the results of a third brood spray trial in 1966. Either dilute

TABLE 1. SPRAY TRIAL, 1966, THIRD-BROOD GRAPE LEAF FOLDER CONTROL, THOMPSON SEEDLESS GRAPES, EXETER

Spray treatment	Gallons per acre	Date applied	Leaf rolls per vine Sept. 27
(1) 1 lb. Carbaryl 50 W per 100 gals	233	Aug. 30	44.9 a†
(2) 1 qt. Thuricide 90 T.S.* per 100 gals	233	Aug. 30	67.2 a
(3) 1 qt. S.S. Thuricide* per 100 gals	252	Aug. 30	71.1 a
(4) 2 qts. Thuricide 90 T.S. per acre (concentrate spray)	35	Sept. 2	96.6 a
(5) 1 qt. Thuricide 90 T.S. per 100 gals	233	Sept. 7	239 b
(6) Untreated	—	—	270 b

* Contained 30 billion viable spores of Bacillus thuringiensis per gram of product.
† Means followed by different letters are significantly different at the 1% level.

TABLE 2. DUST TRIAL, 1967, SECOND- AND THIRD-BROOD GRAPE LEAF FOLDER CONTROL FROM SECOND-BROOD TREATMENT, THOMPSON SEEDLESS, FARMERSVILLE

Dust treatment Applied July 24	Pounds per acre	Leaf rolls per vine: Second brood Aug. 10	Leaf rolls per vine: Third brood Sept. 21
1. 10% Carbaryl	21	36.7 a†	7.41 a
2. Biotrol 2.5 D*	26	37.0 a	6.05 a
3. Untreated	—	181 b	78.6 b

* 2.5 billion viable spores of Bacillus thuringiensis per gram of product.
† Means followed by different letters are significantly different at the 1% level.

TABLE 3. DUST TRIAL, 1967, THIRD-BROOD GRAPE LEAF FOLDER CONTROL, EMPEROR GRAPES, EXETER

Dust treatment applied Sept. 7	Pounds per acre	Leaf rolls per vine Sept. 21
1. 5% Carbaryl	30	10.9 a*
2. Biotrol 2.5 D	32	19.3 a
3. Thuricide 2.5 B†	33	20.8 a
4. Untreated	..	58.0 b

* Means followed by different letters are significantly different at 1% level.
† 2.5 billion viable spores of Bacillus thuringiensis per gram of product.

TABLE 4. SPRAY TRIAL, 1967, SECOND- AND THIRD-BROOD GRAPE LEAF FOLDER CONTROL FROM SECOND-BROOD TREATMENT, THOMPSON SEEDLESS, FARMERSVILLE

Spray treatment applied July 24	Gallons per acre	Leaf rolls per vine: Second brood Aug. 10	Leaf rolls per vine: Third brood Sept. 21
1. 1 lb. Carbaryl per 100 gals	200	66.4 a*	10.2 d†
2. 1 qt. Thuricide 90 T.S. per 100 gals	205	105 b	96.8 e
3. 2 lbs. Biotrol 25 W‡ per 100 gals	194	102 b	124 e
4. Untreated	..	402 c	330 f

* Means followed by different letters are significantly different at 5% level.
† Means followed by different letters are significantly different at 1% level.
‡ Contained 2.5 billion viable spores of Bacillus thuringiensis per gram of product.

TABLE 5. SPRAY TRIAL, 1968 FIRST- SECOND- AND THIRD-BROOD GRAPE LEAF FOLDER CONTROL FROM FIRST-BROOD TREATMENT THOMPSON SEEDLESS, FARMERSVILLE

Spray treatment Applied May 22	Gallons per acre	Leaf rolls per vine: First brood June 27	Leaf rolls per vine: Second brood Aug. 20	Leaf rolls per vine: Third brood Sept. 20
1. 1 lb. Carbaryl 50 W per 100 gals	185	.000 a*	.175 a	.456 a
2. 4 lbs. Standard Lead Arsenate per 100 gals	202	.237 a	.508 a	.422 a
3. 1 qt. Thuricide 90 T.S. per 100 gals	202	.136 a	1.14 a	1.14 a
4. Untreated	..	3.00 b	6.02 b	2.56 b

* Means followed by different letters are significantly different at the 1% level.

or concentrate sprays of Thuricide were comparable with dilute carbaryl sprays except for the late Thuricide treatment applied on September 7, eight days after the comparable earlier spray. The S.S. Thuricide was a special preparation with potency comparable to Thuricide 90 T.S., but supposedly more stable to heat and ultraviolet light.

Dust trials

Two dust trials in 1967 (tables 2 and 3) showed no significant differences in control between carbaryl or the two *Bacillus* preparations, Thuricide 2.5 B or Biotrol 2.5 D. A spray treatment that year (table 4) shows significant differences among carbaryl, the two *Bacillus* preparations, and the untreated check after both the second and third brood.

The 1968 spray trial, established in the first brood and carried through all three broods, shows no significant differences among the three treatments, with all treatments significantly different from the untreated check. Populations remained at extremely low levels in both the second and third brood in this test.

Currently, *Bacillus* preparations are available for sprays as Thuricide 90 T.S. or Biotrol 25 W, or in dust form as Biotrol 2.5 D. Where growers are concerned about the possible deleterious effects of carbaryl on beneficial insects, these *Bacillus* preparations can be expected to give comparable control in most cases. However, applications of *Bacillus* must be carefully timed to coincide with the period when the bulk of the brood makes its first leaf rolls—a period of perhaps not more than four or five days. Carbaryl will perform satisfactorily over the much longer period of at least 10 days and will reduce large larvae in leaf rolls, where *Bacillus* is ineffective.

The carbaryl, standard lead arsenate, or *Bacillus* treatments do not show significant differences in carry-over effect, that is, the reduction of a subsequent brood from an application made in a prior brood.

The *Bacillus thuringiensis* formulations and carbaryl are recommended in the University of California grape schedule for use against any of the three broods. Standard lead arsenate may be used only for first brood treatment, before the edible portions have formed.

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Rolled grape leaf in photo resulted from infestation by grape leaf folder. The rolls are formed from webbing as the larva develops within.

INTEGRATED CONTROL

Newer for grape spider mite

THE RESISTANCE of insect and spider mite pests of grapevines in many areas of the San Joaquin Valley to insecticides has led to the use of combinations of insecticides and often to more frequent applications for control. In view of the history of the use of combinations of chemicals for control of insecticide-resistant pests, these insects and spider mites may soon become resistant to the combinations now in use. Although a great many combinations may be tried and some new ones may be found effective, grape growers need additional and more effective acaricides. To this end, many newer chemicals (not registered for use on grapes) have been tested in the field for the past several years. Some of these are nearing registration and general use; however, the University of California does not have sufficient information to recommend any of these new materials for use on grapevines at the present time.

Pacific mite

Most of the tests have been made to investigate control of the Pacific mite. All the sprays for control of Pacific mite and omnivorous leaf roller were applied with a power sprayer with an "over-the-row" boom. The results of tests made near Caruthers in 1968 show the average number of mites per leaf for nine weekly counts (July 1 to August 27) of mites on 15 leaves per plot and three replicate