CONTROL OF THE GRAPE MEALYBUG[1], *PSEUDOCOCCUS MARITIMUS*, (HOM.: PSEUDOCOCCIDAE), ON CONCORD GRAPE IN WASHINGTON

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ABSTRACT

Ten insecticides were evaluated for control of the mealybug, *Pseudococcus maritimus* (Ehrhorn), (Homoptera:Pseudococcidae) on Concord grape in southcentral Washington during 1981 and 1982. Efficacy was determined from the number of mealybugs in samples taken throughout the season and frompreharvest evaluation of mealybug damage (honeydew and sooty mold, *Clasdosporium* sp.) to fruit clusters. Results showed that parathion, malathion, and permethrin (Ambush®) effectively reduced mealybug numbers and resulted in reduced damage to clusters.

INTRODUCTION

The grape mealybug, *Pseudococcus maritimus* (Ehrhorn), is an economic pest on grapes (Flebut 1922), pears (Madsen and Westigard 1962), apricots (Madsen and McNelly 1960), and *Taxus* spp. nursery stock (Neiswander 1949). Mealybugs are sessile feeders. As they feed they excrete large amounts of honeydew which collects on the berries and provides a suitable substrate for black sooty mold, *Cladosporium* sp. Grape berry clusters contaminated by honeydew, sooty mold, or insect parts have reduced value or may be unsaleable (Stafford and Kido 1955).

Early researchers fumigated to control grape mealybug on *Vitis* sp. stock, but were unsuccessful (Flebut 1922). Since the 1950's parathion has been the most widely used pesticide for mealybug control. It has proven effective as a delayed-dormant spray with oil (Jensen *et al.* 1964) and as a summer spray or dust (AliNiazee and Stafford 1972). Summer sprays are unacceptable for table grapes as they reduce bloom, but they may be used on processed grapes (Frick and Bry 1955).

The grape mealybug was first reported as a pest in Washington vineyards in 1950. Since then it has been controlled with parathion (Frick 1952) and malathion (Cone 1971). Although parathion has been the standard control measure for grape mealybug for 30 years, vineyards with intense spray histories are developing more resistant grape mealybug populations (Jensen *et al.* 1964). Flaherty *et al.* (1982) indicated that the mealybug can develop resistance to parathion. Alternatives to parathion must be found for grape mealybug control.

The objectives of this study were 1) to evaluate parathion and malathion for control of the grape mealybug in southcentral Washington to determine if resistance had developed, and 2) to screen several non-organophosphate insecticides for comparable efficacy. Superior oil with and without insecticide was also evaluated as a control.

MATERIALS AND METHODS

Insecticide trials were conducted on Concord grape, *Vitis labrusca* L., vineyards at the Irrigated Agriculture Research and Extension Center near Prosser, Washington. The 0.8-hectare vineyard, untreated for five years before the experiment began, supported a natural grape mealybug infestation. Plots consisted of 6 replications of 6 vines each, in a randomized complete block design for 10 treatments. In 1981 delayed-dormant sprays were applied on 14-17 April and in 1982 on 22-23 April using the same plot design. The sprays were applied at 21,000 g/cm^2 using a Bean Speed Sprayer® with a nozzle arrangement designed for maximal coverage of the vine. Sprays were applied to both sides of each plot using either the right or left bank of nozzles on the sprayer. The spray volume (3,785 l/ha) soaked the outer bark and allowed penetration of the pesticide under the bark. Five emulsifiable concentrates, 2 wettable powders, and 3 oils were applied to the treated plots (Table 1). Plot rows were separated by unsprayed border rows and untreated plots served as the control. Two large canvas shields (Fig. 1) were used to prevent cross-row contamination. One, mounted on a second tractor, was moved along the row opposite the sprayer nozzles. Since much of the spray rolled back from the protective shield and drifted in the opposite direction, a second shield was mounted on the back of the sprayer to effectively prevent any plot contamination.

Early in the season mealybugs were collected from rough bark samples taken from the trunk and lateral arms. As the season progressed leaf and shoot material was sampled, and finally fruit clusters were included. The early season vine samples were weighed, and placed in Berlese funnels for 24 hours. The mealybugs were collected in vials of 70% ethyl

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TABLE 1. Number of mealybugs per 10 g of Concord grape vine material from experimental plots treated with insecticide, Prosser, Washington, 1981.

Insecticide used and formulation	Rate (kg AI/ha)[a]	1981 Number of Mealybugs per 10 g sample[b]
Parathion 8EC + oil[c]	1.70	4.2 A
Permethrin 2EC + oil	0.23	5.5 A
Malathion 5EC + oil	3.13	5.9 AB
Parathion 8EC + oil	1.13	6.4 AB
Phosmet 50WP	1.13	6.6 AB
Oil	18.95	7.0 AB
Oil	37.90	7.2 AB
Oil	9.48	9.2 BC
Phosmet 50WP + oil	1.13	11.8 CD
Untreated	--	14.0 D

[a] The rates of oil alone are in litres/hectare.

[b] Figures followed by the same letter are not significantly different, DMRT ($P = 0.05$).

[c] All insecticides applied with oil at 18.95 litres of oil/hectare.

alcohol placed below the funnels, and counted later. An index using the number of mealybugs per 10 g of vine material was established to facilitate analysis of the data. Mealybug damage to clusters was determined just prior to harvest. Damage consisted of contamination by honeydew secreted by the mealybugs and/or the growth of sooty mold on the honeydew. Samples consisted of 6 clusters per plot (4 from the top vine-support wire and 2 from the bottom wire) collected near the main trunk. The clusters were pulled apart and each individual berry inspected for the presence of mealybugs and % honeydew contamination.

RESULTS AND DISCUSSION

Results from monitoring the grape mealybug population throughout the growing season in 1981 is summarized in Table 1. Plots treated with parathion + oil or permethrin (Ambush®) + oil had significantly fewer mealybugs than the other treatments. Plots sprayed with malathion + oil, phosmet (Imidan®), or high concentrations of oil alone also had fewer mealybugs when compared to phosmet + oil or the untreated plots. The same treatments were re-applied and similar data were collected in 1982. However, significant differences were not obtained due to an overall reduced mealybug population in the vineyard.

In 1981 plots treated with malathion + oil, parathion + oil, and permethrin + oil had significantly less honeydew contamination of clusters than the other plots (Table 2). Comparison of percent berries with sooty mold and/or mealybugs in 1981 closely paralleled the results for contamination of clusters with honeydew. For 1982, the percent of berries with sooty mold and/or mealybugs among treatment plots was not

TABLE 2. Percent Concord grape berries[a] with honeydew contamination in insecticide treated plots, Prosser. 1981-82.

Insecticide used and formulation	Rate (kg AI/ha)[b]	Percent berries with honeydew[c] 1981	1982
Malathion 5EC + oil[d]	3.13	22.2 A	3.9 AB
Parathion 8EC + oil	1.13	22.7 A	7.5 ABC
Phosmet 50WP + oil	1.13	23.7 A	9.2 BC
Parathion 8EC + oil	1.70	26.8 AB	4.2 AB
Permethrin 2EC + oil	0.23	26.8 AB	8.3 ABC
Oil	37.90	31.1 AB	3.7 A
Phosmet 50WP	1.13	36.9 ABC	8.9 ABC
Untreated	--	44.4 BC	6.2 ABC
Oil	18.95	45.6 BC	7.5 ABC
Oil	9.48	50.1 C	9.9 C

[a] Taken from 66 fruit clusters in 1981 and 36 clusters in 1982.

[b] The rates of oil alone are in litres/hectare.

[c] Figures followed by the same letter are not significantly different, DMRT (P = 0.05).

[d] All insecticides applied with oil at 18.95 litres of oil/hectare.

significantly different due to a reduced mealybug population.

The decrease in *P. maritimus* numbers in 1982 may have resulted from several factors: 1) the 1981 spray program may have reduced numbers enough to affect the 1982 population and, 2) mummies of parasitized mealybugs were collected in the vineyard in 1981 and 1982, so that parasitism may have reduced the population. Quantification of mealybug damage to clusters in 1982 was further complicated by atypical preharvest rains which washed off much of the honeydew.

The parathion + oil, malathion + oil, or permethrin + oil-treated plots which showed low infestation levels of mealybugs throughout the season also had less fruit cluster contamination by mealybugs and mealybug products at harvest. Phosmet without oil or 15.16 l of oil alone produced consistent, yet less effective, control of mealybugs and their damage. Phosmet + oil or low concentrations of oil alone were inconsistent and gave poor control of the mealybug.

These data support a positive correlation between the mealybug numbers in the vineyard throughout the growing season and the economic damage to fruit clusters at harvest. Thus, early season estimates of mealybug density may aid growers in making decisions on summer spray management.

Grape mealybug resistance to organophosphates was not apparent; both parathion and malathion

Fig. 1. Canvas shields arranged to prevent cross-row contamination of plots by insecticides during application.

provided effective control in this trial. However, because the vineyard had been unsprayed for 5 years before the study began, mealybug resistance may have been very low. Also, a large predator and parasite population could have depressed the mealybug population. The effect of the treatments on the natural control agents of the mealybug is uncertain as a large portion of the vineyard remained unsprayed and could have served as a reservoir for parasites and predators.

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