

II. Pome Fruits

d. Chemical control

1. Pandemis leafroller and apple

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Summer Spray Trial, 1993. Studies were conducted to compare the efficacy of Dipel vs PennCap-M for control of pandemis leafroller and to evaluate their respective impacts on secondary pests and natural enemies. Five replicates of 4-tree plots were randomly established in the same Naches Heights orchard. Treatments consisted of an untreated check, Dipel at 1 lb per acre, and PennCap-M at 8 pints per acre. All sprays were applied with a handgun at ca. 200 gal. per acre. Sprays were applied on 22 July. This corresponded to approximately 75% egg hatch based on sampling egg masses.

Prior to the spray applications, precounts of leafroller egg masses and phytophagous mite and predatory mite densities were made. Mite sampling consisted of selecting 10 leaves per tree from each plot. Counts of two spotted spider mite and European red mite were combined. Both mites and leafminers were sampled 3 and 6 wks post-spray. Leafminers were sampled by visually searching each tree for 60 s. Up to 5 mines per tree were later dissected to determine percent parasitism. Leafroller egg masses were counted during the three leafminer samples and totalled for the entire study. Leafroller larvae were sampled 4 weeks after the treatments were applied. Each plot of 4 trees were visually searched for 12 min. All count data were transformed with $\sqrt{x + 0.5}$ and percentage data were transformed with $\arcsin(x)$. All data were analyzed with ANOVA. Significant differences were separated with Newman / Keul's Range test.

Results

Summer Spray Trial. Leafroller populations in this orchard crashed during the middle of the season. Spiders and lacewing larvae appeared to be largely responsible, and a suite of parasites was also important. No healthy leafroller larvae older than a third instar were ever found in the orchard during the 6 week test. Thus despite a very large population overwintering in this orchard and a sizeable number of egg masses laid by this first generation (average of 0.5 per tree) populations in all plots were low and probably do not reflect the use of insecticides in this trial. However, the population density of larvae in late August was lower but not significantly different in the PennCap-treated plots, mean = 1.6 per 12 min search versus 5.0 and 4.8 in the check and Dipel-treated plots, respectively.

Differences in the population density of secondary pests and their natural enemies were found between the Dipel and PennCap-M plots. The effect of PennCap-M and Dipel on mite populations is unclear. In the September sample, significantly more phytophagous mites were found in the PennCap-M than in the Dipel-treated plot, but while the number

of predatory mites was lowest in the Pennicap-M-treated plots the difference was not significant (Table 2). The use of Pennicap-M relative to Dipel significantly decreased the percent parasitism of leafminers though the density of mines was not reduced (Table 3).

Conclusion

From both field and laboratory studies it appears that the use of two applications of Dipel can be very effective in reducing the overwintering population of pandemis leaf-roller. Proper timing of Dipel appears to be bloom and petal fall though the immediate weather conditions will always be important in determining the effectiveness of Bt. These data suggest that the addition of Coax improves the efficacy of Dipel. However, it is not clear whether the addition of Coax is superior to simply increasing the rate of Bt. Finally, this data is rather inconclusive on the effectiveness of Dipel for summer control of leafrollers. However, these data suggest that the use of Pennicap-M may be harmful to the management of both mites and leafminers.

Table 1. The effect of summer insecticide sprays on phytophagous and predatory mites on apple, 1993.

Treatment	Phytophagous mites per 40 leaves			Predatory mites per 40 leaves		
	20 July	11 Aug	3 Sept	20 July	11 Aug	3 Sept
Check	1.0a	2.6a	0.6ab	32.0a	55.4a	32.6a
Dipel	1.8a	0.2a	0.0a	59.2a	50.4a	34.0a
Pennicap-M	0.2a	1.0a	1.2b	33.6a	67.0a	17.4a

Means were separated with the Newman / Keuls Range test, $P = 0.05$.

Table 2. The effect of summer spray applications on leafminers and their parasites.

Treatment	# Leafminers per 4 min		% parasitism	
	11 Aug	3 Sept	11 Aug	3 Sept
Check	26.2a	22.0a	14.0a	57.0a
Dipel	24.0a	14.0a	22.0a	65.6a
Pennicap-M	31.8a	14.8a	3.0b	39.5a

Means were separated with the Newman / Keuls Range test, $P = 0.05$.