1. Thresholds/Monitoring/Sampling

MONITORING LEAFROLLERS WITH PHEROMONE TRAPS

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The ability to monitor and prevent the establishment of leafroller (LR) populations is crucial to the success of pheromone-based pest management programs. Detecting larval infestations before they reach damaging levels is very difficult. An alternative approach is to monitor leafroller populations with pheromone traps.

Pheromone dose: Standard load Pandemis leafroller (PLR) and obliquebanded leafroller (OBLR) red septa, and septa loaded with 10% of PLR pheromone and 5% of OBLR pheromone were obtained from Trécé, Inc. The effectiveness of pheromone traps baited with standard or low load lures was directly compared in 35 orchards; PLR were trapped in 27 orchards and OBLR were trapped in 20 orchards. For each species, Pherocon 1C traps (Trécé, Inc.) baited with red septa containing either the standard or low pheromone dose were uniformly distributed in orchards at a density of one trap per 1.25 acres. The number of male moths captured was recorded weekly and trap bottoms were replaced after a cumulative catch of 50 moths, more often if dirty. To minimize position effects, traps were rotated each time they were inspected. Lures were replaced every four weeks.

Larval densities of the overwintering and summer generation, as well as fruit injury at harvest, were estimated in each of the orchards where traps were placed. Larval sampling was conducted toward the end of each generation. The overwintering generation was sampled after petal fall when the population was comprised of late instar larvae feeding in spur shoot leaves. Densities of the summer generation were estimated in mid-summer when most individuals were late instar larvae feeding in shoot tips. Twenty growing points per 20 trees were examined around each trap during each generation. A sample of 25 fruits on each of 20 trees in proximity to each trap was inspected for LR injury at harvest.

Table 1 summarizes the average PLR and OBLR male catch per trap with standard and low load pheromone lures during each flight period. Male captures were significantly lower in traps baited with a low dose of pheromone. Close to an 80% reduction in catch with a low load compared to a standard load lure was recorded for PLR. The effect appeared to be less pronounced for OBLR, with about a 60% reduction in catch in traps baited with the low dose of pheromone.

Fewer than 10 moths per trap were captured during the OW flight in 16 of 27 orchards monitored for PLR and 11 of 20 orchards monitored for OBLR. At each study site, at least an 86% reduction in moth catch in traps baited with the low load compared to the standard load was recorded in these low catch orchards. In contrast, a less pronounced reduction in catch in low compared to high load traps was recorded in orchards where greater than 10 moths were captured with the low dose. The reduction in catch in these orchards ranged from 57 to 77%.

Table 1. Pandemis and obliquebanded leafroller moth captures in pheromone traps baited with standard or low load lures.

		Overwintering moth capture			Summer moth capture		
		Average per trap			Average per trap		
Species	Number of orchards	Stand.	Low	Percent reduction	Stand.	Low	Percent reduction
PLR	27	73.1	18.8	74	51.3	9.6	81
OBLR	20	60.8	20.2	67	38.8	13.6	56

Fewer than 10 moths per trap were captured during the SU flight in 20 of 27 orchards monitored for PLR and 14 of 20 orchards monitored for OBLR. Thus, low catches were recorded in a greater portion of orchards during this SU flight than during the OW flight. The pattern of reduction in moth catch in traps baited with the low load compared to the standard load in the SU was similar to that recorded during the OW flight. The noticeable exception was the less pronounced reduction in OBLR catch with low dose lures in orchards with high catches during the SU compared to the OW flight. Overall reductions of about 48% and 64% were observed in the SU and OW flights, respectively.

Relationship between captures and activity: PLR and OBLR moth catch in low dose pheromone traps during the OW flight was a good indicator of the level of larval activity. The percentage of shoots or fruit fed on by either species of leafroller was consistently low in orchards with low moth catches in low load traps. Average fruit injury at harvest did not exceed 0.2% in low catch orchards at any of the study sites. Levels of leafroller feeding were substantially higher in orchards with relatively high moth catches in low load traps. Average fruit injury at harvest exceeded 1.0% in high catch orchards at most of the study sites.

Captures of both PLR and OBLR males during the OW flight were highly correlated with fruit injury at harvest. Somewhat unexpectedly, traps baited with either the standard or low load lures provided similar relationships between catch and injury. Correlation coefficients for PLR fruit injury and moth catch in standard and low load traps were 0.80 and 0.70, respectively. Correlation coefficients for OBLR fruit injury and moth catch in standard and low load traps were 0.65 and 0.70, respectively. The strong correlation between LR moth captures in standard traps and fruit injury appeared to be contrary to field observations of instances of high moth catches but low levels of infestation. Very few of these situations were recorded in the study reported herein. The use of a much higher trapping density, one trap/2.5 acres compared to the industry standard of about one trap/20 acres, and the positioning of the majority of traps in the interior rather than the edge of orchards may explain this lack of false positive moth catches in our study.

Longevity of lures: We evaluated the field life of standard and low load lures during the second generation flights of PLR and OBLR. There was no significant change in the attractancy of standard or low load OBLR lures throughout the 45-day test period. The attractancy of standard and low load PLR lures also did not decline for 45 days. To the contrary, replacing the standard PLR lure appeared to have a negative effect on moth captures. Traps baited with new lures captured significantly fewer moths than traps baited with lures field aged for 27, 36 or 45 days.

Trap design: We directly compared the effectiveness of a Multipher, delta, plastic cylinder and wing trap for capturing PLR or OBLR males. The delta trap performed as well as the industry standard, wing trap, for both leafroller species. The Multipher trap was a highly effective trap for OBLR but was less effective for PLR. Significantly fewer PLR were captured in the Multipher compared to the delta or wing traps. The plastic cylinder was a poor PLR and OBLR trap, capturing very few moths throughout the test.

Trap maintenance issues also should be considered in choosing an effective trapping system. The low load trap is easier and less expensive to use than the standard trap because the reduced moth catch in this trap means that fewer replacements of the trap bottom are required. The Multipher trap shows promise as an option for trapping leafrollers. This is a non-sticky trap and should be less expensive and easier to maintain than the wing or delta traps. Our experience with the Multipher trap suggests that the performance of this trap is highly influenced by the choice of knockdown material.