

Biological Control

Trichogramma platneri and Leafrollers

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Leafrollers commonly become the key pest complex in orchards using mating disruption for the control of codling moth. As mating disruption of codling moth is refined and implemented on greater acreage, the amount of damage leafrollers cause to apples and pears will likely increase. While *Bacillus thuringiensis* products Lorsban and Penncap-M are useful at present, continued heavy reliance on them may result in a rapid development of resistance. An alternative to using insecticides for the control of leafrollers is the use of biological control agents. Currently we are conducting research on several parasitoids which attack leafrollers and are attempting to achieve biological control using conservation of native parasitoids, classical biological control and augmentative parasitoid releases.

Parasitoid surveys. Surveys for naturally occurring parasitoids of leafrollers were conducted at three locations in 1995, Mattawa, Tree Fruit Research and Extension Center (TFREC), and Milton-Freewater, OR (MF). The important parasitoids varied between location, and parasitoids were observed to contribute significant mortality in two of the three locations. Tachinid flies were the most common parasitoids attacking OBLR larvae at Mattawa and MF, causing about 50% and 17% mortality, respectively. A pupal parasitoid (*Itopectis* sp.) caused an additional 10% mortality at Mattawa. At the TFREC, the primary parasitoid of pandemis leafroller was *C. florus* which caused >98% mortality of summer generation larvae. Although releases of *C. florus* had been made in this area in previous years, none were made in 1995.

Field releases of *C. florus*. Augmentative releases were made against the overwintering leafroller generation in two locations in 1995, Mattawa (MA) and Milton-Freewater, OR (MF). Releases at MF consisted of a no-release control, an early release of 10 females per tree on release trees and a late release of 10 females, and a single late release of 30 females per tree. Parasitism was highest in the single late release plots with 52% parasitism on the release trees, less in the two-release trees (32%), and 6% in the non-release control. The 6% parasitism in the control may be the result of dispersal by the parasitoids or a background population of *C. florus* resulting from releases made in 1994. *C. florus* dispersed several rows away from the release trees, although percent parasitism gradually declined as the distance from the release trees increased.

***Trichogramma* dispersal.** Several field tests were conducted using *T. platneri* in 1995. One test was designed to look at parasitism rates in release trees at three release rates. Other tests addressed the dispersal of *T. platneri* when released at several rates. The release rates used for all of the tests were 100, 1000 and 10,000 females per tree. The first dispersal study involved a single release at about the time of peak egg density during the summer. Sections of cards

containing eggs parasitized by *T. platneri* were placed in the field. There were four replicates of each release level. The experimental design consisted of a release tree, five sample trees in each direction within the same row as the release tree, and three sample trees in each of two adjacent rows in either direction. The trees sampled in adjacent rows were those nearest the release tree. Two similar tests using the same experimental design were conducted, but weekly releases were made over the duration of the summer generation oviposition period. Evaluation of parasitism was made by collecting all egg masses on all trees described above. The egg masses were returned to the laboratory where the number of masses parasitized and the proportion of eggs parasitized per egg mass were determined.

Rates of parasitism were fairly high at all release locations. Parasitism was dependent on release rate with the proportion of parasitized egg masses and eggs per mass increasing with the number of *T. platneri* females released. At Wondra orchard where releases were made throughout the summer generation (six weeks), 88.6% of egg masses and 57.9% of all eggs were parasitized under high release rates, 62.3 and 34.2% under medium release rates, and 33.0 and 8.5% under low release rates. *T. platneri* dispersed readily, although the percentage of egg masses and eggs per mass parasitized declined as distance from the release tree increased either within the same row or across rows.

This decline in parasitism levels associated with dispersal was greater in orchards with standard plantings than with the high density plantings (Tables 1 and 2). In the latter, trees within a row contained a more continuous swath of foliage than under standard planting. Although the proportion of egg masses parasitized was generally high, the proportion of eggs parasitized per mass was much lower due to the large size of OBLR egg masses. When *T. platneri* was released weekly for the duration of the oviposition period, total egg parasitism rarely exceeded 60% under even the high release rates.

Summary. The success of mating disruption of codling moth will allow us to reduce pesticide input into apples. However, the emergence of leafrollers as a pest in orchards under mating disruption is a continuing problem. There are parasitoids (particularly *C. florus*) which show promise of controlling leafrollers in orchards using soft pest control programs. Large plot studies on the ability of *C. florus* to control leafrollers and continued studies on *T. platneri* in 1966 will give us a better understanding of the potential of these parasitoids and hopefully will lead to their incorporation into leafroller control strategies in the near future.

Table 1. Parasitism of egg masses and dispersal by *T. platneri* released against OBLR, 1995.

Location	Release rate	Percent eggs parasitized								
		Release tree	Within the release row					Across rows (row number)		
			Tree number (distance from release tree)					Release row	Adjacent rows	
			1	2	3	4	5		1	2
Mattawa (single release)	100	58.9	34.5	5.0	44.3	40.0	41.8	21.2		
	1000	100.0	93.3	79.2	75.0	80.2	39.3	95.8	48.1	
	10,000	100.0	100.0	100.0	100.0	100.0	57.5	100.0	99.3	
Mattawa (multiple release)	100	35.5	28.3	27.4	33.6	13.3	3.7	30.9	37.2	30.0
	1000	64.5	65.5	54.9	63.1	62.4	35.1	65.2	37.2	36.9
	10,000	100.0	84.3	83.5	78.3	70.0	62.3	89.6	67.0	35.6
Stoltz (multiple release)	1000	52.0	64.0	47.0	17.0	9.0	15.0	59.0	22.0	
	10,000	80.0	79.0	13.0	36.0	29.0	33.0	80.0	40.0	

Table 2. Total egg parasitism and dispersal by *T. platneri* release against OBLR, 1995.

Location	Release rate	Percent eggs parasitized								
		Release tree	Within the release row					Across rows (row number)		
			Tree number (distance from release tree)					Release row	Adjacent rows	
			1	2	3	4	5		1	2
Mattawa (single release)	100	29.1	8.5	0.8	21.7	13.3	14.7	6.5		
	1000	72.9	54.5	35.4	29.1	21.6	13.7	63.3	15.2	
	10,000	79.3	81.1	66.8	62.1	64.7	45.1	80.6	52.3	
Mattawa (multiple release)	100	12.1	15.1	8.2	13.2	2.8	1.9	14.3	13.7	11.1
	1000	35.8	23.5	22.5	28.8	26.9	13.4	27.6	13.1	12.9
	10,000	83.5	44.5	52.9	48.2	27.3	37.6	57.5	30.9	14.7
Stoltz	1000	17.1	19.9	5.5	3.3	2.4	1.3	19.8	5.3	
	10,000	60.6	44.3	13.7	34.2	13.5	9.0	48.2	24.0	