

Biological Control

Trichogramma Parasitism of Leafroller Eggs

R.S. Pfannenstiel, J.F. Brunner, L. Lampson and M.D. Doerr
Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: pandemis leafroller, *Pandemis pyrusana*, obliquebanded leafroller, *Choristoneura rosaceana*, *Trichogramma platneri*, apple

Two species of leafroller, *Pandemis pyrusana* (PLR) and *Choristoneura rosaceana* (OBLR), have caused fruit damage, in many cases exceeding that of codling moth, in apple orchards using codling moth mating disruption in Washington. Any pheromone-based codling moth management program must account for and plan to mitigate leafroller populations. While *Bacillus thuringiensis*, Lorsban, and PennCap-M are useful at present, continued reliance on them may result in rapid development of resistance. An alternative to using insecticides is biological control. *Trichogramma platneri* is a parasitoid of the eggs of arboreal Lepidoptera. In the last two years we have evaluated this parasitoid as a potential biological control agent of leafrollers in Washington apples.

Age dependent suitability of OBLR and Pandemis egg masses as hosts for Trichogramma: A study on the effect of egg age on suitability to parasitization by *T. platneri* was conducted with OBLR and PLR at 24°C. *T. platneri* was able to parasitize eggs up to 6 d old although the number of eggs parasitized declined from about 14-17 eggs in one-d-old hosts to about 3 eggs in 6-d-old hosts. There was no significant difference in the quality of the egg masses of either species as hosts for *T. platneri* although there did appear to be a trend for PLR to be more frequently parasitized and produce slightly more progeny. There also appeared to be a trend for higher parasitization of 2- to 4-d-old egg masses than in 1- or 5- to 6-d-old egg masses, but this was not significant.

Trichogramma dispersal and control: In 1996 two field studies were conducted using *T. platneri*. One was a continuation of a study begun in 1995 to examine leafroller control by and dispersal of *T. platneri* when released at several rates; the second examined parasitism by *T. platneri* when host density was low, a more realistic field situation. Release rates used for all studies in 1996 were 100, 1000 and 10,000 females per tree. The dispersal study involved multiple releases during each leafroller oviposition period. Sections of cards containing eggs parasitized by *T. platneri* were placed in the field. There were four replicates of each release level consisting of a release tree, five sample trees down the row in each direction, and three sample trees in each of the adjacent two rows in either direction. During the 2nd oviposition period only the 1st, 3rd and 5th trees as well as two trees in the adjacent rows were sampled due to logistic constraints. The second study was conducted in a block with no background population of leafrollers. Sleeve cages with three pairs of male and female OBLR were placed on each of four trees surrounding a *T. platneri* release tree. Each cage was checked over the next two days and when an egg mass was observed the cage was removed, the egg mass flagged and the moths killed. At the end of two days all cages were removed and the moths killed. If there was more than one egg mass on a branch, then all extra egg masses were removed. Each release

level was replicated four times and the whole study was replicated weekly over five weeks. Egg masses were removed weekly, brought to the laboratory and reared out to determine parasitism. In all studies egg masses were collected and evaluated for percentage of egg masses parasitized and the percentage of eggs parasitized.

Results from 1996 were mixed. In the first study, rates of parasitism were low during the 1st oviposition period and were much higher during the 2nd oviposition period. Parasitism declined quickly over even short distances from the release tree. Total egg parasitism in the 1st oviposition period rarely exceeded 60% under even the high release rates. However, parasitism during the 2nd oviposition was much higher. The duration of the second oviposition period was very long, lasting into October, and the egg mass density was extremely high (13.7 egg masses/tree). Reproduction by *T. platneri* in the orchard resulted in higher levels of parasitization than would result from releases alone. The egg parasitization rate in trees adjacent to the medium releases was 20.8% during the first two weeks of releases and increased significantly to 67.4% during the 4th to 5th weeks. Egg masses throughout the orchard were heavily parasitized later in the oviposition period.

To remove the effect of parasitoid reproduction on rates of parasitism from field releases, we conducted a second study looking at impact under low host densities. Evaluation of these weekly releases against low host densities resulted in low rates of parasitism which were directly related to release rate. At the highest release rate of 10,000 females per tree, egg parasitism only averaged 50% (Table 2).

Studies with *T. platneri* have indicated that OBLR and PLR are both good hosts for *T. platneri* and that we can obtain relatively high rates of parasitism. However, the levels of parasitism achieved are still inadequate even at high release rates and, unless quality control and application/dispersal techniques are improved, this species will probably not contribute significantly to economical control of leafrollers.

Table 1. Parasitism and dispersal by *T. platneri* released against OBLR at Mattawa, 1995.

Release generation	Release rate	Percent egg masses parasitized								
		Within the release row							Across rows (row number)	
		Tree	Tree number (distance from release tree)					Release	Adjacent rows	
			1	2	3	4	5		1	2
Egg masses parasitized										
1 st	100	59.7	34.2	13.2	7.3	20.8	4.7	59.7	13.1	10.8
	1000	87.5	49.2	30.1	56.3	35.1	28.4	87.5	25.0	17.8
	10,000	100.0	85.2	90.4	73.6	60.9	50.0	100.0	57.0	39.4
2 nd	100	89.0	73.2		75.5		41.9	89.0	53.5	49.6
	1000	90.2	89.9		84.8		72.5	90.2	68.3	67.9
	10,000	100.0	96.9		92.5		91.0	100.0	91.3	74.3
Eggs parasitized										
1 st	100	31.6	9.0	2.6	1.7	3.4	1.7	31.6	3.7	1.9
	1000	29.5	21.4	11.3	15.3	18.6	8.9	29.5	6.8	5.8
	10,000	88.8	62.3	43.7	29.4	30.1	10.0	88.8	28.1	12.3
2 nd	100	60.4	51.6		40.3		26.3	60.4	36.7	32.1
	1000	74.9	65.2		58.0		49.2	74.9	54.7	54.9
	10,000	94.8	84.0		75.6		69.3	94.8	78.8	61.2

Table 2. Parasitism of OBLR eggs by *T. platneri* at low host density.

Release level	Percent parasitism (by week)					
	1	2	3	4	5	Mean
100	11.3	3.3	8.5	6.8	2.9	6.6
1000	28.5	10.5	16.4	20.0	7.4	16.6
10,000	64.4	57.1	37.1	38.8	52.4	50.0