

Biological Control

Field Releases of *C. florus* Against Leafrollers

Jay F. Brunner and Mike Doerr

Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

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Field releases. *C. florus* was reared in the laboratory using pandemis leafroller (PLR) and obliquebanded leafroller (OBLR) larvae as hosts. Rearing methods were labor intensive and involved placing one host leafroller larva in a small plastic cup along with a small piece of artificial diet used to rear leafrollers. Usually after a few hours to one day, a single female *C. florus* was introduced into the cup. These cups were placed in a growth chamber at 25°C at 40 to 50% relative humidity. After approximately 10 days, cups were examined for presence of *C. florus* pupae. These were stored at 10°C until near the time for a release, at which time they were transferred to 25°C to stimulate transformation to the adult stage. Just prior to releases, plastic cups were opened and the number of female *C. florus* counted. The *C. florus* females were then transferred to new cups with a fixed number per cup, or the number of females within existing cups was recorded on the side of the cup. Approximately 15,000 *C. florus* adults were reared using this method specifically for augmentative release studies.

Releases of *C. florus* were made using different patterns to some extent dictated by the number of parasitoids available, especially in the spring releases, and size of the release area. In the spring at TFREC Block 24, *C. florus* was released on five consecutive trees within a row. Every other row was used for the release, with a total of six rows or 30 trees receiving 25 females per tree (a total of 750 *C. florus*). In Milton-Freewater, OR, a release was made on 26 April in a young orchard (Wondra-MF) with a high infestation of OBLR. Thirty *C. florus* females were released per tree in a block of 36 trees (a total of 1,080 *C. florus*). A release of *C. florus* was also made in a commercial orchard near Wenatchee (Birchmont 1D2) on 19 May. Thirty female *C. florus* were released in a block of 52 trees (each of 13 trees in four rows, a total of 1,560 *C. florus*). Approximately two weeks following the release of *C. florus*, leafroller feeding sites on all release trees were collected and returned to the laboratory to determine the number parasitized by *C. florus*.

Table 1 summarizes the level of leafroller parasitism by *C. florus* in the three different release experiments conducted in the spring of 1994. High levels of parasitism were found from trees on which *C. florus* had been released. This was true whether the site had PLR (TFREC-24) or OBLR (Wondra-MF).

In the summer of 1994, *C. florus* releases were made in replicated small plots. The number of *C. florus* females released per tree at each test site, the percent parasitism, and the average number of progeny and percent females of progeny are shown in Table 2.

Very low levels of parasitism were observed in releases made in mid- to late July, while levels of parasitism increased to expected levels in later releases during August. High

temperatures seemed to be the most important factor limiting the effectiveness of *C. florus* in the summer of 1994. Releases in mid- to late July occurred during average maximum temperatures over 90°F, while releases in August occurred after temperatures declined somewhat, <90°F, and parasitism of leafroller larvae increased to about 85%.

High temperature effects on *C. florus*. *C. florus* adult females were exposed to a series of high temperatures to determine the upper lethal threshold. Newly emerged females were placed in small petri dishes along with a cube of artificial diet used to rear leafroller larvae and a small amount of honey-water. Ten *C. florus* were placed in each dish, and five dishes were placed in each temperature (50 total). Survival rates of *C. florus* were determined after 4 and 8 hours and then daily until all had died. Results are shown in Fig. 1. *C. florus* adults die within a few hours at temperatures >35°C and live for only a few days at temperatures between 32.5 and 27.5°C. In experiments where *C. florus* was reared at different temperatures, no progeny were produced at temperatures above 27.5°C, and at this temperature the number of progeny produced was significantly lower than for *C. florus* reared at 25°C. High summer temperatures which commonly occur in eastern Washington may limit the effectiveness of *C. florus* as a biological control agent for leafrollers.

Table 1. Release of *C. florus* against the overwintering generation of leafroller, 1994.

Location	Release date	No. <i>C.f.</i> per tree	Total <i>C.f.</i> released	Avg. percent parasitism ¹	<i>C. florus</i> offspring	
					Avg. no.	% females
TFREC-24	22 Apr	25	1,080	68.7	10.4	70.2
Wondra-MF	26 Apr	30	750	75.0	19.9	58.0
BM-1D2	19 May	20	1,560	28.8	14.5	73.8

¹Avg. % parasitism reported on the release trees only.

Table 2. Release of *C. florus* against the summer generation of leafroller, 1994.

Location	Release date	No. <i>C.f.</i> per tree	Total <i>C.f.</i> released	Avg. percent parasitism ¹	<i>C. florus</i> offspring		Avg. temp.
					Avg. no.	% females	
Davis	12 Jul	20	2,240	2.6	--	--	91.2
Wondra	12 Jul	20	1,140	0.0	--	--	91.2
Tradeup	20 Jul	10	720	39.0	7.6	70.0	96.5
CV-12	22 Jul	15	1,080	0.0 ²	7.2	18.6	--
TFREC-24	22 Jul	5,10,20	350	20.0 ²	4.8	61.1	97.4
Mattawa	25 Jul	10	1,000	4.6	--	--	--
Grupp	3 Aug	50	500	81.7	--	--	87.5
CV-18	4 Aug	20	900	85.1	16.9	86.7	85.6
CV-18	25 Aug	10	450	88.7	28.5	70.2	81.8

¹Avg. % parasitism reported on the release trees only.

²This is a corrected percent parasitism due to a high level of native parasitism.

