

Biological Control of Oriental Fruit Moth: Field Establishment and Movement

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ABSTRACT

This report summarizes the second year of field implementation of the parasitoid *Macrocentrus ancylivorus* and the experimentation involving recapture of released wasps. Both of these objectives were moderately successful in 2008. The rearing of *Macrocentrus* at the Kearney Agricultural Center required maintenance seven days a week for daily production. We were unable to maintain this production schedule. As in the past, the Colorado Department of Agriculture Division of Biological Control headed by Dr. Dan Bean was generous enough to provide shipments of 2,000 *Macrocentrus* every other week from June 15 through August 30, 2008. This was done at no cost to the project. These wasps were used for field release and field experimentation.

We were able to document flight at 30 yards in one study and consistent recapture from 25 feet in two other studies. Establishment of the sunflower moth and the parasitoid was also accomplished at 3 field locations in 2008. We found an average of 19 and 24 sunflower moth larvae per head in collections from the two Tulare County sites. If we use the figure of 20 moths per head, 105,600 moths would be produced from a single acre of sunflowers. This would be from plants with just a single head. Given a parasitism rate of 30 percent, over 31,680 parasitoids per acre would be the minimum number produced in one sunflower planting.

MATERIALS AND METHODS

Field Releases

Wawona Farms, under the direction of Marko Rinaldi, established two orchards with plantings of commercial sunflowers. These were located in Traver, California. One planting was adjacent to an organically farmed orchard (Avenue 368) of various varieties of nectarines maturing from early June to mid August. The orchard was 40 acres in size and under mating disruption. The second orchard (Road 52) was a 60-acre block of Halloween peaches, also organically farmed. Sunflower plantings were

made on May 20-30, 2008 and a second planting on July 20-25, 2008 at each location. Sunflower plantings were approximately 1/3 mile long approximately 20 feet next to the orchard. Individual plants were on a 1-foot spacing. At maturity, plants are 8 to 9 feet in height with large heads greater than 12 inches in diameter.

On 7/31, 10 heads were bagged with 1-gallon paint strainer bags at the Avenue 368 site. At that time the heads were heavily infested with sunflower moth. A collection of 3 large heads, at the time of bagging, yielded 57 moths, but no *Macrocentrus*. This indicates there was no natural parasitism at the site. Each of the ten heads was caged with 5 female and 1 male *Macrocentrus*. An additional 200 live parasitoids were distributed along the Avenue 368 planting on 8/15.

On 8/1, 4,000 *Macrocentrus* were released at the road 52 site. The sunflowers contained numerous larvae that were just maturing. A second release of 500 *Macrocentrus* was made at this site on 8/22. From the collection of 3 large sunflower heads prior to the release of *Macrocentrus* on 8/1, 80 moths and 5 *Macrocentrus* emerged (4 males and 1 female) indicating a natural population of the parasitoid.

Although not part of this study, a planting of sunflower approximately ¼ mile adjacent to Ross Variety cling peach in Merced county was also studied. This planting contained sunflowers substantially smaller with smaller heads but was heavily infested with sunflower moth. These were collected on 7/30/08. Here, 65 moths emerged from 3 heads and no parasitoids were found. These heads ranged from 6 to 10 inches in diameter. Ten heads were caged with 5 *Macrocentrus* (4 females and 1 male) on 7/30 for establishment of the parasitoid.

***Macrocentrus* Recapture Studies**

A field recapture study was performed on August 8, 2008. At the southern edge of a mixed stone fruit planting at the Kearney Ag Center, six large 7 by 6 ft. sticky traps were aligned. These were anchored to the ground, at the ends of the row facing the release site and were with either light blue or yellow in color (Figure 1.). The following day, after inspecting the traps and finding no parasitoids, a release of 2000 *Macrocentrus* was made from the adjacent maturing snap bean field. These parasitoids were previously marked with whole milk as a protein marker. Checks of the trap were made periodically and parasites removed.

On August 18, an additional 500 *Macrocentrus* were marked with whole milk and released 25 feet from the middle trap in the plot described above. The large sticky traps were checked daily for catch.

Another attempt to better attract parasites released was done in early October. Fifteen dry, sunflower heads having been infested with sunflower moths and with substantial frass present were compared to 15 fresh sunflower heads showing no frass. The heads were set up in an alternating pattern of old, fresh and old, fresh in a vacant field at KAC. Each head was situated on top of two sticky trap bottoms (Figure 2.). Two thousand *Macrocentrus* were marked with whole milk and another 2000 marked with soymilk.

One of the marked groups was released at 25 feet and the other at 50 feet from the central location of the heads. Temperature was 84 degrees F. and a slight NW breeze was present at 6 mph. Two days after release of the parasitoids, the traps were checked for parasitoids.

In another attempt to better attract parasites, a small trial was established in caged containers, 2 x 2 x 2 feet in size. Petri dishes four inches in diameter were filled with either terpinyl acetate, water, or a solution of terpinyl acetate, brown sugar and water. Counts were taken for 3 days and the total number of parasites tabulated.

Finally, in early October, a survey of wild sunflowers at KAC was made for sunflower moth infested heads. Of 50 heads collected, 11 had frass present and 2 heads harbored 1 sunflower moth larvae each.

RESULTS

The results of field establishment of sunflower moth are quite promising. Each site where sunflowers were planted were found infested with high levels of moths. The initial parasitoid release date of 7/31 at Avenue 368 resulted in 57 from the 3 heads collected for an average of 19 moths per head. The heads were collected prior to the parasitoid release. We are holding sunflower heads for spring emergence. None have emerged to date.

The second site, Road 52, where a large release was made on August 1, was found to have a low level of parasitism prior to the release. Eighty moths and five *Macrocentrus* emerged from this collection made on August 1. The parasitism rate was 5.8 % and an average of 24 larvae per head were found. This site received two releases (2000 on August 1, and 500 on August 22). We were unable to find Oriental fruit moth larvae in the adjacent peaches to study parasitism. We are holding sunflower heads to detect spring emergence from this site. None has occurred to date.

***Macrocentrus* Recapture**

The 8/8-recapture trial resulted in one *Macrocentrus* female found 88 feet from the release point. This was discouraging in that 2000 parasitoids were released and we were only able to trap one at a distance of 30 yards. The release of 500 *Macrocentrus* at 25 feet from the orchard was somewhat more promising. Here, on 8/19, the yellow trap at 27 feet had 15 parasitoids on it. The far west yellow trap, at 38 feet, had one parasitoid. None were found on the blue. On 8/20, one more *Macrocentrus* was found on the yellow trap at 38 feet and one on the blue at 27 feet. A total of 16 parasitoids (3% recovery) were captured from almost 13 yards from the site. Fewer were trapped nearer or on the blue colored sticky traps.

The use of the infested sunflowers heads placed on sticky trap bottoms was much more successful. A total of 133 parasitoids were captured 2 days after the release. Of this number, 82 were captured on the fresh heads without frass and 51 on the dried heads with frass. The analysis of the protein markers is currently being accomplished to

determine what distance from the release point they were captured. Still, this was only a 3% recovery rate. Further studies will be conducted with this technique.

We found no difference in attraction between terpinyl acetate (averaging 11 parasitoids), water (averaging 20 parasitoids), and the Oriental fruit moth bait solution (15 parasitoids).

The search for sunflower moth in wild sunflowers resulted in a 50 heads with frass indicating that sunflower moth is also present on that native host. Additionally, two live larvae confirmed the presence of sunflower moth.

DISCUSSION

Sunflower moths have been established at each site where sunflowers have been planted. The subsequent release of parasitoids has not yet resulted in emergence from the field population. However, the infested heads were collected and are being held for emergence this spring. There was one site where a native population of *Macrocentrus* was found. These studies will be continued next year without further requests for funding.

The recapture studies have been more difficult to accomplish. Releases of various numbers of adult parasitoids have resulted in a very low level of recapture. Primarily, these have been done with no attractants but, instead, with 42 square feet sticky traps placed in front of infested peach trees. We have been able to document trapping at 30 yards but with only one trapped wasp using this technique.

In the late summer we were able to utilize infested sunflower heads and this method appears to be more successful. A greater number of wasps were trapped at either 25 feet or 50 feet from the release point. This approach will also be studied in 2009 in an effort to better delineate the distance of flight.

During the last two seasons, we have found definite flight at 25 feet and documented flight at 30 yards from the source of release in one study. We believe distribution is much greater however. Sunflower moths were taken from wild sunflowers and may explain the presence of *Macrocentrus* in areas where other hosts are not found.

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Figure 1. Large sticky traps for *Macrocentrus* capture.



Figure 2. Fresh and dried sunflower heads for *Macrocentrus* recapture.

