III. Section

XENOTEMNA PALLORANA ROBINSON: A MODEL FOR AUGMENTING ALTERNATIVE HOSTS USING GROUND COVERS TO ENHANCE THE BIOLOGICAL CONTROL OF LEAFROLLERS IN TREE FRUITS.

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The Food Quality Protection Act of 1996 promises to eliminate or severely restrict the use of organophosphate insecticides which are relied upon heavily for leafroller control in Washington orchards. With the implementation of mating disruption as a primary control tactic for the key pest, codling moth, and use of softer pesticide programs for other pests, leafrollers have risen to major pest status in pome fruit orchards in Washington. These two factors have increased the urgency to find alternative means for controlling leafrollers. With an uncertain future for broad-spectrum pesticides, the development of new insecticide chemistries that are highly selective, and the increasing adoption of mating disruption as a control for codling moth, the window of opportunity for making better use of biological control in orchards has never been greater. *Colpoclypeus florus*, a parasitic wasp in the family Eulophidae, has shown promise as a biological control agent for leafrollers in Europe and Washington. However, although *C. florus* parasitism of *P. pyrusana* reaches very high levels (>80%) in the summer, it has not been completely effective at controlling leafroller populations. The lack of suitable overwintering hosts may result in local the extinction of *C. florus* populations, necessitating reestablishment in the orchards the following year from non-orchard habitats. The two main leafrollers found in orchards, *C. rosaceana* and *P. pyrusana,* do not overwinter in stages suitable for *C. florus*.

Xenotemna pallorana is a leafroller whose hosts are primarily alfalfa and white sweet clover. In orchards that use alfalfa for ground cover, populations of *X. pallorana* could be propagated and serve as an alternative host for *C. florus*. Not only might this provide for a more suitable overwintering host, but it might also enhance biological control of pest species of leafroller in summer by increasing the number of *C. florus* produced in orchards.

The first part of our research focussed on development of *X. pallorana* on the foliage of fruit crops, apple, cherry, and pear in comparison to alfalfa. It was somewhat troubling to find that *X. pallorana* was able to develop adequately on all three orchard plants. If *X. pallorana* could develop on all three fruit plants it would seem a risky suggestion to propose to introduce them into an orchard environment, even on the cover crop. However, the lack of *X. pallorana* presence in orchards even though they were evidently common in environments around

many orchards suggested that other factors might be important in this leafroller choosing its host plant. When oviposition preference was tested using apple and alfalfa, *X. pallorana* females laid on apple foliage when given no other choice. However, when provided a choice in a natural setting *X. pallorana* showed strong, almost exclusive, preference for ground cover foliage, the most preferred being alfalfa.

Next we looked at the activity of *C. florus* by examining host and habitat preferences. *Colpoclypeus florus* showed no preference between OBLR and *X. pallorana* larvae in laboratory and field studies. Habitat preference studies showed that *C. florus* had a fairly strong preference for apple, compared to ground cover habitats when given the choice of finding host larvae in both locations. From these studies it seems that *X. pallorana* could serve as an alternative host for *C. florus* in orchards without increasing the risk of crop loss. At the very least, *X. pallorana* and an alfalfa cover crop could be used as a model to study the potential of enhancing leafroller biological control in orchards by augmenting populations of an alternative host for a parasite instead of the parasite population. It would seem easier to rear and augment leafroller populations in a cover crop than to rear parasites in an artificial environment, i.e. mass rearing, where concerns over fitness always abound.