FINAL REPORT

Title: Development of Feeding Atttractants as Monitoring Lures for moth pests of apple.

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Objectives:

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1. Use feeding attractant to monitor *Lacanobia*, *Pandemis* leafroller and codling moth through season.
2. Compare feeding attractant to pheromone lures for monitoring.
3. Relate moth capture to egg hatch and to larval densities.
4. Pursue improvements in feeding attractant lures.

Significant Findings:

1. A controlled release system was developed for the feeding attractants that include acetic acid and 3-methyl-1-butanol.
2. A dry trap (Universal Moth Trap) was found to be superior in capturing *Lacanobia* moths attracted to the feeding attractant.
3. A dry trap (large Delta) was found to be superior in capturing *Pandemis* leafroller moths attracted to the feeding attractant.
4. Most female *Lacanobia* moths are captured before they have laid many or none of their eggs.
5. A preliminary assessment of the data indicates that *Lacanobia* and *Pandemis* captures in feeding attractant traps correlate better with larval numbers that do captures in pheromone traps.
6. Best placement of traps baited with feeding attractant for *Lacanobia* is in the upper tree canopy.
7. In all tests, results for spotted cutworm and bertha armyworm were quite similar to results obtained for *Lacanobia*.

Methods:

Gravimetric (weight loss) studies were done on a series of polypropylene vial sizes, and with a range of vial lid hole diameters to determine release rates of acetic acid and 3-methyl-1-butanol from vial dispensers.

A long series of trapping experiments were conducted, using the feeding attractant dispensed from vials to evaluate trap designs, trap placement, vial hole diameters, lure component release rates, lure release rates, and additional fermentation chemicals.

Blocks of 3 to 5 acres of apples were monitored from April to October for *Pandemis* leafroller, *Lacanobia* fruitworm and codling moth. Monitoring was with sex pheromone traps and feeding attractant traps, with all traps checked twice per week. During both generations, plots were sampled for leafroller and *Lacanobia* larvae, and apple fruit infested with codling moth larvae. Leafroller larvae were sampled by visual searching for damage and for rolled leaves. Lacanobia larvae were sampled by limb knocking of larvae onto a sheet on the ground. Codling moth sampling was done by visual searching of apple fruit.

Results and Discussion:

Lure and Trap Optmization

An optimum feeding attractant monitoring system for *Lacanobia* fruitworm was developed. The recommended lure is a pair of 8 ml polypropylene vials, each with a hole in the lid of each that is 3 mm in diameter. One vial possesses 5 ml of acetic acid on cotton, the other vial possesses 5 ml of 3-methyl-1-butanol on cotton. The vials are suspended right-side-up in the bucket of a Universal Moth Trap with a piece of Vaportape to kill captured moths. Traps can be all green or multi-colored Universal Moth Traps, but should be placed in the upper canopy of orchard trees to capture maximum numbers of *Lacanobia* moths. A commercial prototypeof the lure has been field tested and performed comparable to our research lure. The recommended lure should last at least 4 weeks.

This system provides a strong lure and trap system for *Lacanobia*. It is also attractive to other moths however, primarily Noctuidae. This makes monitoring difficult because captured moths must be sorted and the *Lacanobia* moths recognized. This lure and trap was evaluated in a variety of habitats throughout the season to determine what types of moths are trapped (Landolt and Hammon in press). In apple orchards, moths captured are primarily *Lacanobia*, bertha armyworm, and spotted cutworm, while many other species are captured if traps are placed in natural habitats. For this reason, it is recommended that traps be placed well within orchard blocks, in order to minimize capture of non-target moths. Few insects in addition to noctuid moths are captured in these traps and the use of a dry trap makes moth identification much easier than in the previously tested wet trap (Agrisense Dome or Trappitt trap).

An optimum feeding attractant system for *Pandemis* leafroller was also developed. The recommended lure is a single 8 ml polypropylene vial with a hole in the lid that is 3 mm in diameter. The vial possesses 5 ml of acetic acid on cotton and is placed within a large Delta style sticky trap.

An optimum feeding attractant system was also developed for the codling moth, but appears to be too ineffective to be useful. It is comprised of a single 8 ml polypropylene vial with a hole in the lid that is 1 mm in diameter. The vial possesses 5 ml of acetic acid on cotton and is placed within a Pherocon Wing trap.

The development of a dispenser for acetic acid permitted the testing of dry trap designs. The original method of dispensing acetic acid was to place it in the drowning solution of a wet trap. Moths captured in these wet traps were very difficult to identify and were prone to rapid decomposition during hot weather. The dispenser led to the identification of effective dry trap designs for all three species of moths and made the use of the wet traps obsolete.

Comparison of Monitoring Methods

Results of season long monitoring of Lacanobia moths in orchards provided comparisons of pheromonal and feeding attractant monitoring systems. With both types of lures, the general phenology of *Lacanobia* was evident, with two distinct flights of moths. Numbers of moths captured were adequate with both lures at all sites to track moth phenology. However, there was considerable variance in the relationship between numbers of moths captured in feeding attractant traps and numbers of moths captured in pheromone traps. That is, in some blocks many more moths were captured in pheromone traps and in some blocks numbers of moths captured were comparable with the different lures. Although the data analysis is preliminary at this point in time, statistical analyses of trap catch results for *Lacanobia* moths indicates a much stronger correlation between numbers of moths captured in feeding attractant traps versus pheromone traps and numbers of larvae found in the sampling of tree foliage. These data will be combined with earlier sampling done for *Lacanobia* by Mark Hitchcox and work conducted by Jay Brunner's laboratory to see if this pattern is consistent.

Numbers of *Pandemis* leafroller moths captured in feeding attractant traps were consistently less than numbers in pheromone traps. However, these numbers were still sufficient to track the phenology of the moth through the season, with both types of lures. Additionally, as with *Lacanobia* moths, there was consistently a stronger correlation between numbers of *Pandemis* leafroller moths

captured in feeding attractant traps versus pheromone traps and the numbers of leafroller larvae found in searches of orchard blocks.

Improvement of Chemical Blends as Feeding Attractants

A number of additional chemicals were tested in combination with acetic acid or added to the combination of acetic acid and 3-methyl-1-butanol. These included reassessing terpeneols, testing of several plant compounds reported in early literature to be attractive to codling moth, and developing and testing slow release formulations for carbon dioxide. These added chemicals did not consistently increase the capture of *Lacanobia, Pandemis*, or codling moth in traps baited with either acetic acid and 3-methyl-1-butanol or acetic acid.

References

Landolt, P. J. 2000. New chemical attractants for trapping *Lacanobia subjuncta, Mamestra configurata*, and *Xestia c-nigrum* (Lepidoptera: Noctuidae). J. Econ. Entomol. 93: 101-106.

Landolt, P. J. and J. F. Alfaro.2001. Trappinig *Lacanobia subjuncta, Mamestra configurata,* and *Xestia c-nigrum* (Lepidoptera: Noctuidae) with acetic acid and 3-methyl-1-butanol in controlled release dispensers. Environ. Entomol.

Landolt, P. J. and P. Hammond. Captures of non-target moths in traps baited with acetic acid and 3-methyl-1-butanol. J. Lepid. Soc. (In press)

Budget:

Development of Feeding Atttractants as Monitoring Lures for moth pests of apple.
Peter J. Landolt,
Project Duration: 1999-2001
Current Year: 2002

Year	Year 1 (1999)	Year 2 (2000)	Year 3 (2001)
Salary	15,350		17,000
Benefits	5,100		
Supplies	2,500		4,000
Travel	750		1,000
Total	22,750	23,700	22,000

Project cost 1999-2001: $48,450