

PROJECT NO. : ARS (Final Progress Report)

TITLE :Determination of the Chemical Composition and the Controlled Release Dispenser that will Provide the most Efficient Codling Moth Mating Disruptant for Economical Control

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REPORTING PERIOD : January 1, 1991 - December 31, 1995

ACCOMPLISHMENTS :

Contributions to Industry.

We found, contrary to reports in the scientific literature by other research groups, that the codling moth sex pheromone is a single compound. Consequently, industry groups and pheromone scientists do not need to expend effort searching for new components of the sex pheromone nor evaluating compounds incorrectly identified as pheromone components.

We found that the isomers of codlemone, either individually or as a mixture, are substantially superior to codlemone as communication disruptants under a variety of field conditions. Private industry is presently testing mixtures of the isomers of codlemone as mating disruptants in field tests.

We determined the relationship between evaporation rate of pheromone and percent reduction of mating as measured by the percent reduction of fruit infestation. This finding makes it possible to project the performance of commercial dispensers once their evaporation rates are known throughout the season.

We showed that the codling moth sex pheromone decomposes in controlled release dispensers. In Isomate-C, about two thirds of the pheromone is lost by chemical decomposition and only about one third is lost by evaporation. These findings stimulated an effort by the manufacturer to improve their dispenser. The new brown *Isomate-C plus* dispenser appears to have reversed the percentages of decomposition and evaporation.

We made two attempts to develop an improved dispenser, hopefully with negligible chemical decomposition. The first attempt was an unqualified failure. The second attempt (1995) showed that the dispenser when optimized would have moderately less chemical decomposition than the original Isomate-C but more decomposition than Isomate-C plus. Consequently, further work on this dispenser will not be undertaken.

We obtained the first data on evaporation rates from Consep CheckMate dispensers. No one, including the manufacturer, had ever determined evaporation rates from this dispenser.

Contributions to Science.

The composition of the sex pheromone of the codling moth was clarified ; the codling moth is one of a very few number of insect species having a sex pheromone consisting of only one component.

Previously, it was a well accepted principle amongst pheromone scientists, that the most potent insect communication disruptant is an exact replicate of the natural sex pheromone. We demonstrated for the first time non-pheromone communication disruptants of the codling moth that are more potent than the pheromone.

We developed a predictive model based on physical chemical principals for the evaporation rate of sex pheromones including the codling moth sex pheromone that allows one to calculate the field performance of commercial dispensers such as the Isomate-C dispenser. This model made it possible to determine the the percentage of codlemone being lost by chemical decomposition as well as the amount evaporating into the atmosphere.

RESULTS : CY 1995

1. When gray septa were loaded with varing amounts of codlemone, a 3 mg dose was most effective for monitoring male populations in a conventional orchard. This lure was still effective after 100 days in the field. In a mating disrupted orchard, a 20 mg lure (two 10 mg gray septa lures) was most effective for monitoring. Trap efficiency declined after 30 days. This compares with the 10 mg red septa efficiency that declined after 7 days in the field.

2. Field tests were conducted comparing 3 non-pheromone communication disruptants each versus codlemone. The test disruptants were the mixed isomers of 8,10-dodecadien-1-ol acetate, (E,E)-8,10-dodecadien-1-ol acetate, and (E,Z)-8,10-dodecadien-1-ol acetate. All 3 acetates tested superior to codlemone, but not as superior as the isomers of codlemone reported on earlier. The data has not yet been analysed statistically.

3. Consep Corp. Checkmate dispensers were aged in field tests, and collected and partially analysed for residue and evaporation rates. Zero day evaporation rates and doses varied considerably (40%) as did the values for the aged dispensers. The loss of evaporation rate with time appears to be considerably faster than with Isomate dispensers. About a third of the dispensers have not been chemically analysed as of this writing and statistical analyses has not been done either.

4. Because we had data (incomplete) that indicated that chemical decomposition of codlemone in rubber was much slower than in other materials, we designed a dispenser of rubber that could be used for mating disruption. Laboratory and field experiments during 1995 showed that the rubber dispenser was only moderately better than other materials. For example, the rate of decomposition in Isomate-C dispensers corresponds to a half-life of 40 days while the half-life in the rubber dispensers or in rubber septa is 50 days (20% slower rate of decomposition). Since the half-life for

decomposition of codlemone in Isomate-C+ dispensers is 80 days, rubber offers no advantage.

PUBLICATIONS :

L. M. McDonough, W. C. Aller, and A. L. Knight. 1992. Performance characteristics of a commercial controlled-release dispenser of sex pheromone for control of codling moth (*Cydia pomonella*) by mating disruption. *J. Chem. Ecol.* 18 : 2177-2189.

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L. M. McDonough, H. G. Davis, P. S. Chapman, and C. L. Smithhisler. 1994. Codling moth (*Cydia pomonella*) : Disruptants of sex pheromonal communication. *J. Chem. Ecol.* 20 : 171-183.

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L. M. McDonough, H. G. Davis, P. S. Chapman, and C. L. Smithhisler. 1995. Codling moth, *Cydia pomonella*, (Lepidoptera : Tortricidae) : Is its sex pheromone multicomponent? *J. Chem. Ecol.* 21 : 1065-1071.

L. M. McDonough, P. S. Chapman, T. J. Weissling, and C. L. Smithhisler. 1996. Efficacy of non-pheromone communication disruptants of codling moth (*Cydia pomonella*) : Effect of pheromone isomers, and of distance between calling females and dispensers. *J. Chem. Ecol.* 22 : (Accepted for publication ; scheduled for publication, March 1996).

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T. J. Weissling, L. M. McDonough, P. S. Chapman, and C. Smithhisler, and T. S. Miller. 199X. Codling moth (*Cydia pomonella*) : Relationship between pheromone dose and codling moth capture in traps baited with non-isomerizing septa. (In preparation).