

The Control of *Cydia pomonella* L. (Lepidoptera: Tortricidae) by an Experimental “Attract and Kill” Formulation in Pear Orchard

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Abstract. Pheromonal control of the codling moth, *Cydia pomonella* L. by an experimental “attract and kill” formulation called “Mesaj CP” were carried out during 2008 at the Fruit Research Station Cluj, Romania. The experimental product formulated by the researchers of Raluca Ripan-Romania Chemical Research Institute contains the pheromone of the codling moth (E,E-8,10 dodecadien-1-ol) and an synthetic pyrethroid insecticide (cyfluthrin) in order to be compatible with the “attract and kill” strategy. The experimental product was applied in a rate of 4000 droplets per hectare by a hand operated pump dispenser. Field trials showed that this environmentally friendly strategy can compete with the conventional spray application of insecticides and can provide a good alternative for codling moth control in integrated pest management and fruit growing.

Keywords: *Cydia pomonella*, codling moth, pheromonal control, attract and kill

INTRODUCTION

The codling moth *Cydia pomonella* L. is one of the most important pests in fruit trees world wide. In Romania, the codling moth develops two to three generations per year. The first moths appear in the last decade of April or in the first days of May. The flight of the adult moth is continuous till the first decade of September.

“Attract and kill” strategies, combine an attractant with an insecticide, eliminating individuals that contact the lure. This technique proved to be reliable against tortricid pests (Charmillot *et al.*, 2000). The principle is already successfully applied to control the codling moth (Stara and Kocourek, 2004);

Pheromonal control of the codling moth is an environmentally friendly technique, and can compete with conventional control methods when applied under low or medium infestation conditions (Somsai *et al.*, 2008). By eliminating a considerable number of males, the chance of fertilized females is reduced, thus the population is controlled.

The main aim of the field test was the pheromone control of the codling moth *Cydia pomonella* by using an experimental “attract and kill” formulation in a pear orchard.

The research concerning the biological efficacy of the experimental formulations of the synthetic sexual pheromone (E,E-8,10 dodecadien-1-ol) (Roelofs *et al.*, 1971) and a pyrethroid insecticide, was carried out in 2008 at the Fruit Research Station Cluj.

MATERIALS AND METHODS

The experimental products based on the synthetic pheromone of the codling moth were formulated by the researchers of the “Raluca Ripan” Chemical Research Institute from Romania. Field trial in 2008 of the experimental product was conducted at F.R.S. Cluj in the pear orchard, cv Doina, Hydeea, Williams and Napoca organized for experimental trials. The plot sizes used for experiments were 0.5 hectares.

The experimental product, “Mesaj CP”, was applied in a rate of 2000 droplets per treatment with a hand operated pump dispenser on the branches in the upper parts of the crown. Quantitatively 200 g of attracticid/ treatment was applied.

The first application was on May 5th, the second on June 15th and the third on July 20th. During the experiment, in the pheromone treated plot, no insecticide treatments were applied. The flight activity of the codling moth was monitored by specific pheromone traps with synthetic pheromone sources placed in the untreated plots at FRS Cluj (during 2008). The pheromone traps were changed every two weeks.

The oviposition activity was also monitored during the research period.

The larval stage and fruit damage were also monitored. The number of larvae caught in corrugated paper traps placed on the trunk of the fruit trees was also monitored.

The experimental plots size used for experiments were 0.5 hectares (untreated, spray application, attract-and-kill) (Fig. 1).

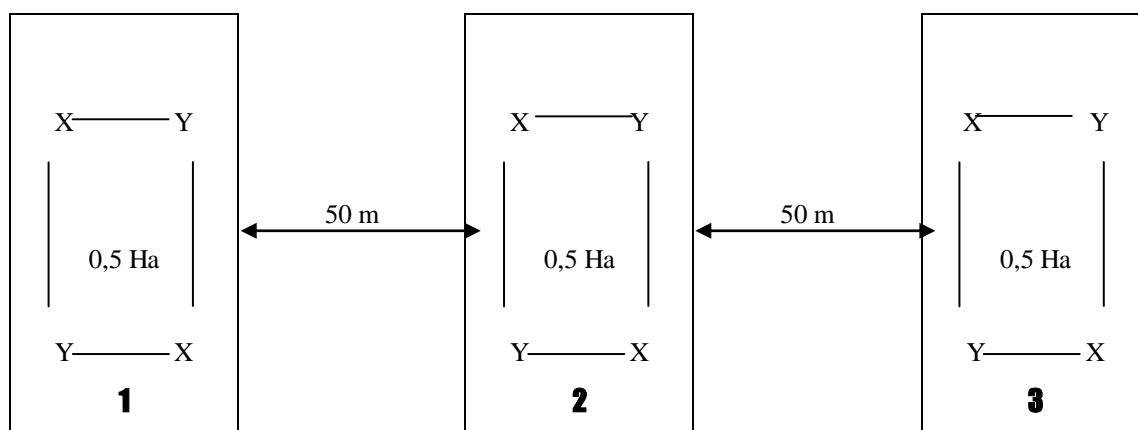


Fig. 1. Experimental plots layout

Note: 1 = Untreated; 2 = Spray application; 3 = Attract-and-kill

The evaluation of the experimental product was done in two ways:

The attract-and-kill technique was considered efficient as long as there are no captures in pheromone traps placed in the experimental plot. The traps were checked twice a week.

The efficacy of the attract-and-kill technique was evaluated by assessing the fruit damage on samples of 500 randomly hand picked fruits.

The efficacy of the tested products were calculated using (E%) Abbott’s formula:

$$E = (1-d/D) \times 100, \text{ in which:}$$

d = Population in treated plot after treatment

D = Population in control plot

Statistical data processing was carried out by Student (t) test.

RESULTS AND DISCUSSION

In the untreated plot there was the highest density of codling moth eggs. Out of one hundred fruits analyzed, 4 to 30 were found with eggs (Tab. 1).

Tab. 1

Fruits with eggs of codling moth in the untreated plot (SCDP Cluj, 2008)

Day of observation	Number of fruits observed	Fruits with eggs
June 3 rd , 2008	100	17
July 7 th , 2008	100	30
August 5 th , 2008	100	4

In the conventionally treated plot the number of codling moth eggs found was the lowest. Only three or four percent of the analyzed fruits were found infested with eggs (Tab. 2).

Tab. 2

Fruits with eggs of codling moth in the conventional plot (SCDP Cluj, 2008)

Day of observation	Number of fruits observed	Fruits with eggs
June 3 rd , 2008	100	3
July 7 th , 2008	100	4
August 5 th , 2008	100	0

In the pheromonal treated plot the infestation rates show a level comparable to the conventionally treated plot (Tab. 3).

Tab. 3

Fruits with eggs of codling moth in Message CP plot (SCDP Cluj, 2008).

Day of observation	Number of fruits observed	Fruits with eggs
June 3 rd , 2008	100	7
July 7 th , 2008	100	3
August 5 th , 2008	100	2

In Tab. 4 the estimation of the codling moth population based on the number of larvae trapped in corrugated cardboard traps collected in autumn is presented.

Tab. 4

Number of larvae in corrugated cardboard traps (SCDP Cluj, 10. 09. 2008)

Treatment	Larvae/tree
Message CP	3
Spray application	1
Untreated	28

The biological efficacy of the „attract-and-kill” technique compared to the conventional chemotherapy is presented in Tab. 5. In terms of crop loss, the biological efficacy of the „attract-and-kill” strategy developed to control the codling moth shows an acceptable damage level comparable with the conventional spray application.

Tab. 5

Efficacy of the „attract-and-kill” technique (SCDP Cluj, 2008)

Treatment	% damaged apples	Efficacy (%)*	% damaged apples	Efficacy (%)*	% damaged apples	Efficacy (%)*
	July 25 th		September 10 th		Total fruit loss	
Message CP	0.8	91.8	0.2	99.5	1	98.1
Spray application	0	100	0.6	98.6	0.6	98.8
Untreated	9.8	-	43.3	-	53.1	-

Note: Biological efficacy of experimental variants is expressed in %. Abbott*

Tab. 6

Statistical data processing, 2008

A. p values for 25.07.2008		
	Message CP	Spray application
Spray application	0.0000715 (***)	
Untreated	0.0000762 (ooo)	0.0000543 (ooo)
B. p values for 10.09.2008		
	Message CP	Spray application
Conventional spray application	0.0022205 (oo)	
Untreated	0.0000015 (oo)	0.0000016 (ooo)
C. p values for the general evaluation		
	Message CP	Spray application
Spray application	0.0159778 (-)	
Untreated	0.0000003 (ooo)	0.0000003 (ooo)

The statistical data processing (Tab. 6) shows a significant difference between the efficacy of the pheromonal and the conventional control methods for the first ($p = 0.0000715$) and the second evaluation ($p=0.0022205$).

The general evaluation between the biological efficacy of the „attract-and-kill” technique compared to the conventional spray application in 2008 also revealed an insignificant difference ($p=0.0159778$).

CONCLUSIONS

In terms of crop loss, the biological efficacy of the „attract and kill” technique shows an acceptable damage level (1%) compared to the economical damage threshold of (1%).

Our results seem to indicate that a rate of 400 grams of attracticid /ha can provide a good control against the codling moth in pear orchards.

Field trials showed that this environmentally friendly strategy can provide a good alternative for integrated pest management and fruit growing.

According to the length of the codling moth's flight activity in the year 2008 three applications application of the experimental formulation gives season long protection.

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