RESEARCH CONCERNING THE BIOLOGICAL CONTROL OF CODLING MOTH (*CYDIA POMONELLA*) USING THE ENTOMOPHAGOUS WASP *TRICHOGRAMMA* SP. IN THE CARANSEBES POMICULTURAL BASIN

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Abstract*: The product Trichotim has as a principle the insect Trichogramma sp. Trichogramma is a wasp measuring only 0.5 mm. It lays its eggs in the pests' eggs, destroying them before they can damage the plants. Trichogramma is efficient in the destruction of 500 species of pests; the product developed based on this wasp has been homologated in Romania only for three such pests: cabbage moth (Mamestra brassicae), European grapevine moth (Lobesia botrana) and codling moth (Cydia pomonella). This wasp species, almost invisible, is extremely widespread. The main issue for researchers was how to capture it from the wild and then how to create the conditions necessary to make it multiply in an artificial environment. The product Trichotim has been tested for four years, an interval during which Trichogramma showed its efficacy in both laboratory cultures and in the cabbage gardens of some farmers in the Arad County to whom it* was *offered as a promotion. The costs are higher than in a treatment with chemical substances, but the cultures we obtained were less risky for our health. One gram contains about 50.000 eggs of Trichogramma, an amount sufficient to store the crop from 1 ha of cabbage, of grapevine or of apple trees. The product Trichotim is used in the control of pests of grains, maize, sunflower, rape, cabbage, peas, clover, alfalfa, grapevine, apple tree, plum tree, and ornamental plants.*

Key words: *Trichotim, treatment, variety, apple worm, effectiveness*

INTRODUCTION

Biological methods to control diseases and pests make up basic concept of integrated control. Codling moth can be controlled with biological preparations based on *Bacillus thuringiensis*. Using oophagus wasps as *Trichogramma embryophagum* ar rates of 300.000 - 400.000 wasps/ha, we can reduce the inoculums reserve with 35-65%.

We used the sexual pheromone Atrapom to establish optimal moments in treatment waring to attract males to pheromone source or to control them directly. The setting of the trap allowed us to establish the flight curve.

Codling moth is a pest with two generations per year who hibernates as a larva wrapped in a cocoon under the trunk bark. Research was carried out in a Jonathan apple tree variety and in order to reduce the population of the pest we used the product Trichotim based on the insect *Trichogramma*. In order to control the codling moth we launched the biopreparation Trichotim on the two generation of pests, applying a rate of 300.000 wasps/ha, of witch 250.000 wasps on the one generation, and 50.000 of wasps on the two generation.

MATERIAL AND METHOD

Research was carried out on an intensive Jonathan apple tree plantation located near the former research station Caransebeş belonging to the S.D.E. Timişoara.

The Jonathan apple tree variety

It is of American origin: it was obtained in 1880 by Ph. Rick, in Ulster, NY. It is very appreciated and widespread in Romania. It can be grafted on all apple tree mother or father

plant. It can be pollinated by Red Delicious, Patul, and Wagner.

The tree is medium vigorous, with a straight trunk; the bark is greyish - silvery and smooth for a long time. The crown is pyramidal at the beginning, semi-spherical irregular, rather thick; fructification branches are rare and long, in general, with predominant twigs and long-footed spurs. Hairy sprouts are light grey, and the pubescent leaves are whitish.

The fruit is medium-size or over-medium size, sometimes small, tronconic, rounded at both ends, symmetrical. The background colour is green-yellowish, partially or totally covered by blood-red colour; on the sun-exposed side it has a fine mycelium-like rusty network. The peduncle is short, the cavity is deep and narrow, the calyx is small and close, the sub-calyx cavity is small and v-shaped. The white-yellowish pulp is crunchy, very succulent, sweet, balanced acidic, and of very high quality. Fruit are harvested in October.

Variety features: precocious, very productive, not very demanding from climate and soil, and frost resistant. It is very sensitive to powdery mildew, resistant to *Eryosoma* and *Carpocapsa*. Fruit obtained in the irrigated plain area or from abundantly nitrogen-fertilised orchards are sensitive to bitter-pit. They have obtained by cloning from this variety the following varieties: Ionared, Red Jonathan, New Red Jonathan, Jonathan Capri, Jonathan 26, etc. By crossing, particularly as a mother variety, they have obtained the following varieties: Aromat de vară, Roşu de Cluj, Fălticeni, Ancuţa, Ionagold, Idared, Idajohn, and Melrose. Research concerning the biological control of codling moth with the product Trichotim was carried out over a period of two years (2009-2010) in the apple tree plantation of the Caransebeş Pomicultural Basin.

In the last few years, there has been significant increase of the attack by the codling moth in Western Romania. To reduce the population of this pest, we used the product Trichotim and the insect *Trichogramma* as an active principle.

To control the codling moth, we applied the Trichotim 3 times on the two generations of the pest (2 applications in the 1st generation and 1 application in the 2nd generation): we applied a rate of 300.000 wasps/ha, of which 250.000 wasps on the 1st generation and 50.000 wasps on the 2nd generation. The entomophagous *Trichogramma* sp. was launched two days after the flight peak of the pest *Cydia pomonella* L. The flight curve was identified with Atrapom pheromone traps set in the trees' canopy after petal shedding.

To determine the efficacy of the product Trichotim, we made observations on both pest generations, the last on the 2nd generation 14 days before fruit harvesting in the plots where we launched 300.000 wasps per ha.

The frequency of fruit attacked by the codling moth was calculated with the formula:

$$F\% = \frac{nx100}{N}$$

where:

F = is the frequency of the attack by the pathogen and by the pest (%);

n = the number of fruit attacked;

N = the number of fruit observed.

RESULTS AND DISCUSSIONS

Table 1 presents data concerning the efficacy of Trichotim in the control of the codling moth in the trial year 2009. As shown below, the three launches of the wasp *Trichogramma* sp. took place on May 29, 2009, on June 9, 2009, and on July 18, 2009.

Table 1.

Efficacy of Trichotim in the control of the codling moth (*Cydia pomonella* L.) in Caransebeş in 2009

Generation	Number of launches	Rate of wasps /ha	Launch date	Number of fruit monitored	Number of fruit attacked	F%
1st	1	120.000	May 29, 2009	P_1 – 100	3	
				P_2 – 100	5	
	2	130.000	June 9, 2009	P_3 – 100	3	
				Total – 300	**11**	**3.66**
	Control		-	P_1 – 100	9	
				P_2 – 100	14	
				P_3 – 100	13	
				Total – 300	**36**	**12.00**
2nd	1	50.000	July 15, 2009	P_1 – 100	13	
				P_2 – 100	10	
				P_3 – 100	14	
				Total – 300	**37**	**12.33**
	Control		-	P_1 – 100	21	
				P_2 – 100	36	
				P_3 – 100	22	
				Total – 300	**68**	**26.33**

Data presented in Table 1 show that, in the 1st generation of codling moth in 2009, where we applied Trichotim twice with a rate of 120.000 wasps/ha in the 1st launch and 130,000 wasps/ha in the 2nd launch (i.e. a total of 250,000 wasps of *Trichogramma* per ha), the frequency of the attack by the codling moth (*Cydia pomonella* L.) diminished between 12% in the control plot and 3.66% in the other plots.

Table 2 presents the Efficacy of the biopreparation Trichotim in the control of the codling moth (*Cydia pomonella* L.) in the trial year 2010.

Table 2.

Efficacy of Trichotim in the control of the codling moth (*Cydia pomonella* L.) in Caransebeş in 2010

Generation	Number of launches	Rate of wasps /ha	Launch date	Number of fruit monitored	Number of fruit attacked	F%
1st	1	120.000	May 29, 2010	P_1 – 100	6	
	2	130.000	June 5, 2010	P_2 – 100	4	
				P_3 – 100	4	
				Total – 300	**14**	**4.66**
	Control		-	P_1 – 100	12	
				P_2 – 100	11	
				P_3 – 100	12	
				Total – 300	**35**	**11.66**
2nd	1	50.000	July 15, 2010	P_1 – 100	14	
				P_2 – 100	12	
				P_3 – 100	12	
				Total – 300	**38**	**12.66**
	Control		-	P_1 – 100	30	
				P_2 – 100	28	
				P_3 – 100	34	
				Total – 300	**92**	**30.66**

As shown in Table 2, the three launches of the wasp *Trichogramma* sp. occurred on May 25, 2010, on June 5, 2010, and on July 15, 2010, respectively.

To control the 2nd generation of codling moth, we practiced a single launch, 3 days after the peak of the pest flight curve, on July 15, 2010, using the product Trichotim at a rate of

50,000 wasps/ha. The frequency of fruit attacked by the codling moth in the control variant (not treated biologically or chemically) was 11.66% in the 1st generation and 30.66% in the 2nd generation, attack frequencies that were reduced using the biopreparation Trichotim with 4.66% in the 1st generation to 12.66% in the 2nd generation.

Table 3 shows data concerning the frequency of the attack by the species *Cydia pomonella* L. in the trial years 2009-2010. Data presented above show that the frequency of fruit attacked by the species *Cydia pomonella* is higher in 2010 (30.66%) than that of the year 2009 (26.33%).

Table 3.

Frequency of the attack by the species *Cydia pomonella* L. in the trial years 2009-2010 in Caransebeș

Generation	Variant	F % 2009	F % 2010
1st generation	Repetition 1	3	6
	Repetition 2	5	4
	Repetition 3	3	4
Control	Repetition 1	9	12
	Repetition 2	14	11
	Repetition 3	13	12
2nd generation	Repetition 1	13	14
	Repetition 2	10	12
	Repetition 3	14	12
Control	Repetition 1	21	30
	Repetition 2	36	28
	Repetition 3	22	34
Total %		**26.33%**	**30.66%**

CONCLUSIONS

Research carried out allows us to draw the following conclusions:

1. The biological product Trichotim based on the entomophagous wasp *Trichogramma evanescens* was applied with good results in the apple tree plantation to control the two generations of codling moth (*Cydia pomonella* L.).

2. The biopreparation Trichotim was launched in the plantation on the 1st generation of the codling moth 2-3 days after we recorded the flight peak of the pest. The flight curve was determined with Atrapom pheromone traps set right after petal shedding.

3. There were good results in the control of this pest when we applied the first two launches. Upon 1st launch, we used 120,000 wasps/ha, and upon 2nd launch we used, 12 days later, 130,000 wasps/ha. Upon 2nd generation, launches of *Trichogramma evanescens* were done 2-3 days after flight peak in the pest using 50,000 wasps/ha.

4. Upon application of this biopreparation, using the rates of entomophagous insects mentioned above, the highest frequency of fruit attacked by the codling moth (*Cydia pomonella* L.) was 12.00% compared to 26.33%, the frequency of the attack on the control in 2009, and 12.66% compared to 30.66%, the frequency of the attack on the control in 2010.

5. The efficacy we recorded and the yield increase recommend the use of the biopreparation Trichotim in the integrated control complexes in apple tree to control the codling moth (*Cydia pomonella* L.) in both pest generations.

6. The use of the biopreparation Trichotim at a rate of 300.000 wasps/ha to control the codling moth (*Cydia pomonella* L.) reduces with 4 the number of chemical treatments and, implicitly, a reduction of environmental pollution on apple tree plantations of 25%.

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