South Western Journal of Horticulture, Biology and Environment
P-ISSN: 2067- 9874

Vol. 1, No. 1, 2010
pp. 1 - 8

STUDIES REGARDING THE BIOLOGICAL CONTROL OF THE *Cydia pomonella* L. IN THE CONDITIONS OF THE OLTENIA CENTRAL AREA

Ion MITREA[1,*], Rodi MITREA[1], Ovidiu TUCA[1], Catalin STAN[1]

1. University of Craiova, Horticulture Faculty, Str. A.I.Cuza 13, Craiova, Romania,
* Corresponding author: I.Mitrea, E-mail: mitreaion@yahoo.com

Abstract: *The codling moth, Cydia pomonella L. (Lepidoptera: Tortricidae), is a pest of worldwide importance in commercial apple growing (Lösel et al., 1998). Broad spectrum insecticides should be avoided for they negatively affect non-target organisms, particularly beneficial insects and trigger the problem of pest resistance and accordingly pest outbreaks (Glenn, 1992). Currently, codling moth is controlled by conventional spray applications, mainly of organo-phosphates or insect growth regulators. The development of resistance makes it necessary to develop novel control strategy compatible with the aims of integrated pest management (Croft et al. 1991). Starting from these reasons within the Banu Maracine Didactical Station, of the University of Craiova, we have initiated some research regarding the biological control of the Cydia pomonella L., using the oophagus wasp parasitoids Trichogramma embryophagum as well other biological products.*

Key words: *Cydia pomonella L., pheromones traps, microbiological products, Trichogramma embryophagum*

INTRODUCTION

In the Oltenia central area conditions, the apple codling moth is the main pest in the apple orchards. The adults are present in the orchards from the beginning of May until September, the larva producing high damages especially the ones from the second generation.

Though there has been made research on the biology, ecology and controlling the apple codling moth even from the beginning of the last century as well on the world plane (Charmillot & Flaux, 1975, Kneifl, 1992) as in our country (Suta, 1969, Drosu, 1997), the problem of reducing the attack risk and of a success control still remain actually. Without control, codling moths could destroy 80 percent of the Northwest's apple crop and half the pear crop (Stelljes, 2001).

In the last years in the orchards from the Banu Maracine Didactical Station of the University of Craiova, there has been recorded high degree attack, reaching 50 %.

This fact allow us to perform some observation regarding the choosing of the treatments apply and choosing different methods in order to reduce the damages under the economic threshold.

In the present paper we propose a presentation of the relations between the temperature and the main moments of the insects' biological cycle, using pheromones traps.

Also there are presented the results of some biological control, using the oophagous parasitoids *Trichogramma embryophagum* and the biological products comparative with the control variant, chemical treated.

Parasitoids are the largest and most important group of natural enemies of apple pests. Most of the parasitoids belong to the Hymenoptera. Some 50 parasitoids, mainly Hymenoptera and a few Diptera, attack various stages of the tortricid moths in temperate Europe (Melika et al. 1990).

MATERIAL AND METHODS

The observations has been made in an apple orchard from the Banu Maracine Didactical Station of the University of Craiova (44°20'0"N, 23°49'0"E) in Oltenia region of Romania with a 2 ha surface, during 2007 – 2009.

In the apple orchard we have initiated some research regarding the biological control of the *Cydia pomonella L*, using the natural antagonism between the oophagous species *Trichogramma embryophagum* and *Cydia pomonella L.*, their eggs constituting the food for the parasitoids specie. The launch method consist in using plates with eggs of *Ephestia kuehniella Zell.* parasited by the *Trichogramma embryophagum* wasp, plates that has been placed in the trees, on the row at 12 m distance between them.

The number of launches for a vegetative season has been established function the pest biological reserve, pest biology and the climatic conditions evolution. The moment for launching the parasitoids wasp has been established using the adults flight curve, based on the pheromones traps ATRAPOM.

The experience comprise 4 variants and there has been made 2 launches for each codling moth generations, using a launching rate of 50000 to 150000 wasps/ha. In the same apple orchard there has been set up an experience regarding the apple codling moth control using the biological products comparative with the untreated control variant.

RESULTS AND DISCUSSIONS

While natural enemies are able to provide complete control of some pome fruit pests, alone they are unable to suppress populations of codling moth below economic levels (Anon, 1999).

The biological methods imply the use of the parasitoids, predators, the entomopathogens microorganisms, autocidia, the hormonal struggle, etc. These methods have the advantage that doesn't pollute the environmental and maintain an equilibrium within the agrobiocoenosis, protecting the useful species, avoiding the excess use of the chemical methods.

From the analyzed data, as a result of the research made in the Oltenia central area, it came out that the pest *Cydia pomonella L.* develop 2 generations/year.

The appearance, the population level and the pest evolution in the apple orchard has been emphasized by the weekly recording of the male captured butterflies in the pheromones traps ATRAPOM.

Based on the recorded data there has been made the pest flight curve and there has been warned the control treatments.

The climatic conditions during 2007 – 2009, have influenced in a different way the biology and the pest presence in the apple orchard. Thus, in 2007, the pest population level has been higher in June for the first generation and from the second half of July until first half of August for the second generation. The first generation has been phased during June – July, with a maximum flight in June. The second generation has phased during July – August, with a maximum flight curve at the end of July, beginning of August.

For each generation there has been made 2 launches with oophagous wasps *Trichogramma embryophagum*.

In 2008, the pest flight curve has presented the same look, but the appearance for each generation has been influenced by the climatic conditions of this year.

The first generation has been phased from May – June, with the maximum flight reach in the third decade of May.

The second generation has phased during July – August, with the maximum flight on the third decade of the August. The best moment for launching the *Trichogramma embryophagum* wasps has been established on the flight curves as in the precedent year, with 2 launches for each generation.

During 2009, the first pest flight phased beginning with the second half of May and last during June, the second flight phased until the last decade of September, reaching a maximum in the third decade of August. Also in

this year there has been made 2 launches with parasitoids wasps for each generation.

Following the observations regarding the biological control of the *Cydia pomonella L.,* using the parasitoids wasp *Trichogramma embryophagum*, during 2007, the percentage of the attacked fruits has been ranged between 19.6 – 22.4 %, for the first generation and of 14.6 – 21.6 % for the second generation, comparative with the control variant chemical treated with Decis 25 EC, dose 0.03%, where the percentage of the attacked fruits has been of 9.6 % for the first generation and 8.2 % for the second generation (Table 1).

Table 1.
The *Cydia pomonella* L control using *Trichogramma embriofagum* during 2007

Variant launching rate (wasps/ha)	First generation		Second generation	
	Attacked fruits (%)	Efficiency (%)	Attacked fruits (%)	Efficiency (%)
50 000	29.4	65.6	21.6	70.2
75 000	25.6	67.2	18.9	71.5
100 000	20.2	68.9	16.9	72.4
150 000	19.6	70.2	14.6	76.6
Decis 2.5 EC (dose 0.03%)	9.6	96.5	8.2	97.2
Untreated control variant	40.5	-	38.6	-

In the untreated variant the percentage of the attacked fruits has been of 40.5 % for the first generation and of 38.6 % for the second generation.

The efficiency of the biological control with *Trichogramma embryophagum* has been ranged between 65.2 % for the variant with 50000 wasps/ha and 70.2 % for the variant with 150000 wasps/ha at the first generation and 70.2 % (50000 wasps/ha) and 76.6 % (150000) wasps/ha for the second generation.

The variant where there has been launched 75000 and 100000 wasps/ha has presented the efficiency ranged between 67.2 and 72.4 %.

The chemical variant treated with Decis 25 EC, dose 0.03% has presented values of the efficiency of 96.5 % for the first generation and 97.2 % for the second generation.

During 2008 the percentage of the attacked fruits has presented values ranged between 18.6 – 27.4% for the first generation and 11.4 – 20.5% for the second generation (Table 2).

Table 2
The *Cydia pomonella* L control using *Trichogramma embriofagum* during 2008

The variant Launching rate (wasps/ha)	First generation		Second generation	
	Attacked fruits (%)	Efficiency (%)	Attacked fruits (%)	Efficiency (%)
50 000	27.4	68.2	20.5	70.2
75 000	23.1	69.6	18.5	73.4
100 000	21.2	70.1	15.6	78.5
150 000	18.6	72.2	11.4	79.6
Decis 2.5 EC (dose 0.03%)	7.6	96.5	5.2	98.2
Untreated control variant	34.5	-	28.4	-

The treatment efficiency has been ranged between 68.2 – 72.2 % for the first generation and 70.6 – 79.6 % for the second generation, comparatively with the chemical treated variant with Decis 25 EC, dose 0.03% which has presented values ranged between 96.5 – 98.2 %.

The same situation for the 2009, when it can be observed a decreasing of the attacked fruit percentage for the variants treated with *Trichogramma embryophagum*, comparative with precedent years; fact explained by the presence of a higher number of *Trichogramma* wasps in the orchard (Table 3).

As a result of the increasing of the biological reserve year after year as well due to the adaptation of some individuals to the climatic conditions.

Thus, the percentage of the attacked fruit in the third year of research has been placed between 16.2 – 25.2 % for the first generation and 14.2 – 20.2 for the second generation.

The efficiency of the *Trichogramma embryophagum* launches in 2009, has increase comparative with the precedent years, from 70.2% to 76.9 % for the first generation and 72.5 – 79.2 % for the second generation.

As a result of the research regarding the *Cydia pomonella L.* control using the oophagum wasp *Trichogramma embryophagum*, we can ascertain that the best result has been obtained at the variants where there has been launched 100000 and 150000 wasp/ha.

Regarding the efficiency of some biological products based on *Bacillus thuringiensis*, it came out that the percentage of the attacked fruit has been ranged between 20.2 and 24.5 % during 2007, between 19.4 and 22.5 % during 2008 and between 18.4 and 20.61 % during 2009.

Table 3
The *Cydia pomonella* L control using *Trichogramma embriofagum* during 2009

The variant Launching rate (wasps/ha)	First generation		Second generation	
	Attacked fruits (%)	Efficiency (%)	Attacked fruits (%)	Efficiency (%)
50 000	25.2	70.2	20.2	72.5
75 000	21.6	72.6	19.6	74.5
100 000	18.6	75.4	16.5	76.8
150 000	16.2	76.9	14.2	79.2
Decis 2.5 EC (dose 0.03%)	5.4	97.5	4.6	98.4
Untreated control variant	29.6	-	20.6	-

The efficiency of the biological products has been ranged between 70.2 % for Dipel 8L, (during 2007) and 74.6 % for Silposan CA 2 (during 2009), comparative with the chemical treated variant where there has been recorded values ranged between 97.6 and 98.4 % (Table 4).

Table 4
The control efficiency of *Cydia pomonella* L. using the biological products

Year	Product	Dose %	Attacked fruits%	Efficiency %
2007	Dipel 8 L	0.1	21.4	70.2
	Foray 48 B	0.05	22.3	70.5
	Silpson CA 2	0.2	20.2	72.6
	Turicide 48 LV	0.1	24.5	71.4
	Control variant (Decis 2.5 CE)	0.03	4.2	97.6
2008	Dipel 8 L	0.1	20.5	71.6
	Foray 48 B	0.05	21.4	71.5
	Silpson CA 2	0.2	19.4	73.2
	Turicide 48 LV	0.1	22.5	72.4
	Control variant (Decis 2.5 CE)	0.03	3.2	97.8
2009	Dipel 8 L	0.1	19.8	72.2
	Foray 48 B	0.05	19.5	73.5
	Silpson CA 2	0.2	18.4	74.6
	Turicide 48 LV	0.1	17.6	72.2
	Control variant (Decis 2.5 CE)	0.03	2.4	98.4

Regarding the advantage of using the oophagum wasp and of the biological products based on *Trichogramma embryophagum*, the high efficiency, their selectivity face the human and useful fauna, the lack of the toxic residues in the fruits, we consider opportune their utilization in the integrated control strategy of the main apple pest.

CONCLUSIONS

The apple codling moth (*Cydia pomonella* L.) constitute the main pest in many orchards of apple, pear, quince, from the central area of Oltenia, presenting 2 generations per year.

The struggle for reducing under the economical threshold the damages produced by this pest represent an aim required by cultivators and desired by the protectionists.

The complexity of this pest biology, of the biological cycle and of the ecological factors which determine the mass multiplication of this pest, required a special surveillance of the populations and the correlations of the ecological factors' complex for a correct prognosis and applied of the treatments.

In order to a correct appreciation of the *Cydia pomonella* L. populations, the correlations of the temperature effective sum with the flight curve evolution must be realized within the context of the direct observation from the orchard, take in care of the biological reserve. The efficiency of the biological products as well of the treatments with oophagum wasps *Trichogramma embryophagum*, has been high, the obtained fruits being without toxic residues, and the useful fauna has been protected.

REFERENCES

Anon, J. (1999): Integrated pest management for apples & pears. University of California Division of Agriculture and Natural Resources Publication 3340, Oakland, CA, pg. 321.

Charmillot, P.J., Flaux, R. (1975): Moyens d'averissement dans la lutte dirigée contre le carpocapse. Revue Suisse de Viticulture, Arboriculture, horticulture 7: 93 – 98.

Croft, B.A. Riedl, H.W. (1991): Chemical control and resistance to pesticides of the codling moth. pp.371-387. In: Van der Geest, L.P.S, Evenhuis, H.H. (eds). World Crop Pests, Vol. 5. Tortricid Pests: Their Biology, Natural enemies and Control, Elsevier Press, Amsterdam.

Drosu, S. (1997): Viermele merelor (*Cydia pomonella* L) – daunator inca periculos in livezi. Proplant' 97, Calimanesti, Vol. II: 363–370. [in Romanian]

Glenn, P.A. (1992): Relation of temperature of the development of the codling moth. Journal of Economic Entomology 15: 193-199.

Kneifl, V.A. (1992): temoperature based Method for the Aimed Chemical Control of Codling Moth (Laspeyresia pomonella L). Acta Phytopathologica et Entomolologica Hungarica 27: 349-352.

Lösel, P.M., Ebbinghaus, D., Elbert, A., Scherkenbeck, J. (1998): Laboratory and field studies for the development of an attract and kill strategy to control the codling moth in apple orchards. Abstracts of the VI European Congress of Entomology. 23–29 August, Česke Budejovice, 640.

Melika, G.G., Zerova, M.D., Sviridov, S.V., Krochko, V.Y., Schoka, V.V., Babilya E.I. (1990): Recommendations on collection, identification and application of entomophagous insects of major pests of apple tree orchards in the Zakarpatie District, Ukraine. Department of Entomophagous Insects and Ecological Principles of Biocontrol, Institute of Zoology of National Ukrainian Academy of Sciences, Uzhgorod. p. 87.

Suta, V. (1969): Noi contributii la studiul biologiei, ecologiei si combaterii viermelui merelor (*Cydia pomonella* L). Analele ICPP Bucuresti, 4: 106–112. [in Romanian]

Stelljes, K.B. (2001) Areawide pest management: An effective strategy for many pests. No coddling for this moth. Agricultural Research 49 (6): 10-12.