

PROTECTION OF APPLE FRUITS, FROM CODLING MOTH (CYDIA POMONELLA), USING THE MATING DISRUPTING PHEROMONES, ISOMATE CTT

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ABSTRACT

In the Korça region of Albania, (*C.pomonella*) is a key insect pest in apple production. Insect develops two complete generations per season. To protect the apple fruits from codling moths, an average of three treatments with conventional insecticides per season are carried out. In the year 2022, the mating disruption method of *C. pomonella*, was used for the first time using the ISOMATE CTT product with the active ingredient (E, E)-8, 10-dodecadien-1-ol (codlemone.) The field tests were carried out in four apple blocks of the Korça area, with a total of 2.66 ha. The product is formulated in dispenser form. Each dispenser consists of duplicate plastic threads, joined & sealed at the ends. Dispensers have absorbed inside the tubes, the codling moth pheromones. Are used 500 dispensaries/ha off the apple. One dispensary thread protects 20 m² of orchards. The dispensers were hung in apple trees, at the time, when the monitoring pheromone traps, caught the first *C. pomonella* adult. An isolation distance of 200 m was respected between the blocks treated and not treated with ISOMATE CTT.

In the whole season, only one treatment is carried out. ISOMATE CTT kept the infection at the limit of the tolerated economic damage; 3-5 infected fruits in 1000 analyzed fruits. The cost with ISOMATE CTT was 30 % more expensive than with conventional insecticides. Product ISOMATE CTT is registered for apple organic production because it has no negative impact on apple fruits and the environment in general. The study was supported by GiZ.

Keywords: *Cydia pomonella*, apple, ISOMATE CTT.

INTRODUCTION

Codling moth (*Cydia pomonella*), as a key pest in apple production, determines the health status of apples, even from other insect pests. Mismanagement of codling moths, destabilizes the biological balance in the apple production ecosystem.

How is this destabilization the apple agroecosystem?

The first; insecticides with high toxicity, reduce the populations of beneficial insects.

This fact creates the conditions for the growth of secondary pest populations such as; the red spider mite, scales, leaf minier moths, cicades, aphids, etc.

The second; the misuse of conventional insecticides, increases the level of resistance of insects to insecticides. In such conditions, additional treatments are needed to maintain insect populations under the economic threshold. Additional treatment increases plant protection costs and the cost of environmental protection.

The use of the biotechnical method with pheromones, which caused the mating disruption of the codling moth of the partners, has avoided the use of conventional insecticides.

Confusion disruption pheromone, used in this study during the season 2022 is called ISOMATE CTT. The study is supported by GiZ, Germany, Albania office.

MATERIAL AND METHODS

The field tests were carried out in the area of Korça, which is known as the main apple production area in Albania. Four apple blocks were selected with sizes of 1.2 ha, 0.72 ha, 0.4 ha, and 0.36 ha. In total, testing fields were 2.68 ha. Against codling moth is used mating disruption pheromone with the trade name ISOMATE CTT. The active substance of ISOMATE CTT is a pheromone. Pheromone is an organic substance, with the same formula, as the pheromones, which are produced by the sex glands of females of *C.pomonella* moths. Pheromones are tools that insects use to facilitate communication between male and female individuals, to achieve copulation between them.

The organic formula of this substance is (E, E)-8,10-dodecadien-1-ol (code one). The product ISOMATE CCT is formulated in the dispenser form. *Each dispenser consists of duplicate plastic threads, joined & sealed at the ends. Dispensers are absorbed inside the pheromone substance of females of codling moths.*

Dispensers are 20-25 cm long and 2-4 mm in diameter. (see the picture below)

Evaporation of the pheromone of dispensers caused a cloudy with the active ingredient of pheromones. In this cloudy with ISOMATE CTT aroma, the males are not able to find the female codling moth. In this confusion avoid the contact between male and female. After this confusion, the female moth remains sterile, not fertile.

When are the dispensaries hanging in the apple block?

The dispensers are hung on the apple trees at the time, when the first moths of codling moth, that emerged from the winter pupae, are caught in the monitoring pheromone.

This phase occurs during the flowering of the apple trees.

How do the dispensaries hang in the Apple block?

The dispensers are hung, considering, that a double thread of the dispenser protects an area of 20 square meters of apple block. On an area of 1 ha of apples are hang 500 threads of dispensers of ISOMATE CTT:

The scheme of hanging the dispensers in the field is related to the planting system of the orchard; the distances between the rows and the distances between the apple trees on the rows. It is recommended that the dispensers be hung in a zigzag form, because this form helps in a uniform distribution of pheromone clouds, during the evaporation of the dispensers. Along the sides of the apple block, the number of dispensers is something more, to create an isolation zone, between treated and untreated apple blocks with confusion pheromones. During the season, the level of infection of apple fruits from *C.pomonella* larvae was analyzed.

With special technical importance is the maintenance so-called "isolation zone" between the block treated with pheromones and those not treated with pheromones, but treated with conventional insecticides. This minimum isolation distance must be 200 meters away.

This isolation zone is necessary because, from the neighboring apples block, not treated with confusion pheromones, there are fertile females, which in short distances come and lay eggs in the block treated with the product ISOMATE CTT. These fertile moths, do not need to mate, but they require apple fruits to lay their eggs on the apple fruits.

Pear, walnut, and any other fruit trees are host plants for the codling moth too. This kind of fruit tree must be 200 meters away from the treated apple block.

In this study, is calculated the cost of treating with ISOMATE CTT and the cost of treating with conventional insecticides to get information, on how much is the cost for one hectare treated with conventional insecticides, 9 apple producers were interviewed. Cost of insecticides include purchase price, labor of workers, and cost of spraying with machines

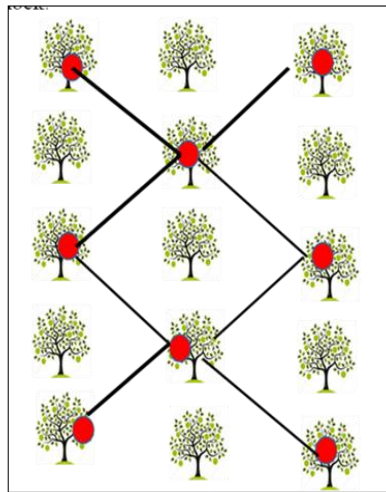
The cost of the ISOMATE CTT product includes the purchase price of the product and the labor cost for hanging the dispensers on the apple trees.

ISOMATE CTT dispenser in the apple branch



Picture Nr.1

Hanging of dispenser in apple block in zigzag forme



Picture Nr.2

RESULTS

Table Nr.1. Infection of apple fruits from codling moth (C. pomonella) in the blocks treated with IOMATE CTT. Field analyzed on June, 04, 2022

Village of apple block	Surface in ha	Fruits analyzed	Fruit bites from larvae	Infection for 1000 fruits (‰)	Treatment time with ISOMATE CCT and number of dispensers
Voskop	0,72	1000	0	0	May 05, 2022 (400 dispensers)
Shamoll	1.2	1000	0	0	May 07, 2022 (650 dispensers)
Zvirine	0,4	1000	1	0,1	May 07, 2022 (200 dispensers)
ACTT	0,36	1000	0	0	May 10, 2022 (200 dispensers)

Table Nr.2. Infection of apple fruits from codling moth (C.pomonella) in the blocks treated with Isomate CTT. Analyzed on, 12.6.2022,

Village of apple block	Surface in ha	Number of analyzed fruits	Fruit bites with larvae	Infection for 1000 fruits (°/000)	Treatment data with Isomate CCT and number of dispensers
Voskop	0,72	1000	4	0,4	May 05,2022 (400 dispensers)
Shamoll	1.2	1000	3	0,3	May 07, 2022 (650 dispensers)
Zvirine	0,4	1000	1	0,1	May 07, 2022 (200 dispensers)
QTTB/ACTT	0,36	1000	4	0,4	May 10, 2022 (200 dispensers)

Table Nr.3. Infection of apple fruits from codling moth (*C.pomonella*) in the blocks treated with Isomate CTT. Analyzed on, 29 and 30.6.2022.

Village of apple block	Surface in ha	Number of analyzed fruits	Fruit bites with larvae	Infection for 1000 fruits (°/000)	Treatment data with Isomate CCT and number of dispensers
Voskop	0,8	1000	4	0,4	May 05, 2022 (400 dispensers)
Shamoll	1.2	1000	1	0,1	May 07,2022 (650 dispensers)
Zvirine	0,4	1000	4	0,4	May 07, 2022 (200 dispensers)
ACTT	0,36	1000	4	0,4	May 10, 2022, (200 dispensers)

Table nr.4. Infection of apple fruits from codling moth (*C.pomonella*) in the blocks treated with Isomate CTT. Analyzed on,17,19 August .2022,

Village of apple block	Surface in ha	Number of analyzed fruits	Fruit bites with larvae	Infection for 1000 fruits) (°/000)	Treatment data with Isomate CCT and number of dispensers
Voskop	0,72	1000	4	0,4	May 05, 2022 (400 dispensers)
Shamoll	1.2	1000	1	0,1	May 07, 2022 (650 dispensers)
Zvirine	0,4	1000	24	2.4	May 07, 2022 (200 dispensers)
ACTT	0,36	1000	6	0,6	May10,2022(200 dispensers)

Table nr.5. Results of interview with producers on the cost per hectare of apples treated with conventional insecticide against the codling moth (*C. pomonella*)

Number of interviewed farmers about the treatment cost with conventional insecticides	Average cost of conventional insecticides per one hectare	Average cost of machines for treatment with conventional insecticides per one hectare	Total cost for one treatment (insecticides and work with machines)	Number of treatments for season	Total cost for the season	Cost calculated in Euro 1 Euro= 120 Albanian Lek(ALL)

9	4700 Albanian Lek (ALL)	4350 Albanian Lek (ALL)	9050 Albanian Lek ALL)	3	27350	227 Euro
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Table 12. Cost of treatment with ISOMATE CTT per hectare of apple.

The price in ALL of one dispensary thread	Number of dispensers used in one hectare of apple	Cost in ALL of dispensers for one treatment	The cost in ALL of hanging dispensaries in the apple block	Total cost in ALL (dispensaries and hanging them for 1 ha)	Total cost calculated in Euro
75 lekë	500	37500	1000	38500	321 Euro

CONCLUSION

The ISOMATE CTT, a mating disruption pheromone for codling moth (*Cydia pomonella*) has protected the apple fruits under the economic threshold, without using another conventional insecticide. The infection of apple fruits from the second generation of codling moth, is something higher in the case of small size apple block of ACTT Korça (0,36 ha), with 2,4 infected fruits in 1000 fruits). According to the ISOMATE CTT product catalog, the critical tolerable limit is recommended; for the first generation the level of infection is accepted as 3 per 1000 fruits (3 ‰), and for the second generation 5 per 1000 fruits (5 ‰).

The study needs to continue for at least two other years, because the data of the year,2022 are only preliminary results.

The cost for ISOMATE CTT treatments was 321 Euros per hectare, with one treatment per season, while the insecticide method costs an average of 227 Euros per hectare with three treatments per season. Treatment with ISOMATE CTT is 30% more expensive, then conventional insecticides treatments.

The cost of confusion pheromones with the product ISOMATE CTT is likely to decrease in the future. This is so because a very small number of dispensers are purchased for the field trials. If the number of purchased dispensers is much more, the price for each dispenser will be reduced.

On the other hand, in the reduction of the cost of treatments with the ISOMATE CTT pheromones, need to be calculated the positive indirect impact of methods, such as the avoiding of chemical residues in apple fruits, protection of the environment, and protection of beneficial insects. Beneficial insects will keep under the economic threshold, the secondary pests in the orchards, such as; thrips, fleas, mining moths, scales, etc. As an ecological product, ISOMATE CTT can be included in agricultural subsidy schemes.

This financial support could help the farmers increase the surface of apple orchards treated with ISOMATE CTT products.

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