



Control of codling moth *Cydia pomonella* L. (Lepidoptera: Tortricidae) by use of the virus product Madex in Bulgaria

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INTRODUCTION

Codling moth (CM), *Cydia pomonella* (L.), is the most important pest of apple orchards in Bulgaria. Its control is currently carried out mainly by application of organophosphates. Pesticides from this group are harmful for the beneficial insect fauna. Moreover, the pest developed resistance to some of them, as was revealed by Charmillot et al. (2007). In order to prevent the appearance of pest resistance while maintaining equilibrium between pests and a beneficial fauna in the orchard ecosystem, it is necessary to improve the arsenal of biological means of control. The aim of this research was to evaluate the effectiveness of the granulosis virus product Madex 3 in the control of codling moth in apple orchards of Bulgaria.



C. pomonella adult



C. pomonella larva

MATERIALS AND METHODS

In 2006-2007 the trial was carried out in a commercial orchard in Kalekovec, Plovdiv region, Central-South Bulgaria, consisting of the 0.50-ha plot A and 1.4-ha plot B. Goldspur, Braeburn, Revena, Golden Delicious, Golden Rider, Melrose, Pinova and Florina cvs are grown there. Prior to the experiment the CM pressure was relatively low, below 2% damaged fruits. Madex 3 is a granulosis virus of codling moth (CpGV), containing $3 \cdot 10^{13}$ granules/l, produced by the firm Andermatt Biocontrol AG, Grosse Dietwil, Switzerland. In the trial plots, Madex 3 was applied at the dosage of 50 ml per ha, from the beginning of May till the beginning of September, at 14-17-day intervals. Altogether there were 10 treatments in 2006 and 2007; till the end of June they were combined with fungicide sprays. As a reference, a 1.8-ha orchard, located in the same region, was used. 15-16 chemical treatments were applied there to control CM, leaf miners, leaf rollers, aphids and mites in 2006 and 2007 as well, nearly all of them were aimed against CM.



Madex 3
granulosis virus product

Prior to the start of CM flight, two CM pheromone traps were installed in the trial plots and two in the reference orchard. In both seasons, damage was evaluated on 1000-2000 fruits during the season and on 3000 fruits from each plot at harvest. In June corrugated cardboard bands were placed on trunks in all plots. In autumn they were recovered and hibernating CM larvae were counted.

RESULTS

The first flight of CM began in the reference on April 26 in 2006 and on April 10 in 2007. It successively intensified, to reach its maximum by the 2nd decade of May in 2006 or the 2nd decade of April in 2007. Flight of the second generation started at the beginning of July, reached maximum in the 3rd decade of July in 2006 or in the 2nd decade of July in 2007, then gradually declined in 2006; however in 2007 another peak of flights occurred in the 3rd decade of August. In both years only a few moths were caught in September. In general, CM flights in 2007 were more intense; the total number of moths caught was then 291, whereas 146 in 2006.

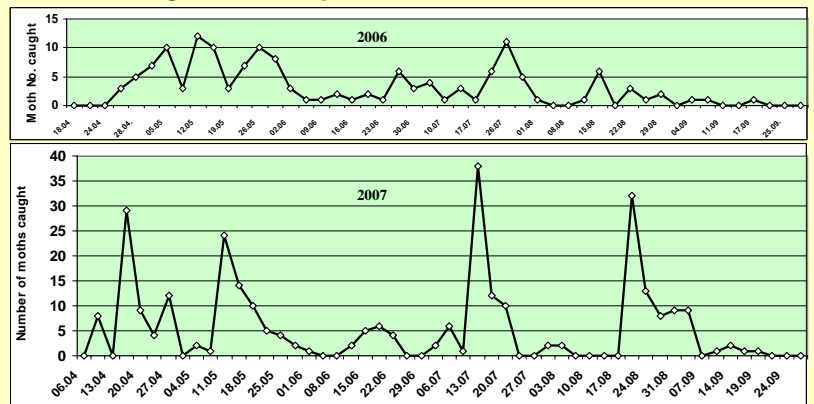
In the Madex-treated plots 34 moths were caught during the entire season 2006 and 35 moths in 2007.

Fruit damage in the Madex treated plots in 2006 was nil till mid-August and at harvest only single damaged apples were found. The damage in trial plots was also very low in 2007.

In the reference orchard, where fifteen to sixteen insecticide treatments were applied during the season, fruit damage rate in 2006 progressed from 0,8% on 19 June up to 6.8% at harvest. In 2007 the damage was much higher and reached 18.7% at harvest.

The overwintering population of CM in the Madex treated plots amounted to only 0.2 larvae per tree in autumn 2006 and 0.25-0.3 larvae per tree in autumn 2007, whereas in the reference orchard, located in the same region, treated 15-16 times with chemical insecticides against CM, 3.3 larvae per tree were recorded in autumn 2006 and almost 8.0 larvae per tree in autumn 2007.

Seasonal flights of *C. pomonella* in the reference orchard



Evolution of fruit damage depending on the treatment

2006				2007			
Date	Madex trial plot A	Madex trial plot B	Reference orchard	Date	Madex trial plot A	Madex trial plot B	Reference orchard
June 1	0	0	0.20	June 2	0	0	0.2
June 19	0	0	0.80	June 23	0	0	21.30
July 31	0	0	2.30	July 5	0	0	0
August 8	0	0	2.50	July 27	0.05	0	2.70
August 22	0.10	0.02	3.30	August 10	0.10	0.05	4.70
September 28	0.05	0.02	5.90	August 31	0.10	0.15	11.20
at harvest	0.05	0.02	6.80	September 27	0.20	0.30	17.40
				at harvest	0.20	0.30	18.70

CONCLUSIONS. Increasing CM population in the conventionally treated orchard, in spite of numerous insecticide treatments, indicates at the incidence of considerable resistance of CM to most of pesticides used. Positive results obtained with Madex show that treatments with this virus product may be effective in control of codling moth under conditions of Bulgaria. Application of this biological product should allow to overcome the problem of resistance of CM to chemical insecticides and would contribute to environment protection and improvement of human health at the same time.

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