

CONTROL OF ORIENTAL FRUIT MOTH *CYDIA MOLESTA* BUSCK BY MATING DISRUPTION IN PEACH ORCHARDS OF BULGARIA

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Abstract: The trials were carried out in Bulgaria in the years 2012 and 2016. The possibilities for using mating disruption (MD) as alternative method for controlling oriental fruit moth have been studied. Isomate OFM rosso and Isomate OFM TT dispensers against oriental fruit moth, provided from Sumit Agro Bulgaria were used in this study. Percentage of damage in the experimental orchard treated with Isomate OFM rosso and Isomate OFM TT was 0.1 and 0.2 %, i.e. rather below the economical threshold; no outbreak of the OFM appearance was noted. The results obtained may open the possibilities of practical use of the method of mating disruption in Bulgaria.

Key words: oriental fruit moth, mating disruption, pheromone traps, damage

Introduction

Mating disruption technology has been successfully used for control of oriental fruit moth, *Cydia molesta* Busck - as reported by (Barnes and Blomefield, 1997), (Trematerra et al., 2000), (Sexton and Il'ichev, 2000), (Kovanci, 2003), (Rot and Blazič, 2005), (Molinari, 2007), (Lo and Cole, 2007), (Kutinkova et al., 2010, 2011, 2012). Oriental fruit moth (OFM) *Cydia molesta* Busck (Lepidoptera: Tortricidae) is a major worldwide pest of peach and nectarine *Prunus persica* (L.) (Rothschild and Vickers, 1991). Originally from northwestern China, oriental fruit moth is now a widely distributed pest throughout the world among the major stone-fruit growing regions of Europe, Asia, America, Africa and Australia. In Australia, this insect is a key pest damaging commercial stone and pome fruit, including peaches, nectarines, apricots, plums, pears and apples. (Il'ichev A. et al., 2006). In Bulgaria OFM is the most important pest of peach, nectarine in the commercial orchards. Its larvae cause damage, infesting shoots and fruits. The larvae of early OFM generations damage current season shoot tips, then they feed in the developing fruitlets and fruits. The larvae of summer generations damage mainly fruits. The chemical pest control in peach and nectarine fruit orchards of Bulgaria has relied on a broad spectrum of organophosphate and pyrethroid insecticides. Recently their effectiveness is decreased, apparently due to the development of resistance in the pest.

Material and methods

The trials were carried out in the years 2012 and 2016 in an isolated peach experimental orchard of one ha in the Fruit Growing Institute, Plovdiv – Central South

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Bulgaria. Mating disruption (MD) was tested as an alternative method controlling oriental fruit moth (OFM), *Cydia molesta* Busck from post-bloom till harvest. Isomate OFM rosso and Isomate CTT pheromone dispensers were installed once during the season and were hung in the upper third of tree canopy with a density of 500 and 250 pieces per ha, before the start of OFM flights. According to the manufacturer, each dispenser is loaded with a minimum 240 mg pheromone mixture.

These dispensers are designed to deliver a long-lasting performance for the whole season, with remarkably fast application. Against other pests occurring in the trial plots, aphicide treatments (one or two per season) were applied during the years of study. In *Anarsia lineatella* was controlled by insecticide treatments. Another 2 ha site served as a reference orchard and was treated in a conventional way. From five to nine chemical treatments were applied there during each season, to control OFM and other pests. Five to eight of them were employed against OFM and PTB.

Monitoring of OFM and PTB flight was carried out by sex pheromone trapping in the years of study. Four sticky Delta traps Pherocon® VI were installed in the trial orchard. Two of them were baited with a standard capsule OFM L2 orfamone and other two with PTB L2 anemone. The traps and lures used were products of Trécé Inc., USA. The traps were installed in the centre and at the edge of the trial orchard before OFM and PTB flight started. For comparison, 4 sticky Delta traps Pherocon® VI, were installed in the reference, conventionally treated orchard. All pheromone traps were checked twice a week.

Early in the season sampling of damaged shoots were carried out on 20 trees, randomly chosen in the trial plot and in the reference orchard. During the season, fruit damages were assessed in the trial and reference plots on 1000 fruits each time. At harvest, 1000 fruits were sampled in both orchards, to evaluate the final damage rate. Significance of differences in damage rate between the trial and reference orchards was estimated by use of Chi-square tests.

Results and discussion

In the reference orchard the first flight of oriental fruit moth in 2012 and 2016 began in the fourth week of March and finished in October (Figure 1). The pests developed 3 generation during the years of study. The traps installed in the reference orchard caught in total, 503 in 2012 and 804 in 2016. The population density of OFM increased season to season. In the trial plot, after installation of Isomate® OFM rosso and Isomate TT dispensers, no moths were caught in the pheromone traps. The dispensers completely inhibited OFM captures in the pheromone traps, installed in the trial plot, indicating at a high level of disruption.

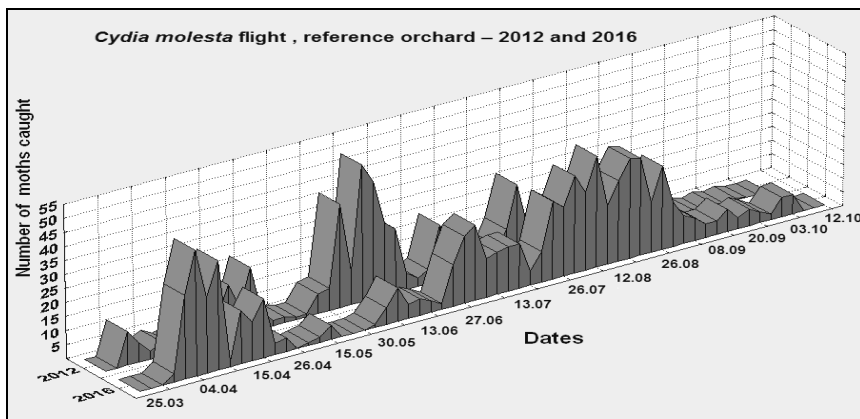


Figure 1. Captures of OFM in the reference orchard in 2012 and 2016

In 2012 in the trial plot, the damage of shoots was nil on May 18 and 21 and stayed at the same level till the 18th of June (Table 1). Damage rates of shoots were significantly different between the treated plot and the reference orchard on May 21 and June (Chi-square test, $p < 0.01$).

Only two damaged fruit was found in the trial plot at the end of the season; at harvest the fruit damage rate amounted from 0.1 to 0.2%.

Fruit damage in the reference orchard progressed from 2.7% on July 25 up to 4.9% at harvest. Damage rates were significantly different between the treated plots and the reference orchard already on July 25 (Chi-square test, $p < 0.01$), and thereafter until harvest (Chi-square tests, $p < 0.001$).

In 2016 in the trials plot, the damage of shoot was nil on May 6 and 16 and stayed at the same level till of the 20th of June. (Table 1). Damage rates of shoots were significantly different between the treated plot and the reference orchard on May 16 and June 20 (Chi-square test, $p < 0.01$).

Only one damaged fruit was found in the trial plot at the end of the season; at harvest the fruit damage rate amounted from 0.0 to 0.1%.

Fruit damage in the reference orchard progressed from 2.2% on July 18 up to 3.7% at harvest. Damage rates were significantly different between the treated plots and the reference orchard already on July 18 (Chi-square test, $p < 0.01$), and thereafter until harvest (Chi-square tests, $p < 0.001$).

Table 1. Evaluation of shoot and fruit damage (%) by *Cydia molesta* in the trial plot and in the conventionally treated orchard in 2012 and 2016

Index	Date 2012	Damage (%)	Damage (%)	Index	Date 2016	Damage (%)	Damage (%)
		trial	reference			trial	reference
	May 18	0.0	0.7		May 6	0.0	2.6
shoot (%)	May 21	0.0	21.3	shoot (%)	May 16	0.0	18.2
	June 4	0.0	23.5		June 13	0.0	19.7
	June 18	0.0	25.4		June 20	0.0	20.3
fruit damage(%)	July 6	0.0	0.0	fruit damage(%)	July 4	0.0	1.0
	July 15	0.0	2.0		July 18	0.0	2.2
	July 25	0.0	2.7		July 26	0.0	2.5
	August 6	0.0	2.5		August 3	0.0	3.0
	August 20	0.0	3.6		August 10	0.0	3.1
	August 27	0.0	4.9		August 22	0.0	3.5
	September 3 at harvest	0.2	5.1		September 1 at harvest	0.1	3.7
		0.0-0.2	1.0-5.1			0.0-0.1	1.1-3.7

Conclusion

Isomate® OFM rosso and Isomate® OFM TT are effective, when used at dosage 500 and 250 dispensers per ha, applied once during the season, before the first onset of OFM, demonstrating that it has an incisive effect even in a small size orchard lots.

For controlling the both important pests in peach orchards, *Cydia molesta* Busck and *Anarsia lineatella* Zell. combined dispensers should be used.

Mating disruption is a perspective alternative to chemical treatments in the peach orchards of Bulgaria.

Acknowledgment

The authors are grateful to the company Summit Agro Romania - SRL, Branch - Bulgaria for providing free materials for the trials.

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