Integrated Fruit Protection in Fruit Crops
IOBC/wprs Bulletin Vol. 54, 2010
pp. 331-336

Control of oriental fruit moth, CYDIA MOLESTA (Busck), by Isomate OFM rosso dispensers in peach orchards in Bulgaria – preliminary results

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Abstract: Peach is the major fruit in South-East Bulgaria. Its main pest is the oriental fruit moth (OFM), Cydia molesta Busck. For a long time pest management in stone fruit production in Bulgaria relied on organophosphate and pyrethroid insecticides. Although originally quite effective, recently their effectiveness decreased, apparently due to the resistance developed in many pests. Hence, alternative means of control are urgently needed. The most common environmentally friendly methods are those related to sex pheromones. Until recently, their use has been limited mainly to monitoring, aiming at precise timing and reduction of chemical treatments. Mating disruption (MD) presents a more promising solution, however. The trials on mating disruption in the present study were carried out with Isomate OFM rosso dispensers (Shin-Etsu, Japan) in an isolated 10-ha peach orchard in 2007 and 2008. Pheromone trap catches were completely inhibited in the MD block whereas they were numerous in the reference, i.e. conventionally treated orchard. The Isomate OFM rosso dispensers, installed before the first flight of OFM at the rate of 500 units per ha, efficiently reduced fruit damage – down to 0.1- 0.2% at harvest. In the reference orchard, with 5-6 insecticide treatments against OFM, damage still reached 5-6%. The results indicate that mating disruption for control of oriental fruit moth may be effective in Bulgaria. Its use will be helpful in meeting the requirements of EU for residues free fruit production.

Key words: IPM, peach, oriental fruit moth, mating disruption, Isomate OFM rosso dispensers

Introduction

Peach is one of the major fruit species in the south-eastern part of Bulgaria. It provides rapid recovery of investments due to early bearing and relatively small phytosanitary problems (Kolev and Jivondov 2000). Its main pest is the oriental fruit moth (OFM), Cydia molesta Busck. The larvae of early OFM generations damage current season shoot tips; then they feed in the developing fruitlets and fruits. For a long time pest management in stone fruit orchards in Bulgaria relied on organophosphate and pyrethroid insecticides. Albeit originally effective, they caused environmental problems and increasing consumer concerns. Recently their effectiveness decreased, apparently due to resistance developed in many pests. Therefore, alternative means of control are urgently needed. The most frequently applied environmentally friendly methods are those related to sex pheromones. Their use has been first limited to monitoring, aiming at precise timing and reduction of chemical treatments. Mating disruption (MD) presents a more promising solution, however though.

Positive results of mating disruption of Cydia (Grapholitha) molesta, have been reported from South Africa by Barnes & Blomefield (1997), from Italy by Trematerra et al. (2000) and from Australia by Sexton & Il'ichev (2000). According to the studies of Molinari et al. (2000), efficacy of synthetic pheromones applied for mating disruption of C. molesta and A.

lineatella was very high. In 74 tests in 1998 and in 119 tests in 1999 damage was below 1%. In the recent investigation of Molinari (2007), confusion methods, involving 300-1000 pheromone dispensers per ha, reduced OFM reproduction in peach orchards provided that the dispensers had been installed before the start of the first flight. They remained effective through the second and third generations of the pest. MD proved also to be effective in control of OFM in peach orchards of Slovenia (Rot & Blazič 2005) and New Zealand (Lo & Cole 2007).

Material and methods

Trial orchard

The well-isolated, 10ha commercial orchard near village Chokoba, Sliven region was established in spring 2005. In the years 2007-2008 a trial on mating disruption (MD) of the oriental fruit moth (Cydia molesta Busck.) was carried out there with Isomate OFM rosso dispensers and aimed at the assessment of this method applied for the first time in Bulgaria.

The Isomate OFM rosso dispensers were installed in the trial orchard at the beginning of April, about the start of OFM flights. The dispensers were hung in the upper third of tree canopies at a density of 500 pieces per ha. According to the manufacturer, each dispenser is loaded with a minimum of 240mg of the OFM pheromone mixture. Against other pests occurring in the trial plot, only one aphicide treatment was applied each in 2007 and 2008.

Reference orchard

Another orchard of 2ha in area served as a reference and was treated conventionally. It was located near the city of Sliven and established in 2003. Twelve treatments (14 active ingredients) were applied there during each season, to control OFM and other pests. Six of the treatment applications were timed against oriental fruit moth. The fruit damage by OFM in this orchard in the years 2004-2006 was about 5%. The economic threshold in Bulgaria is 4-6% damaged fruits at harvest time.

Indices studied

Monitoring of OFM flights was carried out by sex trapping in both seasons. Three triangular traps were installed in the trial orchard – they were baited with a standard capsule (Csalomon) containing orfamone. The traps were installed in the centre and at the edge of the trial orchard before OFM flights started. For comparison, 2 standard traps were installed in the reference, conventionally treated orchard. All pheromone traps were checked twice a week.

Early in the season sampling of damaged shoots was carried out on 50 trees, randomly chosen in the trial plot and in the reference orchard. During the season, sampling for fruit damage was carried out in the trial and reference plot on 1000 fruits at each sampling. At harvest, 3000 fruits were sampled in both orchards, to evaluate the final damage rate.

Evaluation of data

Data on catches of male moths in the pheromone traps were considered as totals for each date of control and presented in a graphical form. The rate of fruit damage by OFM was expressed as percentage of damaged fruits. Significance of differences in damage rate between the trial and reference orchard was estimated by use of the Chi-square test.

Results

OFM FLIGHT DYNAMICS

In the reference commercial orchard with conventional treatments the first flight of oriental fruit moth in 2007 began on April 2. In the trial plot two moths were recorded in the pheromone traps on April 5, when the Isomate OFM rosso dispensers were installed. The flights of the overwintering generation OFM reached their maximum by the third decade of April and continued with varying intensity, till the end of May (Fig. 1). The flight of the first summer generation, which overlapped the overwintering one, started at the beginning of June, reached its maximum in the third decade of June and continued till the end of July. The second generation began to fly at the end of July and finished at the end of August. The third generation began at the end of August and finished on October 8. The traps installed in the reference orchard caught in total 442 moths. In the trial plot, after installation of Isomate OFM rosso dispensers, no moths were caught in the pheromone traps.

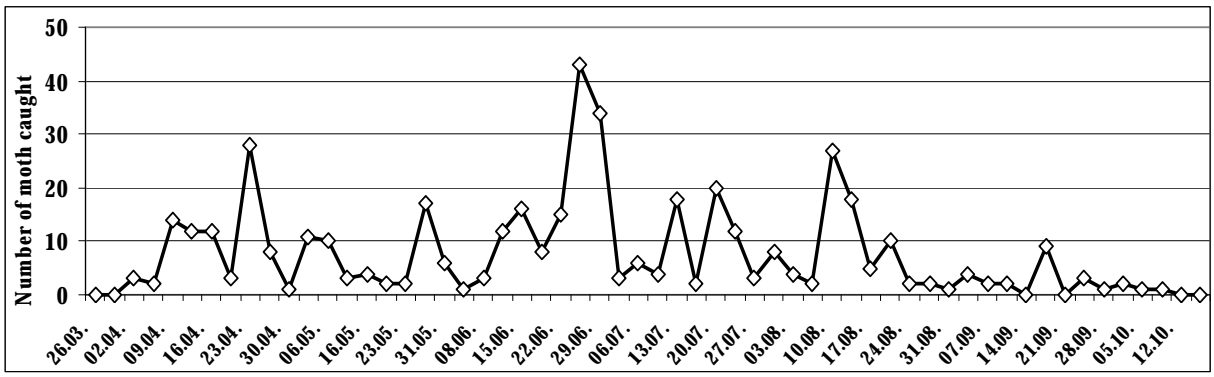

Figure 1. Captures of OFM in the reference orchard in 2007

In 2008, the first flight of OFM in the reference orchard began on April 4. In the trial plot no moths were recorded in the pheromone traps till April 10, when the Isomate OFM rosso dispensers were installed. The flights of the overwintering OFM generation reached its maximum in the second decade of April and continued till the end of May (Fig. 2). The flights of the first summer generation, that overlapped the overwintering one, began at the beginning of June, reached its maximum in the third decade of June and continued till the end of July. The second generation began at the end of July and finished at the end of August. The flights of a partial third summer generation began at the end of August and finished on September 19. The traps installed in the reference orchard caught in total 559 moths. In the trial plot, no moths were caught in the pheromone traps during the whole season.

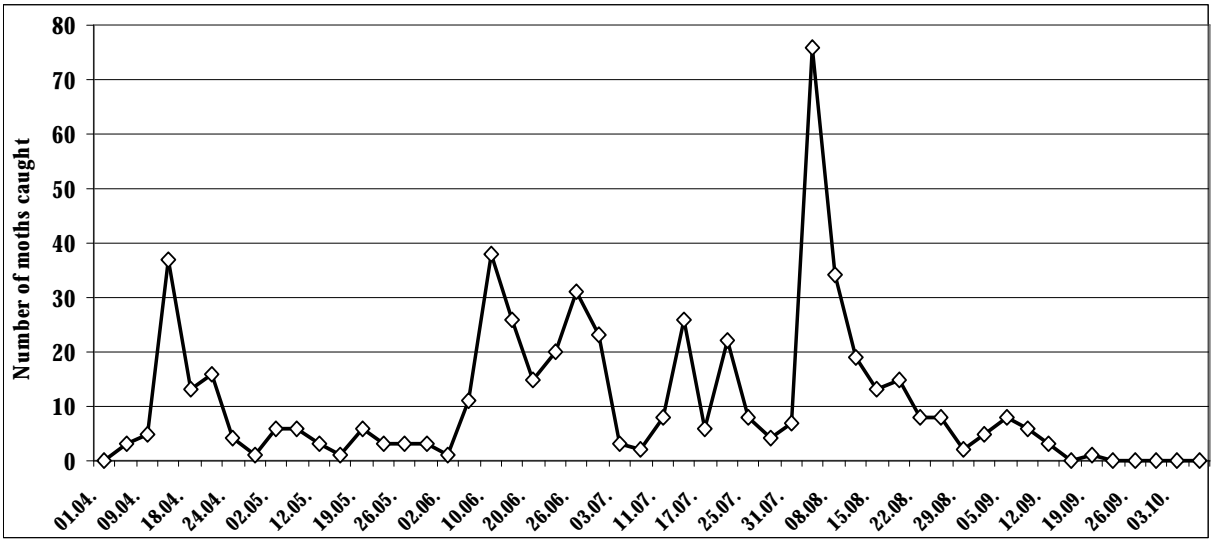

Figure 2. Captures of OFM in the reference orchard in 2008

Evolution of shoot and fruit damage by OFM during the season

In the reference, conventionally treated orchard, severe shoot damage caused by OFM was noted at the end of May in both years of study (Table 1). At the same time, no shoots were damaged in the trial plot, where Isomate OFM rosso dispensers were installed. Damage rates on shoots were significantly different between the treated plots and the reference orchard on 25 May of both years (Chi-square test, $P < 0.01$).

Table 1. Evolution of shoot and fruit damage by OFM in the Isomate OFM rosso trial plot and in the conventionally treated reference orchard in two successive years of study

Index	2007			2008		
	Date	Trial plot	Reference	Date	Trial plot	Reference
Shoot damage [%]	May 5	0.0	0.0	May 6	0.0	0.0
	May 13	0.0	0.0	May 17	0.0	0.0
	May 25	0.0	30.0	May 25	0.0	35.0
Fruit damage [%]	June 9	0.0	0.0	June 8	0.0	0.0
	June 29	0.0	1.5	June 21	0.0	1.2
	July 5	0.0	0.0	July 5	0.0	0.0
	July 29	0.0	1.8	July 18	0.0	2.5
	August 12	0.0	4.8	August 10	0.1	4.9
	-	-	-	August 23	0.1	5.2
	September 6	0.1	6.2	September 7	0.2	6.4
	preharvest	0.03	5.3	preharvest	0.1	5.2
	at harvest	0.1	6.2	at harvest	0.2	6.4

First signs of fruit damage were noted in the reference orchard at the end of June of each year. Starting from the end of June, through August and September, fruit damage rate steadily

increased, reaching 6.2% in 2007 and 6.4% in 2008 at harvest. In the trial plot few damaged fruits were noted at the end of the season; at harvest it was also negligible: 0.1% in 2007 and 0.2% in 2008. Damage rates were significantly different between the treated plots and the reference orchard already on 29 June and 29 July 2007, 21 June and 18 July 2008 (Chi-square test, $P<0.01$) and thereafter until harvest in both years of the study (Chi-square tests, $P<0.001$).

Discussion

In the reference orchard, damage caused by OFM was considerable, in spite of six conventional treatments applied against OFM. It is suspected that the population of OFM in this orchard has developed resistance to some of the insecticides used. Resistance of OFM to organophosphate, pyrethroid and carbamate insecticides was detected in Canada by Pree et al. (1998) and Kanga et al. (1990) and was considered as the main cause of failure of conventional plant protection. Apparently a similar situation may have occurred in Bulgarian peach orchards.

Application of mating disruption with use of Isomate OFM rosso dispensers significantly reduced OFM incidence and damage caused by this pest. This is in line with the reports from other countries (Barnes & Blomefield 1997; Trematerra et al. 2000; Molinari et al. 2000; Sexton & Il'ichev 2000; Rot & Blazič 2005; Molinari 2007; Lo & Cole 2007) and indicates that the MD method may be successfully introduced in Bulgarian peach orchards. This new technology may serve as an alternative means for control of OFM. Its use will be helpful in meeting the requirements of EU for residue free fruit production.

Acknowledgements

This study was supported with a grant of the Swiss National Science Foundation (SNSF) to JS (project No. IB73A0-110978). Isomate OFM rosso dispensers of Shin-Etsu were kindly provided by CBC (Europe), Ltd., Milano, Italy.

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