Evaluation of an active mating disruption concept against codling moth *(Cydia pomonella)* under the aspects of different application systems and varieties

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Abstract

Beside standard systems of mating disruption the activity of the product Exosex CM and Exosex 2 CM under the aspect of different application systems and several varieties were tested at the research station of the Federal College and Institute for Viticulture and Pomology Klosterneuburg. Male insects were attracted into the Exosex dispenser by using the appropriate pheromone, which acts on the pheromone receptive sensors on the male so that they cannot locate calling females. Standard mating disruption techniques usually rely on the introduction of amounts of pheromone emitted by natural populations of pest species into the atmosphere. Exosex CM significantly reduces deployment time and labour costs in the orchards, additionally the flexibility to fit in with IPM programmes was tested. The assessments were done visually on windfall fruits, fruits on the tree and on all fruits at harvest followed by statistical evaluation. Among the fruits sprayed with the IPM system there was an infestation rate of the first (Cydia pomonella) generation at the variety Idared of 0,8%, the second generation treated with Exosex showed an infestation of 13%. In the biological trial however the infestation by the first generation was about 4% and the infestation of the second generation about 31%.

Keywords: codling moth, mating disruption, IPM programmes

Introduction

The aim of this study was to find an alternative method to granulose virus application in order to prevent codling moth *(Cydia pomonella)* damage by population control in a closed area using mating disruption. Several alternative control methods of mating disruption against codling moth *(Cydia pomonella)* were demonstrated and evaluated in apple orchards in Austria and have become established since 1992. Codling moth (*Cydia pomonella)*is the key pest in the apple orchards of the research station Haschhof in Klosterneuburg, Austria (Polesny, 2002). In the last eight years it was primarily controlled by routine applications of granulosevirus. 2007 a new system, Exosex a confusion pheromone dispenser system developed by Exosect Ltd. UK, (Nansen et al. 2007) was tested to facilitate the control of codling moth *(Cydia pomonella)*. The system of Exosex has shown success in Europe against several Lepidopteran pests at a rate of only 25 dispensers/ha. This 'active' technology approach to mating disruption leads to a reduction in mating, egg laying and consequent crop damage with the benefit of very few pheromone dispensers. The male codling moth *(Cydia pomonella)* acts as a mobile pheromone dispenser. The aim of this research was to examine the efficacy of this auto–confusion technique by assessing the infestation.

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Material and Methods

The research station is situated north of Vienna on the right river bank of the Danube at the foothill of the Wienerwald (the Vienna Woods). The apple orchard is hilly and on a south–east slope. The orchard was split into two sections, each 1 hectare, which were further separated into fields. As can be seen in table 1, field 21,51 and 52 were treated with methods of integrated production, whereas field 42 only mating disruption agents were applied. Due to the vast population the first variant (V1) included a treatment against the first generation with the spraying agent diflubenzuron, which was applied on 22nd of May to decimate the outgoing population. The second generation being smaller in population was treated with Exosex a mating disruption agent used as an extension to the conventional agent used for the 1st generation. The dispensers were placed on the 11th of July.

In the second variant (V2) mating disruption with a special system, which has not been tested in Austria yet was used for both generations and replaced after six weeks in order to provide constant conditions On the 3rd of May the dispensers were situated on the trees and replaced on the 10th of July. There were several pheromone traps placed to control the activity.

Table1: trial design

variant	PPS	1st .generation treatment	2nd generation treatment	fields
V1	IP	diflubenzuron	Exosex	21, 51, 52
V2	BIO	Exosex	Exosex	42

The two variants were visually assessed on each ten trees (Topaz and Idared) and their windfall fruits on the 23rd of August . The last assessment was done at harvest, where every apple was examined for codling moth *(Cydia pomonella)* damage.

For the product comparison study, the effects of the treatment on fruit damage were compared for each variant, using ANOVA.

Results

At the beginning of the season the infestation was about 3% higher with variant 2 than with variant 1. With the first generation there were no discernible differences between the varieties. The infestation increased with the second generation. Topaz and Gala showed significantly higher rates of injured fruits than Idared.

Table2: Assessments of the first and second generation

		1. generation		2. generation		windfall fruits	
field	variety/PPS	fruit injury %	total number of assessed apples	fruit injury %	total number of assessed apples	fruit injury %	total number of assessed apples
21	Topaz IP	0,5	441	7	452	30	53
42	Idared BIO	4	568	22	550	76	45
42	Topaz BIO	5	531	27	573	69	105
51	Idared IP	0,8	521	13	488	48	31
51	Topaz IP	0	566	5	536	39	38
52	Gala IP			5	587	29	157

During the season *(Cydia pomonella)* activity was monitored with the help of pheromone traps. Figure 1 shows the activity of the codling moth *(Cydia pomonella)* in 2006 and 2007. The activity was similar in both years. Despite the use of the mating disruption system codling moths *(Cydia pomonella)* were captured throughout the whole growing season.

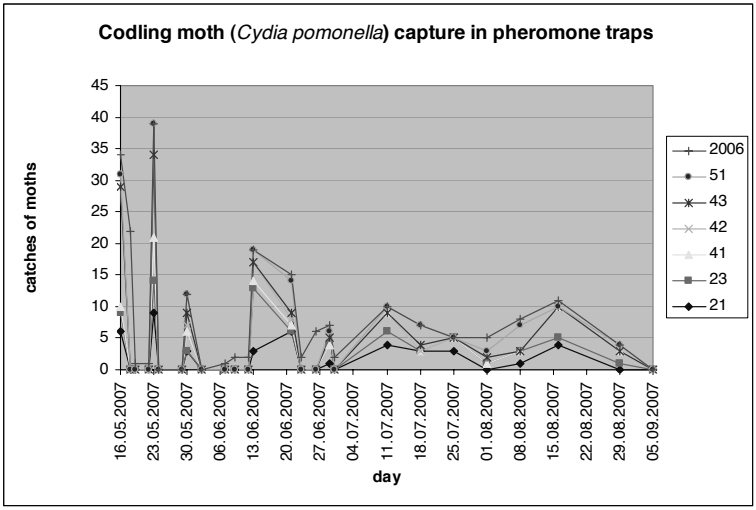

Figure1: Codling moths *(Cydia pomonella)* captured in pheromone traps on the individual patches

The codling moth *(Cydia pomonella)* population was increasing at a significant rate in the ecological variant, from 22% fruit injury in the first generation to 38% at harvest with the variety Idared. However, there was a significant difference between the varieties. So, for instance, Topaz showed an infestation of 43% in the ecological variant, whereas the infestation in the integrated variant was 11%.

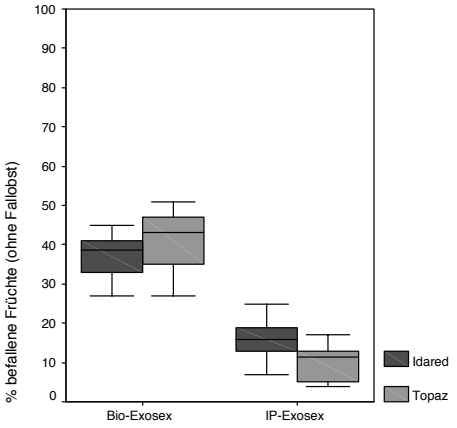

Figure 2: Final assessment at harvest

Discussion

In trials testing the dependence of mating disruption success on moth density there were obvious effects with the different varieties and also with either the ecological variant or mating disruption in connection with an application on the first generation. The attraction of the codling moth *(Cydia pomonella)*, to apple volatile compounds which are known to elicit an antennal response was often tested and there exist differences between the varieties (Corarini et al. 2004).

It is equally well known that the mating disruption technique does not work well with high population densities (Cardé & Minks 1995, Neumann 1997, Casgrande & Jones1997), which was the case in the trials. The pest pressure was higher than 1% due to the organic cultivation and the adverse conditions on the sloping site.

Moths were always found in the traps, even when mating disruption was used. Also, examinations of the fruit at harvest showed an extremely increased activity as compared to the first assessment.

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