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Codling moth granulovirus –
An efficient tool for codling moth control in IPM

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Abstract: The joint action of low concentrations of codling moth granulovirus (CpGV), synthetic insecticides and the „Attract & Kill"-method was tested in the field. It was the aim of these studies to elucidate whether the impact of the conventional treatments on codling moth population could be increased by addition of CpGV. Two orchards, situated side by side, served as test plots. In the orchard additionally treated to the synthetic insecticides and the „Attract & Kill"-method with CpGV, population control was obviously more efficient than in the orchard without additional treatment (additional reduction of larvae in trap bands of 86 - 78 % in the first generation). This resulted also in a better control of damage by the second generation of codling moth. A long term strategy on large plots is proposed to reduce codling moth populations in areas of high infestation.

Key words: Codling moth, Codling moth granulovirus, long term strategy, joint action,

Introduction

During the past five years, in certain regions of Southern Germany, increasing population densities of *Cydia pomonella* L. (CM) were observed. In 1999, in addition to the usual applications of synthetic insecticides like Fenoxycarb, Parathion-Methyl and Tebufenozid, mating disruption was applied to large areas. Nevertheless, mean infestation of fruit at harvest was about 8 %. In this situation, the control strategy must focus not only on the immediate prevention of CM damage but also on the long term reduction of the CM population to an acceptable level. In the growing season of 2000, codling moth granulovirus (CpGV) was tested as an additional tool in the strategy for CM population control, since the reduction of the population was not possible even with the combination of mating disruption and synthetic insecticides. For a long time CpGV has been considered a rather unattractive product for Integrated Production (IP). This was mainly due to the high costs of the frequent applications with the high dosages recommended. Moreover, the efficacy of CpGV in damage control was rather low in comparison to synthetic insecticides (Höhn et al., 1998). Though it was known that the effect of CpGV on CM population was definitely higher than the effect on fruit damage, (Huber & Dickler, 1976; Charmillot, 1998), no attempts were made to use this potential in control strategies in practice. For CM control, long term effects were considered to be of inferior importance. In organic fruit growing however, CpGV was used for the past ten years. In the regions with high infestations of CM, it was observed that in the organic orchards treated with CpGV for a long time, the infestation seemed to be much lower than in the orchards with integrated control. In 1999, a field test showed a better efficacy in population control of CpGV than of phosphoric esters (Kienzle et al., 2001) in combination with mating disruption. On the basis of these results and experiences, in 2000 a field trial was started in a region of Southern Germany with very high infestation of CM. The tests should elucidate whether the use of CpGV in addition to synthetic insecticides and the „Attract & Kill“ method would increase the effectiveness of CM population control.

Material and methods

Two orchards of ca. 1 ha each with the variety Jonagold, situated side by side and separated only by a small strip of stone fruit, were treated both with synthetic insecticides and the „Attract & Kill“ method. In one orchard, CpGV was added in low concentrations (6 times 1/10, one time 1/2 and one time 1/3 of the recommended concentration) to each insecticide treatment against CM. On May 18, CpGV was added also to a fungicide spray (Table 1). Summed up, 540 ml Granupom/ha/year (= 1.83 full concentrations/ha/year) at the cost of ca. DM 140/ha/year were used.

Particular attention was paid to the effect of the CpGV treatments on the population of CM. Thus, 100 - 160 trees per orchard were provided with corrugated cardboard belts to monitor descending larvae. To observe the effect at different periods, these belts were controlled three times during the year.

Table 1: Application schedule of the two orchards in comparison. (The normal concentration of the product Granupom® used in the treatments is 0,15 l/ha/m tree height. Thus, 10 % of the normal concentration means 0,015 l/ha/m tree height)

	Orchards A and B „Conventional„ treatments against CM		Orchard B Additional treatments with CpGV
Application date	Treatment	kg;l/ha/m tree height	Percentage of the normal dosage of CpGV
06. May	Appeal®	3000 drops/ha	10 %
13. May	Parathion-Methyl (ME 605®)	0,25	10 %
18. May			50 %
08. Jun	Fenoxycarb (Insegar®)	0,2	10 %
28. Jun	Tebufenozid (Mimic®)	0,25	10 %
06. Jul	Appeal®	3000 drops/ha	10 %
21. Jul	Fenoxycarb (Insegar®)	0,2	10 %
02. Aug	Fenoxycarb (Insegar®)	0,2	33 %
08. Aug	Parathion-Methyl (ME 605®)	0,25	10 %
19. Aug			50 %

Fruit damage was assessed on the June 7, June 15, July 18, and August 7 (1000 fruits/plot). All injured fruits were counted (even those with stings). At harvest, in each orchard, 4 x 3 trees were marked and completely harvested. All fruits were assessed for injuries by CM, also the windfall fruit under the marked trees. Stings were considered as injuries.

In 2000, in the region investigated, the first generation of CM appeared very early and in high density. The flight started during the last days of April; the first oviposition was observed on May 8, first larvae on May 16. The unusually high temperatures at the end of April and in May were favourable for the first generation. On the other hand, the cold and rainy weather in July (first adults of second generation at second decade of July) was rather adverse for the start of the second generation. Lateron, the temperatures increased, however, the abundance of the second generation was lower than in other years. The last oviposition was observed on August 20.

Results

In June, the differences in fruit damage were small. In July, due to thinning by the fruit-grower, the damage decreased slightly, the differences remained insignificant. Already, during egg deposition of the second generation, a great difference in the number of eggs between the orchard „with GV“ and „without GV“ could be observed. On August 7, the fruit damage in the plot „with GV“ was considerably lower than in that „without GV“ (Fig. 1). At harvest, the difference was very evident.

At each assessment date of the corrugated cardboard belts, in the untreated orchard showed significantly more CM larvae than in the treated one (Fig. 2). On the last assessment date (12.10.00) the additional efficacy of the CpGV treatments in population control was 94,2 %.

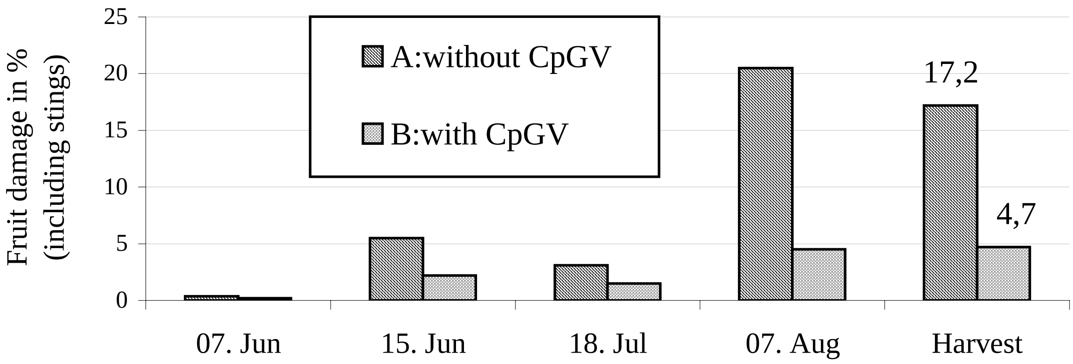
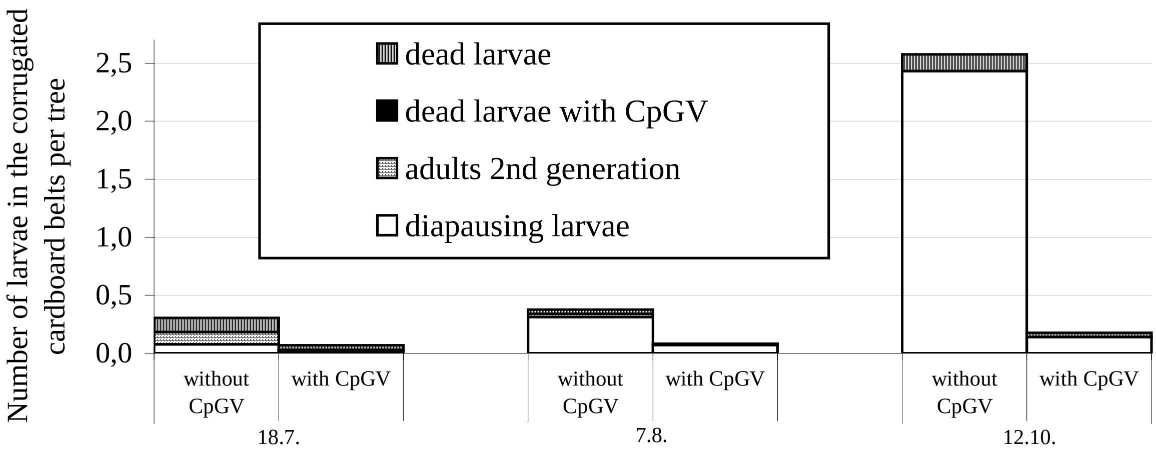


Fig. 1: Fruit damage in the orchards treated and not treated with GpGV



Additional effect: 86,2 % 78,7 % 94,2 %
(compared to the treatment without CpGV)

Fig. 2: Larvae of CM in the corrugated cardboard belts in the treated and untreated plot

Discussion

These first results confirm the practical relevancy of the effect on the CM population found by Huber & Dickler (1976). In the first generation, the population density in the CpGV plot was considerably reduced.

With a lower population density, the „Attract & Kill“ method applied in the orchard, certainly could be more effective in the second generation. Thus, in the CpGV-plot, the number of eggs deposited by the adults of the second generation was remarkably lower. This was the most important reason why the fruit damage caused by the second generation was significantly lower in the CpGV treated plot. Again, in the second generation, the additional efficacy of CpGV in population control (94,2 %) was much higher than the efficacy calculated on the fruit damage at harvest (75 %). These one year results were corroborated by practical experiences in the region, in the same year (reduced catches in trap bands) and support the idea of a long term strategy on larger areas in the regions with high infestation. The aim could be to reduce the population of CM during several generations to an acceptable level. Used in such a kind of strategy, CpGV, generally considered a very expensive and rather inefficient product to use only in areas with low infestation potential, could become one of the most efficient tools to control the current outbreaks of CM. The change of strategy consists in the change of goal from damage control to long term population management. CpGV is used in concentrations and with a frequency of treatments insufficient for damage control but sufficient for population control. Thus, the cost of the CpGV is reduced to ca. DM 100 to DM 140 which is economically acceptable. Additionally, the joint action with mating disruption or „Attract and Kill“ is used. In the first years, for damage control, synthetic insecticides are applied in addition. If the growers learn to effectuate economic calculations not only for the period of one year, but to consider the possibility to reduce insecticide use over several years, they will realize the economic advantages of this kind of strategy.

Further research in commercial orchards is necessary to gain more experience on this subject and to demonstrate to the fruit growers the effect on population control which is very hard to observe in the field. Since the effect is evident only in the second or third generation after the beginning of the treatments, in some regions it can be observed only in the second year. Demonstration projects over several years with the use of corrugated card board belts in commercial orchards will be necessary to introduce such a strategy in common practice. In Southern Germany, in 2001, the addition of CpGV to other control methods will be recommended by the extension service for a long term strategy for CM population control in high infestation areas with problems of insecticide resistance.

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