Use of pheromones and other semiochemicals in integrated production
IOBC wprs Bulletin Vol. 25(•) 2002
pp. •-•

Control of codling moth *Cydia pomonella* by autosterilisation

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Abstract: Autosterilisation is based on the same principle as the attract and kill technique but the insecticide devoted to kill the males by contact is replaced by a product able to sterilise them, in this case by the insect growth regulator (IGR) fenoxycarb. In a small dwarf trees orchard, a trial to control codling moth *Cydia pomonella* was made from 1996 to 2000, by applying on the trees 1'540-4'400 autosterilising droplets per ha, in 2 or 3 treatments per season. In comparison with a high stem non-treated check orchard, population density of codling moth, estimated by the diapausing larvae caught in cardboard band traps, decrease strongly, suggesting that autosterilisation could be more efficient than attract and kill to control that pest.

Key words: *Cydia pomonella,* autosterilisation, sex pheromone, fenoxycarb, population dynamics

Introduction

The attract and kill method (Sirene CM®) is a novel approach using sex pheromones, recently developed by Novartis Crop Protection, to control codling moth *Cydia pomonella*. A viscous paste, containing a sex pheromone and an insecticide, is distributed as small droplets in the crop. Males are attracted by the pheromone and are killed by the insecticide (Hofer & Brassel, 1992; Charmillot et al., 1996; 1997; 2000).

Autosterilisation is based on the same principle as the attract and kill technique but the insecticide devoted to kill the males by contact is replaced by a product able to sterilise them, in this case by the insect growth regulator (IGR) fenoxycarb. Preliminary trials have been made the last 5 years to control codling moth by autosterilisation in a dwarf apple tree orchard of the Research Station of Changins.

Material and methods

Product and application technique. Novartis formulation contained 0.16% codlemone E-8, E-10-dodecadien-1-ol (E8,E10-12:OH) to attract the males and 5% fenoxycarb to sterilize them. The paste was applied with a specially designed dose

tube applicator. 50 µl droplets were dispensed on the branches, containing in average 0.08 mg codlemone and 2.5 mg fenoxycarb. Approximately one third of the droplets was applied in the lower part of the treetop and two thirds in the upper part.

Experimental plot. The small orchard at Changins has a surface of 0.15 ha and consists of 3 rows of 11 apple trees and 2 rows of 17 pear trees. From 1996 to 1999 two applications were made, a first one about one week after the beginning of codling moth flight, generally by the second week of May, and a second application was made 5-8 weeks later, at mid to end of June. In 2000, a third application was made at the end of July. Depending on the year, each application varied between 77-220 g of product per ha corresponding to 1'540-4'400 droplets per ha (Table 1).

Assessment of the autosterilisation treatments in the orchard. During June, corrugated cardboard band traps were placed around tree-trunks in the experimental plot. These were collected in the autumn to estimate the hibernating population density. Corrugated cardboard band traps, placed in a non-treated high stem orchard at Genolier, a neighbouring village, served as control to evaluate the population density fluctuation from one year to the other.

Table 1. Amount of autosterilisation paste formulation applied in the experimental orchard at Changins from 1996 to 2000.

year	1st application (g/ha)	2nd application (g/ha)	3rd application (g/ha)	Total (g/ha)
1995	-	-	-	-
1996	126.3	126.3	-	252.6
1997	220	140	-	360
1998	128	77	-	205
1999	115	83	-	198
2000	154	192	180	526

Results and discussion

The autosterilising formulation almost completely eliminated the catches in the pheromone traps. Figure 1 report the evolution of population density of diapausing larvae in the non-treated high stem orchard at Genolier from 1996 to 2000 as well as from 1995 to 2000 in the experimental orchard were autosterilisation was tested from 1996 onwards. In the high stem check orchard, population density varied from 31 to 76 diapausing larvae per tree from 1996 to 1999 depending on the climatic conditions. However, due to a very precocious and favourable season in 2000, it exploded

to 173 larvae per tree.

In the experimental orchard, without any treatment, population reached 26.4 larvae per apple tree in 1995, than it decreased progressively to 1.56 larvae per tree in 1997 after two years of control by autosterilisation. The small increase of population density from 1997 to 1999 can be attributed to a too low amount of applied product corresponding approximately to 200 g per ha and season (Table. 1). Indeed, the increase of population in apple trees can be attributed at different factors. The almost 3-fold increase of population in the untreated control orchard demonstrates that year 2000 was exceptionally favourable for codling moth development. However, the three applications of droplets in the experimental orchard, instead of two applications, and the much higher amount of product, couldn't avoid an increase of population to 7.48 larvae per apple tree. In pear trees, where cardboard band traps were placed from 1996 on, population dynamics was quite similar as in apple trees, but at a lower level, except in 2000 when the population did not increase.

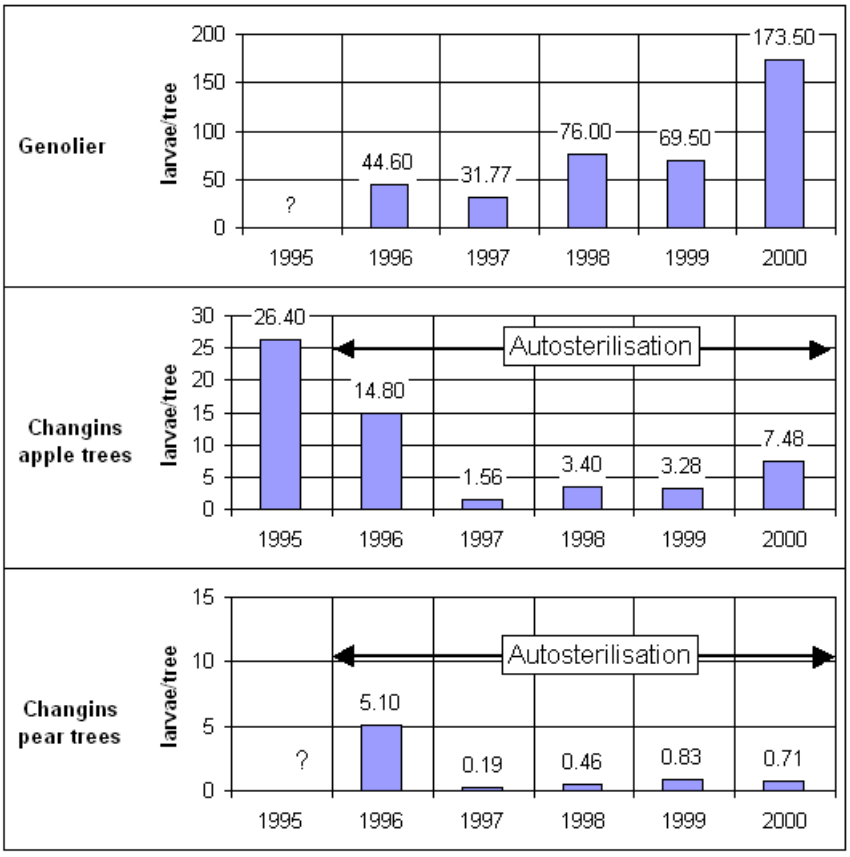

Figure 1. Evolution of larval diapausing population of codling moth in a high stem non-treated orchard at Genolier and in a dwarf trees orchard in Changins where the pest was controlled by autosterilisation from 1996 to 2000.

This trial demonstrates that autosterilisation could be a new method of codling moth control, but it does not bring prove that it's efficiency is higher than attract and kill technique. However, a simulation study on codling moth dynamics under different pheromone based control techniques suggests that autosterilisation should be about twice as effective as attract and kill (Potting at al., 2001).

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