

## CONTROLLING THE CODLING MOTH (*Cydia pomonella* L.) WITH THE “ATTRACT AND KILL” AGENT APPEAL 04 PA

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### A B S T R A C T

Experiments on codling moth control, using "attract and kill" method, were carried out during three years (1998-2000) in different apple orchards. Appeal formulation was applied once or twice in the season – first time just after noticing first moths in pheromone traps and the second one about 6 weeks later. In all those experiments, Appeal 04 PA essentially limited number of damaged fruits but its effectiveness was differential and depended on number of applied drops per ha and number of applications. The results obtained during the experiments proved that, in order to protect fruits against codling moth, Appeal 04 PA should be applied twice a season in dose of 4000 or more drops per ha during the one treatment.

**Key words:** codling moth, control, attract and kill

### INTRODUCTION

Recent advances in pest control are based not only on introducing new, more effective insecticides, but also on finding safer ways to use them. New formulations are high effective and are expected to be less toxic to beneficial organisms and humans.

A good example is Appeal 04 PA, which is used to control the codling moth. It relies on the principle of “attract and kill”. Appeal contains a codling moth pheromone (codlemone 0.1%) which attracts male moths and a synthetic pyrethroid insecticide (cyfluthrin 4.0%) which kills them (Losel et al., 2000).

## MATERIAL AND METHODS

From 1998 to 2000, experiments were carried out to evaluate the efficacy of Appeal 04 PA in controlling the codling moth.

Six trails were conducted in three commercial apple orchards. The first orchard was located in Dąbrowice in central Poland and was planted with 'Jonagold'. The second orchard was located in Skierniewice in central Poland and was planted with 'Elstar'. The third orchard was located in Siedlce in eastern Poland and was planted with 'Idared'. Each orchard was divided into two to six experimental plots, each with an area of 0.25 to 0.5 hectares.

Once or twice a season, Appeal 04 PA was applied manually with a special applicator at rates ranging from 2000 to 6000 drops per hectare per application. The first application was carried out when the first moths were detected in the pheromone traps, and the second application was carried out about six weeks later.

One plot in each orchard was left untreated as the control, and usually another plot was treated with Alsystin 480 SC, which served as the standard.

Efficacy was estimated at harvest time by inspecting 1000 hand-picked fruits from randomly selected trees in the centre of each experimental plot.

Data were statistically elaborated using analysis of variance after transformation according to Freeman-Tukey's formula, followed by means separation using Duncan's multiple-range t-test at  $P \leq 0.05$ .

## RESULTS

In all of the trials, Appeal 04 PA reduced fruit damage. Efficiency varied depending on the number of applications and the application rate (Tab. 1). The best results were obtained with two applications at the highest application rates.

Appeal 04 PA worked much better when the infestation rate was low and the proportion of damage fruits on the untreated plots was only about 1 to 4%.

In the first orchard, Appeal was not very effective at 2 200 or 3 300 drops per hectare in 1999, when the infestation rate was highest. The proportion of damaged fruits was more than 1%, which is over the economic threshold value.

In the second orchard, Appeal was applied twice a season in three consecutive seasons. The proportion of damaged fruits increased from year to year. Appeal was less effective than Alsystin 480 SC, even though Alsystin 480 SC was applied only once during the season.

In the third orchard, which had a low initial infestation rate, Appeal was effective at 4 000 drops per hectare both when applied once a season and when applied twice a season.

Table 1. Efficacy of Appeal 04 PA in controlling codling moth

Treatment	Application rate per hectare*	Number of treatments	Percentage of wormy fruits
Orchard 1 (Dąbrowice, 'Jonagold')			
1998			
Untreated	-	-	0.8 b**
Appeal 04 PA	3300	1	0.0 a
Appeal 04 PA	3300	2	0.0 a
Appeal 04 PA	2200	1	0.1 a
1999			
Untreated	-	-	6.3 d
Appeal 04 PA	3300	1	1.6 b
Appeal 04 PA	3300	2	1.1 ab
Appeal 04 PA	2200	1	3.2 c
Appeal 04 PA	2200	2	1.8 b
Alsystin 480 SC	0.4	1	0.5 a
Orchard 2 (Skierniewice 'Elstar')			
1998			
Untreated	-	-	1.4 b
Appeal 04 PA	6000	2	0.1 a
Appeal 04 PA	2000	2	0.2 a
Alsystin 480 SC	0.4	1	0.0 a
1999			
Untreated	-	-	2.8 b
Appeal 04 PA	6000	2	0.4 a
Appeal 04 PA	4000	2	0.7 a
Alsystin 480 SC	0.4	1	0.4 a
2000			
Untreated	-	-	3.7 c
Appeal 04 PA	6000	2	0.2 a
Appeal 04 PA	4000	2	0.9 b
Alsystin 480 SC	0.4	1	0.2 a
Orchard 3 (Siedlce – 'Idared')			
2000			
Untreated	-	-	1.6 b
Appeal 04 PA	4000	2	0.0 a
Appeal 04 PA	4000	1	0.5 a

\* Appeal 04 PA – number drops (per ha and treatment) Alsystin 480 SC – l/ha \*\*P < 0.05, Duncan's t-test

## DISCUSSION

Appeal 04 PA effective in controlling the codling moth control in Polish commercial apple orchards. Appeal has already been successfully used to control the coddling moth in other countries (Charmillot et al., 1996; 1997; Dickler et al., 1998; Losel et al., 2000; Trematerra et al., 1999).

Appeal 04 PA not only kills male codling moths, but also disrupts mating. After Appeal was applied to the experiment plots, no more moths were detected in the pheromone traps.

Appeal 04 PA is most effective when applied twice a season at 4 000 or more drops per hectare. Appeal is very useful for integrated fruit production because it attracts only the targeted pest without harming beneficial organisms, such as predatory and parasitoid insects (Losel et al., 2000). The “attract and kill” principle can be used as an alternative tactic to control the codling moth in commercial orchards with a relatively low infestation rate and in small orchards where it can be applied by hand.

Appeal 04 PA can reduce fruit damage caused by the codling moth even on trees growing near buildings and other crops, where conventional agents would pose a safety hazard (Płuciennik et al., 2002). Furthermore, Appeal 04 PA can be applied at the edges of the orchard to keep moths from migrating into the orchard from nearby infested sites (Płuciennik et al., 2003).

## REFERENCES

- Charmillot P.J., Pasquier D., Scalco A., Hofer D. 1996. Studies on the control of the codling moth *Cydia pomonella* L. using attractant insecticide. MITT. SCHWEIZ. ENT. GES. 69: 431-439.
- Charmillot P.J., Hofer D., Witzgall P., Arn H. 1997. Control of codling moth, *Cydia pomonella* L., by an attract and kill formulation. OILB/SROP. BULL. 20: 139-140.
- Dickler E., Wirth J., Bäumer S., Lösel P.M., Elbert A. 1998. Experience with two consecutive years of attract and kill in two commercial orchards in the Baden-Württemberg region of Germany in the 1995-96 growing seasons. Abstracts, VI European Congress of Entomology, Ceske Budejovice, August 23-29, 1998, p. 641.
- Losel P.M., Penners G., Potting R.P.J., Ebbinghaus D., Elbert A., Scherckenbeck J. 2000. Laboratory and field experiments towards the development of an attract and kill strategy for the control of the codling moth, *Cydia pomonella*. ENT. EXP. APPL. 95: 39-46.
- Płuciennik Z., Olszak R.W., Tworkowska U. 2002. „Attract and Kill” as control method of codling moth *Cydia pomonella* (L.) in home gardens and allotments. J. FRUIT ORNAM. PLANT RES. 10: 173-176.
- Płuciennik Z., Olszak R.W., Tworkowska U. 2003. Appeal 04 PA – formulation assisting control of the codling moth in apple orchards. ZESZ. NAUK. INST. SADOW. KWIAC. 11: 41-44.
- Trematerra P., Sciarretta A., Tamasi E. 1999. Control of codling moth, *Cydia pomonella*, with an attracticide (attract and kill) method. INF. FIT. 49: 41-44.

ZASTOSOWANIE METODY "ATTRACT AND KILL"  
W ZWALCZANIU OWOCÓWKI JABŁKÓWECZKI  
(*Cydia pomonella* L.)

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S T R E S Z C Z E N I E

Badania nad zwalczaniem owocówki jabłkówekczki metodą "attract and kill" z użyciem preparatu Appeal 04 PA prowadzono w latach 1998-2000 w trzech sadach jabłoniowych (Dąbrowice, Skierniewice i Siedlce). Ogółem wykonano 6 doświadczeń. Stosowano różne dawki środka na określoną powierzchnię sadu (od 2000 do 6000 kropli na 1 ha jedno- lub dwukrotnie w sezonie).

Preparat Appeal 04 PA we wszystkich zastosowanych dawkach znacząco zmniejszał uszkodzenia owoców przez owocówkę jabłkówekczkę. Najbardziej efektywne było stosowanie tego środka w ilości 4 tys. kropli (lub więcej) na powierzchni 1 ha sadu, dwukrotnie w sezonie.

**Słowa kluczowe:** owocówka jabłkówekczka, zwalczanie, "attract and kill"