

STUDIES ON THE ATTRACT & KILL METHOD TO CONTROL THE LEPIDOPTERAN PESTS IN ROMANIAN APPLE ORCHARDS AND VINEYARDS

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ABSTRACT The use of the pheromones in plant protection is one of the ecological methods for monitoring pest control in order to maintain their populations in the agro ecosystem below thresholds. The *Attract & Kill* is a new method that enables us to directly control the pest. It consists of a combination between specific pheromone that attracts the males and the insecticide to kill them. The paper presents the results of the trials carried out during 2006 in different apple orchards and a vineyard with products (MESAJ CP and PRELUDIU LB) obtained by the Research Institute for Chemistry “Raluca Ripan” Cluj-Napoca. The product consists of a viscous formulation containing specific codling moth pheromone (E8, E10-dodecadienol) or vine moth pheromone (E-9-dodecenylacetate and E, Z-7,9-dodecadienyl acetate) and a pyrethroid. The formulation was applied by hand, twice in the season – first time just after noticing first moths in pheromones traps and the second one about 6 weeks later. Males contacting a drop die within a few hours. As a result, the reproduction is reduced and therefore, the level of population as well. The preliminary results on the trials showed a good efficacy. This strategy can compete with conventional spray applications and is therefore a good alternative for codling moth and grapevine moth control in integrated fruit and wine growing respectively.

Key words: *pheromones, plant protection, orchards, vineyard.*

INTRODUCTION

The codling moth (CM) *Cydia pomonella* L. and the grapevine moth (GM) *Lobesia botrana* D&S (Lepidoptera: Tortricidae) are two major pests of the apple orchards and respectively the vineyards worldwide, Romania being one of them. Currently, codling moth and grapevine moth control relies primarily on conventional spray applications. The development of resistance of these pests to insecticides made it necessary to find new control methods; the identification of the pheromones (Roelofs, et al., 1971) and their synthesis has become a widespread method for CM's and GM's monitoring. At the beginning the pheromones were used on a different type of traps to detect the presence of the species and the population dynamics based on the flight curves, warning the right moment to control.

Direct control of the pest by synthetic pheromone in order to use safer methods and less toxic to beneficial organisms and humans was studied by many scientists. At the beginning they used the *mass trapping* method (Charmillot et Baggioni, 1995, Madsen et al., 1996) using high density of the traps, but the method was not efficient enough. The *mating disruption* technique is another method, more efficient, becoming more and more widespread in the apple orchards from many European countries and also in the USA (Charmillot et Bloesch, 1987, Howell, et al., 1992, Neuman, and al., 1992, Charmillot et al., 1997, Brunner, et. al., 2002) and in vineyards (Friedrich, and Schirra, 2001, Charmillot and Pasquier, 2004).

Studies on the *Attract & Kill* strategy, involving the combination of pheromones with an

insecticide were carried out and its principle to control has already been successfully applied: CM in Switzerland (Charmillot et al., 1997a, 1997b), Germany (Dickler et al., 1998; Lösel et al., 1998a, 1998b; Ebbinghaus, 2001) and Poland (Pluciennik et al., 2002; 2006).

In Romania, the Research Institute for Chemistry from Cluj-Napoca has synthesized pheromones for different species 30 years ago and many papers showed the results of the trials made in many Romanian orchards (Jacob, 1977, 1981; Ghizdavu, 1983, 1984; Drosu, 1993, 2001) outlining their efficacy and methods of use.

This paper presents the results of the trials carried out during 2006 with the Romanian products using a *Attract & Kill* method, an alternative for codling moth and grapevine moth control in integrated fruit and wine growing respectively, in different apple orchards (MESAJ CP) and vineyards (PRELUDIU LB).

MATERIAL AND METHOD

The products MESAJ CP and PRELUDIU LB obtained by the Research Institute for Chemistry “Raluca Ripan” Cluj-Napoca consist in a mixture between the specific codling moth pheromone (E8, E10-dodecadienol) or grapevine moth pheromone (E-9-dodecenylacetate and E,Z-7,9-dodecadienyl acetate) and a pyrethroid; this is a paste that was applied manually with a specially applicator ranging the drops uniformly per hectare per application (400g) dispensed on the apple tree branches at approximately 1.5 m high or on the vines.

The experiments were carried out to evaluate the efficacy of MESAJ CP and PRELUDIU LB in controlling the CM and the GM. The first application was done when the first moths were detected in the pheromone traps (second week of May) and the second application was done about six weeks later (end of June to begin of July).

The studies for CM were carried out into an apple orchard located in the middle of the country (Research Development Institute for Fruit Growing Pitesti-Maracineni) (RDIFG) and other two orchards near Bucharest (Research Development Institute for Plant Protection) (RDIPP) and (Moara Domneasca); for the GM the studies were done in a vineyard from Research Development Institute for Viticulture Valea Calugareasca (RDIV) in the middle of the country and another vineyard from The Research Development Station for Viticulture Murfatlar (RDSVM), in the South-Eastern part of the country.

Each experimental area was divided into 3 sections. In the first the *Attract & Kill* treatment with MESAJ CP and PRELUDIU LB respectively, was applied on about 0.5 ha. The second variant was the commercial treatment. Several trees and vines without treatment against target pests represented the third section (control) for each location. In the second variant the treatments: at RDIPP Bucharest – Novadim 40 EC (dimetoat) 0.075% for the first generation and Diazol 60 EC (diazinon) 0.15% for the second generation; at Moara Domneasca the insecticide used was Victenon 50WP (bensultap) 0.075% in the 1st generation and Cipertrin 10 EC (alfa-cipermetrin) 0.015% for the 2nd; at RDIFG Pitesti Calypso 480 SC (tiacloprid) 0.02% and Cypermetrin 10EC (cipermetrin) 0.03% were applied. For the control of grapevine moth at RDIV Valea Calugareasca Karate Zeon was applied and at RDSV Murfatlar, Decis WG.

The treatment efficacy was estimated by the number of affected fruits and grapes, expressed as a percentage of both yields picked up from randomly selected, in the middle of each experimental plot tree or vine (a sample of 1000 fruits or grapes).

The pheromone traps were used to check the efficacy.

RESULTS

Table 1 shows the controlling efficacy of the product MESAJ CP on codling moth in the three apple orchards. The efficacy was between 73.88% and 83.32%. Figure 1 presents the attack level in those orchards, on the experimental variants. The tables 2 and 3 show the efficacy of the *Attract & kill* in two vineyards. It can be observed that product PRELUDIU LB controlling grapevine moth showed an efficacy of 81.37% at Valea Calugareasca and 73.0% at Murfatlar. *Attract & kill* had a comparable efficacy with the chemical standard; this justifies to carry on our studies in order to obtain a Romanian product and implement it in integrated fruit and wine growing control.

The high values of the codling moth attack level on the untreated control show the high density of the populations that had influenced the efficacy of the treatment; Charmillot (1996, 1997a, 1997b) has related that pheromone products and *Attract & kill* technique acted more efficiently when the population levels were lower. The literature, based on the results obtained over many years on large areas, showed that the *Attract & kill* technique and the products used have reduced the attack level of the codling moth and the grapevine moth (Charmillot, 1996, 1997; Pluciennik et al., 2002, 2006), efficacy being about 85% in Germany (Ebbinghaus et al., 2001) and 58.3% to 75.3% in Poland (Pluciennik et al., 2006). *Attract & kill* technique is very useful for integrated management because it attracts only the targeted pests without harming beneficial organisms, such as predatory and parasitic insects (Lösel et al., 2000).

Table 1The efficacy of the MESAJ CP to control the codling moth (*Cydia pomonella*)

	RDIPP Bucharest		Moara Domneasca		RDIP Pitesti	
	Level of attack (%)	Efficacy (%)	Level of attack (%)	Efficacy (%)	Level of attack (%)	Efficacy (%)
MESAJ CP	10.2	83.32	3.38	73.88	18.20	80.72
Standard	16.8	80.26	3.62	72.02	12.35	86.92
Untreated	85.1	-	12.94	-	94.4	-

Table 2The efficacy of the PRELUDIUM LB to control the grapevine moth (*Lobesia botrana*) at Valea Calugareasca

		Attack level on grapes (%)			
		G2	G3		
PRELUDIUM LB	0.7	1.46	2.72	1.62	81.37
Karate zeon	0.4	0.8	1.81	1.08	87.58
Untreated	5.2	7.3	13.6	8.7	-

Table 3The efficacy of the PRELUDIUM LB to control the grapevine moth (*Lobesia botrana*) at Murfatlar

		Attack level on grapes (%)			
		G2	G3		
PRELUDIUM LB	2.5	5.2	3.1	3.6	73.0
Decis WG	1.0	1.3	0.5	0.93	93.0
Untreated	9.6	15.8	14.8	13.4	-

In the studies carried out in Romania, the efficacy of the treatments with pheromones by *Attract & kill* technique was checked using pheromone traps that recorded insects flight in all 3 variants (Tab. 4). It can be observed that *Attract & kill* variant recorded only accidentally captures in orchards and low number in vineyards. That means there was no copulation activity. In the untreated control there was continuous flight and 2-3 peaks registered (Fig. 2). The flight of the codling moth lasted from the beginning of May to the beginning of September. Figure 3 presents the dynamic of the grapevine moth in those 3 variants. The flight activity lasts from the middle of April to the end of August.

Table 4

The situation of the captures in the pheromone traps, 2006

	Mean capture numbers/variant		
	Attract & Kill	Standard	Untreated
RDIPP Bucharest	1.0	42.3	96.3
Moara Domneasca	0.3	22.7	52.0
RDIP Pitesti	1.0	-	89.7
RDIV Valea Calugareasca	5.4	58.7	193.8

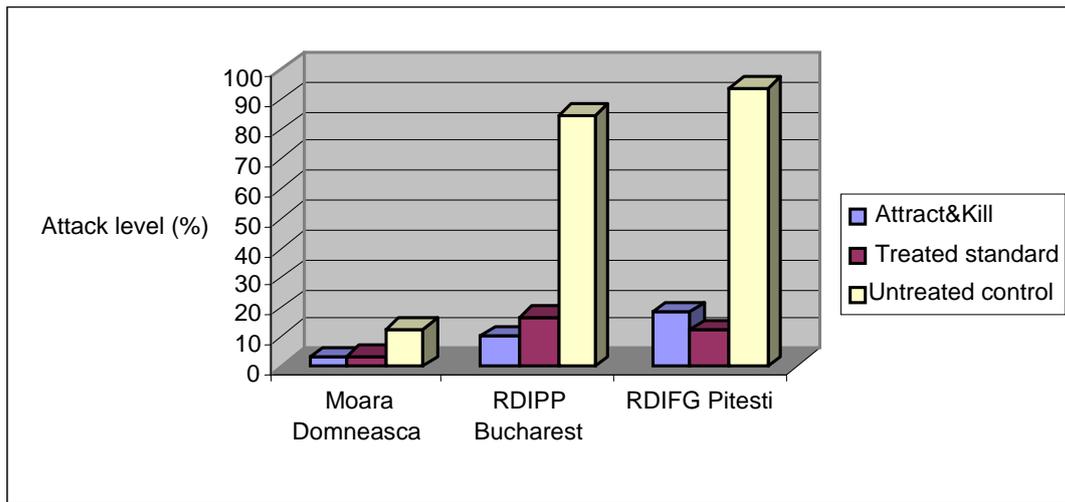


Fig. 1 The efficacy of the treatment with *Attract & Kill* (MESAJ CP)

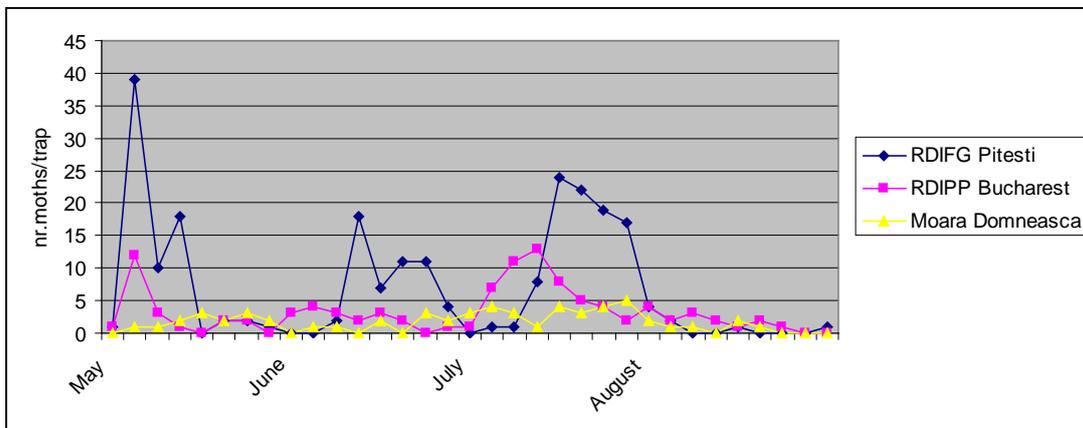


Fig. 2 The flight moth dynamic of the *Cydia pomonella*

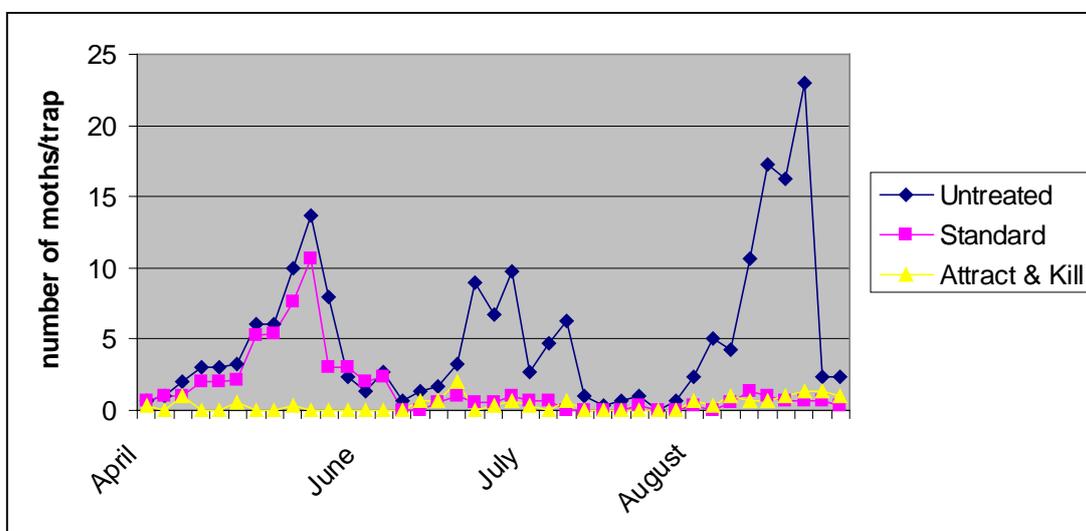


Fig. 3 The flight moth dynamic of *Lobesia botrana*

CONCLUSIONS

Attract & Kill is a highly efficient method controlling lepidopteran in integrated pest management.

The specificity of the sex-pheromones employed ensures that only the target species are affected, avoiding damaging effects on beneficial and other non-target organisms, thus being a safety method for humans and environment.

The combination pheromone-insecticide has a contact action; males are attracted by pheromones and are killed by the insecticide within hours. As a result, the reproduction is inhibited. The efficacy of the method increases when the infestation rate is relatively low.

The trials carried out in Romania with the products MESAJ CP and PRELUDIU LB used in *Attract & Kill* technique showed good results. The method can compete with conventional spray applications and it is therefore a good alternative for codling moth and grapevine moth controlling in integrated fruit and wine growing respectively.

This strategy can be recommended in small orchards where it can be applied by hand.

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