PROTECTION OF APPLE ORCHARDS AGAINST SUMMER FRUIT TORTRIX MOTH (*ADOXOPHYES RETICULANA* HB.) BY BIOTECHNIQUE METHOD *ATTRACT & KILL*

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ABSTRACT

This paper presents the results of the studies carried out during 2008-2009 in apple orchards from RDIPP Bucharest, RDIFG Pitesti-Maracineni and RDSFG Voinesti against summer fruit tortrix moth (*Adoxophyes reticulana*) by *Attract and Kill* biotechnique. Romanian product developed by Research Institute for Chemistry "Raluca Ripan" Cluj-Napoca used. This product consists of specific pheromone of the pest and a pyretroid.
To demonstrate the possibility of simultaneous control of the summer fruit tortrix moth and the codling moth (*Cydia pomonella*), the major pest of apple, combined product containing the same proportion of specific pheromone of both pests was used comparativelly. The results showed good efficacy of the product MESAJ AR (containing pheromone only for *A. reticulana*), 84.6-91.8% respectively and also for the product SIGNAL AC (with specific pheromones for *A. reticulana* and for *C. pomonella*), 89.1-91.4% respectively. It may recommend so, simultaneous control of those two dangerous pests for apple orchards (codling moth and summer fruit tortrix moth), with particular benefits for the environment.

Key words: pheromones, *Attract & Kill*, summer fruit tortrix moth, *Adoxophyes reticulana*

INTRODUCTION

The summer fruit tortrix moth (*Adoxophyes reticulana*) is poliphague pest that causes important dameges especially in apple orchards; Perju (1995) has noted that this species is present at 47 fruit species. *A. reticulana* causes damages on the leaves and fruits. The damage to the leaves is not so harmful, but the damage to the fruit can be important. First generation larvae actively feed on leaves, buds, flowers and developing fruit, the attack being mostly on the fruits. The potential of damage is higher because the possibility of the attack during storage period.

The damage caused by summer fruit tortrix moth is both economic and environmental. Potential economic impact is difficult to assess because it usually appears with other pest species and his attack is secondary; it may become important if management measures does not take into account. By qualitative and quantitative impairment the crop losses can be 10-50%. The impact of this species can expand through trade with infested fruit. Potential environmental impact is that interventions to limit this species can reduce biodiversity, destroying the ecosystem functions.

Given that in recent years there have been major attack of the summer fruit tortrix moth in some orchards in Romania, studies to control by alternative methods, like those of *Attract and Kill* biotechnique were initiated. The results obtained controling by this method codling moth (*Cydia*

pomonella) abroad (Alma, A. et al., 2001; Barić, B. et Ciglar, I., 2003; Charmillot, P.J. et al., 2000; Puciennik, Z. and al., 2002; Stará, J.and Kocourek, F., 2004) and also in our country (Sonica Drosu and al., 2008) are encouraging and a good exemple to use for the pests from the same systematic group, like summer fruit tortrix moth (*A. reticulana*). It were done studies about use of *A. reticulana* specific pheromone by different techniques (mass trapping, mating disruption) many years ago (Charmillot, P.J., 1989; Van der Kraan, C. et Van Deventer, P., 1982; Vantieghem, H., Sterk, G. and Neumann, U., 1991) or recentlly (Navrozidis, E.et all., 2005), with good results.

The aim of this paper is to present results obtained from studies carried out during 2008-2009 in a NP II project partnership, at RDIPP (Research Development Institute for Plant Protection) Bucharest, RDIFG (Research Development Institute for Fruit Growing) Pitesti-Maracineni and RDSFG (Research Development Station for Fruit Growing) Voinesti-Dambovita to control summer fruit tortrix moth (*A. reticulana*) by *Attract and kill* biotechnique.

MATERIAL AND METHOD

The field trials with *Attract and Kill* formulated products were carried out in 2008-2009 in 3 locations: apple orchard from RDIPP Bucharest, RDIFG Pitesti-Maracineni and RDSFG Voinesti-Dambovita (2 locations), where were semnalated high level of attack (30-40%) in the previous years.

Each variant of the experience (*Attract & Kill* and standard with classical treatments) was about 0.5 ha. Two rows without treatment against target pests represented untreated variant.

The products formulated at Research Institute for Chemistry "Raluca Ripan" Cluj-Napoca for *Attract & Kill* biotechnique consist into a mixture between the specific pheromone and a pyrethroid; this is a paste that was applied manually ranging the drops uniformly per hectare per application (400g) dispensed on the apple tree branches (one droplet per tree) at approximately 1.5 m high in the middle of the crown. The product MESAJ AR (containing pheromone only for *A. reticulana*) was used in 2008; in 2009 the product SIGNAL AC (with specific pheromones for *A. reticulana* and for *C. pomonella*) was applied. The first application was made after the first occurrence of the males in the pheromone traps (second week of May) and the second application was made about six weeks later (begin of July).

In the second variant (standard) the treatments with the registered insecticides were applied at the warning moment. The observations on the efficacy were done after each generation and at harvest.

The efficacy estimation of the products used in *Attract & Kill* treatments was made by the following: (i) pheromone traps monitoring the flight activity in those 3 variants; the catches of the males were checked weekly and sticky inserts were changed in case of need; (ii) the observation on the egg masses lying after the pick of the first flight, at 7-10 days interval; 500 leaves and 500 fruits were checked; (iii) evaluation of the fruit injury on treated as well as on untreated plots; this assessment was done at harvest time, sampling 1000 fruits from 50 trees taken at random.

The biological efficacy of the products was calculated by Abbot Formula E= (1-x/y)*100, where x is attack level at treated variant and y is attack level at untreated variant.

RESULTS AND DISCUSSIONS

a) Results on the estimation of the population by catches in the pheromone traps;

Table number 1 presents the situation of the catches of summer fruit tortrix moth in the pheromone traps at the aim to check the efficacy of the products. It can see that at RDIFG Pitesti-Maracineni the treatment in *Attract & Kill* variant reduced considerably the number of males caught in pheromone traps; it was caught 0-0.33 males/trap in *Attract & Kill* variant, 1.66-2.66 males/trap at standard and 4.33-13.0 males/trap at untreated variant respectively. At RDSFG Voinesti-Dambovita the level of the population was higher (0.33-3.66 males /trap in *Attract & Kill* variant, 3.66-26.0 males /trap in standard variant, 15.33-61.0 males /trap at untreated). At RDIPP Bucharest there was not captures in any variant, so was no population.

Table 1

The situation of the catches of summer fruit tortrix moth in the pheromone traps

Year	Mean capture numbers/variant				
	Variant	RDIPP Bucharest	RDIFG Pitesti-Maracineni	RDSFG Voinesti-Dambovita	
				Orchard 1	Orchard 2
2008	V1 (Attract&Kill)	0	0.33	2.0	3.66
	V2 (standard)	0	2.66	19.66	26.0
	Untreated	0	13.0	32.0	61.0
2009	V1 (Attract&Kill)	0	0	0.33	3.66
	V2 (standard)	0	1.66	3.66	10.33
	Untreated	0	4.33	15.33	28.0

The lower number of catches in *Attract & Kill* variant, even where the population is high (RDSFG Voinesti-Dambovita) shows the good activity of the product by reduced sexual communication due to multiple pheromone sources and than the elimination of males by pyretroid.

b) Results on the number of the egg masses lying;

The results on the eggs lying (table 2) show lack of the egg masses in those two years in the variant 1; that demonstrates the absence of the mating activity, that mean good efficacy of the product, compared with untreated variant, where recorded 13 egg masses in 2008 and 6 in 2009. 5 egg masses in 2008 and 2 in 2009 were layed at standard (V2).

Table 2

The situation of the number of the *Adoxophyes reticulana* egg masses laying, RDSFG Voinesti-Dambovita, orchard 1

Observations		Number egg masses					
		V1 (Attract&Kill)		V2 (standard)		Untreated	
2008	2009	2008	2009	2008	2009	2008	2009
15.07	17.07	0	0	0	1	0	2
22.07	23.07	0	0	1	1	4	3
10.08	02.08	0	0	1	0	4	1
23.08	12.08	0	0	2	0	4	0
3.09	29.08	0	0	1	0	4	0
TOTAL	TOTAL	0	0	5	2	13	6

c) Evaluation of the fruit injury;

The observations on the attack level (fig. 1 and fig. 2) of the *A. reticulana* showed good efficacy (table 3) of the *Attract&Kill* biotechnique controlling this pest. The first generation attack level was evaluated on leaves, the fruit injuries being sporadically in this period; for the second generation the fruit attack level at harvest was evaluated. The efficacy of *Attract & kill* method was between 84.6% and 91.8% in 2008 when used the product MESAJ AR (containing pheromone only for *A. reticulana*) and 89.1-91.4% in 2009 when used the product SIGNAL AC (with specific pheromones for *A. reticulana* and for *C. pomonella*); it can note that both products had similar efficacy. It can recommand the combination for simultanous control of the two pests, reducing the costs for the treatment. The efficacy in *Attract & kill* variant was comparable with those recorded at standard (76.3%-88.8%).

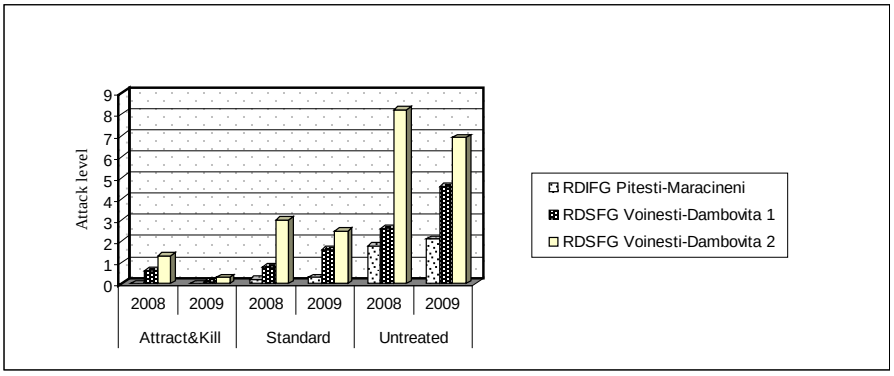

Fig. 1 Attack level of the summer fruit tortrix moth on first generation (leaves)

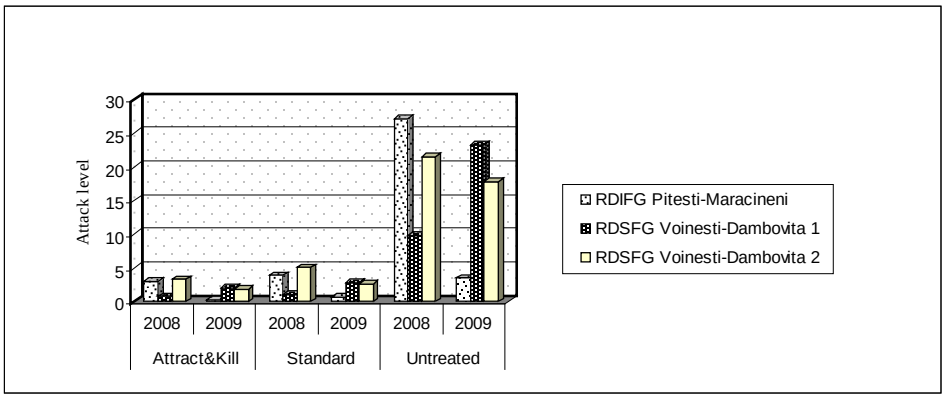

Fig. 2 Attack level of the summer fruit tortrix moth on secund generation (fruits)

Table 3

The efficacy of *Attract&Kill* to control *Adoxophyes reticulana*

Variant	Year	RDSIG Pitesti-Maracineni		SCDP RDSFG 1		RDSFG Voinesti 2	
		% atac	Efficacy (%)	% atac	Efficacy (%)	% atac	Efficacy (%)
V1 (Attract&Kill)	2008	3.1	**88.6**	0.8	**91.8**	3.3	**84.6**
	2009	0.3	**91.4**	2.1	**90.9**	1.9	**89.1**
V2 (standard)	2008	3.9	85.6	1.1	88.8	5.1	76.3
	2009	0.7	80.0	2.8	87.0	2.6	85.1
Untreated	2008	27.1	-	9.8	-	21.5	-
	2009	3.5	-	23.2	-	17.8	-

CONCLUSSIONS

- *Attract & kill* is a biotechnique method with good efficacy, apropiate to use in apple orchards integrated pest management. The specificity of the pheromone action allows the entomofagous populations development and the protection of the environment;
- The results of the trials show good efficacy of the products contaning specific summer fruit tortrix moth pheromone alone formulated for *Attract & kill* application or in combination with codling moth pheromone; it can be used for simultanous control of those two pests;
- *Attract & kill* method can be used easier in isolated, small orchards where the manually aplication is possible.

REFERENCES

Alma, A., Arzone, A., Galliano, A., Vittone, F. (2001). "Attract and kill" a new IPM method in apple orchards against *Cydia pomonella* (L.). Bull. OILB-SROP. 24:139-143.

Baric, B., Ciglar, I. (2003). Testing of the attract and kill technique against *Cydia pomonella* in Croatia. Communications in Agricultural and Applied Biological Sciences, Vol. 68, No. 4a, 275-276.

Charmillot, P.J. (1989). Mating disruption against the summerfruit tortrix *Adoxophyes orana* F.v.R.: study of insect behaviour and control. Rev. Suisse Vitic. Arboric. 21:337-346.

Charmillot, P.J., Hofer, D., Pasquier, D. (2000). Attract and kill: a new method for control of the codling moth *Cydia pomonella*. Entomol. Exp. Appl. 94:211-216.

Drosu, S., Teodorescu, G., Ciobanu, M., Sumedrea, M., Cazacu, S., Chireceanu, C., Gansca L., Oprean,I. (2008). Studies on the *Attract & kill* method to control the lepidopterean pests in Romanian apple orchards and vineyards, RJPP, Vol. 1, Issue. 1, www.rjpp.ro

Navrolzidis, E., Thomidis, T., Tsipouridis, C., Xatzicharisis, I., Fotiadis, I., Servis, D. (2005). Pheromone-based communication disruption of Adoxophyes orana on peach using the new RAK 3+4 dispensers and their effect on development of fruit rot diseas. *Phytoparasitica* 33(2):149-153.

Perju, T. (1995). Entomologie agricolă componentă a protecţiei integrate a agroecosistemelor, Ed. Ceres, 308 p

Puciennik, 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 Orn. Plant Res. 10:173-176.

Stara, J., Kocourek, F. (2004). Utilization of the „Attract and kill" method against codling moth (*Cydia pomonella* L., Lep.: Tortricidae). Acta fitotechnica et zootechnica, Vol. 7, Special Number, Proceedings of the XVI Slovak and Czech Plant Protection Conference organised at Slovak Agricultural University in Nitra, Slovakia, 301-303.

Vantieghem H., Sterk, G., Neumann, U. (1991). Mating disruption technique against leafrollers (*Tortricida*e) in apple and pear orchards in Belgium. Meded. Fac. Landbouww. Rijksuniv. 56:295-304.

Van der Kraan, C., Van Deventer, P. (1982). Range of action and interaction of pheromone traps for the summerfruit tortrix moth, *Adoxophyes orana* (F.v.R.). J. Chem. Ecol. 8:1251-1262.