PROBLEMS OF APHID CONTROL IN APPLE ORCHARDS IN 2007

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ABSTRACT

Reduction of insect susceptibility to insecticides is usually the reason for their application failure, especially those from organophosphate, carbamate and pyrethroid group, while other reasons are rarely mentioned. Therefore, investigations are directed towards effectiveness testing of parallel preparations (of different producers), mixes and those with mechanical way of action (petroleum oils), for *Aphis* sp. on apple. In apple orchards (Begeč, Krčedin and Bačka Palanka) during the year 2007 trials were set under standard (OEPP 1/21, 1997) method. Preparations on the basis of chlorinepyrifos, chlorinepyrifos + cipermetrine and petroleum oils, in quantities for practical use, were applied. Effectiveness and significance of differences for mean value were calculated by Henderson and Tilton formula (ANOVA). Efficacy of tested preparations differed subject to applied quantities and application conditions. Products on the basis of chlorinepyrifos and chlorinepyrifos + cipermetrine in the area of Begeč, Krčedin and Bačka Palanka showed lower efficacy (47% - 85.9%) after one, two and three days, and so did petroleum oils (16.5% - 66.4%). After five and six days from application, chlorinepyrifos and mixes showed efficacy from 11.7% to 84.2% and petroleum oils from no effect to efficacy of 73.2%. Those investigations were done in June and July in conditions of high temperature (max. 36-42 °C). Trials were repeated during September (Bačka Palanka), when the same insecticides revealed high efficacy (88.1% - 97.5%) three to seven days after application treatment, under lower average daily temperatures (max. 28 °C). The cause for such efficacy of insecticides in aphid control in apple could possibly be found in specific agroecological conditions, extremely high temperatures and maybe in unadjusted pesticide formulations for high temperatures, or in presence of other related aphid species amongst of which in 2008. *A. spiraecola* Patch. was detected.

Key words: aphids (*Aphididae*), apple orchard, insecticides, efficacy

1 INTRODUCTION

In our occupational public, presentation of data concerning insufficient insecticide efficacy, especially those from organophosphate and pyrethroid group in aphid control, is becoming more and more often.

According to Elezović *et al*. (2006) in some localities in Serbia lower efficacy of dimethoate in *Aphis pomi* de Geer control was determined. Inđić *et al.* (2006) claim similar, referring to organophosphates and pyrethroids, although there is no organized monitoring or concrete data concerning this unwanted incidence. Change in efficacy of products from neonicotinoid group have not been registered, therefore those insecticides are still successfully used in our region as petroleum oils also. Taking into account resistance as possible and more often consequence of high insecticide selection pressure, the aim of this study was comparative analysis of insecticide efficacy for *A. pomi*, subject to several factors which could have significant impact on efficacy change (quality of comparative products, temperature rise, possible presence of invasive aphid species, susceptibility alternation or differences).

2 MATERIALS AND METHODS

In apple orchards (Begeč, Krčedin and Bačka Palanka) during 2007 trials were set according to standard OEPP (PP 1/21, 1997) method (Anonimus, 1997). Product on the basis of chlorinepyrifos, chlorinepyrifos + cipermetrine and petroleum oils in quantities for practical use were applied (table 1). Treatment was foliar with water consumption of 1000 l/ha. Trials were set in four replicate randomized block design. The trial in Bačka Palanka was set on 13. 06. 2007., in Begeč on 14. 06. 2007., in Krčedin on 13. 07. 2007., and again in Bačka Palanka on 15. 09. 2007. Results are shown through mean values for aphid abundance and efficacy (E %) according to Henderson and Tilton (Wintzel, 1963), as standard deviation (Sd) and lowest significance of differences (ANOVA) also.

Table 1. Products, active ingredient, aplication concentration and producer

Products	**Active ingredient**	**Aplication conc. (%)**	**Producer**
Despot	chlorpyrifos+cypermethrin	0.075; 0.1	Hemovet D.O.O.
Nurelle- D*	chlorpyrifos +cypermethrin	0.1	Dow Agro Sciences
Kozma	chlorpyrifos	0.1; 0.15	Hemovet D.O.O.
Pyrinex 48 EC*	chlorpyrifos	0.15	Makhteshim, Beer-Sheva
Sunspray 7E	petroleum oils	0.05; 1.0; 1.5	Sun oil company, Belgium
Eos*	petroleum oils	1	Makhteshim, Beer-Sheva

* default products

3 RESULTS AND DISCUSSION

Author's aim was not only the analysis of insecticide efficacy for *A. pomi* control in apple, but also determination of possible reasons and conditions for unusually low insecticide efficacy for the above mentioned species (table 2-5). Basic aspects of data analysis are directed towards: a) quality of comparative products; b) temperature conditions; c) development cycle of aphids and distinctive polymorphism d) presence of other aphid species in apple; e) insecticide efficacy change.

Table 2. Average number of green apple aphid (*A. pomi*) and insecticide efficacy two and six days after application (B. Palanka locality, June 2007.)

products (con. %)	**two days after application**			**six days after application**		
	x	**Sd±**	**E %**	**x**	**Sd±**	**E %**
Despot (0.075)	**349.2 cd**	161.9	**58.1**	**511.2 bcd**	172.5	**11.7**
Despot (0.1)	**332.5 cd**	65.5	**62.6**	**343.7 cd**	127.3	**44.3**
Nurelle- D (0.1)	**360.0 cd**	38.1	**51.8**	**332.5 cd**	98.0	**36**
Kozma (0.1)	**592.5 bc**	192.4	**23.2**	**573.7 bc**	249.5	**0**
Kozma (0.15)	**408.7 cd**	127.6	**53.5**	**376.2 bcd**	175.3	**38.4**
Pyrinex 48EC(0.15)	**223.7 d**	160.8	**68.9**	**226.5 d**	109.3	**54.6**
Sunspray 7E (0.5)	**497.5 cd**	218.0	**34.2**	**564.2 bc**	300.4	**0**
Sunspray 7E (1.0)	**863.7 ab**	262.4	**24.4**	**941.2 a**	216.2	**0**
Sunspray 7E (1.5)	**427.5 cd**	133.2	**46.6**	**386.2 bcd**	157.4	**30.6**
Eos (1.0)	**916.2 ab**	445.5	**16.5**	**652.5 abc**	179.9	**14.4**
Untreated	**995.0 a**	89.8		**691.2 ab**	240.9	
LSD 5%	282.1			279.2		

x – mean value; Sd ± - standard deviation; E % - efficacy

Table 3. Average number of green apple aphid (*A. pomi*) and insecticide efficacy one and five days after application (Begeč locality, June 2007.)

products (con. %)	one days after application			five days after application		
	x	Sd±	E %	x	Sd±	E %
Despot (0.075)	**220.0 bc**	74.7	**60.4**	**221.3 bcd**	61.8	**53.8**
Despot (0.1)	**270.0 b**	147.2	**69.6**	**243.8 bcd**	84.8	**68.2**
Nurelle- D (0.1)	**92.5 d**	59.5	**85.9**	**110.0 d**	91.9	**80.6**
Kozma (0.1)	**272.5 b**	38.6	**60.2**	**317.5 bc**	100.9	**46.2**
Kozma (0.15)	**102.5 cd**	78.4	**84.7**	**93.8 d**	33.5	**83.8**
Pyrinex 48EC (0.15)	**98.8 cd**	37.3	**80.4**	**68.8 d**	44.0	**84.2**
Sunspray 7E (0.5)	**323.8 b**	135.5	**52.6**	**345.0 b**	196.6	**41.4**
Sunspray 7E (1.0)	**247.5 bc**	131.3	**66.4**	**170.0 cd**	143.1	**73.2**
Sunspray 7E (1.5)	**275.0 b**	68.2	**61.5**	**201.2 bcd**	94.2	**67.3**
Eos (1.0)	**228.7 bcd**	31.7	**64.4**	**150.0 cd**	65.4	**72.9**
Untreated	**653.8 a**	120.0		**563.8 a**	127.3	
LSD 5%	138.2			153.6		

x – mean value; Sd ± - standard deviation; E % - efficacy

Table 4. Average number of green apple aphid (*A. pomi*) and insecticide efficacy two and six days after application (Krčedin locality, July 2007.)

products (con. %)	three days after application			six days after application		
	x	Sd±	E %	x	Sd±	E %
Despot (0.075)	**597.5 bc**	126.6	**52.7**	**431.2 bc**	129.4	**55.7**
Despot (0.1)	**565.0 bc**	108.1	**47.0**	**431.2 bc**	37.3	**47.5**
Nurelle- D (0.1)	**627,5 bc**	162.8	**51.9**	**538.7 b**	117.3	**46.4**
Kozma (0.1)	**340.0 d**	103.8	**74.0**	**292.5 c**	100.2	**70.9**
Kozma (0.15)	**488.7 cd**	110.2	**60.4**	**333.7 bc**	45.0	**64.9**
Pyrinex 48EC(0.15)	**476.2 cd**	115.7	**59.4**	**367.5 bc**	95.4	**59.3**
Sunspray 7E (0.5)	**688.7 b**	161.1	**43.9**	**461.2 bc**	51.7	**51.3**
Sunspray 7E (1.0)	**587.5 bc**	132.1	**54.2**	**481.2 bc**	128.7	**51.3**
Sunspray 7E (1.5)	**577.5 bc**	216.1	**56.3**	**503.7 bc**	82.9	**50.5**
Eos (1.0)	**447.5 cd**	68.1	**54.5**	**511.2 bc**	194.0	**32.5**
Untreated	**1338.7 a**	203.4		**1031.2 a**	284.9	
LSD 5%	168.9			192.66		

x – mean value; Sd ± - standard deviation; E % - efficacy

Table 5. Average number of green apple aphid (*A. pomi*) and insecticide efficacy three i seven days after application (B. Palanka locality, September 2007.)

products (con. %)	three days after application			seven days after application		
	x	Sd±	E %	x	Sd±	E %
Despot (0.075)	**41.3 b**	32.8	**92.8**	**3.7 b**	4.8	**99.3**
Despot (0.1)	**43.8 b**	39.9	**92.6**	**6.2 b**	9.5	**98.9**
Nurelle- D (0.1)	**46.3 b**	56.2	**91.6**	**3.7 b**	7.5	**99.2**
Kozma (0.1)	**50.0 b**	32.4	**88.1**	**15.0 b**	12.9	**96.3**
Kozma (0.15)	**11.3 b**	13,1	**97.5**	**3.7 b**	7.5	**99.1**
Pyrinex 48EC(0.15)	**10.0 b**	8.2	**97.5**	**5.0 b**	9.9	**98.7**
Sunspray 7E (0.5)	**31.2 b**	13.2	**89.4**	**7.5 b**	8.7	**97.4**
Sunspray 7E (1.0)	**23.8 b**	30.9	**91.1**	**12.5 b**	11.6	**97.2**
Sunspray 7E (1.5)	**13.8 b**	4.8	**97.0**	**9.5 b**	7.5	**97.9**
Eos (1.0)	**16.3 b**	12.5	**95.1**	**3.3 b**	6.5	**98.9**
Untreated	**640.0 a**	164.3		**618.3 a**	138.7	
LSD 5%	79.4			60.3		

x – mean value; Sd ± - standard deviation; E % - efficacy

Comparison of biological effects, as of efficacy of comparative products (same active ingredient, different producer) applied in different conditions, did not bring to conclusion that they have statistically significant difference in efficacy which favours equivalence of quality of products.

We are also witnesses of global warming. Trials were done during June under high temperatures. Maximum daily temperatures were up to 36 °C with precipitation of 30 mm in B. Palanka and Begeč. Insecticide efficacy in locality of Bačka Palanka two days after application was 16.5-68.9% independently from insecticide and quantity, and after six days, from no effect to 54.6%. In locality of Begeč one day after insecticide application, efficacy was 52.6-85.9%, and after five days 41.4-84.2%, also independently from quantity and mode of action of insecticide. During July, maximum daily temperatures were up to 42 °C and precipitation up to 25 mm in Krčedin locality. Insecticide efficacy in this locality three days after application was 43.9-60.4%, and after six days it was 32.5-70.9%, independently from insecticide. In September maximum daily temperature in locality of B. Palanka was up to 28 °C, precipitation 34 mm, and efficacy three days after insecticide application was 88.1-97.5%, and after seven days 97.2-99.3%, independently from application quantity and insecticide mode of action.

Comparing insecticide efficacy realized in June and in September on the same aphid population (B. Palanka) with equal quantities of product, differences are observed, and they could be the consequence of high temperatures or more complex development cycle of aphids because during one year one sexual generation is substituted with several asexual generations (Petrović-Obradović, 2003, Almaši *et al.*, 2004). According to newer results (Petrović-Obradović *et al*., 2007; 2008; 2009) aphid control in apple is becoming more and more significant problem for Serbian producers, referring to occurrence of expressive resistance to insecticides and occurrence of new species – Spiraea aphid, *Aphis spiraecola* Patch, as the main reasons. The same authors found this new species on larger number of plant species, in mixed colonies with *A. pomi* or solely *A. spiraecola* in smaller colonies. It has been detected in many localities and in vicinity of Novi Sad also. Morphologically, these two aphid species are very similar, with similar hosts, yet *Aphis spiraecola* is known for its expressive resistance to insecticides and with global warming it is spreading towards North also. Mezei and Kerekes (2006) characterized *A. spiraecola* as extreme condition resistant and dominant in apple orchards in Hungary.

Accordingly, from the aspect of control it is important to determinate the species, when it occurs, where it overwinters, when colonies start to form, which stage is dominant, when it is the most harmful, is there a secondary host, when and on which plant species it migrates during summer, which are control threshold (Inđić *et al*., 2006).

Concerning possible resistance incidence of *A. pomi* to organophosphate insecticides, pyrethroids, global warming or occurence of new, harmful species (*A. spiraecola*) in community with the above mentioned (Petrović – Obradović *et al*., 2007), the problem of insecticide resistance becomes somewhat more comprehensive.

4 CONCLUSIONS

On the basis of realized insecticide efficacy trials in *Aphis pomi* control and realized differences subject to locality (B. Palanka, Begeč, Krčedin), population and time of application, next conclusions can be made:

- Realized efficacy of insecticides points to differences in quality of comparative products (products of different producers and the same active ingredient);

- Insecticide efficacy realized in June and September on the same aphid population with the same product quantities differs which is probably the consequence of high temperatures and complex aphid development cycle, because during one year one sexual generation is substituted by several asexual populations;
- Detection of *Aphis spiraecola* in our region is also probable cause of efficacy decrease of applied products on mentioned species, which is distinctive for its lower susceptibility to insecticides.

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