

Controlling pear psylla with Abamectin in Bulgaria

Veselin Arnaudov, Hristina Kutinkova

*Institute of Fruit Growing, "Ostromila" 12, 4004 Plovdiv, Bulgaria,
e-mail vaarnaudov@abv.bg*

Considering pear psylla (*Cacopsylla pyri* L.) resistance to insecticides routinely used in Bulgaria the study was undertaken aimed at improving the system of this pest control. The experiments were carried out in Plovdiv region, South-Central Bulgaria on 'Buttira Precoce Morettini' and 'Beurre Hardy' pear trees in 2007–2008. Efficacy of a. i. Abamectin of a pesticide supposed to be more selective, not harmful to beneficial fauna, was tested against the background of a. i. Amitraz as commonly used insecto-acaricide. Post-bloom applications of Abamectin provide a significant control of summer populations of pear psylla. There are needed two consecutive sprays of Abamectin at the rate of 240 g a. i. per ha applied after bloom on young nymphs of the second generation. These treatments do not kill summer adult forms; however, cause a significant reduction in density of summer pear psylla eggs and nymphs. Abamectin may be recommended for the integrated pest management programmes in pear production.

Key words: Abamectin, adults, Amitraz, beneficial fauna, *Cacopsylla pyri*, eggs, efficacy, nymphs, summer populations.

Introduction. Two psyllid species *Cacopsylla pyri* (L.) and *Cacopsylla pyrisuga* (Foster) (Hemiptera: Psyllidae) have been reported to cause damage to pear trees in fruit growing regions of Bulgaria; however, only *C. pyri* is considered as the species of economic importance in commercial pear orchards (Harizanov, 1966). *C. pyri* is key pest of pear in Bulgaria as well as in other European countries. Its extent and intensity of damage caused in Bulgarian orchards over the last 20 years has considerably increased. The pear psylla was particularly abundant in localities, which in the past had been heavily sprayed with non-selective insecticides – probably due to devastation of the natural enemies.

Pear psylla is difficult to control because of its ability to develop resistance to insecticides from various groups, including organophosphates and pyrethroids. Since the mid-1980's, populations of *C. pyri* in Bulgaria, as well as in many other European countries were found to be resistant to a broad spectrum of insecticides (Harizanov, 1982; Berrada et al., 1995; Arnaudov, 2001; Buès, Boudinhon, 2002; Buès et al., 2003). Cross-resistance to organophosphates, pyrethroids and Amitraz has been found in populations of *Cacopsylla pyri* in Europe (Buès et al., 1999). Kocourek and Stará

(2006) reported on resistance of *C. pyri* populations originated from an orchard intensively treated with Nomolt 15 SC (teflubenzuron) in Czech Republic.

According to many growers in Bulgaria, treatments with different insecticides do not provide an expected control of *C. pyri*, with the exception of insecto-acaricide Amitraz. Amitraz was the only product that lately ensured an adequate protection from *C. pyri* in our country. After prohibiting its use in 2005, the most common active ingredient involved is Abamectin, a mixture of 80 % avermectin B-1 a and 20 % avermectin B-1 b, as alternative means for control of the pest.

Biological control by beneficial entomo- and acarofauna present in the orchards offers at least a partial solution of the problem; however, the use of non-selective pesticides greatly reduces effectiveness of predators and parasitoids (Burts, Beers, 1994). Their substitution by soft or selective pesticides allows more effective biological control (Burts, Evereti, 1983). Abamectin is high effective against pear psylla and soft to some beneficial arthropods, naturally controlling population of this pest (Nguyen, Berrada, 1994).

The aim of the present study was to assess the efficacy of Abamectin used for control of *Cacopsylla pyri*, in order to improve the system of this pest control.

Object, methods and conditions. Field studies were carried out in the region of Plovdiv in a commercial orchard, on ‘Buttira Precoce Morettini’ and ‘Beurre Hardy’ pear trees in 2007–2008. Efficacy of Abamectin in controlling *Cacopsylla pyri* was compared with that of Amitraz, traditionally used insecto-acaricide. Both insecticides were applied at the rates recommended by their manufacturers: Lirosect® 2 EC (20 g/l Abamectin) at a dose 1.2 l per ha (240 g a. i. per ha) and Mitac® 20 EC (20 % amritaz) at a dose 2.0 l per ha (400 g a. i. per ha). The insecticides were applied twice, at post-bloom against eggs and newly hatched nymphs of the second generation of *C. pyri* – on May 3 and May 13 in 2007 and on May 9 and May 19 in 2008. The insecticides were applied with “Perla 9” sprayer, using 1 000 L of liquid per ha.

The experiments were set up a block random scheme in 3 variants and 3 replicates (by four trees for each replicate) for each variant, on 6-year-old pear trees with spindle-shaped form, from ‘Beurre Hardy’ cultivar.

The results are given through a direct counting of living nymphs and vital eggs on 20 fruit clusters per replicate, including adjacent leaf rosettes and shoots (5 fruit clusters per tree) sampled from different parts of tree crowns. The evaluation was carried out before the first treatment and on the 3rd and 9th day after each insecticide treatment by inspecting the sampled fruit clusters in the laboratory by binocular and registering the average number of eggs or nymphs per cluster.

Biological efficacy was expressed as a percentage, and was calculated according to the formula of Henderson and Tilton (1955). The data were statistically analyzed by Duncan’s test (Steele, Torrie, 1980).

Results. In 2007, Abamectin (Lirosect® 2 EC) applied twice in the post-bloom period against the second generation of *C. pyri* demonstrated a high biological efficacy against newly hatched nymphs of this pest (on the average 87.6–79.9 %), what was close to the efficacy of Amitraz (Mitac® 20 EC) varying from 87.1 to 66.4 % on the average (Table 1).

Table 1. Efficacy of the pesticides tested for control of *Cacopsylla pyri* nymphs in 2007

1 lentelė. *Cacopsylla pyri* nimfų naikinimui naudotų pesticidų efektyvumas, 2007 m.

Insecticides Insekticidai	Number of nymphs of <i>C. pyri</i> on average per fruit cluster and biological efficacy of the insecticides Vidutinis <i>C. pyri</i> nimfų skaičius ant vaisių kekės ir biologinis insekticidų efektyvumas (%)						
	02.05 T - 1	06.05 T + 3	12.05 T + 9	13.05 T	16.05 T + 3	22.05 T + 9	efficacy efektyvumas (%) 06–22.05
	Number of nymphs of <i>C. pyri</i> <i>C. pyri</i> nimfų skaičius						
Lirosect® 2 EC	21.8	1.5	26.2	-	1.5	16.6	-
Mitac® 20 EC	17.5	5.4	14.7	-	6.8	10.8	-
Control Kontrolė	20.5	62.7	109.3	-	210.3	186.4	-
	Biological efficacy Biologinis efektyvumas (%)						
Lirosect® 2 EC	-	97.75 a	77.46 a	-	97.02 a	62.85 a	84.52 a
Mitac® 20 EC	-	89.91 a	84.25 a	-	75.96 b	56.92 b	76.76 a

The means followed by the same letter do not differ significantly from one another ($p = 0.05$)
Ta pačia raide pažymėtos reikšmės patikimai viena nuo kitos nesiskiria ($p = 0,05$)

Similar results were obtained in 2008. Abamectin applied twice after bloom showed a high biological efficacy against newly born nymphs of *C. pyri* – on the average 82.8–75.6 % (Table 2). It was nearly identical to the efficacy of Amitraz (on the average 81.0–54.4 %). The efficacy of tested insecticides against newly hatched nymphs of *C. pyri* varied throughout the entire period of study on the average between 84.5 and 76.8 % for Abamectin and between on the average 79.2 and 67.7 % for Amitraz.

Table 2. Efficacy of the pesticides tested for control of *Cacopsylla pyri* nymphs in 2008

2 lentelė. *Cacopsylla pyri* nimfų naikinimui naudotų pesticidų efektyvumas, 2008 m.

Insecticides Insekticidai	Number of nymphs of <i>C. pyri</i> in average per fruit cluster and biological efficacy of the insecticides Vidutinis <i>C. pyri</i> nimfų skaičius ant vaisių kekės ir biologinis insekticidų efektyvumas (%)						
	08.05 T - 1	11.05 T + 3	18.05 T + 9	19.05 T	22.05 T + 3	28.05 T + 9	efficacy efektyvumas (%) 11–28.05
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
	Number of nymphs of <i>C. pyri</i> <i>C. pyri</i> nimfų skaičius						
Lirosect® 2 EC	9.5	0	49.8	-	0.8	13.8	-
Mitac® 20 EC	7.5	1.0	28.0	-	3.6	19.0	-
Control Kontrolė	8.0	33.0	86.1	-	110.7	72	-

Table 2 continued
2 lentelės tęsinys

1	2	3	4	5	6	7	8
Biological efficacy							
Biologinis efektyvumas (%)							
Lirosect® 2 EC	-	100 a	51.25 a	-	98.75 a	66.86 a	79.21 a
Mitac® 20 EC	-	96.77 a	65.31 a	-	90.00 a	18.85 b	67.73 a

The means followed by the same letter do not differ significantly from one another ($p = 0.05$)
 Ta pačia raide pažymėtos reikšmės patikimai viena nuo kitos nesiskiria ($p = 0,05$)

Abamectin was very different in respect to its insecticidal properties. Comparing this compound with Amitraz, a faster initial effect of Abamectin was noted. Its persistence was relatively shorter. Abamectin apparently remained active in leaf tissues for not more than 7–10 days. It doesn't kill summer adults, albeit caused significant reductions in the density of summer pear psylla eggs and nymphs. The first 2-instar nymphs of *C. pyri* were much more susceptible to both insecticides than the 3–5-instar nymphs of the pest.

The biological efficacy of tested insecticides against the *C. pyri* eggs ranged in general for Abamectin from 62.6 to 13.9 % in 2007 and from 63.5 to 19.2 % in 2008, whereas for Amitraz from 58.3 to 7.0 % in 2007 and from 39.0 to 9.1 % in 2008. Compared to Amitraz, Abamectin demonstrated a higher biological efficacy against the *C. pyri* eggs (Tables 3 and 4).

Table 3. Efficacy of the pesticides tested for control of *Cacopsylla pyri* eggs in 2007

3 lentelė. *Cacopsylla pyri* kiaušinėlių naikinimui naudotų pesticidų efektyvumas, 2007 m.

Insecticides Insekticidai	Number of eggs of <i>C. pyri</i> in average per fruit cluster and biological efficacy of the insecticides						
	Vidutinis <i>C. pyri</i> kiaušinėlių skaičius ant vaisių kekės ir biologinis insekticidų efektyvumas (%)						
	02.05 T-1	06.05 T+3	12.05 T+9	13.05 T	16.05 T + 3	22.05 T + 9	efficacy efektyvumas (%) 06–22.05
Number of eggs of <i>C. pyri</i> <i>C. pyri</i> kiaušinėlių skaičius							
Lirosect® 2 EC	141	216	129	-	90	45	-
Mitac® 20 EC	156	260	166	-	138	87	-
Control Kontrolė	113	357	393	-	380	90	-
Biological efficacy							
Biologinis efektyvumas (%)							
Lirosect® 2 EC		51.51 a	73.69 a	-	27.85 a	0 a	38.26 a
Mitac® 20 EC		47.25 b	69.40 b	-	14.02 b	0 a	32.92 b

The means followed by the same letter do not differ significantly from one another ($p = 0.05$)
 Ta pačia raide pažymėtos reikšmės patikimai viena nuo kitos nesiskiria ($p = 0,05$)

Table 4. Efficacy of the pesticides tested for control of *Cacopsylla pyri* eggs in 2008

4 lentelė. *Cacopsylla pyri* kiaušinėlių naikinimui naudotų pesticidų efektyvumas, 2008 m.

Insecticides Insekticidai	Number of eggs of <i>C. pyri</i> in average per fruit cluster and biological efficacy of the insecticides Vidutinis <i>C. pyri</i> kiaušinėlių skaičius ant vaisių kekės ir biologinis insekticidų efektyvumas (%)						
	08.05 T - 1	11.05 T + 3	18.05 T + 9	19.05 T	22.05 T + 3	28.05 T + 9	efficacy efektyvumas (%) 11–28.05
	Number of eggs of <i>C. pyri</i> <i>C. pyri</i> kiaušinėlių skaičius						
Lirosect® 2 EC	92	150	69	-	41	19	-
Mitac® 20 EC	68	181	90	-	71	37	-
Control Kontrolė	49	155	171	-	165	39	-
	Biological efficacy Biologinis efektyvumas (%)						
Lirosect® 2 EC	-	48.46 a	78.51 a	-	38.42 a	0 a	41.35 a
Mitac® 20 EC	-	15.85 b	62.07 b	-	18.24 b	0 a	24.04 b

The means followed by the same letter do not differ significantly from one another ($p = 0.05$)
Ta pačia raide pažymėtos reikšmės patikimai viena nuo kitos nesiskiria ($p = 0,05$)

The efficacy of tested insecticides against the *C. pyri* eggs varied throughout the period of study on the average between 41.4 and 38.3 % for Abamectin and between 32.9 and 24 % for Amitraz.

Discussion. The control of the second summer generation of *C. pyri* eggs and larvae is very important in the seasonal programme for control of pear psylla in pear growing areas of Bulgaria. A field study conducted in a commercial pear orchard showed that the tested product Lirosect® 2 EC (Abamectin) gave promising results in control of pear psylla, *Cacopsylla pyri*. This insecticide reduced the populations of *C. pyri* to an extent comparable with that the standard insecticide Mitac® 20 EC (Amitraz), at the rates used. Two consecutive applications of Abamectin after bloom, on young nymphs of the second generation provide a significant control of summer populations of pear psylla.

Abamectin demonstrated a high biological efficacy against pear psylla eggs and newly hatched nymphs, similar to that of Amitraz. Its characteristic features are quick initial toxicity and a relatively short persistence (not more than 7–10 days). The product exhibited a strong deterring effect on oviposition by summer females and hence caused a reduction of the total number of laid eggs. This compound applied twice against *C. pyri* eggs gave better results than the standard compound Amitraz. As far as Abamectin is concerned, the results obtained in this study are in agreement with those reported earlier by the other authors, under different conditions (Buès, Boudinhon, 2002; Marcic, et al., 2002; Kocourek, Stará, 2006).

At the concentration of 0.12 % (Lirosect® 2 EC), the highest biological activity of the product was recorded against the young (1st and 2nd) nymphal stages (up to 95 % mortality) in comparison with the other biological stages of the pest. The insecticide was less active against the older 3–5-instar nymphs, causing only 35 % mortality of them, at the same concentration.

So, Abamectin may be used in control of pear psylla, instead of Amitraz. Considering its selectivity, it is less harmful to beneficial arthropods. Therefore, it should be especially useful as a component of the integrated pest management (IPM) in pear orchards.

Conclusions. 1. The insecto-acaricide Abamectin shows a high biological activity to *C. psylla* eggs and nymphs and may be successfully used in the seasonal control programme against pear psylla.

2. Abamectin does not kill summer adult forms of pear psylla, albeit causes significant reduction in summer densities of pear psylla eggs and nymphs.

3. Abamectin demonstrates a quick initial effect and relatively short persistence – retained only for 7–10 days.

4. Two treatments with Abamectin at a dose of 240 g a. i. per ha, applied after bloom – against newly hatched nymphs of the second generation, should be applied for control of pear psylla.

Gauta 2009 06 30

Parengta spausdinti 2009 08 11

References

1. Arnaudov V. 2001. Efficacy of some pesticides for control of pear psylla, *Psylla pyri* L. in Bulgaria. 9th International Conference of Horticulture, Lednice 2001, 1: 15–19.
2. Berrada S., Nguyen T. X., Merzoug D., Fournier D. 1995. Selection for Monocrotophos resistance in pear psylla, *Cacopsylla pyri* (L.) (Hom, Psyllidae). Journal of Applied Entomology, 119(7): 507–510.
3. Buès R., Boudinhon L. 2002. Insecticide resistance in the pear psylla. Acta Horticulturae (ISHS), 596: 567–570.
4. Buès R., Boudinhon L., Toubon J. F., Faivre D'Arcier F. 1999. Geographic and seasonal variability of resistance to insecticides in *Cacopsylla pyri*, L. (Hom, Psyllidae). Journal of Applied Entomology, 123(5): 289–297.
5. Buès, R., Boudinhon, L., Toubon J. F. 2003. Resistance of pear psylla *Cacopsylla pyri* L. (Hom; Psyllidae) to deltamethrin and synergism with piperonil butoxide. Journal of Applied Entomology, 127(5): 305–312.
6. Buès, R., Toubon J. F., Boudinhon L. 2000. Genetic analysis of resistance to azinphosmethyl in the pear psylla *Cacopsylla pyri*. Entomologia Experimentalis et Applicata, 96(2): 159–166.

7. Burts E. C., Evereti C. 1983. Effectiveness of a soft pesticide program on pear pests. *Journal of Economic Entomology*, 76(4): 936–941.
8. Burts E. C., Beers E. H. 1994. Controlling pear psylla with fenoxycarb in western North America. *OILB/SROP Bulletin*, 17(2): 39–42.
9. Harizanov A. 1966. Chemical experiments for control of the psyllids in the fruit crops. *Horticultural and Viticultural Science*, 3(2): 143–149. (in Bulgarian).
10. Harizanov A. 1982. The pear psyllas. *Plant Protection Newsletter*, 4: 23–27. (in Bulgarian).
11. Henderson C. F., Tilton E. W. 1955. Tests with acaricides against the brown wheat mite. *Journal Economic Entomology*, 48(2): 157–161.
12. Kocourek F., Stará J. 2006. *Journal of Fruit and Ornamental Plant Research*, 14 (Suppl. 3): 167–174.
13. Marcic D., Peric P., Prijovic M., Ogurlic I., Andric G. 2002. Chemical control of *Cacopsylla pyri* L. in Serbian pear orchards using biorational insecticides. *Acta Horticulturae (ISHS)*, 800: 941–946.
14. Nguen T. X., Berrada, S. 1994. Toxicité relative de certains acaricides sur *Anthocoris nemoralis*, prédateur de psylles. *OILB/SROP Bulletin*, 17(2): 53–56.
15. Steel, R., Torrie, J. H. 1980. *Principles and Procedures of Statistics*. McGraw-Hill, Inc., New York.

SODININKYSTĖ IR DARŽININKYSTĖ. MOKSLO DARBAI. 2009. 28(3).

Kriaušių blakučių naikinimas Abamektinu Bulgarijoje

V. Arnaudov, H. Kutinkova

Santrauka

Atsižvelgiant į kriaušinių blakučių (*Cacopsylla pyri* L.) atsparumą įprastiniams Bulgarijoje naudojamiems insekticidams, atliktas tyrimas, siekiant pagerinti šio kenkėjo naikinimo sistemą. Bandymai atlikti 2007–2008 metais Plodinovo regione, pietų-vidurio Bulgarijoje su 'Buttira Precoce Morettini' ir 'Beurre Hardy' veislių kriaušėmis. Abamektino veiklioji medžiaga, kuri laikoma viena iš efektyviausių, nekenksminga naudingajai faunai, kurios efektyvumas palygintas su įprastai naudojama insekto-akaricidu Amitrazės veikliąja medžiaga. Abamektino panaudojimas po žydėjimo gerokai sumažino vasarines kriaušinių blakučių populiacijas. Po žydėjimo ant jaunų antros kartos nimfų Abamektiną reikia purkšti du kartus po 240 g/ha. Šie purškimai nesunaikina vasarinių suaugusių kenkėjų, tačiau gerokai sumažina kriaušinių blakučių vasarinių kiaušinėlių ir nimfų gausumą. Abamektiną galima rekomenduoti naudoti integruotose kriaušių kenkėjų kontrolės programose.

Reikšminiai žodžiai: Abamektinas, Amitrazas, *Cacopsylla pyri*, efektyvumas, kiaušinėliai, naudinga fauna, nimfos, suaugėliai, vasarinės populiacijos.

