Scientific Papers. Series B, Horticulture. Vol. LXVI, No. 1, 2022
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

RESULTS REGARDING THE EFFICACY OF SOME INSECTICIDES IN CONTROLLING *PHYLLONORYCTER BLANCARDELLA* IN APPLE CULTURE IN MĂRĂCINENI AREA IN 2016

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Abstract

This paper highlights the results obtained following the application of different treatments to control Phyllonorycter blancardella. The weather parameters values were correlated with the attack dynamics, establishing precisely both the moments of maximum vulnerability and insecticide application, for the highest possible effectiveness. Data were collected using the Watchdog station and also AtraBlanc-type pheromone traps were used in the field to monitor the adult's flight. In order to analyze the effectiveness, two treatment schemes were proposed, one of which included the active substance spirotetramate (V_2). In the case of the three generations (G_1-G_3) of pest larvae, the calculated efficacy of the two treatment variants recorded the following values: for G_1 the efficacy was 79.41% (V_1) and 98.52% for V_2 variant; for G_2 generation the efficiency was 78.38% for V_1 and 97.3% for V_2, and for G_3 generation, the V_1 efficiency was 76.92%, and in the variant where spirotetramate was applied at three different times the efficiency increased to 97.43%.

Key words: *insecticide, spotted teniform leafminer, treatments.*

INTRODUCTION

Apple is one of the most widespread fruit species in the world and in our country due to its food and economic value. The apple crop has a number of pests, one of the most common being spotted tentiform leafminer, *Phyllonorycter blancardella*, (Gracillariidae: Lepidoptera), which causes significant damage, researchers dedicating many studies to this pest (Proctor et al., 1982; Blommers & Vaal, 1995). The presence of the pest is mentioned in Romania since 1963. Mining moths is common in seed plantations to which abusive non-selective insecticides that reduce the activity of natural enemies are abusively applied.

The active substance spirotetramate is not harmful to insects, but when it reaches the plant, it turns into spirotetramate-enol, thus harmful only to the insects that attack the plant (Mohapatra et al., 2012). The elimination of harmful insects occurs due to the blockade of lipid synthesis. Pyrethroid insecticides effect on *P. blancardella* have been reported since 1986 in Pree et al. (1986). This paper aimed to analyze the effectiveness of insecticides in the control of *Phyllonorycter blancardella*, in apple crop, in Mărăcineni area, Argeș.

MATERIALS AND METHODS

The experimental plot was established in the Research Institute for Fruit Growing Pitesti-Mărăcineni (44°89′91″N24°86′08″E), in a 22-year-old apple orchard, where the trees are planted at a distance of 3.5 x 2.5 meters, irrigated by sprinkling and fertilized with complex fertilizers (16-16-16 dose 90 kg sa/ha and ammonium nitrate 30 kg sa/ha). Climatic conditions of Mărăcineni are characterized by the average annual temperature of 9.7°C and the average annual rainfall of 663.3 mm (Butac et al., 2015). The evolution of meteorological parameters in 2016 was done with the help of the Watchdog station, the dedicated software and IRFAN VIEW (Freeware). In the field, pest monitoring was done by using Atra-Blanc type pheromone traps, the data being correlated with those provided by the monitoring station. The dynamics of the development stages and the elaboration of warnings for the application of treatments were followed. The apple variety on which the experiments were carried out was 'Idared'. For the analysis of the efficacy of some pesticides in the control of *Phyllonorycter blancardella* in apple, two treatment schemes were proposed, presented in Table 1, and the untreated variant was used as a control.

Table 1.The treatment scheme used

Treatment number	Date	BBCH	Active substances applied and rate V_1	Active substances applied and rate V_2
1	4.04	55	Deltamethrin 0.225 l/ha	Deltamethrin 0.225 l/ha
2	14.04	57-60	Thiacloprid 0.3 l/ha	Thiacloprid 0.3 l/ha
3	28.04	66-67	Lambda-cyhalothrin 0.225 l/ha	Spirotetramate 1.875 l/ha
4	6.05	69	Thiacloprid 0.3 l/ha	Thiacloprid 0.3 l/ha
5	13.05	71	Deltamethrin 0.225 l/ha	Deltamethrin 0.225 l/ha
6	20.05	72-73	Thiacloprid+ Deltamethrin 0.75 l/ha	Thiacloprid+ Deltamethrin 0.75 l/ha
7	28.05	73-74	Deltamethrin 0.225 l/ha	Deltamethrin 0.225 l/ha
8	3.06	75	Lambda-cyhalothrin 0.225 l/ha	Spirotetramate 1.875 l/ha
9	29.06	77	Thiacloprid 0.3 l/ha	Thiacloprid 0.3 l/ha
10	12.07	78	Lambda-cyhalothrin 0.225 l/ha	Spirotetramate 1.875 l/ha
11	5.08	81	Deltamethrin 225 l/ha	Deltamethrin 0.225 l/ha
12	26.08	83	Deltamethrin 0.225 l/ha	Deltamethrin 0.225 l/ha

RESULTS AND DISCUSSIONS

The results of the dynamics of the evolution of the pest *Phyllonorycter blancardella* are presented in Table 2.

Table 2. Eco-biology of *Phyllonorycter blancardella* in 2016 (According Specware 9.0)

Date	Necessary days degrees	Calculated days degrees	Event
January 1st	0	0	
March 20th	97	97	First capture
April 7th	183	184	Maximum of G_1 flight
May 13th	434	438	End of G_1 flight
May 30th	590	601	Beginning of G_2 flight
June 21st	891	904	Maximum of G_2 flight
July 14th	1224	1239	End of G_2 flight
July 23rd	1370	1381	Beginning of G_3 flight
August 3rd	1571	1575	Maximum of G_3 flight
August 22nd	1854	1869	End of G_3 flight

The analysis of the results shows that the first catch was recorded on 20th of March. The maximum flight of the first generation took place on 7th of April and the end of the flight was 13th of May. For the second generation, the flight began on 30th of May, the maximum on 21st of June and the end on 14th of July. The third generation began its flight on 23rd of July, the maximum was on 3rd of August and the end on 22nd of August (Table 2).

The graphical representation of the differences between the number of days * degree required and calculated for each biological stage is shown in Figure 1.

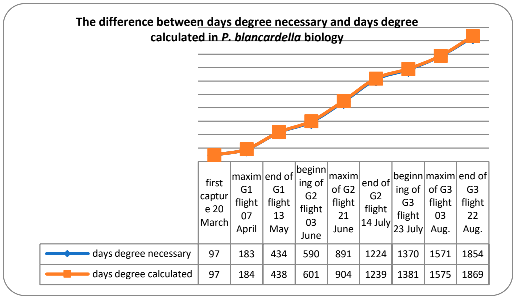

Figure1. Difference between day degree value necessary and day degree value calculated in completing the biological stages of *P. blancardella*

The dynamic flight of *P. blancardella* in untreated variant in 2016 is represented in Figure 2. As shown in the figure, three maximum values in the amount of catches were identified in weeks 18 (over 1200 specimens), 26 (approximately 1300 specimens) and 36 (approximately 1100 specimens). In the same weeks, the average catch was 620, 650 and 550, respectively.

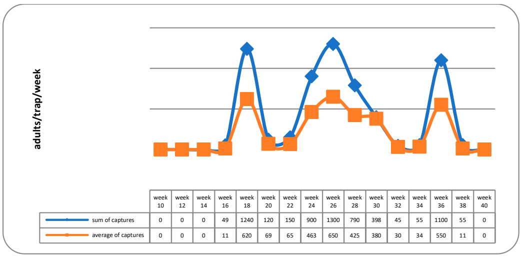

Figure 2. The dynamic flight of *P. blancardella* in untreated variant

The influence of some treatment programs against P. blancaredlla

In 2016, in order to control the main harmful organisms in the apple crop, 12 treatments were administered, the moments of application, the way of complexing the products within the two treatment variants (V_1 and V_2) being presented in table 1. When the flower buds were visible

(BBCH 55), in both variants, a treatment with deltamethrin 0.225 l/ha was applied. The treatment was given at the warning, three days after the registration of the maximum flight G_1 of the pest *P. blancardella*. In the pink bud phenophase - opening of the first flower (BBCH 57-60), thiacloprid was applied for pest control, practically one day after the registration of the end of flight G_1 in the case of the pest *Phyllonorycter blancardella*. After the first petals fading (April 28) (BBCH 66-67), an insecticide treatment was applied with the lambda-cyhalothrin active substance in the first variant, respectively spirotetramate in the second variant, 21 days after the registration of the maximum flight G_1 of the pest *P. blancardella*. On 06.05 (BBCH 69) thiacloprid was applied and at 7 days deltamethrin, followed at another week by both active substances (thiacloprid + deltamethrin) (BBCH 72-73). In variant 2, the second and third treatment with spirotetramate were applied in key phenophases, namely BBCH 75 and BBCH 78, respectively generations. Applying the treatment scheme presented in table 1, it was found that the degree of attack on the leaves of the larvae of the G_1 generation had the value of 7% in the V_1 variant and 0.5% in the V_2 variant (34% in the untreated control). In the case of G_2 larvae, the degree of attack was 8% in the V_1 variant and 1% in the spirotetramate variant, compared to the control (37%) and for the G_3 generation an attack rate of 9% in the V_1 variant and 1% in V_2, in the variant with spirotetramate (39% in untreated).

The efficiency of treatment program applied against P. blancardella

In the case of the three generations of *P. blancardella* larvae, the calculated efficacy of the two treatment variants recorded the following values: for the first generation, the efficacy was 79.41% (V_1) and 98.52% for the V_2 variant; for the G_2 generation the efficiency was 78.38% for the V_1 variant and 97.3% for the V_2 variant, and for the G_3 generation, the effectiveness of the V_1 variant was 76.92%, and in the variant where the spirotetramate was applied at three different times the efficiency of increased to 97.43% (Table 3). Spirotetramate has also proven effective in combating *P. ulmi* in an apple orchard, ensuring very good control with an effectiveness of up to 100% in 1 to 3 weeks after treatment (Labanowska & Piotrowski, 2017). Experiments conducted by Schoevaerts et al. (2011) by applying spirotetramat showed that the precise positioning of the active substance controls several pests simultaneously and can drastically reduce the number of insecticide sprays required in an orchard, and thus the total load of crop residues is reduced. The application of V_1 scheme has reduced the degree of attack of the mining moth, in the case of generation G_1, to 7%, in the case of generation G_2 from 8% and in the case of generation G_3 to 9% while the use of insecticides in variant V_2 decreased the attack rate to 0.5% for G_1 generation larvae and to 1% for G_2 and G_3 generation larvae. In the last years has been noticed an increasing resistance of *Phyllonorycter blancardella* to the contact insecticides. Replacing 2-3 treatments based on contact insecticides per year with a new active systemic substance like spirotetramate increased the efficacy of treatment programs. In the present case, the efficacy increased from 76.92-79.41% up to 97.3-98.52%.

Table 3. The efficiency of treatment program against *P. blancardella*

The variant	G_1		G_2		G_3	
	Leaves		Leaves		Leaves	
	GA%	E%	GA%	E%	GA%	E%
V_1 variant	7	79.41	8	78.38	9	76.92
V_2 variant	0.5	98.52	1	97.3	1	97.43
Untreated variant	34	-	37	-	39	-

CONCLUSIONS

The effectiveness of insecticides applied in variant V_1 for the control of *Phyllonorycter blancardella* pest was 81.08% in the case of G_2 larvae and 76.92% (in 2016) in the case of generation G_3, while the effectiveness of treatment variant V_2 in the control of the mining moth was 98.52 in the case of G_1 generation larvae, 97.3% (in 2016), in the case of G_2 generation larvae and 97.43%, in the case of G_3 generation larvae, the spirotetramate active substance proving its superior effectiveness.

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