

**OBSERVATIONS ABOUT TREATMENTS WARNING AND SOME INSECTICIDES
EFFICACY IN *LEPTINOTARSA DECEMLINEATA* SAY. PEST CONTROL**

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Abstract

The treatment schedule of Leptinotarsa decemlineata Say. pest was 1+2+1 or, where appropriate, 1+2+2. The best efficacy (over 90%) in first generation control had insecticides based on chlorantraniliprol, thiacloprid, deltamethrin and fipronil, and in the second generation control those based on chlorantraniliprol, thiacloprid and fipronil. Biological products based on Bacillus thuringiensis had a good efficacy, which means they can be successfully introduced in the integrated pest management of Colorado potato beetle.

Keywords: *Leptinotarsa decemlineata*, warning, efficacy, insecticides

1. INTRODUCTION

Potato, *Solanum tuberosum*, is the most cultivated tuberous in the world and fourth crop in terms of fresh production, after rice, wheat and maize [1], being cultivated within an area of 19.33 ha [2].

Average losses in global potato production because of pest infestation have been estimated at 39% [3]. Of these pests, the Colorado beetle is the most damaging. It can completely defoliate potato before tubers formation, if not properly controlled [4] and may reduce the production of tubers with more than 50% [5].

To obtain high yields it is necessary to know the optimal moments for applying the most effective treatments and insecticides.

2. MATERIAL AND METHODS

Observations were made in the years 2008 and 2009, at the Phytosanitary Unit of Dâmbovița county, where important populations of *Leptinotarsa decemlineata* Say. were found and aimed first to establish the most appropriate moments to apply treatments, second to test the efficacy of some insecticides in Colorado potato beetle control for different stages of development.

Treatments warning was made as follows:

- before egg laying for overwintered adults;
- biological and ecological criteria were considered for the larvae, respectively, first larvae hatch was monitored in warning cages and the effective temperature, appropriate for warning bulletins issue, was established. Biological efficacy was calculated using Schneider-Orelli formula:

$$E\% = \frac{T\% - M\%}{100 - M\%} \times 100$$

where:

T% = mortality of larvae/adults for treated control (after treatment);

M% = mortality of larvae/adults for untreated control

Observations and measurements were made in laboratory to establish the efficacy of the experimental products. The results were compared to the untreated control estimated attack.

3. RESULTS AND DISCUSSIONS

Treatments warning in the year 2008 (Table 1) was made as follows:

- to control overwintered adults, the issue of the warning bulletin was on April 22, when the effective temperature sum was of 44.4°C, treatment being recommended to be applied in the period April 25 - 29 at first eggs laying.

- to control the insects of the first generation, the warning bulletin was issued on the first larvae hatch, respectively, on May 14. This moment corresponded to a sum of effective temperature of 120.4°C. Second treatment was applied in the period May 17 - 22 and the third treatment was repeated 10 - 12 days after the previous (depending on the insecticide retention), from May 27 to June 1 respectively, when larvae were of age I and II;

- to control the second generation, warning bulletin was issued on July 12 (at first appearance of larvae) at an effective temperature sum of 597.9°C; the

fourth treatment was recommended to be applied in the period May 17-23 and the fifth one between July 27-31, 10-12 days after the previous one, when most of the larvae were age II and III. The apply of this last treatment is required only in case of a strong attack. Treatment schedule for Colorado beetle control in 2009 was, as appropriate, 1+2+1 or 1+2+2.

Treatments warning in the year 2009 (Table 2) was as follows:

- to control overwintered adults, warning bulletin was issued on April 26, at an effective temperature sum of 36.6°C, treatment being recommended to be applied in the period April 29 – May 3, at the same time with first eggs laying;

- warning bulletin issue for second generation insects control was on May 11, time corresponding to the first larvae hatch and an effective temperature sum of 107.2°C. Second treatment was recommended to be applied in the period May 14-19 and the third one, from May 24 to May 29;

- warning bulletin for the second generation insects control was issued on July 13 (at 753.2°C), the fourth treatment being recommended to be applied in the period July 18-23, a period corresponding to age II and III of larval stage. If there is a high degree of attack, the fifth treatment will be applied in the period July 28 – August 1. From the foregoing it follows that treatment schedule to control the Colorado beetle in 2009 was 1+2+1 or, where appropriate, 1+2+2, as in the previous year. Regarding the data obtained on the efficacy of some insecticides during the two years of study, it is noted (Table 3 and 4) that from the 20 insecticides tested, very good results, which have provided an efficacy of over 90% in the control of first generation insects had those based on chlorantraniliprol, thiacloprid, deltamethrin, and fipronil. These products and their efficacy are: CORAGEN TM with a 97.4% average efficacy, CALYPSO 480 SC with an average efficacy of 95.0%, DECIS MEGA 50 EW with a 96.8% average efficacy, DECIS 25 WG with an average efficacy of 96.2% and REGENT 200 SC with an average efficacy of 97.5%. Good results, with an efficacy of over 85% were recorded for products based on cypermethrin - FASTAC 10 EC, CHINMIX 5 EC, ALPHAGUARD, acetamiprid - MOSPILAN 20 SP, *Bacillus thuringiensis* - ECOTECH EXTRA and NOVODOR TM. It was remarkable the efficacy of biological products, which means they can be successfully introduced in the integrated pest management of Colorado potato beetle. The rest of the tested products, except for the insecticide KARATE 2.5 EC (efficacy between

82.3% and 85.1%) had less than 80% efficacy. To control the second generation, insecticides with high efficacy for the first generation control were tested. Thus, it is noted that (Table 5) results are roughly similar except for deltamethrin-based insecticides, which had a significantly lower efficiency, of 72.5% for the product DECIS MEGA 50 EW and 70.3% for the product DECIS 25 WG. This is probably due to volatilization of the active ingredient at high temperatures in summer.

4. CONCLUSIONS

To control overwintered adults, the warning bulletin was issued at the same time with eggs laying at an effective temperature sum around 40.5°C. To limit the first generation of insects, warning bulletin was issued on the first larvae hatch which corresponded to an average effective temperature sum of 113.7°C. To control the second generation, warning bulletin was issued on the first larvae occurrence, at an average effective temperature sum of 675.5°C. Treatment schedule for *Leptinotarsa decemlineata* Say. pest was 1+2+1 or, where appropriate, 1+2+2. The best efficacy (of over 90%) in first generation control had insecticides based on chlorantraniliprol, thiacloprid, deltamethrin, and fipronil, and for the second generation control, those based on chlorantraniliprol, fipronil and thiacloprid. Biological products based on *Bacillus thuringiensis* had a good efficacy, which means they can be successfully introduced in the integrated pest management of Colorado potato beetle.

5. REFERENCES

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Table 1. Biological file of *Leptinotarsa decemlineata* Say. pest in the year 2008, in Dâmbovița county

Generation	Biological stage	Date	T _n - 11 (°C)	Warned period and treatment applying moments
II	adult	- 19.05	- 142.9	Overwintered adults: Bulletin launch: April 22 First treatment: April 25 - 29 First generation: Bulletin launch: May 14 First treatment: May 17 - 22 (L ₁ + L ₂) Second treatment: May 27 - June 1 (L ₂ + L ₃) Second generation: Bulletin launch: July 12 First treatment: July 17 - 23 (L ₁ + L ₂) Second treatment: July 27 - 31 (L ₂ + L ₃)
I	egg	25.04 - 24.05	51.3 - 191.5	
	larva	14.05 - 17.06	120.4 - 372.2	
	pupa	05.06 - 26.07	267.1 - 848.8	
	adult	23.06 - 05.08	422.7 - 935.0	
II	egg	03.07 - 25.08	511.2 - 1,162.5	
	larva	12.07 - 06.09	597.9 - 1,282.8	
	pupa	30.07 - 12.09	907.1 - 1,324.3	
	adult	18.08 - spring	1,109.1 - spring	

Table 2. Biological file of *Leptinotarsa decemlineata* Say. pest in the year 2009, in Dâmbovița county

Generation	Biological stage	Date	T _n - 11 (°C)	Warned period and treatment applying moments
II	adult	- - 24.05	- - 215.8	Overwintered adults: Bulletin launch: April 26 First treatment: April 29 - May 3 First generation: Bulletin launch: May 11 First treatment: May 14 - 19 (L ₁ + L ₂) Second treatment: May 24 - 29 (L ₂ + L ₃) Second generation: Bulletin launch: July 13 First treatment: July 18 - 23 (L ₁ + L ₂) Second treatment: July 28 - August 1 (L ₂ + L ₃)
I	egg	29.04 - 06.06	41.1 - 292.4	
	larva	11.05 - 14.06	107.2 - 373.8	
	pupa	09.06 - 05.07	320.6 - 638.3	
	adult	28.06 - 14.07	532.6 - 753.9	
II	egg	06.07 - 31.07	658.0 - 938.9	
	larva	13.07 - 11.08	724.2 - 1,049.9	
	pupa	01.08 - 02.09	964.1 - 1,217.8	
	adult	16.08 - spring	1,078.1 - spring	

Table 3. Efficacy of some insecticides in Colorado beetle control in the year 2008, first generation

Crt. no.	Active ingredient	Comercial product	Concentration/dosage	Biological efficacy (%)
1.	chlordantraniliprol	CORAGEN TM	50 ml/ha	98.5
2.	thiacloprid	CALYPSO 480 SC	80 ml/ha	97.3
3.	carbaryl	SEVIN 85 WP	0.15%	79.5
4.	deltamethrin	DECIS MEGA 50 EW	0.15 l/ha	97.4
5.	deltamethrin	DECIS 25 WG	40 g/ha	95.7
6.	trichlorphon	DANEX 80 SP	0.15%	79.8
7.	<i>Bacillus thuringiensis var. Kurstaki</i>	ECOTECH EXTRA	4.5 l/ha	87.4
8.	<i>Bacillus thuringiensis var. tenebrionis</i>	NOVODOR TM	5l/ha	88.9
9.	alfacypermetrin	ALPHAGUARD	0.1 l/ha	85.8
10.	fipronil	REGENT 200 SC	0.1 l/ha	96.9
11.	cypermetrin	POLYTRIN 200 EC	0.15 l/ha	85.4
12.	trichlorphon	ONEFON 90 SP	3 l/ha	76.4
13.	pirimiphos-methyl	ACTELIC 50 EC	0.15%	69.8
14.	triazophos	HOSTATHION	0.10 l/ha	74.8
15.	quinalfos + tiometon	ECALUX S	0.75 l/ha	71.9
16.	bensultap	VICTENON 50 WP	0.05%	76.0
17.	alfacypermetrin	FASTAC 10 EC	1 l/ha	88.9
18.	betacypermetrin	CHINMIX 5 EC	0.03 %	85.1
19.	acetamiprid	MOSPILAN 20 SP	0.06 kg/ha	87.3
20.	lambda cyhalotrin	KARATE 2,5 EC	0.2 l/ha	82.3

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2010**

Table 4. Efficacy of some insecticides in Colorado beetle control in the year 2009, first generation

Crt. no.	Active ingredient	Comercial product	Concentration/ dosage	Biological efficacy (%)
1.	chlordaniliprol	CORAGEN TM	50 ml/ha	96.3
2.	thiacloprid	CALYPSO 480 SC	80 ml/ha	92.7
3.	carbaril	SEVIN 85 WP	0.15%	76.5
4.	deltamethrin	DECIS MEGA 50 EW	0.15 l/ha	96.2
5.	deltamethrin	DECIS 25 WG	40 g/ha	96.7
6.	trichlorphon	DANEX 80 SP	0.15%	73.3
7.	<i>Bacillus thuringiensis var. Kurstaki</i>	ECOTECH EXTRA	4.5 l/ha	85.9
8.	<i>Bacillus thuringiensis var. tenebrionis</i>	NOVODOR TM	5l/ha	86.1
9.	alfacypermetrin	ALPHAGUARD	0.1 l/ha	87.3
10.	fipronil	REGENT 200 SC	0.1 l/ha	98.2
11.	cypermetrin	POLYTRIN 200 EC	0.15 l/ha	84.9
12.	trichlorphon	ONEFON 90 SP	3 l/ha	78.3
13.	pirimiphos-methyl	ACTELLIC 50 EC	0.15%	77.4
14.	triazophos	HOSTATHION	0.10 l/ha	76.5
15.	quinalfos + tiometon	ECALUX S	0.75 l/ha	79.8
16.	bensultap	VICTENON 50 WP	0.05%	72.9
17.	alfacypermetrin	FASTAC 10 EC	1 l/ha	86.0
18.	betacypermetrin	CHINMIX 5 EC	0.03 %	87.5
19.	acetamiprid	MOSPILAN 20 SP	0.06 kg/ha	87.8
20.	lambda cyhalotrin	KARATE 2,5 EC	0.2 l/ha	85.1

Table 5. Efficacy of some insecticides in Colorado beetle control in the year 2009, second generation

Crt. no.	Active ingredient	Comercial product	Concentration/ dosage	Biological efficacy (%)
1.	chlordaniliprol	CORAGEN TM	50 ml/ha	95.2
2.	thiacloprid	CALYPSO 480 SC	80 ml/ha	95.0
3.	deltamethrin	DECIS MEGA 50 EW	0.15 l/ha	72.5
4.	deltamethrin	DECIS 25 WG	40 g/ha	70.3
5.	fipronil	REGENT 200 SC	0.1 l/ha	96.2
6.	<i>Bacillus thuringiensis var. Kurstaki</i>	ECOTECH EXTRA	4.5 l/ha	86.1
7.	<i>Bacillus thuringiensis var. tenebrionis</i>	NOVODOR TM	5l/ha	85.9