MODERN METHODS OF PREVENTING AND FIGHTING THE COLORADO BEETLE (*LEPTINOTARSA DECEMLINEATA SAY*)

Bucurean Elena*, Csep Nicolae, Bunta Gheorghe

**University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail: elena_bucurean@yahoo.com*

Abstract

The Colorado beetle (Leptinotarsa decemlineata) is the most important pest in potato crops in our country, as during years that are favorable to the attack, it can lead to production losses of up to 80%. The degree of attack can be reduced from 41.6% to 1.3% after using various treatment methods. Furthermore, the number of larvae after the application of a single treatment can decrease from 463 to 0-20 larvae per potato plant. Some products ensured a high mortality of over 80% among larvae of different ages. Moreover, the study also reports on the results regarding the importance of respecting the optimal moment for applying the treatment, alternating the employed products and combining them in order to prevent the formation of resistant breeds. It is important, however, to respect all the other technological steps that help in preventing the attack by creating the favorable conditions for the growth of the plants, thus making them more resistant and unfavorable to the pest's development.

Key words: pest, species, variant, chemical products

INTRODUCTION

In order to have a proper potato crop, one must protect it against the attack of the Colorado beetle (*Leptinotarsa decemlineata*), which can cause losses of 50-80% out of the entire production during the years favorable to its reproduction. As a matter of fact, this species is considered the limitative factor of potato crops in our country, especially if one does not respect all the technological links meant to create optimal conditions for the development of plants and unfavorable to the Colorado beetle.

This species is dangerous both as an adult and especially as a larva, and according to some authors, the larvae resulted from one adult can destroy during the 15 days of their development the entire foliar surface of 10-12 potato plants, while in the case of powerful invasions, the leaves are entirely consumed, leaving nothing but the stalks, losses reaching, in this case, values of 60-90%.

The purpose of the study is to emphasize the economical importance of the Colorado beetle for potato crops and especially the fact that, if fighting measures against it are not taken timely, crops can be completely compromised, as rare resistances of the pest to some insecticides have appeared. The study presents results regarding the fighting of the pest by using products that inhibit metamorphosis, both biological and chemical products, in the belief that the latter method is and will remain an essential component of integrated pest management.

MATERIAL AND METHODS

In order to survey the pest's evolution in field conditions, the emergence dynamic of hibernating adults and of egg-laying was analyzed, followed by the emergence of larvae, the pupae and the appearance of new adults, which can cause direct damages by destroying the foliar surface, but also indirect damages, by consuming the potato tubercles, especially the ones above the ground. Due to the wounds inflicted by these new adults, various phyto-

pathogens appear on the plants, which can cause several diseases and alteration during storage.

The potato crop was set in the field, having a very good previous crop – peas. The experiment was placed in the field according to the method of the Latin rectangle, in four repetitions, having a different number of variants, depending on the purpose. The surface of the variant was 10 m²; the distance between rows was 70 cm and 50 cm between plants in a single row. The lots were isolated with o.5 m strips and 1 m paths between repetitions. In order to observe the efficiency of chitin metamorphosis inhibiting products, notes were taken 5, 7 and 10 days after treatment in the first experiment, whereas in the second experiment, notes were taken 10, 20 and 30 days after treatment. As to the effect of biological products on larvae of the Colorado beetle, notes were taken 9 and 14 days after treatment.

Regarding the fighting of this dangerous pest, an experiment was conducted with chemical products having various active substances, while the notes for the efficiency test were made 24, 48 and 72 hours following treatment. In all experiments, to the purpose of taking the notes, three potato plants chosen in crisscross were marked in each variant, and the number of larvae was recorded, classified according to age categories, both before and after treatment, in the time interval previously mentioned. Efficiency was calculated according to the Henderson-Tillton formula: $E\%=1-(Ca/Cb \cdot Ta/Tb) \cdot 100$, where Ca is larvae infestation after treatment in variants, Cb is larvae infestation after treatment in reference lot, Ta is larvae infestation before treatment in variants, Tb is larvae infestation before treatment in reference lot. The obtained results are presented in the tables of the study and were statistically processed using the variance analysis method.

RESULTS AND DISCUSSION

The first emergences of hibernating adults in the crop are recorded during the first decade of April, reaching an emergence high in the second part of the month. Eggs are immediately laid on barely surfaced potato plants, or, if these are missing, on the surrounding spontaneous vegetation or on the soil, given that most of the females are fecundated when they go into hiemal diapause and the greatest number of eggs are laid in May.

With chitin metamorphosis inhibiting products it is absolutely essential that the moment of using the treatment be chosen when eggs are massively laid or when first age larvae have been hatched. The longer this moment is delayed, the more reduced the effect of the products.

Regardless of the chosen fighting method, two treatments are compulsory: the first one when larvae appear on the growth ends and the second one approximately two weeks later, when the crop has been re-infested, due to the gradual emergence of larvae.

Chitin synthesis inhibiting products are used after egg-laying or emergence of first larvae, as they work in time, inhibiting the development of larvae, which do not shed or develop anymore.

The experiment concerning the effect of chitin inhibitors on the evolution of Colorado beetle larvae was organized in the field, having 8 variants, the results being presented in table 1. The density of larvae on potato plant decreased 10 days after treatment from 72 larvae in the reference lot to 2-11 larvae of I-II age in the treated variants, and after 30 days there were practically no larvae left in any of the treated variants. This can be explained by the fact that although the larvae hatched, they perished in time, because they were not able to form their cuticle cover.

Of course, the effect of this type of treatment is not noticed immediately, as in the case of shock treatments, but the number of necessary treatments is reduced.

Table 1

Efficiency of chitin inhibiting products
on the Colorado beetle (*Leptinotarsa decemlineata say*) – Oradea 2009

Variant	Dose l/ha	Larvae/plant after treatment						Production	
		10 days		20 days		30 days		Kg/ha	Diff.
		L1-2	L3-4	L 1-2	L3-4	L 1-2	L 3-4		
Calypso 480 SC	0.08	7	2	0	0	0	0	30500	10100 ***
Rimon 10 EC	0.25	2	0	0	0	0	0	28700	8300**
Match 50 EC	0.3	5	1	0	0	0	0	29100	8700**
Samurai 3 EC	0.5	3	0	0	0	0	0	28900	8500**
Sonet 100 EC	0.2	9	3	1	1	0	1	31000	10600 ***
Nomolt 15 SC	0.15	5	1	0	0	0	0	29500	9100**
Cascade 50 CE	0.5	11	5	1	2	0	1	27400	7000**
Reference lot	-	72	43	21	16	14	4	20400	-

LSD 5% - 3500 kg/ha LSD 1% - 7100 kg/ha LSD 0.1% - 9600 kg/ha

However, most of the times biological and chitin metamorphosis inhibiting products do not provide an adequate protection of potato crops and important producers employ the chemical method of fighting the Colorado beetle.

Naturally, this method cannot be excluded from integrated pest management; therefore some of the experiments included several variants with chemical products having different active substances and dosages.

The results in table 2 show that the used products had different active substances and dosages. It is important to point out that all the products used to fight this pest are newly created. A single treatment was performed when larvae of ages 1-2 appeared and the average efficiency was of over 80%, even though most of them are synthesis pyrethroids, but with a higher chemical stability and combined action: shock, contact and ingestion. A low efficiency was recorded in the case of tablet form insecticides (66.5%), Karatezeon (59%) and Deltaplan (70%).

Table 2

New products used in fighting the Colorado beetle
(*Leptinotarsa decemlineata say*) – Oradea 2009

Variant	Dose/ha	Efficiency %				E% (X)
		L1	L2	L3	L4	
Bestseller 100 EC	0.1 l	91	89	83	80	85.8***
Dakillin 50 CE	0.2 l	94	94	87	85	90.0***
Decistab 25%	1.5 tab.	72	70	65	59	66.5 (STD)
Deltaplan 25 EC	0.28 l	77	74	68	61	70.0¯
K'obiol DP2	4 kg	82	80	76	71	77.3*
Karatezeon 2.5 EC	0.2 l	69	62	55	50	59.0¯
Valiant 25 EC	0.08 l	92	90	89	80	87.0***
Zebra 50 EC	0.2 l	84	82	79	76	80.3*
Chess 25 WP	0.4 kg	90	88	73	73	81.0*
Commando 20 CE	0.1%	87	84	80	79	82.5*
Laser 240 SC	0.1 l	96	91	91	90	92.0***
Samurai 3 CE	0.5 l	89	81	79	76	81.3**
Actara 25 WG	0.06 kg	100	100	95	90	96.3***
Match 05 EC	0.3 l	88	93	71	68	77.5*
Reference lot (larvae/plant)	-	428	390	203	184	-

LSD 5% - 10.4; LSD 1% - 14.5; LSD 0.1% -19.3

Actara remains a highly efficient product in fighting the Colorado beetle, although its efficiency was lower than in previous years (96.3% compared to 100% in many previous years). This product belongs to the newest group of nicotinoid insecticides. The advantage of this product is that its effect can be seen 2-3 hours after treatment and lasts for 3-5 weeks. Compared to synthesis pyrethroids, it has the advantage that, because it is not volatile, it can be applied at temperatures exceeding 18°. It is very active against young stages (L1-L2) and also against more resistant larvae (L3-L4).

Following the statistical processing of efficiency data, positive differences were recorded, statistically ensured as very significant (Bestseller, Dakillin, Valiant, Laser and Actara), distinctly significant (Chess, Commando and Samurai), significant (K'obiol, Zebra, Match) and insignificant (Deltaplan, Karatezeon).

CONCLUSIONS

The efficient fighting of the Colorado beetle is performed by choosing the optimal moment, the massive hatching of eggs, whereas on the growth ends larvae of ages 1-2 are predominant.

Treatments are applied in rotation (products with different active substances) to prevent the appearance of resistant breeds.

It is recommended to apply biological and chitin inhibiting products immediately after egg-laying or at the beginning of hatching, because if they are applied later, they lose the effect for which they were created.

The chemical method must not be excluded from the concept of integrated fighting, but it must be applied depending on the economical damage threshold: because in this area the threshold is surpassed every year the following products are recommended: Actara 25 WG, Nurelle D, Valiant and so on.

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