

## LABORATORY RESEARCHES ON UNCONVENTIONAL METHODS FOR CONTROL OF COLORADO POTATO BEETLE (*Leptinotarsa decemlineata* L.)

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### Abstract

Almost all over the world as in Romania, being Holarctic species, the Colorado potato beetle, (*Leptinotarsa decemlineata* L.), is by far the biggest pest for potato growers. Given increasing consumer demand of products without pesticides, concept best expressed by the emergence of the term of „ecological farming” is similar terms „organic farming” or „biological farming” used in other EU Member States. There are a few methods, taking into consideration organic or that work well against potato beetle. Some organic gardeners rely on a broad-spectrum of homemade sprays for reject insects, after the Rodale encyclopaedia. From literature is known that wood ash is highly toxic to adult and larval stages of the Colorado potato beetle continuously exposed to wood ash for periods of up to 10 days but remained low in topical applications. To determine the effect of the experimental products (Dust of grinded beetles dried at 105°C; decoction from grinded beetles dried at 105°C; ash of grinded beetles burned at 250°C; decoction from the ashes of burnt bugs to 250°C; Chilli pepper powder; decoction of Chilli pepper powder; chopped fresh peppers; decoction of fresh chopped peppers; tobacco decoction; check.), potato leaves were sprayed with decoction for about 3 seconds or powdered with dust or powder, put onto the Petri dishes. In present laboratory experiment defined the effect of the 9 extracts on Colorado potato beetle feeding and survival. Colorado potato beetle put onto the Petri dishes filled with leaves, was provided with 5 Colorado potato beetles adults or 5 larvae in stage L2-L3. The experiment was 24, 48 and 72 h long and involved the replacement and supplementing of feed. The test and control combinations (untreated dry leaves) were set up in 5 replications. After 24, 48, 72 and 96 hours the CPB adults or larvae were counted. Tests have shown that the products tested did not significantly effect in combating CPB nor on adults or larvae, either powdered or decoctions, without any repellent effect. So it have been rejected different opinions, spread among potato growers, concerning the use of different products non insecticides.

**Key words:** *Leptinotarsa decemlineata*, control, homemade products.

### INTRODUCTION

Colorado potato beetle originating from North America, where it was first reported in 1824, it spread rapidly in the Americas, entering in 1921, in Europe, where it began a new extension across Old World. In Romania, the Colorado beetle was reported in 1952 in the village Săpânța, then gradually spread throughout the territory, causing large damages especially on potato and *Solanaceae* vegetable crops. Adults and larvae feed on potato foliage and may reduce or destroy foliar surface till skeletonize the crop. Farmers who grow potatoes are familiar with the CPB (*Leptinotarsa decemlineata*). Adults and larvae are feeding on potato foliage and may reduce or

destroy foliar surface till remain only main veins branch and stems of the plants. *Leptinotarsa decemlineata* or Colorado potato beetle (CPB), is the most economically damaging pest to potatoes in all areas of the Romania where is cultivated potato. Crop yield and financial losses attributed to CPB are not frequently published nor are they discussed in major reviews of pest biology and management (Rosca, 2003; Rosca and Istrate, 2009; Rosca et al., 2011). Till now in Romania as all over the world the chemical control of CPB is so far the main and the most successful method and due this fact there are registered and used a great number of insecticides, due to this fact appeared and develop resistance to different insecticides as a result of the resistant

individual's selection. A few commercial botanical preparations are available for use on CPB. Rotenone (restricted material) is derived from the roots of a South American plant. Various products (Neemix™, BioNeem™, and MargosanO™) with the active ingredient azadirachtin (from neem tree seeds) have some efficacy against CPB in the early crop stages. Pyola™ is a natural insecticide product that combines canola oil with pyrethrins. Since much of the canola oil on the market is derived from genetically engineered plants, this product may or may not be acceptable for organic production (Anderman, 2000). A number of herbs and herbal extracts are also reputed to repel or inhibit CPB, though research has been far from thorough. Among the plants believed to have some effect are: *Nepeta cataria*, *Tanacetum vulgare*, *Salvia officinalis* (Kuepper, 2003), *Cannabis* spp. (Grossman, 1989), *Quercus alba* extract (Barbara and Bradley, 1992), extracts from two Piperaceae species (Scott et al., 2003), *Solanum chacoense* extract (Williams and Williams, 1986), and citrus oils (Williams and Williams, 1988). It is worth to underline that could be possibilities for plant extracts to control insecticide resistant populations of pest in addition with other IPM used in practice, in conventional or organic agriculture and in this respect our researches were been done.

## MATERIALS AND METHODS

*Leptinotarsa decemlineata* adults and larvae were collected from a potato culture in Lunguletu, Romania in 12 June 2014 (adults), 3 July 2014 (larvae), before the crop spraying. The adults and larvae pest were kept in laboratory, in plastic Petri dishes, at room temperature and under natural photoperiod, water and potato leaves were available at will. To determine the effect of the 9 experimental products named here "Variants" (1-dust of grinded beetles dried at 105°C; 2-decoction from grinded beetles dried at 105°C; 3-ash of grinded beetles burned at 250°C; 4-decoction from the ashes of burnt bugs to 250°C; 5-Chili pepper powder; 6-decoction of Chili pepper powder; 7-chopped fresh peppers; 8-decoction of fresh chopped peppers; 9-tobacco decoction) and check, on Colorado potato beetle feeding and survival. Potato leaves were sprayed with

decoction for about 3 seconds or powdered with dust or powder, put onto the Petri dishes filled with leaves, was provided with 4 Colorado potato beetles adults or 4 larvae in stage L<sub>2</sub>-L<sub>3</sub>. The experiment was 24, 48, 72 and 96 hours long and not involved the replacement and supplementing of feed only leaves spraying with water. The test and control combinations (untreated dry leaves) were set up in 5 replications (Figure 1). After 24, 48, 72 and 96 hours the CPB adults or larvae were counted. Was studied, too, repellent effect of the 9 variants (of experiences regarding the effect of unconventional insecticide preparations) by placing in a corner of a rearing box of 21/21 cm. a treated leaf (according to the initially protocol), in the opposite corner, an untreated leaves and the center of the box were placed three larvae (L<sub>2</sub>-L<sub>3</sub>) noting larvae preference. Preference scoring was done by the surface of leaf chewed (0 = not eaten; 1 = surface eaten <10%; 2 = surface eaten <30%, 3 = surface eaten <50%, 4 = area eaten <75% and 5 = surface eaten <100%), considering that larva does not eat what is harmful for it.



Figure 1. Laboratory experiment in plastic Petri dishes

## RESULTS AND DISCUSSIONS

Were generalized in the world of "connoisseurs" different empirical methods to control this dangerous pest such as: aqueous extract solutions obtained from the Colorado beetle held about a week (1-3 glasses of concentrate per liter of water), though in phytotoxic effect; chilly infusion (10-20 pieces are scalding hot peppers with boiling water and

leave to infuse for 12-24 hours) diluted with water; aqueous detergent solution (1 teaspoon dish Ferry/1.5 l water); using ashes in course of tubers planting (under or around them); spraying the plants with soap suspension (2 liters of water 200 grams of soap /8 liters of water); suspension of ash and soap (1 kg of ash boiled in 10 liters of water for 15 minutes and leave 2 days, strain and add 50 g squirting after homemade soap or liquid splash concentrate is diluted 1/10); aqueous extract of walnut (leaves, fruits, bark) in 10 liters for 2-3 days at spraying potato extract strain; infusion of "big grass" (Oman or *Inula helenium*); dusting with ground chicken manure on plants previously moistened; concentrated solution of onion (<http://hobbygradina.ro>). Of course there are "stories" about using the Colorado beetle ash, but anyway, till now, no one has tried to demonstrate the effectiveness of these empirical methods. We have to underline that "ALL" preparations mentioned above are not approved to be used for controlling of Colorado potato beetle, the simple reason for this is that the results are not scientifically certified, possible standardization of such a product, a mandatory step for registration, cost and market potential outlets is not sufficiently extensive to cover these expenses. The determinations from June 16, at 96 hours after treatment, it was found that, compared to the control, there was an increase in the number of dead adults, not very large (0.4-0.6), in V2-V6 variants and V8, differences being statistically significant, in V1, no differences in mortality compared to controls, there are negative differences, in variants V7 and V9 (-0.2 -0.4 respectively) as presented in table 1. The determinations from July 7, at 96 hours after treatment, it was found that, compared to the control, there was an increase in the number of dead larvae, as for adults, not very large (0.4-1.2), in variants V6 respectively V1, differences being statistically significant, in V2, V3 and V9, no differences in mortality compared to controls, there are negative differences, in variants V4, V5, V7 and V8 (-0.2; -0.6; -0.8 respectively for two last variants) as presented in table 2.

Based on adult mortality, tested products can be divided into three categories: 6 products with greater efficacy than the control; 1 product

which is similar to the control and 2 products with lower efficacy than in control. Based on larval mortality, tested products can be divided into three categories: 2 products with greater efficacy than the control; 3 products which are similar to the control and 4 products with lower efficacy than in control. Referring to repellent effect of those 9 variants by placing in a corner of a rearing box, a treated leaf, in the opposite corner, an untreated leaves and the center of the box were placed CPB larvae, noting larvae preference, on the scale from 0 to 5 (depending of leaf eaten surface), it is easy to observe, in table 3, that there is a clear repellent effect of some tested variants (scored through difference between leaf eaten surface of treated and untreated leaf, so, on the first places is V3-ash of grinded beetles burned at 250°C (difference of notes 2 that means leaf surface eaten <30%); there is no difference at V8-decoction of fresh chopped peppers and there is a negative difference at V7-chopped fresh peppers (-0.8, less than <10% surface eaten). Surface of eaten leaves, in case of untreated leaves is between note 3.8 (V2 and V3) and 0.8 (V7). In case of treated leaves surface of eaten leaves, is between note 2.2 (V2) and 1.0 (V5).

Table 1. Adults' mortality after 96 hours (16 June 2014)

Variants of treatments	Adults mortality (average after 96 hours)	Difference	Significance
<b>V1</b>	2.0	0	
<b>V2</b>	2.6	+0.6	***
<b>V3</b>	2.4	+0.4	***
<b>V4</b>	2.6	+0.6	***
<b>V5</b>	2.6	+0.6	***
<b>V6</b>	2.6	+0.6	***
<b>V7</b>	1.8	-0.2	oo
<b>V8</b>	2,4	+0.4	***
<b>V9</b>	1.6	-0.4	ooo
<b>Check</b>	2.0	-	-
<i>DL 5%</i>		0.121	
<i>DL1%</i>		0.184	
<i>DL0.1%</i>		0.272	

Table 3. Repellent effect of 9 variants in concordance with leaf damaged surface

Variants	1		2		3		4		5		6		7		8		9	
	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf	Treated leaf	Untreated leaf
Average	1.4	1.6	2.2	3.8	1.8	3.8	1.2	2.4	1.0	2.4	1.4	2.0	1.6	0.8	2.4	2.4	1.8	2.4
Difference	0.2		1.6		2		1.2		1.4		0.6		-0.8		0		0.6	

Table 2. Larvae' mortality after 94 hours (17 July 2014)

Variants of treatments	Larval mortality (average after 96 hours)	Difference	Significance
V1	2.8	1.2	***
V2	1.6	0	
V3	1.6	0	
V4	1.4	-0.2	ooo
V5	1.0	-0.6	ooo
V6	2.0	0.4	***
V7	0.8	-0.8	ooo
V8	0.8	-0.8	ooo
V9	1.6	0	
Check	1.6	-	-

DL 5% 0.071087

DL1% 0.119589

DL0.1% 0.172449

## CONCLUSIONS

- Our experiment proves that "story" about using the Colorado beetle ash, but anyway, till now, no one has tried to demonstrate the effectiveness of these empirical methods.
- Based on adult mortality, tested products can be divided into three categories: 6 products with greater efficacy than the control; 1 product which is similar to the control and 2 products with lower efficacy than in control.
- Based on larval mortality, tested products can be divided into three categories: 2 products with greater efficacy than the control; 3 products which are similar to the control and 4 products with lower efficacy than in control.
- All preparations tested in experiment are not good enough in order to be approved to be used as registered pesticides for controlling of Colorado potato beetle, the results are not scientifically certified, possible standardization of such a product, a mandatory step for registration, cost and market potential outlets is not sufficiently extensive to cover these expenses.

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