



## Results obtained in the biological control of western corn root worm, *Diabrotica virgifera virgifera* Le Conte (2007-2010)

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### Abstract

To establish a pest control strategies in an agroecosystem, the first requirement is the correct diagnosis and identification. In the literature there is much information about the chemical control of the species *Diabrotica virgifera virgifera* Le Conte. In biological control, which is the subject of the present article, we used the bioproduct "BIOBIT" based on *Bacillus thuringiensis* either as seed treatment or vegetation treatments. To determine the efficacy of the product against the western corn root worm, since the spring of 2007 there was organized an experimental field in the area of Tărtăria, Alba County (Romania). The experiments were made according to the experimental technique. Experiment located in an area where the pest has been reported since 2002, under monoculture. Sowing date varied from year to year depending on climatic factors and weather conditions. In 2008 sowing took place on April 21, May 1 in 2009 and April 30 in 2010. During 2008-2010 for preventing and fighting against *Diabrotica virgifera virgifera* Le Conte species larvae, the best results were obtained with products applied to the seed. In the experimental period, the larvae attack symptoms were manifested by the appearance of "goose neck", in control plot, the attack frequency being about 33.36% in 2007, 15.46% in 2008 25.33% in 2009 and 26.88% in 2010. Biobit bioproduct applied only to the seed reduced the incidence of attack to 6.92% in 2007 (79.2% less compared to the control), 5.76% in 2008 (about 71% less compared to the control), 5.76% in 2009 and 6.23% in 2010.

**Key words:** Pest, western corn root worm, biological control, bioproduct, corn.

### Introduction

The pest *Diabrotica virgifera virgifera* Le Conte was accidentally introduced in Europe (1992) in the former Yugoslavia (Serbia)<sup>1</sup>. The western corn root worm (*Diabrotica virgifera virgifera* Le Conte) has in the country of origin, the U.S.A., 1-2 generations per year and in Europe, the investigations of Camprag (1993 to 1994 in the former Yugoslavia) and Grozea (1998-2002 in Timis District - Romania) established a generation per year<sup>2-4</sup>. Researches on the biology, morphology and ecology of insects, in the ecological conditions of our country, have concluded that the species is monovoltine, wintering in the egg stage<sup>5,6</sup>.

The use of pathogenic organisms (viruses, bacteria, fungi) that cause illness and death of the insect is one of biological control methods<sup>7,8</sup>. Bacterium *Bacillus thuringiensis* was used to control the maize pest *Diabrotica virgifera virgifera* Le Conte<sup>9</sup>. Of the 350 species of entomopathogenic fungi, *Beauveria bassiana* is the most important, parasiting over 100 pest species<sup>5,10</sup>.

### Materials and Methods

To determine the efficacy of the bioproduct against the western corn root worm, since the spring of 2007 there was organized an experimental field in the area of Tărtăria, Alba County (Romania). The experiments were made according to the experimental

technique. Experiment located in an area where the pest has been reported since 2002, under monoculture.

The total area of the experimental field was about 900 m<sup>2</sup> of which 670 m<sup>2</sup> were experimental plots and 230 m<sup>2</sup> of technological paths. Sowing was performed manually using special planting tools; the distance between rows was about 70 cm and 20 cm between plants per row, plant density of around 7 m<sup>-2</sup>.

A plot had an area of 10.5 m<sup>2</sup>, and within it, the plants were arranged in three rows of 5 m long each. Sowing date varied from year to year depending on climatic factors and weather conditions. In 2007 sowing took place on May 19, April 21 in 2008, May 1 in 2009 and April 30 in 2010

Data on the frequency of attack of the pest larvae *Diabrotica virgifera virgifera* Le Conte were taken during the 2007-2010 experimental period in the following days: July 19, August 17, and August 31.

Tracking the attack frequency produced by adult pest, both on the leaves and corn silk was made in two periods: first in late July and second in August 1 to 15 taking into account the two treatments applied on vegetation with the bioproduct BIOBIT.

The efficacy of bioproduct BIOBIT, fighting against larvae and adults of *Diabrotica virgifera virgifera* Le Conte, was tested in

the experimental plot. BIOBIT is a product that has the active ingredient *Bacillus thuringiensis* bacterium. The product is approved in dose of 4 ml/100 g to the seed and 3.5 l/ha on vegetation application. Treatments with the tested product were applied to seed and vegetation. The product was applied to seed on sowing day.

### Results and Discussion

In 2007, the use of the product Biobit significantly reduced the attack frequency. Applied only to the seed reduced the incidence of attack by 79.2% compared to the control. In this variant the

number of attacked plants was 6.92% (Table 1). In the variant where the bioproduct was applied in two stages, to the seed and on vegetation, the percentage of attacked plants was reduced up to 4.08%, with an efficacy of 87.8%. This version has increased the efficacy by 8.6% compared to applying only to the seed (Table 1).

In 2008 the use of Biobit product applied only to the seed reduced the incidence of attack by 63% compared to the control, and number of attacked plants was about 5.76%. In the variant where the bioproduct was applied at two stages, to the seed and on vegetation, the percentage of attacked plants was reduced by 4.49%, with an efficacy of 71% (Table 2).

In 2009, Biobit product applied only to the seeds reduced the incidence of attack at 8.12%. In the variant where the bioproduct was applied at two stages, to the seed and on vegetation, the percentage of attacked plants was reduced by 5.62%, with an efficacy of 77.8% (Table 3).

In 2010, the use of the product Biobit significantly reduced the attack frequency. Application only to the seed reduced the incidence of attack by 76.8% compared to the control. In this variant the number of attacked plants was about 6.23%. In the variant where the bioproduct was applied at two stages, to the seed and on vegetation, the percentage of attacked plants was reduced up to 4.28%, with an efficacy of 84.1%. This version increased the efficacy by 7.3% compare to applying only to the seed (Table 4).

Using the product Biobit, the average frequency of attacks in the three years of experimentation, was lower than control, which is between 6.75% (applied to seed) and 12.02% (applied on vegetation) (Table 5). Best efficacy was recorded when the product was applied at two stages, to the seed and on vegetation, this being 81.7%.

### Conclusions

Following the researches carried out during 2007-2010 in Tartaria area (Alba County, Romania), concerning the biological control of western corn roots worm (*Diabrotica virgifera virgifera* Le Conte) in the larva and adult stage, the best results were obtained by applying the Biobit product to sowing and vegetation of corn crops.

The best results in the fight against larvae and adults of western corn root worm were obtained with the bioproduct Biobit applied to seed and on vegetation. At the variant with the bioproduct applied in two rounds to seed and growing, the percentage of plants attacked by larvae was reduced to 4.49% in 2008 (an efficacy of 71%), at 5.62% in 2009 (an efficacy of 78%) and 4.28% in 2010 (84% efficacy).

**Table 1.** The efficacy of products used in the prevention and biological control of *Diabrotica virgifera virgifera* Le Conte larvae (Tărtăria 2007).

No.	Variant	Attack frequency %	% of control	Difference to control	The significance of difference
1	Control	33.36	100.0	0.00	Control
2	Biobit (seed)	6.92	20.8	-26.44	000
3	Biobit (vegetation)	14.21	42.6	-19.15	000
4	Biobit (seed + vegetation)	4.08	12.2	-29.28	000

DL (p 5%) = 4.68; DL (p 1%) = 6.23; DL (p 0.1%) = 8.07.

**Table 2.** The efficacy of products used in the prevention and biological control of *Diabrotica virgifera virgifera* Le Conte larvae (Tărtăria 2008).

No.	Variant	Attack frequency %	% of control	Difference to control	The significance of difference
1	Control	15.46	100.0	0.00	Control
2	Biobit (seed)	5.76	37.3	-9.70	000
3	Biobit (vegetation)	7.62	49.3	-7.84	00
4	Biobit (seed + vegetation)	4.49	29.0	-10.97	000

DL (p 5%) = 4.68; DL (p 1%) = 6.23; DL (p 0.1%) = 8.07.

**Table 3.** The efficacy of products used in the prevention and biological control of *Diabrotica virgifera virgifera* Le Conte larvae (Tărtăria 2009).

No.	Variant	Attack frequency %	% of control	Difference to control	The significance of difference
1	Control	25.33	100.0	0.00	Control
2	Biobit (seed)	8.12	32.1	-17.20	000
3	Biobit (vegetation)	13.47	53.2	-11.86	000
4	Biobit (seed + vegetation)	5.62	22.2	-19.71	000

DL (p 5%) = 4.68; DL (p 1%) = 6.23; DL (p 0.1%) = 8.07.

**Table 4.** The efficacy of products used in the prevention and biological control of *Diabrotica virgifera virgifera* Le Conte larvae (Tărtăria 2010).

No.	Variant	Attack frequency %	% of control	Difference to control	The significance of difference
1	Control	26.88	100.0	0.00	Control
2	Biobit (seed)	6.23	23.2	-20.65	000
3	Biobit (vegetation)	12.79	46.7	-14.09	000
4	Biobit (seed + vegetation)	4.28	15.9	-22.60	000

DL (p 5%) = 4.68; DL (p 1%) = 6.23; DL (p 0.1%) = 8.07.

**Table 5.** The efficacy of products used in the prevention and biological control of *Diabrotica virgifera virgifera* Le Conte larvae (Tărtăria 2007-2010).

No.	Variant	Attack frequency %	% of control	Difference to control	The significance of difference
1	Control	25.26	100.0	0.00	Control
2	Biobit (seed)	6.75	26.7	-18.51	000
3	Biobit (vegetation)	12.02	47.6	-13.24	000
4	Biobit (seed + vegetation)	4.62	18.3	-20.64	000

DL (p 5%) = 2.70; DL (p 1%) = 3.60; DL (p 0.1%) = 4.66.

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