TESTING OF THE NEW ACTIVE INGREDIENTS FOR CONTROLLING OF *THE OSTRINIA NUBILALIS* HBN AT MAIZE CROP, IN CONDITIONS OF ARTIFICIAL INFESTATION, AT NARDI FUNDULEA

Emil Georgescu, Maria Toader, Nicoleta Balaban, Luxita Rasnoveanu, Lidia Cana

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ABSTRACT

In this paper, author collective present preliminary results of new active ingredients testing for vegetation treatment against European corn borer at maize crops. Maize plants were artificial infested witch Ostrinia nubilalis egg batches produced in laboratory conditions, from insects reared consecutive generations, using same artificial diet. Climatic conditions from summer period were favorable for pest evolution in 2016 comparative with 2014. At untreated maize plants, average number of larvae per plant was 3.03 in 2014 and 14.70 in 2016 while average length of the cavities per plants was 13.41 cm in 2014 and 20.18 cm in 2016. At treated variants, in climatic conditions of the summer of 2014 and 2016, higher effectiveness was registered in case of higher dose of indoxacarb active ingredient and chlorantraniliprole active ingredient, in dose of 150 and 200 ml p.c./ha.

INTRODUCTION

Maize occupy first place in Romania, from all crops, being cultivated more then 2.5 million hectares in last five years (MADR data, 2016). Also, from all EU28 countries, Romania occupy first place regarding maize area, but have low production per hectare (Eurostat database, 2016). European corn borer (*Ostrinia nubilalis* Hbn) is one of the main pests of the maize crops in Romania (Popov et Barbulescu, 2007). According Barbulescu et al. (2001), ECB produce high maize yield losses, especially in the central and western region of the Romania, in hilly areas and along the main rivers, in the Danube flooded plains and under irrigations. In south and south-east of the country, *Ostrinia nubilalis* was considered second pest like economically importance, after *Tanymecus dilaticollis* (Cristea et al., 2004). Same author mentioned that, in some favorable years, ECB can produce important yield loses at maize crops, in south-east of Romania, too. Early researches made in years ’60, at ICCPT Fundulea (actual NARDI Fundulea), make in evidence that pest attack in the later vertical phase of the leaves and especially in the panicle, stem and peduncle of the cob, can cause significant damages, reaching 60% of the grain production under particularly favorable conditions (Paulian et al., 1962). Later reports mentioned yield loses ranged from 1400 to 2360 kg/ha, in different farms from Moldavia region, at the middle of the years ’70 (Sapunaru et Hatman, 1975), while recent data from literature suggest that average maize yield losses in Romania, because of ECB attack were 7.5 % (Popov et Rosca, 2007). Between 2000 and 2010 it wasn’t signalized important yield losses because of ECB attack at maize plants. However, after 2010, several reports published in journals for farmers, signalized high attack of *Ostrinia nubilalis* larva at maize crops, first in west part of the country, then in south-west and central parts (Alexandri, 2011; Plants Health, 2012; Farm, 2013). Several studies from Central and Western Europe concluded that the area of ECB extend to northern latitudes (Gathmann et Rothmeier, 2005; Brookes, 2008; Beres, 2012). Also, it has reported increasing of the number of pest generations per year (Brookes, 2007; Derron et al., 2009; Keszthelyi, 2010). According Kocmánková et al., (2010) climate changes represent a possible cause for ECB extending areas from south to north and increasing numbers of generation per year in Europe. Global warming and increasing of extreme weather may produce changes in dynamics of

the main crop pests, exacerbating yield losses (Rosenzweig et al., 2001). Many pests and diseases can be favored by climate changes such as increasing of the temperature in northern latitudes (Gregory et al., 2009; Olesen et al., 2011). Using different mathematic models, Diós et al. (2009) make hypothesis that climate changes will grow significantly by the end of the century, the frequency and the potential of the pests damage at maize crops in Central Europe. For protect maize crops against ECB larva attack, in Romania it has made researches concerning maize inbreed lines and hybrids tolerance at this pest (Barbulescu et al., 1985; 1999; 2001; Barbulescu et Cosmin, 1987; 1997; Mustea D., 1990). Also, it has studied chemical and biological control of this pest in conditions of the artificial infestation of the maize plants with ECB egg batches (Barbulescu, 1989; Muresan et Mustea, 1995). As result of collaboration between maize breeding and plant protection laboratories, from NARDI Fundulea, it has obtained many maize hybrids with tolerance at ECB attack. Similar results were obtained at ARDS Turda. However, in last 10 years, high numbers of foreign maize hybrids with lack of information concerning tolerance at *Ostrinia nubilalis* were cultivated in all regions of Romania (Alexandri, 2011). Alternative solution for protect maize plants against this pest represent chemical treatment. In present, no insecticide is authorized in Romania for chemical protection of maize crops against ECB attack (Codex, 2016). In this paper, author collective present preliminary results concerning new active ingredients testing for chemical control of ECB at maize crops, in climatic conditions of south-east of Romania.

MATERIALS AND METHODS

The researches have been carried out at Plant Protection Collective in frame of National Agricultural Research Development Institute, Fundulea, Calarasi County, Romania. (44° 46′ N, 26° 32′ E, altitude: 68 m). In 2014 and 2016 it has tested two new active ingredients, indoxacarb and cyantraniliprole (Tab. 1). Also, it has tested, lambda-cyhalothrin, active ingredient that belongs to pyrethroid class with a broad spectrum of pest control at different crops. Indoxacarb is a new oxadiazine insecticide that affects insects from direct exposure to spray droplets and through ingestion of treated foliage/fruit. Once absorbed, it kills by binding to a site on the sodium channel and blocking the flow of sodium ions (McCann et al., 2001). Indoxacarb can play a useful role in resistance management programs because it has a mode of action not shared by other insecticides (Lapied et al., 2001). Cyantraniliprole is new active ingredients that belong to ryanoid class. This active ingredient interacts with ryanodine receptors and causes loss of muscle function, leading to paralysis and death of the insects (Selby et al., 2013).

Tab. 1

Active ingredients used in the field experiment concerning *Ostrinia nubilalis* Hbn control from maize crops, at NARDI Fundulea

Insecticide class	Active ingredient	Concentration (g/l)
Oxadiazine	indoxacarb	150
Ryanoids	cyantraniliprole	200
Pyrethroids	lambda-cyhalothrin	50

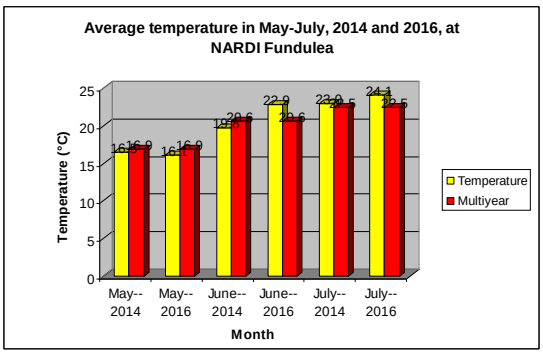
Experimental plots were arranged according randomized blocks scheme. Maize plants were sowed in plots, 10 m length and 4.2 m width (six rows) that correspond on a surface of 42 sqm. In 2014 and 2016 it has tested indoxacarb active ingredient in three doses (170, 250 and 500 ml p.c./ha), cyantraniliprole active ingredient in three doses (125, 150 and 200 ml p.c./ha) and lambda-cyhalothrin in dose of 300 ml p.c./ha. Five days

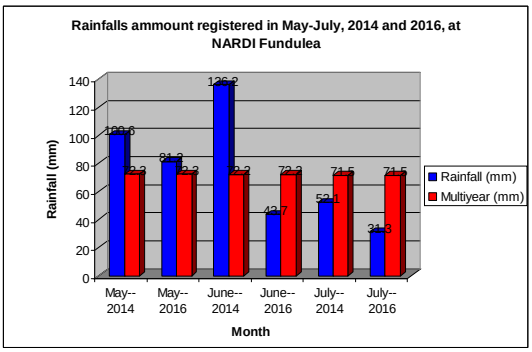
before treatment maize plants were infested with 10 egg batches/plant, twice, 5-6 days, between infestations. At each plot it has infested 20 plants. Artificial infestation of the maize plants it has made with *O. nubilalis* egg batches produced in laboratory conditions, on continuous flux, after a technology described by Barbulescu (1980). Egg-batches used for artificial infestation are in “black-head” stage, when larva head become visible. Attack level of the European corn borer at the maize plants were analyzed in autumn (September) after the end of maize vegetation period, before harvesting (BBCH 99). For this assessments the stalks was cooped in twice and it has determined three parameters: attack frequency, gallery length (cm) per plant and number of the alive larva/plant.

The data were statistical analyzed through variance analysis method, using Microsoft Excel, version 2003 software.

RESULTS AND DISCUSSIONS

Climatic conditions from May to July, at NARDI Fundulea, in 2014 and 2016 were different (Fig. 1-2). Average air temperature was below multiyear averages in May, both years of experiment. Average air temperature registered was below multiyear average in June, 2014 and over multiyear average in June, 2016, while in July, average air temperature was higher then multiyear averages, in both years of study. Rainfalls amount was higher comparative with multiyear averages in May (both years) and June, 2014. In the rest of period, rainfall amount were below multiyear average.





Figures 1 and 2-Climatic conditions at NARDI Fundulea, year 2014 and 2016

Data from table 2 show higher attack of European corn borer (*Ostrinia nubilalis* Hbn), at maize plants, in 2016 comparative with 2014. In conditions of artificial infestation, of maize plants with ECB egg batches produced in laboratory conditions, attack frequency ranged from 0 (higher doses of cyantraniliprole) to 85.00 % (untreated variant) in conditions of the year 2014. Higher values of this parameter was registered in case of first two doses of indoxacarb (170 and 250 ml p.c./ha) and lamda-cihalotrin. In 2016, except variant treated with higher dose of cyantraniliprole (200 ml p.c./ha), at all experimental variants, attack frequency was higher then 62 %. At lowest dose and indoxacarb and control variant, attack frequency was 100 %.

Tab. 2

The effectiveness of some insecticides used for vegetation treatment at maize crop against *Ostrinia nubilais* Hbn, at NARDI Fundulea, in 2014 and 2016

Nr. crt.	Active ingredient	Dose (ml p.c./ha)	Attack frequency (%)		Cavities length/plant (cm)		Alive larva (nr./plant)	
			2014	2016	2014	2016	2014	2016
1	indoxacarb	170	63.75b	100a	4.71b	9.74b	0.79b	6.92b
2	indoxacarb	250	50.00c	98.00a	4.27b	8.45b	0.45c	5.09c
3	indoxacarb	500	33.75d	65.00c	2.23c	4.63c	0.14d	2.75e
4	cyantraniliprole	125	7.50e	68.75c	0.92d	4.02c	0.20d	3.82d
5	cyantraniliprole	150	0e	62.50c	0e	1.76d	0d	1.47f
6	cyantraniliprole	200	0e	17.50d	0e	0.33e	0d	0.21g
7	lambda-cyhalothrin	300	47.50c	92.50b	4.39b	8.24b	0.71b	6.07bc
8	control	—	85.00a	100a	13.41a	20.18a	3.03a	14.70a

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

Regard as cavities length/plant, a parameter that reflect attack intensity of ECB at maize plants, higher values was registered in climatic conditions of 2016 comparative with 2014. In both studied years, at first two rates of indoxacarb, used in this experiment (170 and 250 ml p.c./ha), cavities length/plant has close values without significant statistically differences. Lower attack was registered in case oh higher dose of indoxacarb (500 ml p.c./ha). At variants treated with cyantraniliprole, in climatic conditions of the year 2014, attack of ECB was low at first rate used in this experiment (125 ml p.c./ha), while at higher rates, attack was absent. In conditions of higher pest attack, at variants treated with cyantraniliprole in dose of 150 and 200 ml p.c./ha, ECB attack was low. It is important to mention that, at untreated variant, cavities length/plant was 13.41 cm in 2014 and 20.18 cm in 2016.

Level of the alive larva/plants was higher in 2016 comparative with 2014. At untreated maize plants, in climatic conditions of the year 2016 it has find, in average, 14.70 larva per plants, while in 2014 it was find only 3.03 larva/plant. Higher differences from two years can explained through climatic conditions of the year 2016 that favored this pest. In both studied years, higher rate of indoxacarb, used in this experiment (500 ml p.c./ha) and cyantraniliprole in dose of 150 respectively 200 ml p.c./ha, provide higher protection of maize plants against this pest.

CONCLUSIONS

Higher pest pressure was registered in year 2016. A possible explication of this was because of daily temperature and rainfalls distribution from last 10 days of June and first 10 days of July that favored ECB attack, comparative with similar period from 2014.

In this experiment, higher protection of the maize plants, was provided by higher rate of indoxacarb (500 ml p.c./ha) and cyantraniliprole, in rate of 150 and 200 ml p.c./ha).

Artificial infestation of the maize plants with ECB egg batches, produced in laboratory conditions from insects reared consecutive generations, on same artificial diet is a good research tool to evaluate chemical treatment effectiveness against this pest.

Further studies are necessary to evaluate impact of the climate changes on ECB evaluation in Romania.

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