TESTING EFFECTIVENESS OF THE MAIZE SEEDS TREATMENT CONCERNING MAIZE LEAF WEEVIL (*Tanymecus dilaticollis* GYLL) CONTROL, IN LABORATORY CONDITIONS

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Abstract

Maize leaf weevil (*Tanymecus dilaticollis* Gyll) is an economically important pest of maize crop in south and south-east of the Romania. The insect is favored by high temperature and drought when maize plants are in first vegetation stages. In this assessment it has studied effectiveness of some insecticides used like seed treatment in laboratory conditions, in plastic pots sowed with treated and untreated maize seeds. Each pot was infested with adult insects collected from the field after plant emergence. Insects mortality were higher in case of seeds treated both with thiametoxan (Cruiser 350 FS) and clothianidin (Poncho 600 FS) active ingredients. Seeds treated with tiacloprid active ingredient (Sonido) provide lower mortality values. Attack intensity was lower in case of seeds treated both with thiametoxan (Cruiser 350 FS) and clothianidin (Poncho 600 FS) active ingredients and higher in case of treated seeds with tiacloprid active ingredient (Sonido). Seeds treatment provides satisfactory protection for maize plants in first vegetation stages against *Tanymecus dilaticollis*. Bioassays in laboratory conditions are a complementary method with field testing and provide useful information regarding insect behavior.

Key words: laboratory conditions, seed treatments, effectiveness, *Tanymecus dilaticollis*

With an area higher then 2500000 ha, in last three years, maize is one of the most important crop in Romania. According data from Ministry of Agriculture, in 2013, Romanian maize production occupy second place in EU27 after France (MADR data, 2013). However maize average yield (kg/ha) in Romania has lowest values comparative with other EU27 countries (FAOSTAT database, 2013). Year by year at maize crops it has registered yield losses because of the weeds, diseases and pests (Cristea M. et al., 2004). In some years, only because of the pests attack, maize yield losses in Romania can arrive at 23 % (Trotus E. et al., 2011). Maize leaf weevil (*Tanymecus dilaticollis* Gyll) is an economically important pest of maize crop in south and south-east of the Romania (Barbulescu A. et al, 2001). Year by year are affected over 1 million hectares with maize by this pest (Popov C. et al., 2005). When *T. dilaticollis* attack maize plants in first vegetation stages (BBCH 10-14), yield losses are higher (Paulian F., 1972, Popov C. et Barbulescu A., 2007). High biological reserve of this pest can occur in case of maize monoculture (Voinescu I. et Barbulescu A, 1998). Seed treatments provide satisfactory protection for maize crop at first vegetation stages against maize leaf weevil (Krusteva H. et al., 2006; Popov C. et al., 2006; Čamprag D., 2011).

Each year, at NARDI Fundulea, in field conditions were organized assessments concerning effectiveness of the seed treatments for maize leaf weevil control (Voinescu I. et al., 1991; Barbulescu A. et al., 2001; Vasilescu S. et al., 2005; Popov C. et al., 2007). However climatic conditions from spring time are variable from one year to another. According Popov C. et al. (2006) in years with reduced rainfall level in the spring, the attack of *T. dilaticollis* on maize untreated plants was maximum or almost maximum, while in years with higher rainfall level the attack of *T. dilaticollis* on maize untreated plants was lower. As result, laboratory testing is a complementary method for evaluate seed treatment effectiveness. Paulians F. (1972) make laboratory assessments to evaluate cloro-derivate insecticides (DDT, HCH and Aldrin) effectiveness concerning maize leaf weevil control. Barbulescu A. et al. (2001) and Vasilescu S. et al. (2005) tested the efficacy of chemical treatment of maize and sunflower seeds in laboratory conditions, using plastic pots and

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isolators and a density from four to seven adult insects per plant. Keszthelyi, S. (2008) study effectiveness of seed treatment and soil disinfection, on three soils type, in laboratory conditions, using isolators previously sown with corn (1-2 leaf stage). In Bulgaria, Draganova S. (2012) makes bioassays of *T. dilaticollis* adults with some *Beauveria bassiana* isolates, for biological control of this pest. In last years, at Research-Development Institute for Plant Protection, Bucharest, it has researched mass rearing of *T. dilaticollis*, successive generations, in controlled conditions (Manole T., et al., 2013). According this author, in controlled conditions after a few generations appear physiological disturbances, such as female sterility. As result, for laboratory assessment most of the authors prefer collect adult insect from field, in places were plants or soil is untreated.

MATHERIAL AND METHD

The researches have been carried out at Plant Protection Laboratory, National Agricultural Research Development Institute (NARDI) Fundulea, Calarasi County, Romania.

For laboratory assessments, adult insects of *T. dilaticollis* were collected at the first decade of May, from the maize untreated plants, located both on the Plant Protection Laboratory and Ecological Laboratory experimental fields. Until assessment starting, insects collected from the field are maintaining in laboratory for a few days at 15±2 ºC air temperature and 80-85 % relative air humidity.

In this experiment, it has tested next insecticides: thiametoxan (Cruiser 350 FS in dose of 9,0 l/t), clothianidin (Poncho 600 FS in dose of 4,0 l/t and dose of 2,0 l/t) and thiacloprid (Sonido in dose of 8,0 l/t).

For laboratory assessments we use plastic pots (12x12x10 cm). Before sowing, pots are filing ¾ with soil (brown chernozem), collected from untreated areas (like forest). In each pot, it has sowing five maize seeds. Each experimental variant have four replications, each pot represent one replication. After beginning of the plant emergence, when maize plants arrive at BBCH 11 stage (one leaf stage), it has added insects collected from the field. In each pot it has added 20 insects to have a pest density of 4 adults per plant. After insects were added, the pots were covered with isolators, bonnet with bolter (Fig. 1).

Insects mortality were determined through dead insect counting at 1, 2, 3, 5 and 8 days after plants infestation. Plants height was assessed at 5 and 8 days after plant infestation. Attack intensity of *T. dilaticollis* adults was evaluated at 5 and 8 days after plants infestation. This laboratory assessment is similar with field assessment for maize leaf weevil. The attacked plants have been rated by a scale from 1 to 9, elaborated by Paulian F. (1972) as follows:

- Note 1: plant not attacked;
- Note 2: plant with 2-3 simple bites on the leaf edge;
- Note 3: plants with bites or clips on leaf edge;
- Note 4: plants with leafs chafed in proportion of 25 %;
- Note 5: plants with leafs chafed in proportion of 50 %;
- Note 6: plants with leafs chafed in proportion of 75 %;
- Note 7: plants with leafs chafed almost at the level of the stem;
- Note 8: plants with leafs completely chafed and beginning of the stem destroyed;
- Note 9: plants destroyed, with stem chafed close to soil level.

The data were statistical analyzed through variance analysis method, using Microsoft Excel 2003 and ARM 8.5.0 software.

Table 1

Mortality of *Tanymecus dilaticollis* adults, as result of the maize seed treatments, at NARDI Fundulea, in laboratory conditions

Nr. crt.	Variant	Dose (l/t)	Insects mortality	
			Adults	Percent (%)
1	**Control (untreated)**	**—**	0.25	**1.25**
2	**Poncho 600 FS**	**4.0**	13.25***	**66.25*** **
3	**Poncho 600 FS**	**2.0**	10.00***	**50.00*** **
4	**Sonido**	**8.0**	5.00**	**25.00** **
5	**Cruiser 350 FS**	**9.0**	13.50***	**67.50*** **
		LSD (P<0.05)	2.58	13.29
		LSD (P<0.001)	3.62	18.66
		LSD (P<0.0001)	5.10	26.34

Table 2

Influence of the *Tanymecus dilaticollis* attack concerning Maize plants height, in laboratory conditions

Nr. crt.	Variant	Dose (l/t)	Plant height (cm)	
			At 5 days	At 8 days
1	**Control (untreated)**	**—**	2.70	2.63
2	**Poncho 600 FS**	**4.0**	17.12***	19.92***
3	**Poncho 600 FS**	**2.0**	13.43***	15.67***
4	**Sonido**	**8.0**	4.17*	5.71*
5	**Cruiser 350 FS**	**9.0**	17.44***	20.43***
		LSD (P<0.05)	1.09	2.21
		LSD (P<0.001)	1.52	3.10
		LSD (P<0.0001)	2.15	4.38

Table 3

Effectiveness of the seed treatment concerning *Tanymecus dilaticollis* attack at maize plants, in laboratory conditions

Nr. crt.	Variant	Dose (l/t)	Attack intensity (1-9)	
			At 5 days	At 8 days
1	Control (untreated)	—	8.02	8.60
2	Poncho 600 FS	4.0	3.16***	3.25***
3	Poncho 600 FS	2.0	4.45***	4.61***
4	Sonido	8.0	6.88*	7.66*
5	Cruiser 350 FS	9.0	2.89***	3.04***
		LSD (P<0.05)	0.84	0.68
		LSD (P<0.001)	1.18	0.96
		LSD (P<0.0001)	1.67	1.35

REZULTS AND DISCUSSION

Data from *table 1* show higher insect mortality values in case of plants emerged from maize seeds treated with thiametoxan (Cruiser 350 FS) and clothianidin (Poncho 600 FS) in dose of 4.0 l/t. At variant treated with tiacloprid (Sonido), only 25 % of insects died after 8 days from plant infestation.

Figure 1 **Platic pots with isolators**

In all treated variants it has registered a mortality peek at three days after insect are added in plastic pots (*figure 2*). At variant treated with higher dose of clothianidin (Poncho 600 FS), average adults mortality value, at three days was of 6.75 followed by variant treated with thiametoxan (Cruiser 350 FS) and lower dose of clothianidin (Poncho 600 FS). At variant treated with tiacloprid (Sonido) higher mortality values registered at three days after plant infestation, but those values are lower comparative with other treated variants. In case of plants emerged from seeds treated with thiametoxan (Cruiser 350 FS) and both doses of clothianidin (Poncho 600 FS), average mortality values were close, at one, two, five and eight days after plant infestation. In case of plants emerged from seeds treated with tiacloprid (Sonido), average mortality values are similar with other treated variants, ad two days after plant infestation, while at five and eight days are close with control variant. The differences between treated variants and control are statistically assigned (P<0.0001) except variant treated with tiacloprid (Sonido).

Regarding plant height, data from table 2 show higher differences between treated and untreated plants. Plants emerged from the untreated seeds, have a reduce height at five days after assessment starting, as result of the insect attack. In case of seeds treated with higher dose of clothianidin (Poncho 600 FS) and thiametoxan (Cruiser 350 FS), plant height are higher then 17 cm. At variant treated with lower dose of clothianidin (Poncho 600 FS), plant height, at five days, arrive at 13.43 cm. At variant treated with tiacloprid (Sonido), plant height have lowest values from the experience (4.17 cm), the differences between this variant and control variant are not statistically assigned (P<0.0001). Three days later, at second assessment, plants increasing at all treated variants, except control (untreated) variant, where plant height is lower, as result of *T. dilaticollis* attack. Higher values of the plant height, at 8 days, were registered at variants treated with thiametoxan (20.43 cm) and clothianidin (19.92 cm). In case of variant treated with lower dose of clothianidin, plant height, at 8 days, arrive at 15.67 cm. At variant treated with tiacloprid (Sonido), even if the plants height was higher comparative with first assessment, however differences are slight and not statistically assigned.

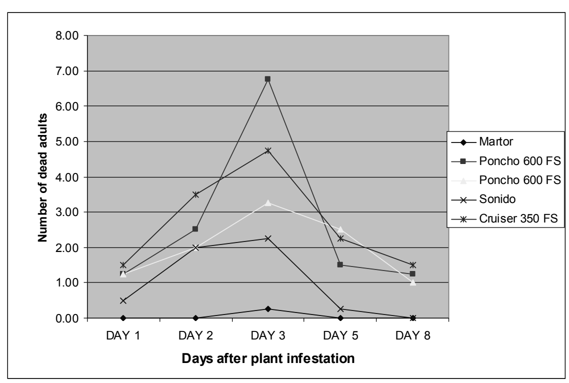

Figure 2 **Mortality of *maize leaf weevil* adults, in laboratory conditions**

The lower values of the plants height in case of variant treated with tiacloprid were as result of the low insect mortality and higher attack, comparative with other treated variants. At control variant, maize leafs are almost 100 % consummated by the adult insects. In this case maize plants can't recover and if this situation is meeting in the field conditions, the maize crop must be replaced.

Data from *table 3* show lower attack intensity of the maize leaf weevil at variants treated with thiametoxan (Cruiser 350 FS) and higher dose of clothianidin (Poncho 600 FS), at five days from plant infestation. In this case maize plants present bites on the leaf edge, and damages are minimum. Insects start feeding immediately after they were added in plastic pots. However, not all insects start feeding in same time. The effect of the insecticide occurs at 10-15 minutes after insect starting feeding with seedlings emerged from treated seeds. Nervous system of the insects is affected and feeding process is stopped. In case of variant treated with lower dose of clothianidin (Poncho 600 FS) the attack intensity, on a scale from 1 to 9 was 4,45. That means, the maize plants has leaf chaffed between 25 and 30 %. At variant treated with tiacloprid (Sonido) attack intensity on a scale from 1 to 9 was of 6.88 that mean the maize plants have leaf chaffed in proportion of 75 % and at some plants chafed almost at the level of the stem. At this variant it has registered lower mortality of the adult insects. As result, many insect feed with maize leaf at five days from plant infestation, even this is a treated variant. Attack intensity at plants emerged from untreated seeds is 8.02. At all plants from the pots, leafs are completely chaffed and at some plants stems are beginning destroyed. In this case, plants can't recover.

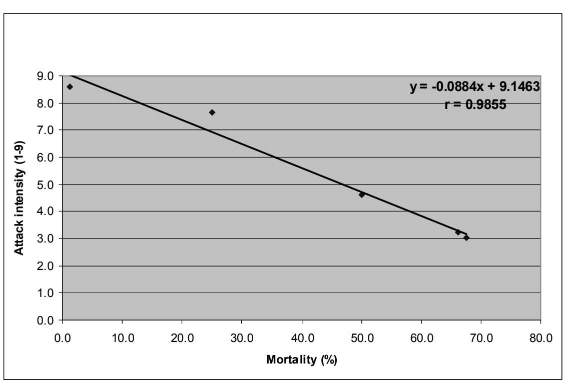

Figure 3 **Relation between insect mortality and attack intensity, in laboratory conditions**

At second assessment, at eight days from plant infestation, in case of plants treated with both doses of clothianidin (Poncho 600 FS) and thiametoxan (Cruiser 350 FS) the attack intensity difference comparative with first assessment are slight. At this variants, insect mortality peek occur after three days from plant infestation. At eight days most of the insect added in plastic pots are dead or affected. As result the insect rest alive don't feed with leaf and attack don't evolve. Contrarily at variant treated with tiacloprid (Sonido) insect mortality have low values, and many insects from plastic pots continue feeding with maize leafs. As result attack intensity increasing comparative with first assessment. At eight days from plants infestation with maize leaf weevil, attack intensity on a scale from 1 to 9 was of 7.66. Most of the plants have leafs chaffed in proportion varying from 75 to 100 % and at some plants, insects starting feeding with stem. More then 50 % of the maize plants from this variant can't recover.

Figure 4 **Maize plants destroyed by *T. dilaticollis*, at control (untreated) variant**

In case of control variant, all plants were destroyed by *T. dilaticollis* adults at eight days from plant infestation (Fig. 4). Regarding maize leaf weevil (*T. dilaticollis*) attack intensity, on maize plants, the differences between variants treated with both doses of clothianidin (Poncho 600 FS), thiametoxan (Cruiser 350 FS) and control (untreated) variant are statistically assigned ($P<0.001$). However, the difference between variant treated with tiacloprid and control variant are not statistically assigned ($P<0.0001$).

CONCLUSIONS

In laboratory conditions, at treated variants, it has registered mortality peek at three days after seed treatment. Higher mortality values was registered at variant treated with thiametoxan (Cruiser 350 FS) and clotianidin (Poncho 600 FS) while lower mortality value it has registered at variant treated with tiacloprid (Sonido).

The insecticides on base of thiametoxan (Cruiser 350 FS) in dose of 9.0 l/t and clothianidin (Poncho 600 FS) in dose of 4,0 l/t have higher effectiveness in control of the maize leaf weevil in laboratory conditions, at a density of 4 adult insects/plant.

The insecticide on base of tiacloprid (Sonido) doesn't assign satisfactory protection against maize leaf weevil, in laboratory conditions, at a density of 4 adult insects/plant..

At control (untreated) variant, all plants were destroyed by *T. dilaticollis* adults.

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