PRELIMINARY RESULTS CONCERNING MAIZE LEAF WEEVIL (*TANYMECUS DILATICOLLIS* GYLL) CONTROL, IN COMMERCIAL FARM CONDITIONS, FROM SOUTH-EAST OF THE ROMANIA

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Abstract

Maize is one of the most important crops in Romania. However, every year, maize plants from approximate one million hectares are attacked by maize leaf weevil (*Tanymecus dilaticollis* Gyll). This pest represents one of the most important problems of this crop, especially in south and south east of the country. The weevils attack is dangerous when maize plants are in first vegetation stages, from plant emergence (BBCH 10) until four leaf stage (BBCH 14). This pest is favored by warm springs and drought. Seed treatment with systemic insecticides was one of the most effective methods for protecting maize plants against weevils attack. As result of the European Commission regulations no. 218/783, 218/784 and 218/785, the use of imidacloprid, clothianidin and thiamethoxam active ingredients for all field crops, both for seed treatment and foliar application will be total banned in EU, from 2019. After these regulations, in Romania, no insecticides will remain available for maize seed treatment against *Tanymecus dilaticollis*. In this paper there were presented preliminary result of a study made in conditions of commercial farm, in south east of the country (Ialomita county), concerning effectiveness of the seed treatment comparative with granules or single foliar spray for control of the maize leaf weevil attack. The experience was made in conditions of high pest pressure (25-30 insects/m^2). It has tested seed treatment with imidacloprid active ingredient, single foliar spray with acetamiprid, thiacloprid and deltamethrine active ingredients. Also it has tested different combinations of granules application (cypermethrin active ingredient) or combinations between seed treatment with thiacloprid active ingredient and granules application with cypermethrin or lambda-cyhalotrin active ingredients. In 2018, the climatic conditions from experimental site were very favorable for insect's attack. Air temperatures registered in April and May were higher compared with precedent years. Rainfalls amount registered in April and May was below multiyear average. The attack of the maize leaf weevil in the commercial farm from south-east of the Romania, where it has made the assessments was high. At control (untreated) variants, almost all maize plants were destroyed by the weevils. Similar situation was occurred in case of variants with single foliar application, without seed treatment. At variants with applied granules weevil attack was high. In conditions of high pest pressure, from commercial farm, seed treatment with imidacloprid active ingredient provides effective protection of maize plants in first vegetation stages (BBCH 10-14) against *Tanymecus dlacitollis* attack.

Key words: maize, weevils, control, insecticides, farm

Cultivated on an area higher than 2.5 million hectares, maize is one of the most important crops from Romania (Vasile A.J. *et al*, 2016; Tudor V.C. *et al*, 2017). According Eurostat (2017) and MADR data (2016), in the last years, Romania occupy second place in EU, after France, with a maize grains production higher then 10 million tones. In the climatic conditions of the Romania, maize production per hectare can decreasing, both because of non-biotic stress such as heat waves from flowering period, draught, storms, low temperatures from emergence period and biotic stress such as weeds, pathogens or pests (Meiselle M. *et al*, 2010; Tokatlidis I.S. *et al*, 2011; Panaitescu L. *et al*, 2013; Ivas A. *et al*, 2013; Hurduzeu G. *et al*, 2014; Rusu T. *et al*, 2015; Viziru O.P. *et al*, 2016; Sopotean L. *et al*, 2017). According Trotus E. *et al* (2011), only because of the pest's attack, maize yield losses in Romania can arrive at 23 %. In south and south-east of the country, maize leaf weevil (*Tanymecus dilaticollis* Gyll) is the most harmful pest for maize crops (Paulian F. *et al*, 1977; Voinescu I., 1985; Barbulescu A. *et al*, 1997; Barbulescu A., 2001; Popov C. *et al*, 2007). The attack is very dangerous when maize plants are in first vegetation stages, from plants emergence until four leafs stage (Čamprag D. *et al*, 1969; Paulian F., 1969; Paulian F. *et al*, 1973). In this stages, in case of higher pest attack, plants can be total destroyed and farmers must sow again (Barbulescu A. *et al*, 2001). After

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four leafs stage (BBCH 14) the attack of *Tanymecus dilaticollis* at maize plants is less economically important, the weevils consume only the leafs margins and plants survive of the attack (Rosca I. *et al*, 2009). High temperatures registered in spring period (April-May) and draught represents the most favorable conditions for insects activity (Popov C *et al*, 2006). According Paulian F. (1972), in case of pest density ranged between 25 and 30 weevils/m^2, average maize yield losses can arrive at 34 %. However, during the time, in Romania it has recorded high densities of this pest (15-80 weevils/m^2), especially in Ilfov, Calarasi, Ialomita, Braila, Galati, Tulcea or Constanta counties (Paulian F. *et al*, 1974, 1977; Barbulescu A. *et al*, 1988; 1993, 1997; Barbulescu A., 2001). In some favorable years there where extreme cases when it has recorded a pest density of 160 weevils/m^2, in Dobrogea area (Voinescu I., 1987 cited by Rosca I. *et al*, 2009). Data from the literature suggest that, every year, in Romania there were attacked approximate one million hectares cultivated with maize by this pest (Barbulescu A. *et al*, 2001; Popov C. *et al*, 2002, 2004, 2007a). Antonie I. *et al* (2012) mentioned that the attack of maize leaf weevil is higher in areas considered until now, unfavorable for this pest, such as Sibiu county (south of the Transylvania). A possible explication for this situation is climate changes. Recent studies demonstrate that in last years it has increased incidents of heat waves and droughts, both in spring and summer period, in the countries with continental climate from the Pannonian zone, which includes Hungary, Serbia, Bulgaria and Romania (Olesen J.E. *et al*, 2011). Čamprag D. (2011) mentioned that climate changes can favor xero-thermophilous pests such as maize leaf weevil. Several years of maize monoculture, favored *Tanymecus dilaticollis* attack (Voinescu I. *et al*, 1998). Same authors mentioned that, high attack of this pest it can registered in case of sunflower cultivated after maize. High areas cultivated both with maize and sunflower are concentrated in south-east of the Romania (Lup A. *et al*, 2017). The aspects mentioned before represent favorable conditions for increasing of the maize leaf weevil attack in the short term future in our country. Researches effectuated in Romania in last 50 year make in evidence that the most effective method to control *Tanymecus dilaticollis* attack, at maize plants, from plants emergence (BBCH 10) until for leafs stage (BBCH 14) is chemical seed treatment with systemic insecticides (Voinescu I., 1985: Barbulescu A. *et al*, 2001; Vasilescu S. *et al*, 2005; Čamprag D., 2007; Popov C. *et al*, 2007b; Popov C. *et al*, 2007; Trotus E. *et al*., 2011; Georgescu E. *et al*, 2015). After European Commission regulations 218/783, 218/784 and 218/785, the use of imidacloprid, clothianidin and thiamethoxam active ingredients for all field crops, both like seed treatment and foliar application will be total banned in UE, starting from 2019 (Official Journal of the European Union, 2018a,b,c). As result no insecticides will remain available for maize seed treatment against maize leaf weevil in Romania. In the last years, at NARDI Fundulea it has made several researches for finding possible alternatives at neonicotinoid seed treatments, in climatic conditions of south-east of the Romania (Georgescu E. *et al*, 2014, 2016). In this paper there were presented preliminary results of the first study effectuated in Romania, in conditions of normal farm system concerning testing of different types of chemical treatments at maize crop for controlling of the maize leaf weevil (*Tanymecus dilaticollis*) attack in conditions of high pest pressure.

MATERIAL AND METHOD

The field trials were carried out in 2018, at commercial farm Sopema SRL, located in Mihail Kogalniceanu, Ialomita County, Romania. GPS limits at the experimental site ranged from 27°40'56.18" E /44°42'53.88" N to 27°40'31.24" E /44°42'52.18" N. In conditions of commercial farm, the area of each experimental plot has 8000 m^2. Maize was sowed in 13 April and plants emergence was recorded in 22 April. It has used MAS 47P maize hybrid. Experimental variants are presented in *table* 1. It has tested single seed treatment with imidacloprid active ingredient (600 g/l-variant 5), single foliar spray with acetamipird (20 %), thiacloprid (480 g/l) and deltamethrin (100 g/l) active ingredients (variants 2-4), combinations between seed treatment with thiacloprid (400 g/l) and granules application with cypermethrin (8.0 g/kg) active ingredients (variants 7-8) and one or two granules application with cypermrthrin (8.0 g/kg) active ingredient (variants 6 and 9). In this experiment it has used two control (untreated) variants. At variants with two applications of granules or granules application after seed treatment, this treatment was made at 7 days from plant sowing. When maize plants arrive in first vegetation stages (BBCH 13-14 and BBCH 15-16) it has assessed plant densities. On each variant it has establish four assessment points. At each assessment point it has counted emerged maize plants from 20 row meters (80 row meters/variant).

Attack intensity was evaluated when maize plants arrive in four leafs stage (BBCH 14), according a scale from 1 to 9, elaborated and improved 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 all leafs 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. At each variant, it has established four assessment points. At each assessment point it has evaluated 50 maize plants, from five rows (10 plants/row). Before assessment plants were marked with sticks, in stair system.

Meteorological data was provided by meteo station of the Sopema farm, located at 1 km from experimental site. It has monitoring air temperature and rainfalls amount occurred in April and May.

Data from the field assessments was statistical analyzed using Newman-Keuls test.

RESULTS AND DISCUSSIONS

During assessments period, at experimental site, climatic conditions from spring period of the 2018 were high favorable for maize leaf weevil attack. Air temperatures registered in April and May was higher compared with precedent years (14.9 and 21.4 °C). Rainfalls amount registered in April and May was below multiyear average (*figure 1*).

Table 1

Active ingredients used **for controlling of the *Tanymecus dilaticollis* Gyll in commercial farm conditions, from south-east of the Romania, year 2018**

Variant	Commercial products name	Active ingredients	Rate	Rate type	Application type
1	**Check 1 (untreated)**	—	—	—	—
2	**Mospilan 20 SG**	acetamiprid (20 %)	0.1	Kg/ha	B
3	**Calypso 480 SC**	thiacloprid (480 g/l)	0.09	L/ha	B
4	**Decis Expert 100 EC**	deltamethrin (100 g/l)	0.075	L/ha	B
5	**Seedoprid 600 FS**	imidacloprid (600 g/l)	8.0	L/to	A
6	**Belem 0.8 MG** **Belem 0.8 MG**	cypermrthrin (8.0 g/kg) cypermrthrin (8.0 g/kg)	12.0 12.0	Kg/ha Kg/ha	C D
7	**Sonido 400 FS** **Belem 0.8 MG**	thiacloprid (400 g/l) cypermrthrin (8.0 g/kg)	0.1 12.0	L/to Kg/ha	A D
8	**Sonido 400 FS** **Ercole**	thiacloprid (400 g/l)+ lambda-cyhalotrin (4 g/kg)	0.1 12.0	L/to Kg/ha	A D
9	**Belem 0.8 MG**	cypermethrin (8.0 g/kg)	12.0	Kg/ha	D
10	**Check 2 (untreated)**	—	—	—	—

A-Seed treatment (BBCH 00); **B**-Foliar applications (BBCH 11-12); **C**-Granules application at sowing time (BBCH 00)
D-Granules application at 7 days after sowing (BBCH 09-10)

Table 2

Results of seed treatment, foliar and granules application for controlling of the *Tanymecus dilaticollis*, in commercial farm conditions, from south-east of the Romania, year 2018

Variants	Plants (no/Rm)	Phytoxicity (%)	Incidence (%)	Attack (I:1-9)	Plants (no/Rm)
	4.05. 2018	4.05. 2018	4.05. 2018	4.05. 2018	24.05. 2018
Check 1 (untreated)	4.55b	**0a**	**100a**	8.41ab	0.45c
Mospilan 20 SG	4.51b	**0a**	**100a**	8.32ab	0.63c
Calypso 480 SC	5.06ab	**0a**	**100a**	8.41ab	0.36c
Decis Expert 100 EC	5.29ab	**0a**	**100a**	8.28ab	0.65c
Seedoprid 600 FS	5.64a	**0a**	**100a**	5.37c	4.99a
Belem 0.8 MG+Belem 0.8 MG	5.11ab	**0a**	**100a**	7.88b	1.65b
Sonido 400 FS+Belem 0.8 MG	4.65ab	**0a**	**100a**	8.56a	0.28c
Sonido 400 FS+Ercole	5.04ab	**0a**	**100a**	8.32ab	1.18bc
Belem 0.8 MG	4.96ab	**0a**	**100a**	8.20ab	0.34c
Check 2 (untreated)	5.40ab	**0a**	**100a**	8.05ab	1.51b
LSD (P=.05)	0.632	0	0	0.383	0.610
Standard Deviation	0.435	0	0	0.264	0.420
CV	8.67	0	0	3.31	34.95
Replicate F	3.476	0	0	1.575	3.133
Replicate Prob. (F)	0.0296	1.0000	1.0000	0.2184	0.0419
Treatment F	2.876	0	0	50.195	45.644
Treatment Prob. (F)	0.0161	1.0000	1.0000	0.0001	0.0001

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

Because of drought registered in south-east of the Romania, in spring of the 2018, maize plants have a slow development in first vegetation stages. At experimental location from Sopema commercial farm, plants emerged at 22 April and arrive in 3-4 leaf stage (BBCH 13-14) at 4 May, when it has made first assessments.

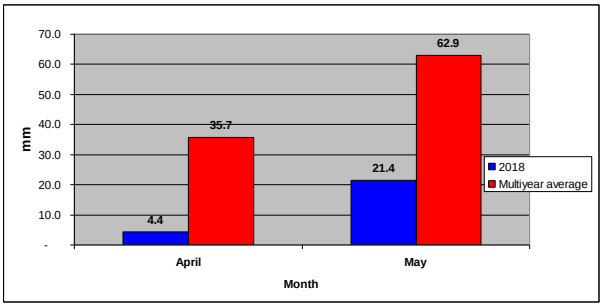

Figure 1 **Rainfalls amount registered at Sopema farm meteorological station, in spring of 2018**

In same time the attack on the maize leaf weevil (*Tanymecus dilaticollis* Gyll) was high both because of favorable climatic conditions for this pest and because of slow maize plants development, especially because of low soil moisture. Data from *table* 2 demonstrate that attack intensity of *T. dilaticollis* at maize plants, on a scale from 1 to 9 was higher then 8 at both untreated variants and single foliar spray (without seed treatment) variants. In these cases, the majority of the plants were destroyed by weevils.

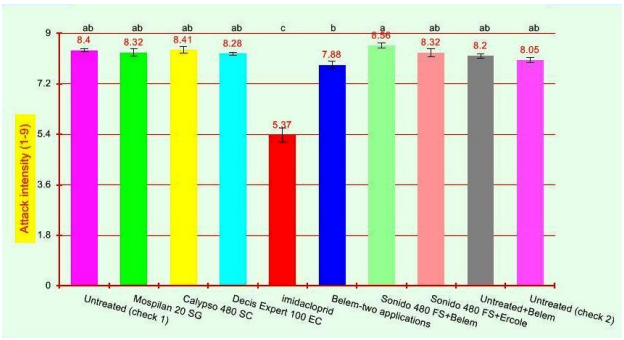

Figure 2 **Attack intensity of *Tanymecus dilaticollis* at maize plants, at Sopema farm (4.05.2018)**

According Student-Newman-Keuls (SNK) test there weren't statistical differences between untreated variants and single foliar spray variants (without seed treatment). In conditions of high pest pressure (25-30 insects/m^2) from experimental location, seed treatment with thiacloprid active ingredient followed by granules application at 7 days after sowing, both with cypermrthrin and lambda-cyhalotrin, didn't provide protection of maize leaf plants, in first vegetation stages (BBCH 10-14) against *T. dilaticollis* attack (*figure 2*). According Student-Newman-Keuls (SNK) test there weren't statistical differences between untreated variants and combination between seed treatment with thiacloprid active ingredient and granules application, at 7 days after sowing, with cypermrthrin or lambda-cyhalotrin active ingredients.

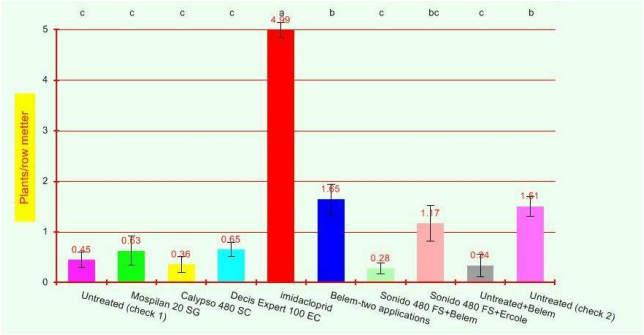

Figure 3 **Maize plants density, at experimental location from Sopema farm (24.05.2018)**

In conditions of high pest pressure (25-30 insects/m^2) from experimental location, single granules application with cypermrthrin active ingredient, at 7 days from sowing, didn't provide protection of the maize plants, in first vegetation stages (BBCH 10-14) against *T. dilaticollis* weevils. The attack was higher and the most of the plants were destroyed. According Student-Newman-Keuls (SNK) test there weren't statistical differences between untreated variants and single granules application with cypermrthrin active ingredient. In conditions of high pest pressure (25-30 insects/m^2) from experimental location, two application of granules treatment with cypermrthrin active ingredient, first application at sowing followed by second application at 7 days after sowing didn't provide protection of maize plants, in first vegetation stages (BBCH 10-14) against *T. dilaticollis* weevils. Even if the attack were lower at two application times of cypermrthrin comparative with single application of same active ingredient or comparative with untreated variants however pest attack was higher at variants with applied granules comparative with imidacloprid seed treatment variant (*figure 3*). Seed treatment with imidacloprid active ingredient, is efficient for preventing the *T. dilaticollis* attack in conditions of normal farm system. At this experimental variant the attack of weevils at maize young plants (BBCH 10-14) was high, as result of high pest pressure and good weather conditions. Most of the plants has leafs chaffed in proportion of 50-75 %. However, maize plants survive at the weevils attack and have normal development.

CONCLUSIONS

Climatic conditions from spring period of the 2018 (April-May) at experimental site (Sopema farm, Ialomita county) were very favorable for maize leaf weevil (*Tanymecus dilaticollis* Gyll) attack.

In 2018, in conditions of high pest pressure (25-30 weevils/m^2) from experimental site, seed

treatment with imidacloprid active ingredient is efficient for preventing of the maize leaf weevil attack in conditions of normal farm system.

In conditions of high pest pressure (25-30 weevils/m^2) from experimental site, registered in 2018, only single foliar spray, without seed treatment, didn't provide protection of maize plants, against *Tanymecus dilaticollis* attack.

In conditions of high pest pressure (25-30 weevils/m^2) from experimental site, granules application didn't provide protection of maize plants, against *Tanymecus dilaticollis* attack.

From all chemical control methods, tested in conditions of commercial farm system, in 2018, at Ialomita County, only seed treatment with systemic insecticide provide effective protection of the maize plants, in first vegetation stages (BBCH 10-14) against *Tanymecus dlacitollis* attack, in conditions of high pest pressure (25-30 weevils/m^2).

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