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DRAUGHT INFLUENCE CONCERNING MAIZE LEAF WEEVIL (*Tanymecus dilaticollis* GYLL) ATTACK ON MAIZE CROPS AT NARDI FUNDULEA

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Abstract

In this paper, authors collective present draught effects concerning evolution of the maize leaf weevil (Tanymecus dilaticollis Gyll), in period 2010-2013, at NARDI Fundulea, both at untreated and treated plants. From the years taken in study, the most favourable for the pest attack at untreated maize plants were 2012 and 2013. However in last years, rainfall distribution is not similarly then in the past. In same months we can have periods with draught (more then 10 days without rain) and air high temperatures followed by days with heavy rainfalls and moderate air temperatures. As result, maize leaf weevil attack in 2012 was higher even if total rainfall amount registered in last decade of April and first two decades of May were higher from all four years taken in study. Seed treatment provide good protection for the maize plants in first vegetation stages against this pest, in different climatic conditions from the spring period.

Key words*: daily distribution, draught, maize, weevil*

INTRODUCTION

With a maize grains production of 10.72 million tones, Romania occupy in 2013, second place in EU-27, after France (MADR data, 2013; FAOSTAT database, 2013). This data confirm once again that maize is one of the most important crops from our country (Has et al., 2010). However maize production per hectare can decrease because of the biotic stress such as weeds, pathogens or pests. According Trotus et al. (2011) only because of the pests attack, maize yield losses in Romania can arrive at 23%. Maize leaf weevil (*Tanymecus dilaticollis* Gyll) is the main pest of this crop in south and south-east of the Romania, but many areas from the south-west or west of the country can be affected by this insect (Cristea M. et al., 2004). The pest is dangerous for maize when plants are in first phases of vegetation, between plant emergences until four leaf stage (Popov et al., 2007). According Paulian F. (1972), maize leaf weevil is a thermo- and xerophytes insect and the adults are very active at high temperatures and low air relative humidity, while low temperatures and high rainfall interfere very much with their activity. Many studies effectuated at NARDI Fundulea demonstrate that drought from last decade of April and first two decades of May, period that coincide with first vegetation stages of maize plants (BBCH 10-14), favourite maize leaf weevil attack. According Vasilescu et al. (2005) and Popov et al. (2006) in 1985, 1986, 1989 or 1995 due to reduced rainfalls in the spring period (last decade of April-first two decades of May) the attack of the pest on maize untreated plants was maximum or almost maximum, while in 1984, 1999 or 2000 higher rainfalls from the spring period has reduced attack at untreated plants.

According Čamprag (2007) climate changes can favour xerothermophilous pests such as *Tanymecus dilaticollis*. New researches show that climate changes can have negative impact on agriculture, such as increased incidents of heat waves and droughts for the countries with continental climate from the Pannonian zone, which includes Hungary, Serbia, Bulgaria and Romania (Olesen et al., 2011). Long term studies on precipitation evolution show a decreasing trend, especially in spring period (Bozo, 2011). Same author mentioned that sometime, increasing precipitations is visible as a shorter term tendency.

Seed treatments provide satisfactory protection for maize crop in first vegetation stages against maize leaf weevil (Barbulescu et al., 2001; Krusteva et al., 2006; Popov et Barbulescu, 2007; Keszthelyi et al., 2008). Mass insecticidal seed treatment of maize in the period 2001-2010 contributed in reducing harm of *Tanymecus dilaticollis* Gyll., and other field crop pests (Čamprag, 2011). However, losses occurred especially at small farmers who practice traditional cultivation of maize after maize many years and do not uses seed treatments (Barbulescu et al., 2001; Popov, 2007). Recently farmers from Dolj county report that maize from untreated seeds was destroyed by *T. dilaticollis* attack (Orjanu, 2013). According EU decision 485/2013, from 1 December 2013, the use of neonicotinoids insecticides are restricted for seed treatment on maize crop. In this paper, authors collective study rainfall distribution from the spring period and temperature influence concerning *T. dilaticollis* attack on maize plants emerged both from the untreated and treated seeds.

MATERIALS AND METHODS

The observations were carried at the experimental field of the Plant Protection Laboratory from NARDI Fundulea, Calarasi County, between 2010 and 2013. Maize plants were sowed during the third decade of April, each year. Attack intensity is evaluated when the maize plants are in BBCH stage 14 (four leaf stage), according 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.

After 30 days from plant emergence, the saved plants percentage was evaluated by counting all the emerged plants from a plot and comparing them with the sowing seeds number/plot.

Climatic data were provided by meteorological station from NARDI Fundulea.

The data were statistical analyzed through the analysis of variance method by using of the Microsoft Excel 2003 and ARM 8.5 software.

RESULTS AND DISCUSSIONS

Data from Tables 1-6 show high climatic variability, during third decade of April and first two decades of May. Rainfalls registered in last decade of April were low in all study years at NARDI Fundulea. At first decade of May, in 2010 and 2013, rainfall amount has low values, while in 2011, rainfall amount was of 48.4 mm and in 2012 was of 14.2 mm. High value of the rainfall amount were registered in last decade of May, year 2012 (87.8 mm). Summarized data from tables 1-3, rainfalls registered in period April (third decade) and May (decades I-II), when maize plants are the most susceptible for *T. dilaticollis* attack, were over multiyear average in 2011 and 2012 and below multiyear average in 2010 and 2013 (Figure 1).

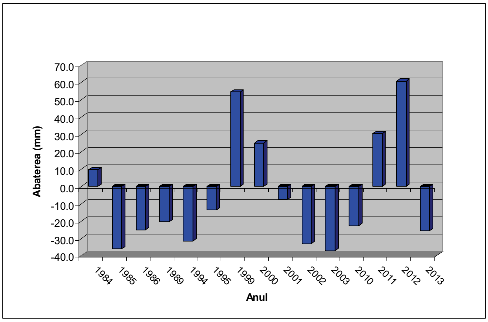

Figure 1. Diference between rainfalls registered in April (decade III)-May (decade I-II) and multiyear average, at NARDI Fundulea

In this climatic conditions, the attack of *T. dilaticollis* on maize untreated plants, at NARDI Fundulea, on a scale from 1 to 9, was 5.15 in 2010, 5.80 in 2011, 6.69 in 2012 and 6.25 in 2013 while saved plants percent, varied between 64.75 % in 2012 and 82.5 % in 2010.

Historical data from NARDI Fundulea show that higher attack values of maize leaf weevil occurs in case of low rainfall amount level while lower values of the attack occur in case of high rainfalls amount (Paulian, 1972; Vasilescu et al., 2005; Popov et al., 2006). However, if we compare data from last years (2010-2013) with historical data we don't find similar correlations (Figure 2). Thus, attack values at maize untreated plants are higher in 2012, even if rainfalls level is with 60.8 mm over multiyear average (Table 1).

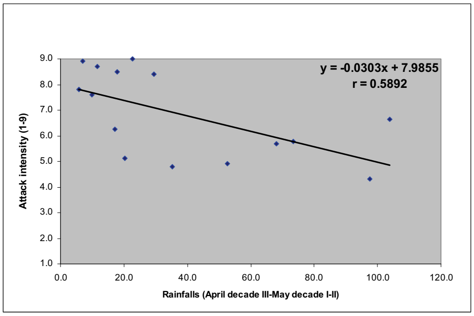

Figure 2. Relation between rainfalls level from spring and T. dilaticollis attack intensity at maize untreated plants at NARDI Fundulea (period 1984-2013)

Analysing data from table 7, it has ascertained that, in spring period of 2012, between 21 April and 8 May it has registered 2,6 mm of rainfalls, and 11 days without any rainfall. In the same time, data from tables 4-6 show that in third decade of April and first decade of May, average air temperature, were over the multiyear average. These climatic conditions were favourable for maize leaf weevil (*T. dilaticollis*) attack at plants emerged from untreated seeds. In spring period of 2012, rainfall amount occurred in second decade of May were higher comparative with multiyear average. But, from total rainfalls amount occurred in second decade of May (Table 7), 52,7 mm were registered only in one day, at the end of the decade (19 May), which represent 66,8 % from total decade amount. That means in May 2012, we have drought conditions at the beginning of the month followed by days with high rainfall level. Analysing data from other years taken in study, it has ascertained that in last decade of April, rainfalls level are below multiyear average (Figure 3). In first decade of May, registered rainfalls are bellow multiyear average, except year 2011. In second decade of May, rainfalls registered are below multiyear average in 2010 and 2013. In last years, in period April (third decade)-May (decades I-II), when maize plants are most susceptible for *T. dilaticollis* attack, it has registered long periods without rains or low level of precipitations.

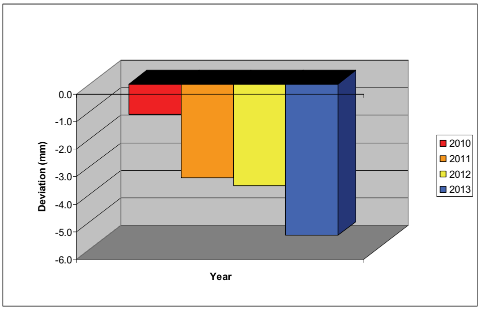

Figure 3. Diferences between rainfalls registered in third decade of April and multiyear average, at NARDI Fundulea (2010-2013)

Regard as air temperature evolution, in first vegetation stages of the maize plants, data from Tables 4-6 show that in 2010 the temperatures were over multiyear average. In 2012 and 2013, average temperature values from period April (decade III)-May (decade I-II) were with 4.0°C respectively 4.7°C over multiyear average. Higher air temperatures comparative with multiyear average in last decade of April and first decade of May and rainfalls amount registered in similar period, bellow multiyear average has result increasing of the maize leaf weevil attack (*T. dilaticollis*) on maize plants emerged from untreated seeds.

Rainfall evolution from spring period at NARDI Fundulea is not similar with some climatic models (Bozo, 2011) that show a decreasing trend in this period, but seems that rainfall distribution can favoured insect attack, even in the years with rainfalls amount over multiyear average. At similar conclusion arrive other authors (Olesen et al., 2011).

In case of maize plants emerged from seeds treated with Poncho 600 FS (clothianidin active ingredient) and Cruiser 350 FS (thiametoxan active ingredient), *T. dilaticollis* attack have low values, bellow 2.60 on a scale from 1 to 9.

Table 1. Influence of the rainfalls from spring concerning the attack of the *T. dilaticollis* on maize plants emerged from untreated seeds, at NARDI Fundulea

Year	**Attack intensity (1-9)**	**Saved plants percent (%)**	**April**	**May**		**Total (mm)**	**Multiyear average (mm)**	**Deviation (mm)**
			Decade III	Decade I	Decade II			
2010	5.15	82.50	4.4	2.6	13.3	20.3	**43.0**	**-22.7**
2011	5.80	76.00	2.1	48.4	23.0	73.5		**+30.5**
2012	6.69	64.75	1.8	14.2	87.8	103.8		**+60.8**
2013	6.25	77.50	0	5.8	11.4	17.2		**-25.8**

Table 2. Influence of the rainfalls from spring concerning the attack of the *T. dilaticollis* on maize plants emerged from seeds treated with Poncho 600 FS, at NARDI Fundulea

Year	**Attack intensity (1-9)**	**Saved plants percent (%)**	**April**	**May**		**Total (mm)**	**Multiyear average (mm)**	**Deviation (mm)**
			Decade III	Decade I	Decade II			
2010	2.41	98.50	4.4	2.6	13.3	20.3	**43.0**	**-22.7**
2011	2.39	99.00	2.1	48.4	23.0	73.5		**+30.5**
2012	2.45	96.25	1.8	14.2	87.8	103.8		**+60.8**
2013	2.53	98.75	0	5.8	11.4	17.2		**-25.8**

Table 3. Influence of the rainfalls from spring concerning the attack of the *T. dilaticollis* on maize plants emerged from seeds treated with Cruiser 350 FS, at NARDI Fundulea

Year	**Attack intensity (1-9)**	**Saved plants percent (%)**	**April**	**May**		**Total (mm)**	**Multiyear average (mm)**	**Deviation (mm)**
			Decade III	Decade I	Decade II			
2010	2.35	98.75	4.4	2.6	13.3	20.3	**43.0**	**-22.7**
2011	2.30	99.50	2.1	48.4	23.0	73.5		**+30.5**
2012	2.39	98.50	1.8	14.2	87.8	103.8		**+60.8**
2013	2.40	99.25	0	5.8	11.4	17.2		**-25.8**

Table 4. Influence of the air temperatures from spring concerning the attack of the *T. dilaticollis* on maize plants emerged from untreated seeds, at NARDI Fundulea

Year	**Attack intensity (1-9)**	**Saved plants percent (%)**	**April**	**May**		**Average T (°C)**	**Multiyear average (°C)**	**Deviation (°C)**
			Decade III	Decade I	Decade II			
2010	5.15	82.50	13.4	15.9	16.4	15.2	**14.2**	**+1.0**
2011	5.80	76.00	12.2	11.8	17.1	13.7		**-0.5**
2012	6.69	64.75	17.4	16.6	20.8	18.3		**+4.0**
2013	6.25	77.50	18.1	19.3	19.4	18.9		**+4.7**

Table 5. Influence of the air temperatures from spring concerning the attack of the *T. dilaticollis* on maize emerged from seeds treated with Poncho 600 FS, at NARDI Fundulea

Year	**Attack intensity (1-9)**	**Saved plants percent (%)**	**April**	**May**		**Average T (°C)**	**Multiyear average (°C)**	**Deviation (°C)**
			Decade III	Decade I	Decade II			
2010	2.41	98.50	13.4	15.9	16.4	15.2	**14.2**	**+1.0**
2011	2.39	99.00	12.2	11.8	17.1	13.7		**-0.5**
2012	2.45	96.25	17.4	16.6	20.8	18.3		**+4.0**
2013	2.53	98.75	18.1	19.3	19.4	18.9		**+4.7**

Table 6. Influence of the air temperatures from spring concerning the attack of the *T. dilaticollis* on maize emerged from seeds treated with Cruiser 350 FS, at NARDI Fundulea

Year	**Attack intensity (1-9)**	**Saved plants percent (%)**	**April**	**May**		**Average T (°C)**	**Multiyear average (°C)**	**Deviation (°C)**
			Decade III	Decade I	Decade II			
2010	2.35	98.75	13.4	15.9	16.4	15.2	**14.2**	**+1.0**
2011	2.30	99.50	12.2	11.8	17.1	13.7		**-0.5**
2012	2.39	98.50	17.4	16.6	20.8	18.3		**+4.0**
2013	2.40	99.25	18.1	19.3	19.4	18.9		**+4.7**

Table 7. Daily rainfalls amount registered in period April (third decade)—May (decades I-II), versus the monthly means, at NARDI Fundulea, between 2010 and 2013 multiyear average

Day/Year	**April (decade III)**				**Day/Year**	**May (decade I)**				**Day/Year**	**May (decade II)**			
	2010	**2011**	**2012**	**2013**		**2010**	**2011**	**2012**	**2013**		**2010**	**2011**	**2012**	**2013**
21	4.4				1					11		0.1		
22					2		1.5			12	0.2	6.5		
23					3		5.1			13	6.6		0.0	0.0
24					4		7.5		5.0	14	1.5	0.1		9.2
25					5		6.2		0.8	15	2.9		13.7	2.0
26			1.8		6		0.2			16	0.3	1.2		0.2
27					7	0.8				17	0.3	3.6	10.0	
28		0.9			8	1.0	17.3	0.8		18	0.0		2.5	
29		0.0			9	1.3	9.3	7.4		19	1.5	11.5	52.7	
30		1.2			10	0.4	1.3	6.0		20	0.0			
Average (mm)	4.4	2.1	1.8	0.0	**Average (mm)**	3.5	48.4	14.2	5.8	**Average (mm)**	10.4	23.0	78.9	11.4
Multiyear average	5.5	5.5	5.5	5.5	**Multiyear average**	17.5	17.5	17.5	13.1	**Multiyear average**	20.0	20.0	20.0	20.0
Deviation (mm)	**-1.1**	**-3.4**	**-3.7**	**-5.5**	**Deviation (mm)**	**-14.0**	**+30.9**	**-3.3**	**-7.3**	**Deviation (mm)**	**-9.6**	**+3.0**	**+58.9**	**-8.6**

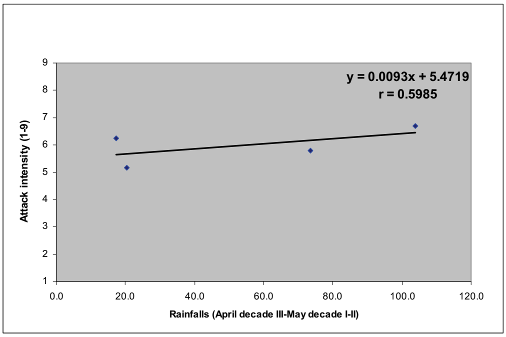

Figure 4. Relation between rainfalls level from spring and *T. dilaticollis* attack intensity at maize untreated plants at NARDI Fundulea (period 2010-2013)

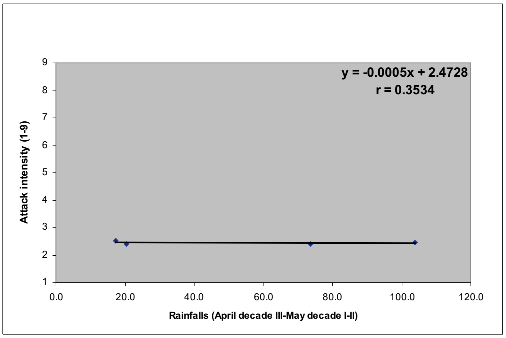

Figure 5. Relation between rainfalls level from spring and *T. dilaticollis* attack intensity at maize treated with Poncho 600 FS at NARDI Fundulea (period 2010-2013)

From Tables 1-6, it has ascertained that between 2010 and 2013, in different climatic conditions from spring period (April, decade III-May, decades I-II), at NARDI Fundulea, saved plants percent were equal or higher the 96.25%, and differences from one year to another have low values (Figures 4-6).

The results concerning influence of the seeds treatment concerning maize leaf weevil (*T. dilaticollis*) attack are similar with those obtained by Barbulescu et al. (2001), Vasilescu et al. (2005), Krusteva et al. (2006), Keszthelyi et al. (2008), Čamprag (2011).

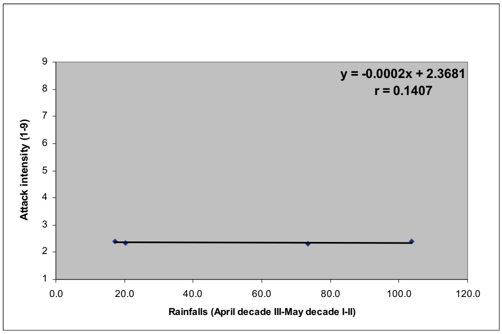

Figure 6. Relation between rainfalls level from spring and *T. dilaticollis* attack intensity at maize treated with Cruiser 350 FS at NARDI Fundulea (period 2010-2013)

CONCLUSIONS

Climatic conditions from spring period, April (decade III)-May (decades I-II) seems to favoured xerothermophilous pests such as *T. dilaticollis*. Even if total rainfall amount registered in this period can be higher then multiyear average, like in 2012, rainfall distribution and high values of the air temperature can favour this pest. In same month we can have periods with draught (more then 10 days without rain) and high air temperatures values followed by days with heavy rainfalls and moderate air temperatures.

In case of maize plants emerged from untreated seeds, more then 35% of plants can by destroyed by *T. dilaticollis* attack.

In a wide range of climatic conditions from spring period, seed treatment is one of the most effective method for controlling maize leaf weevil attack.

Further studies concerning the impact of the climatic changes on *T. dilaticollis* evolution are necessary.

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