

**THE INFLUENCE OF ECOLOGICAL FACTORS FROM NORTH-  
WESTERN PART OF ROMANIA ON *DIABROTICA VIRGIFERA*  
*VIRGIFERA LE CONTE* (WESTERN ROOT CORN WORM)  
SPECIES**

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**Abstract**

*Western corn root worm (Diabrotica virgifera virgifera Le Conte) over 10 years since its occurrence in Romania it is considered at this hour an very important pest for the maize which produce economical damage at regional level. Increasing of pest adults population year by year can be evaluated through a monitoring system. This paper presents the results regarding of pest evolution in correlation with main ecological factors between 2009-2011 at Agricultural Research and Development Station Oradea. The frequency of adults was varied depending on the year of sowing and the ecological condition. The maximum number of captures were between 175 and 223 adults / trap/day registered in the first decade of July with an average between 28,5 and 30,51 but with a large variability. Analysis of correlations between daily dynamics of adults and ecological factor show significant positive correlation with air temperature and soil temperature and negative correlation with air humidity. Significant and positive correlation were registered with quantity of rainfalls in 2009 and 2010 and weak signification were registered in 21011 when rainfalls from July were over multiannual average. In conclusion we can notice that when rainfalls and humidity are high, the number of adults decrease because they are favored by an high air temperature and short rainfalls.*

**Key words:** western corn root worm, monitoring, adult, correlation, ecological factors.

**INTRODUCTION**

A large spread area of *Diabrotica virgifera virgifera Le Conte* species in Romania in a short time (since 1996) is an indicator of this species invasive potential and the fact that repeated crops with maize and favorable ecological condition are directly responsible for spreading this pest.

The extended surfaces with maize monoculture and crops with maize cultivated year by year, favorable climatic condition and a faulty control system are the main responsible factors for the growth and spreading of *Diabrotica virgifera virgifera Le Conte*.

Forecast for optimal development of *Diabrotica virgifera virgifera Le Conte* is not easy to estimate because all stages, except the adults, develop in the soil.

Data regarding the appearance of larvae and adults are directly correlated with ecological factors, with different temperature and not

necessary with maize plants phenology (Roșca I., 2008). The adult's flight and the biological cycle are also influenced by the climatic factors.

The adults are present in the maize crops in our country from the first decade of July to the end of September (Grozea I., 2002; Pălăgeșiu I. et al., 2001) but they could appear from the end of June (Anička J. Galo, 2002; Krnjajic S., 1995 ) till the end of September. Adults' longevity is influenced by the length of day light and quality of food.

In this paper we propose to approach the research related to pest biology (biological cycle, the annual flight, daily dynamics of flight) to establish the influence of environmental factors on the adults' development in order to obtain an integrated control.

## **MATERIAL AND METHODS**

*Diabrotica virgifera virgifera Le Conte* experienced remarkable expansion in the North – Western part of Romania beginning with the first occurrence in 1998 and had permanent development in many new areas.

At Agricultural Research and Development Station Oradea the pest was signaled for the first time in 2000. The researches regarded the annual flight of adults and the daily dynamics of flight depending on climatic factors; thus, Atravirg traps with sexual pheromones (from the Chemical Institute Cluj-Napoca) were used and installed in the fields with maize monoculture, in sunflower and soybean field (sown after maize). Two traps situated at 50 m distance were installed in every field since the middle of June. The numbers of adults were daily registered and also the climatic conditions were registered every day at the Meteorological Station in Oradea situated at 1,000 m from the experimental fields.

## **RESULTS AND DISCUSSION**

The monitoring of *Diabrotica virgifera virgifera Le Conte* species using pheromone traps showed an increasing of pest population year by year in the regions where the traps were used and the adaptability of this species is confirmed by the new infested areas.

Maize is the favorite food for adults (pollen, silk, young cobs, leaves ) but also they can eat other plants which can assure their food (sunflower pollen, soybean, pumpkin, etc.).

Adult's emergence date is correlated with the environmental factors with different level of temperature and it is not necessary correlated with maize plants phenology. The adults' flight (biological cycle) is influenced by the abiotic factors like climatic factors. In the monitoring period (2009-2011) first adults were registered in the sunflower fields (after maize) beginning with 19-25 June with an average of adults flight of about 32 days,

in maize fields (monoculture) from 22 June to 1 July with an average of 83 days; in soybean field it was registered an average of adults flight of about 156 days beginning with 2-8 August, respectively 15 days (Table 1).

Table 1

Number of adults captured on traps with sexual pheromones (AtraVirg) between 2009-2011

Culture	2009	2010	2011	Time of flight (days)		
				2009	2010	2011
Maize	2807	2674	1938	92	92	65
Sunflower	87	233	1007	28	31	38
Soybean	92	101	166	12	17	15

The higher number of adults was registered in maize monoculture in July with values between 1293 and 1673, with an average of about 41.7 and 53.9 adults/day compared with August when the values were 16.2-29.4 and in September with values of 8.23-8.25 adults/day (Fig.1).

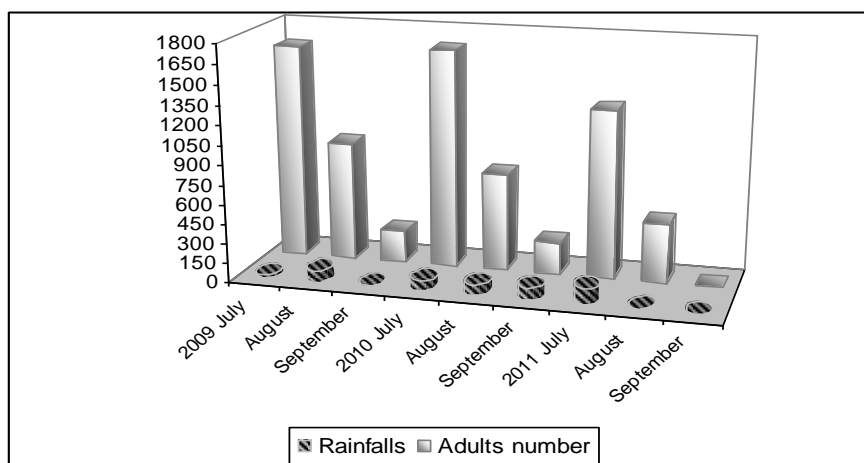


Fig. 1. Number of adults captured (July - September) in correlation with monthly rainfalls registered since 2009-2011

Statistical analysis of registered dates show that the maximum number of adults register values between 159 to 223 in the first decade of July with an average of adults number between 28.5 and 30.51 and a large variability between 95.64-124.55% (Table 2).

Table 2

Statistical analysis of data recorded (adults/trap) at Oradea between 2009-2011

Specification	2009	2010	2011
<b>Total number of adults</b>	2807	2674	1938
<b>Daily number of flight</b>	92	92	65
<b>Minimum value</b>	3	2	2
<b>Maximum value</b>	159	223	175
<b>Average (<math>\bar{x}</math>)</b>	30,51	29,06	28,5
<b>Standard deviation (s)</b>	29,18	36,19	30,76
<b>Index of variability (s%)</b>	95,64	124,55	107,93
<b>Average standard deviation (<math>s\bar{x}</math>)</b>	3,04	3,77	5,55
<b>Difference standard deviation (sd)</b>	4,30	5,34	5,39

The analysis of ecological factors on daily captures of adults denoted that in the period between 2009 and 2011 significant correlations were registered in relation with air temperature average, which had constant high values leading to an increase in the adults' number. The rainfalls in July 2011 (125.6 mm) caused the decrease of temperature and, indirectly, the decrease of the number of adults captured on traps. A significant and positive correlation was registered, also depending on soil temperature (at 10 cm depth).

Following the evolution of adults' number in relation with air humidity and quantity of rainfalls one can notice a decrease of adults' number when humidity and rainfalls are high as well as a positive correlation compared with rainfalls in 2009 and 2010, the correlation being insignificant compared to the humidity (Table 3).

Table 3

Regression equation of daily mean registration of adults in correlation with climatic factors

Specification	2009	2010	2011
Average of air temperature T°C	$y = -24.331 + 2.6985x$ $R^2 = 0.1885^{**}$	$y = -12.944 + 2.1259x$ $R^2 = 0.0661^*$	$y = -50.781 + 0.6458x$ $R^2 = 0.1724^*$
Average of soil temperature T°C	$y = -40.738 + 3.0599x$ $R^2 = -0.0871^{**}$	$y = -18.299 + 2.1876x$ $R^2 = 0.0602^*$	$y = 54.811 - 1.1406x$ $R^2 = 0.0628^*$
Humidity U%	$y = -3.1094 + 0.5863x$ $R^2 = 0.042$	$y = -114.74 - 1.1445x$ $R^2 = 0.039$	$y = 40.244 - 0.177x$ $R^2 = 0.045$
Precipitations (mm)	$y = 67.452 - 0.7944x$ $R^2 = 0.5286^{**}$	$y = 68.236 - 0.8424x$ $R^2 = 0.36862^{**}$	$y = 34.069 - 0.4244x$ $R^2 = 0.0165$

When analyzing the flight dynamics of adults compared with ecological factors registered, it was noticed that the adults' flight is favored by days with high temperature in correlation with low quantity and very short rainfalls. After high quantity of rainfalls and low temperature, the number of adults is decreasing in the maize field. After the occurrence of adults it is noticed that the maximum level of flight was registered at the end

of first decade of July followed by the second level in the first decade of August (Fig. 2, Fig.3, Fig. 4).

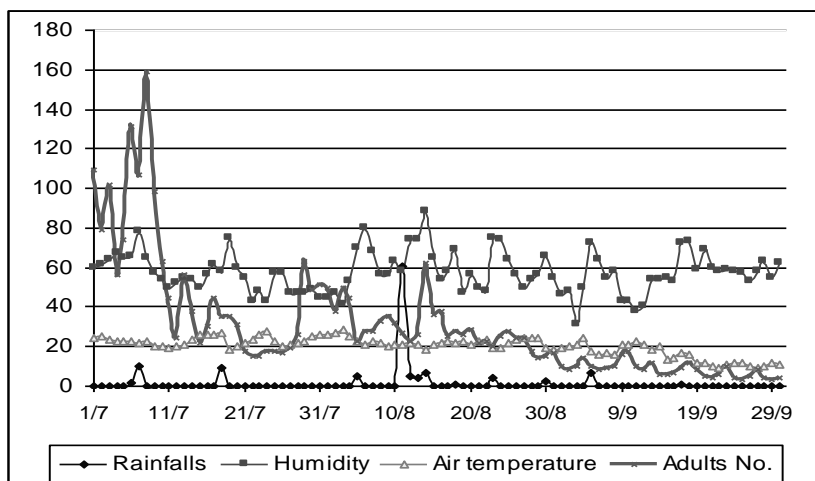


Fig. 2. Daily evolution of *Diabrotica virgifera virgifera* Le Conte in correlation with ecological conditions, Oradea 2009

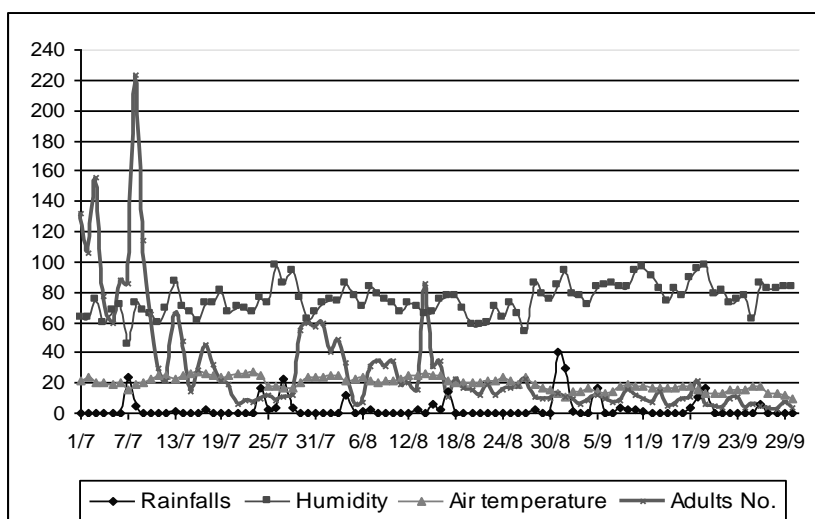


Fig. 3. Daily evolution of *Diabrotica virgifera virgifera* Le Conte in correlation with ecological conditions, Oradea 2010

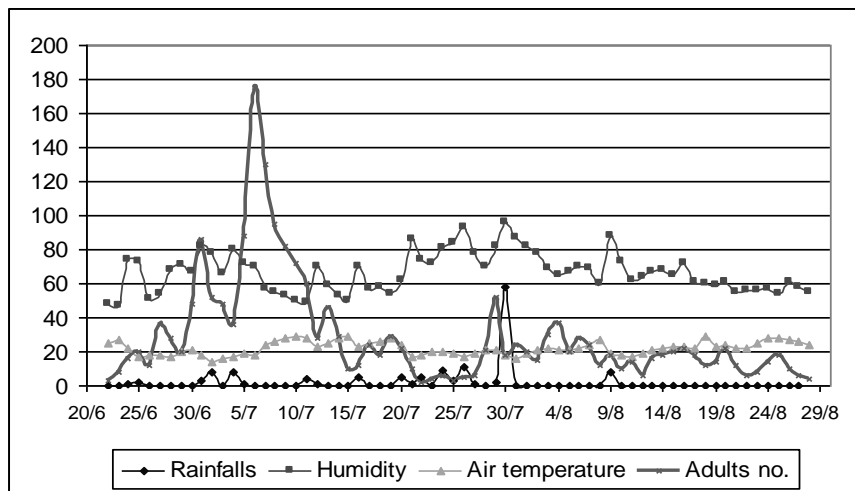


Fig. 4. Daily evolution of *Diabrotica virgifera virgifera* Le Conte in correlation with ecological conditions, Oradea 2011

In July and August the captures registered were higher, revealing a maximum flight, air and soil temperature increasing with high values and determined an increase in adults number. Rainfalls (over 50 mm) determined a decrease of temperature and number of adults captured. The correlation of pest with ecological factors are essential for an optimum integrated control management of pest. Also using pheromone traps for the monitoring of western corn root worm plays a role in estimating the population level and determining the time of application of chemical treatments for an integrated management control.

## CONCLUSIONS

Daily dynamics of *Diabrotica virgifera virgifera* Le Conte adults varied in the studied period, being in correlation with specific ecological conditions.

The descriptive analysis of daily registration of adults reveals minimum and maximum values, average and standard deviation of registered captures and a broad variability of this registration.

The analysis of ecological factors registers positive and significant correlation between daily number of captured adults and the average of air and soil temperature; yet, it does not register significant correlation between daily number of adults captured and the average of air and soil temperature and air humidity.

In 2009 and 2010 positive correlation with rainfalls quantity was obtained. Significant correlation was registered in July 2011 because of the

rainfalls quantity, which exceeded the multiannual average factors that lead to a decrease in the number of adults.

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