

DEVELOPMENT OF PARTIAL MAPS OF WCR SPREADING IN ACCORDANCE WITH ENVIRONMENTAL FACTORS

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Abstract: *Western corn rootworm (WCR, Diabrotica virgifera virgifera Le Conte) are serious economic pest of maize (Zea mais L) in U.S. and an important invasive insect for European maize cultures. The actual situation in Romania showed a continuous extension of the WCR from west part to east part of country. In 1996 the insect was signaled for the first time in Nadlac locality from Arad County. In 1997 the Diabrotica virgifera virgifera Le Conte adults was very frequent along the border with Yugoslavia, but it also registered in the area near to Hungary. In 1998 the pests has begin to spread especially in Timis County. After, 2000 the Diabrotica population heaves increased strongly year by year until now, occupying news zones from Romania. For counties from west part of country, the invasive species are become very damaging, so we tried by means this paper to develop some partial maps of spreading in accordance with environmental factors. Following the statistically data it can be observed positive correlations between daily no of adults and environmental factor. The spreading maps were realized taking in consideration the number of individuals/location. We establish groups of frequency (low, middle and high level) marked with different colors. Groups: low level 600-5000 individuals/locality (600-1000 ad., 1100-1500 ad., 1600-2000 ad., 2100-2500 ad., 2600-3000), (3100-3500 ad., 3600-4000 ad., 4100 – 4500 ad., 4600-5000 ad., middle level 6100 – 10500 individuals/locality (6100-6500 ad., 6500-6550 ad.) and high level (10500 – 11000 ad., 11500-12000 ad., 14500 – 15000 ad., 18500-19000 ad., 21100 – 21500ad.). The maps of spreading shown a high level for Timis and Arad counties; middle level for Bihor county and low level for Caras Severin, Cluj Satu Mare and Salaj counties. We acknowledge a technical support of all farmers from different localities who have provided us the maize fields. The Ministry Education financed this work within the framework of PN-II-ID-PCE-2007-1/RO project.*

Key words: *WCR, Diabrotica virgifera virgifera Le Conte, adult, spreading, maps, maize.*

INTRODUCTION

Maize (*Zea mays L.*), the world's third leading cereal crop following wheat and rice, is grown commercially in over 25 countries. Maize yields are negatively impacted by a number of insect pests. One of the pernicious in USA is the corn rootworm (PERSHING et al., 2004). In the past years Western corn rootworm (WCR) (*Diabrotica virgifera virgifera*, Le Conte 1868), originating from North America has spectacularly quickly spread in various countries of the European Union (EKE et al., 2004, BERGER, 1997). The corn is growing annual approximately on 3 million ha in Romania and about 35% is cultivated in the infested district. For this reason the pest western corn rootworm (*Diabrotica virgifera virgifera Le Conte*) present a danger for Romanian corn production and its monitoring was carried out since the first occurrence (1996) until now (VONICA, 1998, CEAN, 2005, GROZEA 2009).

Population density of *Diabrotica virgifera virgifera* dramatically fluctuates since 1992 when it was discovered in localized outbreak area (SIVCEV and STANKOVIC, 2004).

In according to European Commission Decision of 24 October 2003 on emergency measures to prevent the spread within the Community of D.v.v member states shall each year conduct official surveys for the presence of the organism areas in their territory, where maize is grow (2003/766/EC). Taking into consideration those mentioned before many European

countries beginning or continued their monitoring activities. In 2002, some specialists tried to get a clear picture of the relation between the potential distributions of *D. virgifera* and climatologically conditions. This means weighing of species parameters related to climate, such temperature or moisture. The resulting distribution maps should reflect the potentialities of the species in the northwestern European climate, and particularly in the Netherlands (STIGTER and De BOER, 2002). Having in mind some testing in this domain we try to realize the partial spreading maps in infested areas from Romania and estimate the real level populations, by using groups of frequency established by us.

MATERIAL AND METHODS

Research locations

In 2009 the research location were established on 8 counties of western half of Romania: Timis, Arad, Bihor, Caras Severin, Cluj, Satu Mare, Salaj and Hunedoara. In each county we installed traps in follow localities: Timișoara, Gataia, Simand, Covasant, Chelmac, Soimi, Gura Văii, Gurasada, Nusfalau, Varfurile, Prisaca, Resita, Teregova, Domasnea, Negreni and Valisoara.

Type of traps

For these kind of studies we used the pheromone traps (type of Csalomon®), of Hungarian provenance. The traps (three traps/localities) were placed in middle part of the field, to a distance of 50 or 100 m, beginning to end of June. Their replacements were made each two weeks, depending on weather conditions, between months June until September. The captures were reading daily.

Movement

For movement we used the car of Entomology and Agricultural Zoology department and for determination of altitude we used a GPS apparatus.



Figure 1 Aspects of trap reading on Resita locality



Figure 2 Change traps once every two weeks

Groups of frequency

We establish groups of frequency (low, middle and high level) marked with different colors. Groups:

1. **low level** 600-5000 individuals/locality (600-1000 ad., 1100-1500 ad., 1600-2000 ad., 2100-2500 ad., 2600-3000 ad.), (3100-3500 ad., 3600-4000 ad., 4100 – 4500 ad. , 4600-5000 ad.)
2. **middle level** 6100 – 10500 individuals/locality (6100-6500 ad., 6500-6550 ad.)
3. **high level** 10500- 21500 individuals/locality (10500 – 11000 ad., 11500-12000 ad., 14500 – 15000 ad., 18500-19000 ad. , 21100 – 21500 ad.).

RESULTS AND DISCUSSIONS

In most of cases, following the statistically data it can be observed positive correlations between daily no of *Diabrotica virgifera virgifera* adults and environmental factor (mean air temperature, mean soil temperature and relative humidity of air).

In two localities positive correlations were established between number of captured individuals and air temperature, so in Simand (0.52) and Domasnea (0.50) (table 1).

Results show some positive correlations between soil temperature and captures in pheromone traps, too. This kind of correlative was observed after analyzing data in Domasnea (0.62) and Resita (0.51) (table 1). Regarding this factor we can observe negative correlations (-0.50) compared with number of captures/traps/locality (Soimi, Prisaca and Budureasa).

The relative humidity of air is an important environmental factor that could have a negative or positive influence on *Diabrotica virgifera virgifera* populations. So, positive correlations (0.62) were registered between air humidity and number of captures in Soimi, Prisaca and Budureasa. Negative correlations were established in Domasnea (-0.55) (table 1).

The other environmental (climatical) factors taking in consideration showed no significant correlations compared to number of individuals captured on traps.

Table 1

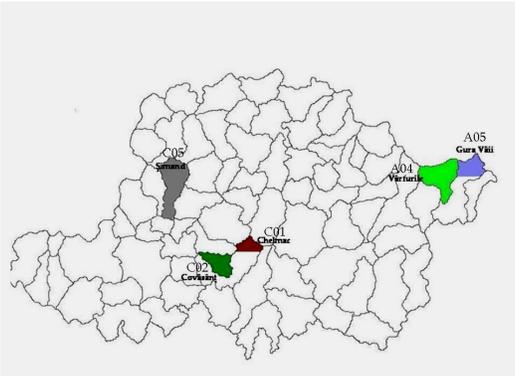
Correlations established between the average number of captures per day and climatic factors

Mean adults number/place	Mean air temperature	Mean soil temperature	Relative air humidity	Average rainfall
Value/Gataia	-0.02	0.36	-0.29	-0.21
Value/Timisoara	-0.05	0.37	-0.26	-0.20
Value/Domasnea	0.50	0.62	-0.55	-0.28
Value/Teregova	0.40	0.46	-0.30	-0.25
Value/Resita	0.24	0.51	-0.47	-0.32
Value /Chelmac	0.48	-	-0.28	-0.20
Value /Covasant	0.43	-	-0.31	-0.21
Value /Simand	0.52	-	-0.31	-0.26
Value /Varfurile	-0.21	-0.39	0.46	-0.16
Value /Gura Vaii	-0.21	-0.39	0.45	-0.27
Value /Soimi	-0.38	-0.50	0.62	-0.23
Value /Budureasa	-0.38	-0.50	0.62	-0.30
Value /Prisaca	-0.38	-0.50	0.62	-0.31
Value /Gurasada	-0.17	-0.36	0.36	0.02
Value /Valisoara	-0.17	-0.36	0.36	0.17
Value /Negreni	0.29	-	-0.15	-0.16
Value /Nusfalau	0.40	-	-0.19	0.03
Value /Blaja	0.41	-	-0.42	-0.24

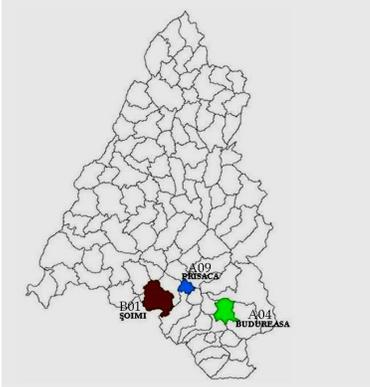
For a better view of *Diabrotica virgifera virgifera* species in different geographical areas achieved partial maps can be seen in the climatic conditions of observation points located at different altitudes (figure1-spreading maps).

The maps of spreading showed a high level for Timis and Arad counties; middle level for Bihor County and low level for Caras Severin, Cluj Satu Mare and Salaj counties.

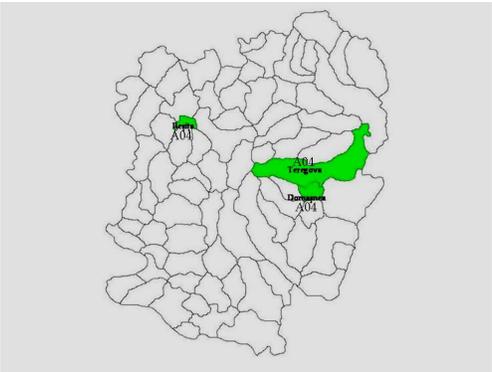
Partial spreading maps of WCR



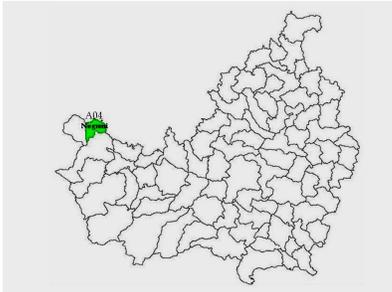
County Arad



County Bihor



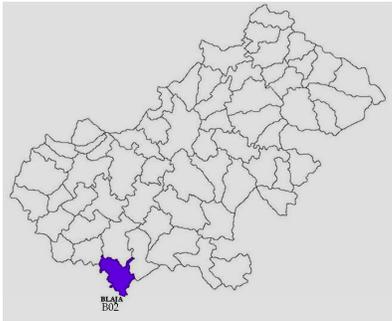
County Caraș Severin



County Cluj



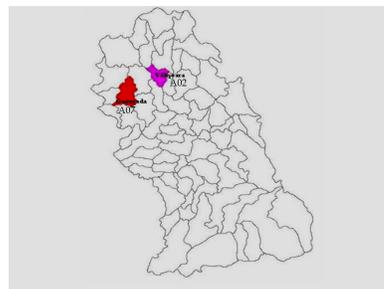
County Timiș



County Satu Mare



County Sălaj



County Hunedoara

 A01	600-1000-beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A02	1100-1500 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A03	1600-2000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A04	2100-2500 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A05	2600-3000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A06	3100-3500 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A07	3600-4000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A08	4100 – 4500 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 A09	4600-5000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 B01	6100 – 6500 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 B02	6500-6550 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 C01	10500 – 11000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 C02	11500-12000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 C03	14500 – 15000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 C04	18500-19000 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality
 C05	21100 - 21500 beetles of <i>Diabrotica virgifera virgifera</i> captured/locality

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CONCLUSIONS

The maps of spreading showed a high level for Timis and Arad counties; middle level for Bihor County and low level for Caras Severin, Cluj Satu Mare and Salaj counties.

Following the statistically data it can be observed, in generally, positive correlations between daily no of adults and environmental factor.

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