INVOLVEMENT OF THE PEST *OSTRINIA NUBILALIS* Hb IN THE AMPLIFICATION AND MOVEMENT OF THE PATHOGEN WITHIN THE PATHOSYSTEM

IMPLICAREA DĂUNĂTORULUI *OSTRINIA NUBILALIS* Hb, ÎN AMPLIFICAREA ŞI VEHICULAREA PATOGENULUI DIN PATOSISTEM

Dorin JURCA*, Gheorghe POPESCU

**Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara, Romania*
Corresponding author: jurca-dorin@yahoo.com

Abstract: The objective of this work was the establishment of the value implication of the European maize gimlet in the dissemination and amplification of the pathogen within the system (Fusarium roseum). Regarding the movement of the fungus Fusarium roseum in the conventional and transgenic maize fields, we may say that: - in **2008**, in the conventional maize, fusariosis movement was performed by wind (9.34%) and by the insect Ostrinia nubilalis, the Fusarium percentage of 41.93% belonging to this; - in the case of the Yield Gard maize, fusariosis was moved by wind, which spred the spores in the attack of 9.34%, a percentage that can be due to anemochoria (2008); - **in 2009**, in the case of the genetically modified maize (MON 810), the fusariosis was of anemochoric type and it was performed in an aggression mean of 7.7%, while in the conventional maize, it was performed with a plus of 23.9%, with the help of zoochoria, concretely due to the European maize gimlet; this expression refers to the attack mean of the four conventional maize hybrids – 31.6% and 7.7% - Yield Gard-type maize (MON 810) .

Rezumat *:Scopul acestei lucrări fost de a stabili implicarea valorică a sfredelitorului european al porumbului în diseminarea şi amplificarea patogenului din sistem (Fusarium roseum). Cu privire la vehicularea ciupercii Fusarium roseum în lanurile de porumb convenţional şi transgenic putem spune: - în **anul 2008**, la porumbul convenţional, vehicularea fuzariozei a fost făcută de vânt (9,34%) şi de insecta Ostrinia nubilalis, căreia îi revine procentul fuzarian de 41,93%; - în cazul porumbului Yield Gard, fuzarioza a fost vehiculată de vânt, care a răspândit sporii în realizarea atacului de 9,34, deci procent care se datorează anemochoriei (anul 2008); - în anul 2009, în cazul porumbului modificat genetic (MON 810) fuzarioza a fost de tip anemochor şi s-a realizat într-o medie a agresivităţii de 7,7%, pe când la porumbul convenţional a fost realizată cu un plus de 23,9%, prin intermediul zoochoriei, concret datorită sfredelitorului europan al porumbului (exprimarea se referă la media de atac per cei 4 hibrizi de porumb convenţional – 31,6% şi 7,7% - porumbul tip Yield gard (MON 810).*

Key words*: dissemination, conventional maize, YG maize, Ostrinia, Fusarium*
Key words: *diseminare, porumb convenţional, porumb YG, Ostrinia, Fusarium*

INTRODUCTION

Of all maize diseases, fusariosis is the most important one because of its spread in the crop areas and also because of the high-frequency attack, causing the most significant yield losses. It occurs during two distinct periods of the vegetation cycle in maize: from germination to the stage of 3-4 leaves and from flowering to maturity (ELENA NAGY, 2004).

Within pathosystems, there are specific interactions between pathogens and maize, but there are also interactions between pathosystems and insects or abiotic (climatic factors) and other biotic-type factors.

In their relationship with the pathosystems of the agricultural plants, insects are considered, for some of these plants, vectors of pathogen spreading, namely a zoochoric variant

that comes beside the other variants, like the anemochoric, pedochoric, hydrochoric, antropochoric one etc. About their role in maize pathosystems, the bibliographic information show that:

- in the case of the **pathosystem *Zea mays* L. - *Fusarium roseum f. cerealis* (Cke) Snyder and Hansen,** the *Fusarium*-infections are correlated with the attack caused by *Ostrinia nubilalis* and *Helicoverpa zeae* larvae; the attack of *Ostrinia nubilalis* larvae and the persence of moth leads to the increase of frequency and intensity of maize fusariosis, favouring the disease (VIORICA IACOB, E. ULEA, I. PUIU, 1998; VIORICA IACOB, 2003).

Regarding the movement of the fungus *Fusarium roseum* in maize crops, we may mention that the wind plays an important role in *Fusarium* spore spreading, a phenomenon known as anemochoria. The fusariosis movement involves insects, too. VIORICA IACOB, E. ULEA et al. (1998); I. OROIAN, V. FLORIAN et al. (2006) specify that this zoochoria is an hypothesis, but FLOAREA ADAM and GH. POPESCU (2008) proved it experimentally, in the case of the involvement of the new pest *Diabrotica virgifera virgifera le Conte* (IOANA GROZEA, 2006) in the epidemy and pandemy of maize fusariosis. The involvement of the European maize gimlet in the zoochoric fusariosis spreading, also as hypothesis, is mentioned by J.J. CHRISTENSEN, C.L. SCHNEIDER (1950); G.P. MUNKVOLD et al. (1999); C. P. MUNKVOLD, R. L. HELMICH, 2000; C. PAPST et al. (2005), etc.

MATERIALS AND METHOD

The researches were performed in Horia, on conventional maize hybrids (DKC 5783, DK 315, DKC 3511, DK 440, DKC 4626 and DKC 5143) and Yield Gard-type hybrids (DKC 3946YG, DKC 3512 YG, DKC 4442YG, MEB 438 BT, DKC 5018YG and DKC 5784YG).

These hybrids were studied under ***normal system*** and under ***refuge area system***.

The objective of the cultivation of a ***refuge area*** with conventional maize is to maintain a significant population of sensible insects.

The experimental data regarding the aggression and attack intensity of the parasites were recorded during the period June-September, in the case of the pest insect *Ostrinia nubilalis*, and during July-August, in the case of the system pathogen, namely *Fusarium roseum*. For these periods, we used the climatic data recorded at the Weather Station Arad.

Among the parasite features, we noted ***attack frequency*** or ***aggression*** (F%) (*Ostrinia nubilalis, Fusarium roseum*) expressed through parasitical or attack percentages, established according to the classic well-known method, and the ***attack intensity***, expressed through density mean (*Ostrinia nubilalis).* The limit differences of the hybrids were compared with the control variant (Mt) – DK 440 – in the case of the conventional maize and DKC 4442 YG, in the case of the genetically modified maize (MON 810).

RESULTS AND DISCUSSION

Fusarium anemochoria and zoochoria were studied by us, too, in the experiments with conventional maize cultivated in refuge area system near transgenic maize (MON 810) in Horia, Arad County.

In the case of the genetically modified maize, ***in 2008***, fusariosis, in terms of aggression, was reduced, having a mean per 4 hybrids of 9.34%. In the hybrids cultivated in the refuge area for maize gimlet, the mean per 4 conventional hybrids was a very high one, namely 51.27% (table 1). The Yield Gard maize (MON 810) was not attacked by the gimlet, due to the protein Cry 1 Ab specific to this pest. In this experience, fusariosis was moved by wind, which spred the spores in the achievement of the 9.34% attack, a percentage that can be due to anemochoria. In the conventional maize, fusariosis movement was carried out by wind (9.34%) and by the insect *Ostrinia nubilalis*, in a percentage of 41.93% (figure 1).

In ***2009***, the involvement of the pest *Ostrinia nubilalis* in the amplification and movement of the pathogen within the pathosystem *Zea mays - Fusarium roseum* took place as follows: in the case of the genetically modified (MON 810), fusariosis was of anemochoric type and was performed in an aggression mean of 7.7%, while in the conventional maize, it was performed with a plus of 23.9% (fig. 2), with the help of zoochoria, concretely due to the European maize gimlet (the expression refers to the attack mean per 4 conventional maize hybrids – 31.6% - table 1 and 7.7% - the Yield Gard-type maize (MON 810) – table 1, experimented in 2009).

Table 1

Mean attack aggression (F%) of the fungus *Fusarium roseum f. cerealis* (Cke) Snyder and Hansen, on the conventional and Yield Gard hybrids comprised in a comparative crop located in Horia, Arad County, during 2008-2009

No.	Hybrid	X -2008 conventional hybrids	X -2008 YG hybrids	X -2009 conventional hybrids	X -2009 YG hybrids
1	DK 315 - DKC 3946 YG	56.40	10.25	26.66	4.44
2	DK 440 - DKC 4442 YG (Mt.)	48.71	7.69	31.10	8.88
3	DKC 5018YG	55.33	11.08	31.1	6.66
4	DKC 5783 - DKC 5784 YG	44.44	8.33	37.77	11.10
X		51,27	9,34	31,66	7,7

CONCLUSIONS

Regarding the evolution of the system ***Zea mays - Fusarium roseum f. Cerealis (Cke.) Snyder and Hansen – Ostrinia nubilalis,*** with reference to the involvement and dissemination of fusariosis, we may draw the following conclusions:

- the Yield Gard maize (MON 810) gets involved in the reduction of the *Fusarium roseum* attack, between the limits of 36 and 46%; the mean attack reduction is 41% - ***in 2008***;
- the type of genetic reaction of the conventional maize is of sensibility to cob fusariosis, meaning that this germplasm misses the minor genes (polygenes) with horizontal genetic expression (polygenic) or the major ones (olygogenes) that govern the vertical resistance (oligogenic) ;
- the type of genetic reaction of the Yield Gard-type maize (MON 810) is of transgenic resistance to cob fusariosi and not of genetic resistance or euresistance ;
- movement, dissemination or spreading of fusariosis in the case of the transgenic maize (Yield Gard) is performed only by wind, so that it is of anemochoric type 9.34%, in 2008 and 7.7% in 2009 – means per the 4 hybrids ; the European gimlet cannot get involved because of the toxic protein Cry 1 Ab contented by maize and which is specific to this ;
- in the conventional maize crop, fusariosis movement is performed on the anemochoric way (7.7% - 9.3%), and on the zoochoric way, with the pest *Ostrinia nubilalis*, in percentages of 23.9 - 41.9% - ***2009***;
- the comparative analysis of the conventional maize and of the genetically modified one (MON 810), with the experimental results 2008-2009, in terms of ***aggression*** of the pathogen *Fusarium roseum* within the pathosystem, of the ***type of genetic reaction***, of the ***genic complementarity*** through which the infections occur, of the *Fusarium* prophylaxis and of pathogen dissemination in maize crops, represents a premiere.

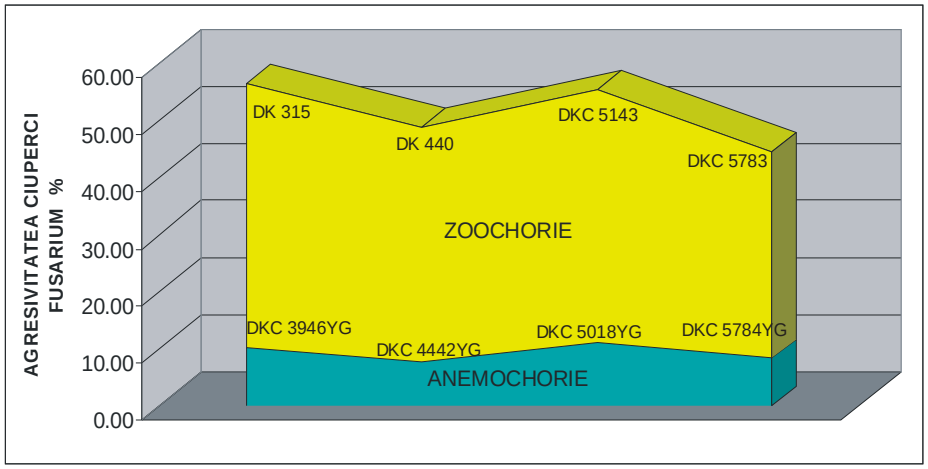

Figure 1 Movement of the fungus Fusarium roseum in the anemochoric and zoochoric achievement of infections in maize, in 2008

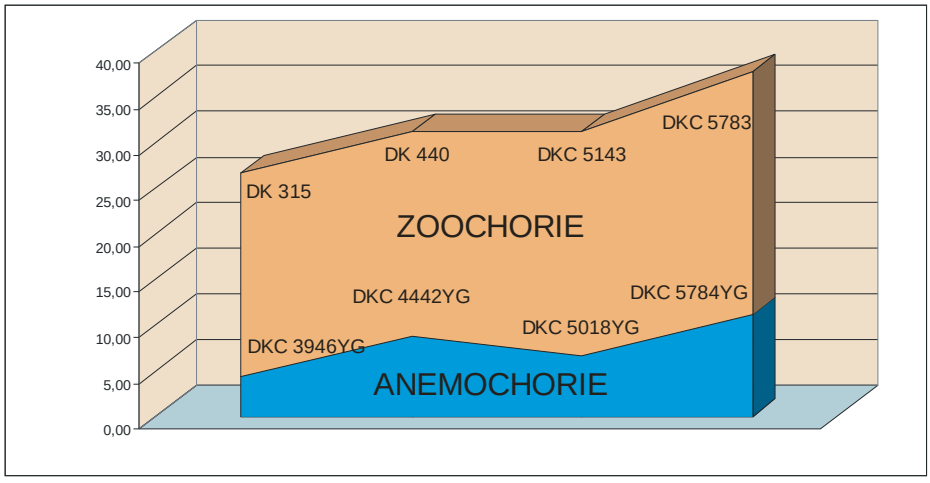

Figure 2 Movement of the fungus Fusarium roseum in the anemochoric and zoochoric achievement of infections in maize, in 2009

BIBLIOGRAPHY

1. ADAM FLOAREA, POPESCU GH., 2008- *Cercetării privind interacţiunea dintre patosistemele porumbului şi Diabrotica virgifera virgifera Le Conte (viermele vestic al rădăcinilor de porumb) în partea de vest a României*, Teza de doctorat,Ed. Mirton, 399p;
2. CHRISTENSEN J.J., SCHNEIDER C.L., 1950, *European corn borer (Pyraustra nubilalis) in relation to shank, stalk and ear rot of corn*, Phytophatology, 40: 533-537;
3 GROZEA IOANA, 2006, *Entomologie specială*, Ed. Mirton, Timişoara, 40-46;
4. IACOB VIORICA, ULEA E., PUIU I., 1998, *Fitopatologie agricolă*, Ed. Ion Ionescu de la Brad, Iaşi, 67-78;
5. IACOB VIORICA, 2003–*Fitopatologie*, Ed. Ion Ionescu de la Brad, Iaşi, 49-61;
6. MUNKVOLD G. P., HELLMICH R. L., RICE L. G., 1999, *Comparison on fusarium concentration in kernels of transgenetic Bt maize hybrids and non- transgenic hybrids*, Plant Diseases, 83:

130-138;
7. MUNKVOLD G. P., HELLMICH R.L., 2000, *Genetically modified, insect resistance maize implication for management of ear and stalk diseases*, Plant Health Progress , 1-8;
8. NAGY ELENA, 2004, *Bolile porumbului în monografia porumbului*, Vol. I, Ed. Academiei Române, 568-580;
9. OROIAN IOAN, FLORIAN VIOREL, HOLONEC LIVIU, 2006, *Atlas de fitopatologie*, Ed. Academiei Române, 86, 92;
10. PAPST C., UTZ H. F., MELCHINGER A. E., EDER J., MAGG T., KLEIN D., BOHN M., 2005, *Mycotoxin produced by Fusarium spp. In isogenic Bt vs. non Bt maize hybrids under European corn borer pressure*, Agronomy Journal, vol. 97, 219-22