COMMENTS ON THE MAIZE HYBRID STRENGTH TO DISEASES AND PESTS, IN SOUTHERN MUNTENIA REGION

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Abstract
The high temperature and precipitation alternation, which has increasingly been felt during the last decades, has led to the declining of harvests; this is why it is necessary to identify some cultivars or genetic hybrids offering a better strength or tolerance to pathogen agents and pest attack. Cultivation of resistant cultivars or hybrids is the most efficient and non-pollutant means of preventing plant diseases and pests, which is why their use in the integrated fighting schemes is required. Since a plant's strength does not last for long - as in the pathogen agent and pest population, in many cases, new virulent races may occur - we have carried out a study on the strength of 10 maize hybrids to pathogen agents and pests which limit production in Southern Muntenia region. Experiments were carried out and notes were taken in the experimental fields of C.T.S. Târgovişte, between 2009 and 2012. Ten maize hybrids of the average precocity group were monitored in the present study. The maize seed was treated against diseases and pests. Treatments against diseases and pests were not carried out, in order to notice the different strength of each hybrid. For the attack assessment, there were calculated - as indicators – the attack frequency and intensity.Out of the analysis of the results obtained during 4 years, we may notice that the EF 5209, KXA 9483 and NJ 5481 hybrids are sensitive to stalk and cob rot, fusarium ear blight -, all the other hybrids monitored during experiment are resistant to the common smut attack, whereas the NJ 5481 hybrid is sensitive to the attack of the maize boring pest.

Keywords: maize, hybrids, strength, deseases, pests

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1. INTRODUCTION

Maize is situated on the third place as importance in the world's crop (Muntean et al., 1995) because the grains of this plant are used in human diet, industry and animal feeding (Bîlteanu, 1998). Maize productivity, the same as with any other crop, is the result of the interaction between all the factors involved one way or the other in the vegetal production. For a better use of farm lands and of natural resources for maize, in order to reach a profitable production, a sensible setting of the areas for cultivated hybrids, depending on climate resources and biological needs of hybrids, is required (Rusu et al., 2006).

The researches approached regarding the improvement of the technologies for producing the maize seeds have been oriented towards the specific requirements for obtaining seeds of a varietal purity, high quality and sanitary condition indices, as well as the obtaining of a high production of seeds/ha so that the activity should be efficient (Sarca and Oprea, 2007).

Maize is a hosting plant for a relatively high number of pathogen agents - over 50 - which invade all the plant's organs from the germination moment up to harvest, and infections of kernels and cobs often continue during the storage of the harvest, as well. Pathogen agents contribute to the degradation and quantitative and qualitative diminution of the production, which on average on national level is of 20-25% (Nagy et al., 2009).

Out of these, a significant prejudice in Southern Muntenia region is caused by pathogen agents like *Ustilago maydis* (DC.) *Corda* and *Giberella zeae* (Schw.) Petch f.c. *Fusarium graminearum* Schw.

Economic losses from common smut can be significant if resistant hybrids are not used. For example, the incidence of infected plants was 6 to 18% with maize fields near Ames, Iowa and other occurrences of over 75% incidence of smut infection of open-pollinated cultivars

were reported occasionally prior to the development of hybrids (Pataky and Snetselaar, 2006). In Romania, this disease is present in all the maize cultivation zones, causing prejudices which amount to 2.5 - 5% (Severin et al., 2001).

Giberella zeae, is responsible for billions of dollars in economic losses worldwide each year (De Wolf et al., 2003). For preventing and fighting fusarium ear blight, in the context of the climate changes, strategies must also consider factors such as tillage regime, wheat cultivar (flowering time and disease resistance) and fungicide use, which also influence the severity of fusarium ear blight and related toxin production (West et. al., 2012).

European maize borer (*Ostrinia nubilalis* Hbn.) is also a pest that causes extensive damage to maize. Thus, in the USA, it is estimated that the total annual cost (control costs and yield losses) of O. nubilalis has exceeded $1 billion (Korycinska and Cannon, 2010). In northern Europe, losses of around 8% of yield are reported, but the damage varies from year to year. In Germany, some reports of yield loss are as high as 25% (Bohn et al., 1999).

2. MATERIALS AND METHODS

Experiments were carried out and notes were taken in the experimental fields of C.T.S. Târgovişte, between 2009 and 2012. Ten maize hybrids of the average precocity group were monitored in the present study.

The maize seed was treated against diseases and pests.

Treatments against diseases and pests were not carried out, in order to notice the different strength of each hybrid.

For the attack assessment, there were calculated - as indicators – the attack frequency and intensity. Attack frequency was calculated according to the following relation:

$$F\% = \frac{n}{N} \times 100$$

F = attack frequency;
n = number of attacked plants or organs;
N = total number of analyzed plants or organs.

For the attack intensity assessment, a scale from one to ten was used.

3. RESULTS AND DISCUSSION

From the perspective of the hybrid's behaviour to diseases and pests, at C.T.S. Târgovişte, we have assessed the attack frequency and intensity for common smut (caused by *Ustilago maydis* fungus), stalk and cob rot, fusarium ear blight (caused by *Gibberella zeae* f.c. *Fusarium graminearum* fungus) and borer maize (*Ostrinia nubilalis*).

As for the symptoms which the common smut causes, the disease occurs on all the plant aerial organs, sometimes even on roots. Tumours having a silver membrane on the outer side – whitish or grey in colour - appear on the attacked organs. At the beginning, the bag content is mucilaginous, then it turns into a wet brown-blackish mass, consisting of the fungus teliospores. When reaching maturity, the bags break, and teliospores are set free as blackish powders.

In case of fusarium ear blight, plants are attacked in all development stages, the disease occurring on roots, stalks and cobs. During or right after emergence, the plant's underground part is covered by a paste – which at the beginning is white-yellowish, then pink in colour – which consists of the fungus mycelium and conidia. In more advanced stages, within the medullar tissue there occur cavities lined by white or pink felt-like mycelium colonies, and, in some cases, the tissue is completely disintegrated, so that only the vascular fibres remain. The cobs are attacked during the milk-wax stage. The tissues are covered by a thick pink-ruby mould. The fungus-covered seeds are brown, dry or rotten.

Ostrinia nubilalis produces small orifices, which sometimes may have a linear disposition. As for the panicle, larvae eat stamina and punch the panicle's branches and peduncle, which break easily during the windy and rainy weather. Through the attack on the male inflorescence the pollination process is affected. The older larvae dig tunnels inside the stalk or inside the cob peduncle. On the

outside, on orifices, there usually occur flour clusters, white-yellowish-brownish in colour. Along the stalk we may notice one or more orifices, starting from the upper towards the determine a disturbance of the plant development, as well as a breaking of numerous stalks or cobs, which often leads to a kernel weakening, therefore, a production decrease. Stalk and cob breaking creates favourable fusarium ear blight conditions.

Thus, as we may notice in table 1, under the climatic conditions of the year 2009, all hybrids studied during the experiment show a high strength to the common smut attack.

In case of fusarium ear blight, we may notice a relative low strength at the hybrids EF 5209, EGZ 9505, KXA 7482, KXA 9483 and NJ 5481.

As for the maize borer, the CSM 7717 and NJ 5481 hybrids have appeared as particularly sensitive. We may also notice sensitivity to this pest for the F322 witness hybrid.

For the year 2010, the common smut attack could not be noticed, which proves a good strength of all hybrids to the *Ustilago maydis* fungus.

The EGZ 9501, EGZ 9505 and KXA 9483 hybrids have been noticed as sensitive to fusarium.

All the hybrids monitored during our experiment have shown a very good strength to the *Ostrinia nubilalis* attack, except for EF 5209, which has shown an attack frequency of 8% and an intensity corresponding to a grade of 5.

Table 1. The behavior of maize hybrids to diseases and pests between the years 2009 and 2012

Crt. no.	Disease/pest name	Fusarium ear blight (*Gibberella zeae*)								*Ostrinia nubilalis*								Common smut (*Ustilago maydis*)							
	Year / Hybrid	2009		2010		2011		2012		2009		2010		2011		2012		2009		2010		2011		2012	
		F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	0	0	0	0	0	0	1	1
1	FUNDULEA 322 (martor)	0	0	0	0	0	0	0	0	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	CSM 7717	0	0	0	0	0	0	0	0	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	CSM 7769	0	0	0	0	5	8	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	EF 5209	3	7	8	5	3	6	3	7	0	0	7	6	0	0	0	0	0	0	0	0	0	0	0	0
5	EGZ 8301	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	EGZ 9501	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	EGZ 9505	0	0	8	5	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0
8	KXA 7482	4	8	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0
9	KXA 8481	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	KXA 9483	3	8	8	5	0	0	3	7	0	0	0	0	0	0	1	6	1	1	0	0	0	0	1	1
11	NJ 5481	3	7	0	0	3	7	2	6	2	6	0	0	3	6	1	6	0	0	0	0	0	0	0	0

In the year 2011, the common smut was not present in any experiments, fusarium ear blight occurred on 4 hybrids (CSM 7769, EF 5209, KXA 8481 and NJ 5481), and the EGZ 9505, KXA 7482 and NJ 5481 hybrids appeared sensitive to the *Ostrinia nubilalis* attack.

Under the climatic conditions of the year 2012, we may notice that the EF 5209, KXA 9483 and NJ 5481 hybrids are sensitive to fusarium ear blight; the NJ 5481 hybrid is sensitive to the maize borer attack; the 10 hybrids monitored during our experiment are resistant to the common smut attack.

4. CONCLUSIONS

Under the climatic conditions of the Southern Muntenia region, the maize production may be limited by the stalk and cob rot – fusarium ear blight, the common smut and European maize borer.
As for the behaviour of the 10 maize hybrids to pest attack throughout the 4 years of study, we may notice that:

- the EF 5209, KXA 9483 and NJ 5481 hybrids are sensitive to the fusarium attack;
- the NJ 5481 hybrid is sensitive to the maize borer attack – *Ostrinia nubilalis*,;

the 10 hybrids studied during our experiment are resistant to the common smut attack.

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