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Research Article

A Study on Semi-Late Maize Hybrids for Resistance to Smut of Maize */Ustilago maydis/*

Iliana Ivanova*, Lyubomir Ivanov and Gergana Ivanova

Institute of Agriculture and Seed Science "Obraztsov Chiflik", Bulgaria

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***Corresponding author**

Iliana Ivanova, Institute of Agriculture and Seed Science "Obraztsov Chiflik", Bulgaria, Email: tri_dve@abv.bg

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Abstract

The most efficient method of controlling diseases of economic importance in agricultural crops is breeding of resistant varieties. The objective of the study was to determine the extent of the attack of smut of maize */Ustilago maydis/* on 22 hybrids and 4 maize standards under conditions, conducive to the spread of the pathogen.

The study was conducted in the experimental fields of the Institute of Agriculture and Seed Science "Obraztsov Chiflik", Ruse during the period 2012 - 2014. 26 germplasms of Preliminary Variety Trial N 2 (PVT) were included.

Ustilago maydis is a common disease in most parts of the world, where maize is grown. In all above-ground organs of the plant, tumors of smutty mass are formed. The pathogen attack leads to stunted growth of the host plant, reducing yield, and economic losses.

The analysis of data about the new hybrids of IASS "Obraztsov Chiflik" - Ruse showed that fifteen of them were resistant. The resistance was the highest in the hybrids: St.20, Eks.12, Eks.10, Eks.23, Eks.16, Eks.2, Eks.3, Eks.4, Eks.6, Eks.9, Eks.13, Eks.17, Eks.19, Eks.20, 2 Eks.6. They may be used as sources of resistance. Susceptible were: Eks.15, Eks.11, Eks.8, Eks.24, Eks.1, Eks.5, St.7, Eks.14, Eks.18, Eks.22, Eks.25.

Introduction

The most effective method of combating economically important diseases is the selection of resistant varieties. Until now, different genetic and genetic methods have been used for this purpose, distinguished by greater or lesser effectiveness in this direction.

In selection, an important influence on the development of agriculture in perspective is the introduction of the new achievements of the local selection, which is aimed at creating new varieties with increased resistance or prematurity [1].

The annual losses of corn production as a result of attacks from different diseases amount to 7-17 %, and in some regions these percentages are even higher [2]. Diseases reduce yield and reduce production quality [3,4].

Ustilago maydis Is a common illness in most parts of the world [5]. *Ustilago maydis* is a common illness in most parts of the world. [5]. Typical symptoms of the disease are the formation of tumors in all plant organs above ground [6,7]. The prevalence and severity of the disease, and the reduction in yields, vary according to the hybrid, agro-technology and climatic conditions. [1,8,9,10]. The infection leads to slow growth of the host plant, decreased yields and economic losses. It has been established that, in a natural defect of plants, galliums reduce the yield to an average of 60% and more [11].

In our country the selection of maize for resistance to diseases was led by Popov and Popova, Ivanova, Momchilova, Mitev and others [8,9,12,13]. They have found the resistance of more than 1,500 native and synthetic populations, varieties, self-pollinated maize and hybrids of corn. As a result, the development of genotypes with the desired level of resistance results in higher productivity [14].

The aim of the study is to determine the degree of attack on 22 hybrids and 4 standard maize stings (*Ustilago maydis*) in conditions favoring the development of the pathogen.

Material and Methods

The study was carried out in the Field of Expertise of the Agricultural and Seminar Institute "Obrazcov Chiflik" - Rousse in the period 2012-2014. There are a total of 26 genoplasms from one PGI (preliminary variety experience) 2 (Figure 1).

The experience is based on the blocking method in 3 reps with a plot size of 10m^2 with a strong infectious background under irrigated conditions at a density of 5500plants/da. The infectious

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Figure 1: PVT N 2 (preliminary variety trial).

background is created by spreading tumors from the blister in the experience.

Phytopathological readings were carried out during the months of July and August in the scraping phases and maize-waxy maturity of maize by listing the main plants. Each of them is assigned a corresponding ball depending on the degree of damage from 0 to 5, the 5-degree Popov scale.

Results and Discussion

During the study period agro-meteorological conditions were favorable for the growth and development of maize.

According to data for the three years of the survey (Figure 2), in April 2012, the month of April is 2.8°C above the average rate. Rainfall this month is 19.0mm below normal. In the second 2013, the same month is 2.0°C above the average and rainfall, below the norm by 4.2mm. During the last ten days of April and the first ten days of May in the two years continued to increase the average daily temperature and despite the lower rainfall in 2013 by 8.8mm below the norm, conditions were favorable for a fast early maize growth.

In June, rainfall in 2012 is 63.6mm below normal and average daily temperatures close to 3°C above normal. In July, as a result of higher than normal 4.7°C average daily temperatures and almost complete rainfall of only 0.9mm, there was severe drought.

In June of 2013, Rainfall was 34.9mm above normal and average daily temperatures higher than 1.0°C.

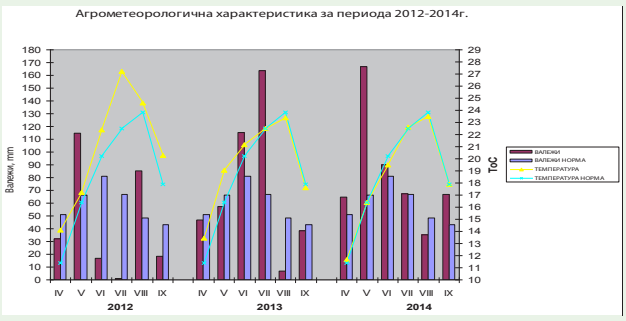

Figure 2: Agro-meteorological characteristics, 2012-2014.

The month of July was characterized by average daily temperatures of 22.2°C very close to normal and significant rainfall exceeding 95.0mm.

In 2012, The falling rainfall over the norm in the second and third ten days of August proved to be of no economic significance, because the hybrids in the experiment had come into technical maturity as early as the beginning of the same month in 2013. Is unfavorable, with precipitation 42.1mm below normal.

In 2014, Spring was characterized by rainfall and temperature around the norm. Exceptions are rainfall in May that was 100mm above normal. Around the norm is the rainfall in June and July, but it is distributed in 17 and 13 days respectively. Precipitation during the vegetation months created conditions for the development of mushroom diseases, and overall the year is moderately beneficial for corn.

Finally, it can be noted that the three years of the study are near-normal temperatures except in July 2012, and in terms of rainfall with very large variations in both quantities and months.

Table 1: Assessment of resistance of perspective experimental hybrids of IASS "Obraztsov Chiflik", Ruse to smut of maize (*Ustilago maydis*).

No	Генплазма Germplasm	*Ustilago maydis*				
		Б а л Grade				Характеристика Characteristics
		2012	2013	2014	Средно	
1	St. 20	0	0	0	0	Устойчив Resistant
2	Eks. 12 - II	0	0	0	0	Устойчив Resistant
3	Eks.15 - II	0	1	1	1	Чувствителен Susceptible
4	Eks.11- II	1	0	0	1	Чувствителен Susceptible
5	Eks.8 - II	0	1	0	1	Чувствителен Susceptible
6	Eks.10 - II	0	0	0	0	Устойчив Resistant
7	Eks.24 - II	0	0	1	1	Чувствителен Susceptible
8	Eks.23 - II	0	0	0	0	Устойчив Resistant
9	Eks.1 - II	1	0	0	1	Чувствителен Susceptible
10	Eks.16 - II	0	0	0	0	Устойчив Resistant
11	Eks.2 - II	0	0	0	0	Устойчив Resistant
12	Eks.3 - II	0	0	0	0	Устойчив Resistant
13	Eks.4 - II	0	0	0	0	Устойчив Resistant
14	Eks.5 - II	1	0	1	1	Чувствителен Susceptible
15	Eks.6 - II	0	0	0	0	Устойчив Resistant
16	St.7	0	1	0	1	Чувствителен Susceptible
17	Eks.9 - II	0	0	0	0	Устойчив Resistant
18	St.13	0	0	0	0	Устойчив Resistant
19	Eks.14 - II	1	0	0	0	Чувствителен Susceptible
20	Eks.17 - II	0	0	0	0	Устойчив Resistant
21	Eks.18 - II	0	1	1	1	Чувствителен Susceptible
22	Eks.19 - II	0	0	0	0	Устойчив Resistant
23	Eks.20 - II	0	0	0	0	Устойчив Resistant
24	Eks.22 - II	0	0	1	0	Чувствителен Susceptible
25	Eks.25 - II	3	0	0	3	Чувствителен Susceptible
26	St.26	0	0	0	0	Устойчив Resistant

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Figure 3: Smut of maize Ust. Maydis.

Figure 4: Tumors Ust. Maydis and healthy hybrid.

In 2012 in the 2nd PSO of the 22 observed numbers 5 were infected with bladder. In 2013 there are 4 numbers and in 2014 - 2015.

We found that there were significant differences in the sustainability of the options studied and in the three years of experience (Table 1).

Hybrids exhibit resistance to the pathogen to varying degrees. It is highest at St. Hybrids. 20, Ekc.12, Ekc.10, Ekc.23, Ekc.16, Ekc.2, Ekc.3, Ekc.4, Ekc.6, Ekc.9, Ekc.13, Ekc.17, Ekc.19, Ekc.20, 2Ekc.6. These hybrids can be used as sources of resistance to common bladder (*Ustilago maydis*). The following are sensitive: Ekc.15, Ekc.11, Ekc.8, Ekc.24, Ekc.1, Ekc.5, St.7, Ekc.14, Ekc.18, Ekc.22, Ekc.25 (Figures 3 and 4).

The reasons for this are the genetic diversity between the hybrids, which from a genetic point of view are a complicated heterozygous material.

The analysis of the resistance to common blotches in the 26 genplasms examined, of which 4 standards and 22 hybrids of the AAS "Model Chef" - Russe show that 15 are resistant and 11 are sensitive

Table 2: Resistance of experimental maize hybrids of the collection of IASS "Obraztsov Chiflik" to *Ustilago maydis*.

Поражение от *Ustilago maydis* Damage by *Ustilago maydis*		
Бал Grade	**Оценка Assessment**	**Хибриди, бр. Number of hybrids**
1	Имунни Immune	-
2	Устойчив Resistant	15
3	Умерено чувствителен Moderately susceptible	-
4	Чувствителен Susceptible	11
5	Силно чувствителен Highly susceptible	-

(Table 2). They should work towards the risks of possible losses caused by the disease in separate years in Bulgaria. Table 2 Resistance of experimental maize hybrids of the collection of IASS "Obraztsov Chiflik" to *Ustilago maydis*.

In the process of the team, the genes that show a strong sensitivity to *Ustilago maydis* are gradually eliminated.

Conclusion

Fifteen of the tested hybrids exhibit resistance to one degree or another, to *Ustilago maydis*. It is highest in hybrids: St. 20, Ekc.12, Ekc.10, Ekc.23, Ekc.16, Ekc.2, Ekc.3, Ekc.4, Ekc.6, Ekc.9, Ekc.13, Ekc.17, Ekc.19, Ekc.20, Ekc 2 Ekc.6. They can be used as sources of sustainability and used in the selection for the creation of maize-resistant maize lines and hybrids of corn. Ecc.15, Ekc.11, Ekc.8, Ekc.24, Ekc.1, Ekc.5, St..7, Ekc.14, Ekc.18, Ekc.22, Ekc.25 are sensitive, and in the process of The team should gradually eliminate genes in which genes are involved.

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