STUDIES ON DISEASES AND PESTS OF WHEAT ECOSYSTEMS IN THE SOUTH MUNTENIA REGION – ROMANIA AND THEIR CONTROL

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Abstract
Given the recent climate change - with extreme phenomena such as severe heat waves, drought, extreme summer heat, floods more and more often, it is important to know the varieties of wheat which have a constant behavior at diseases and pests in different environmental conditions. In addition to the climatic factor, Romanian farmers who want to obtain high and quality yields in crops, should take into account other aspects, when deciding on the cultivar of wheat they will grow. Thus, 8 cultivars of wheat were characterized, which presented the following fungi and pests: Puccinia spp., Mycosphaerella graminicola f.c. Septoria tritici, Blumeria graminis f.c. Oidium monilioides, Leptosphaeria nodorum f.c. Septoria nodorum, Gibberella zeae f.c. Fuzarium graminearum; Eurygaster spp. , Haplothrips tritici. The observations were made between 2018 and 2020, in the South Muntenia Region of Romania and the attack of diseases and pests was assessed by estimating the frequency of attack, the intensity of attack and the degree of attack. A treatment scheme for wheat diseases and pests control in the generative stage using approved products was also developed. In order to chemically control the main diseases and pests of wheat in the generative stage, it is necessary to apply two treatments, depending on the degree of attack and, respectively, the economic threshold.

Keywords: wheat, cultivars, resistence, diseases, pests

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1. INTRODUCTION

Knowing pests and diseases that may cause injuries and are likely to affect plant health and quality is critical to minimizing the gap between attainable yield and actual yield. Climate change is likely to modify the wheat disease spectrum in some regions, and pathogens or pests considered unimportant today may turn out to be potential new threats in future [3]. Increased climate variability, frequent extreme weather events, and new variants of pathogens and pests further jeopardize linear productivity growth into the future. Breeding wheat for climatic change tolerance and disease resistance combined with good agronomy can potentially improve wheat productivity to meet the future demands [8].
Wheat is the most important grass, which is why it is grown on the widest areas in the whole world. It is the most important crop in Romania, cultivated on approximately 2 million hectares [8]. Wheat is cultivated in over 100 countries [4]. In addition to the climatic factor, Romanian farmers who want to achieve crop performance should consider other aspects when deciding on the cultivar of wheat they will grow [8]. Autumn wheat can be grown in our country in very favorable conditions on 19.5% of the arable area, favorable on 70.4% and unfavorable on 7.2% [1].
The use of disease-resistant and pest-resistant wheat cultivars is an important link in crop protection management. Genetic resistance to diseases and insect pests is usually the most effective, economical, and environmentally sound method of control [2]. Depending on the cultivated cultivar, the climatic conditions and the cultivation technology, the foliar apparatus is affected in proportion of 40-50% by a series of pathogens: *Blumeria graminis f. sp. tritici, Septoria tritici, Stagonospora nodorum, Puccinia striiformis, Puccinia recondita, Helminthosporium tritici repentis* [5].
In this study, we identify certain cultivars of winter wheat with good resistance to powdery mildew, rust, leaf and prickly septoria, wheat

thrips, and grain weeds. A disease and pest control scheme is also being developed.

2. MATERIALS AND METHODS

The researches were carried out in the experimental fields of C.T.S. Târgoviște, during the period of the years 2018-2020, on 8 cultivars of wheat, and the attack of the diseases and pests was assessed by estimating the frequency of attack (F%), the intensity of attack (I%) and the degree of attack (G.A%).
The frequency of attack (F%) was calculated using the formula:

$$F = \frac{N}{N_t} \times 100$$

where:

N = number of plants (organs) attacked;
Nt = total number of plants (organs) observed (controlled).
The intensity of attack (I%) was calculated using the formula:

$$I(\%) = \sum \frac{i \times f}{n}$$

where:

i = percentage of the mark awarded;
f = number of plants (organs) marked by the respective mark;
n = total number of plants (organs) attacked analyzed.
We used a grading scale from 0 to 6, as one can observe from Table 1.

Table 1:Scale marking the intensity of the attack

Attacked area (%)	*Mark for the intensity of the attack*
0	0
1 - 3	1
4 - 10	2
11 - 25	3
26 - 50	4
51 - 75	5
76 - 100	6

The degree of attack was calculated according to the relation:

$$G.A.(\%) = \frac{F(\%) \times I(\%)}{100}$$

where:
F = frequency of attack;
I = intensity of attack.
The control scheme was carried out using various catalogs of approved products.

3. RESULTS AND DISCUSSION

As can be seen in Table 2, in the climatic conditions of the year 2018, we can observe that *Blumeria graminis* had a degree of attack between 0 and 8%, a percentage that is below the economic threshold, thus not requiring treatment. All cultivars showed good resistance to powdery mildew, and the RETEZAT, A 38-04 and FD 08080 cultivars did not show any attack.
Regarding rust diseases, only one of the 8 cultivars analyzed showed sensitivity (FD 08080). Septoriosis presented a degree of attack between 7 and 31.5%, the most resistant cultivars being FD 08080 and APRILIO, and the most sensitive, the RETEZAT, BOEMA and BC DORA cultivars In the climatic conditions of the year 2019 (Table 3), the degree of attack of the *Blumeria graminis* fungus was between 5 and 10%. The economic threshold is at an attack rate of 10%. *Puccinia spp.* and *Mycosphaerella graminicola* did not show a significant attack.

Table 2: The behavior of wheat cultivars to diseases and pests in the year 2018

Crt. no.	*Cultivar code*	*Cultivar name*	*Fungus name*									*Pest name*					
			Blumeria graminis			*Puccinia spp.*			*Mycosphaerella graminicola*			*Haplothrips tritici*			*Eurygaster spp.*		
			F %	I %	GA %	F %	I %	GA %	F %	I %	GA %	F %	I %	GA %	F %	I %	GA %
1.	349	BOEMA 1MT	40	20	8	-	-	-	60	35	21	30	15	4.5	-	-	-
2.	184	DROPIA 1MT	30	15	4.5	15	10	1.5	30	45	13.5	30	15	4.5	-	-	-
3.	474	GLOSA MT	10	5	0.5	-	-	-	60	35	21	30	15	4.5	-	-	-
4.	766	RETEZAT	-	-	-	-	-	-	70	45	31.5	30	15	4.5	5	5	0.25
5.	761	BC DORA	100	5	5	20	10	2	60	35	21	40	20	8	5	5	0.25
6.	774	A 38-04	-	-	-	20	10	2	60	30	18	-	-	-	3	5	0.15
7.	757	FD 08080	-	-	-	60	35	21	35	20	7	20	10	2	5	5	0.25
8.	752	APRILIO	100	5	5	15	5	0.75	40	25	10	5	5	0.25	5	5	0.25

Table 3: The behavior of wheat cultivars to diseases and pests in the year 2019

Crt. no.	*Cultivar code*	*Cultivar name*	*Fungus name*									*Pest name*					
			Blumeria graminis			*Puccinia spp.*			*Mycosphaerella graminicola*			*Haplothrips tritici*			*Eurygaster spp.*		
			F %	I %	GA %	F %	I %	GA %	F %	I %	GA %	F %	I %	GA %	F %	I %	GA %
1.	349	BOEMA 1MT	100	10	10	30	15	4.5	20	10	2	30	20	6	-	-	-
2.	184	DROPIA 1MT	100	10	10	20	10	2	10	5	0.5	20	10	2	10	5	0.5
3.	474	GLOSA MT	100	5	5	20	10	2	20	10	2	10	5	0.5	10	5	0.5
4.	766	RETEZAT	100	5	5	30	15	4.5	20	10	2	45	10	4.5	-	-	-
5.	761	BC DORA	100	5	5	10	5	0.5	20	10	2	10	5	0.5	-	-	-
6.	774	A 38-04	100	10	10	20	10	2	20	10	2	5	5	0.25	-	-	-
7.	757	FD 08080	100	10	10	10	5	0.5	20	10	2	10	5	0.5	-	-	-
8.	752	APRILIO	-	-	-	-	-	-	10	5	0.5	-	-	-	-	-	-

For the *Haplothrips tritici* pest, the attack rate was between 0.25 and 6%, and most cultivars did not show an attack on *Eurygaster spp*.

In the year 2020 (Table 4), the powdery mildew attack was much higher than in previous years, between 10 and 30%, the lowest degree of attack being observed for the FD 08080 and APRILIO cultivars. The rusts also had high values of the degree of attack, which was between 30 and 60%. The RETEZAT cultivar had the lowest value. The degree of attack of *Mycosphaerella graminicola* was low for all analyzed cultivars. The degree of attack of the *Haplothrips tritici* pest was between 0.25% (A 38-04 cultivar) and 6.75 for the DROPIA cultivar. There was no attack of *Eurygaster spp*.

Given the recent climate change - with extreme phenomena such as severe heat waves, drought, extreme summer heat, floods more and more often, it is important to know the cultivars that have been constant in behavior in different environment conditions.

After the 3 years of observations, as seen in Table 5, the most resistant cultivars to powdery mildew were APRILIO and FD 08080, which presented the average values of the degree of attack of 5% and 6.66%, respectively. *Puccinia spp.* showed a more severe attack than powdery mildew for all cultivars.

Thus, the degree of attack ranged from 11.5% (for the RETEZAT cultivar) to 27.16 for the FD 08080 cultivar. All cultivars had a good resistance to the *Mycosphaerella graminicola*

fungus attack, the lowest values being recorded at FD 08080 and APRILIO, respectively 3.66% as well as for the DROPIA cultivar, respectively, 4.8%. *Haplothrips tritici* showed an average attack value of between 0.16 and 5.5%, the most resistant to attack of this pest being A 38-04, APRILIO and FD 08080 cultivars. Wheat bugs - *Eurygaster spp.* did not have a significant attack in the 3 years of the study.

Table 4: The behavior of wheat cultivars to diseases and pests in the year 2020

Crt. no.	*Cultivar code*	*Cultivar name*	*Fungus name*									*Pest name*					
			Blumeria graminis			*Puccinia spp.*			*Mycosphaerella graminicola*			*Haplothrips tritici*			*Eurygaster spp.*		
			F %	I %	GA %	F %	I %	GA %	F %	I %	GA %	F %	I %	GA %	F %	I %	GA %
1.	349	BOEMA 1MT	100	20	20	100	40	40	20	10	2	20	30	6	-	-	-
2.	184	DROPIA 1MT	100	20	20	100	50	50	10	5	0.5	45	15	6.75	-	-	-
3.	474	GLOSA MT	100	30	30	100	60	60	10	5	0.5	10	5	0.5	-	-	-
4.	766	RETEZAT	100	30	30	100	30	30	10	5	0.5	22	10	2.2	-	-	-
5.	761	BC DORA	100	20	20	100	50	50	10	5	0.5	-	-	-	-	-	-
6.	774	A 38-04	100	20	20	100	60	60	40	20	8	5	5	0.25	-	-	-
7.	757	FD 08080	100	10	10	100	60	60	20	10	2	10	5	0.5	-	-	-
8.	752	APRILIO	100	10	10	100	60	60	10	5	0.5	10	5	0.5	-	-	-

Table 5: The behavior of wheat cultivars to diseases and pests between the years 2018 and 2020

Crt. no.	*Cultivar code*	*Cultivar name*	*Fungus name*			*Pest name*	
			Blumeria graminis	*Puccinia spp.*	*Mycosphaerella graminicola*	*Haplothrips tritici*	*Eurygaster spp.*
			GA % - average value	GA % - average value	GA % - average value	GA % - average value	GA % - average value
1.	349	BOEMA 1MT	12.66	14.83	8.33	5.5	-
2.	184	DROPIA 1MT	11.5	17.83	4.8	4.41	0.16
3.	474	GLOSA MT	11.83	20.66	7.83	1.83	0.16
4.	766	RETEZAT	11.66	11.5	11.33	3.73	0.08
5.	761	BC DORA	10	17.5	7.83	2.83	0.08
6.	774	A 38-04	10	21.33	9.33	0.16	0.05
7.	757	FD 08080	6.66	27.16	3.66	0.6	0.08
8.	752	APRILIO	5	20.25	3.66	0.25	0.08

In order to chemically control the main diseases and pests of wheat in the generative stage, it is necessary to apply two treatments (Table 6), depending on the degree of attack and the economic threshold. The economic threshold is as follows: *Puccinia spp* - at an attack rate of 10% on leaves; *Mycosphaerella graminicola f.c. Septoria tritici* - degree of attack greater than 10%, *Blumeria graminis f.c. Oidium monilioides* - at an attack rate of 10% on leaves, *Leptosphaeria nodorum f.c. Septoria nodorum* - 5% on wheat ears, *Gibberella zeae f.c. Fuzarium graminearum* - at a rate of attack of 10% on wheat ears,*Eurygaster spp.* - 5 specimens/sqm - hibernating adults and 3 larvae/sqm, *Haplodiplosis marginata* - 30 larvae/sqm; *Melanopa motto* - 10 hibernating adults/sqm and 250 larvae/sqm; *Wheat haplothrips* - 8 adult specimens/wheat ear and 25 larval specimens/wheat ear.

The following products can also be used against the pest *Eurygaster spp.*: Cyperguard 25 EC - 0.06 l / ha, Zebra Lambda-Cyhalothrin - 0.2 l/ha, Karate Zeon - 0.15 l / ha, Decis 25 WG – 30g/ha, as well as other approved insecticides. If *Eurygaster ssp.* and *Lema melanopa* are in the wheat crop, the product Vantex 60 CS - 0.07 l/ha can be used. Thiovit

Jet 80 WG can be used to control the *Blumeria graminis* fungus. The treatment schedule can be adapted according to the presence of various diseases and pests.

Table 6: Treatment scheme for wheat diseases and pests control in the generative stage

Treatment	*Product*	*Active ingredient*	*Dosage*	*Pathogen*	*Vegetation stage*
T1	Mirage 45 EC + Faster 10 EC/ Kaiso Sorbie 5 EG	procloraz + cipermetrin/ Lambda-Cihalotrin	1 l/ha 150 ml/ha; 0.15 kg/ha	*Puccinia spp., Mycosphaerella graminicola f.c. Septoria tritici, Blumeria graminis f.c. Oidium monilioides, Leptosphaeria nodorum f.c. Septoria nodorum Eurygaster spp., Haplodiplosis marginata, Lema melanopa*	starting with the stem elongation to the bellows phase
T2	Amistar/ Bumper250 EC/Orius 25 EW	azoxistrobin/ propiconazol/ tebuconazol + pirimifos metil	0.75- 1 l/ha	*Puccinia spp., Mycosphaera graminicola f.c. Septoria tritici, Blumeria graminis f.c. Oidium monilioides, Leptosphaeria nodorum f.c.Septoria nodorum, Gibberella zeae f.c. Fuzarium graminearum, Eurygaster spp., Haplothrips tritici*	the begining of heading until the milk-wax phase

4. CONCLUSIONS

The most resistant cultivars to powdery mildew were APRILIO and FD 08080. *Puccinia spp*. showed a more severe attack than powdery mildew on all cultivars. Thus, the degree of attack with the lowest value was recorded for the RETEZAT cultivar.

All cultivars had a good resistance to the attack of the fungus *Mycosphaerella graminicola*, the lowest values being recorded for FD 08080, APRILIO and DROPIA.

The plants showed a low average attack value for the pest *Haplothrips tritici* and did not have a significant attack on *Eurygaster spp*.

In order to chemically control the main diseases and pests of wheat in the generative stage, it is necessary to carry out two treatments, depending on the degree of attack and, respectively, the economic threshold.

5. REFERENCES

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