Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 21, Issue 4, 2021
PRINT ISSN 2284-7995, E-ISSN 2285-3952

BEHAVIOUR OF SOME OAT LINES TO THE ATTACK OF THE FUNGUS *BLUMERIA GRAMINIS* (D. C.) F. SP. A*VENAE* EM. MARCHAL

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Abstract

Blumeria graminis (DC) f. sp. avenae Em. Marchal (powdery mildew) fungus is considered an important foliar pathogen for oat that can affect the yield and the quality, mainly in the years with cool and humid weather. Climate conditions in the spring of 2019 in Banat Plain (Lovrin area) were favourable for infections. The research objective was to identify the oat lines with good resistance to powdery mildew. Thus, there were monitored 15 oat lines. The research method applied was the calculation of the incidence, severity and infection degree of the fungus. The relative resistance of the oat lines was set by comparing the infection degree of the tested material with the oat line that had the highest sensitivity to the attack of the pathogen. The frequency of the plants with powdery mildew symptoms was comprised between 5% and 100%. The infection severity had values between 10% and 70%. The most resistant oat line from the experience was 2509 and the most sensitive was 2515. The resistant lines could be used to the creation of some productive oat varieties with a good resistance to the attack of powdery mildew.

Key words*: Blumeria graminis, relative resistance, disease severity, winter oat*

INTRODUCTION

During the last twenty years the Agricultural Revolution has been associated with new cropping technologies, technical and genetically progress, machinery revolution, a better management of biotic and abiotic constrainers, faster access to the information of the farmers, global population increase and a higher demand for food supply worldwide [1][2][3][4][5][6][9][17][18][19][20][28][29][31][32][37][38][39].

The etiologic agent of oat powdery mildew is the fungus *Blumeria graminis* (DC) f. sp. *avenae* Em. Marchal framed in the regnum *Fungi*, phylum *Ascomycota*, class *Leotiomycetes*, order *Erysiphales*, family *Erysiphaceae*, genus *Blumeria*, species *avenae*. *Blumeria graminis,* produces the powdery mildew disease in wheat, barley, rye and oat and in many cultivated and spontaneous grasses species (*Poaceae*). According with Eliade (1990), the polyphagia of this fungus in only apparent in reality because in the framework of the species *B. graminis* exist special forms (*f. sp.*) and physiological strains or pathotypes strictly specialized [10]. According with [16] and [27] exist eight forms specialized on species of *Triticum* (f. sp. *tritici*), *Hordeum* (f. sp. *hordei*), *Secale, Avenae* (f. sp. *avenae*), *Poa* (f. sp. *poae*), *Bromus* (f. sp. *bromi*), *Dactylis* (f. sp. *dactylidis*) şi *Agropyron* (f. sp. *agropyri*). Every specialize form has a limited infection capacity to only one host species [33][45].

Blumeria graminis is an ectoparasitic bound fungus that forms a branched white mycelium on the surface of the attacked organs and sends the branched haustoria in the parasite cells. On the mycelium are forming the asexual anamorph fructification organs, respectively the conidiophores with conidia (conidian form or anamorph f. c. *Oidium monilioides* Lk.) and the teleomorph sexual ones, respectively the cleistothecia [10][30][43].

This fungus attacks in the beginning the basal leaves of oat and then is spreading to sheats and stems. Powdery mildew covers entire plant in favourable climate conditions. On the surface of the infected organs are forming white – light greyish mycelium patches with felty aspect and later the mycelium became powdery and coloured in grey. The leaves covered with mycelia will dry later [8][34][42]. The severe infections in early stages of development of the oat plants can affect the tillering and later the size of the inflorescences. The infections that appear later in the vegetation period and reach the flag leaf can affect the grain filling and affect in general the normal development of the plants [8][42].

According with [15] powdery mildew is one of the most harmful disease of oat, mainly in the areas with cool and wet climate. The yield loses from the years favourable to the disease can reach even 32% [14]. Other authors underlined that the yield loses produced by powdery mildew varies between 5% and 30% [11][46].

In Banat Plain powdery mildew can appear with high frequency and intensity in winter oat only in the years with cool and wet spring [42].

The factors that are predisposing the oat to the powdery mildew disease are similar to the ones that determinate the appearance of the disease in the other cereals. In general, the factors that favour the disease are high densities, excessive nitrogen fertilisation, climate and the early falling of the plants [30][34][42].

The resistance of the oat genotypes to the attack of the fungus *Blumeria graminis* can be evaluated by comparing the disease attack severity with the severity level of the disease of the most sensitive genotype analysed. Thus, the relative resistance of a variety varies from 0 (highly sensitive) to 1 (completely resistant). Zadoks (1972b) recommends the comparison with the infection degree of the tested biological material that manifests the greatest susceptibility, to eliminate the environment influence on the resistance [48]. Estimation of the intermediate resistance levels in the case of the pathogens is recommended to be done by a monocyclic test and a polycyclic test [7][48].

According with [36], oat powdery mildew can be controlled difficultly using prevention methods and even chemical ones. The most efficient control method is the use of resistant varieties [23][24][25].

There were identified and characterized eight genes for the oat resistance to powdery mildew until nowadays. In the plant inbreeding programs are used and present in oat varieties most often the genes Pm1, Pm3 and Pm6 [26][40]. Hsam *et al.* (2014) showed that in Europe the gene Pm7 is used mostly in the oat inbreeding programmes without naming the varieties that are having the gene [13]. Okon (2015) shows that the resistance determined by the genes Pm1, Pm3 and Pm6 isn't efficient in the case of the new strains of the pathogen [22]. The same is happening in the case of the gene Pm7. Now, only the gene Pm4 provides the best resistance to the oat powdery mildew. With all of these, having in view the increased variability of the *Blumeria graminis* populations, there is the risk to get lost this resistance in the following years too. That is why in the oat inbreeding programmes must to be identified new powdery mildew resistance sources [12][26][41].

In this work were analysed 14 oat genotypes from the point of view of the response to the attack of the fungus *Blumeria graminis* f. sp. *avenae*. The tested varieties were compared with the control variety Sorin that had proved to be the most sensitive to the powdery mildew attack. The tested genotypes were monitored in conditions of natural infection because powdery mildew appears every year in the oat crops from Banat, with different attack frequencies and intensities. The purpose of this research is to identify the genotypes that manifest resistance to *Blumeria graminis* attack in a year with the spring and first summer month characterized by a cool and moist weather, respectively the year 2019.

MATERIALS AND METHODS

The comparative and competitive trial consisted in fifteen oat genotypes placed in the territory of the Agricultural Research and Development Station Lovrin (ARDS Lovrin) (Western Romania) in the field plot dedicated to the oat inbreeding. The plots were placed randomized using the Latin rectangle with three replicates. The size of every plot was 10 m^2 (1 m x 10 m) with pathways between every plot having 0.40 m width. The pathways between the replicates have 2.5 m width.
The data regarding the fungus attack degree were collected at every 10 days in the interval May – June 2019. The incidence of the attack was set using the metric frame (50 cm x 50 cm) considering the relative value of the attacked plants number in relationship with the total number of plants or organs analysed.
The attack degree was calculated according with the formula, respectively as the product between the incidence and severity of the disease divided to 100. Disease severity was assessed on a 0 – 9 scale [44].
The relative resistance of the analysed genotypes was assessed on a scale from 0 to 1, by comparing the infection degree of the tested genotype with the same feature of the genotype that manifest the greatest sensitivity to the pathogen [47].
The reaction of the genotypes to the pathogen *Blumeria graminis* was set using the three resistance levels: resistant (R) between 0 – 20% foliar surface affected by disease; intermediary (I) or medium resistant (MR) between 20 – 50% of the foliar surface affected by disease; susceptible (S) more than 50% of the foliar surface affected by the pathogen [21]. Climate data from the analysed period were collected from the meteorological station of ARDS Lovrin.
The statistical analysis of the results (ANOVA, Pearson's and Spearman's correlations) was done using the statistics software JASP 2.0.

RESULTS AND DISCUSSIONS

In Lovrin area the climate from the period March - April 2019 was humid, mostly in the second half of the analysed time interval. In March the rainfalls amount was 15 mm, respectively with 17.3 mm less than the multiannual average value for this month that is 32.3 mm.
The rainfall deficit was registered in April too, in comparison with the multiannual average rainfall amount (34 mm) the registered deficit was 8.7 mm. Entire rainfall amount from April was distributed in the second and third decade. From the second decade of April toll to the end of June the rainfalls were almost continuous, their distribution in time being relatively evenly (Figure 1).
The months May and June were characterised by a cool and humid climate in first part and warmer in the second part of the interval. The rainfalls were far exceeded the multiannual of the months May and June. The rainfall excess from May was 34.7 mm and in June 19.9 mm (Figure 1).
Entire rainfall amount from the interval March – June 2019 was 229 mm, respectively with 28.6 mm greater that the multiannual average of the three months. As rate, 44% from the rainfall amount that had to be in a year, respectively 520.6 mm was registered in that interval of the year 2019 (Figure 1).

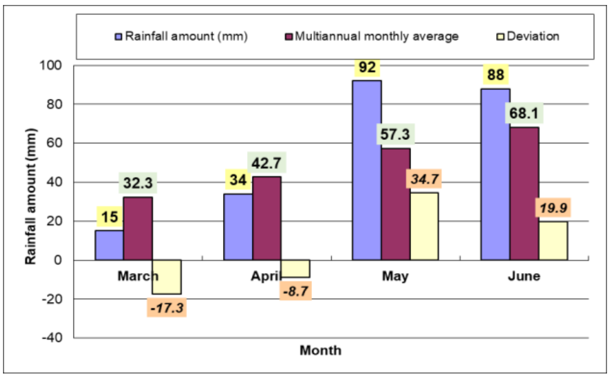

Fig. 1. Rainfall amount from Lovrin during March – June 2019 in comparison with multiannual monthly averages
Source: Original graph generated based on the climatic data (precipitation) registered at the Meteorological Station of ARDS Lovrin.

From the point of view of the thermal regime there were registered deviations from the multiannual monthly average (Figure 2).

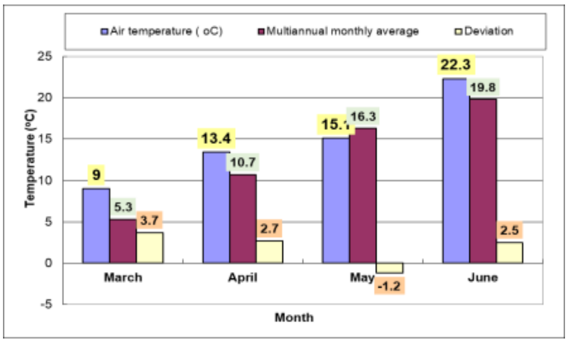

Fig. 2. Thermal regime from Lovrin during March – June 2019 in comparison with multiannual monthly averages
Source: Original graph generatedl based on the climatic data (temperatures) registered at the Meteorological Station of ARDS.

Temperatures in the months March, April and June had positive deviations, overpassing the multiannual monthly averages with 3.7 ^{o}C in March, 2.7 ^{o}C in April and 2.5 in June. In May, the monthly average temperature was lower with 1.2 ^{o}C in comparison with the multiannual average value of the month for Lovrin area (Figure 2).

On this climatic background powdery mildew appeared in the trial formed from the most valuable descendances of 15 genotypes of winter oat (one variety and 14 lines). The variety Sorin was chosen as control because it was proved to be the most sensitive to powdery mildew attack. This variety was created the Agricultural Research and Development Station Lovrin.

The attack frequency of the powdery mildew attack in the analysed genotypes was comprised between 2.66 and 100%. In 12 genotypes the frequency of the plants with powdery mildew symptoms was 100% at the last data collection. The lines2508, 2509 and 2510 were highlighted by lower attack frequencies (F% = 2.66 - 36%). The lowest incidence was registered in the line 2509 (F = 2,66%) (Figure 3).

The amplitude of the attack severity (I%) on plant was comprised between 1.66% (line 2509) and 60% (control variety Sorin). Eight lines of winter oat from the trial had registered a lower severity of the attack comprised between 1.66% and 20% (the lines 2505, 2506, 2507, 2508, 2509, 2510, 2511 and 2513). In the other lines the attack severity was comprised between 36-60% (Figure 3).

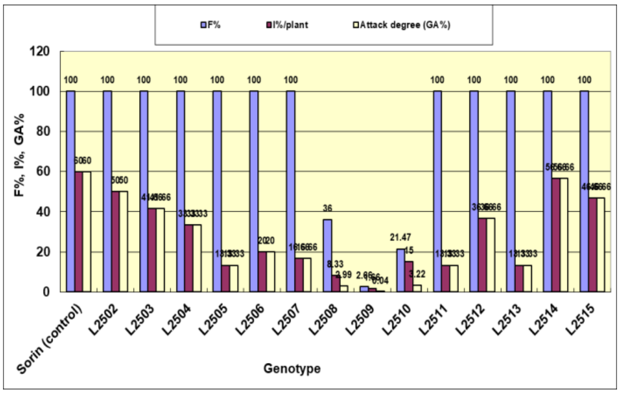

Fig. 3. Diagram of frequency and severity of powdery mildew (*Blumeria graminis* f. sp. *avenae*) attack in the winter oat lines from the comparative and competitive trial from 2019
Source: Original graph generated based on the calculated experimental values

The obtained attack degree was similar with the attack severity (I%) in the case of 12 lines from the total 15 analysed, because the frequency of the infected plants was 100%. The oat lines with low frequency and severity have presented low attack degree, respectively 0.04% in line 2509, 2.99% in line 2508 and 3.22 in line 2510 (Figure 3).

Severity of the infection of the levels of the plants was set separated by the other investigations with the purpose to highlight the oat lines at that the pathogen had reached the flag leaf. There were analysed the four leaves below the inflorescence starting with the flag leaf.

Analysing the obtained results following the observations there was noticed that the flag leaf (Leaf 1) was infected only in a single oat line, respectively 2515. The foliar surface of this line was covered in a 70% rate with powdery mildew mycelia. Leaf 2 was covered with mycelia only in four lines from the total of 15 and the attack intensity was comprised between 10% (2502) and 50% (2503).

Leaf 3 was affected by the pathogen in rates comprised between 10% and 75% in 12 lines from the trial. Only in three lines the leaf 3 had remained healthy (2505, 2508, 2509).

Leaf 4 was covered with powdery mildew mycelium in different rates comprised between 0 (line 2509) and 100% (line 2514). The average severity of the infection of the leaves from the superior level is presented in Figure 4.

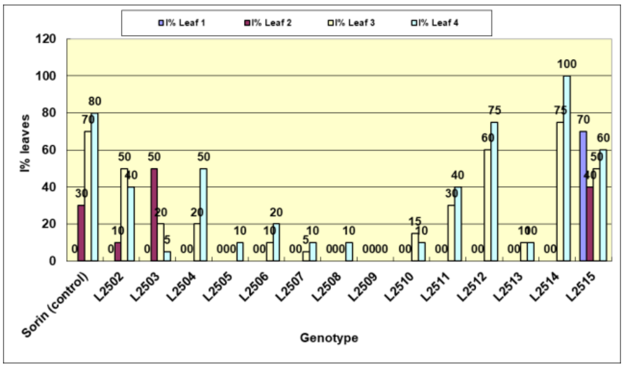

Fig. 4. Diagram of frequency and severity of powdery mildew (*Blumeria graminis* f. sp. *avenae*) attack of the leaves from the upper level of the winter oat lines from the comparative and competitive trial from 2019
Source: Original graph generated based on the calculated experimental values

In the control variety Sorin, the leaf 4 was 80% covered with powdery mildew mycelia. Line 2509 is highlighted by the resistance to the pathogen. In this line, the fungus wasn't reached the upper level of the plants and the only symptoms registered were at the base of the plants as very small mycelium patches. The evolution of the fungus in this line was stopped surely by the genetic resistance mechanisms.

In 6 lines from the trial the infection on the leaf 4 was lower than 10% (2503, 2505, 2507, 2508, 2510, 2513).

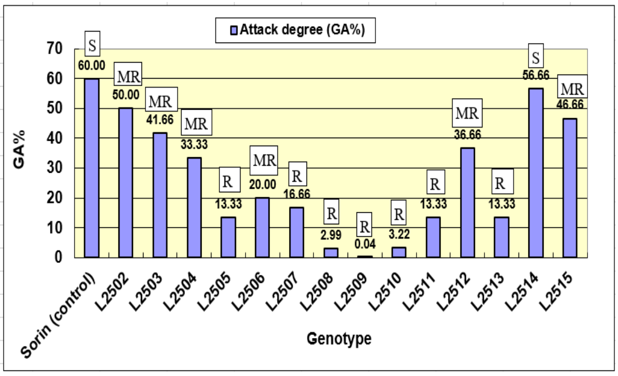

Fig. 5. Response of the winter oat lines from the comparative and competitive trial to the powdery mildew attack in 2019
Source: Original graph generated based on the calculated experimental values.

The response of the fifteen oat lines to the powdery mildew attack was associated using two assessment scales regarding the resistance to the pathogens. According to the scale used by [21], 7 lines from the trial were reacted as resistant (2505, 2507, 2508, 2509, 2510, 2511, 2513) and 6 lines medium resistant (2502, 2503, 2504, 2506, 2512, 2515). The control variety Sorin and the line 2514 have showed increased sensitivity to the pathogen (Figure 5).

The relative resistance (RR) calculated using the formula of Zadocks (1972b) had classified more severe the response of the oat lines to the powdery mildew attack (Figure 6).

Thus, according with the obtained results using this method only three lines were considered as resistant (2508, 2509 și 2510). The attack frequency and severity were very low in these lines. Five lines from the trial had manifested medium resistance (2505, 2506, 2507, 2511, 2513). Low sensibility to the pathogen (SR) was registered in the lines 2503, 2504 and 2512. The line 2515 was characterized as sensitive to the pathogen (S). The most sensitive lines to the powdery mildew attack were the genotypes 2514, 2502 and the control variety Sorin, the response being as the most sensitive (FS) genotype from the trial with RR between 0 and 0.2.

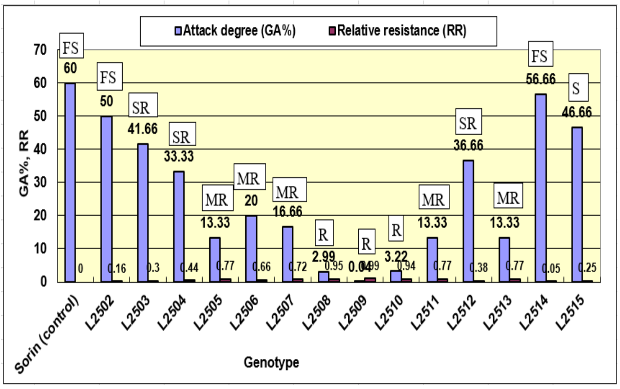

Fig. 6. Relative resistance (RR) of the winter wheat genotypes from the comparative and competitive trial to the powdery mildew attack in 2019
Source: Original graph generated based on the calculated experimental values.

Comparing the results regarding the response of the oat lines to the attack of the fungus using the scale of [21] is obvious the fact that it is more permissive compared with the scale proposed by [47], because only two lines are sensitive from this point of view. In the case of the more severe RR scale 7 lines have manifested sensitivity to the pathogen. Both scales are highlighting the special resistance of three winter oat genotypes, respectively 2508, 2509 and 2510. From these lines, the line 2509 presents interest for the following inbreeding programs of the winter oat from the Station of Research and Development for Agriculture Lovrin. The statistical analysis (ANOVA) supports the obtained results. Thus, the effect of the attack intensity (I%) on the analysed genotypes is significant (Table 1). The analysis between the effect of the infection factors (intensity and frequency) and the oat genotypes shows that there is significance from the point of view of the variation of the attack intensity and frequency (Table 2 and Figure 7). The Levene test for the equality of the variances (ANOVA) shows the existence of the signification only in the case of the attack frequency (Table 3).

Table 1. Analysis within the effects of the infection factors with powdery mildew and genotype (ANOVA)

Cases	Sum of Squares	df	Mean Square	F	p
RM attack intensity I%	69457.223	1	69457.223	1459.708	< 0.001
RM I% ✻ Genotype	16592.671	14	1185.191	24.908	< 0.001
Residuals	1427.488	30	47.583		
Note. Type III Sum of Squares					

Source: Own calculation based on experimental data.

Table 2. Analysis between within the effects of the infection factors with powdery mildew and genotype (ANOVA)

Cases	Sum of Squares	df	Mean Square	F	p
Genotype	46255.239	14	3303.946	60.216	< 0.001
Residuals	1646.055	30	54.868		
Note. Type III Sum of Squares					

Source: Own calculation based on experimental data.

Table 3. Levene's test for equality of variances (ANOVA)

	F	**df1**	**df2**	**p**
Blumeria graminis attack intensity (I%)	1.244	14	30	0.297
Blumeria graminis attack frequency (F%)	8.016	14	30	< .001

Source: Own calculation based on experimental data

Table 4. Post-hoc comparisons between the control oat variety Sorin with the analysed lines (ANOVA)

Genotype	Mean Difference	95% CI for Mean Difference		SE	t	p tukey	
		Lower	Upper				
Sorin	-	-	-	-	-	-	-
2502	5.000	-11.762	21.762	4.277	1.169	0.996	
2503	9.167	-7.595	25.929	4.277	2.143	0.698	
2504	13.333	-3.429	30.095	4.277	3.118	0.168	
2505	23.333	6.571	40.095	4.277	5.456	< 0.001	***
2506	20.000	3.238	36.762	4.277	4.677	0.004	**
2507	21.667	4.905	38.429	4.277	5.066	0.001	**
2508	57.833	41.071	74.595	4.277	13.523	< 0.001	***
2509	77.800	61.038	94.562	4.277	18.192	< 0.001	***
2510	61.762	45.000	78.524	4.277	14.442	< 0.001	***
2511	23.333	6.571	40.095	4.277	5.456	< 0.001	***
2512	11.667	-5.095	28.429	4.277	2.728	0.336	
2513	23.333	6.571	40.095	4.277	5.456	< 0.001	***
2514	1.667	-15.095	18.429	4.277	0.390	1.000	
2515	6.667	-10.095	23.429	4.277	1.559	0.955	
*** p <0 .05, ** p < 0.01, *** p < 0.001**							

Source: Own calculation based on experimental data.

Statistical analysis (ANOVA, post-hoc p_{tukey}) compares the oat variety Sorin (control) with the other lines from the winter oat trial shows the existence of the highly significant differences of six lines in comparison with the control (*** $p < 0.001$), respectively the lines 2505, 2508, 2509, 2510, 2511 and 2513. In the case of two lines from trial (2506 and

2507) the differences compared with the control were also significant (** p < 0.01). For the remained lines from the trial weren't found significant differences in comparison with the control (Table 4). The oat lines that have registered statistically significant differences they were reacted as medium resistant (2505, 2506, 2507, 2511 and 2513) and resistant (2508, 2509 and 2510) to the powdery mildew attack.

Table 5. Correlation (Pearson's *r* and Spearman's *rho*) and *p*-values matrix among the analysed variables of the infection with powdery mildew in winter oat

Variable		*B. graminis* I% / plant	*B. graminis* F%	*B. graminis* I% / leaves	Attack degree AD%	Leaf 1	Leaf 2	Leaf 3	Leaf 4
B. graminis F%	Pearson's r	0.552 *	—						
	p-value	0.033	—						
	Spearman's rho	0.582 *	—						
	p-value	0.023	—						
B. graminis I% / leaves	Pearson's r	0.826 ***	0.455	—					
	p-value	< 0.001	0.088	—					
	Spearman's rho	0.755 **	0.463	—					
	p-value	0.001	0.082	—					
Attack degree AD%	Pearson's r	0.989 ***	0.632 *	0.819 ***	—				
	p-value	< 0.001	0.012	< 0.001	—				
	Spearman's rho	0.978 ***	0.697 **	0.749 **	—				
	p-value	< 0.001	0.004	0.001	—				
Leaf 1	Pearson's r	0.265	0.131	0.258	0.264	—			
	p-value	0.339	0.641	0.353	0.341	—			
	Spearman's rho	0.248	0.133	0.250	0.248	—			
	p-value	0.372	0.637	0.369	0.372	—			
Leaf 2	Pearson's r	0.570 *	0.262	0.262	0.565 *	0.515 *	—		
	p-value	0.027	0.346	0.345	0.028	0.050	—		
	Spearman's rho	0.635 *	0.295	0.338	0.635 *	0.476	—		
	p-value	0.011	0.286	0.218	0.011	0.073	—		
Leaf 3	Pearson's r	0.884 ***	0.437	0.950 ***	0.869 ***	0.234	0.321	—	
	p-value	< 0.001	0.103	< 0.001	< 0.001	0.402	0.243	—	
	Spearman's rho	0.857 ***	0.501	0.941 ***	0.844 ***	0.218	0.440	—	
	p-value	< 0.001	0.057	< 0.001	< 0.001	0.435	0.100	—	
Leaf 4	Pearson's r	0.790 ***	0.458	0.967 ***	0.789 ***	0.220	0.125	0.933 ***	—
	p-value	< 0.001	0.086	< 0.001	< 0.001	0.431	0.656	< 0.001	—
	Spearman's rho	0.718 **	0.528 *	0.880 ***	0.734 **	0.252	0.135	0.847 ***	—
	p-value	0.003	0.043	< 0.001	0.002	0.364	0.630	< 0.001	—

* p <0 .05, ** p < 0.01, *** p < 0.001

Source: Own calculation based on experimental data

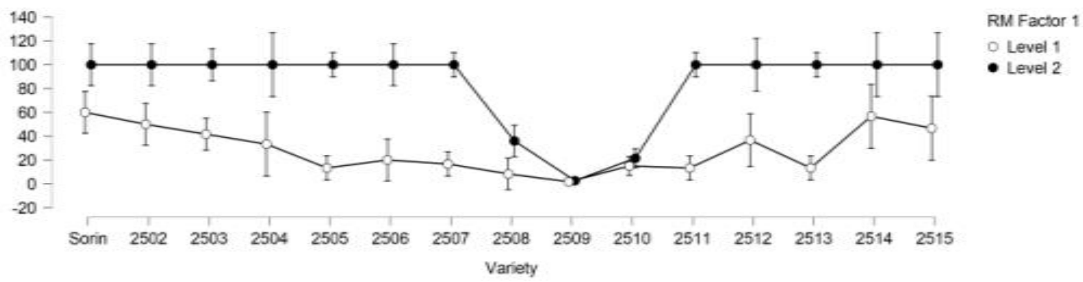

Fig. 7. Descriptive plot representing powdery mildew attack intensity I% (Level 1) and attack frequency F% (Level 2) in winter wheat trial
Source: Own research.

The obtained results were statistically processed using the correlation coefficients Pearson *(r)* și Spearman (*rho*), searching for the identification of some interrelations amongst the parameters of the powdery mildew attack on the winter oat. In Table 5 is presented the matrix of the Pearson's *r* and Spearman's *rho* and the significance levels (*p-value*).

According with the obtained results there weren't identified great differences among two types of correlation coefficient used, the obtained values being quite similar in almost all the correlations except two cases (Table 5). In the first case the correlation was significant for Pearson *r* between the powdery mildew attack on leaf 1 and leaf 2 (*r* = 0.515*) and in the case of Spearman *rho* wasn't significant; and the second the correlation found was significant with Spearman *rho* between F% and leaf 4 (*rho* = 0.528*), but for Pearson *r* wasn't significant. Thus, after the statistical analysis there were identified many correlations. The attack intensity (I%) was positively correlated with the attack frequency (F%) (*r* = 0.552*; *rho* = 0.582*), with the average intensity of the attack on leaves (*r* = 0.826***; *rho* = 0.755**), with attack degree (GA%) (*r* = 0.989***; *rho* = 0.978***), with the attack intensity on leaf 2 (*r* = 0.570*; *rho* = 0.635*), with attack intensity on leaf 3 (*r* = 0.884***; *rho* = 0.857***) and with the attack intensity on leaf 4 (*r* = 0.790***; *rho* = 0.718**). The attack frequency of the powdery mildew was correlated with attack degree (GA%) (*r* = 0.632*; *rho* = 0.697**) and attack intensity on the leaf 4 (*rho* = 0.528*). Attack intensity on leaves was correlated positively with attack degree (GA%) (*r* = 0.819***; *rho* = 0.749**), attack intensity on the leaf 3 (*r* = 0.950***; *rho* = 0.941***) and the attack intensity and leaf 4 (*r* = 0.967***; *rho* = 0.880**). Attack degree of the fungus was also positively correlated with the attack intensity on leaf 2 (*r* = 0.565*; *rho* = 0.635*), with attack intensity on leaf 3 (*r* = 0.869***; *rho* = 0.844***) and attack intensity on the leaf 4 (*r* = 0.789***; *rho* = 0.734**). Other positive correlations obtained here were between the attack intensity on leaf 1 with attack on the leaf 2 (*r* = 0.515*) and between the attack intensity on the leaf 3 with the attack on the leaf 4 (*r* = 0.933***; *rho* = 0.847***).

The obtained value for the multivariate normality Shapiro - Wilk was 0.284, respectively $p<0.001$. It shows that the variability of the correlated variables is normal (Table 6).

Table 6. Shapiro - Wilk test for multivariate normality of the correlated variables

Shapiro-Wilk Test for Multivariate Normality	
Shapiro-Wilk	**p**
0.284	< 0.001

Source: Own calculation based on experimental data

In the program for winter oat inbreeding from the Agricultural Research and Development Station Lovrin an important purpose is the obtaining of resistant genotypes to the attack of the specific pathogens. From all the pathogens that attack oat *Blumeria graminis* f. sp. a*venae* is considered very important and dangerous due to the yield significant loses determined, even 40% according with some researches, mainly in the years favourable for this pathogen [35].

Powdery mildew is very common in winter oat crops in Banat Plain, western Romania.

According with the results regarding the relative resistance 21.4% from the winter oat lines analysed were resistant to powdery mildew, 35.7% were manifested medium resistance to the pathogen, 21.4% were low resistant, 7.1% were sensitive and 14.3 very sensitive. Among the resistant lines was highlighted the line 2509 due to its great resistance to powdery mildew, being the only one from the trial where the leaves weren't attacked, the disease showing very small patches on the plants base that had stopped from evolution. This line presents interest for the inbreeding and can be used for the creation of new varieties of winter wheat at Agricultural Research and Development Station Lovrin.

In the future the researches will be oriented to the identification of the genes for resistance for powdery mildew from the oat lines used for inbreeding. Creation of new varieties with resistance to powdery mildew is important in the management of the pathogen, there being known that the most efficient method for the prevention of the appearance of the disease is the use of biologic material with high genetic resistance.

CONCLUSIONS

The comparative and competitive trial with 14 winter oat lines and a variety was set with the purpose to select resistance sources to the attack of the fungus *Blumeria graminis* f. sp. *avenae*. From the analysed lines in the conditions of natural infection only three have presented high relative resistance, respectively the lines 2508, 2509 and 2510. The line 2509 there was identified a great resistance to the powdery mildew attack. This line will be used in the future for the creation of new varieties. In the future are demanded researches of genetics for the identification of the genes for resistance to powdery mildew (Pm) from the winter oat lines from the Agricultural Research and Development Station Lovrin.

ACKNOWLEDGEMENTS

This research was possible due to courtesy of Oat Inbreeding Laboratory from Agricultural Research and Development Station Lovrin and the Monitoring Centre for Invasive Species from Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara

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