Cercetări Agronomice în Moldova
Vol. XLI , No. 1 (133) / 2008

RESISTANCE OF SOME BARLEY CULTIVARS AT LEAF DISEASES

Domnica Daniela PLĂCINTĂ*, Danela MURARIU

Bank of Plant Genetic Resources, Suceava

Received September 14, 2007

ABSTRACT *- Plant genetic resistance at diseases is a decisive factor for the productivity of every species. The diseases produced by fungi in barley crops had a large virulence spectrum and an infection intensity, which depended on the ecological conditions from the cultivation zone and the biological status of the genotype. The study has involved investigations conducted in the experimental field, under the climatic conditions of the years 2001 and 2006 on 42 barley genotypes (lines, varieties and landraces) from the Suceava Genebank collection. The biologic material was studied by the methodology of evaluation resistance within the European Project Genres CT98-104, in which Romania was a partner (1999-2002). The leaf diseases developed on plants were powdery mildew (Erysiphe graminis f.sp. hordei), leaf stipe (Pyrenophora graminea), spot bloth (Drechslera sorokiniana), leaf rust (Puccinia recondita) and scald (Rhynchosporium secalis). The infection degree on the leaf area was estimated for every studied genotype. The assessments were made during the vegetation period, by using the FAO notation and percentage. The results obtained in both years were pointed out by the different reaction of cultivars to diseases. Some genotypes developed immunity to fungi, like Pyrenophora graminea, Erysiphe graminis var. hordei, Rhynchosporium secalis, while others were extremely resistant at every identified fungus, pointing out the main role of the genotype in the resistance reaction. The climatic conditions of the two years, characterized by water deficit and normal temperatures, were a relevant factor in assessing the infection degree at diseases in the studied cultivars. The extremely resistant and immune genotypes could be used as a resistance source in the barley breeding programs.*

Key Words: diseases, resistance, genotype, infection, attack degree

REZUMAT - Rezistența la boli foliare a unor cultivare de orz. *Rezistența genetică la boli este un factor decisiv pentru productivitatea fiecărei specii. Bolile produse de fungi pe plantele de orz au un spectru larg de virulență şi o intensitate de infecție, care depinde de condițiile ecologice din zona de cultură şi de statutul biologic al genotipului. Studiul implică cercetări*

* E-mail: genebank@suceava.astral.ro

efectuate în câmpul experimental, în condiţiile climatice ale anilor 2001 şi 2006, pe 42 de genotipuri de orz (linii, soiuri, populaţii locale) din colecţia Băncii de Gene Suceava. Materialul a fost studiat prin aplicarea metodologiei de evaluare a rezistenţei din cadrul proiectului european Genres CT98-104, unde România a fost partener în perioada 1999-2002. Bolile foliare ce s-au manifestat pe plante au fost: făinarea (Erysiphe graminis f.sp. hordei), sfâşierea frunzelor (Pyrenophora graminea), helmintosporioza (Drechslera sorokiniana), rugina brună (Puccinia recondita), arsura frunzelor (Rhynchosporium secalis). Gradul de infecţie pe suprafaţa frunzelor a fost estimat pentru fiecare genotip. Estimările s-au efectuat în timpul perioadei de vegetaţie, utilizând note FAO şi procente. Rezultatele obţinute în ambii ani de studiu s-au evidenţiat prin reacţia diferită a cultivarelor la boli. Unele genotipuri au manifestat imunitate faţă de fungi, ca Pyrenophora graminea, Erysiphe graminis var. hordei, Rhynchosporium secalis, iar altele au fost extrem de rezistente şi rezistente la fiecare dintre fungii identificaţi, evidenţiind rolul principal al genotipului în reacţia de rezistenţă. Condiţiile climatice din cei doi ani, caracterizate prin deficit hidric şi temperaturi cu valori foarte apropiate de normală, au constituit un factor relevant în evaluarea gradului de infecţie la boli pe cultivarele studiate. Genotipurile evaluate extrem de rezistente şi imune pot fi utilizate ca sursă de rezistenţă în programele de ameliorare a orzului.

Cuvinte cheie: boli, rezistenţă, genotip, infecţie, grad de atac

INTRODUCTION

The genetic resistance against biotic stress is a decisive factor for the productive value of each crop species. The factors influencing the productivity in main crops are climatic conditions, sensibility or resistance to the attack of pathogens, fungi spectrum and parasitical capacity (Cristea, 2006). Although great progress was obtained by using chemical systemic and contact substances, and in the field of genetic breeding of resistance to diseases, too, the intensity and incidence of several disease attacks did not diminish (Ceapoiu, Negulescu, 1983). Generally, this happened in all crop species, but the highest damages were registered in case of cereals leaf diseases, especially in barley (Giosan, Ceapoiu, 1977). The study involves the resistance estimate of some leaf diseases, in the two years with different climatic conditions, in barley genotypes, as infraspecific germplasm source.

MATERIALS AND METHODS

Investigations were conducted in the experimental field of the Suceava Genebank, in the years 2001 and 2006, on 42 genotypes belonging to some different biological categories (35 lines, four cultivars and three local landraces) from Genebank's germplasm collection, preserved on average term at the temperature of +4ºC. In the experiencing years, temperatures were close to the normal ones and rainfall was in excess in 2006 (*Table 1*). In order to study the resistance of these genotypes to leaf diseases, we have used the methodology from the European Genres CT98-104 Project, where Romania was partner during period 1999-2002. The experience was set up in blocks with 2-meter row length; the distance between rows was of 25 cm and between samples, of 50 cm.

Table 1 - The average rainfall and temperatures during barley vegetation period (2001 and 2006)

Month	April		May		June		July		August	
	2001	2006	2001	2006	2001	2006	2001	2006	2001	2006
Mean temperatures (T°C)	8.9	9.0	14.0	13.3	16.2	16.6	20.9	19.7	19.7	18.6
Mean rainfall (mm)	60.5	73.0	29.9	70.7	94.1	164.7	91.4	119.6	73.4	211.5

The infection percentage on the leaf area was visually assessed, beginning with the incipient phase of disease and continuing with the optimum stage of disease development, until harvesting.

The visual observation concerning the intensity and the frequency of the attack was done by using typical schemes and FAO notation systems (1-immune, 2- extremely resistant, 3- resistant, 4- moderately resistant, 5- transition from 4 to 6, 6- moderately susceptible, 7- susceptible, 8- transition from 7 to 9 and 9 - highly susceptible).

Data with field observations were assumed in the special spreadsheet prepared in the file Xls, which automatically calculates the average of infection percentage for each identified disease.

RESULTS AND DISCUSSION

During the vegetation period, on the studied genotypes the following micromycetes were pointed out: *Erysiphe graminis var.hordei, Puccinia recondita, Pyrenophora graminea, Drechslera sorokiniana, Rhynchosporium secalis.*

The resistance of the tested barley cultivars, under the climatic conditions of the years 2001 and 2006, had a different reaction for each identified disease.

In 2001 and 2006, the low temperatures during the germination period, from April to May, have influenced the infection with *Pyrenophora gramineea* and *Drechslera sorokiniana* (*Table 2, Figure 1*). The temperature differences of 16°C-20.9°C and rainfall from June and July in the growing period have favoured the infection with *Erysiphe graminis var.hordei*, *Puccinia recondita* and *Rhynchosporium secalis*. We observed that in the both experiencing years, *Pyrenophora gramineea* did not develop on two genotypes, *Erysiphe graminis var.hordei* on a genotype and *Rhynchosporium secalis* on another genotype; these have shown immunity to the attack of the respective pathogenic agents. Four extremely resistant genotypes were found at the attack of *Puccinia recondita* and one resistant genotype at each mycromicete: *Drechslera sorokiniana, Erysiphe graminis var.hordei* and *Puccinia recondita.*

Table 2 - The genotype behaviour to certain mycromicetes

Pathogenic agent	Total tested genotypes	Genotypes (access numbers)	Attack degree (%)		FAO notation		The resistance reaction
			2001	2006	2001	2006	
Pyrenophora graminea	10	10959, 10696	0	0	1	1	Immune
		10745, 10754 11086, 11187 2680, 11093 11176, 11293	2.3-3.3	0.3-0.5	3	1	Immune-Resistant
Drechslera sorokiniana	5	11530	3.3	3.5	3	3	Resistant
		10252, 2654 2672, 10799	2.2-3.3	0.7-3.8	3	1	Immune-Resistant
Erysiphe graminis var.hordei	10	2709	3.3	3.5	3	3	Resistant
		10251	0	0.5	1	1	Immune
		2651, 10782	3.1-3.5	1.0-1.6	3	2	Extremely resistant-Resistant
		2687, 2648	2.7-3.7	6.3-6.5	3	4	Resistant-Moderately resistant
		10703, 11049 10961, 10739	3.6-4.4	13.0 28.0	4	7	Moderately resistant Susceptible
Puccinia recondita	11	10761, 11166 11284, 6624	1.4-1.9	0.7-0.8	2	2	Extremely resistant
		2673	2.5	2.2	3	3	Resistant
		2695, 2660	2.2-2.9	0-0.7	3	1	Immune-resistant
		11204, 5641	1.4-1.6	0	2	1	Immune-Extremely resistant
		10697, 11219	1.0-1.4	3.0-3.8	2	3	Extremely resistant-Resistant
Rhynchospo-rium secalis	6	10954, 11526, 6594	3.5-3.6	0	3	1	Immune-Resistant
		2711	0.5	0.5	1	1	Immune
		11486, 6603	1.4-1.9	0.6	2	1	Immune-Extremely resistant

Showing certain immune or extremely resistant genotypes to some pathogenic agents, which diminished production because of determined leaf diseases, was very important for their use in barley breeding works. The transmission of these resistance traits contributed to increasing the yield capacity of the new cultivars.

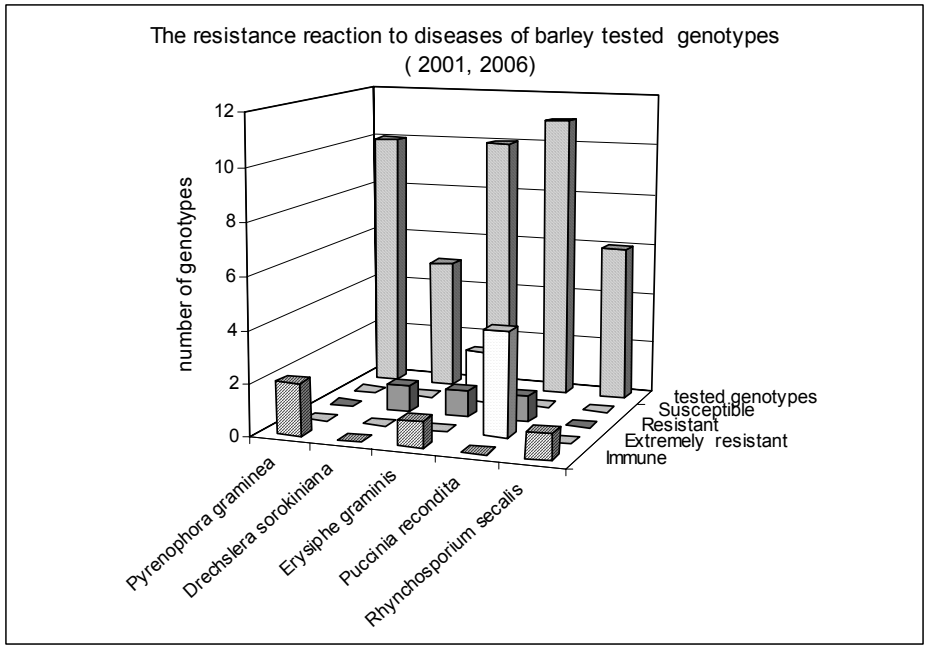

Fig. 1 - **The resistance reaction of barley genotypes infested with mycromicetes**

CONCLUSIONS

The resistance reaction of tested barley genotypes, under the climatic conditions of 2001 and 2006, at leaf diseases, produced by *Pyrenophora graminea, Drechslera sorokiniana, Erysiphe graminis var.hordei, Puccinia recondita, Rhynchosporium secalis,* were manifest by chlorotic or necrotic spots, different infection degree pustules, according to the specific features of each disease.

By processing data, significant differences resulted in both experiencing years; from eleven tested genotypes, three extremely resistant lines (10761, 11166 and 11284), one cultivar (6624) and one resistant line (2673) have been identified at the leaf rust infection; from ten tested genotypes, one resistant line (2709) and one immune local landrace (10251) have been identified at the powdery mildew infection; from ten tested genotypes, two immune lines (10959, 10696) have been identified at the leaf stripe infection; from five tested genotypes, one resistance line (11530) has been identified at the spot bloth infection; from six tested genotypes, one immune line (2711) has been identified at the scald infection.

The obtained results pointed out the essential role of the genotype in the resistance reaction, but the climatic conditions in both years, with close hydric

and thermal values, represented an important factor in assessing the micromycetes attack degree in studied cultivars. The estimated genotypes, which were resistant and immune, could be used as resistance source in breeding susceptible barley cultivars.

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