Influence of the brown rust *Puccinia recondita* (Dietel & Holw.) on the nutritive values in different sorts of wheat

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Abstract

In this paper are presented data concerning the influence of the brown rust on some biochemical parameters which determine the nutritive value of 6 wheat sorts, recently homologated, cultivated in the experimental field from the Agricultural Research Station Podu Iloaiei, Iasi. The studied sorts are: Faur, Maruca (Bety) (homologated in 2004), Iasi 2 (homologated in 2002), Magistral (homologated in 1998), Gabriela (homologated in 1992), Fundulea 2 (homologated in 1987). We present the data regarding the determinations concerning the content in soluble proteins (albumins and globulins) and mineral elements (sodium, potassium and calcium) and we noticed differences in each sort in connection with resistance to brown rust.

Keywords: wheat sorts, brown rust, nutritive values

Introduction

Brown rust is a disease presented in Romania, with medium loss of culture of 5 - 10%, in some years they might reach 40%. Pathogen agent produced structural, anatomo-morphological, physiological and biochemical modifications in the host plant, according with its sensibility, with the virulence of the pathogen agent, with elaborated enzymes and toxynes, as well as a series of factors from the environment, all those modifications are the symptomathology of the diseases or their pathography. Physiological and biochemical modifications were studied by different authors, a referenced monographic synthesis being published by V. P. Kuprevici, the most of the results presented in this paper being valid in the present [9]. Recently, a monographic study was published concerning the relation of pathogen agents with host plants [18]. In Romania there were made many research concerning physiological and biochemical of the sick plant. Valeria Barbu wrote a doctoral thesis concerning the influence of rust (*Phragmidium mucronatum)* and of black spot (*Diplocarpon rosae*) of rose on some physiological and biochemical processes in the host plant [3]. Valentina Jurcă & al. studied peroxidase and isoperoxidase in the apple tree leaf attacked by powder mildew (*Podosphaera leucotricha*) and under the effect of pesticide treatment [7, 8]. Alice Pisică - Donose and her collaborators made physiological and biochemical research in some species of plants of meadows, healthy and attacked by some different pathogen agents [10, 11]. Eugenia Eliade, in her monography concerning erysiphaceae from Romania, presented the results of some Romanian and foreign authors concerning biochemical modifications (the content of water, carbon hidrats, clorophylla, enzymes) and physiological (perspiration, photosynthesis, respiration) caused by the attack of erysiphaceae on different species of plants [6]. Anca Antohe and her collaborators made ecophysiological studies in some sorts of plums in conditions of applying the treatment with pesticides and of the attack of *Polystigma rubrum* [1]. Ştefania Surdu & al. [19, 20, 21, 22], Zenovia Olteanu & al. [12, 13, 14, 15, 16], as well as Lăcramioara Antohe & al. [2] published data concerning the dynamic of some biochemical indicators in rye plants damaged by *Claviceps purpurea*, and Crăiţa Roşu made studies concerning modifications brought by the attack of phytopathogen fungi on the sugar beet [17].

In some complex research concerning the study of the biology of the *Puccinia recondita* (brown rust) on different sorts and lines of wheat cultivated in the Moldavian area, in the present paper are presented the results concerning the influence of this pathogen agent on some parameters that determine the nutritive value of wheat sorts: soluble proteins (albumins and globulins) and mineral elements (sodium, potassium and calcium). The proteins from the wheat are, first of all, from prolamins (4 - 5 g/100gr sorts) and glutins (3 - 4 g/100gr sorts) and less from albumins (0,3 - 0,5,g/100gr sorts) and globulins (0,6 - 1 g/100gr sorts). The mineral substances are represented by a large number of chemical elements has a contribution of 1,5 - 2,3 mg/100 g wheat, being in the peripherical parts of the wheat [5].

Materials and Methods

The research was carried on wheat sorts *Faur, Maruca (Bety)* (homologated in 2004), *Iasi 2* (homologated in 2002), *Magistral* (homologated in 1998), *Gabriela* (homologated in 1992), *Fundulea 2* (homologated in 1987) cultivated in the experimental field from the Agricultural Research Station Podu Iloaiei, Iasi. The experimental field is situated in the inferior terrace of Bahluieţ river, with a cambial chernozem soil typical, medium levigated; the area is favorable for wheat culture. The climate regime of 2005 - 2006 was

characterized by the lack of rainfall in autumn, that postponed the period for seeding the wheat with 10 to 15 days outside the optimum period. For making and filling of the wheat grain, the quantity of rainfall was of 64,2 mm in three days, the humidity conditions with high temperatures during that period lead to great values of the attack of brown rust. The attack of brown rust was appreciated by grades from 1 to 9, a measuring system made after F.A.O. scale (Table 1), resulting the following classification of the sorts:

Table 1. Resistant of sorts of wheat in *Puccinia recondita*

Crt. no.	Sorts	Classification	Medium production (kg/ha) 2006
1.	Iaşi 2	Resistant - R	5.383
2.	Maruca (Bety)	Medium resistant - MR	4.870
3.	Faur	Medium resistant - MR	4.807
4.	Magistral	Medium sensible - MS	5.193
5.	Gabriela	Sensible - S	4.703
6.	Fundulea 4	Sensible - S	3.693

Determination of soluble proteins was made by Bradford method [4], of sodium and potassium by spectrophotometry by atomic emission (M 410 Sherwood scientific) and calcium was determined by titrymetric method (titration with EDTA).

Results and Discutions

The results concerning the influence of *Puccinia recondita* attack on the proteins content (albumins and globulins) and mineral elements (sodium, potassium and calcium) in different sorts of wheat are presented in figures 1 - 5.

In figure 1 is presented the content of albumins, the highest value - 1,7517 mg/g grains - was determined at *Fundulea 4*, sensible to brown rust, and the lowest one - 1,6790 mg/g grains at *Maruca* (*Bety*), medium resistant to this pathogen agent. Between these two extremes values are situated the other sorts of wheat: *Magistral* - medium resistant to brown rust - 1,7407 mg/g grains, *Gabriela* - sensible to brown rust - 1,7336 mg/ g grains, *Iasi 2* - resistant to brown rust - 1,7053 mg/g grains, *Faur* - medium resistant to brown rust - 1,6804 mg/g grains. It was noticed that for the sorts *Fundulea 4, Magistral* and *Gabriela*, sensible and medium sensible to brown rust the highest quantity of albumins was determined, and all the values are much higher then those mentioned by N. Ceapoiu and collaborators [5].

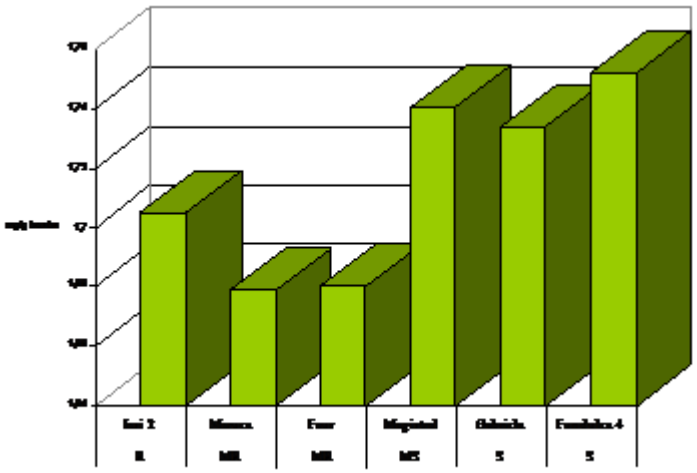

Figure 1. Influence of *Puccinia recondita* attack on the content of albumins in different sorts of wheat

The variation of the globulins content is presented in figure 2, from which result the values of this protein, on sorts, were the following: *Iasi 2* - 1,2473 mg/g grains, *Gabriela* - 1,1890 mg/g grains, *Maruca* (*Bety*) - 1,1854 mg/ g grains, *Fundulea 4* - 1,1611 mg/g grains, *Faur* - 1,1322 mg/ g grains, *Magistral* - 1,1276 mg/g grains. The highest quantity of globulins was evidenced in *Iasi 2*, resistant to the attack of *Puccinia recondita*; this increase may be explained by the fact that globulins intervenes in the increase of the immunity before the face of the pathogen agents.

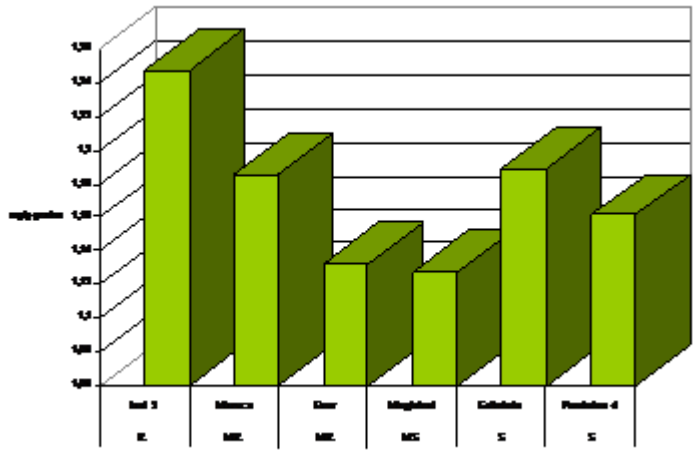

Figure 2. Influence of *Puccinia recondita* attack on the content of globulins in different sorts of wheat

The results concerning the influence of *Puccinia recondita* attack on the content of sodium are presented in figure 3, from which we can see that the highest value of this element was determined in *Gabriela* - 0,0998 mg/g grains, followed in a decreasing order by *Iasi 2* - 0,0990 mg/g grains, *Maruca* (*Bety*) - 0,080 mg/ g grains, *Magistral* - 0,0798 mg/g grains*, Fundulea 4* - 0,0770 mg/g grains and *Faur* - 0,0597 mg/g grains. These data shows that it was impossible to establish a direct correlation between the grade of brown rust attack and the sodium content of sorts.

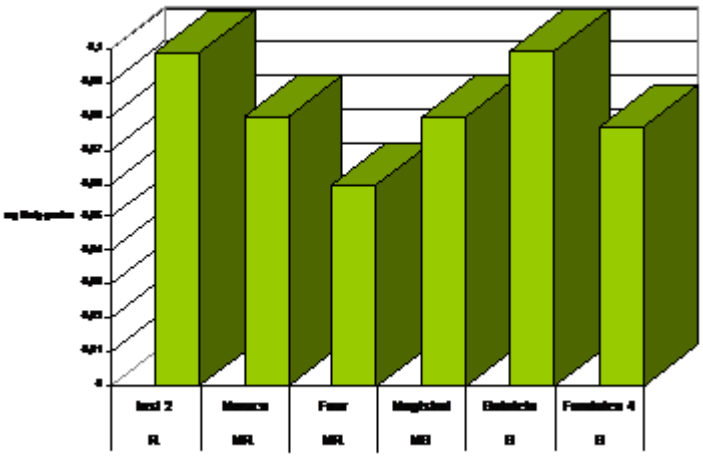

Figure 3. Influence of *Puccinia recondita* attack on the content in sodium in different sorts of wheat

In figure 4 are presented data concerning the content of potassium of wheat sorts according to the resistance to brown rust, from which we can notice the values of this mineral element are approximately equal for all the sorts: *Maruca* (*Bety*) - 2,635 mg K/g grains, *Faur* - 2,576 mg K/g grains, *Fundulea 4* - 2,483 mg K/g grains, *Iasi 2* - 2,215 mg K/g grains, *Magistral* - 2,092 mg K/g grains, without differences according to the resistance in *Puccinia recondita* attack.

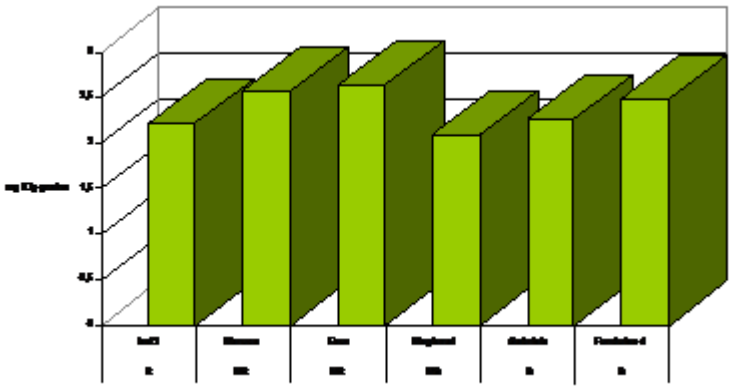

Figure 4. Influence of *Puccinia recondita* attack on the content in potassium in different sorts of wheat

Data concerning the influence of *Puccinia recondita* attack on the content of calcium in the wheat sorts are presented in figure 5, from which we can notice that the highest value of this mineral element - 0,2396 mg Ca/g grains was determined in *Magistral* sort, and the lowest value - 0,079 mg Ca/g grains in *Fundulea* 4; for the other sorts of wheat at which the value of calcium had the following values: *Faur* - 0,2390 mg Ca/g grains, *Maruca* (*Bety*) - 0,1598 mg Ca/g grains, Gabriela - 0,1597 mg Ca/g grains, *Iasi 2* - 0,01590 mg Ca/g grains; we couldn't also establish a direct correlation between the content of calcium in a different sorts of wheat and their resistance to the brown rust attack.

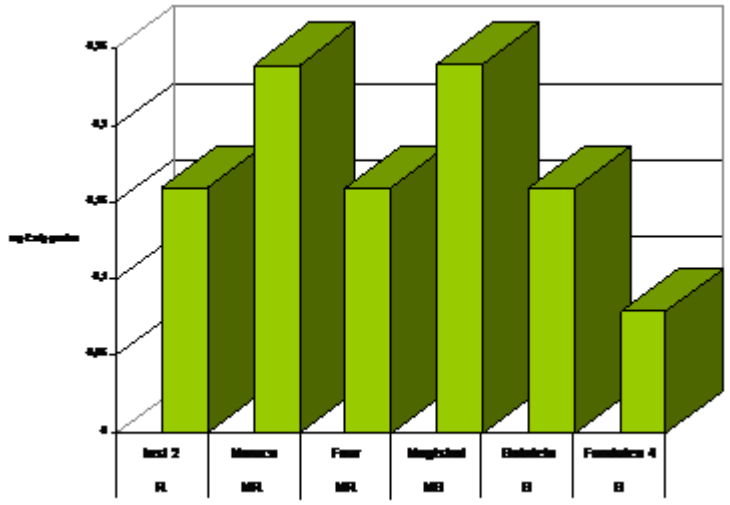

Figure 5. The influence of *Puccinia recondite* attack on the content in calcium in different sorts of wheat

Conclusions

1. The content of albumins had increased values in sorts with sensible and medium sensible to brown rust (*Fundulea, Magistra and Gabriela*) and in globulins to *Iasi 2*, resistant to the *Puccinia recondita* attack.

2. In sorts of wheat studied there was not established a direct relation among content of sodium, potassium, calcium and the grade of brown rust attack.

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