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RESEARCH ON BARLEY DISEASES IN THE CONVENTIONAL CULTURE AND IN THE CONVERSION PERIOD, MURIGHIOL LOCATION, TULCEA COUNTY

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Abstract

The aim of our research was to establish the incidence of micromycete attack on barley grown in classical technology and in culture during the conversion period to move to organic farming, in the Murighiol area, Tulcea county, in 2020/2021. The most common micromycetes in barley crops were P. teres which causes net blotch of barley, P. graminea responsible for barley leaf stripe disease and Puccinia hordei agent pathogen of leaf rust on barley. In the case of barley cultivated in a conventional system, the control variant determined a degree of attack of 29.5% for P. teres, 6% for P. graminea and 11% for P. hordei. In the barley variant during the conversion period, the values recorded were 28.5% for P. teres, 4.5% for P. graminea and 12% for P. hordei. The application of treatments to conventionally grown barley was over 50% effective in controlling pathogens and in the barley variant during the conversion period to which the Amer Micro product was applied, there were lower values of the attack of the monitored pathogens, compared to the control variant.

Key words*: barley, pathogens, diseases, degree of attack.*

INTRODUCTION

Barley is one of the oldest cultivated plants with uses in human nutrition, animals and as a raw material in industry (Muntean et al., 2003). The protection of barley crops ensures productions that satisfy the requirements of cultivating this plant in obtaining superior quantitative and qualitative productions. Barley is attacked by cereal and barley-specific pathogens, such as *Blumeria graminis* f. sp. *hordei* that causes powdery mildew, net blotch of barley caused by *Pyrenophora teres*, micromycete barley leaf stripe disease caused by *Pyrenophora graminea*, the leaf rust whose pathogen is *Puccinia hordei*. Barley diseases affect the health of plants causing severe symptoms but also cause significant economic losses (Neate and McMullen, 2005). Cultivation of resistant genotypes and interventions in crop technology and the application of strategies to control them can reduce the losses caused by barley disease. *Pyrenophora teres* the causative agent of barley net blotch one of the most important economic diseases in barley producing losses between 10% and 40% and even with the possibility of compromising crops (Galano et al., 2011; Jayasena et al., 2007) being present wherever barley is grown (Shipton et al., 1973; Sato and Takeda, 1997; Tekauz, 1990; Moya et al., 2018). *Pyrenophora graminea* causes the leaf stripe disease and the plants with characteristic symptoms on the leaves produce sterile ears (Zad et al., 2002), causing production losses of both quantitative and qualitative nature (Arabi et al., 2004; Porta-Puglia et al., 1986; Damaci and Aktuna, 1983; Aktas, 1984). The attack of the pathogen was present in barley in two rows (Cristea and Gheorghies, 1997). The attack of leaf rust caused by the micromycete *Puccinia hordei* occurs in all areas of barley cultivation with variable values of the incident producing more severe yield losses in sensitive varieties and in areas where barley crops mature later. The leaf rust attack reduces crop levels by reducing the number of fertile ears and grain weight (Arnst et al., 1979). In epidemic conditions, production losses of up to 62% have been reported for susceptible varieties (Park et al., 2015). The calculation of the effectiveness of treatments in combating diseases of cultivated plants is required to ascertain their impact on health and crop yield

(Alexandru et al., 2019; Buzatu et al., 2018; Jaloba al., 2019; Toth and Cristea, 2020).

MATERIALS AND METHODS

The aim of the research was to identify and establish the attack of the main diseases of barley grown in conventional cultivation system and barley in the conversion period for the transition to organic cultivation. Diseases were identified and the frequency, intensity and degree of attack were calculated. To calculate the incidence of the attack or its frequency, the formula was used: Frequency (F%) = n x 100/ N, where N = number of plants observed (%), n = number of plants specific symptoms (%). The intensity was noted in percentages and calculated according to the formula: Intensity (I%) = Σ (ixf)/n (%) where, i = percentage given, f = number of plants/organs with the respective percentage, n = total number of attacked plants/organs. Based on the data obtained by calculating the frequency and intensity, the degree of attack was calculated: GA= F x I/100 (%), where: GA = attack degree (%), F = frequency (%), I = intensity (%). The effectiveness of the treatment was calculated according to the formula: E (%) = [(GA var c – GA var t)/GA var c], where: GA var c = degree of attack in the control variant (untreated) and Ga var t= degree of attack in the treated variant. The biological material was the Cardinal variety. The treatment of the barley seed in conventional cultivation was done with the product Admiral 0.5 l/t and the fungicide Zamir was applied at a dose of 0.75 l/ha. The witness was untreated. For the barley crop in the conversion period for the transition to an ecological system, the seed used for sowing was untreated, but passed through the selector and administered the AmerMicro product, certified from an ecological point of view. The barley control variant during the conversion period was free of treatment.

RESULTS AND DISCUSSIONS

In the conditions of the agricultural year 2020-2021 (Figure 1) in the area of experimentation for barley cultivation both in conventional cultivation system (Figure 2) and for barley cultivation in the conversion period (Figure 3), in order to the transition to organic cultivation showed important and common diseases of barley, caused by micromycetes: the barley net blotch caused by *Pyrenophora teres*, barley leaf stripe disease caused by *Pyrenophora graminea*, the leaf rust agent pathogen *Puccinia hordei*. In the case of the attack of *Pyrenophora teres* on the leaves, characteristic brown spots with velvety appearance were found as a result of the formation of specific asexuate fructifications (Figure 4).

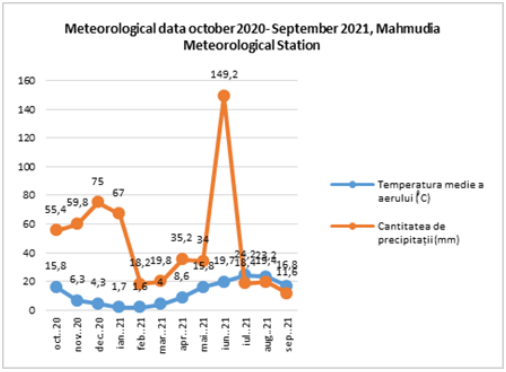

Figure 1. Meteorological data October 2020 - September 2021, Mahmudia Meteorological Station, Tulcea County

In the case of the attack of barley leaf stripe disease *Pyrenophora graminea*, the presence of elongated brown-gray spots with a larger darker border with a velvety gray center was noted due to the formation of specific fructifications (Figure 5). The presence of pustules with uredospores and teleutospores specific to the genus *Puccinia* (Figure 6) identified the rust attack on barley grown in the two cropping systems. In the conditions of the agricultural year 2020-2021, barley net blotch recorded a frequency of 100% and an intensity of 29.5% which led to an attack value of 29.5%. At the same variant, barley leaf stripe disease registered a frequency of 6% and in terms of the attack of leaf rust it had an incidence of attack of 100% and an intensity of 11%, resulting in a value of the degree of attack of 11%. In barley culture in conventional culture, the treated values of the monitored pathogens were reduced so that the intensity in the case of *Pyrenophora teres* attack decreased to 12.5%, the frequency remained maximum which led to a value of the degree of attack equal to the value intensity, GA = 12.5%.

Regarding the attack of barley leaf stripe disease, it can be said that the treatment of the seed reduced the incidence of the pathogen to 1.5%, compared to the control variant in which a value of 6% was noted. Observations on the rust attack on the leaves showed a decrease in the intensity of the attack which reached 5% (Table 1). Observations on the pathogen attack evaluated for barley in the conversion period, data from the same table (Table 1) show that the attack of *Pyrenophora teres* had a frequency of 100%, in both variants as well as in conventional culture but with a value of intensity I = 28.5%, resulting in a degree of attack of GA = 28.5%. Regarding the attack of *Pyrenophora graminea*, the data showed that the frequency of the attack was F = 4.5%. The net blotch and barley leaf stripe disease were present with different incidents in barley varieties grown in Romania (Pana et al., 2015). Research on the influence of technological links on *P. graminea* attack has established correlations on the level of fungal attack (Cristea et al., 1998). We consider that subjecting the seed to the selection operation has removed the seeds carrying a potential attack. The micromycete *Puccinia hordei* recorded a significantly higher attack value of 12% than in the control variant in the conventional culture system. In the barley version in the conversion period to which the Amer Micro product was applied, the attack values of the monitored pathogens were lower (Table 1).

Figure 2. Barley crop aspect - conventional culture (original)

Figure 3. Aspect of the barley crop in the conversion period (original)

Figure 4. *Pyrenophora teres* (FA *Drechslera teres*-conidia) (original)

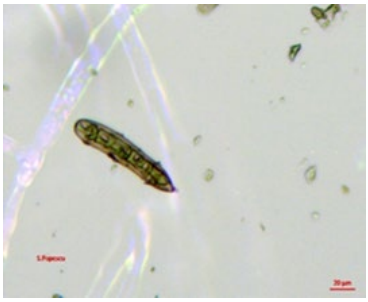

Figure 5. *Pyrenophora graminea* (FA *D. graminea*-conidia) (original)

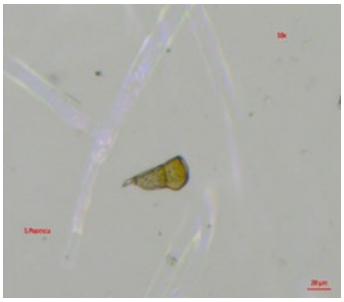

Figure 6. *Puccinia hordei* (teleutospore) (original)

Table 1. Observations regarding the attack of barley leaf diseases in conventional culture and in the conversion period (2020-2021) Sarinasuf - Murighiol location, Tulcea county

Variety/culture system	Variant Treat/ control	The pathogen/disease *Pyrenophora teres*/ Barley net bloch			*Pyrenophora graminea*/ Leaf barley stripe	*Puccinia hordei*/ Leaf rust		
		F (%)	I (%)	GA (%)	F (%)	F (%)	I (%)	GA (%)
Cardinal/ conventional system	Treat	100	12.5	12.5	1.5	100	5.0	5.0
	Control	100	29.5	29.5	6.0	100	11	11
Cardinal/ conversion period	Treat	100	21.5	21.5	3.0	100	8.5	8.5
	Control	100	28.5	28.5	4.5	100	12	12

The application of the treatment with the Zamir product in a dose of 0.75 l/ ha to the barley cultivated in conventional system registered values of efficacy of 57.6% in the case of the net blotch attack and of 75% in the case of the *P. graminea* attack and of 54.5% for leaf rust attack (Table 2). Research on the application of treatments has shown that they have significantly reduced the attack of barley pathogens.

Table 2. Effectiveness of treatment on barley leaf diseases in conventional culture (2020-2021) Sarinasuf - Murighiol location. Tulcea county

Variety/culture system	Variant Trait/ control	The pathogen/disease *Pyrenophora teres*/ Barley net bloch		*Pyrenophora graminea*/ Leaf barley stripe		*Puccinia hordei*/ Leaf rust	
		GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)
Cardinal/ conventional system	Trait	12.5	57.6	1.5	75	5	54.5
	Control	29.5	-	6.0	-	11	-
Cardinal/ conversion period	Trait	21.5	24.5	2.5	44.4	8.5	29.2
	Control	28.5	-	4.5	-	12	-

CONCLUSIONS

Incidence diseases of barley in the experimental area in the conditions of the year 2020-2021 cultivated in conventional systems and during the conversion period were caused by the micromycetes of *Pyrenophora teres*, *Pyrenophora graminea*, and *Puccinia hordei*. The frequency of the attack was maximum in *P. teres* and *P. hordei* micromycetes in all experimental variants. The attack values of *P. teres and P. hordei* were significantly higher in the barley crop during the conversion period. The attack of *P. graminea* micromycete was lower in the barley in the conversion period compared to the untreated variant in the conventional system. which we attribute to the seed selection operation.

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