Scientific Papers. Series A. Agronomy, Vol. LXVI, No. 1, 2023
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

RESEARCH ON FOLIAR DISEASES OF BARLEY, MURIGHIOL LOCATION, TULCEA COUNTY

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Abstract

The research followed the evolution of the mycosis attack of autumn barley cultivated in the classical culture and during the conversion period to switch to the ecological culture, in the agricultural year 2021-2022, in Tulcea county. The frequent micromycetes were Pyrenophora teres, Pyrenophora graminea, Puccinia hordei, Rhynchosporium secalis and Blumeria graminis f.sp. hordei. In the barley cultivated in the two systems, the incidence of attack by Pyrenophora teres and Puccinia hordei was 100%. The frequency of the Pyrenophora graminea attack was 5% and 6% in the control variants. The powdery mildew attack was more sensitive to barley in the conventional culture and the Rhynchosporium secalis attack was subunit in both culture systems. The application of the treatment in the conventional system ensured an effectiveness of over 64%.

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

INTRODUCTION

The phytosanitary status of barley crops constitutes a condition for high and quality productions. Barley is attacked by specific pathogens such as *Pyrenophora graminea* which causes the leaf stripe disease, *Pyrenophora teres* which induces net blotch of barley, rust caused by the micromycete *Puccinia hordei, Rhynchosporium secalis*, responsible for the appearance of scald, *Blumeria graminis* f. sp. *hordei* causes powdery mildew. Barley pathogens induce changes in plants and severely reduce barley production (Neate & McMullen, 2005). When the attack of *Blumeria graminis* f. sp. *hordei* is not controlled it can become devastating (Haugaard et al., 2001), and the control by using fungicides is usually fast but the fungus has the potential to develop tolerance to the most used chemical products (De Waard et al., 1993). *Pyrenophora graminea*, a pathogen with a major impact on seeds as well (Zad et al., 2002; Manole & Cristea, 2015) requires adequate control (Cristea & Gheorghies, 1997), the losses produced by this pathogen being important for barley culture (Porta-Puglia et al., 1986; Damgaci & Aktuna, 1983). *Pyrenophora teres* has become one of the most common diseases of barley (Shipton et al., 1973; Popescu & Cristea, 2022) which produces yield losses of up to 40% in sensitive plants (Beckes et al., 2021) with an impact on seeds and even compromising production (Liu et al., 2011). The manifestation of the disease differs with the virulence of the pathogen, the genotype of the host, environmental conditions and losses being different for sensitive and resistant varieties (McLean et al., 2009). *Rhyncosporium secalis* causes leaf blotch or scald of barley and is found wherever barley is grown (Goodwin, 2002) causing production losses of over 35% (Shipton et al., 1973) being also present on other plant species (Caldwell, 1937). The attack of the micromycete *Puccinia hordei* differs with the genotype and causes production reductions of up to 62% in sensitive varieties (Park et al., 2015). The measures to prevent and control the pathogens of cultivated plants have in mind an integrated control, with an emphasis on the cultivated genotype (Pana et al., 2015) and where the application of treatments is required, it is necessary to calculate their effectiveness (Toth & Cristea, 2020; Toth &

Cristea, 2018; Jaloba et al., 2019). Biopesticides based on natural components, extracted from microorganisms constitute a means of biological control (Haugaard et al., 2001; Schonbeck & Dehne, 1986; Reglinski et al., 1990).

MATERIALS AND METHODS

The aim of the research was to monitor barley diseases in the conventional culture and the culture in the conversion period for the transition to the ecological culture in the year 2021-2022. The experiments were located in Sarinasuf, Murighol, Tulcea County. The Cardinal variety was cultivated in a conventional system and conversion for the transition to ecological culture. For the culture experience in the conventional system, the seed was treated with the fungicide Amiral (0.5 l/t), and the vegetation was treated with the fungicide falcon, in a dose of 0.8 l/ha, together with the foliar fertilizer First Power and the biostimulator Aminoplant, 1 l/ha. No treatments were applied to the control variant. In the case of the experience with barley during the conversion period for the transition to ecological culture, the seed was untreated, but passed through the selector. Foliar fertilization was carried out with the product Inofol 10 l/ha with the Delfan biostimulator, in a dose of 2 l/ha, these fertilizers being ecologically certified. The control variant was free of treatment. Based on the clinical picture, the characteristic symptoms were identified and the responsible pathogens were identified microscopically.

Observations were made regarding the incidence of the attack (F%), the intensity (I%), calculating the degree of attack for the detected diseases based on the data obtained. Calculation formulas were used: Frequency (F %) = n x 100/N, where N = number of plants observed (%), n = number of plants specific symptoms (%), 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, GA = attack degree (%), F = frequency (%), I = intensity (%). The effectiveness of the tratment was calculated acoording to the formula E (%) = [(GA var c – GA var t)/GAvar c], where: GA var c = degree of attack in the control variant and si Ga var t = degree of attack in the traded variant. The Cardinal variety was cultivated in a conventional system and conversion for the transition to ecological culture. The experiments were located in Sarinasuf, Murighol, Tulcea County. For the culture experience in the conventional system, the seed was treated with the fungicide Amiral, (0.5l/t), and the vegetation was treated with the fungicide Falcon, in a dose of 0.8l/ha, with the foliar fertilizer First Power and the biostimulator Aminoplant, 1 l/ha. No treatments were applied to the control variant. In the case of the experience with barley during the conversion period for the transition to ecological culture, the seed was untreated, but passed through the selector. The foliar fertilization was carried out with the Inofol 10 l/ha product together with the Delfan biostimulator, in a dose of 2 l/ha, these fertilizers being ecologically certified. The control variant was free of treatment.

RESULTS AND DISCUSSIONS

In the conditions of the year 2021-2022 (Figure 1) in the experimental area, barley culture was monitored in the conventional system (Figure 2) and in the conversion period for the transition to ecological culture (Figure 3). The detected diseases were: net blotch, caused by the micromycete *Pyrenopfora teres*, the leaf stripe disease, caused by the pathogen *Pyrenophora graminea*, rust, produced by *Puccinia hordei* (Popescu & Cristea, 2021), the powdery mildew caused by the fungus *Blumeria graminis* f. sp. hordei, scald caused by *Rhynchosporium secalis* (Table 1). The data regarding the attack of diseases in the experience of barley grown in the conventional system show that, in the case of the reticular leaf spot attack, a frequency of 100% was found on barley leaves in both culture systems. Regarding the intensity of the attack of the pathogen *Pyrenophora teres* in the conventional system, the value was 30.5% in the control variant and in the treated variant the value of the intensity of the attack was lower, of 9.5%, which led to values of the degree of attack of 30.5% and respectively 9.5. In the case of the leaf tearing attack, the incidence on the leaves was noted, resulting in a frequency of 6% in the control variant and 2% in the treated variant. The net blotch and barley stripe leaf disease were present with different values of the attack in barley varieties cultivated in Romania (Pana et al., 2015). The attack of the micromycete *Puccinia hordei* was manifested with the maximum frequency (F = 100%) so the values of the intensity of the attack made the difference regarding the degree of attack. The intensity of the rust attack was 26.5% in the control variant and 9.5% in the treated variant. The powdery mildew attack was 2.6% in the control and was reduced below 1% in the control variant. The biggest difference in attack values was found in attack frequency, respectively 31% in the control variant and 14% in the treated variant. Regarding the intensity value, it was 6.5% for the treated variant and 8.5% for the control variant. The attack of the micromycete *Rhynchosporium secalis* on the leaves was also noted with a frequency of 8% and an intensity of 4.5% in the treated variant and F = 12% and I = 6% in the control variant. The values of the degree of attack when burning the leaves was below 1% in both cases (Table 1).

Research has shown that the application of treatments reduced the attack of barley pathogens (Cristea & Gheorghies, 1997). The data from the same table regarding the attack of pathogens detected in the experience with barley in the conversion period for the transition to ecological culture showed that the values of the attack of pathogens were higher. Thus, in the case of the *Pyrenophora teres* attack, it manifested itself with maximum frequency, but the intensity values were 27.5% in the control variant and 20.5% in the variant to which the certified products were applied. The attack of *Pyrenophora graminea* fungus recorded an incidence of 3% and 5%, respectively, and the frequent rust attack on all analyzed plants varied between 11.5% and 7.5% in the variants of this culture system. In the case of the *Blumeria graminis* f. sp. *hordei* attack, attack values of around 1% were recorded, and as regards the presence of the *Rhynchosporim secalis* fungus, it had a higher but still sub-unit attack level.

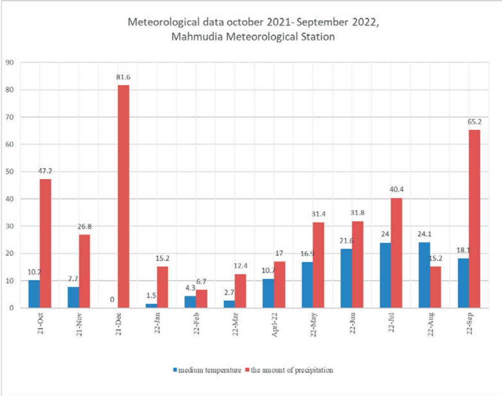

Figure 1. Meteorological data October 2021 - September 2022, Mahmudia Meteorological Station, Tulcea County

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

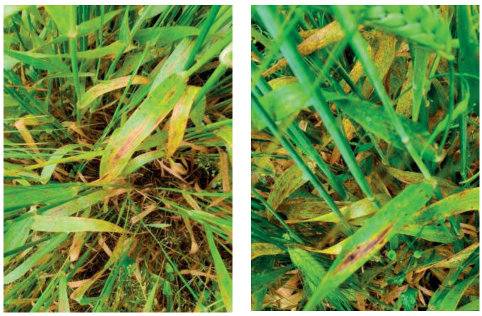

Figure 3. Barley crop aspect- in the conversion period (original)

Table 1. Data regarding the attack of foliar diseases in barley (2021-2022), Murighiol, Tulcea county

Variety/ culture system	Variant Trait/ Control	The pathogen/disease												
		Pyrenophora teres/ Barley net blotch			*Pyrenophora graminea*/ Barley leaf stripe	*Puccinia hordei*/ rust			*Blumeria graminis* f.sp. *hordei*/ Powdery mildew			*Rhynchosporium secalis* / Scald		
		F (%)	I (%)	GA (%)	F (%)	F (%)	I (%)	GA (%)	F (%)	I (%)	GA (%)	F (%)	I (%)	GA (%)
Cardinal/ conventional system	Trait	100	9.5	9.5	2	100	9.5	9.5	14	6.5	0.9	8	4,5	0.3
	Control	100	30.5	30.5	6	100	26.5	26.5	31	8.5	2.6	12	6	0.7
Cardinal/ conversion period	Trait	100	20.5	20.5	3	100	12.5	12.5	16.5	7	1.1	11	5.5	0.6
	Control	100	27.5	27.5	5	100	28.5	28.5	15.5	9.5	1.5	16	6.5	0.8

The application of the treatment to the seed and in vegetation to barley in the conventional culture, reduced the attack of the detected pathogens and ensured effectiveness of over 65% in the case of the net blotch attack, leaf strep disease, and powdery mildew. In the case of the attack of rust, the effectiveness was 64.1% and in the case of the attack of rhynchosporiosis, the effectiveness was 57%. In the barley crop in the conversion period, where the sorting of the seed and the application of certified products in the vegetation had an important role, these interventions ensuring a level of attack that does not worry in the second year of observation (Popescu & Cristea, 2022) (Table 2). The application of treatments ensures the effectiveness in the control of the attack of plant diseases with an impact on agricultural production (Buzatu et al., 2018). Management on net blotch requires the consideration preventive and curative control measures (Backes et al., 2021).

Table 2. The effectiveness of phytosanitary intervention on foliar diseases in barley

Variety/ culture system	Variant Treated/ Control	The pathogen/ disease									
		Pyrenophora teres/ net blotch		*Pyrenophora graminea*/ leaf stripe		*Puccinia hordei*/ Rust		*Blumeria graminis* f.sp.*hordei*/ powdery mildew		*Rhynchosporium secalis*/ scald	
		GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)
Cardinal / conventional system	Treated	9.5	68.8	2	66.6	9.5	64.1	0.9	65,4	0.3	57.1
	Control	30.5	-	6	-	26.5	-	2.6	-	0.7	-
Cardinal / conversion period	Treated	20.5	25.4	3	40	12.5	56.1	1.1	21.4	0.6	20
	Control	27.5	-	5	-	28.5	-	1.4	-	0.8	-

CONCLUSIONS

The frequent diseases of autumn barley in the experimental area in the conditions of the year 2021-2022 cultivated in the conventional system and during the conversion period were caused by the micromycetes of *Pyrenophora teres*, *Pyrenophora graminea, Puccinia hordei, Blumeria graminis* f. sp. *hordei*, *Rhynchosporium secalis*. The incidence of the attack was maximum in the micromycetes *P. teres* and *P. hordei* in all experimental variants.

The application of treatments to barley grown in the conventional system reduced the attack of the monitored pathogens. The attack of the micromycete *P. graminea* was less in the barley in the conversion period compared to the untreated variant in the conventional system, which we attribute to the seed selection operation used at sowing.

ACKNOWLEDGEMENTS

We wish to thank "Dima Ancuta" PFA, Tulcea County for technical support.

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