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ASSESSMENT OF EFFECTIVE MICROORGANISM ACTIVITY (EM) IN WINTER WHEAT PROTECTION AGAINST FUNGAL DISEASES

OCENA DZIAŁANIA EFEKTYWNYCH MIKROORGANIZMÓW (EM) W OCHRONIE PSZENICY OZIMEJ PRZED CHOROBAMI GRZYBOWYMI

Summary: The studies aimed at comparison of health of leaves, ears and stem base of winter wheat under the influence of Effective Microorganism (EM) application, the EM with added plant material and the Biosept 33 SL preparation.

The research was conducted in 2005 in Krzemieniec village near Mielec. The experiment was set on good wheat complex soil in three replications. EM, Biosept 33 SL and EM jointly with nettle leaves, couch-grass rhizome and seeds of white mustard, winter rapeseed and yellow lupine were applied five times during wheat vegetation period. The obtained results were compared with the control. On the basis of the conducted experiment it was found that protective measures using Effective Microorganisms (EM) defended wheat most efficiently against Septoria disease (*Septoria nodorum*) and brown leaf blight (*Drechslera tritici-repentis*). On the other hand the EM with added winter rape seeds inhibited the development of brown rust on leaves (*Puccinia recondita*), whereas the Biosept 33 SL plant preparation revealed fungicidal properties towards *S. nodorum* (septoria disease of leaves and wheat ears) and *Fusarium* spp. (fusarium take-all patch). The tested preparations did not have any significant effect on *Gaeumannomyces gramminis* or *Pseudocercosporella herpotrichoides* infection.

Keywords: winter wheat, fungal diseases, Effective Microorganisms (EM)

The parasitisizing of fungi on plants depends on many environmental (abiotic) factors. Among these the climatic conditions and agrotechnical factors have the greatest effect on fungal disease development [1–3]. Phytopatogenic fungi (*Septoria nodorum, Puccinia spp., Fusarium* spp., *Gaeumannomyces graminis, Pseudocercosporella herpotrichoides*), which parasitize wheat, inhibit its development and growth and as a result decrease the seed yield and worsen its quality [1, 2]. Properly selected wheat protection

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during the vegetation period may prevent these negative results [4]. Due to a harmful influence of synthetic pesticides upon the environment, attempts have been made recently to limit or eliminate chemical plant protection, which causes a necessity to seek a possible replacement with biological plant protection [5]. A new biological preparation arousing considerable interest is EM – Effective Microorganisms. The EM is a natural biological substance containing photosynthetizing bacteria, lactic acid bacteria, *Actinomycetales*, yeast and other fungi [6]. According to Hig [6] soil inoculation with effective microorganisms enhances its biological activity and eliminates rotting processes, dissolves mineral hardly bioavailable compounds, improves soil fertility and its structure. The EM used for plant protection decreases exacerbation of diseases and also stimulates development of other useful microorganisms. On the other hand, application of the Effective Microorganisms (EM) with herb addition allows to replace synthetic fungicides and lower the costs of plant cultivation. The presence of natural organic compounds of plant origin in the EM preparation as antioxidants increases the effect and efficiency of this vaccine [7].

The paper aimed at comparing the health of leaves, ears and stem base of winter wheat under the influence of the EM biopreparation and the EM with plant material application with Biosept 33 SL plant preparation.

Material and methods

The field experiment was conducted in 2005 in Krzemieniec village near Mielec. A single-factor experiment was set up in three replications on soil of good wheat complex. Winter wheat, edible Turnia c.v. was seeded in the amount of 200 kg · ha^{-1} in the third decade of September. Tillage was carried out according to the rules of agrotechnics. During the vegetation period wheat was protected using the Effective Microorganisms (EM) biopreparation, EM with added nettle leaves, couch-grass rhizome and white mustard, winter rape and yellow lupine seeds, and with natural fungicide – Biosept 33 SL. The EM preparation and its mixture with the plants mentioned above was prepared using the Zajączkowski method [6]. 60 g of air dried mass of the tested plants was added to 1 dm^3 of the EM in each combination. The EM biopreparation contains a mixture of lactic acid bacteria, photosynthetizing bacteria, yeast and other beneficial microorganisms [6]. It is designed for use at organic farms. On the other hand, the registered Biosept 33 SL originated on the basis of a grapefruit extract. 310 $dm^3 \cdot ha^{-1}$ of the tested preparations were used five times: at shooting stage, at developed flag leaf, at earing, by the end of flowering and at kernel formation. The obtained results were compared with the control.

Leaf and ear infection with *Septoria nodorum*, *Drechslera tritici-repentis* and *Puccinia recondita* were assessed on a 9-degree scale according to Ralski and Muszyńska [8]. The health of stem was assessed on a 4-degree scale according to Bojarczuk and Bojarczuk [9]. The obtained results were presented as an infection index, which was subjected to statistical computations and the significance was verified with the t-Student test on a significance level $\alpha = 0.05$.

Results and discussion

The obtained results revealed that at grain milk maturity winter wheat leaves were more strongly attacked by *Septoria nodorum* than ears (Table 1). The applied preparations significantly affected the index of wheat leaves infection by *S. nodorum*, *Drechslera tritici-repentis* and *Puccinia recondita*. Among the compared combinations wheat treatment with the EM preparation applied five times best protected plants against brown leaf blotch (*D. tritici-repentis*). Similarly, while testing the EM on triticale, Waleryś [10] found a decreased plant infection by all leaf pathogens. The author's own investigations revealed positive effects of wheat protection against septoria diseases (*S. nodorum*) in comparison with the control also under the influence of EM combined with rape seeds applied five times. On this object wheat leaves revealed also the lowest index of *P. recondita* infection. The obtained results may be due not only to the microorganisms present in the EM preparation but also to the rape seeds properties. Fungicide effect of rape on some phytopatogenic fungi was also demonstrated by the research conducted by Martyniuk and Wróblewska [11], since glucosinolates are released during this plant decomposition and inhibitory activities are ascribed to these compounds. On the other hand Biosept 33 SL plant preparation revealed a tendency to inhibit the analyzed diseases. Still, its best effect was visible as limited leaf infection with *P. recondita*. A similar opinion was expressed by Solarska and Jończyk [3]. According to Orlikowski et al. [12] Biosept 33 SL inhibits the development of over 30 pathogenic fungi. This preparation is a grapefruit extract and contains various biological compounds, among others aliphatic aldehydes and monoterpens which may reveal inhibitory or stimulating effect on microorganism development [13]. On the other hand the EM with added nettle applied five times caused increased intensification of septoria diseases (*S. nodorum*) both on leaves and on ears and leaf infection with *D. tritici-repentis* in comparison with the control.

Table 1

Mean infection index of wheat leaf and ear by phytopatogenic fungi

Treatments	*Septoria nodorum* infection		*Drechslera tritici-repentis* infection of leaves	*Puccinia recondita* infection of leaves
	leaves	ear		
EM +nettle leaves	66.37	21.76	27.49	51.50
EM + couch-grass rhizome	47.02	9.73	23.90	55.19
EM + white mustard seeds	58.42	3.39	22.56	62.97
EM + yellow lupine seeds	55.44	1.99	21.38	36.13
EM + winter rapeseeds	44.00	1.99	23.30	16.03
EM	40.10	0.00	14.08	41.76
Biosept 33 SL	56.52	3.13	20.52	33.00
Control	69.28	17.11	22.92	55.95
$LSD_{0.05}$	8.94	n. s.	9.59	7.92

n. s. – no significant difference

A weaker effect of the tested preparations was registered concerning fungi infecting the wheat stem base (Table 2), although Waleryś [10] and Majchrzak et al. [14] are of a different opinion. In their own research on take all diseases the Authors have only detected a significant inhibition of the development of a fusarium take-all patch (*Fusarium spp.*) under the influence of the EM preparation with a supplement of yellow lupine seeds, winter rape and white mustard. Majchrzak et al. [14] obtained similar results demonstrating that effective microorganisms (EM) most efficiently protected the triticale stem base against *Fusarium* ssp. According to Tokeshi et al [15], Boligłowa [16] foliar application of the EM with a herb supplement also limits development of other crop diseases. The analysis of winter wheat stem infection by phytopatogenic fungi also revealed efficient plant protection against *Fusarium* spp. using Biosept 33 SL preparation. The other fungi infecting the stem base (*Gaeumannomyces graminis*, *Pseudocercosporella herpotrichoides*) did not show any apparent sensitivity to wheat protection using biological preparations. Phytosanitary assessment of wheat conducted by Solarska and Jończyk [3] confirms the obtained research results.

Table 2

Mean index of stem base infection by some pathogenic fungi

Treatments	Stem base infection by:		
	Fusarium spp.	*Gaeumannomyces graminis*	*Pseudocercosporella herpotrichoides*
EM + nettle leaves	35.66	22.84	0.00
EM + couch-grass rhizome	42.25	9.27	0.00
EM + white mustard seeds	18.74	11.35	1.63
EM + yellow lupine seeds	11.12	26.27	2.10
EM + winter rapeseeds	13.68	16.64	4.36
EM	42.18	17.00	1.38
Biosept 33 SL	14.41	19.07	1.00
Control	42.95	8.18	0.00
$LSD_{0.05}$	8.46	n. s.	n. s.

n. s. – no significant difference

Conclusion

Phytosanitary assessment of winter wheat revealed a diversified exacerbation of fungal diseases under the influence of biopreparation application. Protective measures conducting the use of the Effective Microorganisms (EM) most efficiently defended wheat against *S. nodorum* and *D. tritici-repentis*. On the other hand the EM with winter rape seeds supplement limited the development of *P. recondita* infection, whereas the Bio-sept 33 SL plant preparation revealed fungicidal properties towards wheat leaf and ear septoria diseases (*S. nodorum*) and the fusarium take-all patch (*Fusarium spp.*). The tested preparations did not have any marked influence on stem infection by *G. graminis or P. herpotrichoides.*

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S t r e s z c z e n i e

Celem badań było porównanie stanu zdrowotnego liści, kłosów i podstawy źdźbła pszenicy ozimej pod wpływem stosowania Efektywnych Mikroorganizmów (EM), EM z udziałem materiału roślinnego oraz preparatu Biosept 33 SL.

Badania prowadzono w 2005 w Krzemieńcu koło Mielca. Doświadczenie założono na glebie kompleksu pszennego dobrego w trzech powtórzeniach. W okresie wegetacji pszenicy, pięciokrotnie aplikowano EM, Biosept 33 SL oraz EM, łącząc z zielem pokrzywy, kłączami perzu i nasionami gorczycy białej, rzepaku ozimego, łubinu żółtego. Uzyskane wyniki porównywano do obiektu kontrolnego. W oparciu o przeprowadzone badania stwierdzono, że zabiegi ochronne Efektywnymi Mikroorganizmami (EM) najskuteczniej chroniły pszenicę przed septoriozą (*Septoria nodorum)* i brunatną plamistością liści (*Drechslera tritici-repentis).* Z kolei EM z dodatkiem nasion rzepaku ozimego ograniczyło rozwój rdzy brunatnej na liściach *(Puccinia recondita).* Natomiast preparat pochodzenia roślinnego Biosept 33 SL wykazał właściwości fungicydalne w odniesieniu do septoriozy liści i kłosów pszenicy *(S. nodorum)* oraz fuzaryjnej zgorzeli podstawy źdźbła *(Fusarium spp.).* Testowane preparaty nie miały istotnego wpływu na porażenie źdźbła pszenicy przez *Gaeumannomyces graminis i Pseudocercosporella hrpotrichoides.*

Słowa kluczowe: pszenica ozima, choroby grzybowe, Efektywne Mikroorganizmy (EM)