

EFFICACY OF TRIAZOLE FUNGICIDES ON *Pyrenophora teres* ON WINTER BARLEY

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Abstract

Net blotch of barley (Pyrenophora teres Drechsler (anamorph Drechslera teres (Sacc.) Shoemaker)) is common foliar disease of winter barley in Bulgaria. The paper reports results of field experiment performed with triazole fungicides on winter barley variety Nives during 2017-2018 in Agricultural University in Plovdiv. Epoxiconazole 125 g/l was applied in full dose in two applications. Combination of tebuconazole 107 g/l and bromuconazole 167 g/l was used in tree doses of two applications. The aim of the current study was to obtain efficient disease control and to identify the impact of different triazole fungicides. The fungicide efficiency was assessed at the end of April. The trial results show that biologically effective control of barley diseases could be achieved with timely use of lower fungicide dose due to two triazole synergism.

Key words: winter barley, *Pyrenophora teres*, triazole fungicides.

INTRODUCTION

Winter barley (*Hordeum vulgare* L.) is the second most important and significant grain fodder crop after the corn in Bulgaria, with growing area of 112.26 thousand ha (Bulletin № 367, 2019).

One of the most widely distributed and harmful phytopathogens of barley is *Pyrenophora teres* Drechsler (anamorph *Drechslera teres* (Sacc.) Shoem.).

It is the causal agent of net blotch which is one of the most important diseases in barley resulting in 40-100% yield lost worldwide (Afanasenko, 2009; Rajaa & Brahim, 2009; Lai et al., 2007). The time and level of disease infection in the field depends on the susceptibility of the barley variety, therefore the resistance of varieties has also importance in the control of plant diseases. *Pyrenophora teres* is most effectively controlled using a combination of cultural and chemical means, in addition to host resistance (Liu et al., 2011).

In recent years, intensive cereal cultivation with limited crop rotation and control with products with same active ingredients have increased the occurrence of net blotch in barley. Chemical control measures are needed to avoid yield reduction by disease infections.

To achieve economic profitability, it is important to deploy integrated pest management. Inclusion of new active ingredients and still unused combinations in plant protection program is important to avoid or to reduce fungicide resistance risk.

Triazole-based fungicides are economically important agricultural chemicals as they are widely used on different crops (Buchenauer, 1987; Filipov & Lawrence, 2001). They inhibit the C14 demethylation step in fungal ergosterol biosynthesis, known as demethylation inhibitors (DMIs) (Gisi et al., 2000) as are major systemic group of fungicides, currently used to control cereal diseases. Fungicide resistances in *Pyrenophora teres* to different active ingredients have been reported (Sheridan et al., 1985; Campbell & Crous, 2002).

Three triazole fungicides, namely tebuconazole, bromuconazole and epoxiconazole, deserve particular attention. Tebuconazole and epoxiconazole are widely used in cereals with high efficacy against main diseases. Bromuconazole is used as a broad-spectrum fungicide, with preventative and curative action, for control of diseases caused by Ascomycetes, Basidiomycetes and Deuteromycetes (Menegola et al., 2005). For Bulgaria it is a new molecule and important

tool for DMI alternance and resistance management.

The aim of the study was to find out the efficacy of different triazoles at different disease control intensities on winter barley varieties.

MATERIALS AND METHODS

Field trials on disease control of spring barley were conducted with four replicates in a randomized design 16.5 m² plots at Agricultural University - Plovdiv during the season of 2017-2018. Two winter barley varieties with different resistance levels were used: Dimitra (moderately resistant to net blotch), Nives (susceptible to net blotch). There were tested two formulated products: combination of tebuconazole 107 g/l and bromuconazole 167 g/l (TEB+BRO) in three different dose rates and epoxiconazole 125 g/l (EPO) in full dose rate used as a standard. Fungicide applications were at stages BBCH 32-33 (T1) and BBCH 65-69 (T2) (Table 1). Treatment dates were 17 March 2018 and 26 April 2018.

Disease infection was scored as the percent of leaf area infected by *Pyrenophora teres* and at BBCH 71-75. The three top leaves of the plant were assessed separately on three adjacent tillers at 10 randomly selected places on each plot. The infection level was expressed as an infection score on flag leaf and second leaves

(L-2; the first leaf under the flag leaf). The lesions of net blotch were determined according description of Tekauz (1985). Registered products in winter barley against *Pyrenophora teres* were collected from Bulgarian Food and Safety Agency list of authorized plant protection products (Fungicides, 2020).

RESULTS AND DISCUSSIONS

In Bulgaria registered triazoles in winter barley to control *Pyrenophora teres* are triadimenol, tebuconazole, epoxiconazole, flutriafol, metconazole, prothioconazole and cyproconazole. Benchmark DMI fungicides contain epoxiconazole (0.125 g ai/Ha) or tebuconazole (0.25 g ai/Ha) straight or in combination with different active ingredients. There is only one recently registered product with the molecule bromuconazole. It is in combination with tebuconazole. It is currently registered on wheat for control of powdery mildew, rust and leaf spot diseases with high efficacy and long lasting effect.

Hot and dry weather during winter and early spring limited development of *Pyrenophora teres* on the variety Dimitra when only slight damage by net blotch infection was observed (Figure 1).

The highest infection levels were observed on the variety Nives (Figure 2).



Figure 1. Dimitra variety on 22 April 2018



Figure 2. Untreated control (Nives variety)

Net blotch of barley symptoms have occurred on the leaves of the plants. Small circular to elliptical brown spots appeared on leaves and enlarge into, narrow, dark brown and transverse striations, forming the characteristic netlike pattern. The affected part of the leaf turned brown and the adjoining tissue became chlorotic and areas of dead tissue were formed. Severely infected leaves became completely necrotic and dry up. The fungus produces pseudothecia on infected tissues when the plant has matured.

The most significant damage occurred in April on second leaves.

Epoxiconazole (EPO) has moderate effect against *Pyrenophora teres* in barley. Significant synergism has been demonstrated for the combination of tebuconazole with bromuconazole (TEB+BRO). Reduced dose showed slightly higher control of the disease. The best effect was achieved with the highest dose rate of TEB+BRO (Figure 3). High protection of flag and second leaves was provided even with the first treatment (Figure 4).

Treated plots with the combination of tebuconazole and bromuconazole showed better vigor.

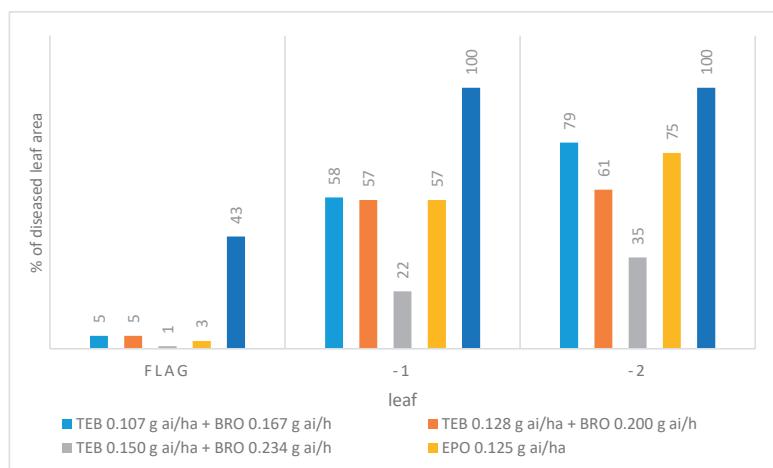


Figure 3. Efficacy of epoxiconazole, tebuconazole and bromuconazole against *Pyrenophora teres*



Figure 4. Treated Nives variety plots

CONCLUSIONS

High disease pressure and non-inclusion of active ingredients in EU requires studies of new uses of the registered products. It was compared the control of net blotch in barley of 2 formulated products - reference product with the active ingredient epoxiconazole and new triazole combination for Bulgarian market containing tebuconazole and bromuconazole. The weather conditions during 2017-2018 were unfavorable to the development of the infection in resistant variety Dimitra, while Nives variety showed high susceptible to *Pyrenophora teres*. Sufficient control and better effect was achieved with the triazole combination (tebuconazole and bromuconazole).

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