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Determination of the seedling reactions of some barley cultivars to *Drechslera teres* f. *teres*[1]

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ÖZ

Bazı arpa çeşitlerinin *Drechslera teres* f. *teres*'e fide dönemi tepkilerinin belirlenmesi

Yirmi beş arpa çeşidinin fide dönemi reaksiyonları, arpada ağ benek hastalığının ağ formunu oluşturan *Drechslera teres* f. *teres*'in üç izolatına karşı sera koşullarında değerlendirilmiştir. İzolatlar Eskişehir, Diyarbakır ve Sivas illerinden elde edilmiştir. Çeşitlerin fungal izolatlara tepkileri dayanıklı-orta derecede dayanıklı ile orta derecede hassas-hassas olarak değişmiştir. Bülbül 89 ve İnce 04 çeşitleri en hassas çeşitler olarak bulunmuş olup, bu çeşitleri Çıldır 02, Özdemir 05 ve Hamidiye 85 çeşitleri takip etmiştir. Harman çeşidi en dayanıklı çeşit olarak bulunmuştur. Bu çeşidi Lord, Yerçil 147, Erginel 90, Bilgi 91, Ünver ve Aydan Hanım çeşitleri takip etmiştir. İzolatlar arasında virülenslik bakımından farklılıklar görülmüştür. Diyarbakır izolatı virülensi en düşük izolat olarak bulunurken Sivas izolatı virülensi en yüksek izolat olarak bulunmuştur.

Anahtar kelimeler: Ağ benek hastalığı, arpa, *Drechslera teres*, *Pyrenophora teres*, dayanıklılık, Türkiye

ABSTRACT

Seedling stage reactions of 25 barley cultivars were evaluated against three isolates of *Drechslera teres* f. *teres* causing net form of net blotch of barley under greenhouse conditions. Isolates were obtained from Eskişehir, Diyarbakır, and Sivas provinces of

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Turkey. The reactions of cultivars to fungal isolates ranged between resistant-moderately resistant and moderately susceptible-susceptible. Cultivars Bülbül 89 and İnce 04 were found as the most susceptible cultivars, which were followed by cvs. Çıldır 02, Özdemir 05 and Hamidiye 85. Cultivar Harman was found as the most resistant cultivar. This cultivar was followed by cvs Lord, Yerçil 147, Erginel 90, Bilgi 91, Ünver, and Aydan Hanım. Virulence differences among the isolates were observed. Diyarbakır isolate was the least virulent isolate whereas Sivas isolate was the most virulent isolate.

Keywords: Net blotch, barley, *Drechslera teres*, *Pyrenophora teres*, resistance, Turkey

INTRODUCTION

Barley (*Hordeum vulgare* L.) is one of the oldest cultured plants and it is the second most common cereal plant after wheat in Turkey. Barley is mainly used as an animal feed and in malt industry (Kün 1996, Geçit et al. 2009). Barley production in Turkey is 7.900.000 tonnes (Anonim 2013).

Net blotch caused by *Drechslera teres* (teleomorph: *Pyrenophora teres*) is an important disease of barley. The pathogen has two biotypes. *D. teres* f. *maculata* forms spot form of the disease and *D. teres* f. *teres* forms net form of the disease (Liu et al. 2011, Shipton et al. 1973). Both forms of the disease are present in Turkey. Aktaş (1997) and Karakaya et al. (2014) reported spot form as more common. In another study, Damgacı (2014) reported the net form as more common. In the net form of the disease, longitudinal and transverse streaks develop in leaves and a netlike pattern occurs (Mathre 1982). The disease decreases the quality and quantity of barley in worldwide. In Turkey 15-25%, in the World 10-40% yield losses due to this disease were reported (Aktaş 1984, Göbelez 1956, Mathre 1982, Shipton et al. 1973). Planting resistant cultivars is an important control measure. Although numerous studies have been accomplished for finding resistant cultivars to spot form of net blotch, no studies have been performed about the net form resistance of barley cultivars grown in Turkey (Aktaşdoğan et al. 2013, Karakaya and Akyol 2006, Taşkoparan and Karakaya 2009, Usta et al. 2014).

In this study, seedling resistance status of 25 barley cultivars to 3 isolates of the fungus was determined under greenhouse conditions.

MATERIALS AND METHODS

This study was carried out in the greenhouse of Central Research Institute for Field Crops located in Ankara, Turkey. Twenty-five barley cultivars were obtained from Central Research Institute for Field Crops, Ankara, Turkey, Transition Zone Agricultural Research Institute, Eskişehir, Turkey and Thrace Agricultural

Research Institute, Edirne, Turkey. For inoculation, single spore cultures of *D. teres* f. *teres* isolates obtained from Diyarbakır, Sivas, and Eskişehir provinces of Turkey were used. Inoculation procedures were similar to previous experiments (Aktaşdoğan et al. 2013, Douiyssi et al. 1998, Karakaya and Akyol 2006, Taşkoparan and Karakaya 2009, Usta et al 2014). After inoculation, plants were placed in metal boxes and a plastic cover was placed on top of each box. In addition, boxes and plastic covers were wrapped with nylon sheets. After fourth day nylon sheets and plastic covers were opened. Plants were grown in a greenhouse with a night and day temperature regime of 18± 2/ 23±2 ^{o}C. Five days after inoculation, plants were evaluated with a 1-10 scale developed for *D. teres* f. *teres* by Tekauz (1985). In this scale values were 1: R (Resistant), 2: R-MR (Resistant-Moderately Resistant), 3: MR (Moderately Resistant), 4: MR-MS: (Moderately Resistant-Moderately Susceptible), 5: MR-MS (Moderately Resistant-Moderately Susceptible), 6: MR-MS (Moderately Resistant-Moderately Susceptible), 7: MS (Moderately Susceptible), 8: MS-S (Moderately Susceptible-Susceptible), 9: S (Susceptible), 10: VS (Very Susceptible).

RESULTS AND DISCUSSION

Three days after inoculation, first symptoms appeared in some cultivars. At the fourth day, symptoms were observed in all cultivars. Evaluations were performed 5 days after inoculation. Reactions of the cultivars ranged between resistant-moderately resistant and moderately susceptible- susceptible (Table 1). There were differences among the reactions of the cultivars to the isolates. Isolates showed some differences in pathogenicity to each cultivar.

Barley cultivars Bülbül 89, Hamidiye 85 and İnce 04 exhibited a moderately susceptible reaction to Eskişehir isolate. Cultivars Avcı 2002, Çetin 2000, Burak Bey, Tarm 92, Zeynelağa, Yalın, Aydan Hanım, Akar, Çıldır 02, Özdemir 05, Ünver, Bilgi 91, Keser, Kalaycı 97, Sladoran, Bolayır, Martı, and Lord showed a moderately resistant-moderately susceptible reaction to this isolate. Cultivars Özen, Erginel 90, Yerçil 147, and Harman showed a moderately resistant reaction to Eskişehir isolate.

Diyarbakır isolate was the least virulent isolate. Barley cultivars Zeynelağa, Özen, and Akar showed a moderately resistant-moderately susceptible reaction to this isolate. Cultivars Avcı 2002, Çetin 2000, Burak Bey, Tarm 92, Yalın, Aydan Hanım, Çıldır 02, Ünver, Kalaycı 97, Erginel 90, Hamidiye 85, Yerçil 147, İnce 04, and Sladoran exhibited a moderately resistant reaction to Diyarbakır isolate. Cultivars Bülbül 89, Özdemir 05, Bilgi 91, Keser, Harman, Bolayır, Martı, and Lord showed a resistant-moderately resistant reaction to this isolate.

Sivas isolate was the most virulent isolate. Barley cultivar Bülbül 89 showed a moderately susceptible-susceptible reaction to Sivas isolate. Cultivars Tarm 92, Çıldır 02, Özdemir 05, Kalaycı 97, and İnce 04 exhibited a moderately susceptible reaction to this isolate. Cultivars Avcı 2002, Çetin 2000, Burak Bey, Zeynelağa, Özen, Yalın, Aydan Hanım, Akar, Ünver, Bilgi 91, Keser, Erginel 90, Sladoran, Bolayır, Hamidiye 85, and Martı showed a moderately resistant-moderately susceptible reaction to this isolate. Cultivars Yerçil 147, Harman, and Lord showed a moderately resistant reaction to Sivas isolate.

Cultivars Bülbül 89 and İnce 04 were found as the most susceptible cultivars followed by cvs Çıldır 02, Özdemir 05, and Hamidiye 85. Bülbül 89 cultivar also showed moderately susceptible to susceptible reactions to *D. teres* f. *maculata* isolates (Aktaşdoğan et al. 2013, Karakaya and Akyol 2006, Taşkoparan and Karakaya 2009, Usta et al. 2014).

Barley cultivar Harman was found as the most resistant cultivar followed by cvs Lord, Yerçil 147, Erginel 90, Bilgi 91, Ünver, and Aydan Hanım. Harman cultivar also showed resistant-moderately resistant reactions to *D. teres* f. *maculata* isolates (Usta et al. 2014).

Using one isolate of *D. teres*, Aktaş and Tunalı (1994) found the cv Hamidiye 85 as susceptible and cv Yerçil 147 as moderately susceptible. Aktaş (1995) found the cv Bülbül as susceptible to *D. teres*. Aktaş and Katırcıoğlu (2008) found cv Hamidiye as susceptible and cv Yerçil 147 as moderately susceptible to an isolate of *D. teres*. In our study, cv Hamidiye 85 showed a moderately susceptible reaction to Eskişehir isolate, a moderately resistant reaction to Diyarbakır isolate and a moderately resistant-moderately susceptible reaction to Sivas isolate. In our study, cv Yerçil 147 showed a moderately resistant reaction to all 3 isolates. In our study, cv Bülbül 89 showed a moderately susceptible reaction to Eskişehir isolate, a resistant-moderately resistant reaction to Diyarbakır isolate and a moderately susceptible-susceptible reaction to Sivas isolate.

Virulence differences among the isolates were observed. Virulence differences among the isolates have also been reported by other researchers (Steffenson and Webster 1992, Tekauz 1990).

With this study, resistance status of some barley cultivars grown in Turkey to *Drechslera teres* f. *teres* was determined for the first time in Turkey. There were differences among the resistance status of cultivars ranging from moderately susceptible-susceptible to resistant-moderately resistant. It appears that variation is present in barley cultivars grown in Turkey to *D. teres* f. *teres*. Resistant cultivars could be used by farmers and in breeding disease resistant barley genotypes.

Table 1. Seedling reactions of 25 barley cultivars to 3 *Drechslera teres* f. *teres* isolates*.

Barley cultivars	Isolates						Mean
	Eskişehir		Diyarbakır		Sivas		
	Mean scale value	Reaction type	Mean scale value	Reaction type	Mean scale value	Reaction type	
Bülbül 89	7,33	MS	2,33	R-MR	8,33	MS-S	6
Avcı 2002	4,33	MR-MS	3,33	MR	4,33	MR-MS	4
Çetin 2000	4	MR-MS	3,33	MR	5,67	MR-MS	4,33
Burak Bey	4,33	MR-MS	3	MR	4,33	MR-MS	3,89
Tarm 92	5,33	MR-MS	3,33	MR	7,33	MS	5,33
Zeynelağa	5	MR-MS	4	MR-MS	4,33	MR-MS	4,33
Özen	3,33	MR	4,33	MR-MS	3,67	MR-MS	3,78
Yalın	4,33	MR-MS	3	MR	5,67	MR-MS	4,33
Aydan Hanım	4,33	MR-MS	3	MR	4,67	MR-MS	4
Akar	4,33	MR-MS	3,67	MR-MS	4,33	MR-MS	4,11
Çıldır 02	6,33	MR-MS	3	MR	7,33	MS	5,55
Özdemir 05	6,33	MR-MS	2,33	R-MR	7,33	MS	5,33
Ünver	4	MR-MS	2,67	MR	4,33	MR-MS	3,67
Bilgi 91	3,67	MR-MS	2,33	R-MR	4,33	MR-MS	3,44
Keser	5,33	MR-MS	2,33	R-MR	5,67	MR-MS	4,44
Kalaycı 97	6	MR-MS	2,67	MR	7,33	MS	5,33
Erginel 90	3	MR	2,67	MR	4	MR-MS	3,22
Hamidiye 85	6,67	MS	3,33	MR	6	MR-MS	5,33
Yerçil 147	3,33	MR	2,67	MR	3,33	MR	3,11
İnce 04	6,67	MS	3	MR	7,33	MS	5,67
Sladoran	4	MR-MS	2,67	MR	5	MR-MS	3,89
Harman	2,67	MR	2,33	R-MR	2,67	MR	2,56
Bolayır	4	MR-MS	2,33	R-MR	5	MR-MS	3,78
Martı	4,33	MR-MS	2,33	R-MR	6	MR-MS	4,22
Lord	3,67	MR-MS	1,67	R-MR	3,33	MR	2,89
General Mean	4,66		2,87		5,26		4,25

*A 1-10 scale developed for net form of net blotch by Tekauz (1985) was used in the evaluations. Numbers are mean of three replications. R-MR: Resistant-Moderately Resistant, MR: Moderately Resistant, MR-MS: Moderately Resistant-Moderately Susceptible, MS: Moderately Susceptible, MS-S: Moderately Susceptible-Susceptible.

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