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Studies on the Biology of *Drechslera teres* Under Ankara Conditions*

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Abstract: Net blotch caused by *Drechslera teres* is an important disease of barley. There is no study regarding the biology of the pathogen in Turkey. Therefore, studies were conducted to elucidate some parts of the biology of the pathogen under Ankara conditions. Conidia, conidiophores and pseudothecia of the pathogen were observed on the leaves left on the ground and buried. These propagules were more common on the leaves left on the ground. No ascospores were detected. Pycnidia were detected in cooled incubator studies. In a cooled incubator, fungal cultures survived 0°C and –10°C and fungus in diseased leaves survived –10°C. It appears that fungus can survive during the winter months in Ankara and conidia has an important role in the infections.

Key Words: *Drechslera teres, pyrenophora teres,* net blotch of barley, Turkey

Ankara koşullarında *Drechslera teres*'in Biyolojisi Üzerinde Çalışmalar

Özet: *Drechslera teres* tarafından oluşturulan ağbenek leke hastalığı arpaların önemli bir hastalığıdır. Türkiye'de patojenin biyolojisi ile ilgili yapılan bir çalışma bulunmamaktadır. Bu yüzden, Ankara koşullarında patojenin biyolojisinin bir kısmını aydınlatacak çalışmalar yürütülmüştür. Toprak altında ve toprak üstünde bırakılan hastalıklı yapraklarda etmenin konidi ve konidioforları ve pseudotheciumlar bulunmuştur. Bu yapılar toprak üstünde bırakılan örneklerde daha yoğun olarak bulunmuştur. Askosporlara raslanamamıştır. Piknitlere soğutmalı inkübatör çalışmalarında raslanmıştır. Soğutmalı inkübatörde petri kutularındaki fungus 0 ve –10 derecelerde, hastalıklı yapraklarda ise –10 derecede canlılığını muhafaza etmiştir. Hastalık etmeni kışı Ankara koşullarında canlı olarak geçirebilmekte ve konidilerin enfeksiyonda önemli rol oynadığı sanılmaktadır.

Anahtar Kelimeler: *Drechslera teres, pyrenophora teres,* arpa ağbenek leke hastalığı, Türkiye

Introduction

Net blotch is an important disease of barley (*Hordeum vulgare* L. emend. Bowden) in the world (Mathre 1982, Aktaş 1987). It is caused by the fungus *Drechslera teres* (Sacc.) Shoem. (teleomorph: *Pyrenophora teres* Drechs.). In Turkey, the disease was reported by Bremer et al. in 1947. Later on, Göbelez (1956), İren (1962) and Karaca (1968) emphasized the disease.

In Central Anatolia, 93% of the barley growing areas were found infected with the disease (Aktaş 1997). Two biotypes of the disease were reported. *Pyrenophora teres* f. *teres* causes net type and *Pyrenophora teres* f. *maculata* causes spot type symptoms (Smedegard-Petersen 1971). In Central Anatolia both biotypes were found. The percentage of the net and spot type infected fields were 93.35% and 6.94%, respectively (Aktaş 1997). Crop losses due to this disease can reach to 100% in susceptible cultivars. However, typical losses range between 10-40% (Mathre 1982).

The fungus develops straight and cylindric conidia on the olive to brown color conidiophores. The fungus also develops pseudothecia. Production of pycnidia were also reported (Mathre 1982).

In Turkey, there is no study regarding the biology of the pathogen. Therefore, studies were conducted in order to elucidate some parts of the biology of *Drechslera teres* under Ankara conditions.

Material and Methods

This study was carried away during the winter periods of 1999-2000 and 2000-2001 growing seasons. The temperature, relative humidity and precipitation values were presented in the Table 1. Diseased leaves were collected from fields showing disease symptoms. Care was taken to ensure that other diseases (mainly powdery mildew, scald and barley stripe) were not present. In some cases diseased leaves were obtained from the artifically diseased leaves in the greenhouse. Some of the leaves left on the ground and some of the leaves were buried. Samples were taken approximately every month. Materials were examined using a stereomicroscope and a light microscope. When necessary, diseased leaves were washed with tap water, surface sterilized with 1% NAOCl for 90 seconds, washed with sterile distilled water and placed on plates containing PDA. In a cooled incubator, Petri plates containing Potato Dextrose Agar (PDA) and the fungus were held at 0°C and –10°C for 9 months.

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Table 1. Meteorological data of the experimental area for the years 1999, 2000 and 2001

Months	Temperature (°C)			Relative humidity (%)			Precipitation (mm)		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
January	3.3	-3.4	3.0	72	79.7	72.4	27.9	47.3	6.8
February	3.2	-1.1	4.1	72	77.7	69.9	86.2	42.6	43.0
March	6.6	4.5	11.5	63	63.3	59.6	54.5	41.4	32.8
April	12.1	13.1	12.6	60	66.3	61.1	14.2	75.6	27.3
May	16.9	15.5	14.8	52	59.5	63.2	7.3	17.3	110.0
June	20.0	19.8	21.9	60	60.8	40.2	35.4	34.6	0.0
July	24.4	26.5	26.3	51	37.7	42.8	44.7	0.0	2.5
August	23.8	22.8	24.7	52	49.1	46.4	31.0	24.4	19.3
September	18.8	18.9	20.8	55	55.6	46.4	20.8	4.5	13.0
October	13.9	12.2	13.2	64	65.8	46.2	43.3	20.5	1.0
November	6.7	8.7	6.9	68	62.1	47.5	31.1	7.4	64.8
December	5.0	2.2	2.5	73	81.1	72.3	38.9	31.1	116.9

*Source: General Directorate of the State Meteorological Office, Ankara, Turkey

Samples were taken at monthly intervals and placed on PDA. Also diseased leaves were kept 3 months at –10°C. Diseased leaves were transferred to sterile Petri plates containing moist filter paper and examined using a stereomicroscope and a light microscope.

Results and Discussion

Conidia, conidiophores and pseudothecia of the pathogen were found on the leaves both left on the ground and buried. Pseudothecia were more common on the buried leaves as compared to leaves left on the ground. Conidia and conidiophores were more common on the leaves left on the ground as compared to buried leaves.

All samples yielded *Drechslera teres*. In addition, conidia and pseudothecia were taken and placed on PDA. *Drechslera teres* development occurred from these samples. It appears that fungus remains alive under these conditions. During the experimental period, ascus and ascospores were not detected. This could be due to heterothallic nature of the fungus as well as the long time requirement of the maturation of the pseudothecia.

Fungal development also occurred from the samples that were held at 0°C and –10°C for 9 months in a cooled incubator.

Jordan (1981), in England, reported the pseudothecium of the pathogen in plants growing in the field. We were unable to see pseudothecium in the plants growing in the field. Apparently, no psedothecium development occurred during the growing seasons of the experimental period. We were able to see the pseudothecium of the pathogen on the detached leaves both left on the field and buried.

It appears that, under Ankara conditions, fungus remains alive and overwinters with the diseased plant parts remained both above and underground. Mycelium, conidiophore and conidia of the pathogen was commonly observed especially from the samples that left on the ground. It is very likely that these propagules could be the inoculum sources. Primary inoculum sources could be fungal propagules developing in the infected plant parts left on the ground. It is known that diseased seeds can start the disease . This could be important in the introduction of the disease into clean fields. If the seed is disease free, primary inoculum sources could be the fungal propagules overwintering on the diseased plant parts (Jordan 1981, Shipton et al. 1973).

During the experimental period, pycnidia of the fungus were not observed in both field studies and in cooled incubator where fungus cultures were kept in Petri dishes. However, pycnidia were common on leaf samples that were kept 3 months in a cooled incubator at –10°C. Diseaşed leaves were transferred to sterile Petri plates containing moist filter paper. Three days later, conidiophores, conidia, pseudothecia and a large amount of pycnidia were observed. Pycnidia production were reported previously. Picniospores are not able to cause disease and possibly act as spermatia (Jordan 1981, Shipton et al. 1973).

Duczek et al. (1999), in Canada, were able to find conidia of *Drechslera teres* and pseudothecia of *Pyrenophora teres* after two winter seasons. In their study, in general, after a period of two winter seasons, there was a decrease in the number of conidia, however, in one experiment there was an increase in the number of pseudothecia. Conidia numbers were decreased after one winter season. During their experimental period, the lowest temperatures were –20.8°C, -24.6°C and –14.6°C. Sporulation differed with the year and host. Also, in their study, conidia of *Drechslera teres* were found 100 to 1000 fold more in barley as compared to wheat. Conidial growth on wheat implies that wheat is not a suitable crop to use in a rotation with barley.It is also reported that inoculum present on the infected plant parts could be responsible for seedling infections in the early spring. Our findings also support this wiev. It is also reported that at least 2 years barley should not be planted in the same field.

In another study performed in Canada, conidia were detected in spor traps, however, no ascospores were detected (Van den Berg and Rossnagel, 1991). In our study, conidia and psedothecia were present but ascospores were not observed. (Van den Berg and Rossnagel 1991). Conducted their experiment using diseased plant parts above ground. Our studies show that

the pathogen could overwinter on the diseased plant parts on the ground as well as on the diseased plant parts that buried. Buried diseased plant parts can also be a source of inoculum and helps the pathogen for survival.

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