

# Isolates of *Pyrenophora teres* from Montana and the Mediterranean Region That Produce Spot-Type Lesions on Barley

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## ABSTRACT

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Isolates of *Pyrenophora teres* f. *maculata*, the causal organism of spot-type symptoms on barley leaves, are described from Morocco, Tunisia, Turkey, and Montana. Growth on V-8 agar and conidial characteristics were indistinguishable from those of *P. teres* f. *teres*. In seedling inoculations, the *maculata* isolates from Morocco, Tunisia, and Turkey generally produced larger lesions than the Montana isolate. Most cultivars tested were intermediate in reaction to the isolates from Morocco, Tunisia, and Turkey. The cultivar Dekap was susceptible to all but one isolate.

Additional key words: net blotch

with slight chlorosis, 3 = moderate-sized dark brown lesions (2-3 mm) with moderate chlorosis, and 4 = large, coalescing dark brown lesions with extensive chlorosis.

## RESULTS AND DISCUSSION

Symptoms on leaf tissue collected from the field in Montana and countries in North Africa and the Middle East have ranged from typical net blotch to spot types. *P. teres* was isolated in most cases and caused net-type symptoms when inoculated onto barley seedlings. In Montana before 1981, several leaf samples with spot symptoms were collected, but when the isolates from such leaves were inoculated onto seedlings, net-type symptoms resulted. In 1981, however, all leaf samples collected at Fairfield, MT, yielded *P. teres* f. *maculata*. Some lesions on the Fairfield leaf samples appeared to be net types, but when *P. teres* was isolated and inoculated onto seedlings, spot-type symptoms developed.

The seven *P. teres* f. *maculata* isolates from Morocco, Tunisia, and Turkey differed from the Montana spot isolate (81 F) in seedling inoculations in that they produced larger lesions on most cultivars. The only previously published report of a *P. teres* f. *maculata* isolate from the North Africa-Middle East region is that of McDonald (5); he studied an isolate collected in Israel. In collections during the past 7 yr, the *maculata* form was commonly found in the Mediterranean region.

Growth characteristics on V-8 agar were indistinguishable between the eight isolates of *P. teres* f. *maculata* and the *P. teres* f. *teres* isolate B. Conidia of the *maculata* isolates were not significantly different in size (11-14 × 68-125 μm) from conidia of the *teres* isolate (11-15 × 57-114 μm). Conidial septation, shape, and coloration were indistinguishable.

Results of the seedling pathogenicity test are shown in Table 1. The cultivar Dekap was susceptible or intermediate in reaction to all isolates tested. None of the cultivars were resistant to the *C. sativus* isolate. The lesions observed on seedlings inoculated with 81 F were much smaller than those observed in the field. Cultivars that tested resistant to the B (net) isolate were generally not as resistant to the spot forms from Morocco, Tunisia, and Turkey. Most reactions to these spot

*Pyrenophora teres* Drechs., the causal organism of net blotch of barley (*Hordeum vulgare* L.), shows considerable variation (6). The disease is named for the netlike lesions on leaves. Occasionally, however, isolates have been found that produce spot-type lesions easily confused with symptoms produced by *Cochliobolus sativus* Drechs. ex Dastur. Spot-causing forms of *P. teres* are common in northern Europe (2,4,7) and have also been reported on several occasions in Canada (5,8-10), Israel (5), and Western Australia (3). Smedegaard-Petersen (7) divided *P. teres* into two forms: *P. teres* f. *maculata* for the spot-causing isolates and *P. teres* f. *teres* for the net-causing isolates. This paper describes isolates of *P. teres* f. *maculata* collected in Morocco, Tunisia, Turkey, and Montana from 1974 to 1981.

## MATERIALS AND METHODS

**Description of isolates.** Isolates of *P. teres* were collected annually from countries in North Africa and the Middle East. Seven of the approximately 50 isolates collected produced spot-type symptoms when inoculated onto barley seedlings. In 1981, spot-type lesions were observed on irrigated barley in a nursery and a farmer's field at Fairfield, MT. A single-leaf sample was collected on 2 July and 11 samples from different cultivars

were collected on 12 August. Subsequently, all 12 samples collected at this location produced spot-type symptoms. They were composited and designated 81 F. Isolate B of *P. teres* from Baker, MT, which produces typical net blotch symptoms, and isolate Mt 77-5II of *C. sativus* from barley leaves collected at Sidney, MT, were studied for comparisons. Origins of the isolates are shown in Table 1.

**Isolation and maintenance of cultures.** Leaf tissue was surface-sterilized in 1% sodium hypochlorite solution and placed on water agar plates. Twenty-four to 48 hr later, emerging conidia were transferred singly to 20% V-8 juice agar. All cultures were maintained on V-8 agar.

**Pathogenicity tests.** Pathogenicity tests were conducted on barley seedlings. Cultures of *P. teres* and *C. sativus* were grown on 20% V-8 agar. A conidial suspension from 8- to 10-day-old cultures (about  $4 \times 10^4$  conidia per milliliter) was atomized onto seedlings at the two-leaf stage. The plants were placed immediately in a dew-simulation chamber at 20 C for 24 hr. The plants were then returned to a growth chamber at a 15-25 C (dark/light) temperature regime. After 7 days, symptoms were rated. Net-type symptoms caused by *P. teres* f. *teres* were: 0 = no observable infection, 1 = pinpoint lesions (1 mm) with no chlorosis, 2 = slightly elongated (1-2 mm) dark brown lesions with no chlorosis, 3 = restricted longitudinal brown streaks with slight chlorosis, and 4 = brown elongated lesions, crisscrossed with dark netlike venation and marked chlorosis. Spot-type symptoms caused by *P. teres* f. *maculata* and *C. sativus* were: 0 = no observable infection, 1 = pinpoint lesions (1 mm) with no chlorosis, 2 = slightly elongated (1-2 mm) dark brown lesions

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**Table 1.** Disease reactions<sup>a</sup> of barley seedlings to isolates of *Pyrenophora* spp. and *Cochliobolus sativus*

Cultivar	CI number	<i>P. teres</i> f. <i>teres</i> B	Isolate <sup>b</sup>								
			<i>P. teres</i> f. <i>maculata</i>					<i>C. sativus</i>			
			81 F	79-27	79-30	79-32	79-38	Pt-6	ELS 77-5	Tunis 75	Mt77-5II
Dekap	3351	4	3	3,4	3	4	3,4	3	3,4,2	3,2	3,4
Klages	15478	3	3	2	2	2	2	...	...	...	3,4
Shabet	13827	3,4	3	2,3	1,2	2	2,3	2,3	2,3	2,1	3,4
Ingrid	10083	2,3,4	1	1,2	1,2	2	1,2	2,1	2,3	2,1	3
Unitan	10421	1	1	1,2	1,2	3	2	1,2	2,3	1,2	3,4
Arimont	15509	3,4	1	1,2	1,2	2,3	1,2	2,1,3	2,1	1,2	4
Steptoe	15229	1,2	1,2	2,3	2,3	2,3	2,3	2,3	2,3	2,3	4
Tifang	14373	1	1,2	2,3	2,3	3,4	2,3	3,2,4	2,3	2,3	3,4
	5791	1	1,2	2	2	2,3	2,3	1,2	2,1	2,1	4
	7584	1	1,2	3	2,3	2,3	2,3	3,4	2	3,2	4
	9776	1	1	1,2	1,2	2,3	2	1,2	2,1	2,1	3,4
	9819	1	1	2,3	2,3	3,4	2,3	2,3	3,2	3,2	4

<sup>a</sup> Net-type symptoms caused by *P. teres* f. *teres*: 0 = no observable infection, 1 = pinpoint lesions (1 mm) with no chlorosis, 2 = slightly elongated (1–2 mm) dark brown lesions with no chlorosis, 3 = restricted longitudinal brown streaks with slight chlorosis, and 4 = brown elongated lesions, crisscrossed with dark netlike venation and marked chlorosis. Spot-type symptoms caused by *P. teres* f. *maculata* and *C. sativus*: 0 = no observable infection, 1 = pinpoint lesions (1 mm) with no chlorosis, 2 = slightly elongated (1–2 mm) dark brown lesions with slight chlorosis, 3 = moderate-sized dark brown lesions (2–3 mm) with moderate chlorosis, and 4 = large, coalescing dark brown lesions with extensive chlorosis. Ratings given in order of prevalence.

<sup>b</sup> Origins: B from Baker, MT; 81 F from Fairfield, MT; 79-27 from Merchouch, Morocco; 79-30 from Tunis, Tunisia; 79-32 from Fahs, Tunisia; 79-38 from Tunisia; Pt-6 from Turkey; ELS 77-5 from Morocco; Tunis 75 from Tunis, Tunisia; and Mt77-5II from Sidney, MT.

forms were in the intermediate category. Isolate 79-32 gave a reaction rating of 2 or higher on all cultivars. Khan and Tekauz (3) also found that spot forms generally gave intermediate reactions and there were very few resistant or susceptible plants.

No estimates of losses due to *P. teres* f. *maculata* were made. In 1981 at Fairfield, MT, however, spot symptoms were present on all leaves (including the flag leaf) of most plants in a commercial field of Klages barley, and Composite Cross XXXVIII, a barley recurrent selection population with high levels of resistance to net blotch (1), was mostly susceptible, indicating a virulence pattern different from that of *P. teres* f. *teres*. The same location was surveyed in 1982 and *P. teres* f. *maculata* was found again but not at damaging levels. It was also isolated from several other locations in Montana in

1982 (C. B. Karki, *personal communication*).

*P. teres* f. *maculata* has now been reported from a wide variety of locations around the world. Because its virulence pattern appears to differ from that of the *teres* form, attention should be given to locating and studying sources of resistance. Our results and those of others (3,10) indicate that most cultivars and lines are intermediate in reaction in seedling tests. Emphasis should be placed on obtaining data under field conditions.

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