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First report on tan spot disease (*Pyrenophora tritici-repentis*) of wheat in Syria

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Summary. During the annual pest survey in 2001 severe leaf spotting was observed in two fields in the Efrin and Akhtar regions of northwestern Syria, where durum wheat cultivation has recently been introduced. The spots observed were typical of tan spot disease. The causal agent was isolated and identified as *Pyrenophora tritici-repentis* (anamorph *Drehslera tritici-repentis*). To our knowledge this is the first report on this disease in Syria.

Key words: *Triticum turgidum* L. subsp. *durum*, yellow leaf spot, seed-borne disease.

Introduction

Durum wheat is one of the major cultivated food crops in Syria. The area planted with durum wheat in 2000 covered 1.0 million hectares (Anonymous, 2000). Durum wheat is traditionally cultivated in the south of the country due to its adaptation and traditional cultivation in the crescent valley as well as to farmers' preference for locally grown crops. The introduction of new production techniques such as irrigation, desalinization, weed control, and fertilizers in northern Syria encouraged farmers to grow durum wheat crop, which also has a greater market value, rather than barley and bread wheat. Nonetheless, productivity remains low, in part due to the impact of complex biotic stresses.

Several pests and pathogens attack durum wheat. Foliar diseases are common and cause severe yield losses (Mamluk *et al.*, 1990, 1992; Mamluk and Naimi, 1992). Conducting annual surveys for wheat diseases during the main growing areas has become a major annual activity for plant protection specialists in Syria. In the 2001 survey, severe leaf spotting, consistent with tan spot of wheat, was observed in two fields. Tan spot of wheat is caused by the ascomycete *Pyrenophora tritici-repentis* (Died) Drechs. (anamorph, *Drehslera tritici-repentis* (Died) Schoem.), a pathogen previously unreported in Syria (Mamluk *et al.* 1992; CABI, 2000). Tan spot or yellow leaf spot is a seed and stubble-borne disease (Schilder and Bergstrom, 1995) and a quarantine disease in Syria.

Pyrenophora tritici-repentis infects several gramineae, including wheat and barley (Shoemaker, 1962; Mathre, 1982) and is significant in areas where wheat stubble is retained (Rees *et al.*, 1982; Diekmann and Putter, 1995). Losses due to tan spot re-

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sult from a kernel size reduction that can reach 50% (Rees *et al.*, 1982). The objective of this study was to isolate and characterize the pathogen responsible for the spotting observed on durum wheat in 2001.

Materials and methods

The annual field survey was conducted in May 2001 in cereal growing areas in Syria and covered wheat and barley fields. One hundred and eleven wheat fields were surveyed. Severe leaf spotting was observed on durum wheat in two fields in northwestern Syria, one in the Ifrin and one in the Akhtarín region. Infected leaves from these fields were collected, dried and brought to the laboratory for processing. Leaf segments were incubated in a moisture chamber at room temperature with a photoperiod of 12 hours. Specimens were examined under a dissecting microscope (10×4.5) after 18, 24 and 36 hours. Cotton-blue slides were prepared from the growing structures on the leaf segments and examined under the microscope. Microscope measurements (10×20) were performed on 200 conidia from leaf fragments collected from each field. Attempts to develop the sexual state at room temperature for 45 days were unsuccessful. However, fruiting bodies developed after incubation for 60 days at 4°C. Measurements were performed on 100 fruiting bodies, 100 asci and 100 ascospores from each field.

Pathogenicity test

Inoculum from a pure culture of the fungus (derived from a single conidium) was produced on V8-PDA as described in Lamari and Bernier (1989). Seedlings of the cultivars Glenlea (hexaploid wheat) and Coulter (tetraploid wheat) of known susceptibility to *P. tritici-repentis*, were inoculated at the two-leaf stage with a conidial suspension of 3000 spores ml⁻¹ amended with 10 drops l⁻¹ of Tween 20 (polyoxyethylene sorbitan monolaurate). After inoculation, seedlings were placed in a misting chamber for 24 hours. Continuous leaf wetness was provided by two ultrasonic humidifiers. The seedlings were then moved to a growth room bench and kept at 22–18°C (day/night) with an 18-hour photoperiod. Symptoms were recorded seven days after inoculation.

Results and discussion

Tan spot was assessed at the two fields which were affected. At Efrin, using a 0–9 rating scale (Stubbs *et al.*, 1986), disease development was rated 4, with a severity of 5; whereas in the field at Akhtarín, disease development recorded was 2, with a severity of 7. Symptoms observed consisted of elongated lens-shaped lesions, 8–12 mm in length, tan-colored with a yellow margin and a dark spot in the center. Lesions often coalesced to form

Table 1. Conidia, pseudothecia, asci and ascospores characteristics of the pathogen causing tan spot at two sites in Syria, Efrin and Akhtarín (this paper), as compared with sizes of *Pyrenophora tritici-repentis* reported in the literature.

Character	This paper ^a		Wiese, 1987 Range (µm)	Zillinsky, 1983 Range (µm)	Diekmann and Putter, 1995 Range (µm)
	Range (µm)	Avg (µm)			
Conidia					
Length	90–245	191.8	45–200	90–170	n.r.
Width	15–17.5	15.2	12–21	12–24	n.r.
No. of septa	5–11	8	4–7	4–10	n.r.
Pseudotecia	250–425	342.5	200–350	n.r.	n.r.
Ascus					
Length	180–250	208.6	n.r.	n.r.	n.r.
Width	30–38.5	35	n.r.	n.r.	n.r.
Ascospore					
Length	40–46	44	40–70	40–60	45–70
Width	15–20.5	17.6	18–25	18–25	18–28

^a Data from 200 measurements.
n.r., not recorded.

large necrotic areas. These symptoms are typical of tan spot of wheat caused by *P. tritici-repentis*.

Characteristics of the conidia are presented in Table 1 and Fig. 1a. Conidiophores are brown to dark-brown, bearing a single hyaline to subhyaline conidium. Conidia are large, cylindrical and 5–9 septate; the apical cell is round and the basal segment typically conical and often shaped like a snake's head (Fig. 1a). This is in accordance with the description of *Drehslera tritici-repentis* given by Zillinsky (1983). Measurements of conidium length, width and number of septa, as compared to those in the literature on *D. tritici-repentis* are given in Table 1. Conidium shape,

length (90–245 μm , average 192 μm) and width (15–17.5 μm , average 15.2 μm) are consistent with those previously reported for *D. tritici-repentis* (Shoemaker, 1960; Ellis and Waller, 1976). The length of conidia ranged from 90 to 245 μm , with an average of 191.8 μm . The conidium width ranged from 15 to 17 μm , with an average of 15.2 μm . The number of septa in a conidium ranged from 5 to 11, average 8.

Pseudothecia produced in the laboratory (Fig. 1b) were dark-brown, spherical, with short spines surrounding short beaks. The pseudothecium diameter ranged from 250 to 425 μm , with an average of 342.5 μm (Table 1), which is within the

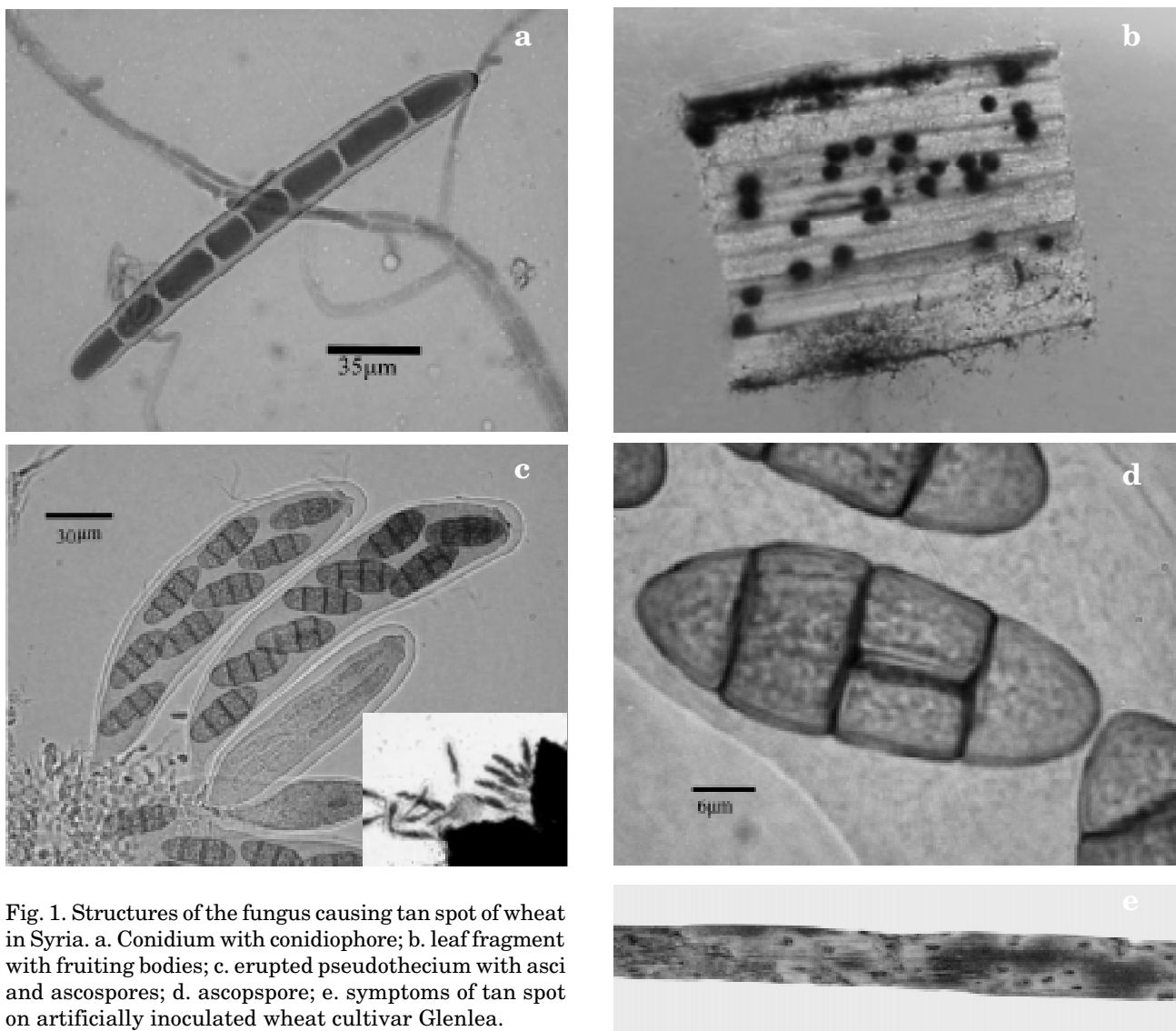


Fig. 1. Structures of the fungus causing tan spot of wheat in Syria. a. Conidium with conidiophore; b. leaf fragment with fruiting bodies; c. erupted pseudothecium with asci and ascospores; d. ascospore; e. symptoms of tan spot on artificially inoculated wheat cultivar Glenlea.

diameter range reported by several authors (Shoemaker, 1960; Wiese, 1987).

The observed asci and ascospore measurements are shown in Table 1. Mature asci and ascospores were obtained and observed under a compound microscope. Asci were bitunicate, 180–250 µm (average 208 µm) and typically contained eight ascospores each (Fig. 1c). Ascospores were transversely 3-septate with a vertical septum in one of the central cells (Fig. 1d). The shape, length (40–46 µm, average 44 µm) and width (15–20.5 µm, average 17 µm) of ascospores is consistent with previous reports of *P. tritici-repentis* (Shoemaker, 1960; Zillinski, 1983; Wiese, 1987; Diekmann and Putter, 1995).

The wheat cultivars Glenlea and Coulter, inoculated with inoculum from a single-spore culture of the pathogen, developed necrotic symptoms typical of tan spot (Fig. 1e) (Lamari and Bernier, 1989a). Lesions from Glenlea and Coulter, incubated in a moisture chamber as described above, produced abundant conidia of *Drechslera tritici-repentis*, fulfilling Koch's postulates.

The symptoms of the yellow spot disease observed in the durum wheat field at Ifrin and the field at Akhtar in Syria were typical of tan spot. Measurements of the fungal spores (conidia, pseudothecia, asci, and ascospores) were similar if not identical to those of the anamorph (*D. tritici-repentis*) and teleomorph (*P. tritici-repentis*) asexual/sexual stages of the causal agent of tan spot of wheat caused by *Pyrenophora tritici-repentis*. To our knowledge this is the first report of this disease in Syria. Additional studies are needed to determine the distribution and to assess the economic impact of this important disease in Syria.

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