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Development of tan spot (*Pyrenophora tritici-repentis*) in winter wheat under field conditions

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Abstract. The pathogen that causes tan spot on wheat is *Pyrenophora tritici-repentis* (Died.) Drechs. (anamorph *Drechslera tritici-repentis* (Died.) Shoemaker). In recent years tan spot has become a potentially destructive disease of wheat in Lithuania and neighbouring countries. Three winter wheat cultivars (*Aron*, *Tauras* and *Hereward*) were grown during three seasons. Weather conditions were observed from April to August when the tan spot pathogen spreads. During the experimental years the weather conditions varied from season to season. A severe epidemic of tan spot occurred in 2004 when there was a sufficient amount of rain and the air temperature was close to optimal. The other two seasons were not extremely favourable for tan spot occurrence, especially in 2005, because of the lack of rain during the main growing period.

Investigations of tan spot development patterns under field conditions enable wheat growers to better forecast tan spot and achieve better timing of fungicide applications.

Key words: weather conditions, tan spot, winter wheat

INTRODUCTION

Pyrenophora tritici-repentis (Died.) Drechs. (anamorph: *Drechslera triticirepentis* (Died.) Shoemaker) is a fungal foliar pathogen of many gramineous species and a foliar pathogen of wheat (*Triticum* spp.) that causes tan spot on leaves. The fungus produces two types of spores, which are wind-borne. Ascospores are forcibly ejected from pseudothecia, whereas the conidia are positioned in the air stream by elevated conidiophores on diseased leaf tissues. Wind speed as low as 2 m s^{-1} is sufficient to cause 100 percent conidial dispersal. Maturation of pseudothecia and ascospores occurs from 5-20°C but optimal temperature ranges from 15–18°C. (Wright & Sutton, 1990). Conidia are produced at temperatures between 10-25°C; the optimum is 21°C (Luz & Bergstrom, 1986). Ascospores are the major source of primary inoculum, followed by repeated cycles of conidial production, on diseased leaf tissue. But conidia might be a source of primary inoculum as well. Prolonged wet periods of 48 h or longer are favourable to saprophytic growth of tan spot (Hosford et al., 1987).

An increase in the economical significance and distribution of tan spot in Lithuania and neighbouring countries fostered an increased awareness and interest among researchers. Yield losses attributed to this disease reach 50 percent or more. Shorter rotations, continuous wheat cultivation and especially conservation or min-tillage systems increased the incidence of this disease (Lamari & Bernier, 1994; Ciuffetti & Tuori, 1999). The objective of the present study was to determine the

effects of the weather conditions, i.e. temperature and amount of rainfall, on the development of *Pyrenophora tritici-repentis* under field conditions.

MATERIALS AND METHODS

Field trials were established on three winter wheat cultivars: *Taura*s, *Aron* and *Hereward.* The data on the weather conditions (temperature and amount of rainfall) were collected during the main disease-spreading period (from April to July). For a higher level of primary infection, the experimental plots were covered with straw infected with tan spot pathogen post-emergence of wheat crops. Top free (?) fully expanded leaves were scored for percent of leaf area affected by chlorosis and necrosis. The diseased area was visually assessed on 10 randomly selected main tillers from each plot (Guidelines…, 1997).

RESULTS AND DISCUSSION

During the experimental years the first visible symptoms of tan spot were detected at the beginning of stem elongation growth stage (BBCH 31) in all cultivars.

A relatively lower tan spot epidemic was observed in the 2003 growing season. Optimal temperature for the growth of the pathogen occurred in the middle of May and the amount of rainfall was sufficient (Fig. 1). But later, the air temperature rose, while the amount of rainfall declined. New leaves of winter wheat emerged but they were less affected than previous ones.

The most favourable weather conditions for tan spot development were in the 2004 growing season. The air temperature was close to optimal for fungus development at the beginning of May, and this exerted some influence on the primary infection.

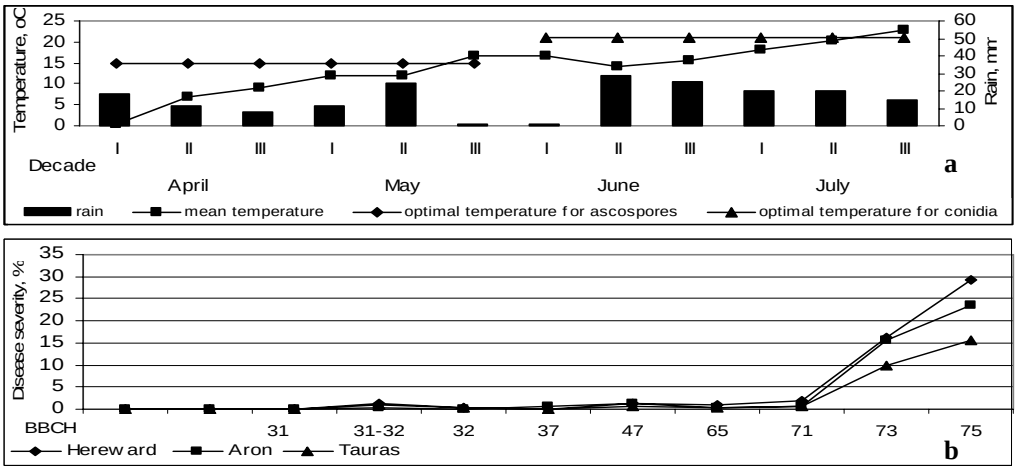

Fig. 1. Weather conditions and optimal temperature for the development of tan spot (a) and disease development pattern in winter wheat during the 2003 growing season (b).

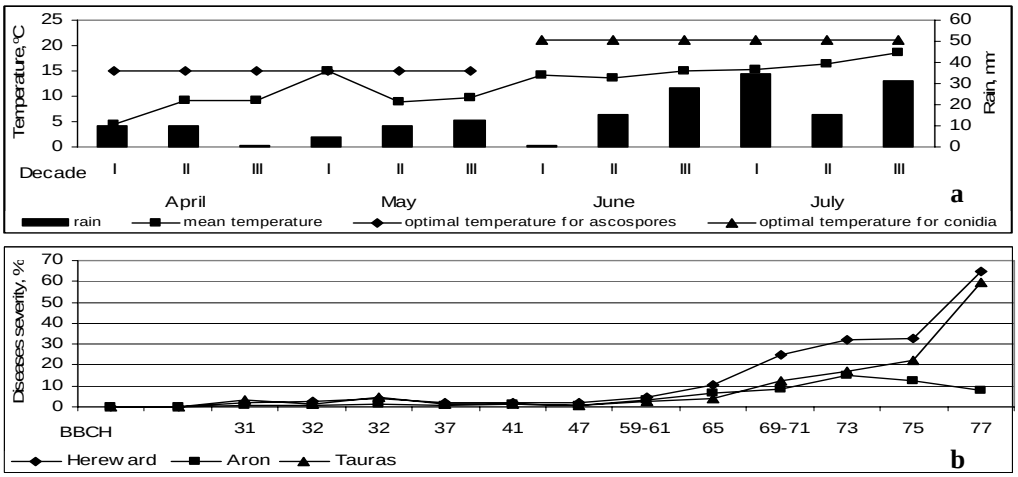

Fig. 2. Weather conditions and optimal temperature for the development of tan spot (a) and disease development pattern in winter wheat during the 2004 growing season (b).

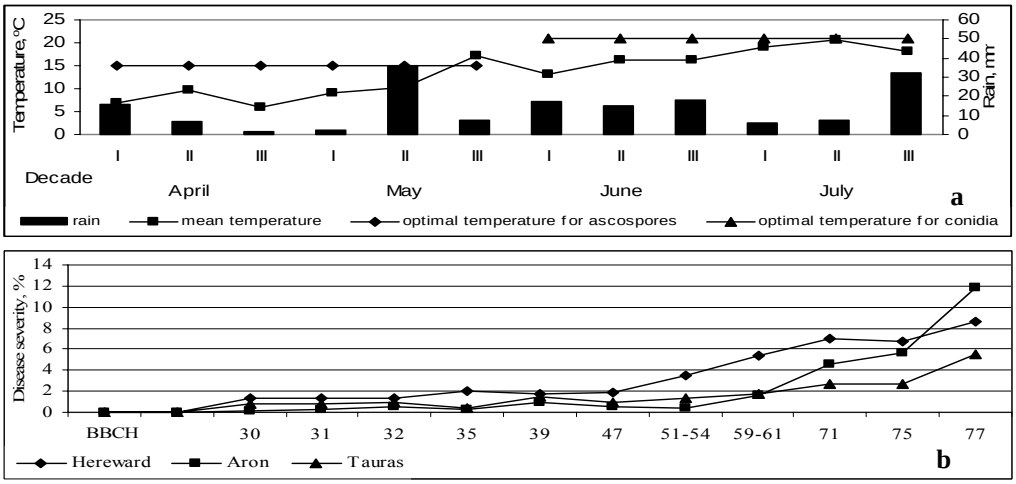

Fig. 3. Weather conditions and optimal temperature for the development of tan spot (a) and disease development pattern in winter wheat during the 2005 growing season (b).

Note: disease severity scales differ for all figures.

During the periods of rainfall and high humidity, multiple cycles of conidial production and release occurred, leading to rapid development of tan spot pathogen in the following months. (Fig. 2, a).Pathogen development was suppressed by dry weather conditions during the 2005 season. During April and May the weather conditions were suitable for the release of ascospores from pseudothecia but in the following months the second, conidia-infection cycle, was inhibited (Fig. 3). Production of primary inoculum of tan spot depends on the successful survival and saprophytic growth of *Pyrenophora tritici-repentis* in the residue. Researchers determined that levels of primary inoculum have been correlated with the development

of tan spot epidemics in the field (Zhang & Pfender, 1993). Our experimental evidence suggests that optimal temperature for the incidence of ascospores at the beginning of May might lead to a severe epidemic of tan spot in the field. The amount of rainfall did not have any significant effect during this period, because for the primary infection of *Pyrenophora tritici-repentis* fungus, soil moisture has a major role (Bockus & Shroyer**,** 1998). Rapid onset of tan spot was observed at the beginning of heading. Researchers note that this occurs due to the senescence of winter wheat leaves (Evans et al., 1999). Looking closer at the figures presenting the weather conditions we can point out that the air temperature in June is similar for all investigated years. But the amount of rainfall differed from season to season. A severe epidemic was observed during the 2004 growing season when the number of rainy days and the amount of rainfall were highest. Researchers detected that a longer post-inoculation wet period and optimal temperature increased conidial germination, the number of germ tubes per conidium, theength of germ tubes, appressoria production, papillae production and percentage of appressoria colonizing host cells (Hosford et al., 1987; Summerell & Burges, 1989; Sah, 1993). Our study indicates that rain played a major role in the incidence of tan spot pathogen in winter wheat under field conditions.

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