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Causal agents of stem-base diseases of winter wheat in Eastern Hungary

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Abstract

The significance of stem-base diseases has increased, especially as caused by Fusarium *species. Plant samples with visible stem-base symptoms were collected from different areas of Eastern Hungary. We isolated and identified the following four* Fusarium *species:* Fusarium equiseti, F. culmorum, F. oxysporum, *and* F. acuminatum. *A few occasions found the sharp eyespot disease (*Rhizoctonia cerealis*) with symptoms of characteristic light-coloured spots surrounded by sharp, brownish-black margin on the first node. As a result of* Rhizoctonia *delimitation it was the first evidence the occurrence of* Rhizoctonia cerealis *in Hungary. We observed the occurrence of* Bipolaris sorokiniana *only once. However, the most frequent damage caused by* Fusarium *species was evident (approx. 80 %) and it was confirmed the importance of* Fusarium *species as stem-base pathogens on wheat. The most commonly occurred species was* F. culmorum.

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Introduction

In spite of their widespread occurrence in Hungary,. stem-base diseases have not generally been considered sufficiently important to warrant detailed investigation. However, depending on season and climate factors, losses may reach 20 to 40 per cent in Hungary (KÜKEDI & SZABÓNÉ, 1986).

In the early 1960`s, although the importance of *Bipolaris sorokiniana* (= *Helminthosporium sativum*) was stressed nationally, imported wheat varieties were mainly damaged by eyespot disease (*Ramulispora /=Pseudocercosporella/ herpotrichoides* var. *herpotrichoides* and *R. herpotrichoides* var. *acuformis*) (CSUTI, 1960; 1963). These fungi also have teleomorphic stages: *Tapesia yallundae* var. *yallundae* and var. *acuformis* (for discussion of latest taxonomy see KÖVICS, 2000).

KÜKEDI & SZABÓNÉ (1986) showed that yield losses due to take-all (*Gaeumannomyces graminis* var. *tritici*) might reach 50 per cent. Losses are higher if irrigation has been applied in the absence of any fungicide sprays.

The sharp eyespot disease of cereals caused by *Rhizoctonia solani* (teleomorph: *Thanatephorus cucumeris*) and *Rhizoctonia cerealis* (teleomorph: *Ceratobasidium gramineum*). Although *Rh. cerealis* is a world-wide distributed fungus in temperate regions of the world, records before 1971 are often erroneously ascribed to *Rh. solani*. The latter may also occurs on Poaceae reported in the US (AG-4) and Australia (AG-5) causing yellow patch disease, however in western Europe *Rh. solani* is certainly not the cause of the sharp eyespot (BOEREMA et al., 1992). A study of ABDELSHIFE et al. (1982) indicated that *Rh. cerealis* is highly pathogenic on cereals at lower temperatures, while *Rh. solani* isolates are most pathogenic at higher temperature. The natural host range of *Rh. cerealis* is apparently

restricted to Poaceae. The fungus represents also a separate anastomosis group within the binuclear rhizoctonias indicates as CAG 1 and as AG-D (BOEREMA et al., 1992). All hyphal cells of *Rh. solani* are multinuclear, whereas *Rh. cerealis* is a binuclear fungus and the two species can be separate by nuclear staining method of Bandoni (KÖVICS, 2000). Although BALOGH et al. (1992) found about 10-15 % infested fields by "*Rh. cerealis*" in a wide-scale field observation of stem-base diseases in Hungary but there was no report about exact mycological identification, delimitation of species, and/or laboratory confirmation. The formal mycological description of *Rhizoctonia cerealis* as a new fungus on wheat in the region has not happened yet.

The significance of stem-base diseases has increased, especially as caused by *Fusarium* species. Although there are excellent Hungarian wheat varieties available which are grown on approximately 1.0 million ha, there are no satisfactory and effective resistance sources against foot-rot diseases caused by *Fusarium* species among current breeding lines. The other appearance of *Fusarium* ear diseases caused heavy epidemics during the early 1970`s, and resulted serious mycotoxicosis outbreaks. Since then these pathogens have remained important especially when weather conditions are wet during anthesis (DEADMAN et al., 1995).

A large number of *Fusarium* species can occur on wheat. NIERENBERG (1981) listed 18 *Fusarium* spp.: *Fusarium acuminatum, F. anthophilum, F. avenaceum* var. *avenaceum, F. culmorum, F. dimerum, F. equiseti* var. *equiseti, F. graminearum, F. sacchari* var. *subglutinans, F. merismoides* var. *merismoides, F. nivale* var. *nivale* and var. *majus, F. oxysporum* var. *oxysporum, F. poae, F. sambucinum* var. *sambucinum, F. solani* var. *solani, F. sporotrichoides* var. *sporotrichoides, F. tricinctum* and *F. verticilliodes*. BURGESS et al. (1982) described a further *Fusarium* species, which may

contribute to cereal diseases: *Fusarium crookwellense* Burgess, Nelson & Toussoun. All *Fusarium* species can be seed-borne and cause pre- and post-emergence seedling disease (HEWETT, 1967, 1983). Recently, reports of symptomless infection and the detection of systemic stem vascular colonisation by *Fusarium* species have been made (HUTCHEON & JORDAN, 1992; DEADMAN et al., 1995).

In our studies we intended to identify the pathogens causing stem-base diseases and determined their relative frequency in the Trans-Tisza region (Eastern Hungary).

Materials and methods

For the laboratory identification we collected plant samples from 5 Eastern Hungarian areas in June and July 2000. Soil residues were removed from stem-base and roots by washing in running water first, than 3 cm-long segments excised samples. Surface sterilisation of plant material was carried out in two steps involving immersion in 1.5 % NaOH solution for 15 minutes followed by rinsing with sterile distilled water, and immersion in 70 % ethanol solution for 10 minutes. Plant pieces were placed in wet chambers. Samples were incubated at 25 °C for 12 days.

After appearance of mycelium on the surface, fungi were transferred on Potato-Dextrose-Agar (PDA) and made isolates for mycological identification. Isolates were also put into the Microbiological Gene-bank Collection of Plant Protection Department.

For the identification we studied the characteristics of fungus colonies: growing rates, colour of upper and back side, mycelium and sporulation. 30 measurements of micro- and macroconidia, chlamydospores,

and hyphae were made by each isolate. Drawings and photos were also made for confirmation data.

For studying the number of nuclei and delimiting *Rhizoctonia* species we applied safranin-staining method of BANDONI (1979).

Results

Field observations

We started our field observation before harvesting and continued on the stubble. On the first nodes the long brown stripes showed mainly the *Fusarium* stem-base symptom. Most of damaged stem-bases were splitted, stems were broken and sometimes the whitish mycelia of *Fusarium* species were visible. The most frequent occurrence of *Fusarium* species was observable which confirmed by laboratory identification.

Only a few occasions found the sharp eyespot disease (*Rhizoctonia cerealis*) with symptoms of characteristic light-coloured spots surrounded by sharp, brownish-black margin on the first node.

Laboratory observations

The identified pathogens on the collected winter wheat stem samples in Eastern Hungary are shown in the *Table 1*. We could isolate and identify four *Fusarium* species, *Bipolaris sorokiniana* and *Rhizoctonia cerealis* respectively. *Gaeumannomyces graminis* and *Ramulispora herpotrichoides* did not occur in our study.

The relative frequencies of *Fusaria* were about 80 % in the samples.

Table 1. **Identified pathogens on the collected samples in Eastern Hungary in 2000**

No. of sample	Date of collection	Place of collection	Identified pathogens causing stem-base diseases
1	12. June	Kismacs	*Rhizoctonia cerealis, Fusarium oxysporum*
2	30. June	Mezőnyárád	*F. culmorum, F. equiseti*
3	02. July	Mezőnyárád	*Bipolaris sorokiniana, F. culmorum, F. equiseti*
4	02. July	Mezőnyárád	*F. culmorum F. equiseti*
5	07. July	Mezőnyárád	*B. sorokiniana, F. equiseti*
6	10. July	Mezőnagymihály	*Rh. cerealis*
7	10. July	Szentistván	*F. acuminatum, F. culmorum*
8	10. July	Mezőkeresztes	*F. equiseti*
9	10. July	Mezőnagymihály	*F. culmorum, F. equiseti*
10	14. July	Mezőkeresztes	*F. equiseti*

We could identify the following *Fusarium* species: *F. acuminatum, F. culmorum, F. equiseti, F. oxysporum*. The most frequent species was *F. culmorum*.

As a result of *Rhizoctonia* delimitation it was the first evidence the occurrence of *Rhizoctonia cerealis* in Hungary. Furthermore studies are necessary to identify the relative abundance among stem-base diseases and economical importance of the pathogen in the winter wheat production.

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