SHORT COMMUNICATIONS

Wrocław University of Environmental and Life Sciences, Wrocław, Poland

STAGONOSPORA TAINANENSIS – NEW PATHOGEN OF GIANT MISCANTHUS (MISCANTHUS × GIGANTEUS) IN POLAND

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Abstract

The health status of Miscanthus × giganteus plants was studied in 2007–2009. The greatest threat to the plants’ leaves was Stagonospora tainanensis. The most intensive infection of leaves by the pathogen occurred in 2009 on crop planted in 2007, when approximately 20% of young plants displayed lesions, covering up to 40% of the leaf area.

Key words: Stagonospora tainanensis, Miscanthus × giganteus

Introduction

The giant miscanthus (Miscanthus × giganteus) has been recently more and more frequently grown for energy biomass. The traits of this plant which speak in its favour are high growth rate at early development stages, low nutritional requirements, long and relatively stable yielding, as well as high resistance to pathogens. Furthermore, considering the limited water resource of Poland (Majtkowski 2007, Żurek 2008), the low water requirement of the plant, oscillating between 2000–3000 m³ annually per 1 ha of the crop, is of particular importance.

The greatest losses in the giant miscanthus crops occur where the plant is grown under climatic conditions similar to those prevalent in its origin zone, namely in the South-East Asia. On the other hand, weather conditions of Lower Silesia, one of the warmest regions of Poland, are favourable to infections by pathogenic fungi.

In August 2008 and 2009, symptoms of plant infestation by Stagonospora tainanensis were observed in two giant miscanthus crops in Pawłowice near Wroc-
law (south-west Poland). These symptoms were brown lesions of gradually increasing diameter with a beige centre and visible pycnidia.

The aim of the accomplished observations was to assess to what extent the giant miscanthus crop is threatened by the infection by *S. tainanensis* and by the resulting damage.

**Material and methods**

The miscanthus experiments were conducted in 2007–2009 in Pawłowice (51°10’N 17°12’E) near Wrocław, in the Agricultural Experimental Station of the Wrocław University of Environmental and Life Sciences. They were set up by the Department of Crop Production of the University, using split-plot design in four replicates. The plots of 5 m² size were located within two different miscanthus crops, established in 2004 and in 2007, respectively.

The field observations of the plants’ health status had been carried out weekly, starting at the stage of flowering, until the end of October. On each observation date 25 randomly chosen plants were observed along the diagonal of the plot. The assessment of leaf infection by *S. tainanensis* was performed by the end of August each year, when the most severe disease symptoms were visible. The infestation scale used in the process has been designed by the authors and involved 5 grades: 1° – healthy plants, 2° – lesions cover 1–10% of the leaf surface, 3° – 11–20%, 4° – 21–40%, and 5° – more than 40% of the leaf surface, respectively. Subsequently, the index of plant infection by *S. tainanensis* was calculated:

\[ WP = \frac{\sum (P \times W)}{n} \]

where \( P \) is the number of plants infected in the grade \( W \) and \( n \) stands for the number of all the assessed plants.

*Stagonospora tainanensis* was isolated from 20 infected leaves in the laboratory of Plant Pathology and Mycology Section (Department of Plant Protection). From the leaves that were previously rinsed in sterile water, the fragments of 0.5 cm diameter were cut out from the pathogenically altered leaf portion. These fragments were placed on Petri dishes with PDA medium acidified with citric acid in concentration of 3 ml per 250 ml of medium. The colonies of fungi growing on the medium were split out and planted onto PDA slants, from where they were identified taxonomically (Hsieh 1979).

**Results**

Delayed start of vegetation occurred in miscanthus crops in 2007. It resulted from lower temperatures and precipitation in spring, compared to the relevant vegetation phase according to long-term data. Further in that season the temperatures were higher than long-term recordings and that favoured the plant development. The decrease in temperatures was observed only in October that year. The second year of the study was different: in April and May both temperature and precipitation favoured vigorous plant growth and development. In contrast to 2007, precip-
itation decreased in June, which slowed down the plants’ growth. The situation improved again in July and August, when precipitation distribution was more typical of the region. The 2009 vegetation season started only by the end of April. In May and June precipitation distribution was favourable for the plants, but the situation worsened at the turn of May and July when precipitation increased considerably compared to long-term data. Such conditions also favoured leaf infection by *Stagonospora tainanensis* conidial spores. The situation improved only in July and August, when both the rainfall volume and temperatures became more similar to the long-term data.

The results of field observations point out that *S. tainanensis* is a fairly serious threat to the health status of the miscanthus leaves. Although on the crop established in 2004 no symptoms of infestation by *S. tainanensis* were observed in 2007 and 2008 (i.e. in the 3rd and in the 4th year after planting), in the case of the younger crop, planted in 2007, symptoms were recorded already in 2008 and 2009 (in the 2nd and in the 3rd year after planting; Table 1).

### Table 1

<table>
<thead>
<tr>
<th>Infestation scale</th>
<th>Years 2007</th>
<th></th>
<th>Years 2008</th>
<th></th>
<th>Years 2009</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1° (healthy plants)</td>
<td>100</td>
<td>100</td>
<td>96</td>
<td>100</td>
<td>80</td>
<td>98</td>
</tr>
<tr>
<td>2° (1–10% damaged leaf area)</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3° (11–20% damaged leaf area)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>4° (21–40% damaged leaf area)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5° (&gt; 40% damaged leaf area)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Infestation index</td>
<td>1.00</td>
<td>1.00</td>
<td>1.04</td>
<td>1.00</td>
<td>1.38</td>
<td>1.02</td>
</tr>
<tr>
<td>LSD0.05</td>
<td>n.s.</td>
<td>n.s.</td>
<td>0.10</td>
<td>n.s.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of infected plants</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>20</td>
<td>2</td>
</tr>
</tbody>
</table>


On the young plants, planted in 2007, the disease lesions on leaves occurred sporadically in 2008, but in 2009 the infestation increased considerably, reaching on average 20% of the inspected plants (Phot. 1). Occasionally, the pathogenic lesions covered up to 30–40% of the leaf blade. As the disease progressed, the lesions gradually merged and the infected leaves prematurely desiccated. On the crop planted in 2004, the septoriosis was observed only in 2009. However, the infestation of these plants by *S. tainanensis* was clearly lower than that of those planted in 2007.
In Europe the giant miscanthus shows considerable resistance to infection by various pathogenic organisms. Nevertheless, it has been argued that should the cultivation area of this plant in Poland increases, the crops will be increasingly threatened by a number of fungal pathogens including *Fusarium*, *Stagonospora*, *Cercospora*, *Helminthosporium* and *Alternaria*.

According to O’Neill and Farry (1996) *Stagonospora* spp. infect mostly young plants in a crop. Our results confirm their findings. In particular, the spore propagation from the pathogen’s pycnidia during the moist and humid 2009 season, created favourable conditions for successful infections of the leaves.

In spite of the fact that leaf lesions on miscanthus may also be caused by fungi of other genera, including *Helminthosporium*, *Bipolaris* and *Drechslera* (Remlein-Staroza 2007), in our study only *S. tainanensis* was isolated from the infected leaves. Disease symptoms similar to those induced by *S. tainanensis* are also observed in plants infected by *Cercospora miscanthi* (Goh and Hsieh 1987). The trait that distinguishes the two pathogens is pycnidia formation on the surface of lesions induced by *S. tainanensis*, as observed in our study.

Discussion
Conclusions

1. *Stagonospora tainanensis* is a considerable threat to the health status of younger leaves of miscanthus, in the annual and biennial crops.
2. Older plants in the perennial crops are less susceptible to infection by *Stagonospora tainanensis* than the younger ones.

Streszczenie

*STAGONOSPORA TAINANENSIS – NOWY PATOGEN MISKANTA OLBRZYMIEGO (MISCANTHUS × GIGANTEUS) W POLSCE*


Literature


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*Accepted for publication: 27.08.2010*