Improvement of resistance of winter triticale to *Parastagonospora nodorum*

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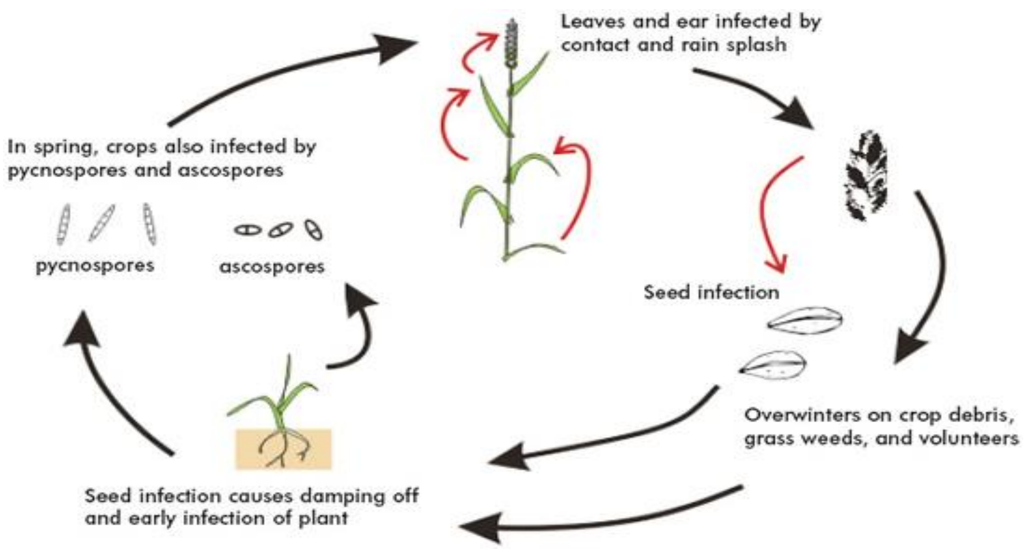
INTRODUCTION

The fungus *Parastagonospora nodorum* is a necrotrophic pathogen of triticale in many parts of the world. It can cause severe losses in grain yield wherever triticale is grown. Inoculum is usually more important in initiating the later phases of the disease, however fungus carried on the seed is more likely to be responsible for septoria seedling blight (Figure 1.). *P. nodorum* causes disease by secreting proteinaceous effectors which interact with proteins encoded by dominant susceptibility genes in the host. The outcome of the host-pathogen interaction results in necrosis of affected plant tissue in which the fungus is able to survive. In recent years appeared quite a number of reports on proteinaceous host selective toxins produced by *P. nodorum* in infected plant tissue. The Tox3 is the most common toxin produced by isolates collected in Poland.

In this study, an effort was undertaken to compare seedlings of winter triticale somaclonal and dihaploid lines and conventional varieties according to *P. nodorum* resistance and sensitivity to Tox3 among.

Figure 1. Life cykle of *Parastagonospora nodorum*



PLANT MATERIAL

Eight triticale commercial cultivars (Table 1.), two somaclonal lines and fifteen double haploids produced from cultivars varying in resistance to *P. nodorum* were evaluated under controlled environment conditions.

Table 1. Triticale cultivars used for crossings

TRITICALE CULTIVARS	
Algoso	Meloman
Borowik	Tomko
Borwo	Panteon
Cyrkon	Pigmej

TAKE HOME MESSAGE

Traditional plant breeding techniques have led us to depend more on chemical pesticides to protect our crops. Resistance breeding shows farmers, and plant breeders how to use a long-neglected technique to develop plant varieties that are naturally resistant to pests and pathogens.

METHODS

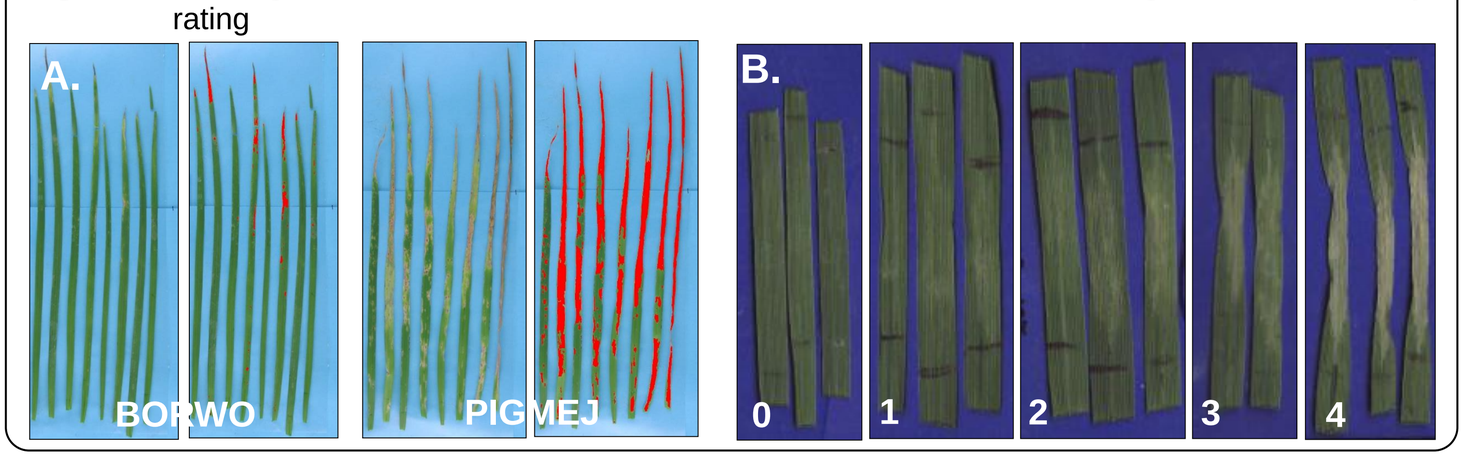
RESISTANCE TO *P. NODORUM*

1. Preparation of *P. nodorum* inoculum (concentration 5 x 10^6 spores/ml),
2. Inoculation of seedling leaves with spores suspended in water until run-off,
3. Incubation of inoculated seedlings in the dark for 72h (temp. 22°C, relative air humidity nearly 100% followed by 10 day incubation of seedlings at 20°C, relative air humidity close to saturation),
4. Rating of disease severity on seedling leaves (Figure 2A.), on scale: 0-10% - resistant, >90% -susceptible.

TOX3 SENSITIVITY TEST

1. Purification of Tox3 using chromatography.
2. Infiltration of fully expanded second leaves of seedlings (12-14 days after planting) with Tox3 using a 1-mL syringe without a needle.
3. Incubation of plant material in 21°C ± 2°C for 4 days.
4. Rating of symptoms according to a scale (Figure 2B.), on scale: 0 = insensitive (no reaction) 1 = slight chlorosis 2 = chlorosis 3 = chlorosis with some necrosis 4 = necrosis.

Figure 2. Coverage of leaves with chlorotic/necrotic lesion: A. PNB disease rating; B. Tox3 sensitivity rating



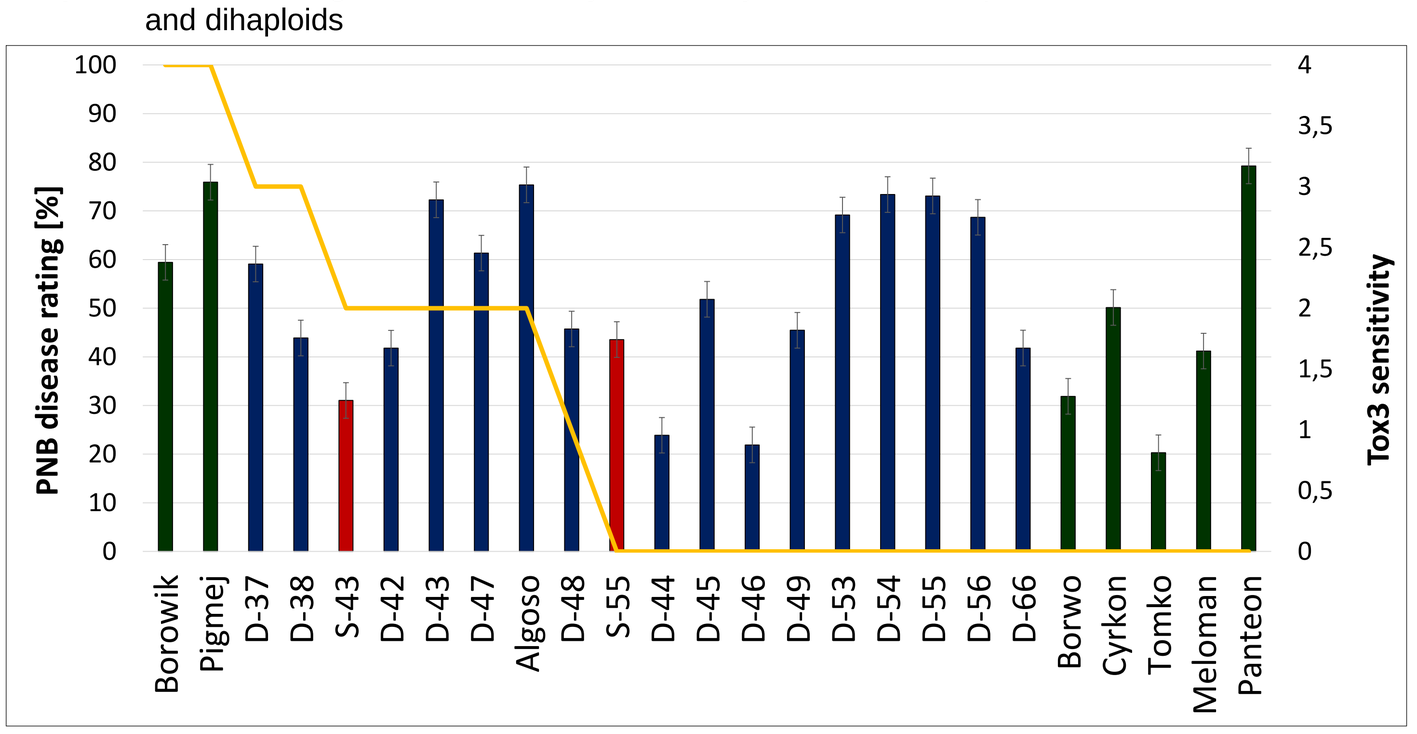
RESULTS

The differences between seedling leaves for all variance components were statistically significant. Most of the somaclonal and dihaploid lines produced from commercial triticale cultivars showed significantly improved resistance to the pathogen in question (Graph 1). On average, disease severity reached 37% on leaves of somaclones and 52% on leaves of dihaploids. Some of genotypes were showing low leaf infection, e.g. dihaploid D46 obtained from F1 plants of of a cross Tomko x Cyrkon. Similarly, lower disease severity was observed on a somaclone S43 produced from F1 plant of Borowik x Cyrkon.

Correlation between Tox3 resistance and *P. nodorum* phenotype resistance is statistically significant. This fact suggests the need to incorporate Tox3 sensitivity tests to triticale breeding programs.

Correlation p < ,05000; N=25			
	AVERAGE	**SD**	**CORRELATIONS**
PNB disease rating	19,29	16,53	**0,44**
Tox3 sensitivity	0,92	1,36	

Graph 1. Disease rating and Tox3 severity caused by *P. nodorum* on parental cultivars, somaclones and dihaploids



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