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Evaluating the *Pyrenophora teres* international standard barley differential set with Canadian isolates of the pathogen

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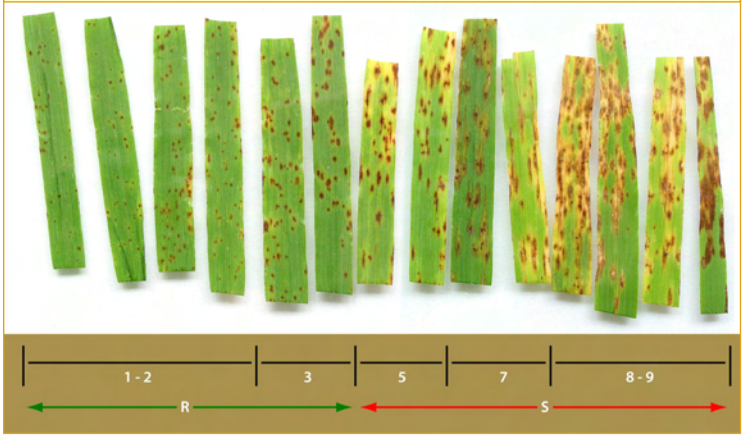
Introduction

Determining the variability in plant pathogenic fungal species is a strategic adjunct to initiating and maintaining an effective breeding program targeting disease management by genetic resistance. In Canada and elsewhere, net blotch caused by *Pyrenophora teres* Drechs, is an important disease. 'Net blotch' manifests itself as two symptom forms, 'netted net blotch' (NNB) and 'spotted net blotch' (SNB), which respectively, are incited by two forms of the pathogen, *P. teres* f. *teres* (*Ptt*) and *P. teres* f. *maculata* (*Ptm*). While the variability in *P. teres* has been sampled and evaluated in many different barley growing regions, such assessments have not been done using uniform protocols, i.e. the same number or identity (= set) of differential barley genotypes. To address the desire to provide this uniformity - for the purpose of evaluating and comparing pathogen virulence globally, and, identifying potential sources of resistance for use locally - an international set of barley differential genotypes (IBDS) was developed for *Ptt* and proposed for universal use (Afanasenko et al. 2009). The results of a preliminary study to test the usefulness of the IBDS in assessing the current virulence in *Ptt* (and *Ptm*) in a Canadian context, are presented here.

Fig. 1. Reaction scale (1-9) for infection of barley by *Pyrenophora teres* f. *maculata*. Values of 1-3 and 5-9 represent resistant and susceptible phenotypes, respectively.



Materials and Methods

Seedlings of the IBDS were grown in potted soil in a controlled environment and inoculated with various isolates of *Ptt* and *Ptm* when 2-weeks old using standard protocols (Xi at al. 1999). After 7-10 days, seedlings were scored for infection phenotype on the second and/or third leaves using a 1-10 or 1-9 reaction scale (Fig. 1), for *Ptt* and *Ptm*, respectively (Tekauz 1985). Values of 1-5 (*Ptt*) and 1-3 (*Ptm*), were regarded as the resistant phenotype; higher values were classified as 'susceptible'. The different R/S demarcation results from the tendency of barley genotypes to display enhanced resistance to *Ptt* as adult plants vs. their reaction as seedlings (Tekauz 1986).

Results and Discussion

The infection phenotypes developing on the IBDS for *Ptt* and *Ptm* are listed in Tables 1 and 2. The provenance of the 9 *Ptt* isolates included the provinces of Manitoba (6), Ontario (2) and Quebec (1); the 6 *Ptm* isolates originated from Manitoba. Isolates all had individual infection profiles on the IBDF, and these also differed from those of standard *Ptt* isolates WRS102 and WRS858, or the standard *Ptm* isolate WRS857. Based on the average reaction scores on the 18 barley genotypes, '09-118' was the most virulent *Ptt* isolate tested (score of 7.6). Two genotypes, CI5791 and CI9819 were resistant to this isolate whereas a minimum of 7 genotypes were resistant to all other isolates tested. The range of *Ptm* virulence appeared to be relatively narrow, and while their infection profiles differed, the three most virulent isolates had reaction scores (5.4-5.7) similar to that of standard isolate WRS857 (5.5). Two different members of the IBDS were resistant to all isolates of either *Ptt* or *Ptm*.

Table 1. Seedling reactions (1-10) of the 18-genotype IBDS resulting from infection by Canadian isolates of *P. teres* f. *teres*. Green shading denotes resistant phenotype (1-5); red shading, susceptible (>5–10).

Barley Line	WRS 102	WRS 858	09-64	09-86	09-118	'75'	'136'	'142'	'10ON'	'5ON'	'12QC'	Average
1. CI2710	5	5	6	8	8	5	7	6	4.5	5	5	5.9
2. Harbin	10	6	10	7	10	6.5	7	8	9	6.5	7	7.9
3. K8755	4	4	5	6	6	3	3	6	3.5	5	4	4.5
4. K20019	3	4	4	5	7	4	4	5	3	5	4.5	4.4
5. Manchurian	7	5	8	5	10	4	4	3	4	7	5.5	5.7
6. Tifang	9	4	10	5	10	3	5	4	9	6	7	6.5
7. CI9819	2	2	3	3	2	2	4	3	1	2	2	2.4
8. CI9825	2	6	5/7	3/8	2/6	5	6	5	2.5	5	3	3.3
9. CI5791	1	2	2	2	2	3	2	3	1	1	1	1.8
10. CI2330	10	7	10	9	10	3	8	9	9	8	9	8.4
11. Beecher	6	4	4	3	9	4	5	7	4	7	4	5.2
12. CI9214	3	2	6	3	8	5	5	5	8	6	6	5.2
13. Skiff	6	10	7	10	8	7	9	10	9	7	8	8.3
14. CI11458	8	10	7	8	9	5	4	7	9	7.5	9	7.6
15. Prior	8	6	9	8	9	6	5	8	10	9	9	7.9
16. Corvette	8	7	9	9	9	7	7	10	10	9	7	8.4
17. Pirkka	9	9	10	9	10	7	9	9	8.5	7	8	8.7
18. Harrington	8	10	9	10	10	8.5	10	10	9	7	6	8.9
Average	6.1	5.7	6.7	6.1	7.6	4.9	5.8	6.6	6.3	6.1	5.8	

Table 2. Seedling reactions (1-9) of the 18-genotype IBDS resulting from infection by Canadian isolates of *P. teres* f. *maculata*. Green shading denotes resistant phenotype (1-3); red shading, susceptible (5–9).

Barley Line	WRS 857	09-39	09-71	09-92	09-142	'82'	'121'	Average
1. CI 2710	8	-	9	5	3	5	7	6.1
2. Harbin	7	-	7	7	5	5	5	6.0
3. K8755	7	-	5	3	3	7	3	4.7
4. K20019	8	-	7	7	5	7	8	7.0
5. Manchurian	2	2	2	3	2	3	3	2.4
6. Tifang	3	7	5	9	7	3	7	5.9
7. CI 9819	3	5	5	8	5	3	7	5.1
8. CI 9825	3	2	2	5	3	3	5	3.3
9. CI 5791	5	3	5	5	3	3	3	3.9
10. CI 2330	5	3	5	5	2	3	3	3.7
11. Beecher	5	7	7	7	7	5	8	6.6
12. CI 9214	3	2	3	2	3	3	2	2.6
13. Skiff	8	7	5	3	3	5	7	6.1
14. CI 11458	8	8	8	7	7	5	5	6.9
15. Prior	7	7	8	9	7	7	7	7.4
16. Corvette	5	3	5	3	2	5	3	3.7
17. Pirkka	3	3	8	7	3	7	7	5.4
18. Harrington	9	5	5	8	5	8	7	6.7
Average	5.5	4.6	5.6	5.7	4.2	4.8	5.4	

Conclusions

The IBDS was useful in demonstrating the pathogenic variability among the Canadian isolates of *Ptt* and *Ptm* tested. However, 5, and possibly 6 barley genotypes resulted in the same reaction profiles (S) to isolates of *Ptt* and *Ptm*, respectively, indicating that some redundancy is present in the IBDS. This likely is inevitable given the 'international' intent for IBDS use. Somewhat surprisingly, the IBDS, which was developed specifically for use with *Ptt*, also differentiated among isolates of *Ptm*. The latter is significant given the apparent resurgence of SNB in western Canada (Tekauz and Desjardins 2011). Testing of the IBDS with additional isolates of both pathogen forms is needed to validate these preliminary findings and to evaluate the current virulence in *Ptt* and *Ptm* in Canada.

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