Effect of wheat seed colour on the incidence and severity of red smudge and black point caused by *Pyrenophora tritici-repentis*

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Introduction

Pyrenophora tritici-repentis (Died.) Drechs. (anamorph *Drechslera tritici-repentis* (Died.) Shoemaker) causes red smudge, black point and dark smudge (Fernandez et al., 1998; 2001; Francl and Jordahl, 1993). This discoloration could result in downgrading due to low tolerance levels in the top grades (Canadian Grain Commission, 1994). Incorporation of disease resistance into all wheat classes would therefore be of economic benefit to producers.

Fernandez et al. (2001) determined that cultivars in all four wheat quality classes tested were susceptible to *P. tritici-repentis* but that they differed in the predominant type and/or intensity of the discoloration and in incidence and severity of the infection. Some of the differences in the incidence and severity of the discoloration among cultivars appeared to be related to seed colour. Because there were differences also within classes not related to seed colour, the impact of seed colour *per se* on the development of kernel discoloration caused by *P. tritici-repentis* could not be accurately assessed.

The objective of this study was to assess the incidence and severity of kernel discoloration caused by *P. tritici-repentis* in near-isogenic lines for seed coat colour so that genotypic effects could be separated from seed colour.

Materials and Methods

The pairs of common wheat genotypes near-isogenic for seed colour were all F6-derived F8 lines. Plants were grown in pots, as described by Fernandez et al. (1998), in a controlled environment at 16 h light, 22?C, and 8 h dark, 15?C. There were two plants per pot, each pot representing a replicate. Two heads per plant (main and first tillers) were inoculated at milk stage (growth stages 73-77; Zadoks et al., 1974) by immersion for a few seconds in a conidial suspension of *P. tritici-repentis* ($3X10^3$ conidia/mL). A drop of Tween 20 (polyoxyethylene sorbitan monolaurate) was added to every 250 mL of spore suspension. A mixture of 10 isolates was used. Plants were then placed in a humidity chamber and incubated at 100% relative humidity for 24h. Plants were then returned to the same growing conditions as before inoculation. Controls consisted of plants treated in a similar manner with sterile distilled water. There were two replicates per cultivar arranged in a randomized complete block design, and the experiment was done twice.

After harvest, each head was individually threshed and kept in a separate paper envelope at room temperature. Samples were then rated for percent incidence (number of kernels) and severity (>50% of area of kernel affected) of red smudge, black point, and both red smudge and black point.

Means of incidence and severity for each plant and replicate (i.e. pot) were calculated. Arc-sined transformed values were analyzed using SAS Proc GLM (SAS Institute Inc. 1985). Trial and its interaction with genotype were considered to be random effects. Single degree of freedom contrasts were used to compare genotypes within each of the pairs, and between all white- and all red-seeded genotypes.

Results and Discussion

In most of the near-isogenic pairs, one-degree of freedom contrast showed a significant difference within the pair for either black point, red smudge, black point plus red smudge, or discoloration covering more than 50% of the surface area of the kernel. In all these cases, the white-seeded line had a greater percentage of discoloration than the red-seeded line. There were more differences in black point incidence than in red smudge incidence. When all white-seeded lines were compared to red-seeded lines, the former had a significantly greater ($P<0.01$) incidence and severity of discoloration, except for incidence of red smudge (Table 1).

These results show that white-seeded near-isogenic lines were more susceptible to kernel discoloration caused by *P. tritici-repentis*. The fact that this was true mostly for black point suggests that the differences in incidence between the red and the white lines were not due to any difficulty in detecting the discoloration.

This study confirms observations by Fernandez et al. (2001) that seed colour plays a role in the development of discoloration caused by *P. tritici-repentis*. Phenolic compounds are precursors of the red seed coat colour. Differences in reaction between red- and white-coated kernels might be due to the presence of phenolic compounds and/or peroxidases with antifungal properties in the former (Caruso et al., 2001; Waniska et al., 2001).

Table 1. Incidence of red smudge, black point and red smudge plus black point, and severity of discoloration (more than 50% of kernel surface area), of near-isogenic lines for seed coat color.

	Incidence (%)			Severity[1] (%)		
Seed colour	red smudge	black point	red smudge + black point	red smudge	black point	red smudge + black point
White (n=7)	42	29***	60***	8**	7***	16***
Red (n=7)	39	19	49	6	4	10

[1] Discoloration covering more than 50% of the kernel surface area.

*, ** and ***, white-seeded members of near-isogenic pairs significantly different from red-seeded members at $P<0.10$. 0.05 and 0.01, respectively.

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