

# PROGRESS IN COMPARING *FUSARIUM PSEUDOGRAMINEARUM* INFECTION LEVELS AND CROWN ROT SYMPTOMS IN STEM INTERNODES OF CEREALS

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## INTRODUCTION

Wheat (*Triticum aestivum*), durum (*Triticum turgidum* ssp. *durum*), barley (*Hordeum vulgare*), and oats (*Avena sativa*) are susceptible to infection by the crown rot pathogen *Fusarium pseudograminearum* (1). This study describes the differences in infection levels of *F. pseudograminearum* in bread and durum wheat, barley, and oat internodes using a species specific quantitative PCR (qPCR) assay and relates the average amount of fungal DNA found in the internodes to the average visual ratings of the internodes based upon a severity scale (2).

## MATERIALS AND METHODS

Seedlings of the bread wheat cultivars Puseas, Sumai 3, and 2-49, the durum wheat cultivar Jandaroi, the barley cultivar Lindwall, and the oat cultivar Cleanleaf, were inoculated using the layered inoculum method of Wildermuth and McNamara (3). Internodes 1 and 2 from all tillers of inoculated and non-inoculated plants were harvested when the main tiller of each plant was at anthesis. Internodes 1 and 2 of each cultivar were dried for 24 hours in a lyophilizer and individual stem sections were rated for disease symptoms (per cent discolouration) according to the scale of Rossi *et al.* (2). Primers were designed to elongation factor  $\alpha$  of *F. pseudograminearum*, elongation factor  $g$  of wheat (4), elongation factor  $\alpha$  of barley, and the tubulin gene of oats (GenBank). The quantity of *F. pseudograminearum* DNA in infected stem internodes was detected using the fluorescent dye SYTO® 9 in a qPCR assay. Mean stem score ratings, and levels of fungal DNA for internodes were calculated and analysed using one-way ANOVAs with l.s.d.'s calculated to determine treatment effects. Means with similar letters do not differ significantly ( $P = 0.05$ ).

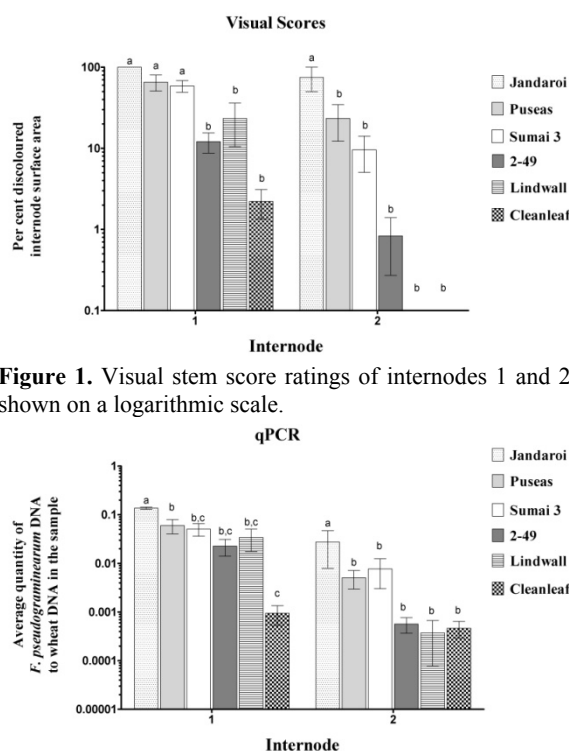
## RESULTS

**Table 1.** Number of internodes analysed per cultivar.

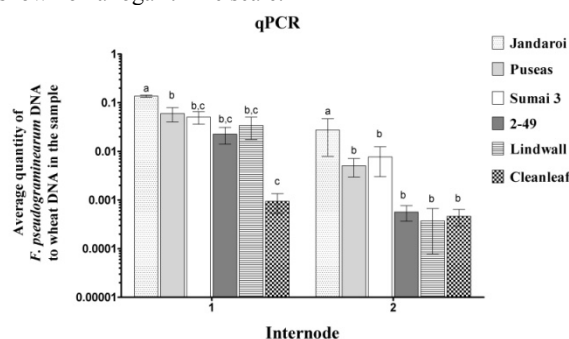
\* High rates of seedling death.

Cultivar	Internode 1	Internode 2	Tiller
Jandaroi *	2	2	2
Puseas	10	10	10
Sumai 3	10	10	10
2-49	10	10	10
Lindwall	6	6	6
Cleanleaf	9	8	9

Jandaroi, Puseas, and Sumai 3 had significantly higher levels of per cent discolouration than 2-49, Lindwall, and Cleanleaf for internode 1 (Figure 1). Results of the qPCR assay for internode 1, showed all cultivars were significantly different from Jandaroi, and Puseas was significantly different from Cleanleaf (Figure 2). The visual scores of per cent discoloration for Internode 2 showed all cultivars were significantly different from Jandaroi, but that there were no differences among the other cultivars (Figure 1). The qPCR assay results for internode 2 showed significant differences between Jandaroi and all other cultivars (Figure 2).



**Figure 1.** Visual stem score ratings of internodes 1 and 2 shown on a logarithmic scale.



**Figure 2.** qPCR results of internodes 1 and 2 shown on a logarithmic scale.

## DISCUSSION

The durum cultivar Jandaroi had significantly higher levels of infection than all other bread wheat, barley, or oat cultivars. Among the bread wheat cultivars, levels of infection detected in internode 1 were not significantly different, even though the visual scores indicated they were. The barley variety Lindwall was not significantly different from the bread wheat, or oat cultivars in level of infection. A low level of infection was detected in the oat cultivar Cleanleaf, and the barley cultivar Lindwall, even when visual symptoms were not evident. This study shows that qPCR can be used to understand symptom expression and resistance to crown rot.

## REFERENCES

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