Could Super Necrosis be used in *Septoria tritici* blotch disease management ?

F. Newman[1], L. Chartrain[1], A. Hafeez[2], J. Brown[1], **P. Nicholson**[1]

[1] John Innes Centre, Norwich Research Park, Colney Ln, Norwich, NR4 7UH,
[2] TSL, Norwich Research Park, Colney Ln, Norwich, NR4 7UH

Septoria Tritici Blotch (STB) caused by the *Zymopseptoria tritici* is a major foliar wheat pathogen in the UK and western Europe. causing significant damage to crops and reducing yields.

The disease is multi-cyclic with initial infection caused by ascospores produced in perithecia formed on crop debris (**Figure 1**). The pathogen spreads up the plant as pycnidiospores produced on infected leaves and dispersed by wind and rain initiating the next cycle of infection.

This cyclic amplification of inoculum enables the pathogen to eventually reach the flag leaf where the disease has greatest the impact on yield**.**

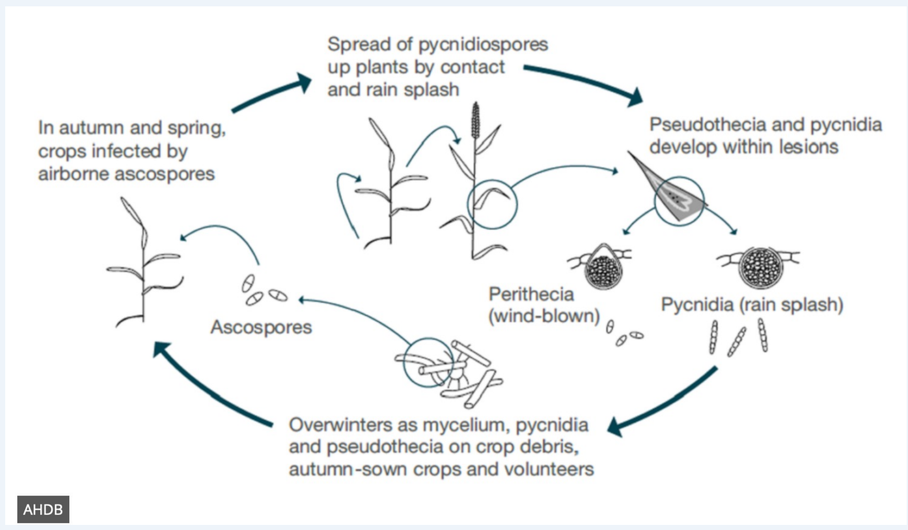

Figure 1 – Life cycle of *Zymoseptoria tritici*. Image from the AHDB website

What is Super Necrosis (SN) and how might it be useful ?

Following inoculation with *Zymoseptoria tritici* the leaf tissue collapses rapidly (**Figure 2**).

Super necrosis (SN) appears to be an incomplete form of plant resistance.

SN is not followed by formation of pycnidia as occurs in susceptible interactions (**Figure 3**).

Preventing formation of pycnidia reduces inoculum production and infection pressure for upper leaves.

Figure 2 - Super necrosis phenotype shown by the middle three plants 7 days after inoculation shows the speed of plant response and leaf necrosis. Longbow is very susceptible line which is used to show the normal disease progression.

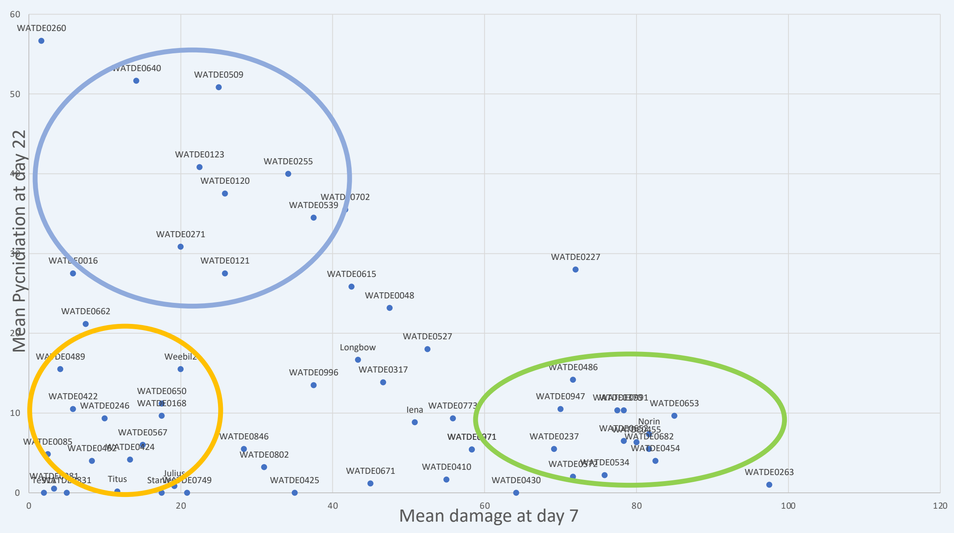

Figure 3 – Leaf damage 7dpi and pycnidial production at 22 dpi.
highly susceptible wheat lines are highlighted in **blue**, traditional resistance lines are highlighted in **orange**, super necrosis lines are highlighted in **green**.

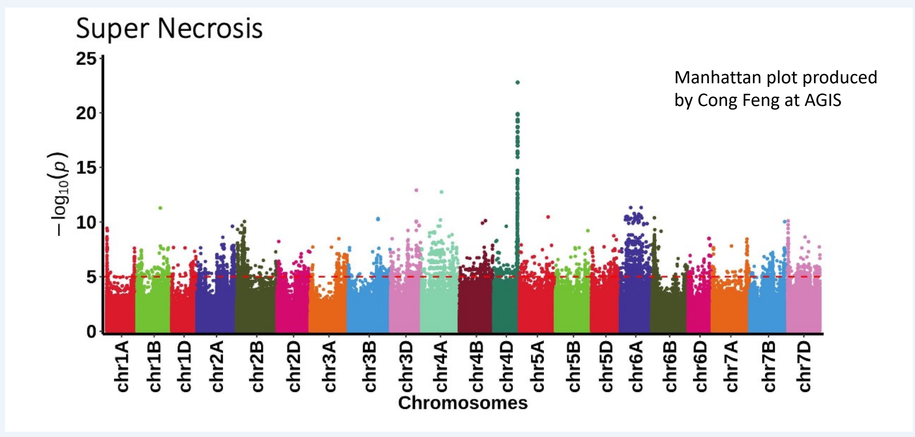

Figure 4 - Manhattan plot of the association between the SNPs in the Watkins collection and their association with SN phenotype.

My investigation:

The SN phenotype has been associated with a region on chromosome 4D (see **Figure 4**) by Amber Hafeez using the Watkins core collection (1).

I am testing additional lines from the Watkins collection that have haplotype associated with SN to establish whether they also exhibit the SN phenotype.

Comparison polymorphisms among the genes present in this window for SN lines will enable me to reduce the potential number of candidate genes and, ultimately, to isolate the causal gene.

A field trial has been established at the JIC farm (**Figure 5**) to determine whether the SN phenotype observed in laboratory conditions results in reduced disease on flag leaves of accessions displaying this trait.

Stb is already established on plants (**Figure 5** inset).

Figure 5 – Field trial looking to determine if SN phenotype occurs in the field and if it reduces the volume of inoculum to protect the upper canopy

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Reference:

1) Cheng et al 2023 Harnessing Landrace Diversity Empowers Wheat Breeding for Climate Resilience bioRxiv 2023.10.04.560903; doi: https://doi.org/10.1101/2023.10.04.560903