

# The role of the plant immune system in a virulent-avirulent strain coinfection

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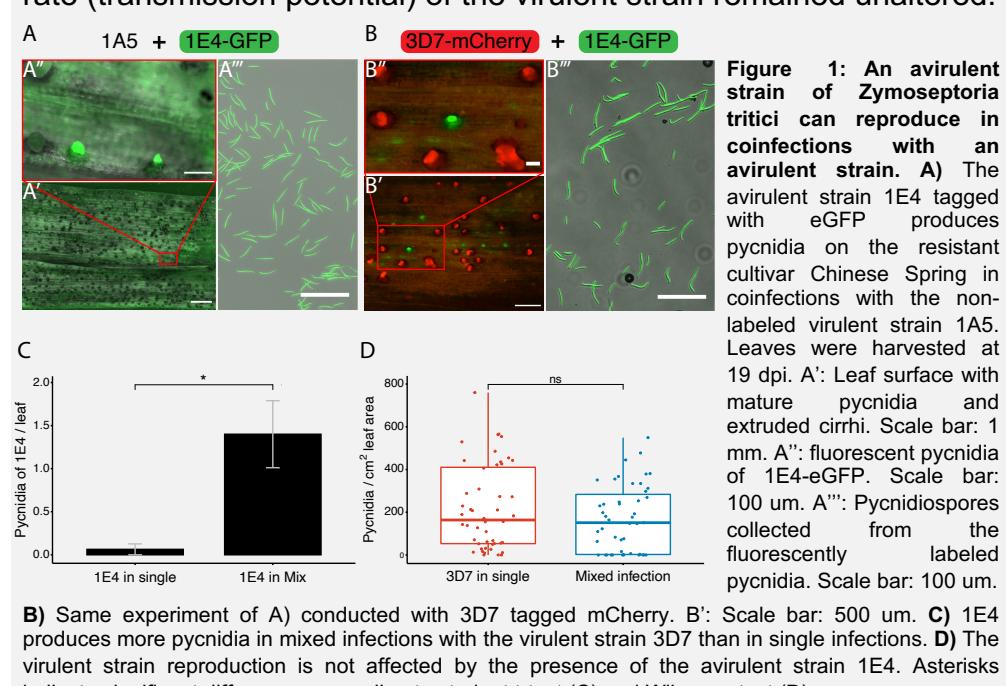
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## Introduction

In natural epidemics, populations of highly diverse isolates of *Zymoseptoria tritici* usually co-exist and very frequently co-infect the same leaf or lesion. Additionally, there is a quantitative distribution of virulence phenotypes, ranging from highly virulent to completely avirulent strains. In general, how these strains interact with each other remains unexplored. In particular, it remains to be determined if there is host immunity cross-reaction in mixed infections in which an avirulent strain and a virulent strain co-exist. AvrStb6 is an avirulence factor that is present in numerous strains of *Z. tritici*, including 1E4. AvrStb6 is recognized by the resistance gene Stb6 (present in Chinese Spring), which will subsequently trigger an immune response that prevents the infection by the avirulent strain.

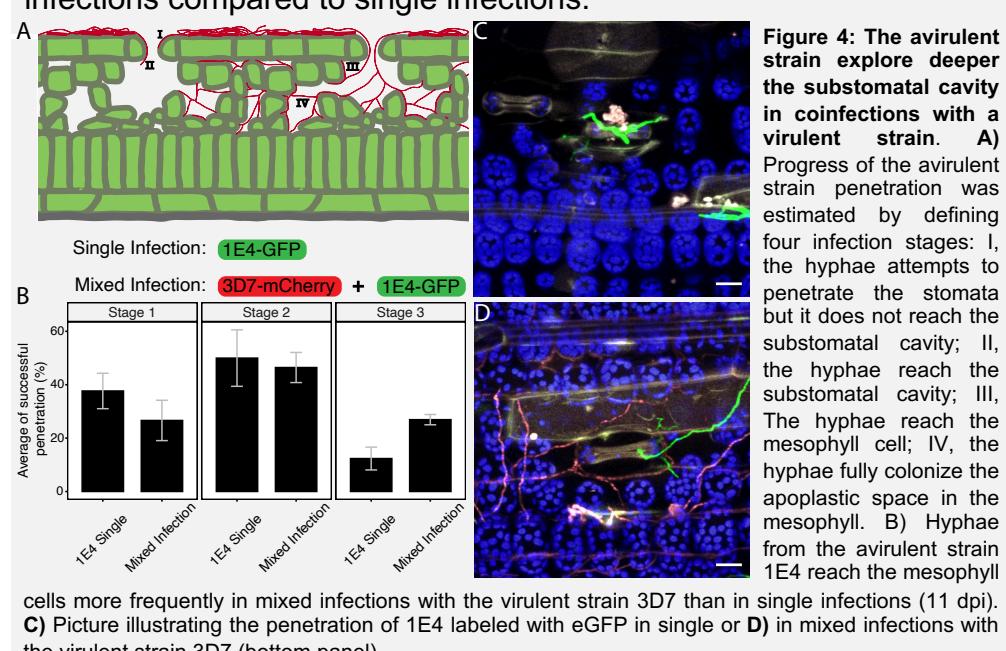
## Avirulent strains reproduce on a resistant cultivar

The avirulent strain successfully reproduces on a resistant cultivar in the presence of a virulent strain. Furthermore, the reproduction rate was higher in mixed- than in single-infections, while the reproduction rate (transmission potential) of the virulent strain remained unaltered.



## The avirulent strain reaches the mesophyll cells more frequently in the presence of virulent strains

Early observation of the infection revealed more frequently deeper colonization of the apoplastic space of the avirulent strain in mixed infections compared to single infections.

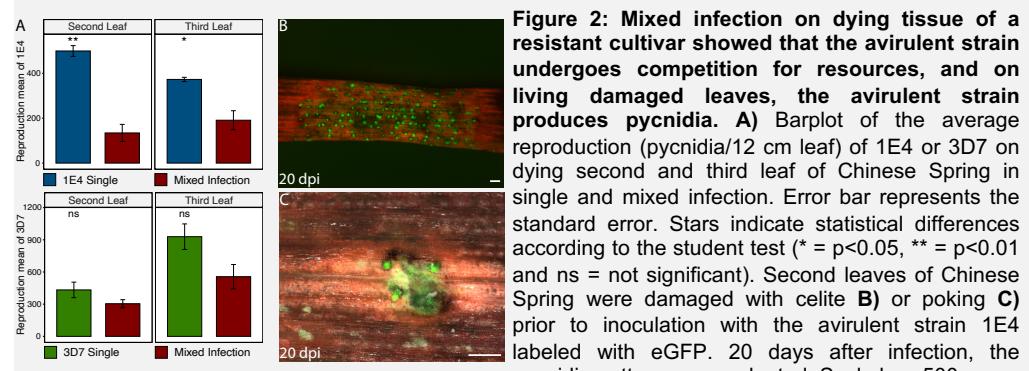


## Objectives

1. Comprehend if in mixed infections:
  - 1) a virulent strain's infection process is hindered by the presence of an avirulent strain
  - 2) an avirulent strain's infection process is enabled by a virulent strain
2. Determining the mechanisms behind the success of the avirulent strain
3. Do the virulent strains suppress the immune response?

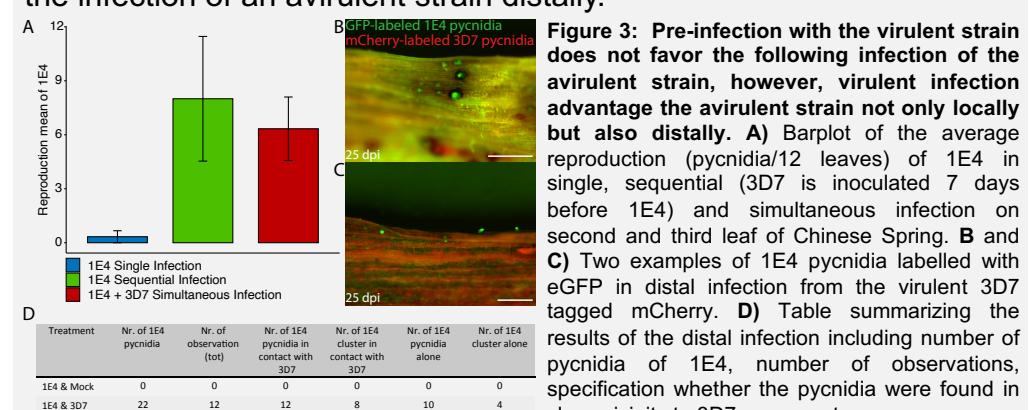
## Avirulent strains compete for resources and cell damage allows avirulent strain reproduction

Mixed infection on dying tissue of a resistant cultivar revealed that the avirulent strain suffered from competition of resources, while the virulent strain was not affected. In addition, tissue or cell damage allowed the reproduction of the avirulent strain on a resistant cultivar



## Virulent strain infection do not favor following avirulent infection, but it favors distal infection

Pre-infection with a virulent strain does not facilitate the reproduction of the avirulent strain. However, infection of a virulent strain facilitated the infection of an avirulent strain distally.



## Conclusion

- The avirulent strain successfully reproduces and with higher success in mixed- than in single-infections
- The avirulent 1E4 does not impact the reproduction of the virulent strain 3D7; however, the reproduction of 1E4 is reduced in the presence of the virulent strain 3D7.
- Cell damage enables the reproduction of the avirulent strain on a resistant cultivar, while host priming does not advantage the avirulent strain. Furthermore, the effect produced by the virulent strain act not only locally but also distally.
- The avirulent strain reaches the mesophyll cells more frequently in the presence of a virulent strain than in a single infection.

## Follow-up

Investigate the expressional changes between single avirulent infection and virulent-avirulent mixed infection. Does the immune response play a role?