The changing *Phytophthora infestans* population: implications for Late Blight epidemics and control

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Introduction

In recent years there has been a change in the composition of the GB *P. infestans* population, with an increase in the A2 mating type being observed (Fig.1). This increase is largely due to the presence of the 13_A2 genotype, which was first identified in 2005. The proportion of 13_A2 isolates in the population increased from 12% in 2005 to 72%, 78% and 67% in the years 2007-2009 respectively.

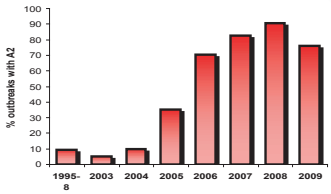

Fig 1. Percentage of blight outbreaks in which A2 isolates of *P. infestans* were detected in GB between 1995 and 2009.

The dominance of the 13_A2 genotype of *P.infestans* compared with other genotypes may be due to a combination of increased aggressiveness, virulence and fungicide resistance, all of which are likely to make late blight more difficult to control.

For example, the ability of genotype 13_A2 to overcome host resistance in cultivars resistant to other genotypes of *P.infestans* is illustrated in Fig 2.

If some genotypes are found to have unusual phenotypic characteristics, such as the ability to infect at lower temperatures than previously thought, then this could have implications for disease forecasting and control strategies.

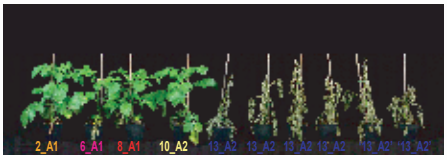

Fig 2. Plants of cultivar Stirling infected with isolates of genotype 13_A2 compared with isolates of genotypes 2_A1 6_A1, 8_A1 and 10_A2

Project Aims

Here we introduce a new study that will investigate the reasons why genotype 13_A2 is dominant in the GB *P. infestans* population by:

- Characterising the aggressiveness of isolates of 13_A2 compared with other genotypes
- Determining whether the temperature range at which *in vitro* growth, leaf infection and lesion development can take place is affected by genotype and whether there is an interaction with humidity
- Studying competition between isolates of various genotypes in laboratory and field experiments.

Ongoing and Future Experiments

Isolates - Fifty eight isolates of *P.infestans* collected between 2006-2008 from a diverse set of cultivars and geographical locations have been selected and characterised for genotype using SSR markers.

Aggressiveness - aggressiveness of these 58 isolates will be tested on five cultivars. Preliminary results using 7 isolates belonging to 6 genotypes tested on cultivar Craig's Royal are shown in Fig 3. This initial experiment shows that there are significant differences between isolates for aggressiveness. Conclusions regarding genotype differences cannot be made until all isolates have been tested.

Infection Efficiency - all isolates will be tested for infection efficiency and lesion development on detached leaves at 6°C, 8°C, 10°C, 12°C, 14°C, 16°C and 18°C using a temperature gradient plate incubator with a light/dark cycle of 16/8 hours respectively.

Competition Between Genotypes - Isolates belonging to various genotypes will be tested in competition with each other and the 13_A2 genotype *in vitro* and *in vivo* to elucidate the mechanisms of competition between genotypes.

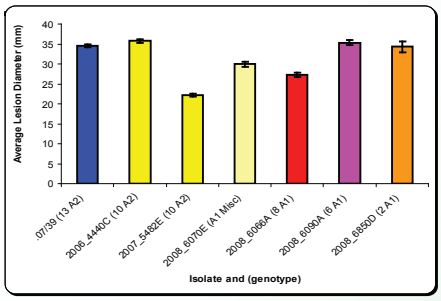

Fig 3. Mean lesion diameter (mm) of 7 isolates of *P. infestans* tested on detached leaflets of cultivar Craig's Royal after 7 days incubation at 15°C and 16 hour light/dark. Values are the mean of 30 leaves. Bars are coloured according to genotype and standard error bars are shown.

Growth Rate - *In vitro* growth rates on Rye A agar plates incubated at 5°C, 10, 15°C, 20°C, 25°C and 30°C under a 16/8 hour light/dark cycle will be assessed. Early results showing differences in growth rates at 5°C are shown in Fig 4. Four of the 54 isolates tested did not show any growth at 5°C after 44 days incubation and growth of the remaining isolates was in a range 10–60mm. There does not appear to be a clear relationship between genotype and *in vitro* growth at 5°C. Results from additional temperatures and infection studies will allow a full analysis of genotype x temperature relationships to be made.

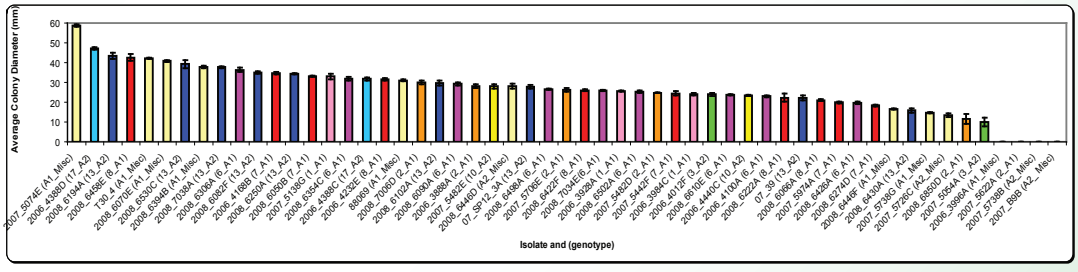

Fig 4. Average colony diameter (mm) of 54 isolates of *P. infestans* grown on Rye A agar at 5°C with a 16 and 8 hour light/dark cycle respectively for 44' days incubation. Bars are coloured according to isolate genotype and standard error bars are shown.