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Study of invasive French populations (2006-2008) of *Phytophthora infestans*, the Oomycete causing potato late blight

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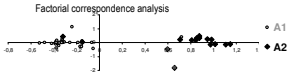
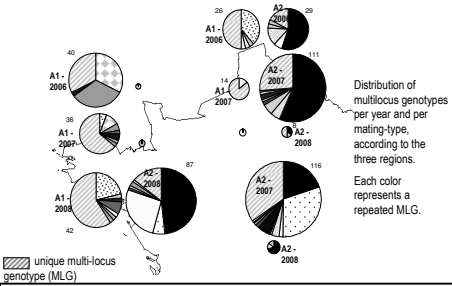
Late blight is an important potato disease, caused by *Phytophthora infestans* which is responsable of aerial and polycyclic epidemics.
This Oomycete is heterothallic with two mating-types named A1 and A2.
Before 2003, French populations contained almost only A1 isolates. Then, drastic changes in *P. infestans* populations have been observed : the frequency of A2 isolates dramatically increased with a very fast and steady progression of these A2 isolates.
This invasion was first observed in Northern France (6% A2 in 2003 to 76% in 2007), then in all potato production areas (5% A2 in 2005 to 75% in 2008, in Brittany and 100% A2 in Center of France in 2007).
To understand the population dynamics of this pathogen, we explored the genetic and phenotypic variations of isolates sampled from the three main potato production areas during 2006 to 2008.

Microsatellite markers reveal that A1 and A2 isolates are two genetic distinct populations.

The genotypes of 480 isolates collected over 3 years (2006 to 2008) from Brittany, North and Center of France are explored using 12 microsatellite loci (Knapova and Gisi, 2002; Lees *et al*., 2006).

This analysis reveals :
- a structuration according to mating types.
- a clonal, but large genotypic diversity with many unique multi-locus genotypes.
- a larger diversity among A1 isolates than A2 isolates.
- a clonal lineage making more than 50% of the A2 isolates (named 13_A2 genotype), in North and in Brittany.
- no structuration according to regions and years.
- no relationship between genotypes and virulence patterns.



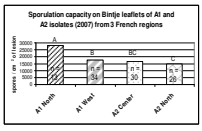


All A2 isolates are resistant to metalaxyl fungicide.

Fungicide resistance is assessed with a floating leaf disk method, with 10 and 100 µg metalaxyl /mL.

Aggressiveness does not explain the fast expansion of A2 isolates in France.

Aggressiveness of 111 A1 and 127 A2 isolates (collected from 2004 to 2007) is tested under controlled conditions, by comparing lesion size and sporulation of each isolate inoculated on detached leaflets of a susceptible cultivar (Bintje).

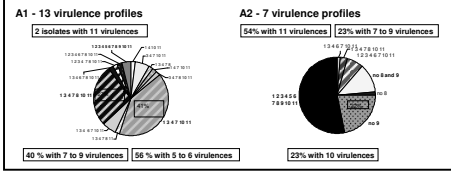


⇨ A1 isolates are slightly more aggressive than A2, under our experimental conditions.

⇨ The highest sporulation is in A1 isolates from Northern France, where Bintje has been the dominant host since several decades.

A2 isolates have more complex virulence profiles (7 to 11 virulence factors), but they are less diverse than those of A1.

Virulence patterns are determined using an international set of potato clones, each possessing one or more pathotype-specific resistance genes (R1to R11)



A2 isolates are genetically and phenotypically different from A1 isolates. The majority of A2 isolates shows new virulence patterns : they overcome most or all resistance genes from *Solanum demissum*, including those which have not been introduced into potato cultivars so far (e.g. R9). They are also insensitive to metalaxyl, although this fungicide has been scarcely used during the past years.

On the opposite, A1 population shows more genotypic and phenotypic diversity than the A2 population and seems more aggressive. Other life history traits, possibly related to environmental or climatic changes, should now be considered to explain the emergence of A2 isolates. The role and importance of sexual reproduction also has to be assessed to understand these population changes.

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