Assessing changes in aggressiveness of Irish populations of *Phytopthora infestans* on potato

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Introduction

The A2 mating type was reported in field populations of *P. infestans* in Ireland in the early 1990s with an overall frequency of 35% (O'Sullivan & Dowley, 1991). This was followed by a steady decline of the incidence of the A2 mating type in the Irish populations until only A1 types were detected during national surveys in the early 2000s. However, in 2007, novel genotypes were detected once again and their prominence has steadily increased within the Irish population since then. Critically, it is important to determine if these new populations of *P. infestans* are fungicide-resistant and how aggressive they are against existing potato germplasm.

Objective

Comparatively assess the aggressiveness of novel blight strains against the more established *P. infestans* isolates.

Materials and methods

Characterization: 96 *P. infestans* isolates collected from commercial potato crops in Ireland during a nationwide survey in 2009 were analyzed for SSR profiles (Knapova & Gisi, 2002; Lees *et al*., 2006) and metalaxyl sensitivity using leaf discs (Cooke, 1981)

- Isolates of the 13_A2 ('Blue 13') and 6_A1 ('Pink 6') genotypes were analyzed for infection efficiency (IE) on detached leaflets of cv. Kerr's Pink (Lebreton et al. 1999); lesion growth rate (LGR), on detached leaflets of five potato cultivars (Cara, Bionica, Sarpo Mira, Desiree and Setanta) and for tuber aggressiveness on three potato cultivars (British Queen, Rooster, Kerr's Pink) commonly grown in Ireland.
- **Foliar Aggressiveness**: 5 leaflets each inoculated with a 20 µl droplet of the sporangial suspension (5 x 10^4 sporangia/ml) in each isolate-cv interaction. After inoculation, leaflets were be incubated (8 d, 18°C, 16 h light/day). Lesion diameter (average of two) was measured daily from 3 days after inoculation (dai) for 5 days.
- **Tuber Aggressiveness**: 10 tubers were inoculated by dipping in a freshly prepared sporangial suspension (5 x 10^4 sporangia/ml) for each isolate-cv interaction. After inoculation the tubers were incubated in plastic trays (3 weeks, 18°C) in the dark and scored for percent internal tissue with necrotic lesion.

Results

58% of isolates tested were metalaxyl-resistant (Fig 1), including all the 13_A2 isolates. SSR genotyping showed that 49% of isolates were 13_A2 (B13) and 4% were 6_A1 (Pink 6) (Tab. 1).

- 13_A2_2 had 90% infection efficiency on Kerr's Pink compared to a control A1_8 genotype which had 15% infection efficiency (Fig 2).
- At 6 days post inoculation (dpi), 13_A2_2 genotype and 6_A1 genotype infected and caused sporulating lesion diameters of 30-42 mm diameter on conventional resistant cultivars (Cara, Sarpo Mira and Setanta), but, cv. Bionica had slowed lesion expansion to less than 20 mm for the three isolates tested (Fig 3).
- The three cultivars tested had varying levels of tuber susceptibility to 13_A2 and 6_A1; the most severe tuber damage was caused by 13_A2_2 on British Queen (Fig 4).

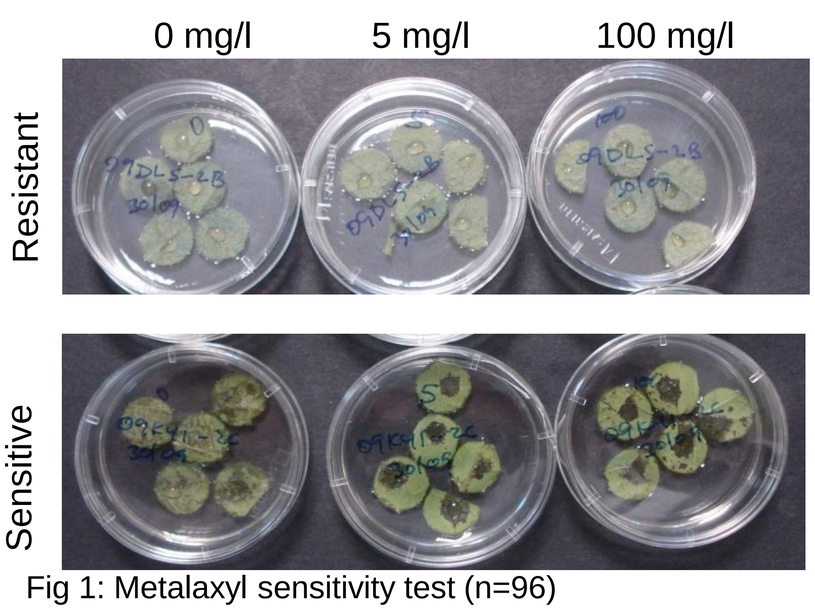

Fig 1: Metalaxyl sensitivity test (n=96)

Resistant: 58%; Sensitive: 34%; Intermediate: 7%; nd: 0.9%

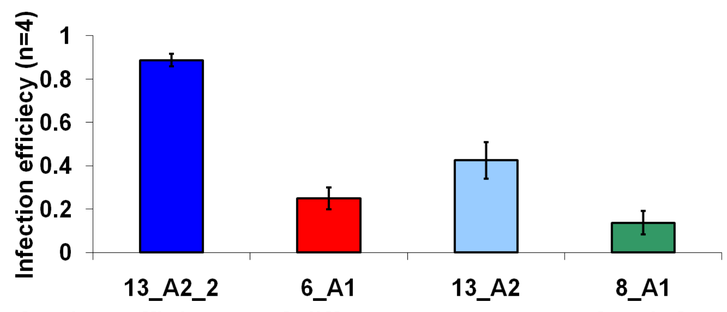

Fig 2: Infection efficiency of different genotypes of *P. infestans* on Kerr's Pink

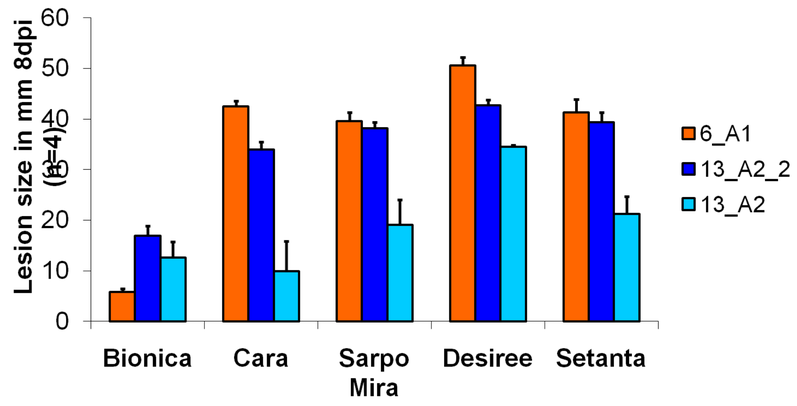

Fig 3: Lesion size in diameter (mm) 8 dpi of leaflets from five cultivars inoculated with three genotypes of *P. infestans*

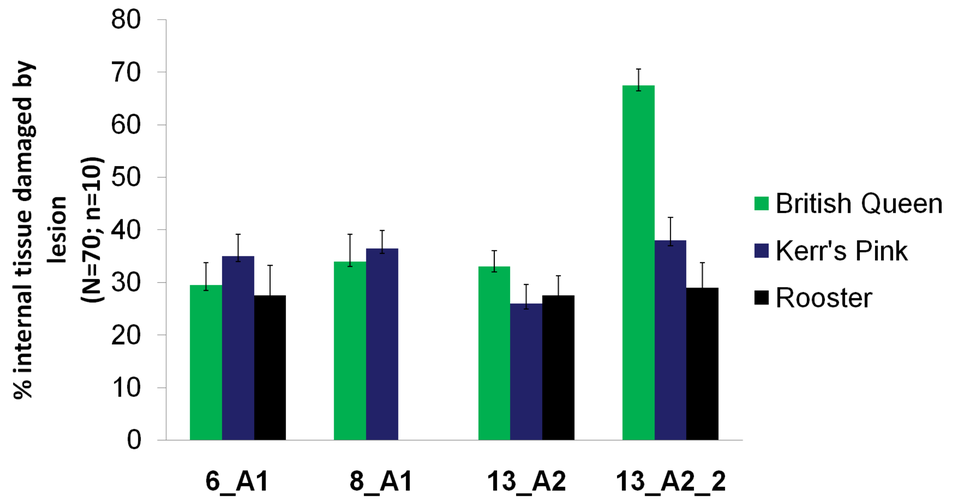

Fig 4: Tuber tissue damage on three potato varieties inoculated with three genotypes of *P. infestans*

Discussion

The high infection efficiency shown by 13_A2 and the expansion of sporulating lesions on foliage of both susceptible and resistant hosts induced by both 13_A2 and 6_A1 genotypes implies that the isolates of these genotypes have the potential to spread faster than the old A1genotypes and cause severe damage to potato crops. There is a possibility of pairing between 13_A2 and 6_A1 in potato fields which may lead to formation of oospores and give rise to more complex genotypes. The occurrence of more aggressive, metalaxy-resistant strains with potential to overcome resistance in conventional varieties presents the twin challenge of finding alternatives to metalaxyl as well as durable host resistance. Although lesions induced by the studied isolates of the 13_A2 and 6_A1 genotypes on susceptible Desiree expanded faster, cv. Bionica (which has *blb2* gene homoloque) suppressed expansion of lesions induced by these two genotypes . The deployment of resistance conferred by this gene becomes a vital tool in the management of these new strains of *P infestans* .

References

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Table 1: Simple Sequence Repeat genotyping (n=96)

Genotype	Pi02	Pi02	Pi02	D13	D13	D13	G11	G11	G11	Pi89	Pi89
13_A2	160	162		136	154		154	160		179	
13_A2_2	160	162		136	154		154	160	164	179	
8_A1	162			136			156	162		179	181
6_A1	152	160	162							181	197

Acknowledgements

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