

Monitoring the Dutch *P. infestans* population for virulence against new R-genes

Marieke Förch, Trudy van den Bosch, Petra van Bekkum, Bert Evenhuis, Jack Vossen and Geert Kessel



Introduction

- *S. demissum* R-genes R1 – R11 introduced in the past
- New R-genes have / will be introduced to the market:
 - Sarpo mira,
 - Toluca (Blb2)
 - Bionica (Blb2)
 - Fortuna (BASF, Blb1 + Blb2),
 -
- More is to come:
 - *S. berthaultii*
 - *S. stoloniferum*
 - *S. chaquense*
 - *S. venturi*
 - *S. edinense*
- A need to monitor for virulence!



Picture: BASF

Materials & Methods

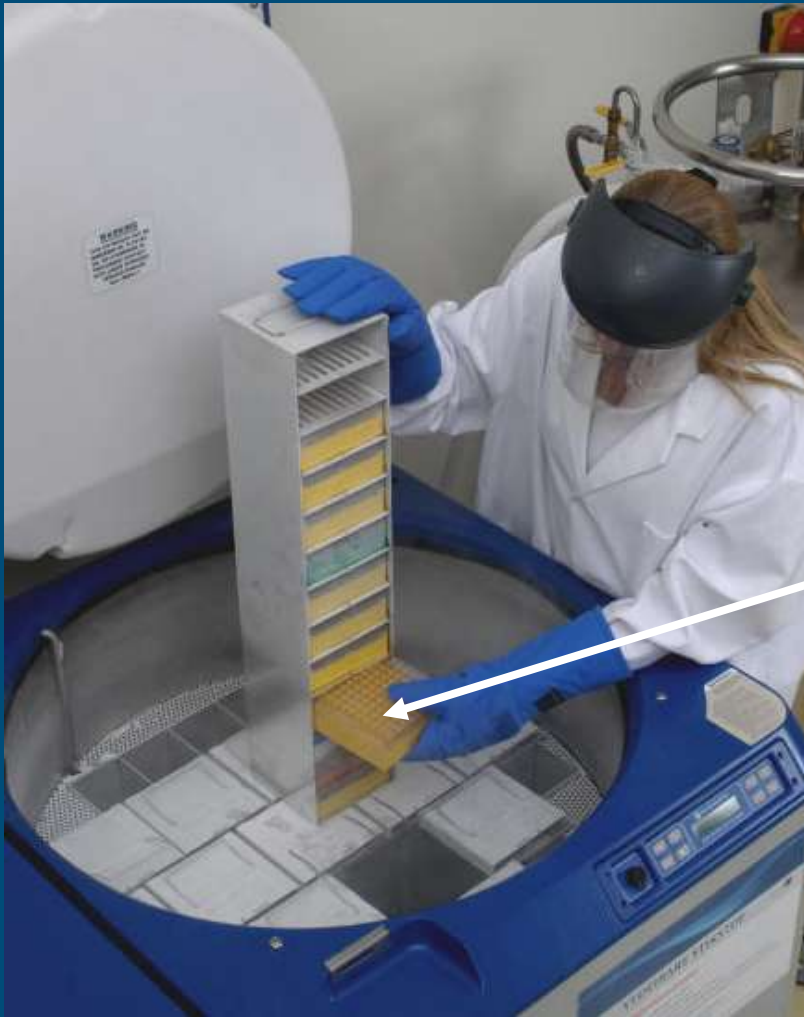
- Annual sampling of NL *P. infestans* population:
 - Farmers fields, dumps, volunteers etc.
 - Bait fields at three locations:
 - Resistant (commercial) cultivars
 - R1 – R11 differential set (up to 2008)
 - Advanced breeding lines NL breeders
 - Wild *Solanum* spp.
 - Unprotected by fungicides
 - Sampled weekly, active *P. infestans* removed
 - *P. infestans* isolates individually characterized



Lelystad 2009 Bait field ~ 100 genotypes



Storage of *P. infestans* pure cultures



S. microdontum

Detached leaf assay

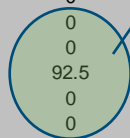


Results: Virulence testing

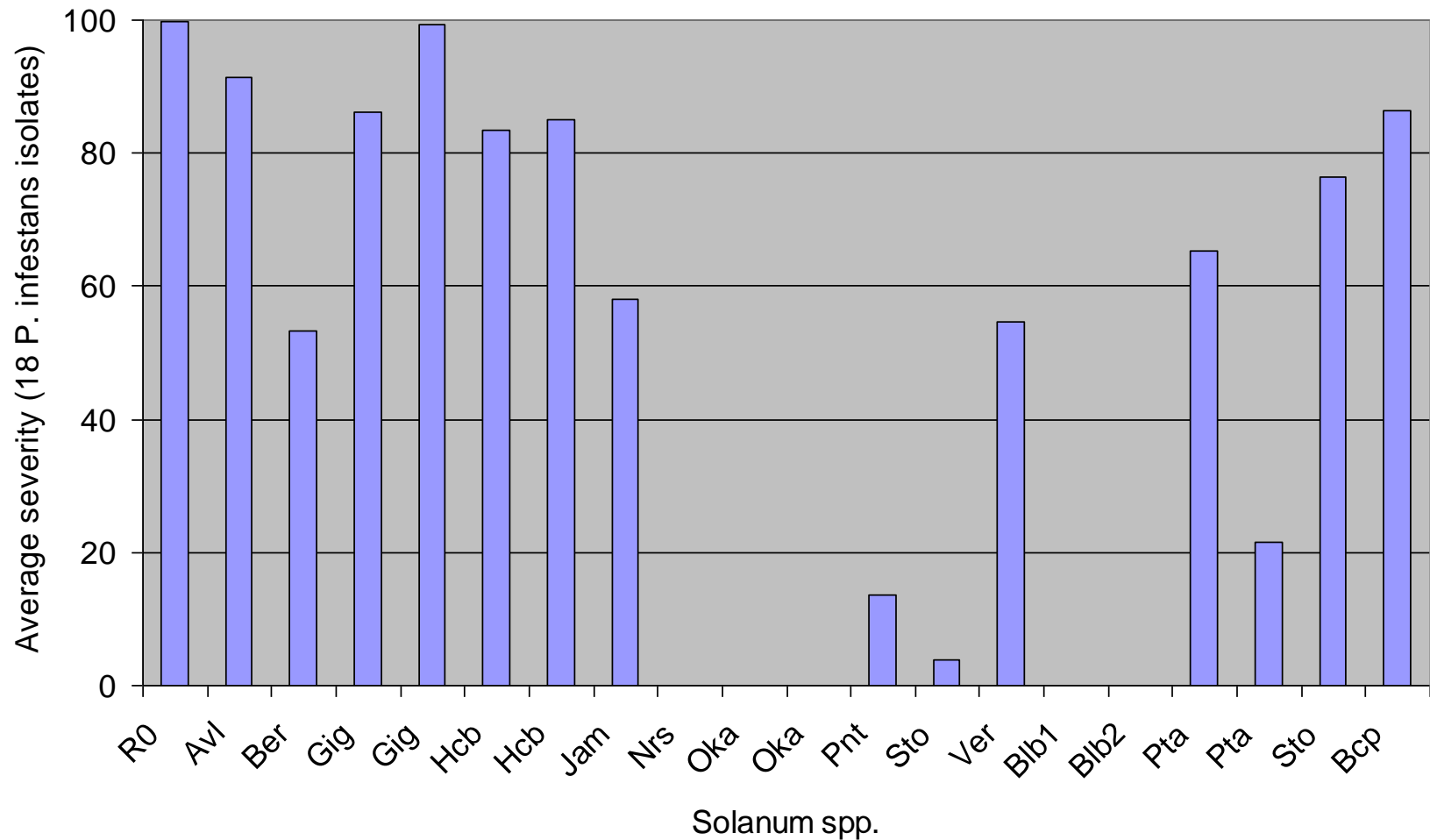
Isolate	Virulence spectrum																
	R0	Agf	Avi	Ber	Bcp	Blb2	Blb1	Cap	Chc	Qum	Hcb	Mcp	Oka	Pta	Pnt	Pnt	
NL07135	100	0	70	90	0	0	0	0	55	0	95	75	0	45	0	3.75	15
NL07138	100	100	0	0	0	0	0	0	0	0	100	0	0	0	0	2.5	0
NL07160	100	0	60	50	0	0	0	0	80	0	100	15	0	35	0	10	0
NL07163	100	0	85	70	0	0	0	0	10	45	100	35	0	35	0	6.25	2.5
NL07171	100	0	62.5	85	0	0	0	0	82.5	0	100	10	0	3.75	0	42.5	1.25
NL07209	90	0	50	50	0	0	0	0	0	0	100	10	0	0	2.5	55	27.5
NL07215	100	0	35	50	0	0	0	0	50	0	100	25	0	0	1	35	26.25
NL07223	100	0	100	77.5	0	0	0	0	20	0	100	20	0	50	0	65	12.5
NL07245	100	15	90	100	0	0	0	0	85	0	100	40	0	45	5	10	0
NL07263	70	0	47.5	0	0	0	0	0	30	0	40	0	0	2.5	0	7.5	21.25
NL07272	100	0	61.5	80	0	0	0	0	25	0	100	0	0	35	0	0	45
NL07307	100	0	0	40	0	0	0	0	35	0	92.5	0	0	97.5	0	37.5	10
NL07311	95	0	45	0	0	0	0	0	27.5	0	99.5	0	0	0	1.25	80	30
NL07316	97.5	0	40	0	0	0	0	0	20	0	69	25	0	50	0	0	7.5
NL07322	100	0	45	0	0	0	0	0	45	0	85	0	0	23.75	0	0	40
NL07334	100	0	87.5	30	0	0	0	0	35	0	95	10	0	12.5	12.5	90	75
NL07337	100	0	95	0	2.5	0	0	25	55	0	100	0	0	35	5	50	30
NL07340	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.5	10
NL07347	100	0	100	50	0	0	0	0	65	0	50	12.5	0	45	0	25	2.5
NL07358	100	35	80	50	15	0	0	0	85	0	25	15	0	24.75	0	27.5	40
NL07365	100	12.5	0	0	0	0	0	0	22.5	24.75	10.5	2.5	0	47.5	0	37.5	0
NL07367	100	0	99	0	0	0	0	0	10	0	100	55	0	0	0	1.25	15
NL07377	100	0	70	50	0	0	0	0	69.5	0	100	35	0	0	0	85	40
NL07379	100	0	100	97.5	0	0	0	0	0	0	0	0	0	0	0	0	85
NL07387	100	0	50	45	0	0	0	0	0	0	0	0	0	0	0	20	90
NL07391	100	0	100	0	0	0	0	0	0	0	0	10	0	85	0	35	35
NL07400	95	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL07405	100	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL07408	100	0	0	0	0	0	0	0	45	0	0	10	0	0	0	20	90
NL07410	100	0	77.5	45	0	0	0	0	85	0	100	40	0	0	0	35	35
NL07418	100	0	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL07422	100	0	100	50	0	0	0	0	40	0	49.5	0	0	0	0	2.5	75
NL07426	85	0	35	0	0	0	0	0	32.5	0	100	0	0	50	0	20	20
NL07434	100	0	90	0	5	0	0	0	40	0	50	0	0	50	0	12.5	30
NL07436	100	0	5	0	0	0	0	0	0	0	100	0	0	0	0	0	0
NL07460	100	0	95	0	7.5	0	0	0	90	0	100	0	0	95	1	2.5	50
NL07493	90	0	72.5	0	0	0	0	0	50	0	99.5	0	0	20	0	5	99.5
NL07497	100	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0

P. infestans isolate NL07434

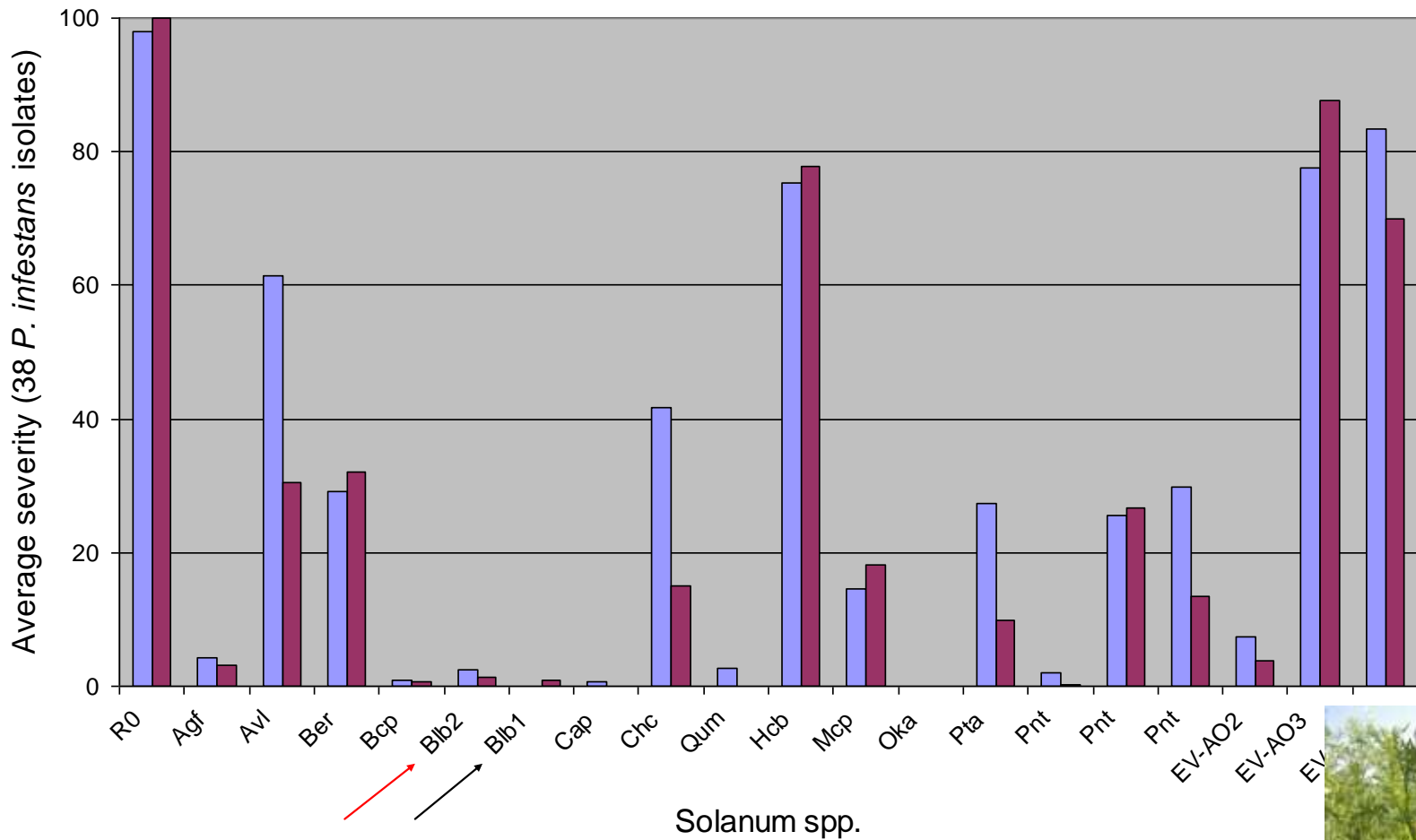
Originates from ABPT clone



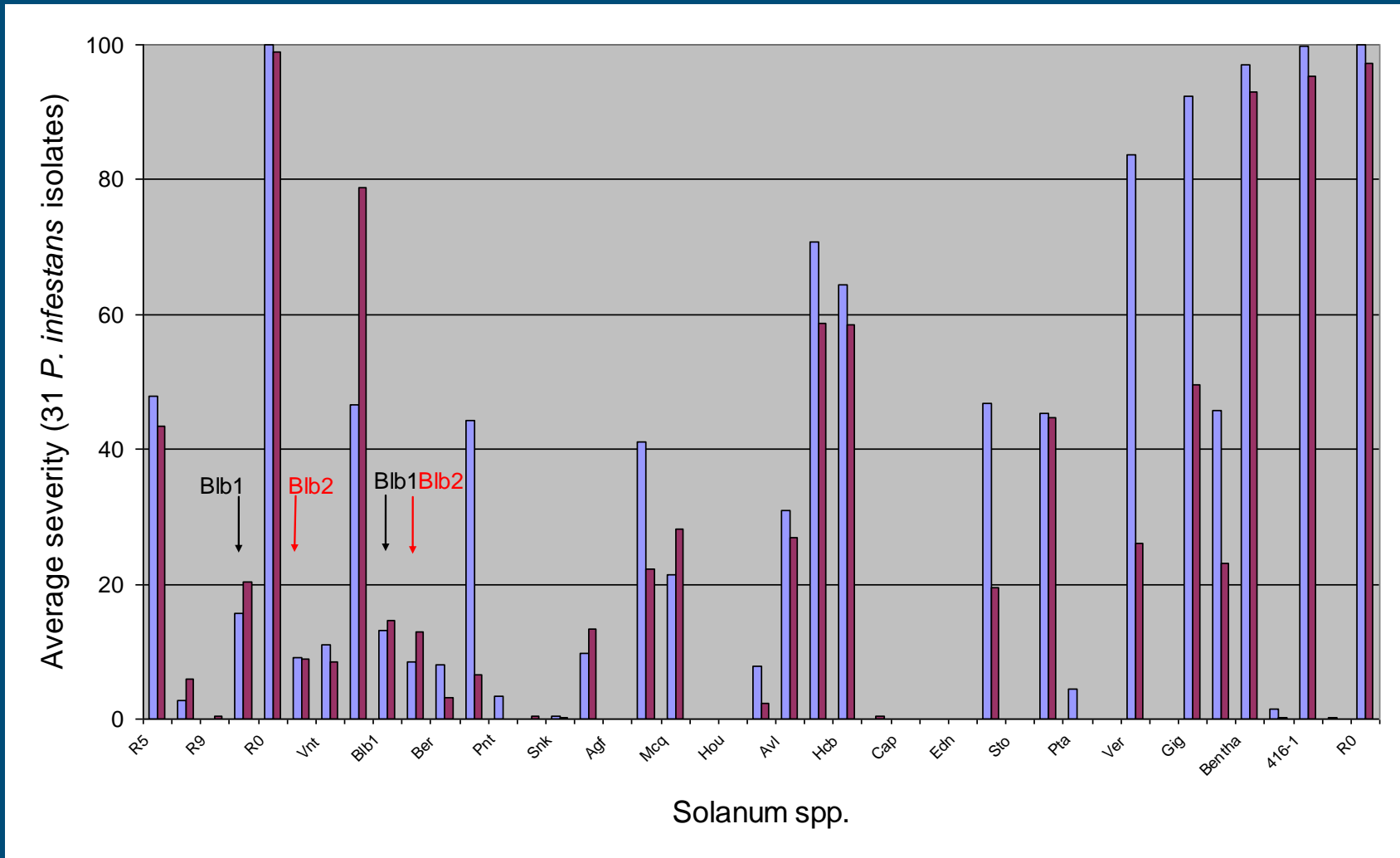
Virulence spectrum of 2006 isolates



Virulence spectrum of 2007 isolates



Virulence spectrum of 2008 isolates



Virulence monitoring: Blb2



Virulence monitoring: Blb1



Virulence monitoring: Blb2

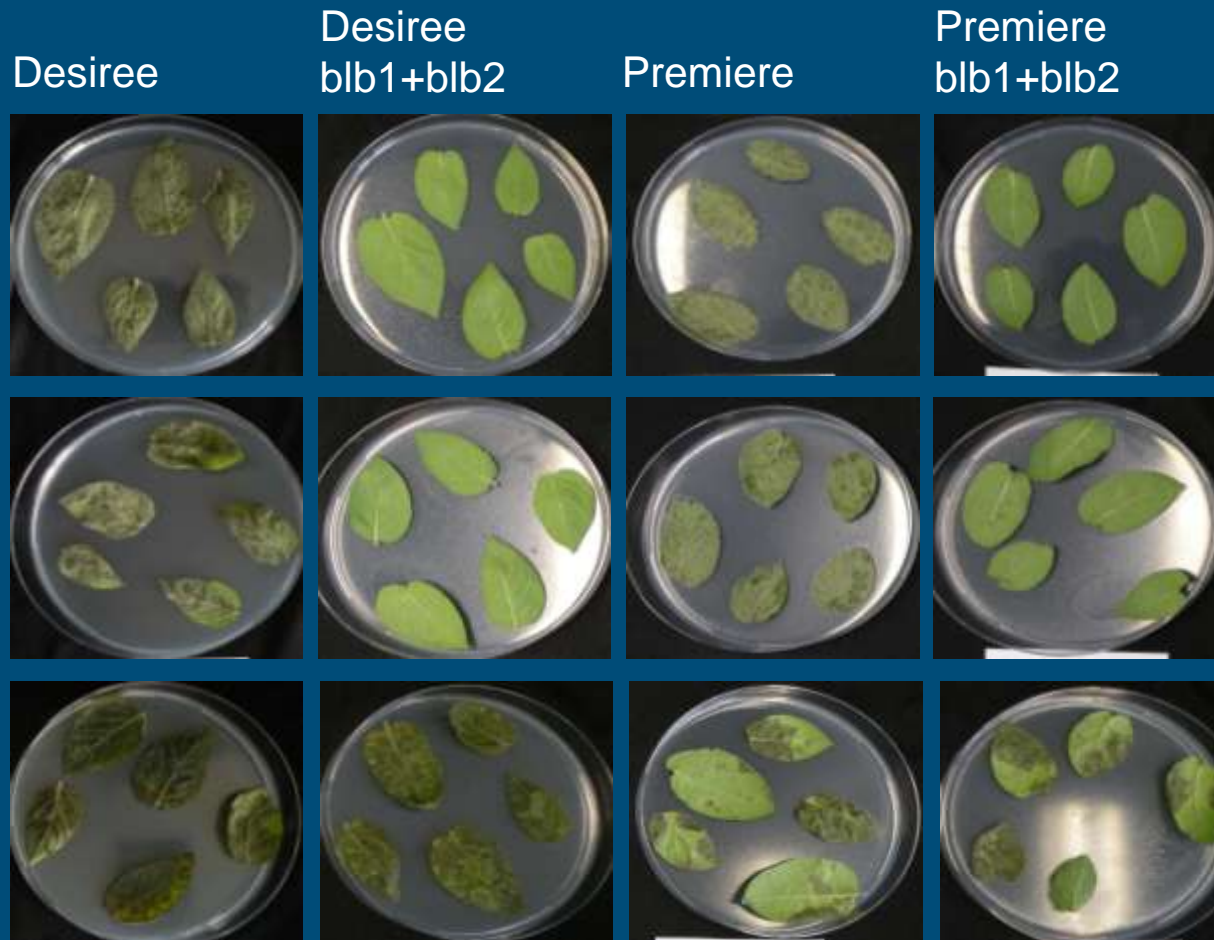


- NL07434 also virulent on Blb2002

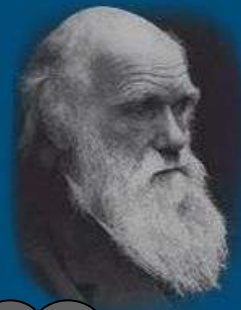
Field grown Bionica, August 2009



Virulence monitoring: Blb1 + Blb2 (stacked)




In Conclusion

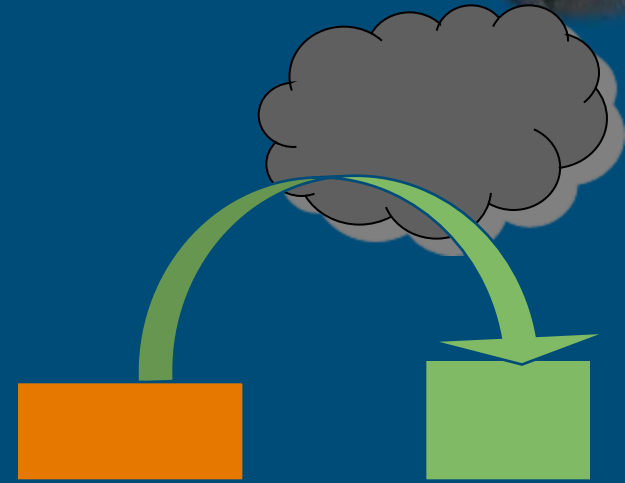


■ Phytophthora still adapts

● Also the new R-genes can be broken:

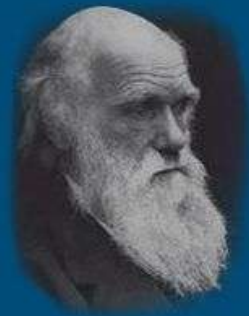
- Virulence for all single R-genes tested is found in the detached leaf test although some are rare!
- Most Solanum genotypes are also infected in bait fields
- Virulence for stacked Blb1 + Blb2 is found in detached leaf test

- Two options:
 - Virulence was present in the Pi gene pool
 - On site mutations 
 - » Mutations occur on a susceptible host.....
 - » Selection takes place on the resistant host!
 - » 1×10^8 spores/m² leaf → 4×10^{12} spores/ha

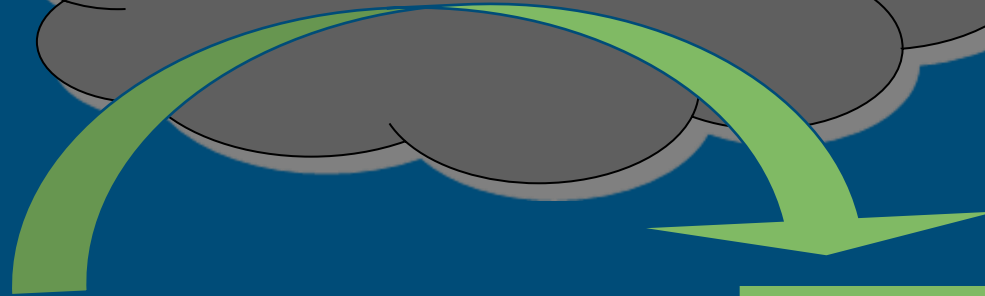


■ Future growing systems:

- Resistant cultivars (conventional / GMO)
- + Low level input of fungicides
- Prevent large outbreaks



Questions?



PLANT RESEARCH INTERNATIONAL
WAGENINGEN UR



Umbrella plan
Phytophthora

