

Recent changes in the population of *P. infestans* in Great Britain



Sárvári Research Trust
Henfaes Research Centre
Bangor, Wales



David Shaw and

Debbie Evans: SRT, Bangor, Wales

**Zoltan Nagy: Plant Protection Institute, National
Academy of Sciences, Budapest**

**Kenneth Deahl: USDA-Agricultural Research
Service, USA**

GB population pre 2000

- 1981: A2 detected
- 1980s: small samples indicated A2 was rare
- 1995-8 small samples: A2 at 9.6% of 354 sites
- 1995-7 small samples from Scottish sites: 20% A2 (included gardens and allotments)

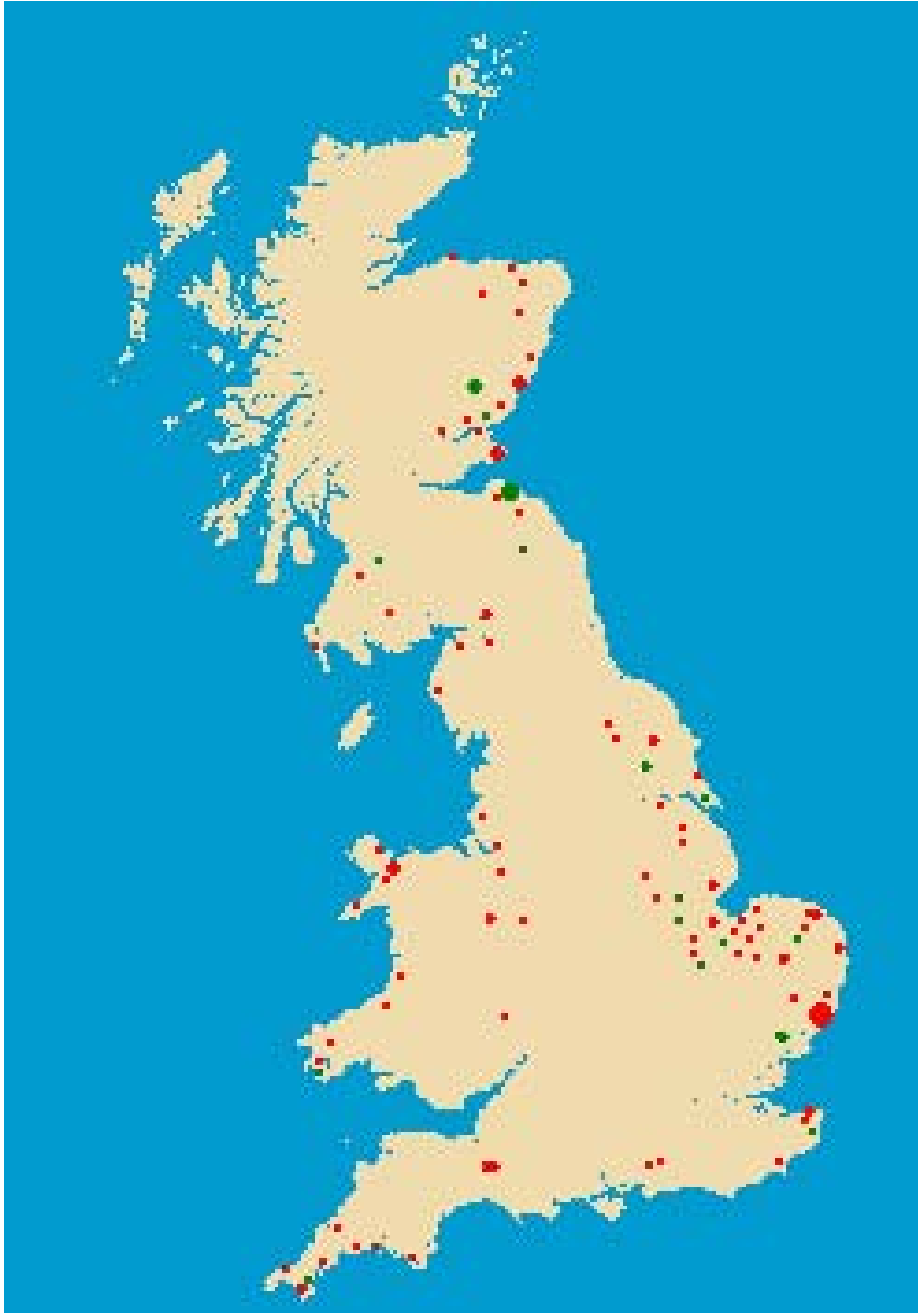
Post 2000

- BPC 2003 GB: A2 at 5.3% of sites (n=114)
- BPC 2004 GB: A2 at 10.2% of sites (n=72)
- BPC 2005 GB: A2 at 32.8% of sites (n=70)
- Non-BPC 2005 GB: A2 at 15 of 29 sites (51%); A1 and A2 at 6 sites (20%)

Variation in collections from 1995-8

RG57, mt haplotypes, metalaxyl sensitivity

- Population appeared to be largely clonal
- A1: three clonal lineages – RF039 > RF002 > RF006; 24 other genotypes detected
- A2: one clonal lineage (RF040) detected at 29 of 37 A2 sites; other 5 genotypes uncommon or unique
- None of the A2s were fully resistant to metalaxyl



BPC samples 2005

one isolate from
each of 70 sites
collected by BPC
Blight Scouts

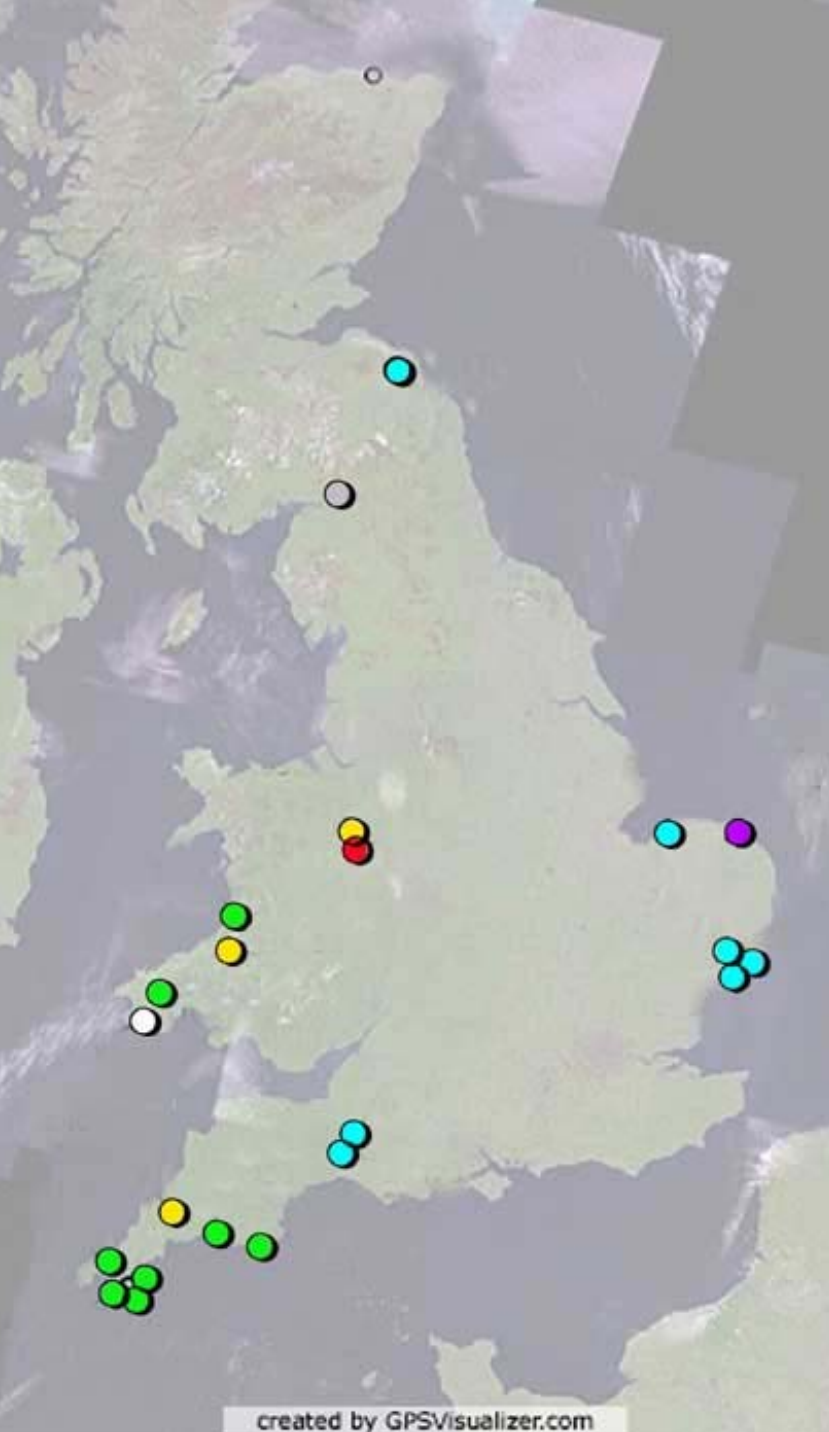
A2 detected at
23 sites (32.8%)

2005, BPC A2 isolates

Samples	County	mt DNA	RG57 Fingerprint	Metalaxyl	comment
14500	Norfolk	la	1,2, , , ,8, ,10,13,14,17,19,20,21,22,24,25	R	Morene
16012	Scottish Borders	la	1,2, , , ,8, ,10,13,14,17,19,20,21,22,24,25	R	Maris Piper
14473	Somerset	la	1,2, , , ,8, ,10,13,14,17,19,20,21,22,24,25	R	Estima
15094	Somerset	la	1,2, , , ,8, ,10,13,14,17,19,20,21,22,24,25	R	Estima
15715	Suffolk	la	1,2, , , ,8, ,10,13,14,17,19,20,21,22,24,25	R	Carlingford, 2nd crop
15985	Suffolk	la	1,2, , , ,8, ,10,13,14,17,19,20,21,22,24,25	R	Maris Peer, 2nd crop
16201	Suffolk	la	1,2, , , ,8, ,10,13,14,17,19,20,21,22,24,25	R	Carlingford, 2nd crop
12448	Cornwall	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	R	Dump, stem LB Charlotte
13042	Cornwall	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	R	Allotment, Desiree
13555	Cornwall	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	R	Estima
13663	Cornwall	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	R	Maris Peer
16039	Cornwall	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	R	Lady Rosetta
14554	Devon	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	I	Estima
13960	Ceredigion	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	I	Organic K Edward
12637	Pembrokeshire	la	1, ,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	I	Allozo
14635	Ceredigion	IIa	1,2,3,5,7, ,9,10,13,14,17,19,20,21,22,24,25	S	Organic, Minerva
14662	Cornwall	IIa	1,2,3,5,7, ,9,10,13,14,17,19,20,21,22,24,25	S	K Edward, severe
13528	Shropshire	IIa	1,2,3,5,7, ,9,10,13,14,17,19,20,21,22,24,25	S	Organic, Cosmos
13582	Shropshire	IIa	1,2,3,5,7, , ,10,13,14,17,19,20,21,22,24,25	S	Organic, Princess
13501	Norfolk	IIa	1, ,3,5,7, , ,10,13,14, ,19,20,21,22,24,25	S	Asterix, headland
14176	Cumbria	IIa	1, , ,5, , ,10,13,14,17,19,20,21,22,24,25	S	Maris Piper
13096	Pembrokeshire	la	1, , ,5, , , ,10,13,14,17, , ,20,21, ,24,	S	Charlotte
16444	Banffshire		no data		Cara

BPC samples 2005

**Location of sites
where A2 detected**



BPC A2 samples 2005

- 7 genotypes among 22 isolates
- None of these strains detected in 1995-98 period when most A2s were of a single strain
- Clustering of genotypes on map
- Indicates: new clonal lineages and maybe unique genotypes

BPC A2 samples 2005

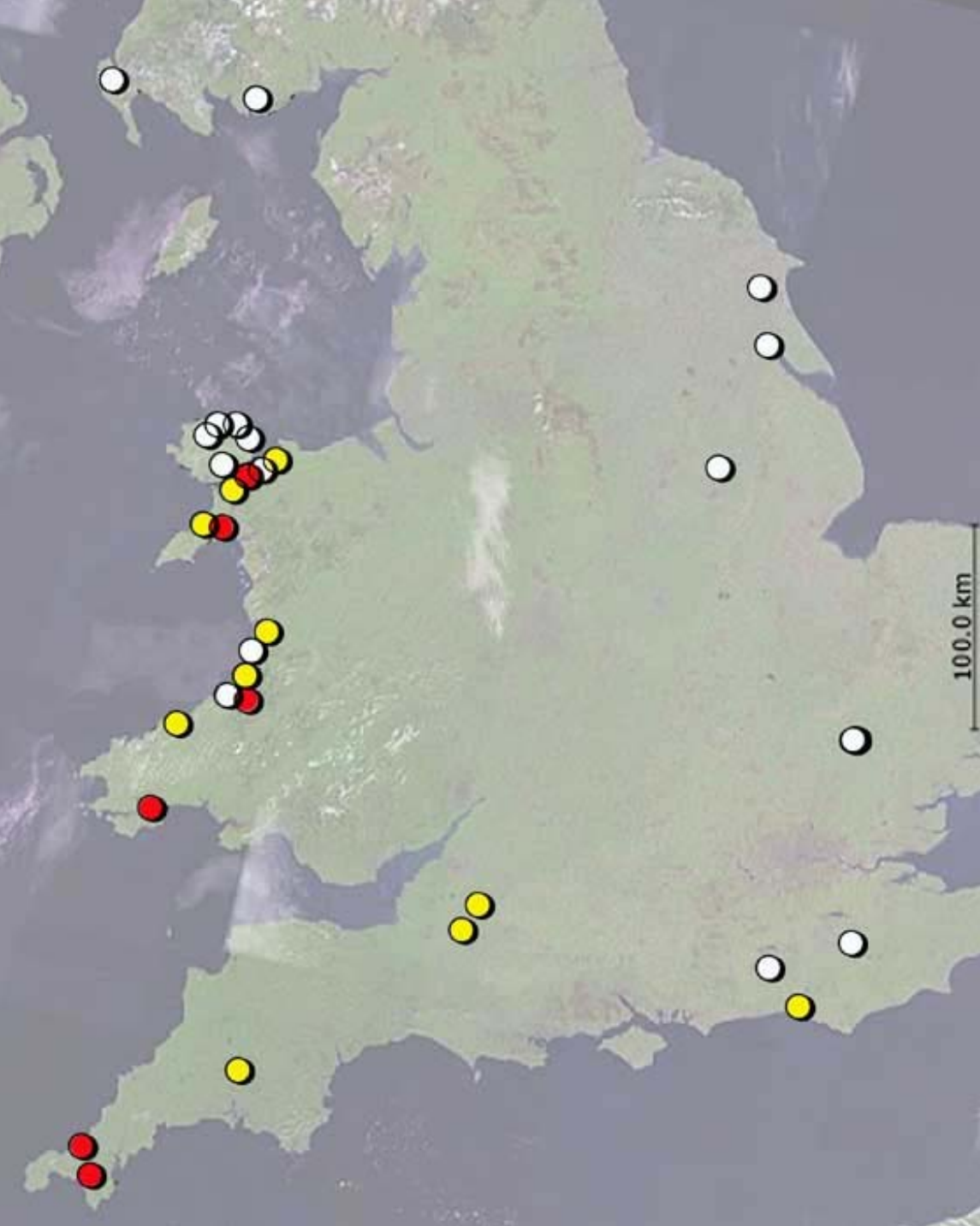
Metalaxyl sensitivity

- 12 of 22 A2s were fully resistant to metalaxyl
- Level of sensitivity associated with genotype. All greens and blues resistant
- Yellows and uniques are sensitive
- Mt DNA type Ia are resistant, type IIa are sensitive (except white Ia is sensitive)

non-BPC samples 2005

- 34 sites: total of 198 isolates
- Many garden and allotment samples
- Larger sample size
- More samples from South and West
- Higher frequency of sites with A2 (50%)

Non-BPC samples 2005





A1 sites

A2 sites

A1+A2 sites

ID	Post Code	Mt	RG57 fingerprint	Type	Metalaxyl*	**	Mating type
14392	L39	Ia	1,2,3,5,6,7,10,13,14,16,20,21,22,24,25		65	R	A1
14608	PE22	Ia	1,2,3,5,6,7,8,10,13,14,16,20,21,24,25		30	I	A1
15472	LL57	Ia	1,2,3,5,7,10,13,14,16,20,21,22,24,25	V	25	I	A1
15499	LL57	Ia	1,2,3,5,7,10,13,14,16,20,21,22,24,25	V	52	R	A1
M21		Ia	1,2,3,5,7,10,13,14,16,20,21,22,24,25	V	16	S	A1
12988	YO17	Ia	1,2,3,5,7,10,13,14,16,20,21,24,25	VI	65	R	A1
M14		Ia	1,2,3,5,7,10,13,14,16,20,21,24,25	VI	22	I	A1
M34		Ia	1,2,3,5,7,10,13,14,16,20,22,24,25		32	I	A1
M31		Ila	1,2,3,5,7,9,10,13,14,17,20,21,24,25	VIII	48	R	A2
M8-2		Ila	1,2,3,5,7,9,10,13,14,17,20,21,24,25	VIII	37	I	A2
M15-2		Ia	1,2,5,10,13,14,16,17,20,21,24,25		32	I	A2
12556	CT7	Ia	1,2,5,10,13,14,16,17,20,22,24,25		46	R	A1
M15-1		Ia	1,2,5,10,13,14,16,20,22,24,25		35	I	A1
12799	IV31	Ia	1,2,5,13,14,17,20,22,24,25		8	S	A1
14149	AB51	Ia	1,2,5,8,10,13,14,20,22,24,25		44	R	A1
14905	CA6	Ila	1,2,5,9,10,13,14,16,20,21,22,24,25		56	R	A1
13636	NR28	Ia	1,2,8,10,13,14,16,17,20,21,22,23,24,25		66	R	A1
M11-2		Ia	1,2,8,10,13,14,16,17,20,21,22,24,25		92	R	A2
13150	CW6	Ia	1,3,5,6,7,8,10,13,14,16,20,21,24,25		200	R	A1
15769	TF10	Ia	1,3,5,6,7,8,9,10,13,14,16,17,20,21,22,24,25		72	R	A1
13285	TA14	Ia	1,3,5,6,7,8,9,10,13,14,16,20,21,24,25	II	8	S	A1
13609	GU29	Ia	1,3,5,6,7,8,9,10,13,14,16,20,21,24,25	II	83	R	A1
14743	LN8	Ia	1,3,5,6,7,8,9,10,13,14,16,20,21,24,25	II	65	R	A1
14851	PE7	Ia	1,3,5,6,7,8,9,10,13,14,16,20,21,24,25	II	50	R	A1
16282	NG23	Ia	1,3,5,6,7,8,9,10,13,14,16,20,21,24,25	II	80	R	A1
13420	PE22	Ia	1,3,5,6,7,8,9,10,13,14,17,20,24,25		19	S	A1
14419	DD11	Ia	1,3,5,6,7,8,9,10,13,14,20,24,25		100	R	A1
M13		Ia	1,3,5,6,7,9,10,13,14,16,17,20,21,25		88	R	A1
16120	CT3	Ia	1,3,5,6,7,9,10,13,14,16,20,21,24,25		71	R	A1
M22		Ia	1,3,5,7,10,13,14,16,17,20,21,24,25	VII	20	S	A2
M30		Ia	1,3,5,7,10,13,14,16,17,20,21,24,25	VII	51	R	A2
M23-1		Ia	1,3,5,7,10,13,14,17,19,20,21,24,25	III	96	R	A1
M23-2		Ia	1,3,5,7,10,13,14,17,19,20,21,24,25	III	73	R	A2
M33		Ia	1,3,5,7,10,13,14,17,19,20,21,24,25	III	34	I	A2
M20		Ia	1,3,5,7,10,13,14,17,20,21,24,25	IV	43	R	A2
M25-2		Ia	1,3,5,7,10,13,14,17,20,21,24,25	IV	78	R	A2
M7		Ia	1,3,5,7,10,13,14,17,20,21,24,25	IV	49	R	A2
M25-3		Ia	1,3,5,7,10,13,14,20,21,22,24,25		83	R	A2
M8-1		Ia	1,3,5,7,9,10,13,14,16,19,20,21,25		204	R	A1
M10		Ila	1,3,5,7,9,10,13,14,17,20,21,22,24,25		62	R	A2
13447	PH2	Ila	1,5,10,13,14,16,20,21,24,25	IX	11	S	A1
13933	DD10	Ila	1,5,10,13,14,16,20,21,24,25	IX	32	I	A1
13852	NR17	Ila	1,5,13,14,17,20,21,24,25		10	S	A1
M11-1		Ia	1,5,6,9,10,13,14,17,20,21,24,25		11	S	A1
14878	YO61	Ila	1,5,9,10,13,14,16,20,21,22,24,25		56	R	A1
12502	NR16	Ila	1,5,9,10,13,14,16,20,21,24,25	I	66	R	A1
12529	IP12	Ila	1,5,9,10,13,14,16,20,21,24,25	I	18	S	A1
12610	DG9	Ila	1,5,9,10,13,14,16,20,21,24,25	I	16	S	A1
12772	1P12	Ila	1,5,9,10,13,14,16,20,21,24,25	I	13	S	A1
12880	LL76	Ila	1,5,9,10,13,14,16,20,21,24,25	I	37	I	A1
12907	NR16	Ila	1,5,9,10,13,14,16,20,21,24,25	I	17	S	A1
12961	DD6	Ila	1,5,9,10,13,14,16,20,21,24,25	I	53	R	A1
13069	SA73	Ila	1,5,9,10,13,14,16,20,21,24,25	I	26	I	A1
13258	NR10	Ila	1,5,9,10,13,14,16,20,21,24,25	I	24	I	A1
13393	NG32	Ila	1,5,9,10,13,14,16,20,21,24,25	I	26	I	A1
13474	CA22	Ila	1,5,9,10,13,14,16,20,21,24,25	I	36	I	A1
13690	PE32	Ila	1,5,9,10,13,14,16,20,21,24,25	I	55	R	A1
14068	DG7	Ila	1,5,9,10,13,14,16,20,21,24,25	I	31	I	A1
14203	DD2	Ila	1,5,9,10,13,14,16,20,21,24,25	I	38	I	A1
14365	CA4	Ila	1,5,9,10,13,14,16,20,21,24,25	I	15	S	A1
14716	YO7	Ila	1,5,9,10,13,14,16,20,21,24,25	I	30	I	A1
M1		Ila	1,5,9,10,13,14,16,20,21,24,25	I	39	I	A1
M16		Ila	1,5,9,10,13,14,16,20,21,24,25	I	21	I	A1
M19		Ila	1,5,9,10,13,14,16,20,21,24,25	I	33	I	A1
15904	KY10	Ila	1,5,9,10,13,15,17,20,21,24,25		11	S	A1

Characteristics of all A1 isolates and non-BPC A2 isolates

- RG57
- mt haplotype
- metalaxyl sensitivity R 
- mating type 

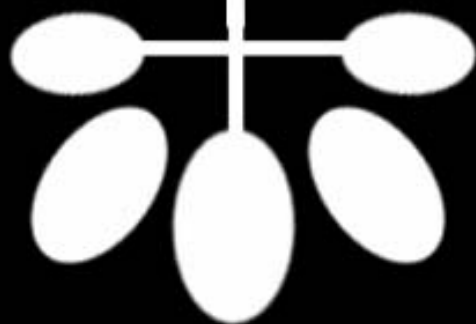
Common clonal lineage has same RG57 as RF006 identified in 1990s

Conclusions

- Of all 99 sites sampled, A2 detected at 38 (38.4%). Substantial increase from previous years
- A2s detected with full metalaxyl resistance; also detected in northern France in 2005
- A1 and A2 clonal lineages still detected but, with one exception, new ones
- A total of 39 genotypes detected
- A1 clonal lineage RF039 (found at > half of sites in 1990s) was not detected in 2005

“.....if oospores occurred very frequently, then an immediate and general attack of the disease in the spring would be unavoidable.”

Anton de Bary, 1876



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