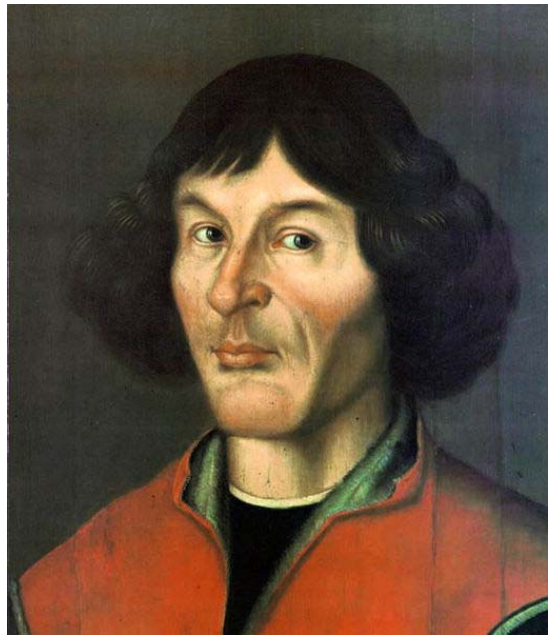


Nicolaus Copernicus (Mikołaj Kopernik)
studied at **University of Bologna** in **1497.**
On the 9th March he observed the brightest star Aldebaran in the *Taurus* constellation, and this observation confirmed his doubts on the geocentric theory of the universe.

Collection of *P. infestans* isolates

333 Polish and 37 isolates from other countries

Characterisation of *P. infestans* isolates for:

- mating type
- virulence
- resistance to metalaxyl
- SSR (Simple Sequence Repeat) markers
- mitochondrial haplotype (mtDNA)
- aggressiveness

Mating type of *P. infestans*

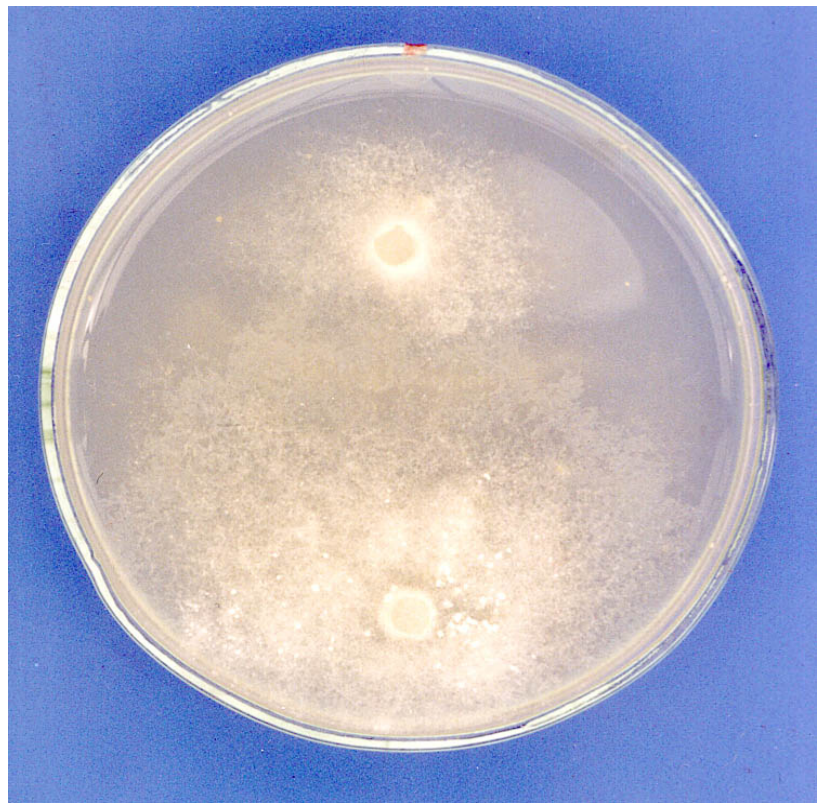
A1 – 67%

A2 – 33%

n = 1033

(1996 - 2006)

Oospore,
Phot. W. Fry



Virulence of *P. infestans* isolates

Black's differentials *R*1-*R*11
(*in-vitro* plants from SASA)

Craigs Royal

*R*2

*R*4

*R*6

*R*8

*R*10

Bzura

*R*1

*R*3

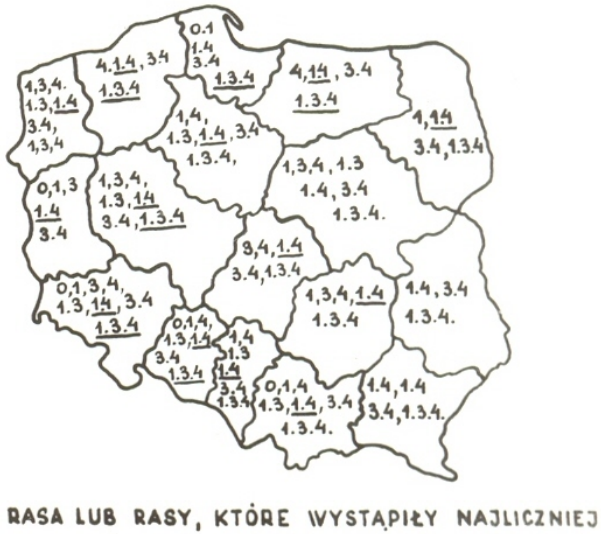
*R*5

*R*7

*R*9

*R*11

Pathotypes of *P. infestans* in 1968



1

3

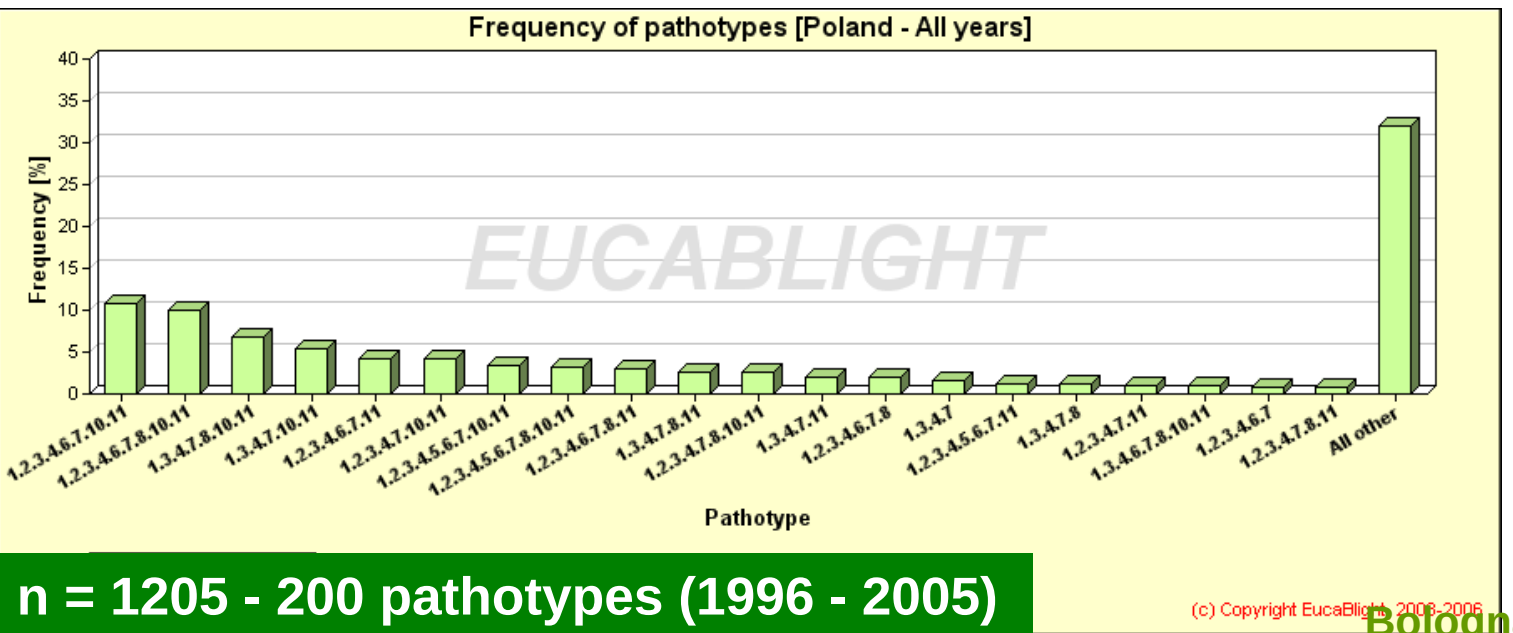
4

1.3

1.4

3.4

1.3.4



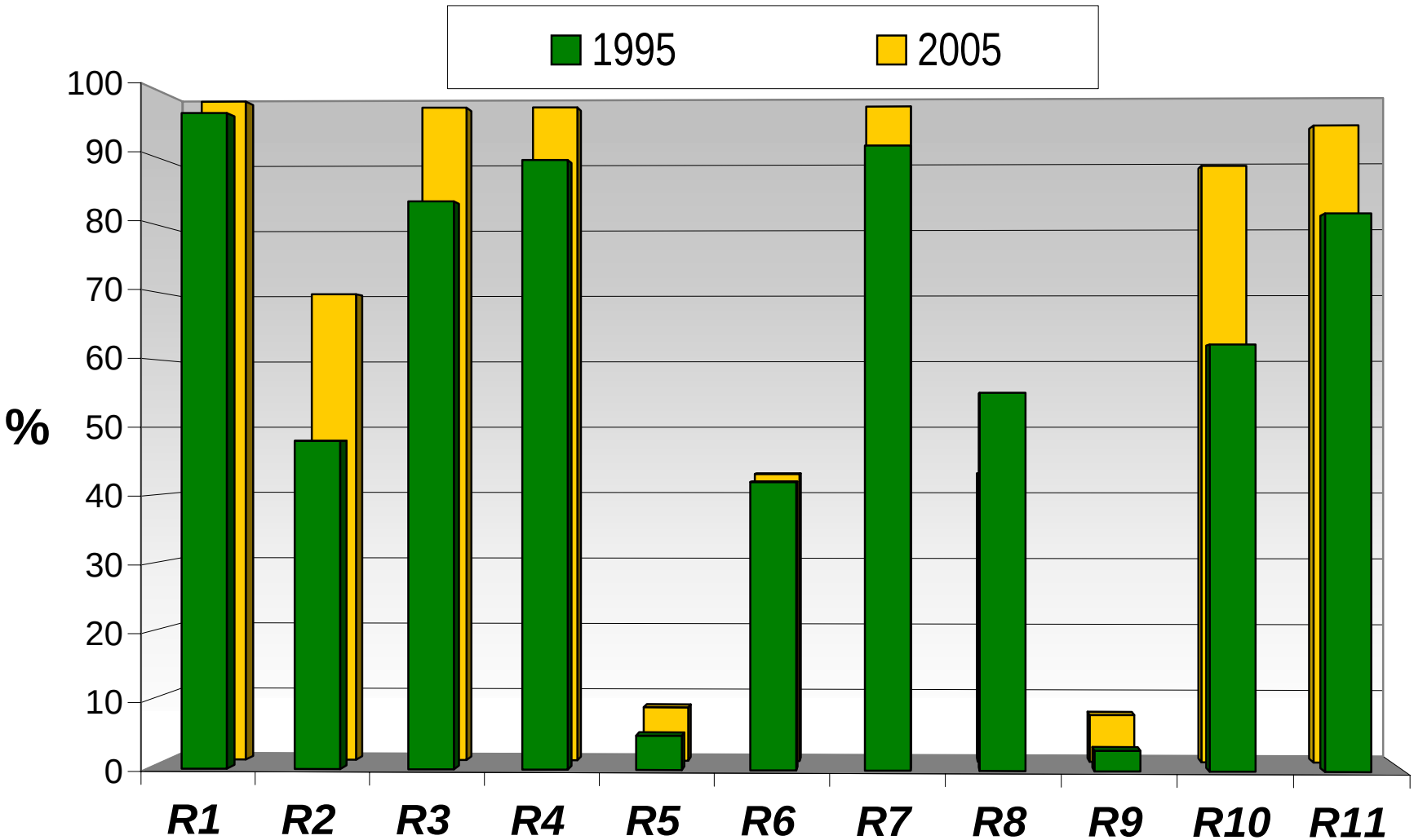
Pathotypes in 2005

1.2.3.4....

1.3.4.....

n = 1205 - 200 pathotypes (1996 - 2005)

Frequency of virulence of *P. infestans* isolates in 1995 and 2005



Virulence of *P. infestans* isolates

Cv. Sarpo Mira

Cv. Biogold (*Solanum acaule, S. bulbocastanum, S. phureja, S. tuberosum)*

Cv. Bzura (*S. demissum*)

DG 92-227 (*S. phureja, S. stenotomum*)

❑ **Bintje** (*R*-gene free)

Virulence of *P. infestans* isolates

S. ruiz-ceballosii

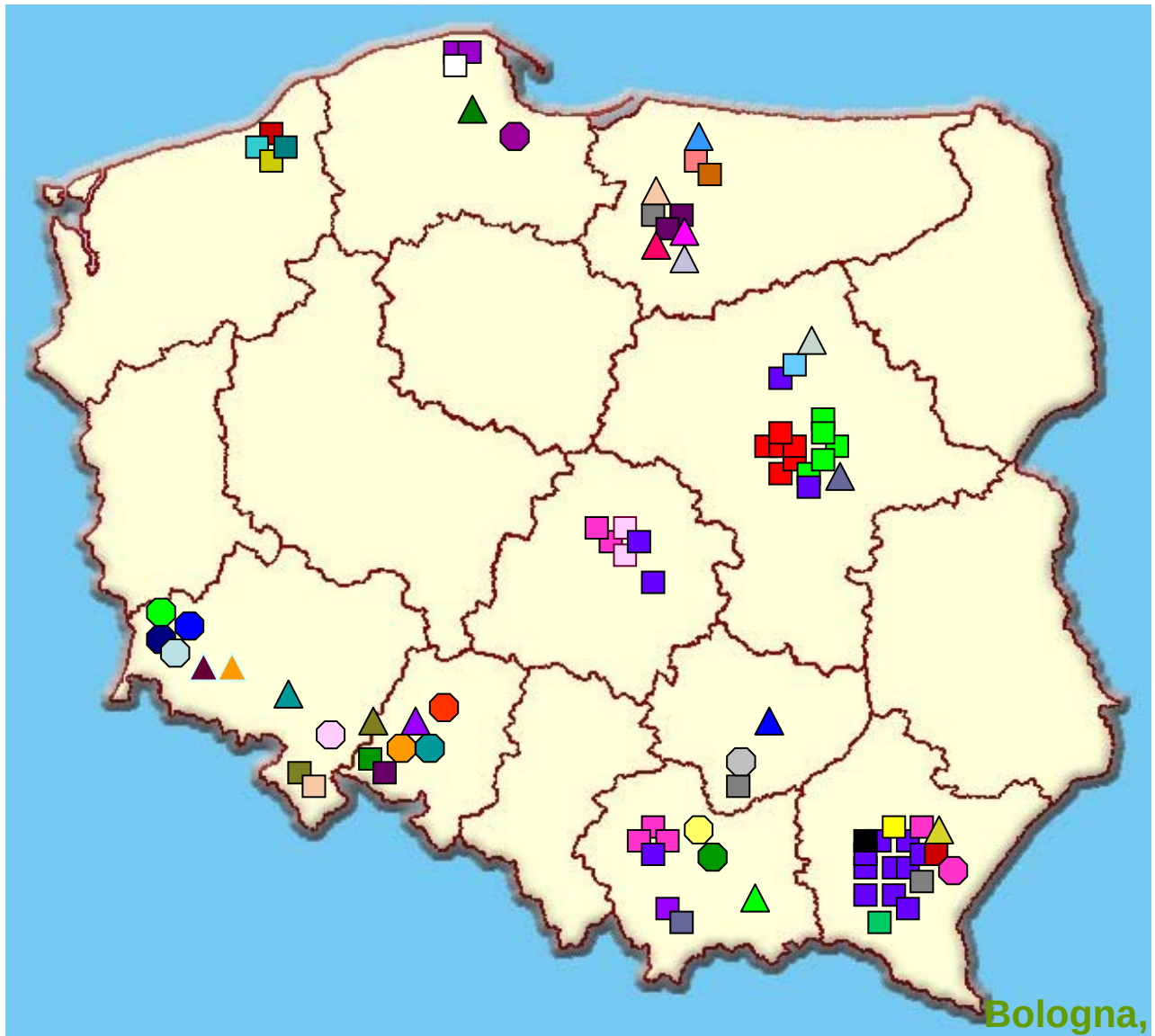
1. 99-10/13
2. VIR 7370/6
3. 99-10/5

Genotyping of *P. infestans* isolates with SSR markers (in frame of Eucablight)

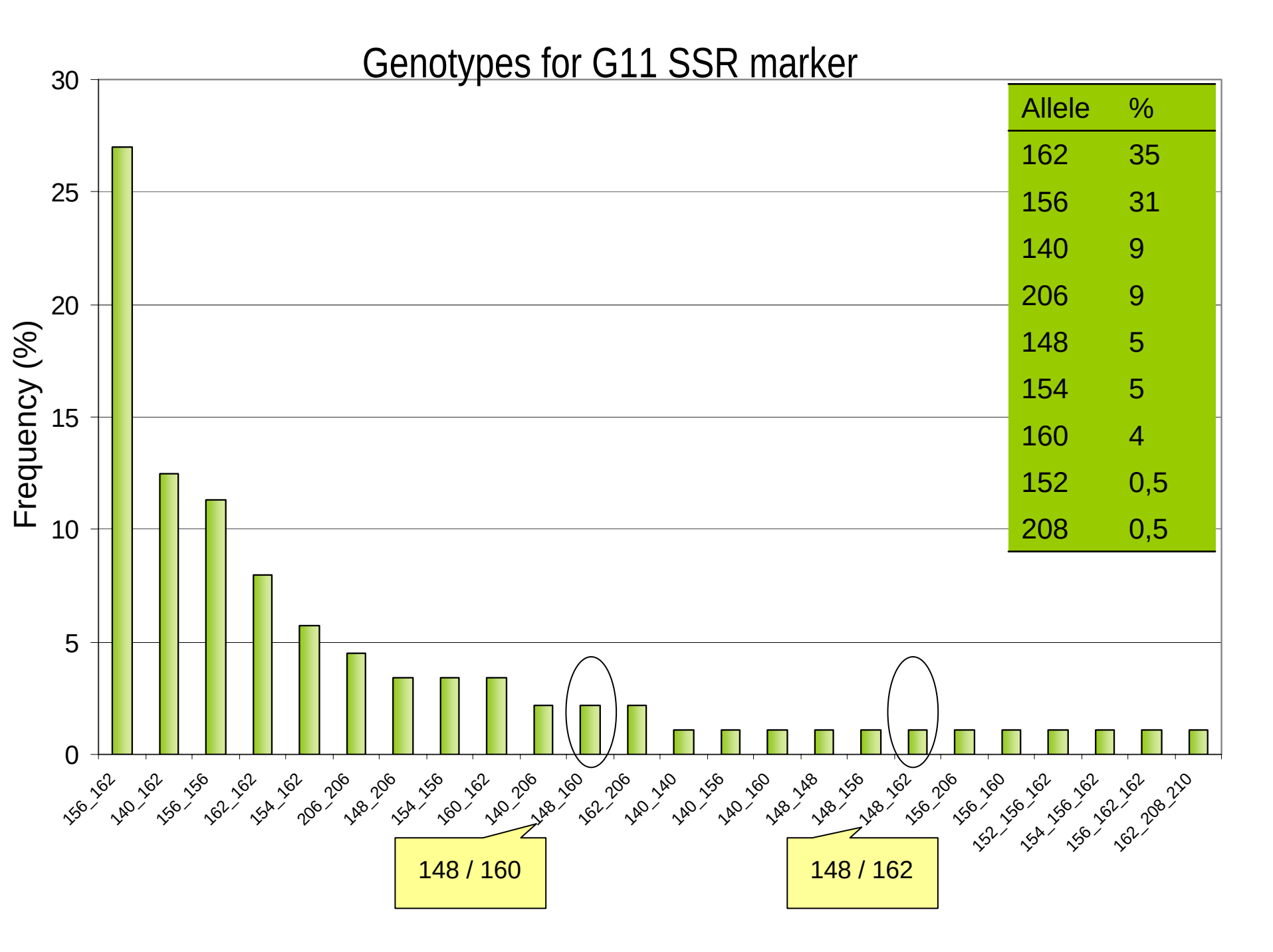
Sample Name	Pi02	Pi02	Pi16	Pi16	Pi33	Pi33	Pi56	Pi56	Pi63	Pi63	Pi63	Pi66	Pi66	Pi66	Pi70	Pi70	Pi89	Pi89	Pi4B	Pi4B	Pi4B	G11	G11
MP623	162	162	176	176	203	203	176	176	148	157		229	229		192	192	179	179	213	213		148	148
MP628	162	162	178	178	203	206	176	176	157	157		228	230		192	192	179	181	205	213		140_141	162
MP631	162	162	178	178	203	206	174	176	148	151	157	229	229		192	192	179	179	205	217		156	162
MP645	162	162	178	178	203	203	174	176	151	151		228	230		192	192	181	181	217	217		156	160
MP646	160	162	178	178	203	203	176	176	151	157		230	230		192	195	181	181	205	213		156	205_6
MP647	162	162	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		156	162
MP697	162	164	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		156	162
MP650	160	162	176	178	203	203	176	176	151	151		228	228		192	192	179	179	213	217		156	162
MP651	162	162	176	178	203	203	176	176	157	157		229	230		192	195	179	179	205	217		205_6	205_6
MP652	162	162	176	178	203	206	176	176	157	157		229	230		192	192	179	179	213	217		140_141	160
MP653	162	162	178	178	203	203	176	176	157	157		229	230		192	192	179	179	205	217		140_141	162
MP 654	152	162	176	178	203	203	174	176	148	151	157	228	230		192	195	179	179	217	217		154	156
MP 655	162	162	176	178	203	206	174	176	151	157		228	229		192	192	179	179	205	217		156	162
MP 656	162	164	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		156	162
MP 657	162	162	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		160	162
MP 662	152	162	176	178	203	206	176	176	157	157		228	230		192	192	181	181	205	217		162	162
MP 672	162	164	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		156	162
MP 674	162	162	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		156	162
MP 698	160	162	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		156	162
MP 678	162	162	178	178	203	203	176	176	148	157		228	229		192	192	181	181	205	213		162	205_6
MP 679	162	162	178	178	203	203	176	176	148	157		228	229		192	192	181	181	205	213		162	205_6

- all markers were polymorphic,
- from 2 – 12 alleles for individual markers were determined,
- combinations of these markers allow to discriminate 55 different genotypes among 90 tested ones.

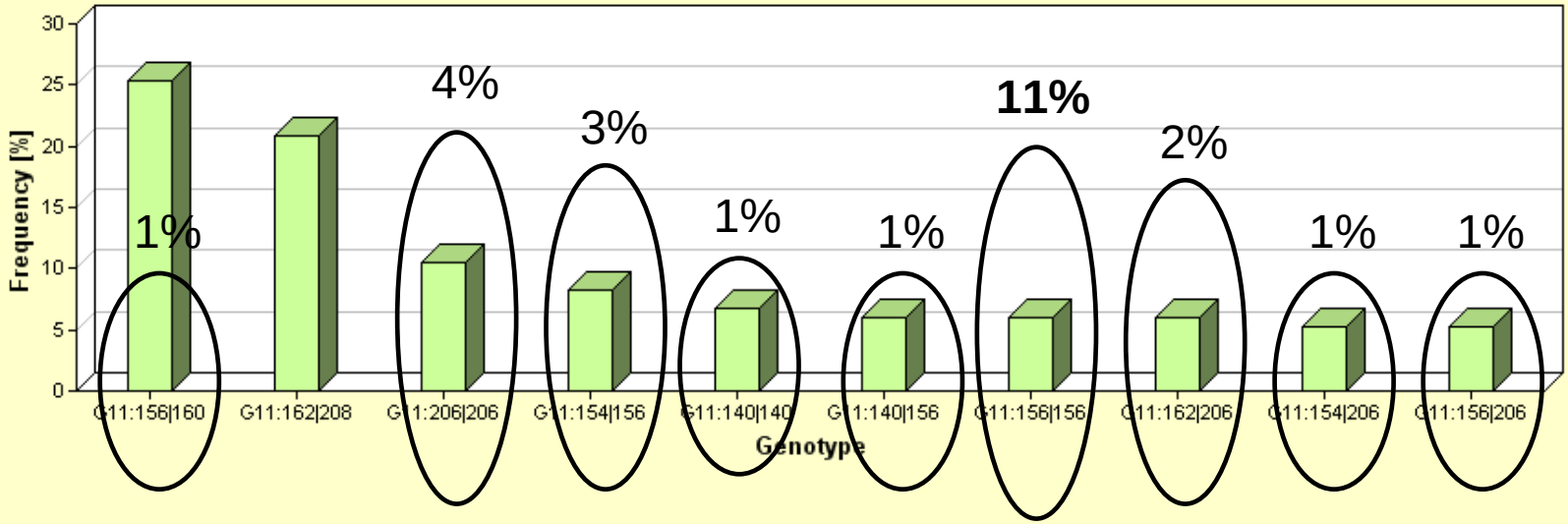
Distribution of *P. infestans* genotypes with use of 10 SSR markers (in frame of Eucablight project)



Bologna, Italy, 2-5.05.2007

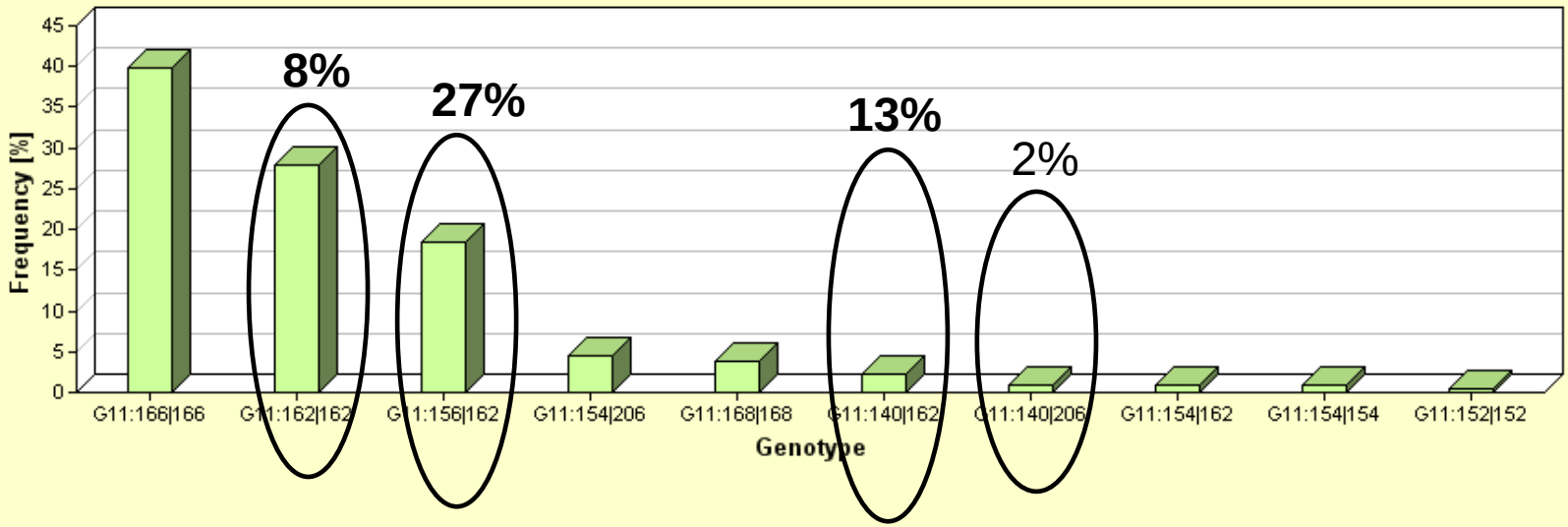

Genotypes for G11 SSR marker
Frequency (%)
30
25
20
15
10
5
0
Allele %
162 35
156 31
140 9
206 9
148 5
154 5
160 4
152 0,5
208 0,5
156_162
140_162
156_156
162_162
154_162
206_206
148_206
154_156
160_162
140_206
148_160
162_206
140_140
140_156
140_160
148_148
148_156
148_162
156_206
156_160
152_156_162
154_156_162
156_162_162
162_208_210
148 / 160
148 / 162

Frequency of genotypes [Hungary - All years]



Number of isolates: 184 | Number of genotypes: 29
Shannon index: 2,88 | Shannon Equitability J: 0,86 | Shannon Equitability E: 0,61
Simpson's index of diversity: 0,92

Frequency of genotypes [Scotland - All years]



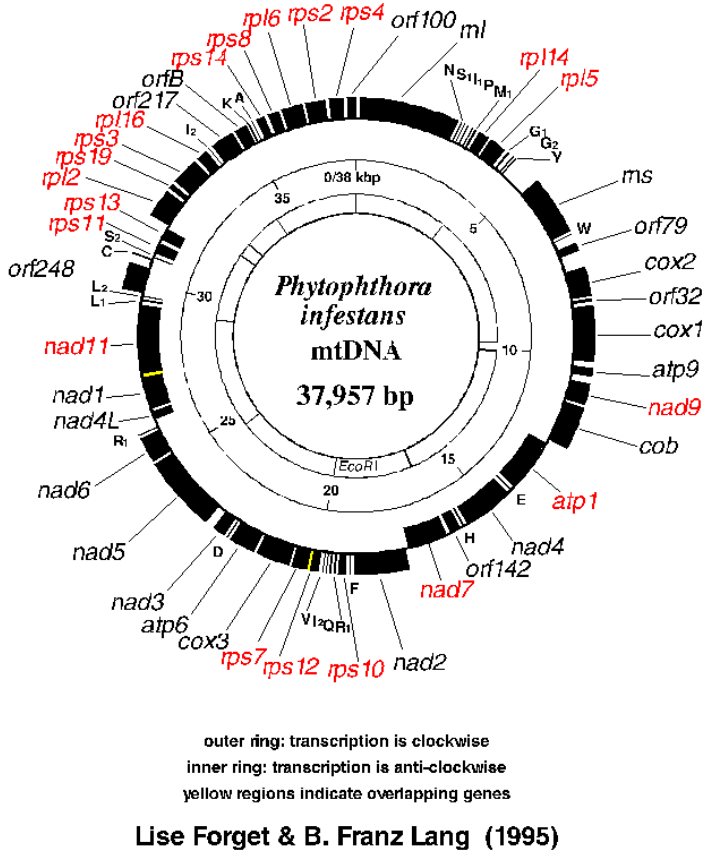
Number of isolates: 600 | Number of genotypes: 22
Shannon index: 1,67 | Shannon Equitability J: 0,54 | Shannon Equitability E: 0,24
Simpson's index of diversity: 0,74

Haplotype of mitochondrial DNA of *P. infestans* isolates (%)

- Ia
- Ib
- IIa
- IIb

	n	Ia	IIa	Ib
1987-1991 *	64	**23**	**64**	13
1997-2005	74	**89**	11	0

***** Gavino and Fry, 2002



Haplotype of mitochondrial DNA of *P. infestans* isolates (%)

	Ia	**IIa**	n
Poland	**89**	11	74
England, Scotland, Wales	**88**	12	1415
The Netherlands	**88**	12	178
France	**82**	18	176
Northern Ireland	19	**81**	559
Ireland	23	**77**	110
Finland	30	**70**	165
Hungary	32	**68**	122
Austria	33	**63**	69

Ib – single isolates were found in The Netherlands and France

IIb – single isolates were found in Northern Ireland and France

Source www.eucablight.org

Resistance to metalaxyl of *P. infestans* isolates

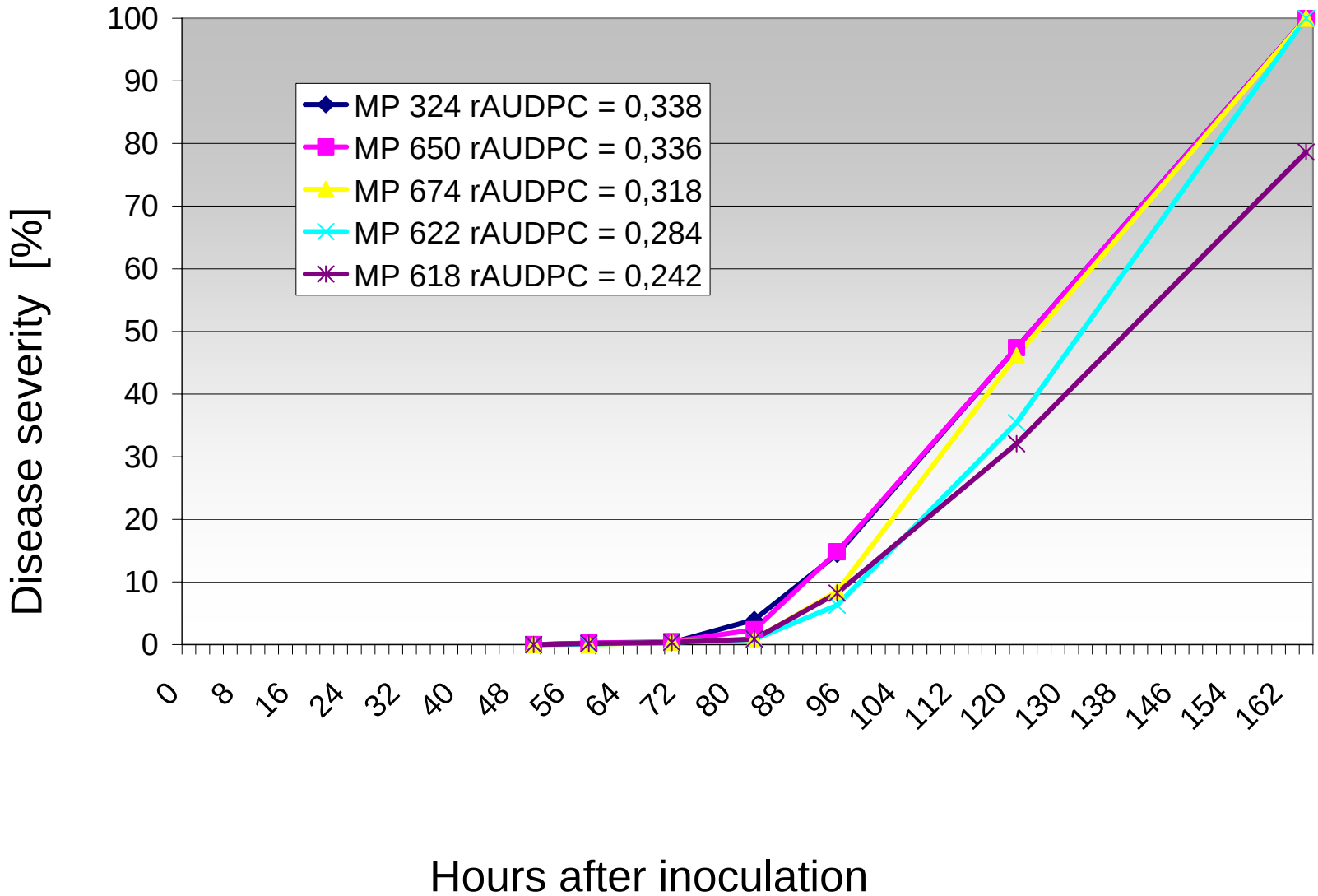
Number of isolates	%		
	Resistant	Intermediate	Sensitive
666 (from protected fields 1995 -1999) (Kapsa et al. 1999; Kapsa, 2001)	**39,7**	**18,7**	**41,4**
76 from protected fields	22,4	5,2	72,4
128 from unprotected fields	4,6	2,3	92,9
204 (1995-2005)	**11,2**	**3,5**	**85,3**
87 (2006)	**33,3**	**10,3**	**56,3**

Isolates of *P. infestans* selected for aggressiveness test

Name	Pi02	Pi02	Pi16	Pi16	Pi33	Pi33	Pi56	Pi56	Pi63	Pi63	Pi63	Pi66	Pi66	Pi66	Pi70	Pi70	Pi89	Pi89	Pi4B	Pi4B	Pi4B	G11	G11	G11	Pi04	Pi04
MP 622	152	162	178	178	203	203	176	176	151	157		227	228		192	192	179	181	205	217		205_6	205_6			
MP 324	162	162	176	178	203	206	176	176	151	157		228	228		192	192	179	179	205	217		156	156		166	170
MP 650	160	162	176	178	203	203	176	176	151	151		228	228		192	192	179	179	213	217		156	162	164		
MP 653	162	162	178	178	203	203	176	176	157	157		229	230		192	192	179	179	205	217		140_1	162			
MP 618	162	162	178	178	203	206	174	176	151	157		228	229		192	192	181	181	217	217		154	156			
MP 674	162	162	176	178	203	206	174	176	148	151	157	228	229		192	192	179	179	205	217		156	162			

Name	Mating Type	Mitochondrial haplotype	Metalaxyl Resistance
MP 622	A1	Ia	sensitive
MP 324	A1	IIa	resistant
MP 650	A1	IIa	sensitive
MP 653	A1	Ia	sensitive
MP 618	A2	Ia	resistant
MP 674	A2	Ia	intermediate

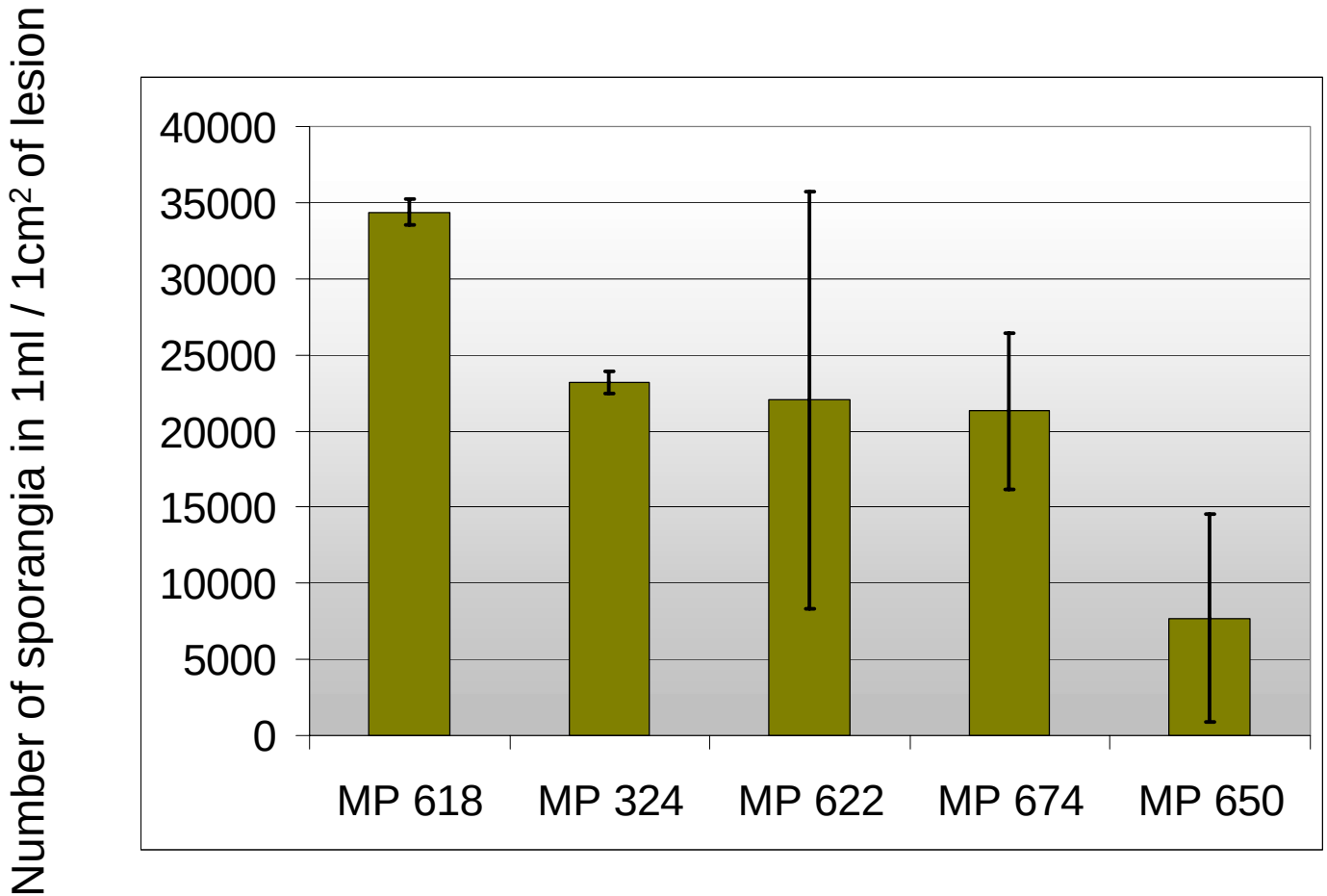
Aggressiveness of selected *P. infestans* isolates



Sporulation 3,8 days after inoculation with MP 324

Bologna, Italy, 2-5.05.2007

Sporulation intensity

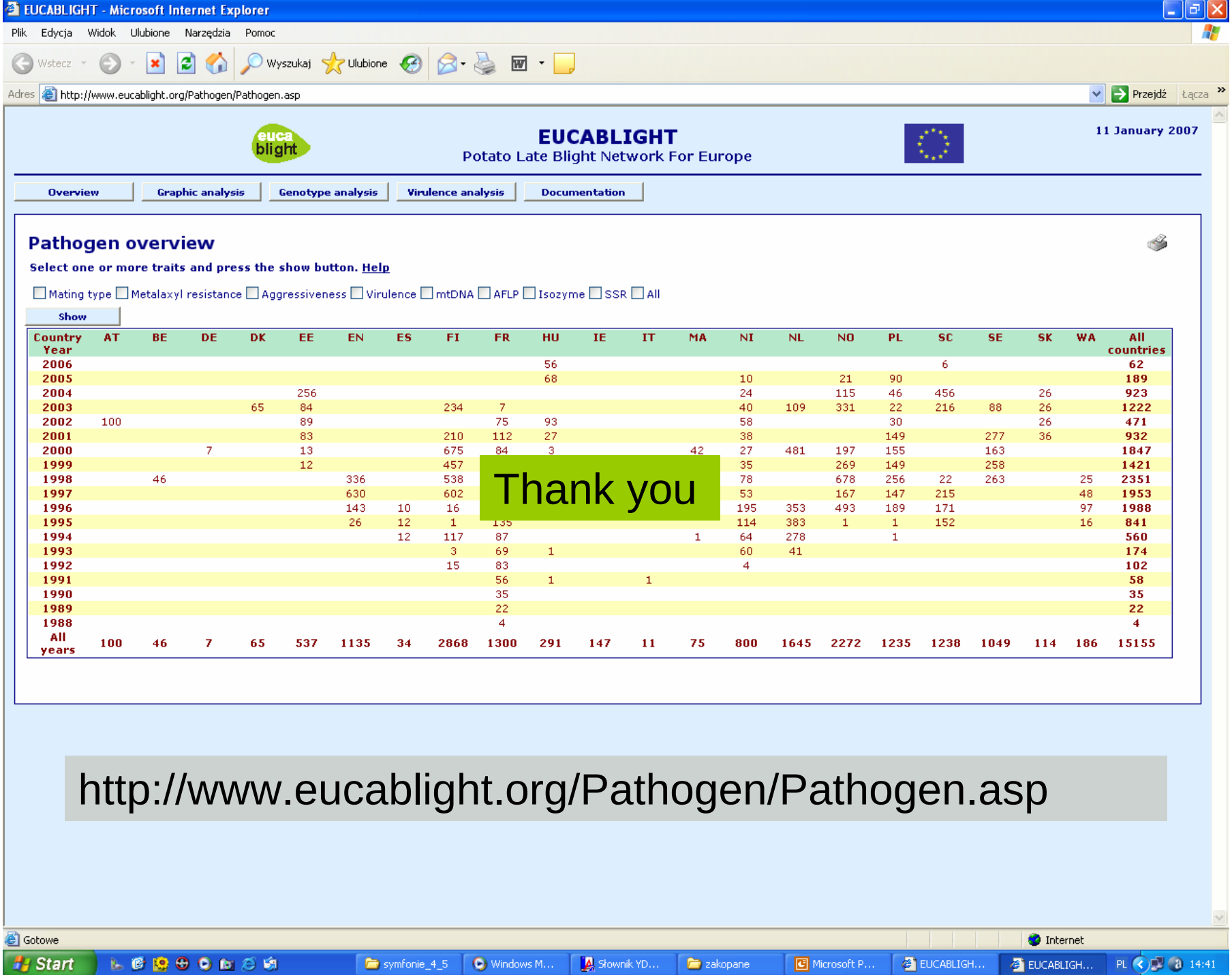


Characterisation of Polish population of *P. infestans* - summary

- A1 mating type occurs two times more frequently than A2,
- mean number of virulence factors = 7,4 per isolate, is the highest in European isolates, which data are in Eucablight database,
- simple races and complex composed of two to three virulence factors are not found, isolates containing 4 and 5 virulence factors are rarely found,

Characterisation of Polish population of *P. infestans* - summary

- mt DNA - Ia and IIa, Ia haplotype dominates,
- genotypically highly diversed - 90 isolates = 55 genotypes were found,
- Polish *P. infestnas* population differs in frequency of alleles with other european *P. infestans* populations,
- two alleles of G11 marker were specific for Polish *P. infestans* isolates - 148/160 and 148/162.



Country Year	AT	BE	DE	DK	EE	EN	ES	FI	FR	HU	IE	IT	MA	NI	NL	NO	PL	SC	SE	SK	WA	All countries
2006										56								6				62
2005										68				10		21	90					189
2004					256									24		115	46	456		26		923
2003				65	84			234	7					40	109	331	22	216	88	26		1222
2002	100				89				75	93				58			30			26		471
2001					83			210	112	27				38			149		277	36		932
2000			7		13			675	84	3			42	27	481	197	155		163			1847
1999					12			457						35		269	149		258			1421
1998		46				336		538						78		678	256	22	263		25	2351
1997						630		602						53		167	147	215			48	1953
1996						143	10	16						195	353	493	189	171			97	1988
1995						26	12	1	135					114	383	1	1	152			16	841
1994							12	117	87				1	64	278		1					560
1993								3	69	1				60	41							174
1992								15	83					4								102
1991									56	1		1										58
1990									35													35
1989									22													22
1988									4													4
All years	100	46	7	65	537	1135	34	2868	1300	291	147	11	75	800	1645	2272	1235	1238	1049	114	186	15155