



Fine Mapping and Potential for PCR based Markers for *Frl*



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Fusarium Crown and Root Rot

- ❖ *Fusarium oxysporum* f.sp. *radicis-lycopersici*
 - Soil-borne fungus
- ❖ Worldwide distribution
- ❖ Substantial losses during cool conditions
 - Field
 - Greenhouse



Control



❖ Integrated Management

- Nutrient control
- Fungicides
- Crop rotation
- Solarization of soil
- Biocontrol
- Soil fumigation
- Soil pH 6-7

❖ Genetic resistance



Genetic Resistance

A background image of a tomato plant with green leaves, yellow flowers, and a single large red tomato in the center.

❖ Two sources of genetic resistance

- *S. pennellii*
- *S. peruvianum*

❖ At least three sources in *S. peruvianum*

- PI 126926
- PI 128650
- PI 126944

Genetic resistance: *S. peruvianum*

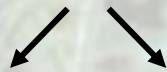
**Japan,
1975
PI 126944**



IRB #301



Ohio 89-1



Fla 7464 Fla 7226

**France, 1969
PI 126926**



'Mopérou'

**USA, 1963
PI 128650**



'Momor' 'Mocis'

'Mogéor' AVRDC

❖ **Occurred while breeding
for TMV resistance**

- **Linkage discovered later**



TMV and *Frl*

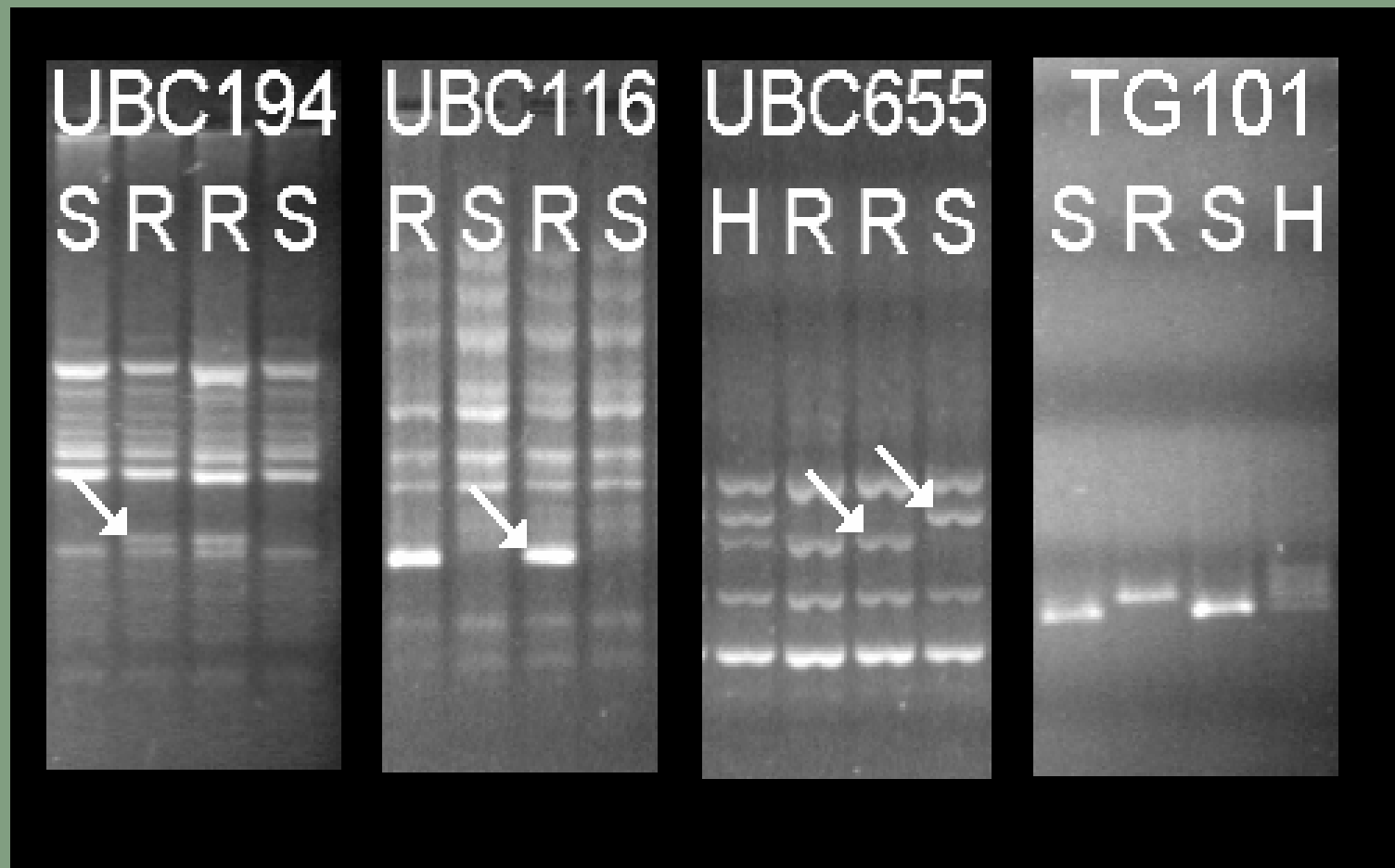
- ❖ Linkage discovered in 1988
 - Elkind et al.
- ❖ 1991: all 3 sources are allelic
 - Laterrot & Moretti
- ❖ 1997: 5.1 cM between *Frl* and *Tm-2*
 - Vakalounakis et al.
- ❖ Linkage helps identify chromosomal location of *Frl*





Frl Markers

(Fazio et al. 1999)



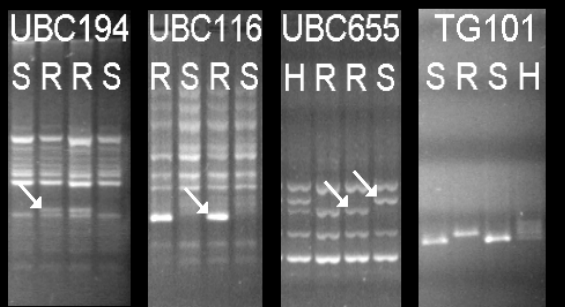


Linkage map

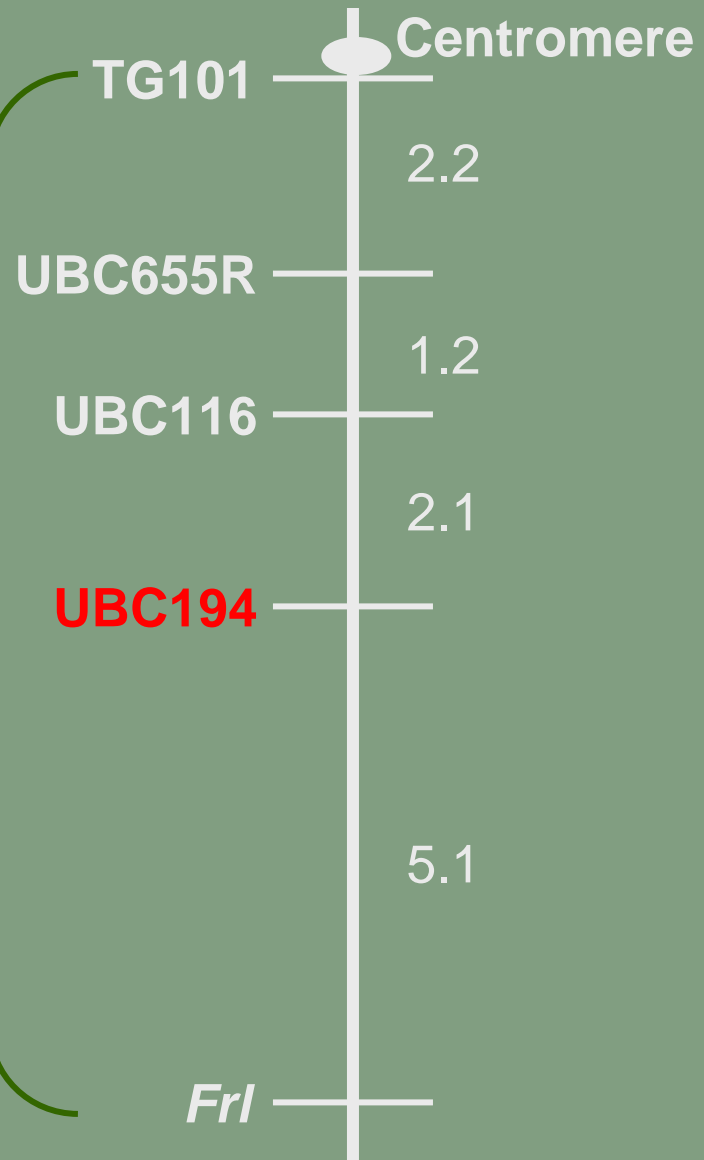
(Fazio et al. 1999)



Momor
Ohio 89-1
Fla 7464



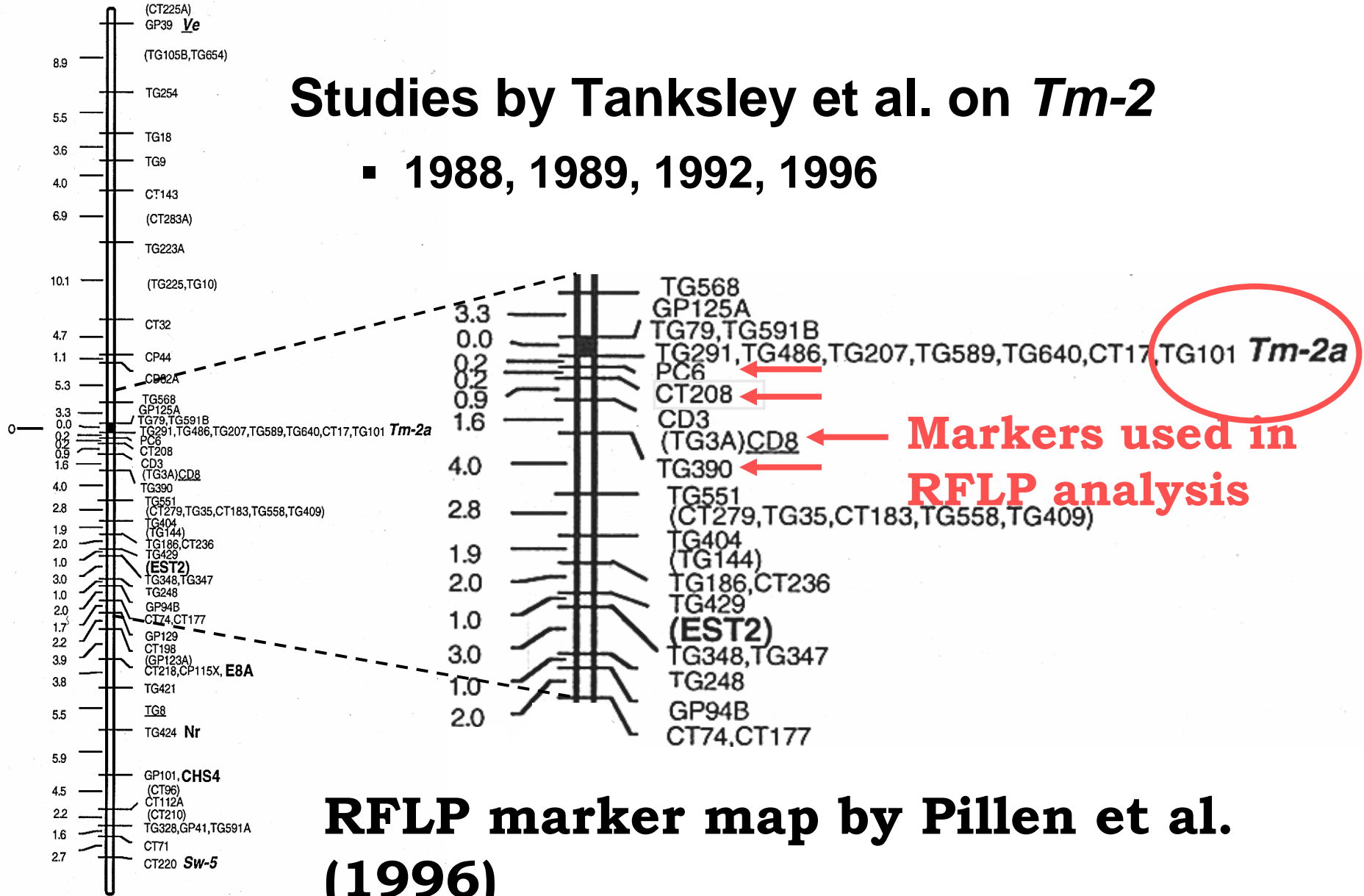
Mocis
Fla 7226



General location of *Frl*

Studies by Tanksley et al. on *Tm-2*

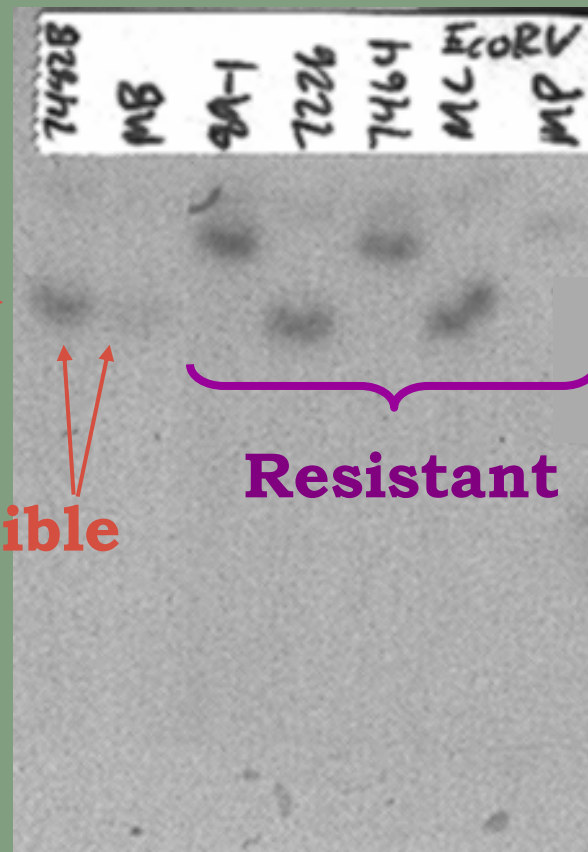
- 1988, 1989, 1992, 1996



RFLP marker map by Pillen et al. (1996)

RFLP results

Only CT208 showed polymorphisms

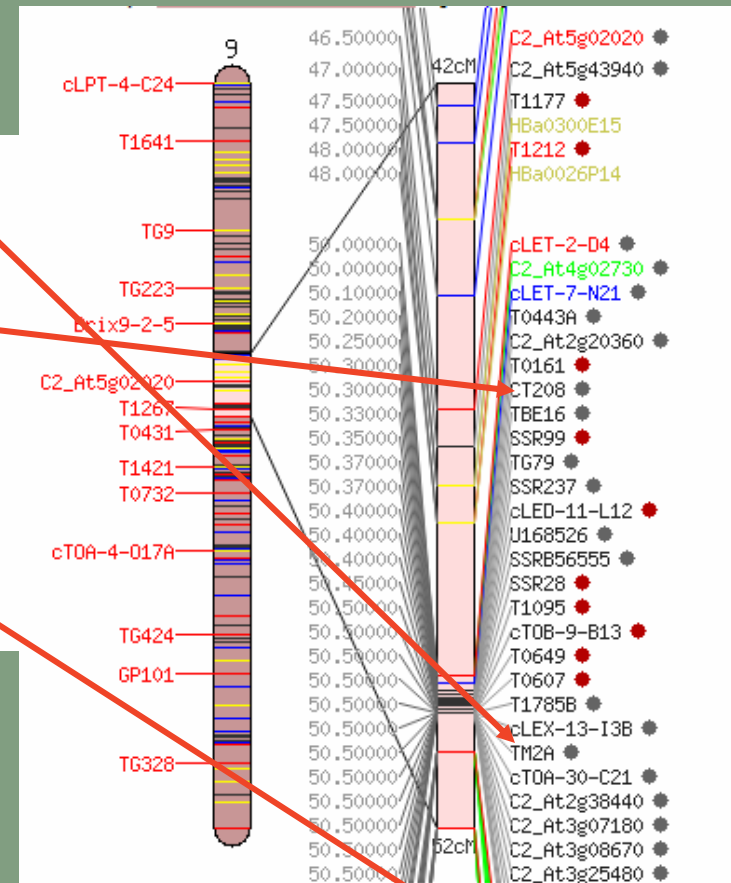
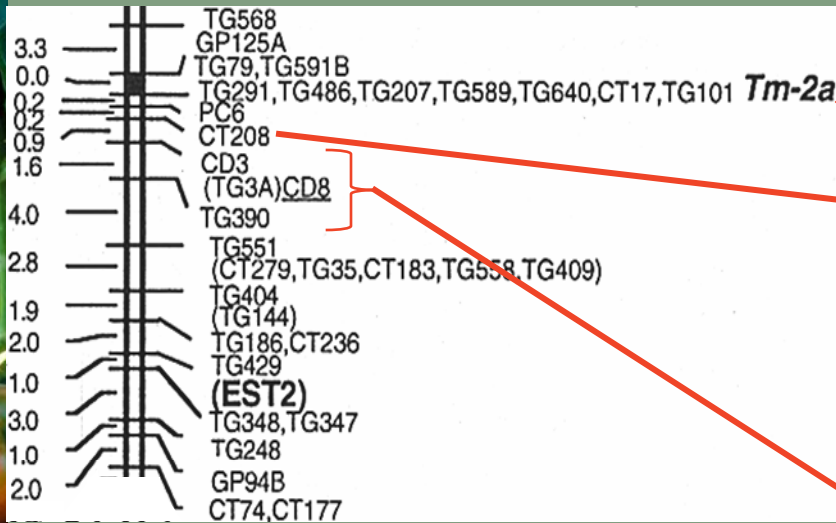




Key – More Markers Comparison Mapping

ExPen 2000

Tanksley et. al. 1992



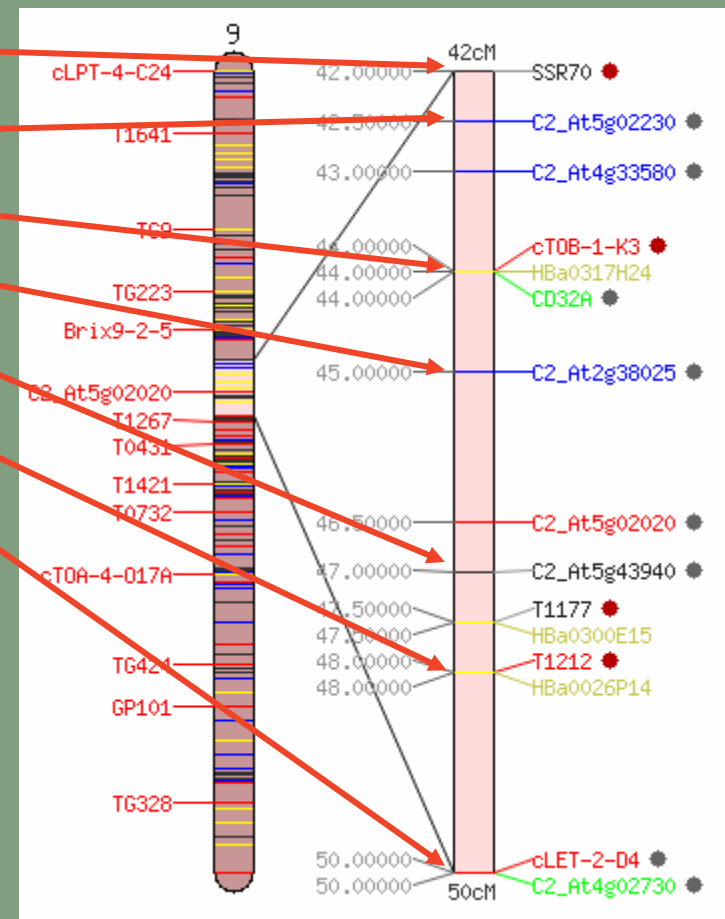


New Markers Tested



- ❖ SSR70 42.0 cM
- ❖ C2_at5g02230 42.5 cM
- ❖ cTOB-1-K3 44.0 cM
- ❖ C2_at2g38025 45.0 cM
- ❖ T1177 47.0 cM
- ❖ T1212 48.0 cM
- ❖ cLET-2-D4 50.0 cM
- ❖ TG101 unknown
- ❖ SSRB63839 unknown
- ❖ LeOH31 unknown
- ❖ UBC194 unknown
- ❖ UBC655 unknown

ExPen 2000





New BC₁ Population

- ❖ 128 BC₁ resistant plants were used for molecular marker study
 - 59 – 7482B x (89-1 x 7482B)
 - 69 – (89-1 x 7482B) x 7482B
- ❖ First tested with TG101
 - 24/128 of the plants absent *S. peruvianum* DNA at TG101
- ❖ Seed (BC₁S₁) of these 24 plants were rescreened for FCRR
 - 17 clearly indicated FCRR resistance – others were escapes in the F₂ population





Frl Germplasm “Panel”



Line	<i>Frl</i> PI #
AVRDC	PI128650
Mocis	PI128650
Mogéor	PI128650
Momor	PI128650
Monalbo	Susceptible
Mopérou	PI126926
Motelle	Susceptible
Fla7226	PI126944
Fla7464	PI126944
Fla7482B	Susceptible
Ohio 89-1	PI126944



Selected Plants from the *Fr1* “BC₁ Population”

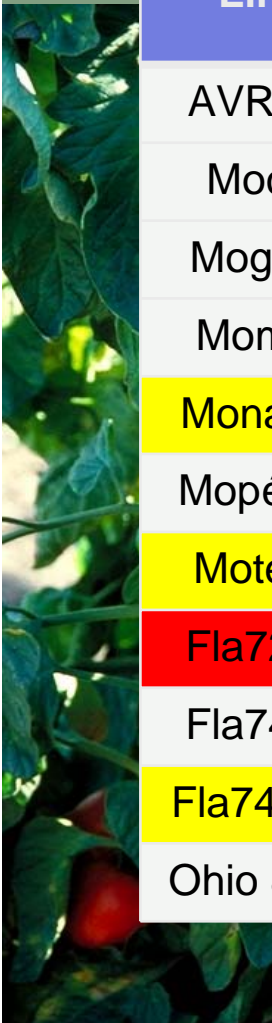


Resistant BC ₁ Line	TG101	cLET-2-D4	T1212	T1177	C2_at2g38025	cTOB-1-K3	SSR70
1-28	H	H	H	H	H		L
1-44	L	L	H	H	H	H	H
2-19	L	H	H	H	H		H
2-20	H	H	H	H	H		L
2-42	L	H	H	H	H		H
2-43	L	H	H	H	H		H
2-59	L	L	H	H	H	H	H
3-14	L	H	H	H	H		H



Frl Germplasm “Panel”

Line	PI #	TG101	cLET-2-D4	T1212	T1177	C2_at2g 38025	cTOB-1- K3	SSR70
AVRDC	128650	P	P	P	P	P	P	P
Mocis	128650	L	L	P	P	L	L	L
Mogéor	128650		P	P	P	P	L	L
Momor	128650	P	P	P	P	P	P	L
Monalbo	Suscep	L	L	L	L	L	L	L
Mopérou	126926	P	P	P	P	P	P	L
Motelle	Suscep	L	L	L	L	L	L	L
Fla7226	126944	L	L	L	L	L	L	L
Fla7464	126944	P	P	P	P	P	L	L
Fla7482B	Suscep	L	L	L	L	L	L	L
Ohio 89-1	126944	P	P	P	P	P	P	P

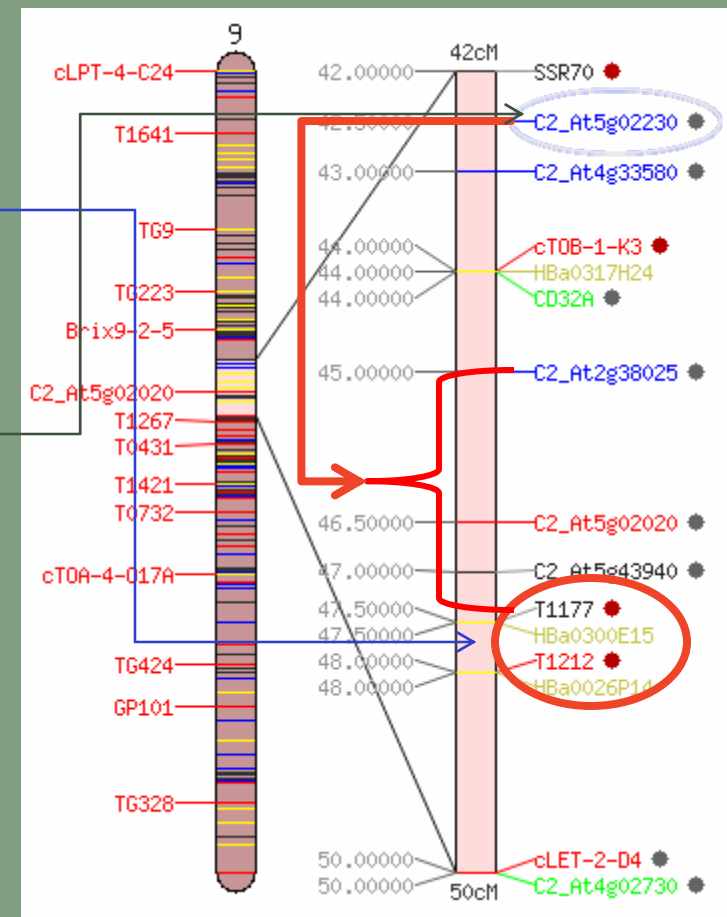




Frl Location and Possible Markers



- ❖ Data suggest
 - T1177 & T1212 are < 1 cM from *Frl*
- ❖ We do have evidence that *c2at5g02230* is located here in our population



Conclusions

- ❖ Each “PI” introgression (128650, 126926, & 126944) have SNPs and INDEL distinct from each other
- ❖ Some mild rearrangements of markers compared to EXPEN 2000 map
- ❖ No markers have been identified linked to *Frl* in Fla7226
- ❖ T1212 and T1177 appear to have the tightest linkage to *Frl*

