Reniform Nematode Resistance from *Gossypium longicalyx* - Cytogenetics, Breeding & Molecular Marker Development

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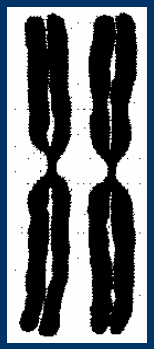
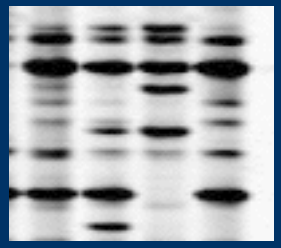
Objectives

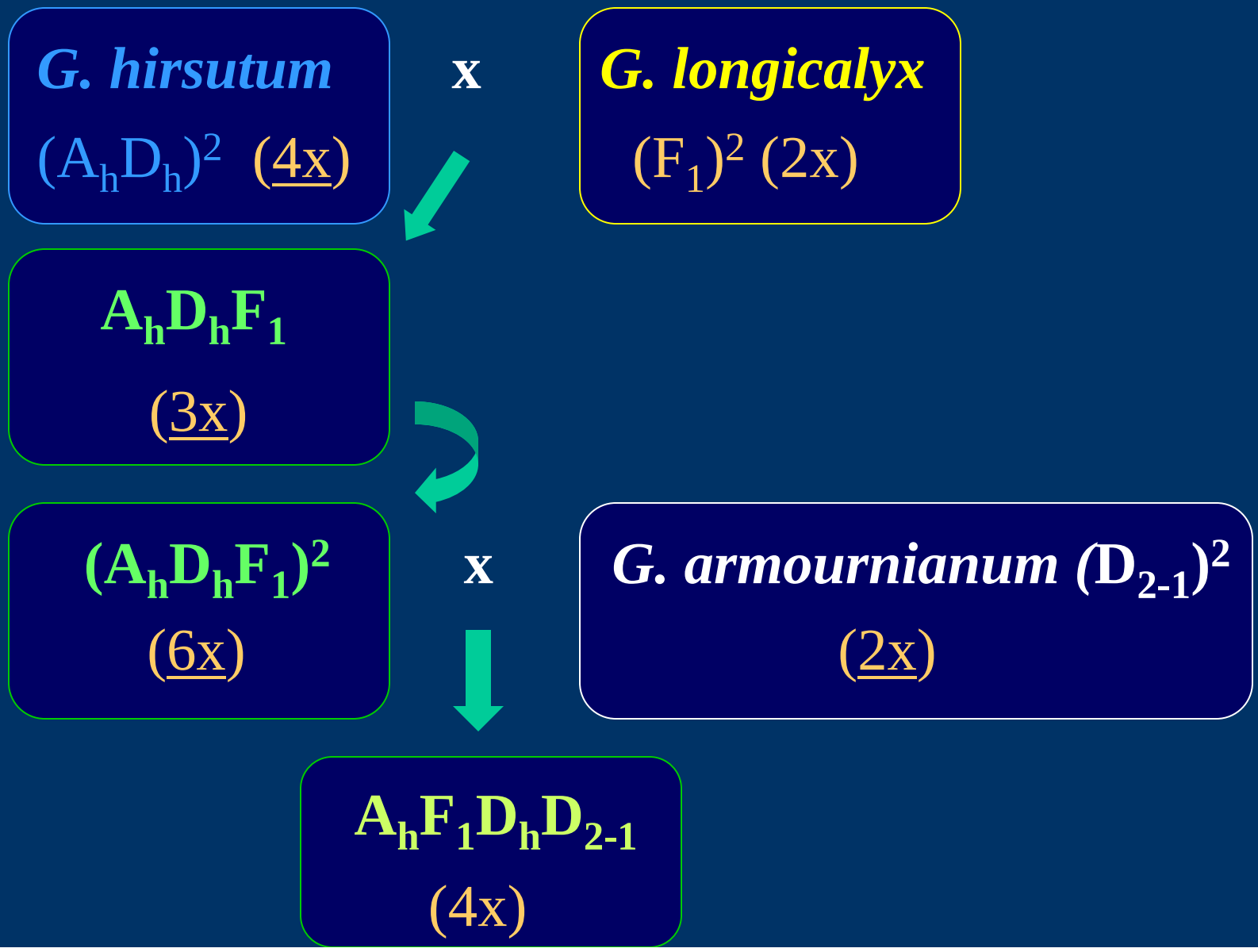




- **INTROGRESSION (selective):**
  - Resistance to reniform
  - NOT undesirable traits
- **CYTOGENETICS:**
  - Chromosomal constitutions
  - Numbers and kinds of aberrations
  - Recombination
  - Alien segment size
- **MARKERS:**
  - Analyses
  - MAS

Triple Species Hybrids

(Bell and Robinson, USDA)



Two Triple-species Hybrids

(Bell and Robinson, USDA)

TWO resistance sources:

1) (*G. hirsutum* x *G. longicalyx*)^2 x *G. armourianum* (HLA)

2) (*G. hirsutum* x *G. herbaceum*)^2 x *G. longicalyx* (HHL)

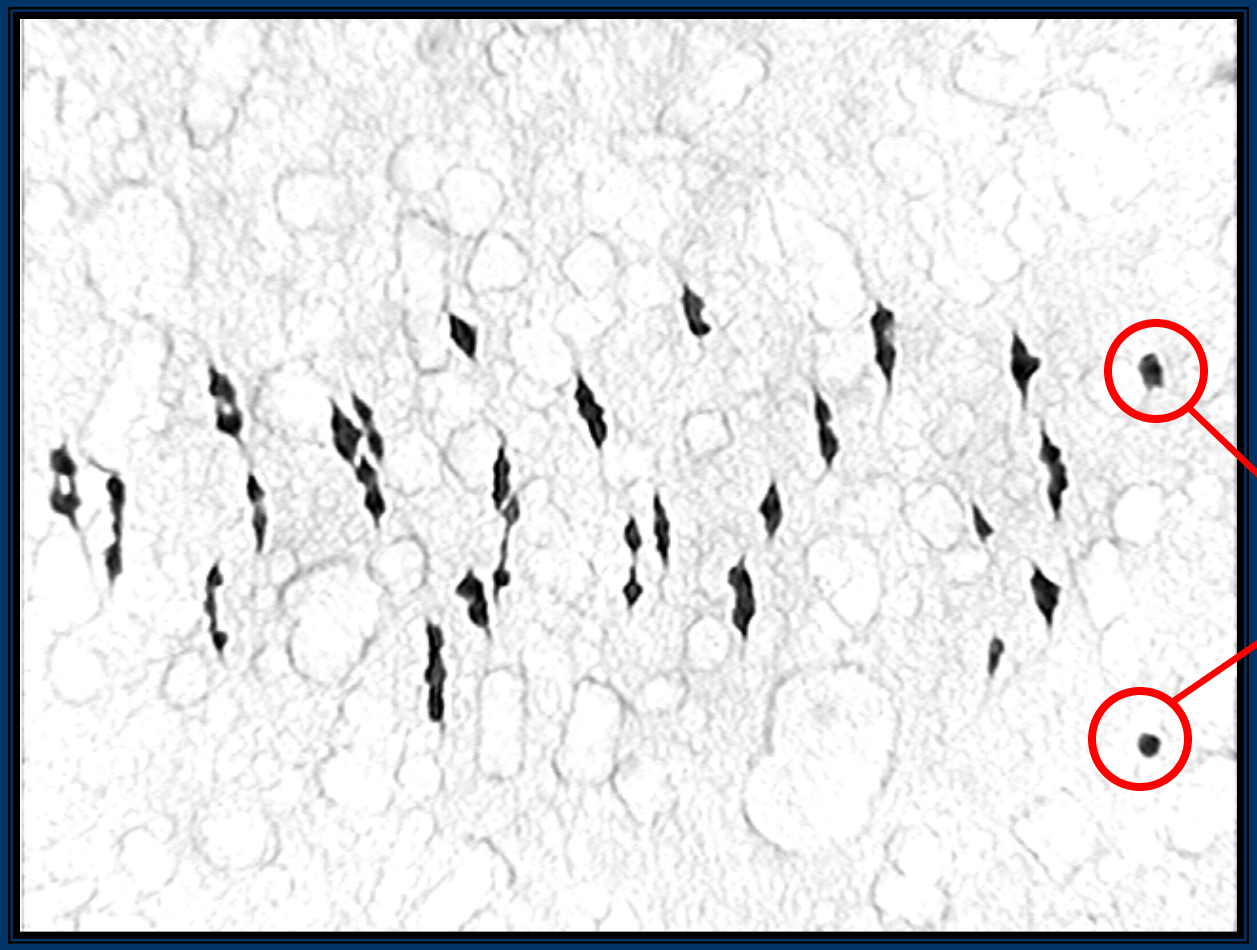
Cytogenetics Data Summary

Generation	# Plants Analyzed
BC1F1	38
BC1S1	31
BC2F1	94
BC3F1	23
BC4F1	15
BC5F1	2
Total	203

Chromosome numbers

Chrom. / Gener.	51 Chr.	52 Chr.	53 Chr.
BC1F1	(5%) 2	(66%) 25	(29%) 11
BC1S1	(3%) 1	(84%) 26	(13%) 4
BC2F1	(22%) 21	(61%) 57	(17%) 16
BC3F1	0	(100%) 23	0
BC4F1	0	(100%) 15	0
BC5F1	0	(100%) 2	0

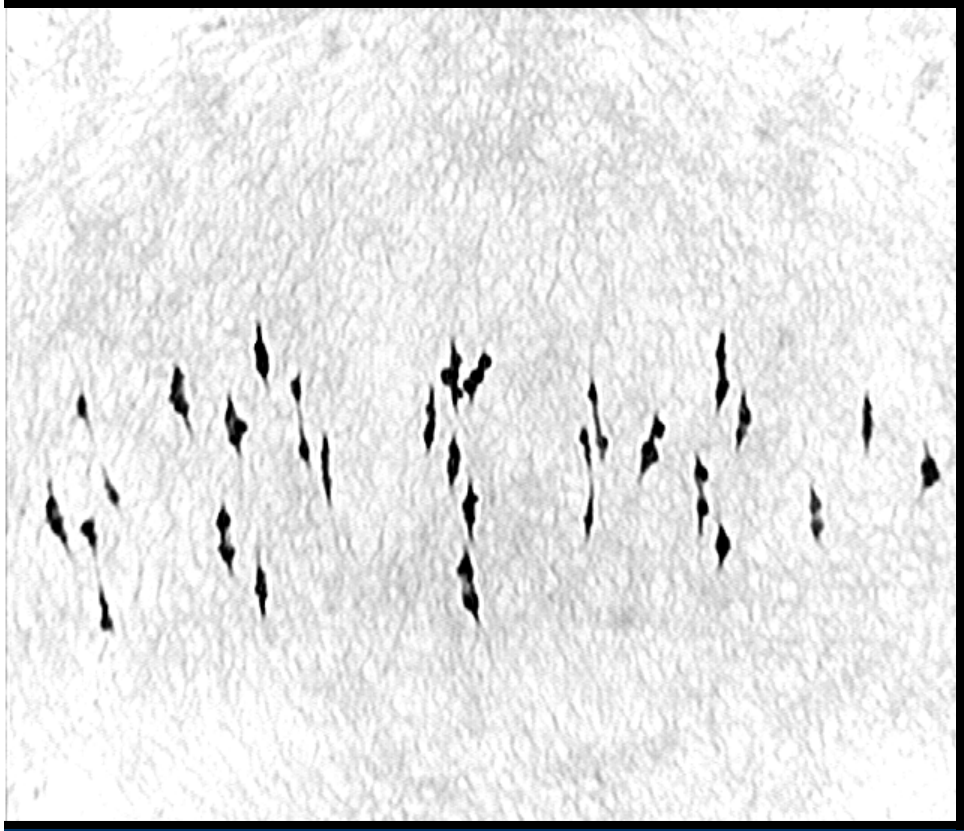
Model Type in BC2



(***Not*** recombinant)

25II+2I (Res-BC2-129

Modal Type in Resistant BC3, BC4 and BC5 Plants



26II

26II

Recombination

Proximal and distal XOs are too distant.

Proximal XO is okay. Distal XO is too distant.

Proximal XO is too distant. Distal XO is okay.

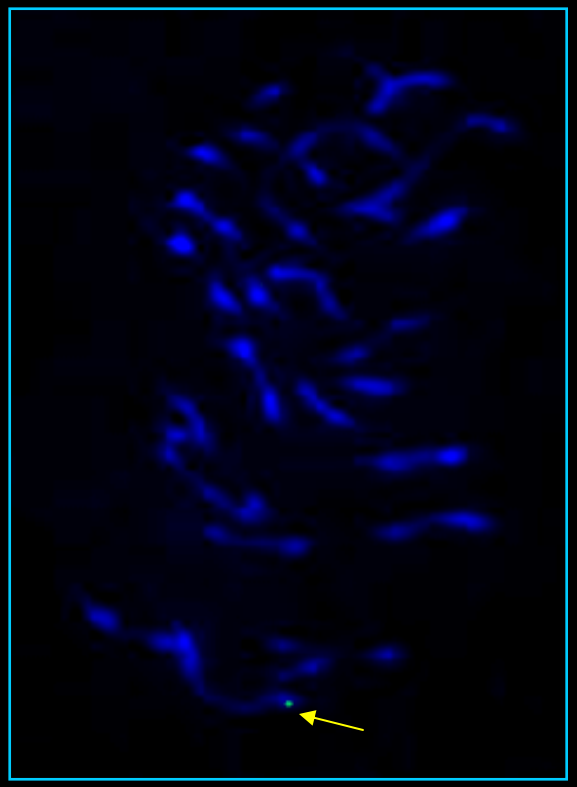
Proximal and distal XOs are okay.

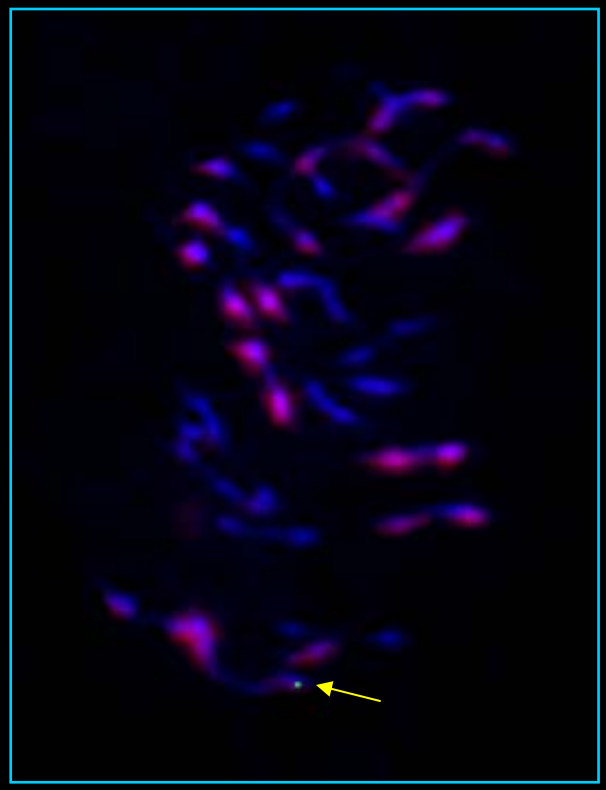
Recombination

* **Estimate of Recombination in BC2**
- **2/20 Resistant Plants Analyzed form either 26II OR 1IV+24II**
- **At least ~10% Recombination in BC2**

* **Estimate of Recombination in BC3 and BC4**
- **Approx. 85% of the Resistant Plants Analyzed form 26II OR 1IV+24II**

GISH (Genomic in situ hybridization) on BC3 1-6 (Resistant)





Blue---All the chromosomes

Red----A1-genome

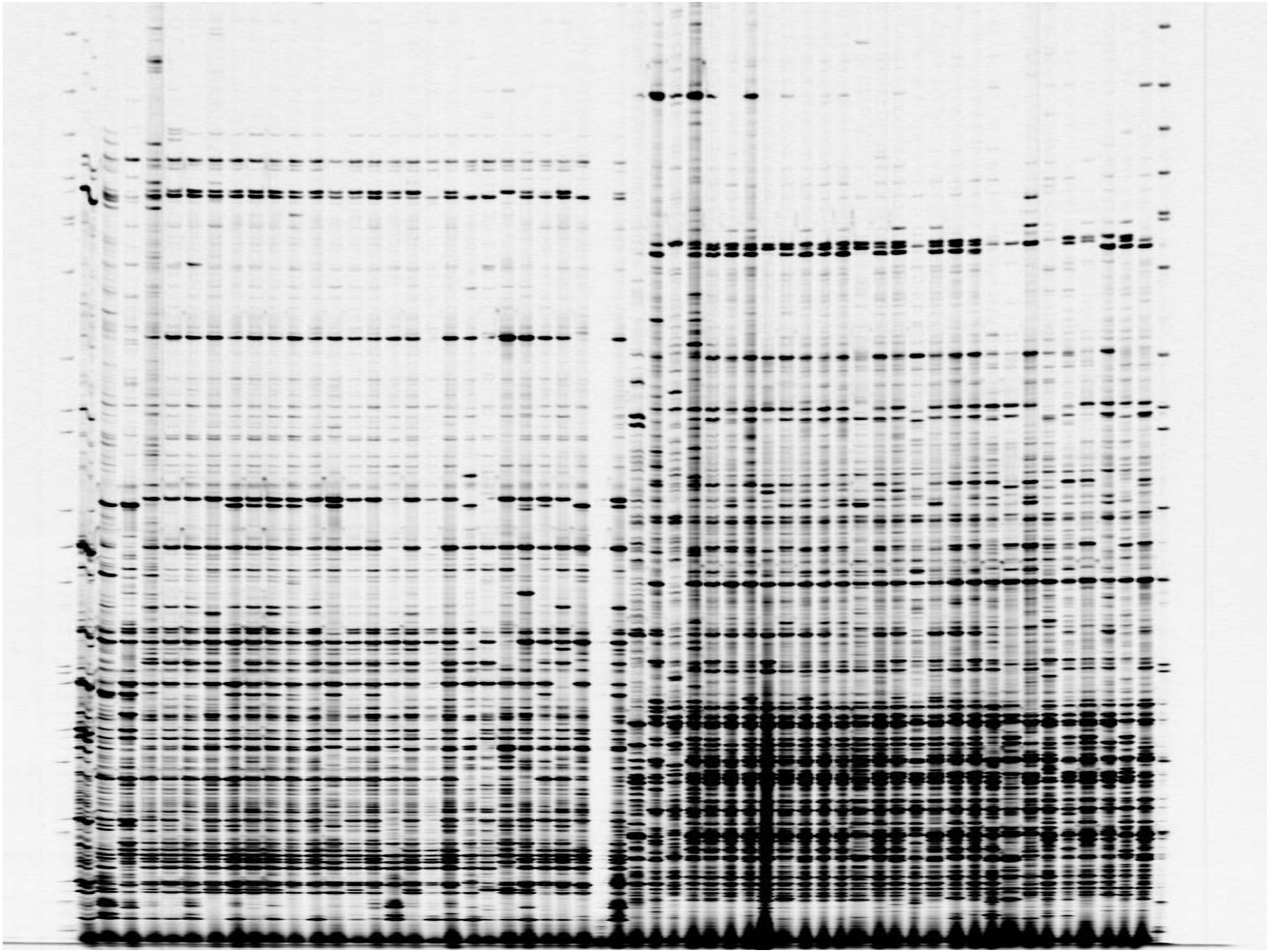
Green—F1-genome

<u>BC3 1-6</u>
Highly Resistant plant
26II Chrom. Config
BC4F1 Segregating 1:1 (5R:5S)

MARKER DEVELOPMENT

- **“PHASE-I” MARKERS: alien AFLPs**

- **SCREENING PANEL:**
  - ***G. hirsutum*** **(AD_1)**
  - ***G. longicalyx*** **(F_1) and *G. armourianum* ($D_{2\text{-}2}$)**
  - **Resistant BC_1 parents (Bulked)**
  - **12 most resistant plants of 186 BC_2 plants**
  - **12 most susceptible plants of 186 BC_2 plants**
- **Li-Cor System**



Potential Markers

Potential Markers

Marker Development

Research in Progress..

- **Identify AFLP markers tightly linked to the reniform nematode resistance gene**

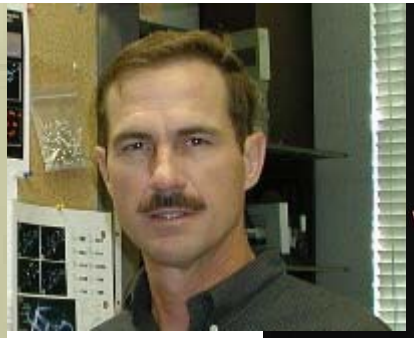
THEN:

- **"Phase-II" Markers -- e.g. SSRs**
  - Identify linkage group *(using mapped loci)*
  - MAS, especially among inbreds ("Zygosity assays")

STATUS SUMMARY

- **The existing data indicate successful introgression!!**

- **NEEDS:**
  - **Markers for MAS**
    - Backcrossing
    - Inbreeding
  - **Eliminate unnecessary alien germplasm**
    - GISH (physical size of alien segment)
    - Markers
    - Phenotypic screens
    - Yield and fiber assessments



Acknowledgments

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