

# Introgression of reniform nematode immunity from *G. longicalyx* into Upland cotton (*G. hirsutum*)

## Cytology, Genetics & Gene Tagging



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# Objectives

1. Transfer of the immunity trait to *G. hirsutum*
2. Determine genetic control and inheritance
3. Create resources that will expedite breeding of immune cultivars

# Triple-Species Hybrids & Backcrosses

- Two types of triple-species hybrids

“HLA” :

$$= (G. \textit{hirsutum} \times G. \textit{longicalyx})^2 \times G. \textit{armourianum}$$

“HHL” :

$$= (G. \textit{hirsutum} \times G. \textit{herbaceum})^2 \times G. \textit{longicalyx}$$

# Ongoing Efforts

BC<sub>1</sub> & BC<sub>2</sub> populations from  
*G. longicalyx* backcrossed to *G. hirsutum*



Resistance classification &  
Fertility screening



**Chromosomal composition**  
(metaphase I analysis)



**Develop molecular markers**  
closely linked to immunity gene

1841

12

13



19



1841

20



# Plant Materials for Cytological Study

## ➤ **BC<sub>1</sub> plants**

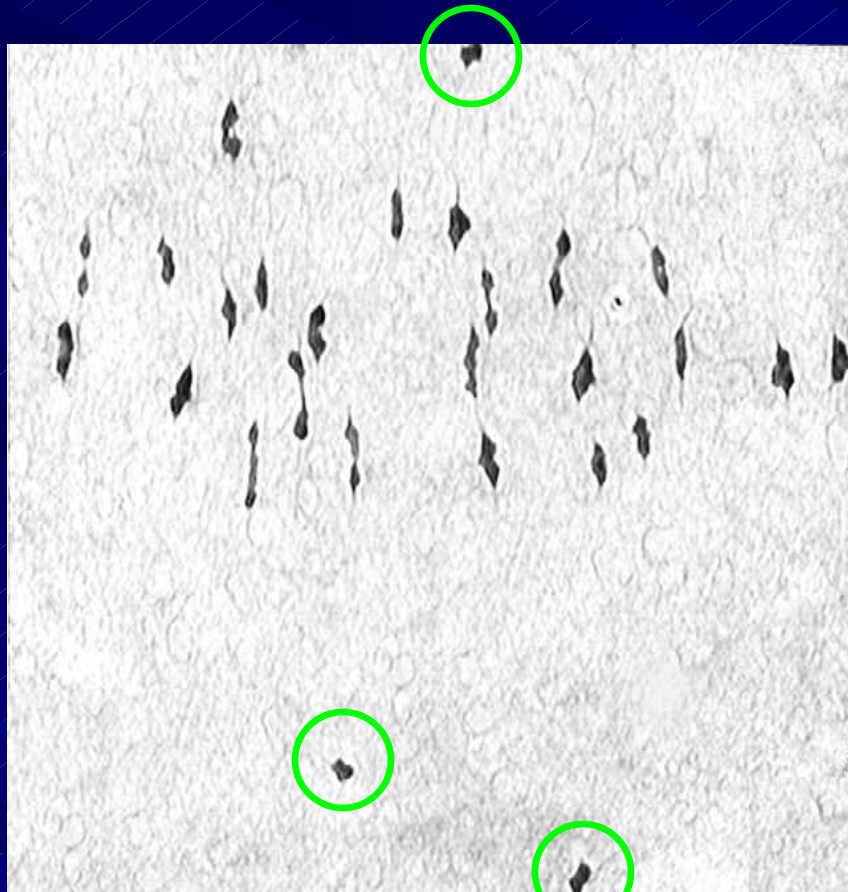
- Female-fertility tests underway for 500 male-sterile BC<sub>1</sub> plants (unknown resistance, as yet). *(Only female-fertile plants will be considered for chromosome analysis.)*
- Also, ~120 male-fertile BC<sub>1</sub> plants currently under reniform nematode resistance test (USDA) will also be studied cytologically

# Plant Material Under Cytological Study

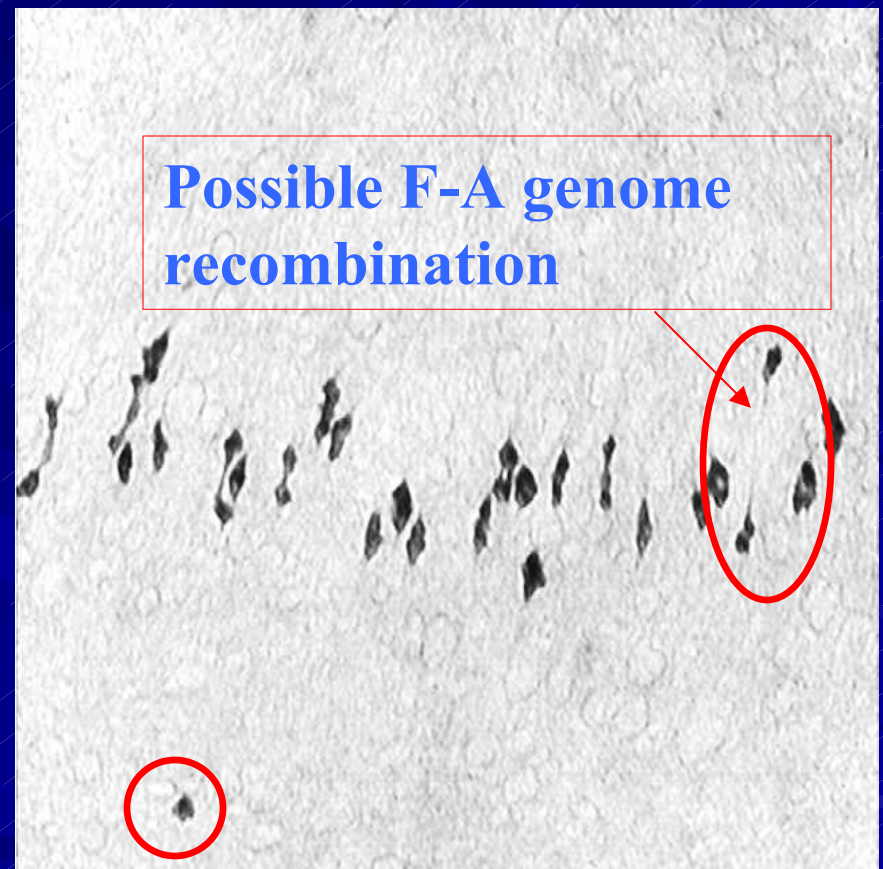
## ➤ **BC<sub>2</sub> plants**

- ◆ 100 fertile BC<sub>2</sub> plants having high resistance to reniform nematodes
- ◆ *Ca.* 130 fertile BC<sub>2</sub> plants having moderate to low reniform nematode resistance

# *G. longicalyx* (F<sub>1</sub>) hybridized *G. hirsutum*-BC<sub>2</sub> Monosome

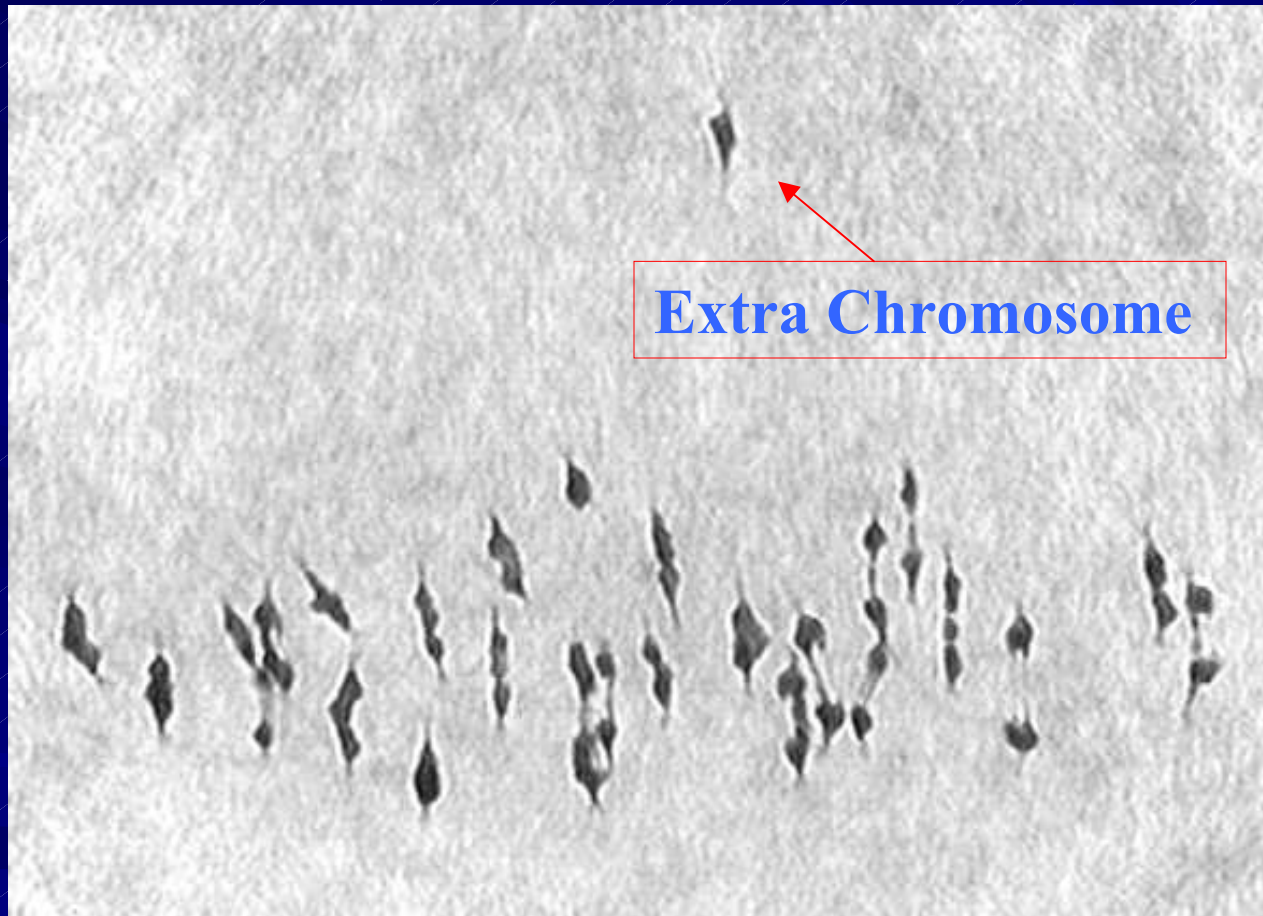


3 I + 24 II (51 chromosomes)



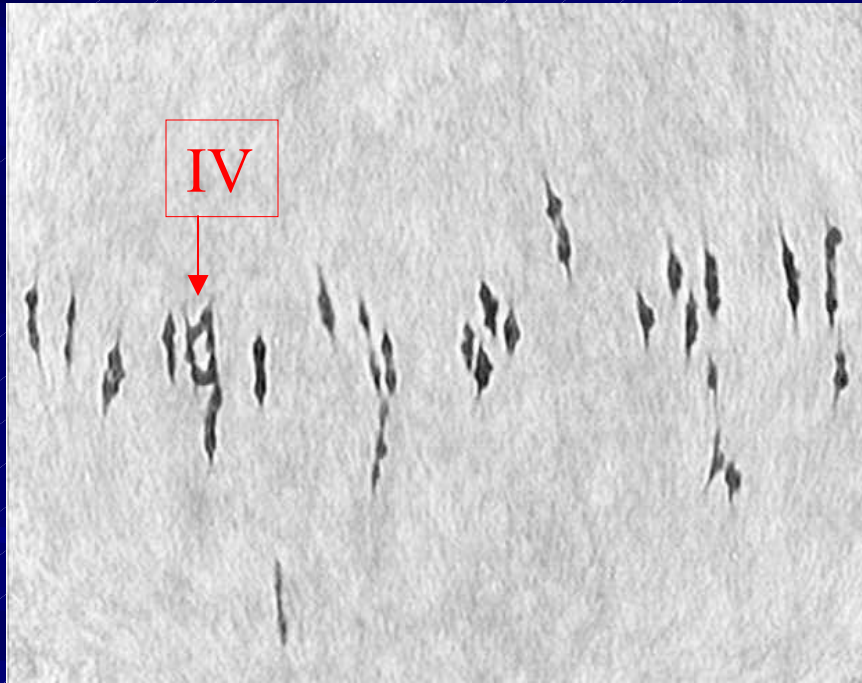
1 I + 25 II (51 chromosomes)

# BC<sub>2</sub> With An Extra Alien Chromosome



1 I + 26II (53 chromosomes)

# Chromosomal Translocation In Highly Resistant BC<sub>2</sub> Plant Cells

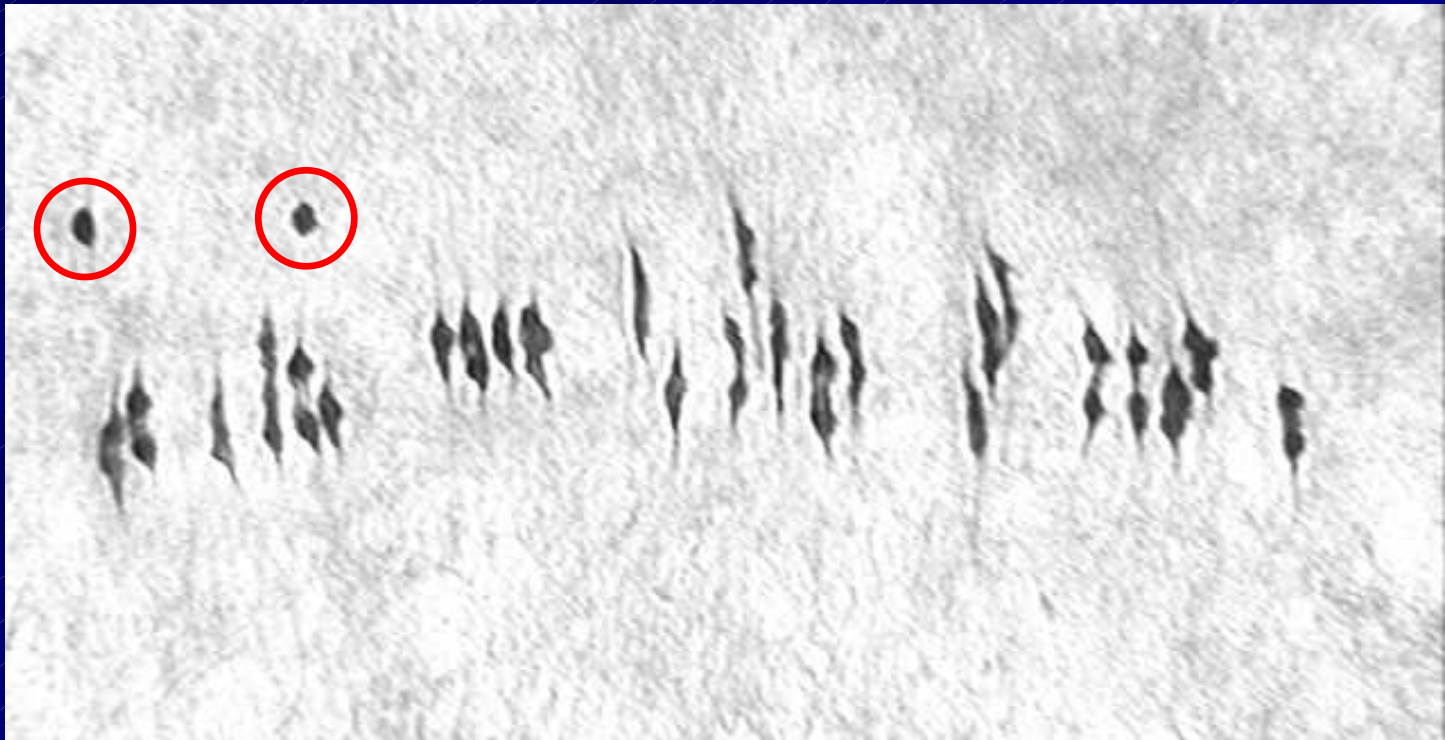


24 II + 1 IV (52 chr.)



1 I + 1 III + 24 II (52 chr.)

# Modal chromosomal type of the BC<sub>2</sub> population



2 I + 25 II (52 chr.)

# Summary

- Approximately 80 BC<sub>2</sub> plants analyzed

| <b>Number of plants</b> | <b>Chromosomes / cell</b> |
|-------------------------|---------------------------|
| <b>6</b>                | <b>53-54</b>              |
| <b>10</b>               | <b>49-51</b>              |
| <b>64</b>               | <b>52</b>                 |

# Gene Tagging of immunity-conferring genes

## ■ PURPOSE:

1. Enable marker-assisted selection to expedite development of reniform-immune cultivars

## ■ APPROACH

1. Bulk Segregant Analysis (BSA) -- for initial marker development, e.g., 20 most resistant and susceptible BC<sub>2</sub> plants
2. Amplified Fragment Length Polymorphism (AFLP) markers

# Conclusions

- We have observed chromosome numbers approaching and equal to those of Upland cotton
- We have observed evidence of recombination and possible recombination products
- Observations suggest just one chromosome may carry the immunity factors (but more data are needed)
- INFERENCE: Introgression seems feasible
- Mapping and gene tagging for MAS seem feasible (after recovery of recombinants).