Reniform Nematode Resistance in Asiatic Cottons

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Introduction

- Asiatic cottons:
  - *G. herbaceum* (A1)
  - *G. arboreum* (A2)

- A-genome accessions with resistance have been identified (Carter, 1981; Yik and Birchfield, 1984)

Stewart and Robbins, 1994:

- 27 *G. herbaceum* and 140 *G. arboreum* accessions
- About 10% of the A-genome accessions in the NPGS were highly resistant
- Nearly all the accessions were more resistant than *G. hirsutum*.

Objectives

1. Develop fertile hybrids between resistant diploid cottons and upland cotton.

2. -Determine the number and inheritance of genes conferring resistance.

   -Identify molecular markers linked to RN resistance in *G. arboreum*

Objective 1

- Develop fertile hybrids between resistant diploid cottons and upland cotton.

Germplasm Availability

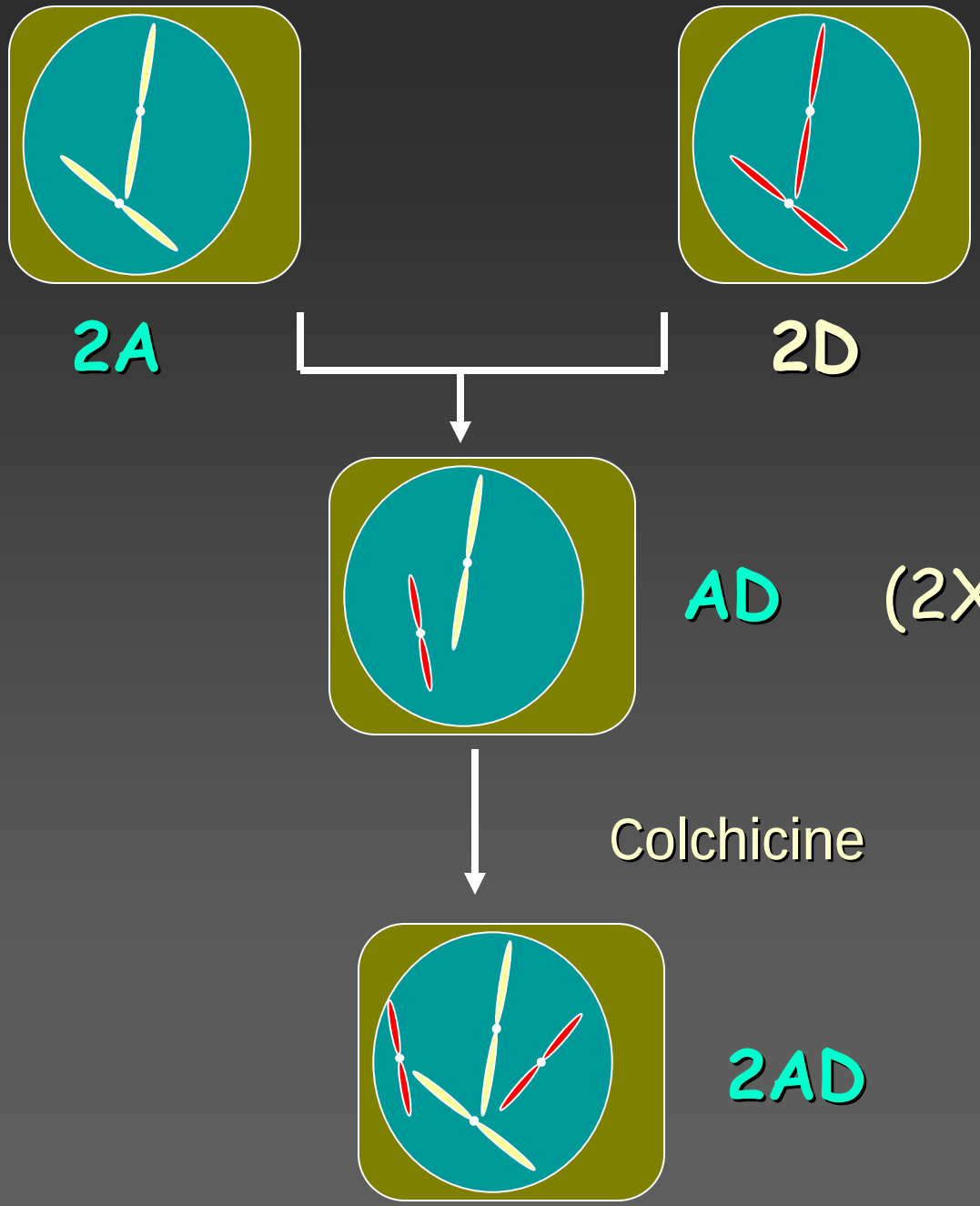
Species	Accessions
G. herbaceum	A1-24, A1-51
G. arboreum	A2-19, A2-190, A2-194
G. armourianum	D2-1
G. aridum	D4
G. raimondii	D5
G. gossypioides	D6
G. trilobum	D8

Materials and Methods

- Greenhouse
- Flowers were emasculated
- Cross pollinization

STEP 1

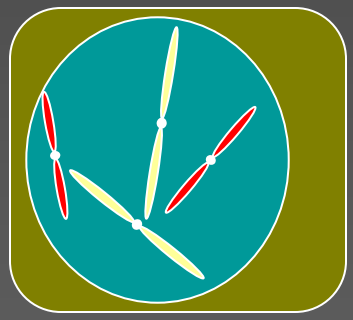
A)



B)

2A **2(ADD)***

*[(AD1)xD2-1]6X



2(AD) (4X)

Results

Pedigree	#Crosses	#Set Bolls	# Seeds	# plants	% G
A1-15 x D4	24	2	30	5	16.7
A2-190 x D5	19	2	25	1	4
A2-190 x D8	2	2	4	2	50
A2-194 x D8	9	3	7	4	57
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
TOTAL	570	34	244	12	4.9

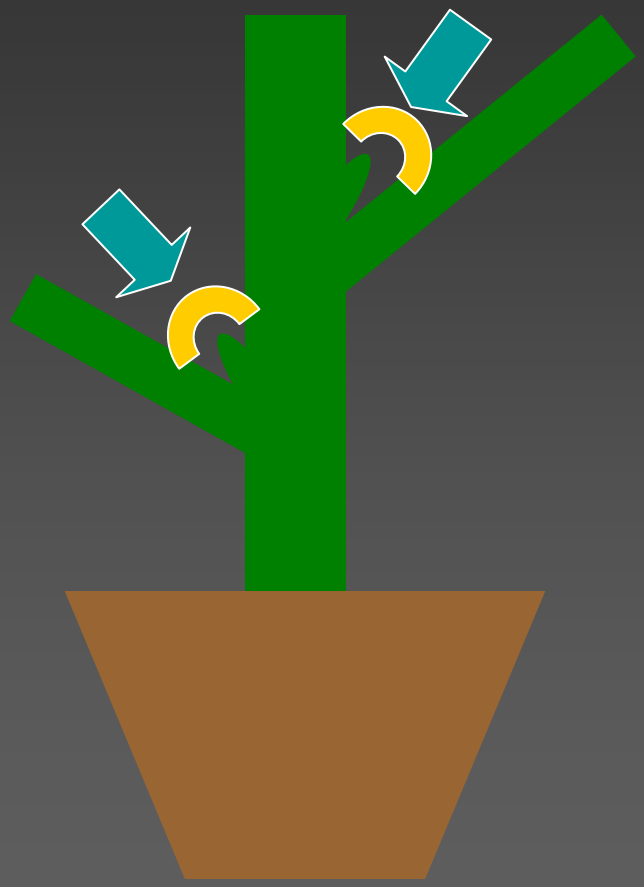
Step 2:
Double the chromosome number

PLANT MATERIAL

1. Dighe (2003):
   - A2-194xD8
   - (A2-128xA2-19)R61F2 x D4
2. Seed from step 1

- *In situ* Colchicine application

1% colchicine in lanolin



Step 3:

Cross synthetic allotetraploids with upland cotton

- Methodology:

AD1 x {2 (*A2-194* X D8)}

↓

F_1 x **AD1**

↓

BC_1

AD1= DP491, Delta Pearl

Summary (Obj. 1)

- 12 AxD diploids hybrids
- One tetraploid chimeric plant
- Two plants [AD1 x 2(AxD)]
- BC_1, BC_1F_2, and BC_2

Conclusion (Obj. 1)

- Hybridization of reniform resistant *G. arboreum* with cultivated cotton has been successfully accomplished crossing synthetic allotetraploid [2(A2-194 x D8)] with tetraploid upland cotton

Ongoing Research

- RN screening of BC_1F_2 and BC_2 populations
- Optimization of Ovule culture technique for interspecific crosses
- Chromosome doubling

Objective 2

- Determine the number and inheritance of genes conferring resistance.
- Identify molecular markers linked to RN resistance in *G. arboreum*

Materials and Methods

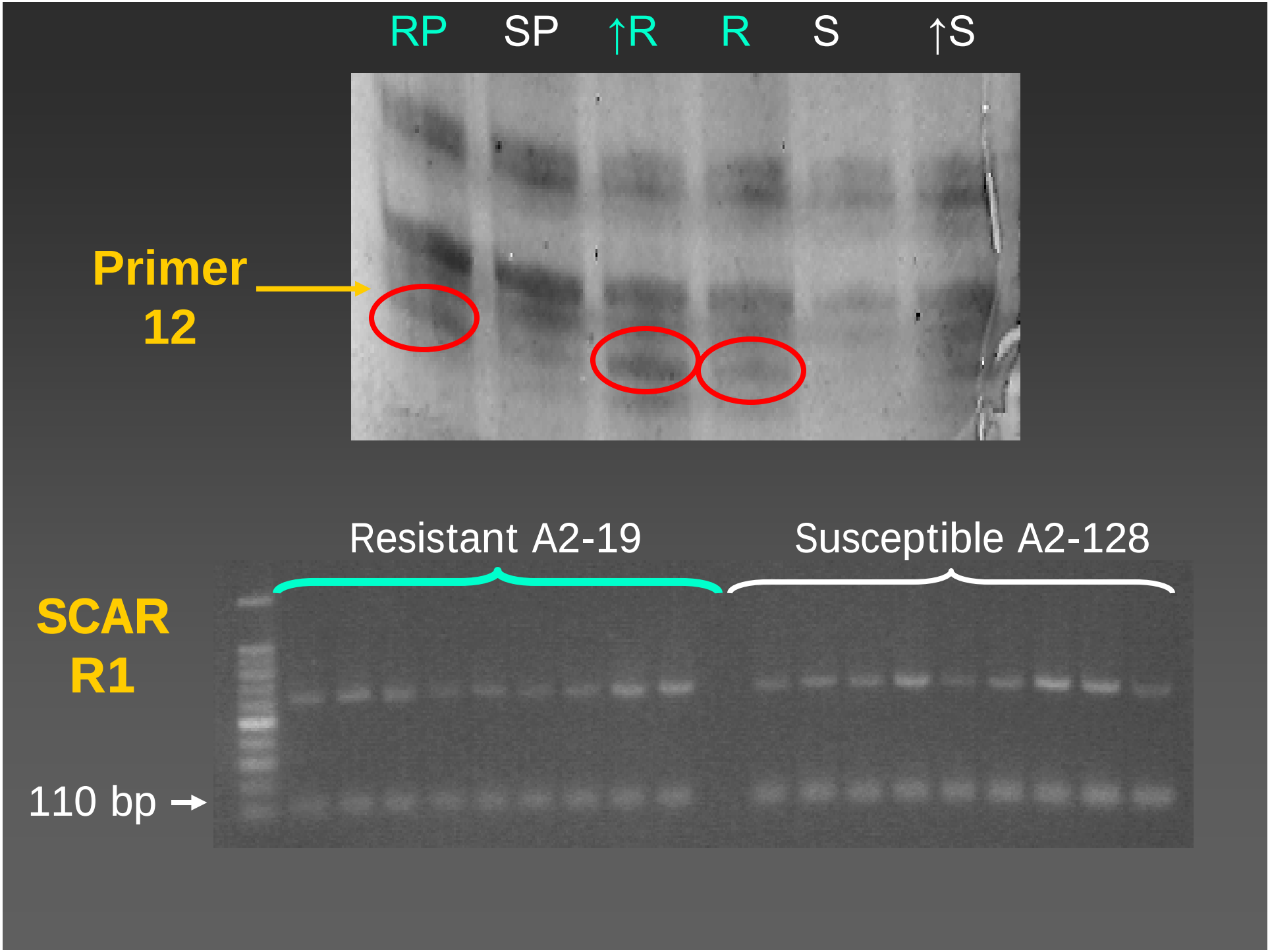
- Amplified Fragment Length Polymorphism (AFLP)
- Bulk Segregant Analysis (BSA)
- *G. arboreum* hybrid A2-128 x A2-19
- Two reniform nematode screenings

2003 RN screening

- 227 F2 (A2-128xA2-19) plants
- 25 A2-128
- 25 A2-19
- Inoculated 3300 RN/plant
- pf/pi index

DNA Bulks for AFLP

1. F2 most resistant
2. F2 most susceptible
3. F2 resistant equal to control parent
4. F2 susceptible equal to control parent
5. A2-19 resistant control parent
6. A2-128 susceptible control parent

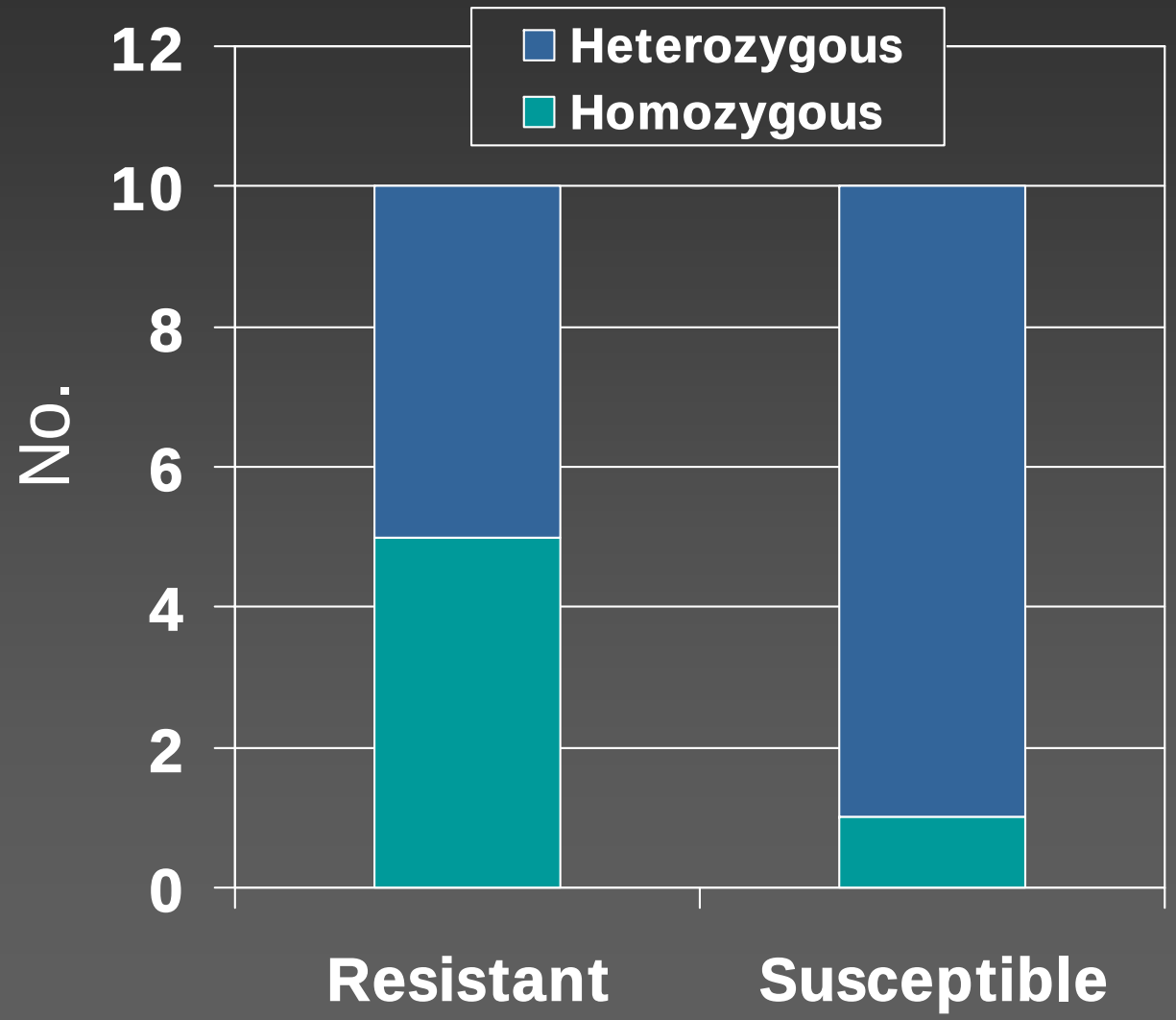

RP
SP
↑R
R
S
↑S
Primer
12
Resistant A2-19
Susceptible A2-128
SCAR
R1
110 bp

2004 RN screening

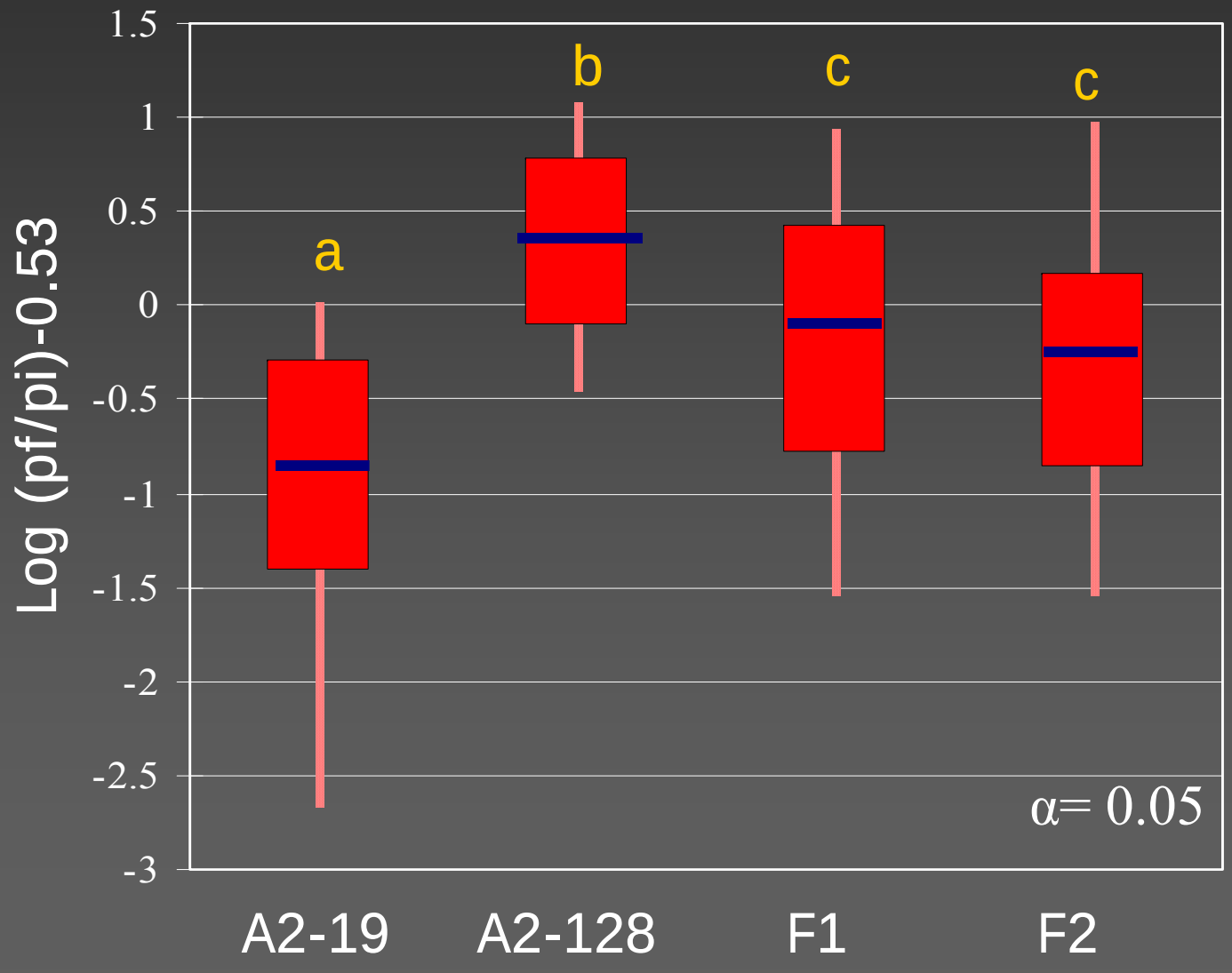
- 29 F1 (A2-128xA2-19)
- 127 F2 (A2-128xA2-19) plants
- 141 F2-3 (A2-128xA2-19)
- 31 A2-128
- 42 A2-19

- Inoculated 3300 RN/plant
- pf/pi index

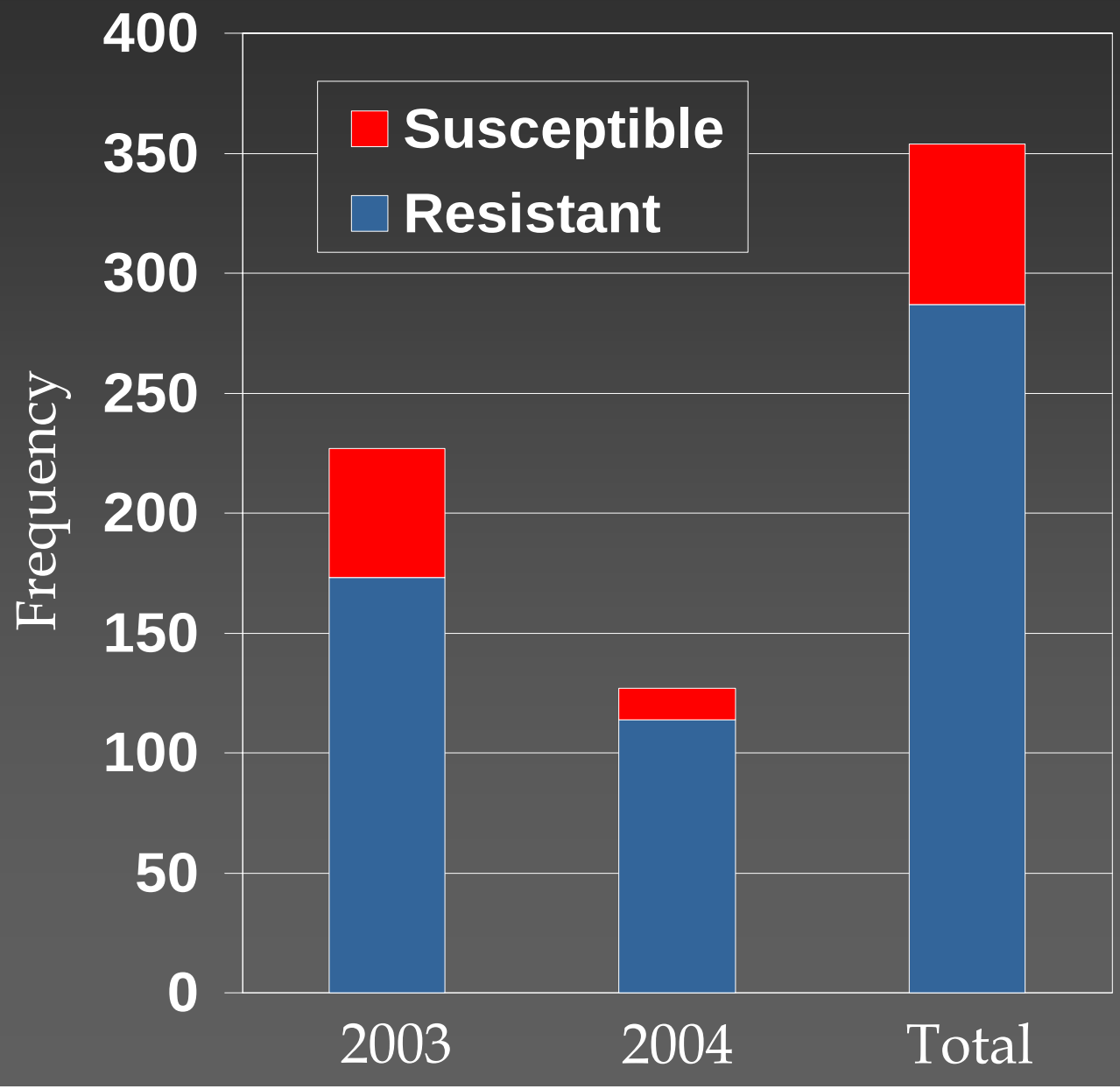
Progeny Test



Populations Distribution



F2 Resistance Segregation



Conclusions (Obj. 2)

- A single additive gene confers resistance to the reniform nematode
- A molecular marker linked to RN resistance was not found because bulks formed for AFLP were not completely homozygous for resistance and susceptibility.

Ongoing Research

- AFLP with homozygous Resistant and Susceptible bulks
- New populations for marker development:
  - A2-194 x A2-128
  - A1-51 x A2-128