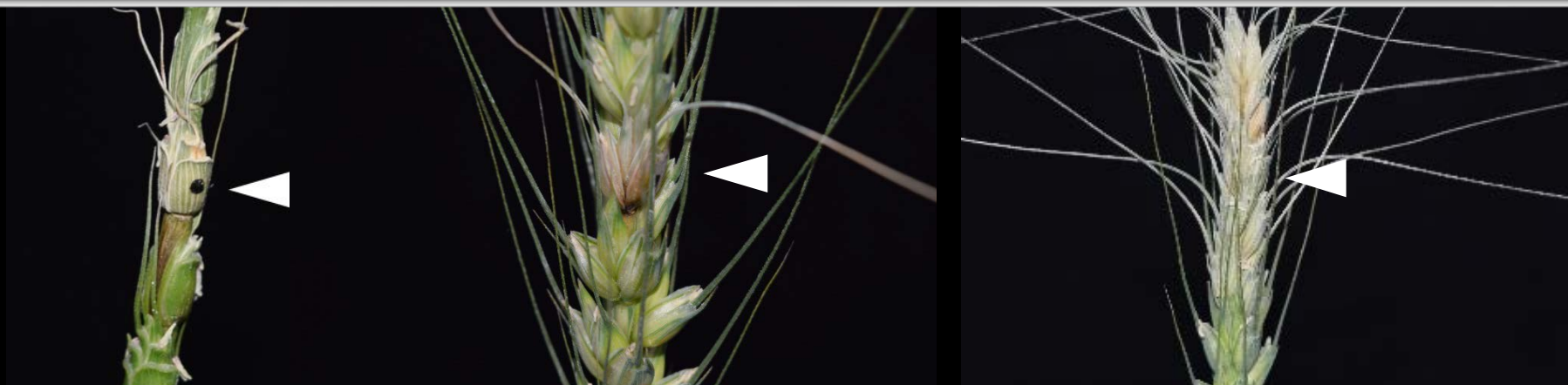


Characterization of Fusarium Head Blight Resistance in *Aegilops tauschii* and QTL Discovery in Hexaploid Wheat



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DEPARTMENT OF
PLANT, SOIL AND MICROBIAL SCIENCES

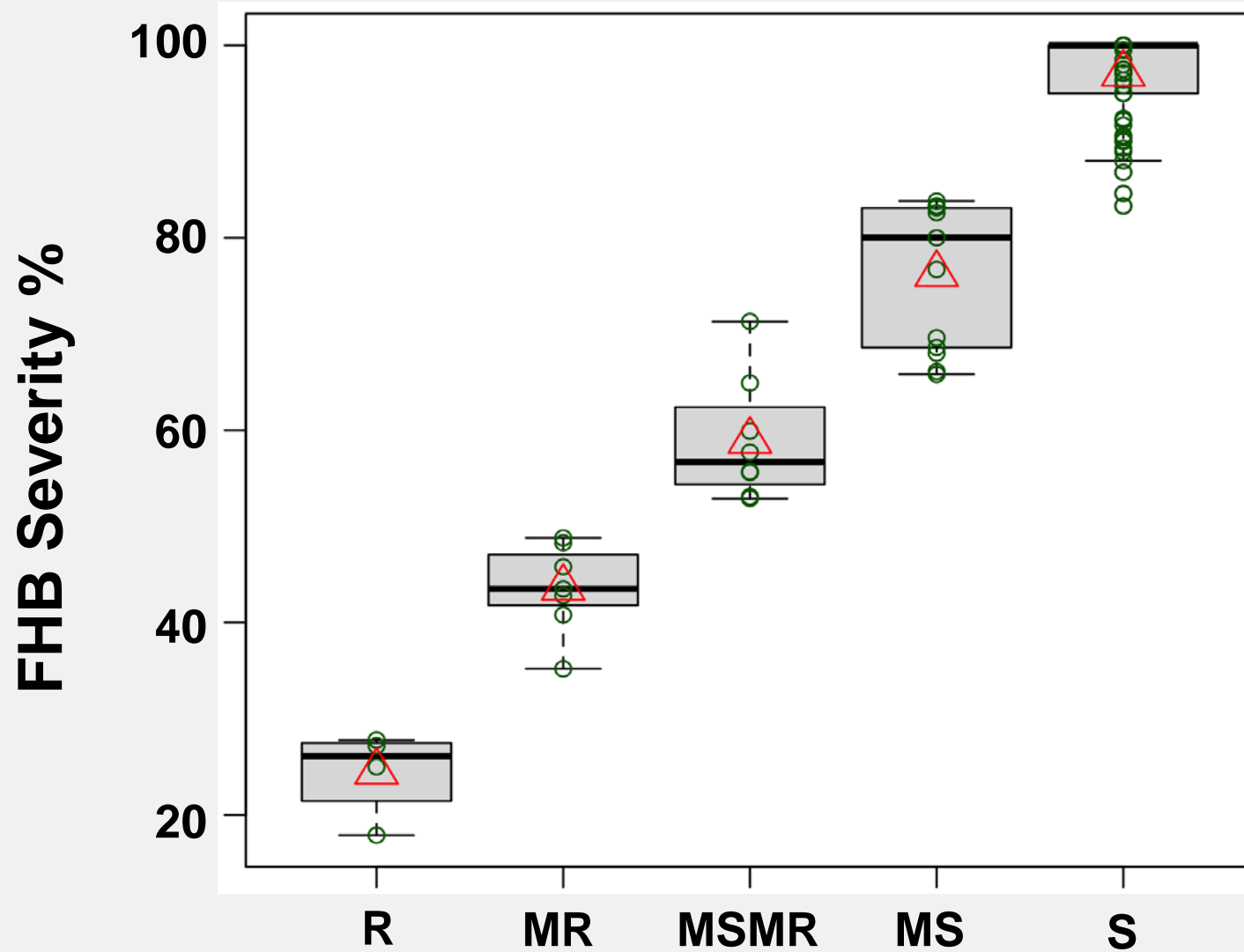
Origins of *Ae. tauschii* accessions and FHB severity

Origin	Accessions
Afghanistan	45
Azerbaijan	5
China	4
Iran	23
Kosovo	4
Pakistan	4
Russia	2
Syria	1
Tajikistan	3
Turkey	2
Turkmenistan	6
Uzbekistan	2
Unknown	7
Total	109



- Two screening experiments, Spring and Fall 2015
- 4 – 8 replications of each genotype

FHB severity across resistance classes



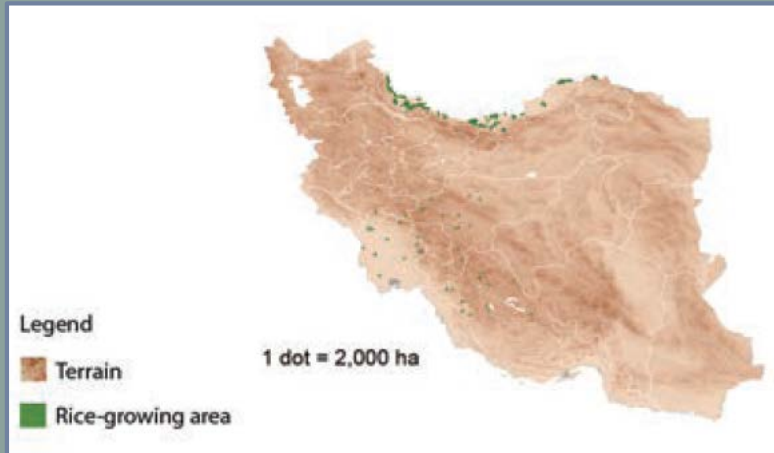
Origins of *Ae. tauschii* accessions and FHB severity

Origin	Accession	S	MS	MSMR	MR	R
	S					
Afghanistan	45	41	4	1	-	-
Azerbaijan	5	2	2	-	1	-
China	4	3	1	-	-	-
Iran	23	6	4	5	4	4
Kosovo	4	2	2	-	-	-
Pakistan	4	3	1	-	-	-
Russia	2	-	-	1	1	-
Syria	1	-	-	-	1	-
Tajikistan	3	3	-	-	-	-
Turkey	2	2	-	-	-	-
Turkmenistan	6	4	2	-	-	-
Uzbekistan	2	2	-	-	-	-
Unknown	7	4	-	2	-	1
Total	109	72	16	9	7	5

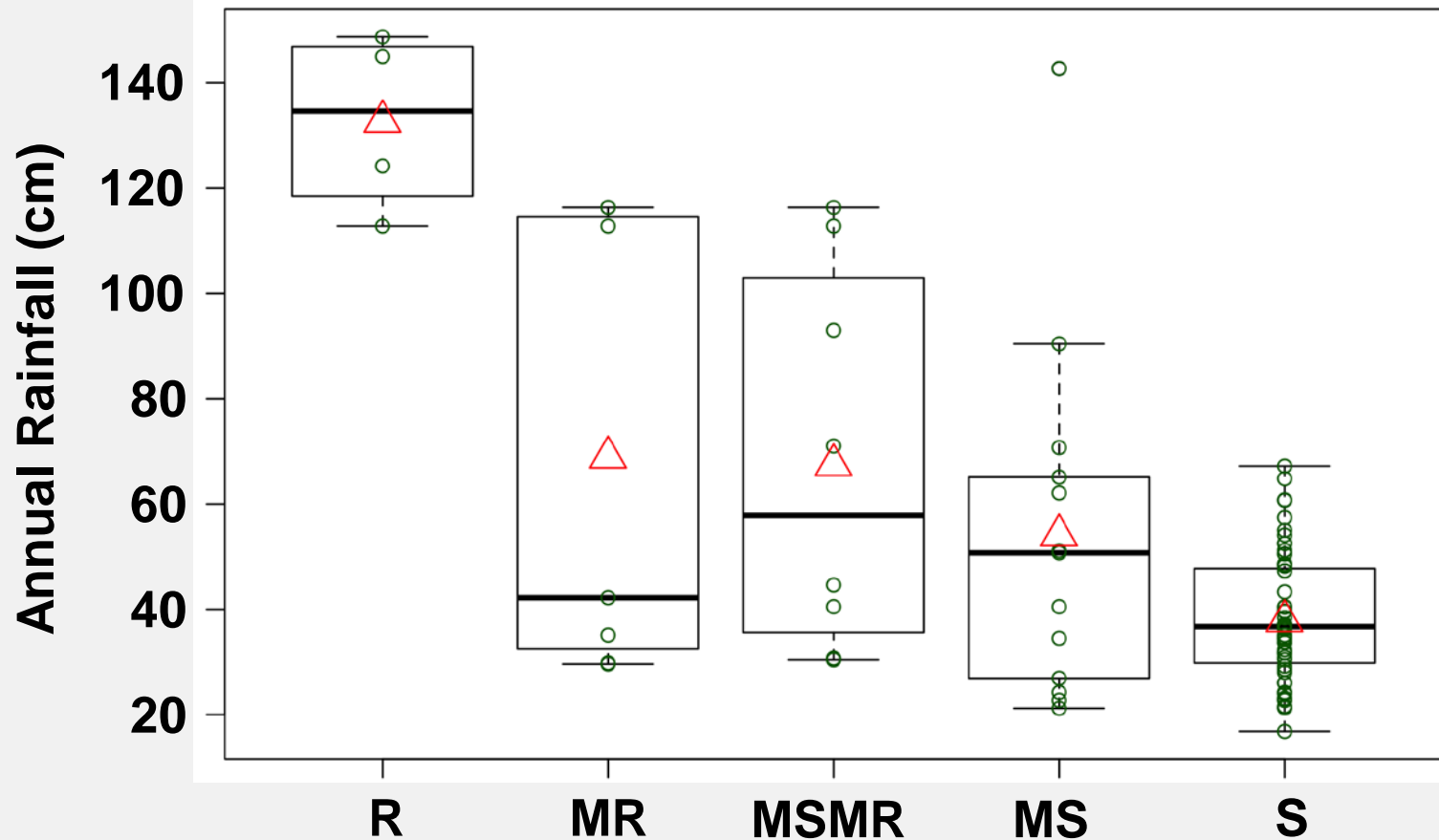
Resistant and Moderately Resistant *Ae. tauschii* accessions

Accession	Subspecies	Origin	FHB Severity (%)	Class
TA2477	<i>tauschii</i>	Iran	17.9 ± 22.0	R
TA1691	<i>tauschii</i>	unknown	19.7 ± 16.7	R
Clae 23	unknown	Iran	25.0 ± 20.4	R
TA1715	<i>tauschii</i>	Iran	27.2 ± 32.0	R
TA2478	<i>tauschii</i>	Iran	27.8 ± 21.4	R
AUS18913	<i>tauschii</i>	Iran	35.2 ± 19.7	MR
TA1662	<i>tauschii</i>	Azerbaijan	40.8 ± 37.4	MR
TA1642	<i>strangulata</i>	Iran	42.8 ± 38.6	MR
TA1599	unknown	Iran	43.5 ± 25.0	MR
TA10142	<i>tauschii</i>	Syria	45.8 ± 37.6	MR
PI 431603	unknown	Russia	48.3 ± 38.8	MR
Clae 24	unknown	Iran	48.8 ± 26.5	MR

Origins of ten *Ae. tauschii* accessions that are resistant or moderately resistant to FHB



Annual rainfall within FHB severity classes



$$r_{\text{severity, rainfall}} = -0.68$$

Differences in rainfall between FHB severity classes

Class	Rainfall	R	MR	MSMR	MS
R	132.7				
MR	68.9	63.8 ***			
MSMR	67.4	65.3 ***	1.5		
MS	54.1	78.6 ***	14.8	13.4	
S	37.8	94.9 ***	31.1 **	29.6 **	16.3

** Significant at the 0.01 level

*** Significant at the 0.001 level

Hybridizations forming hexaploid wheat



Triticum urartu
($2n=2x=14$, AA)



Triticum turgidum
($2n=4x=28$, AABB)



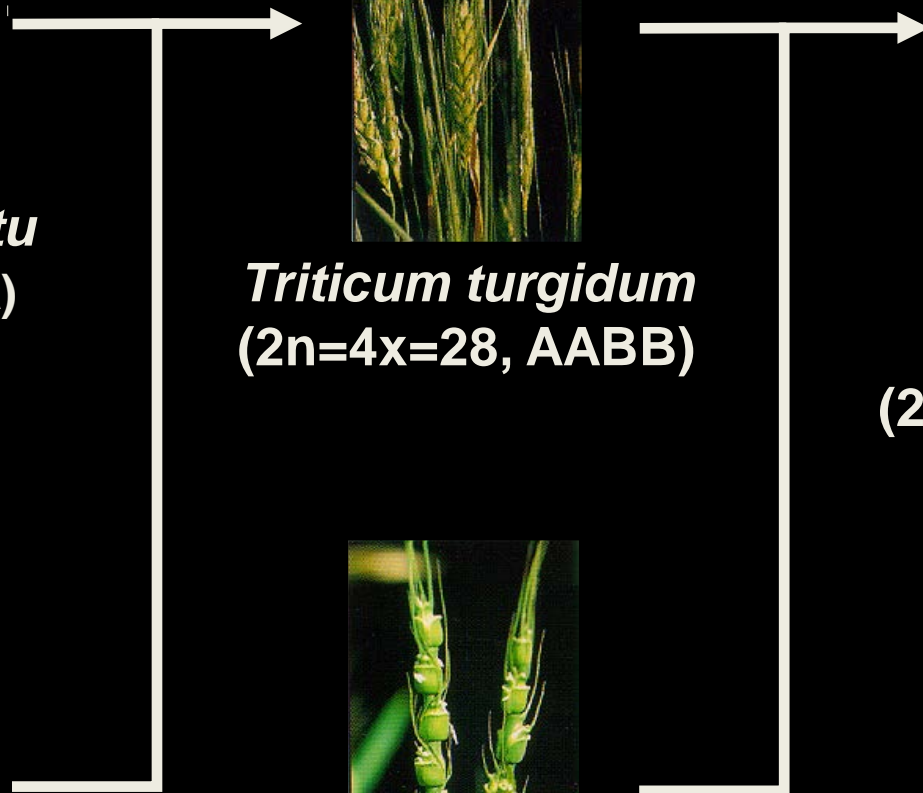
Triticum aestivum
($2n=6x=42$, AABBDD)



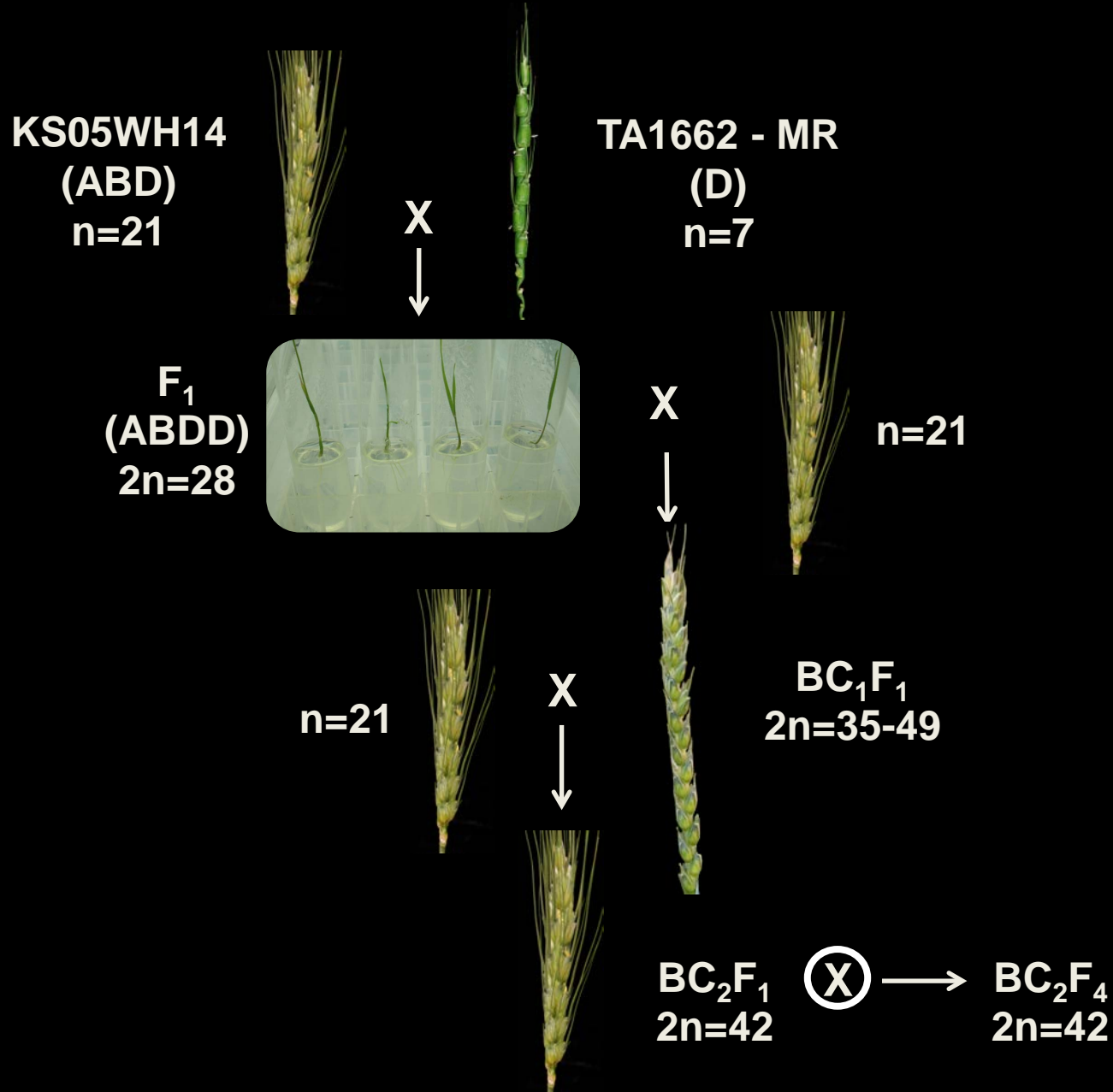
~ *Aegilops speltoides*
($2n=2x=14$, SS)



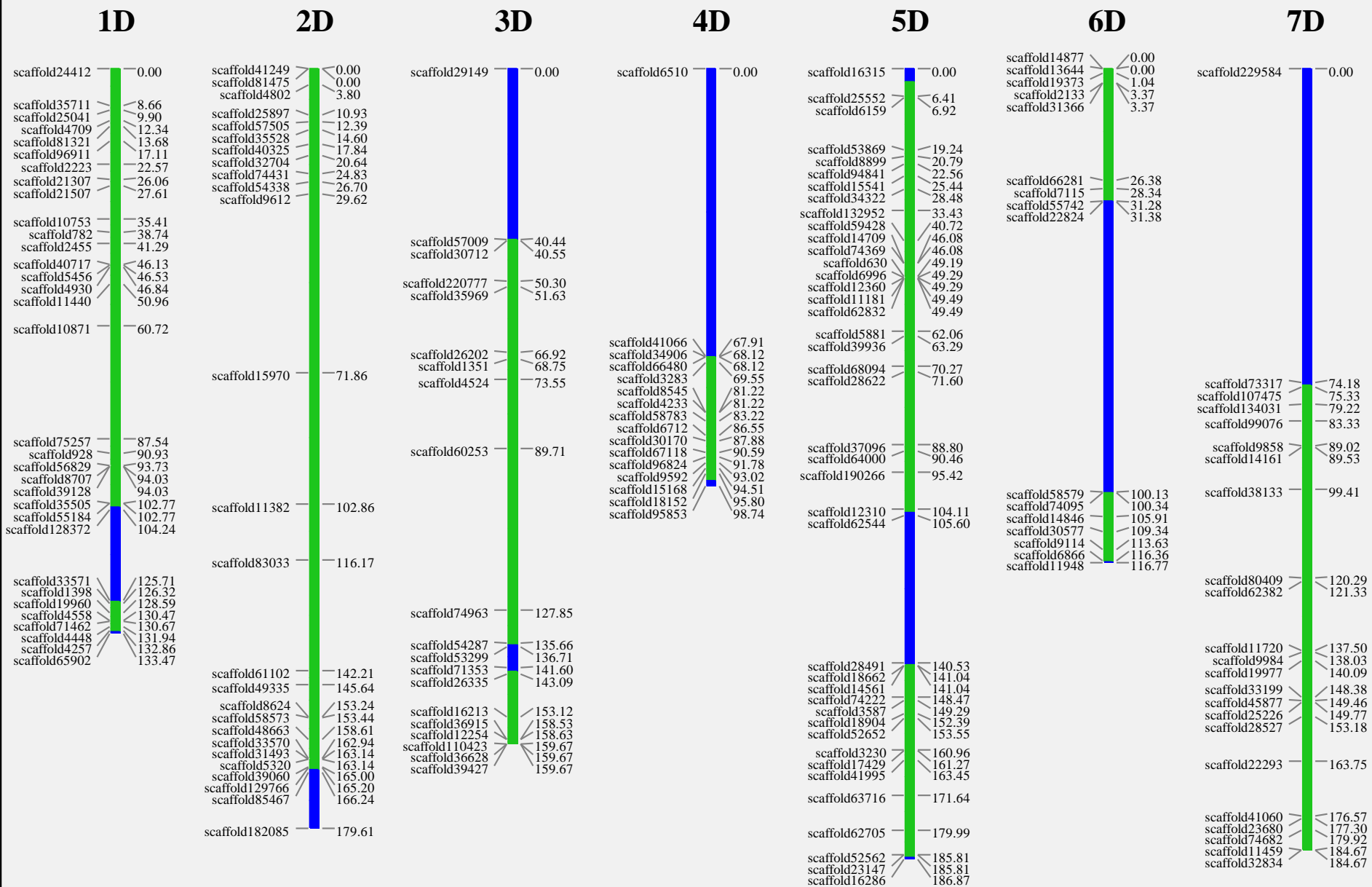
Aegilops tauschii
($2n=2x=14$, DD)



Gene transfer by direct hybridization

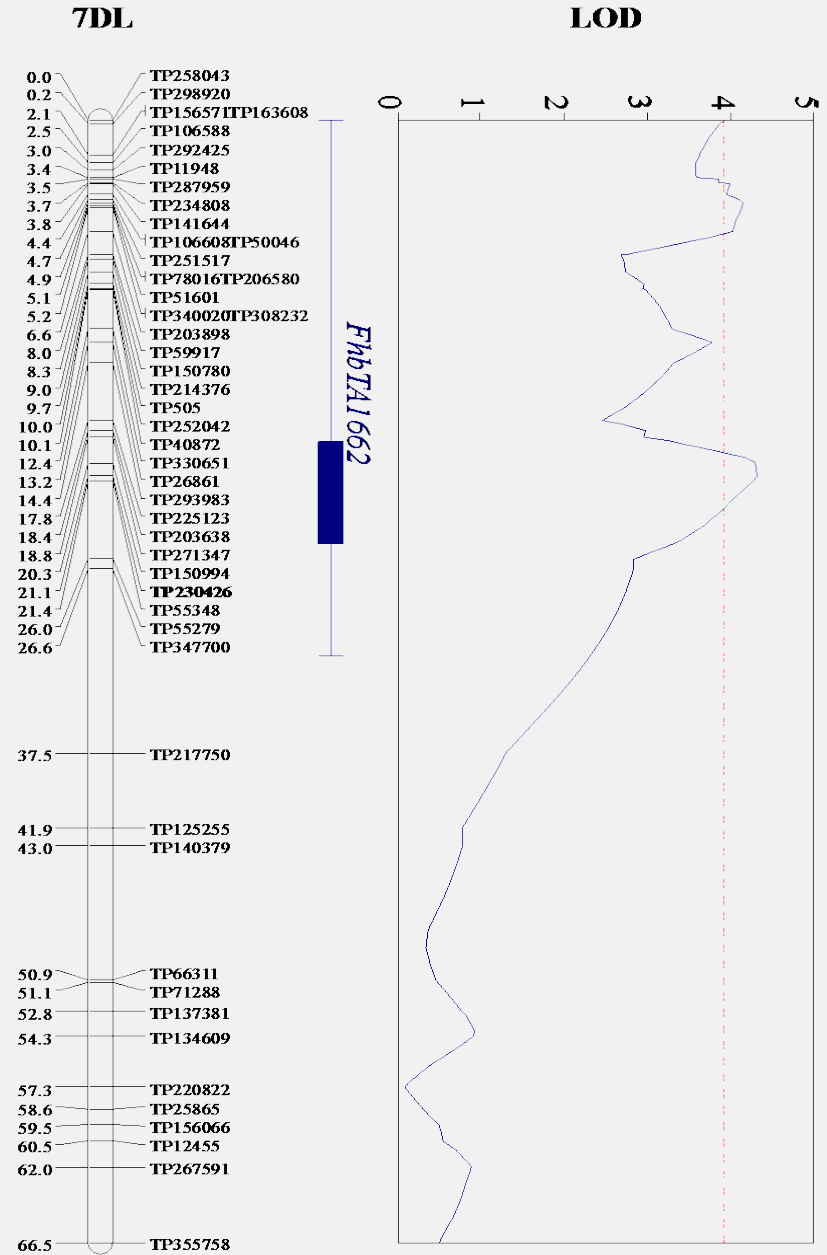
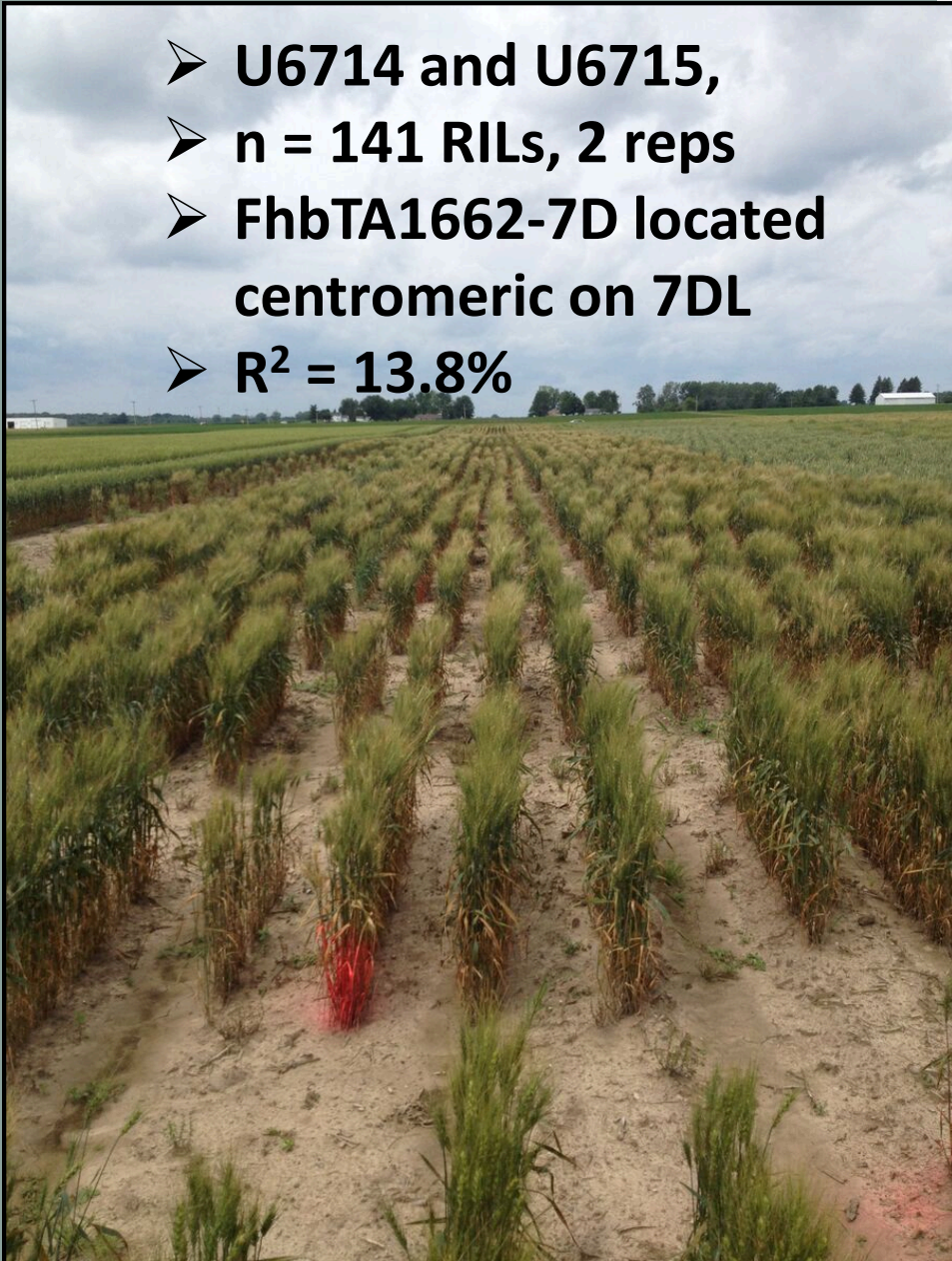


TA1662 alleles segregating in a BC₂F₄ population

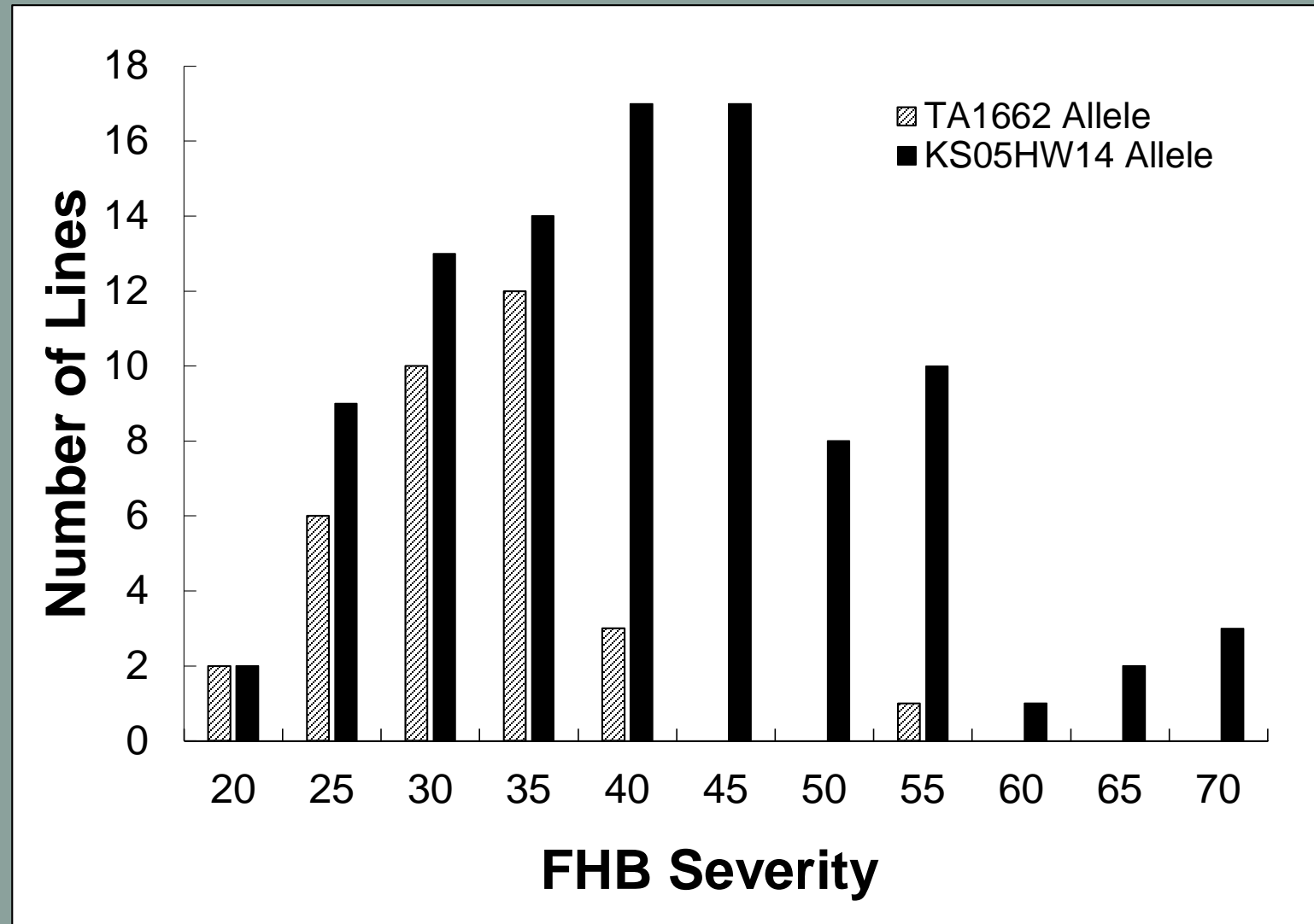


FhbTA1662-7D

- U6714 and U6715,
- n = 141 RILs, 2 reps
- FhbTA1662-7D located centromeric on 7DL
- $R^2 = 13.8\%$

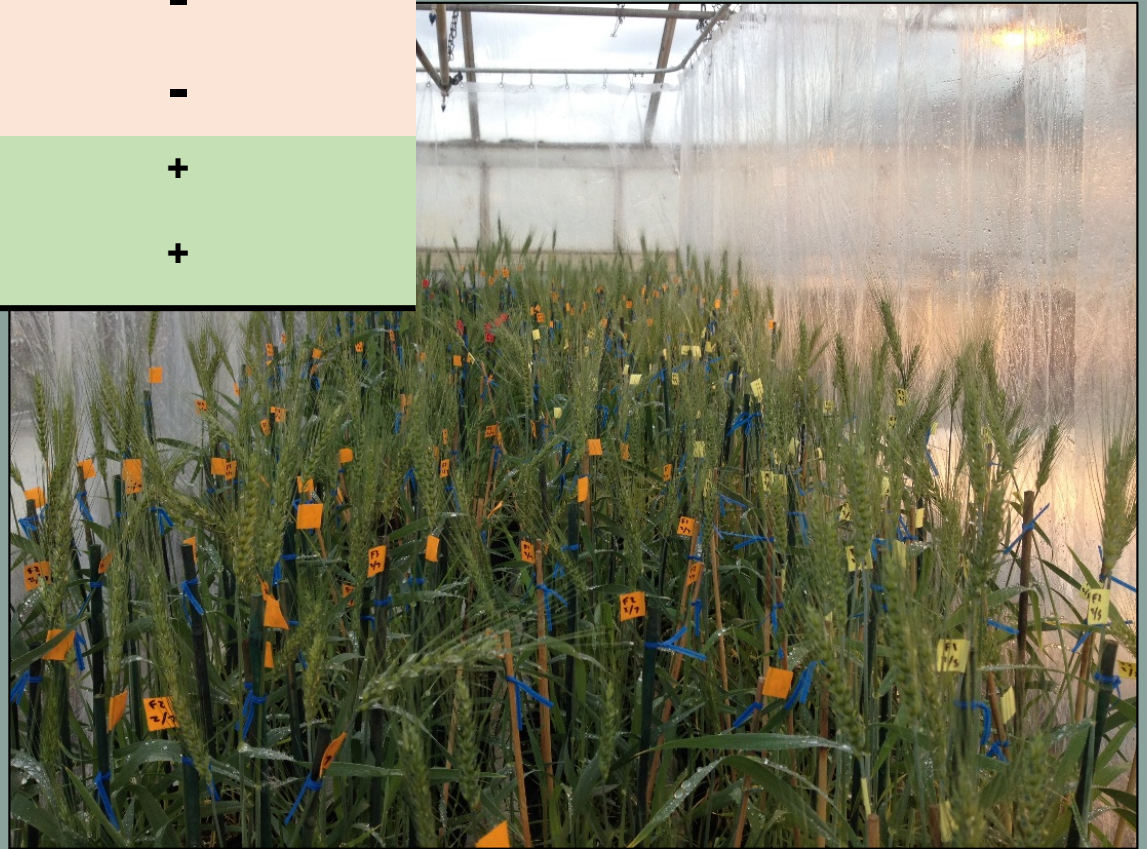


Field FHB Severity Distribution at *FhbTA1662-7D*



Single floret inoculations of *FhbTA1662-7D*

Genotype	Ploidy	<i>FhbTA1662-7D</i>
KS05HW14	6X	-
U6714-A-017	6X	-
TA1662	2X	+
U6714-B-041	6X	+

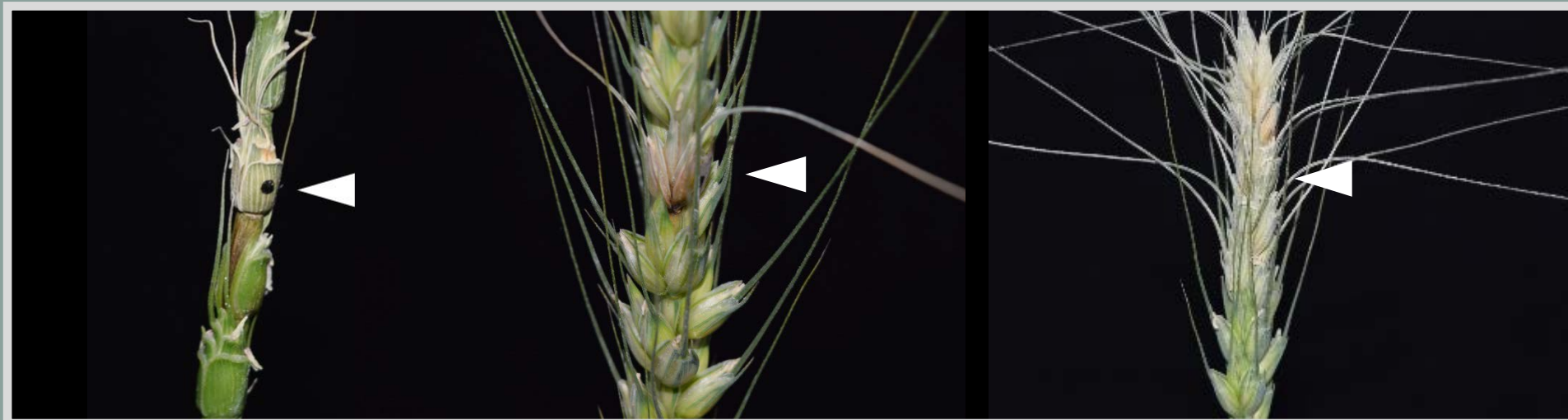


FhbTA1662-7D reduces FHB severity in single floret inoculations

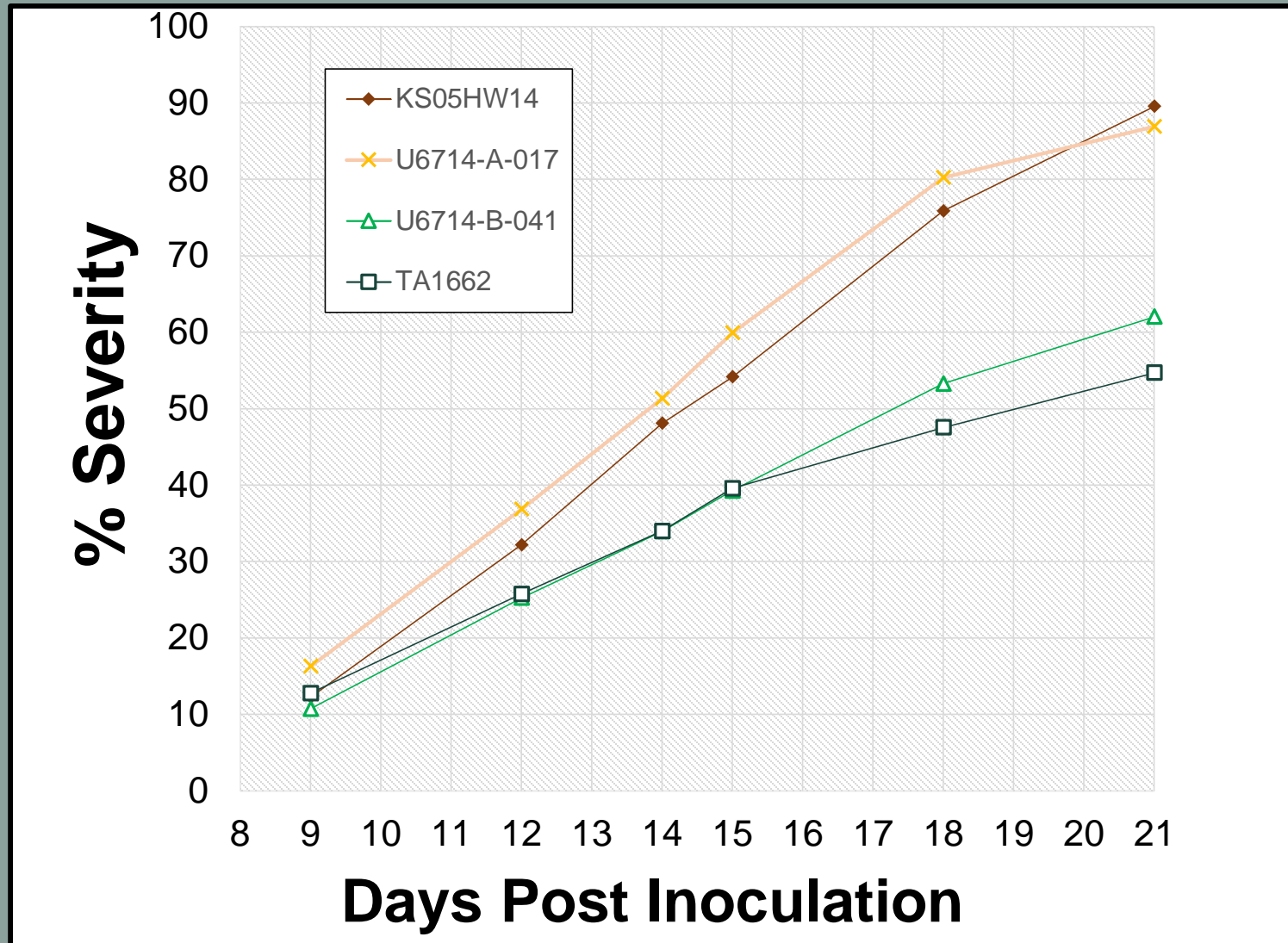
TA1662

U6714-B-041

KS05HW14



FhbTA1662-7D reduces FHB severity in single floret inoculations



FhbTA1662-7D reduces FHB severity in single floret inoculations

Genotype	Class	Severity 21 dpi †	KS05HW14	U6714-017	TA1662
KS05HW14	S	79%	-	-	-
U6714-017	S	80%	+1%	-	-
TA1662	R	45%	-34%**	-35%***	-
U6714-041	R	52%	-27%**	-28%**	+7%

† LS means for severity with inoculation date as a random effect

‡ Pairwise differences in mean percent FHB severity

** Significant at the 0.01 level

*** Significant at the 0.001 level

Conclusions and Future Directions

- **Variation for FHB resistance exists in *Ae. tauschii* germplasm**
- **Accessions from areas receiving high rainfall have higher levels of resistance**
- ***Resistance is effective in hexaploid wheat***
- **2017 phenotyping of *FHBTA1662-7D*:**
 - **Mason, MI – 3 reps – grain spawn**
 - **E. Lansing, MI – 3 reps - grain spawn***
 - **Wooster, OH – 3 reps – conidia***

Acknowledgements

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