A Novel FHB-Resistance QTL with Uncertain Origin and its Introgression into Durum and Hard Red Spring Wheat

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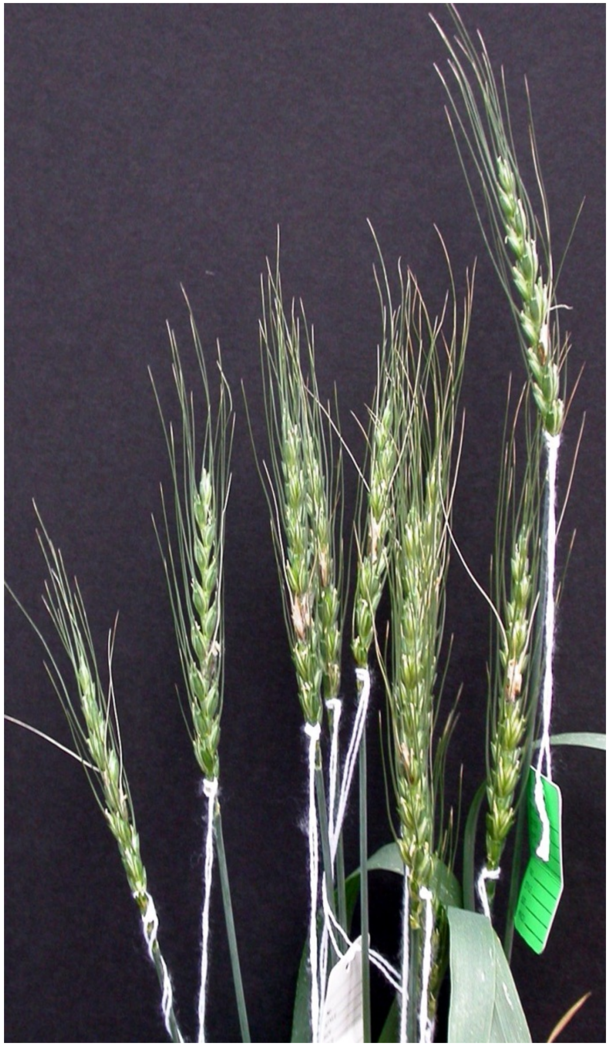
Tetraploid wheat (*Triticum turgidum* L.) germplasm collections other than durum wheat

Sub species	**No. of accessions**	
	NSGC†	**Received**
T. turgidum ssp. *carthlicum*	97	93
T. turgidum ssp. *dicoccoides*	928	880
T. turgidum ssp. *dicoccum*	620	528
T. turgidum ssp. *paleocolchicum*	4	3
T. turgidum ssp. *polonicum*	80	77
T. turgidum ssp. *turanicum*	107	79
T. turgidum ssp. *turgidum*	457	453
Total	2,293	2,113

† USDA National Small Grains Collection (http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?410371)



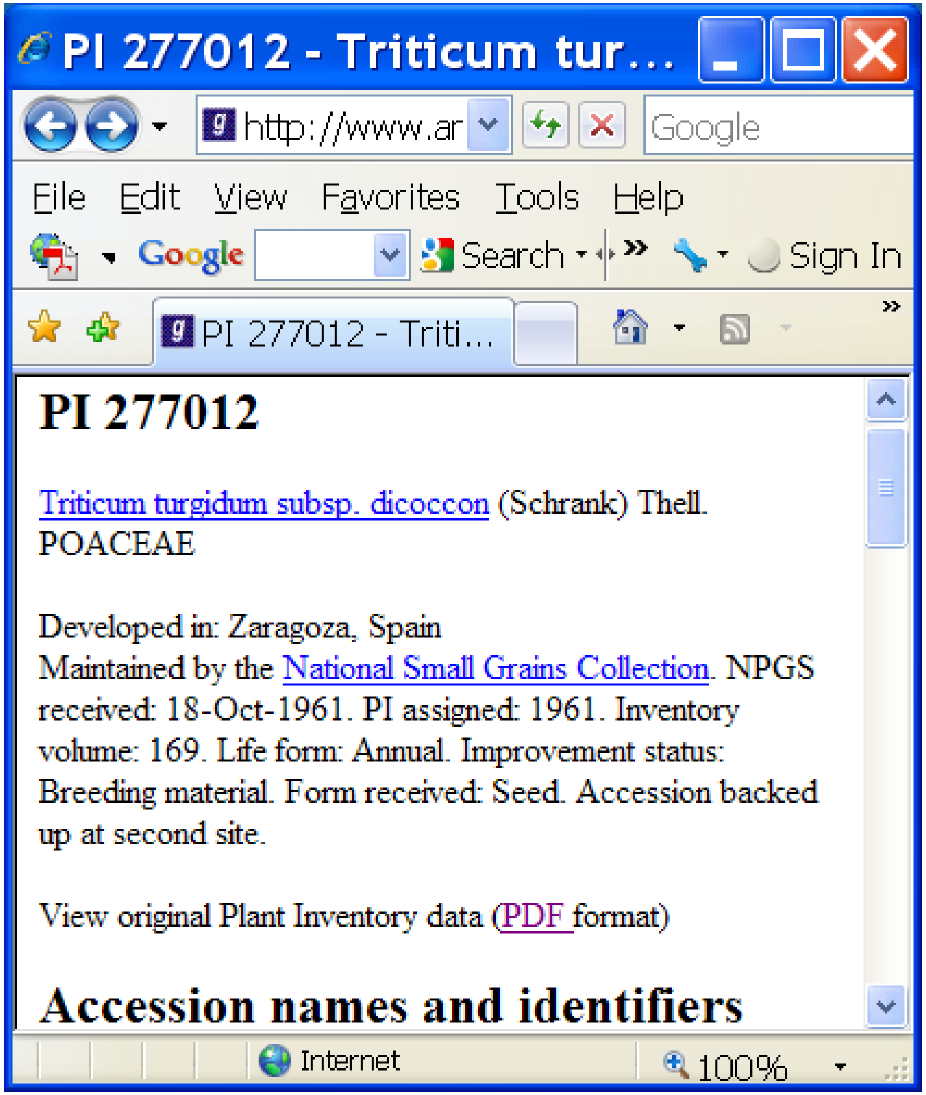
Reaction of “*T. turgidum* ssp. *dicoccum*” PI 277012 to FHB in greenhouse, 2008

Field Evaluation (Fargo, ND, 2010)

PI 277012

Sumai 3

Grandin



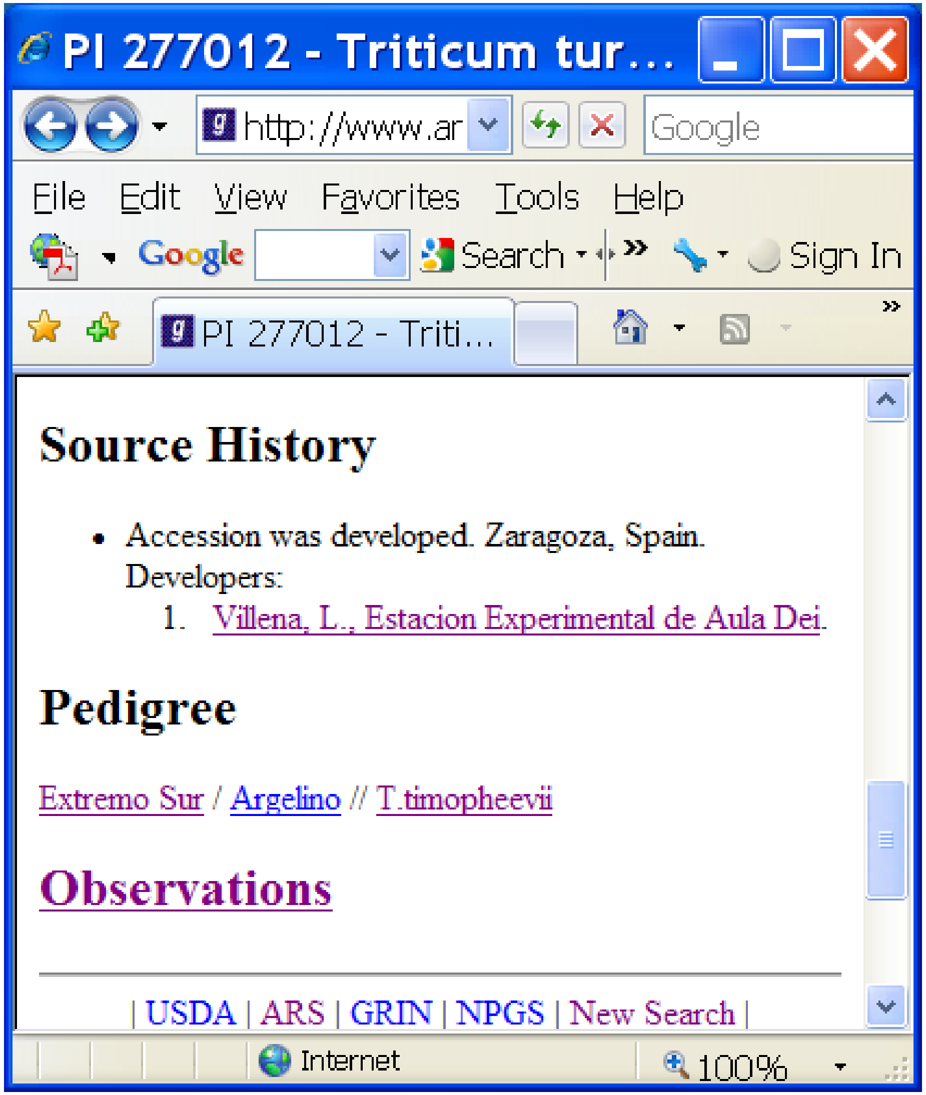
PI 277012

Triticum turgidum subsp. dicoccon (Schrank) Thell.
POACEAE

Developed in: Zaragoza, Spain
Maintained by the National Small Grains Collection. NPGS received: 18-Oct-1961. PI assigned: 1961. Inventory volume: 169. Life form: Annual. Improvement status: Breeding material. Form received: Seed. Accession backed up at second site.

View original Plant Inventory data (PDF format)

Accession names and identifiers



Source History

- Accession was developed. Zaragoza, Spain.
  Developers:
  1. Villena, L., Estacion Experimental de Aula Dei.

Pedigree

Extremo Sur / Argelino // T.timopheevii

Observations

| USDA | ARS | GRIN | NPGS | New Search |

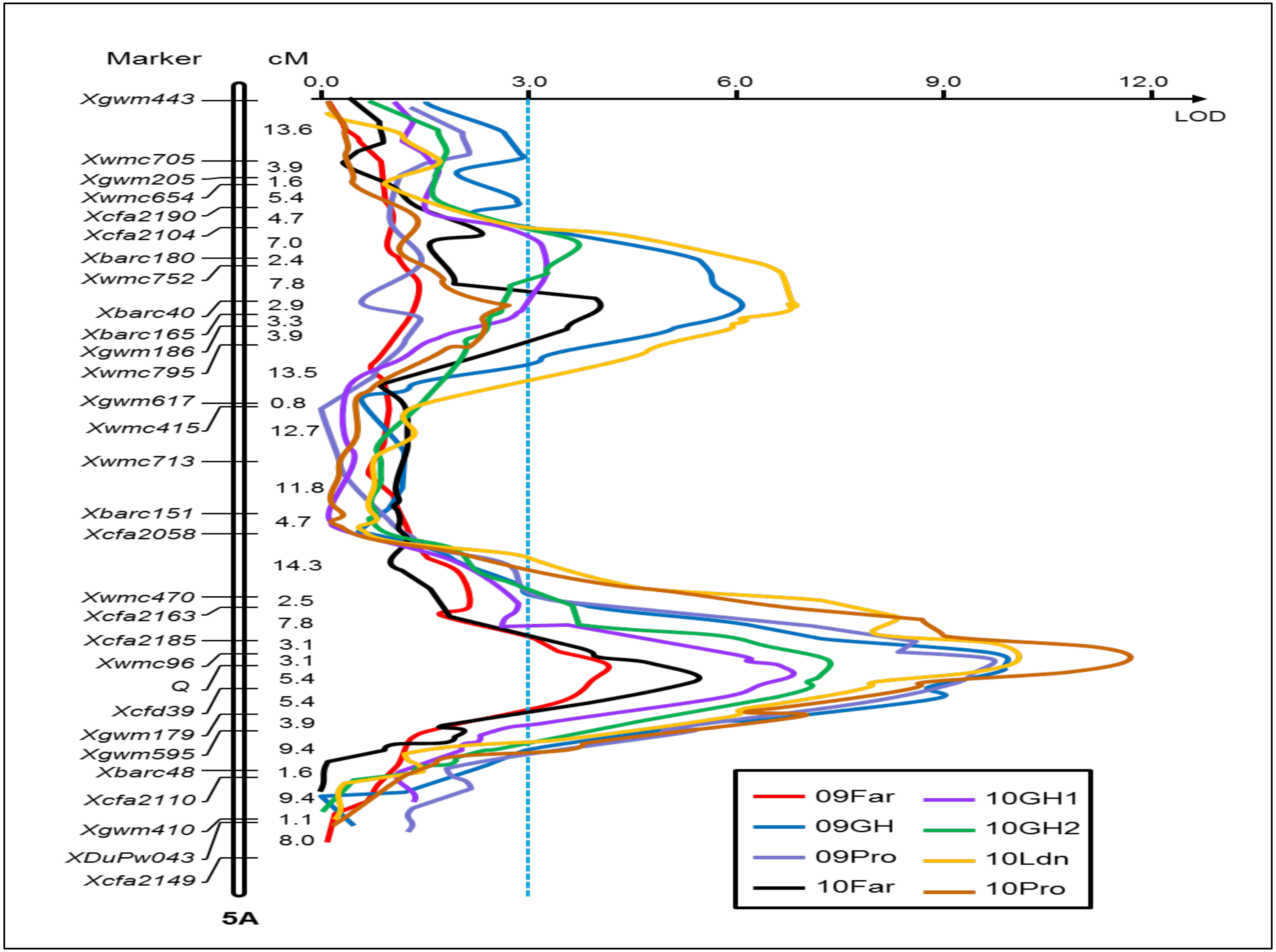
Spike morphology of *T. turgidum* ssp. *dicoccum*

PI 298578 PI 254189 PI 355474 PI 190932 PI 276000 PI 352361 PI 276021 PI 330544 PI 352341

PI 355472 PI 355471 PI 277012

PI 277012 - Cytogenetic and genetic characteristics

- Somatic chromosome count: $2n = 42$
- HMW glutenin subunits: 1Dx2+1Dy12
- Chromosome pairing in F_1 hybrid with hard red spring wheat ‘Grandin’: 0.03 IV + 16.97 II (ring) + 3.34 II (rod) + 1.38 I (29 cells)
- Genomic *in situ* hybridization: *T. timopheevii* G-genome chromosome or large segments were not detected.
- Haplotype analysis: Not carry *Fhb1*



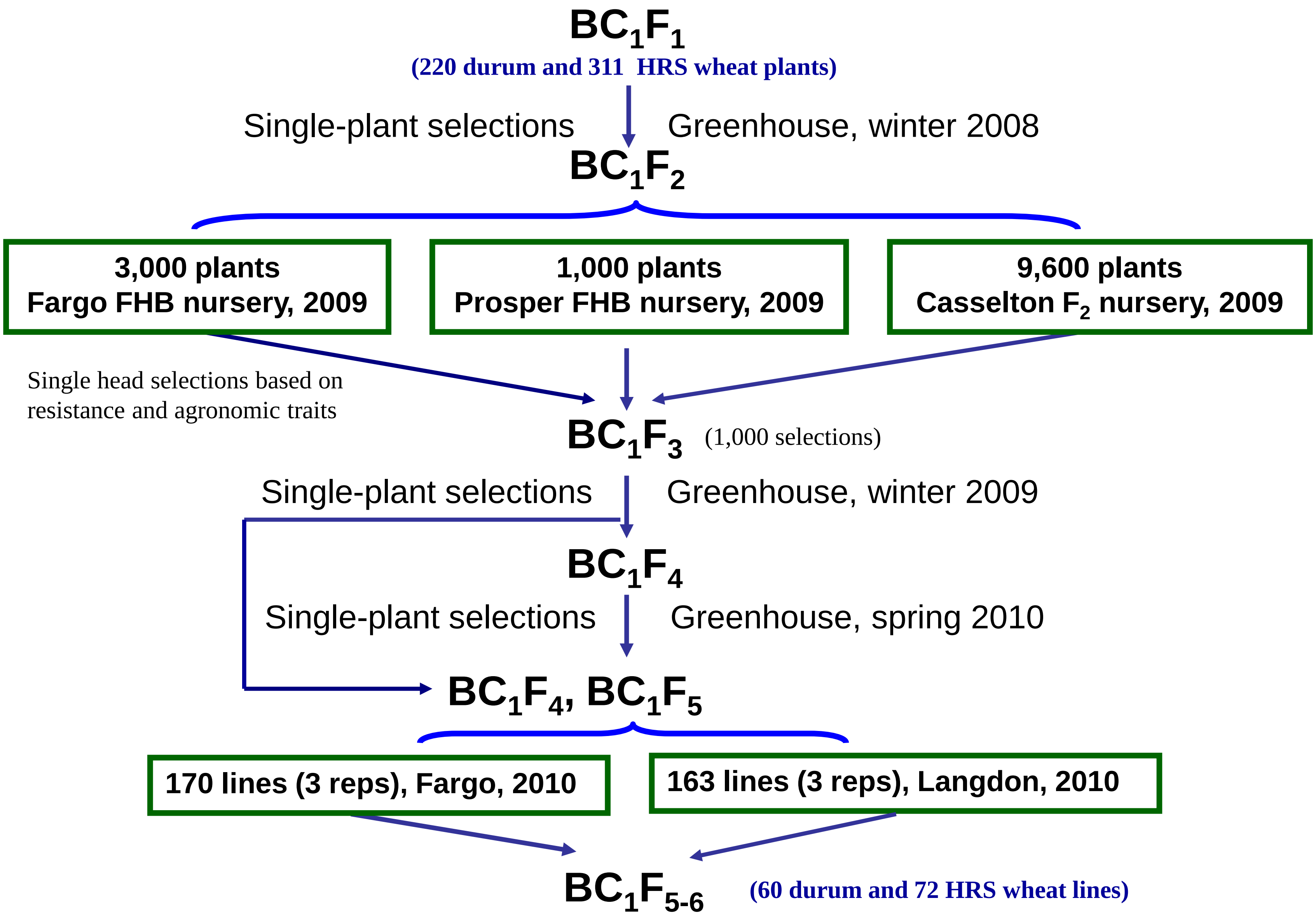
Two FHB resistance QTLs identified on chromosome 5AS and 5AL based on 130 doubled haploids from the cross between PI 277012 and 'Grandin'.

Double haploid (DH) and backcross populations from crosses between PI277012 and hard red spring (HRS) wheat cultivars

Pedigree	Generation	No. of plants
Grandin/PI277012//Grandin	BC_1F_1	69
Glenn/PI277012//Howard	F_1	50
Reeder/PI277012//Reeder	BC_1F_1	66
Reeder/PI277012//Russ	F_1	15
Russ/PI277012//Russ	BC_1F_1	111
Total		311

Backcrosses and three-way crosses between PI277012 and ND durum wheat cultivars

Pedigree	Generation	No. of Plants
Ben/PI 277012//Ben	BC_1F_1	34
Ben/PI 277012//Maier	F_1	11
Divide/PI 277012//Divide	BC_1F_1	39
Divide/PI 277012//Ben	F_1	10
Lebsock/PI 277012//Lebsock	BC_1F_1	42
Lebsock/PI 277012//Ben	F_1	13
Mountrail/PI 277012//Alkabo	F_1	14
Mountrail/PI 277012//Ben	F_1	9
Mountrail/PI 277012//Divide	F_1	11
Mountrail/PI 277012//Maier	F_1	15
Mountrail/PI 277012//Lebsock	F_1	22
Total		220



BC_1F_1

(220 durum and 311 HRS wheat plants)

Single-plant selections

Greenhouse, winter 2008

BC_1F_2

3,000 plants
Fargo FHB nursery, 2009

1,000 plants
Prosper FHB nursery, 2009

9,600 plants
Casselton F_2 nursery, 2009

Single head selections based on resistance and agronomic traits

BC_1F_3 (1,000 selections)

Single-plant selections

Greenhouse, winter 2009

BC_1F_4

Single-plant selections

Greenhouse, spring 2010

BC_1F_4, BC_1F_5

170 lines (3 reps), Fargo, 2010

163 lines (3 reps), Langdon, 2010

BC_1F_{5-6} (60 durum and 72 HRS wheat lines)

(Marker genotyping, disease evaluations, 2nd round introgression, winter 2010)

Introgression of FHB resistance from PI 277012 to durum and spring wheat

Reeder/P12//Reeder (BC$_1$F$_5$) Russ/P12//Russ (BC$_1$F$_5$)

Divide/P12//Divide (BC$_1$F$_3$)

Russ/PI 277012//Russ (BC$_1$F$_5$)

Russ

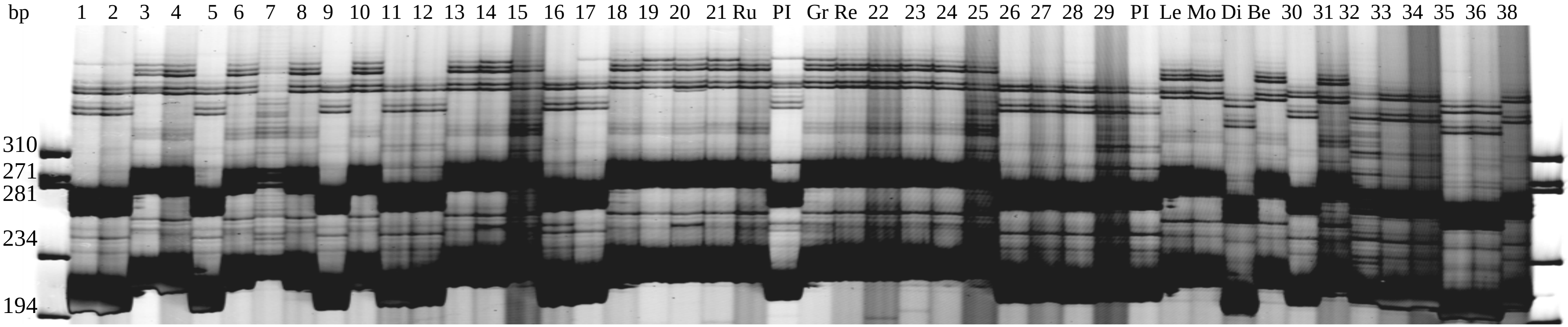
Mountrail/PI 277012//Divide (F_4)

Divide

Markers analyzed in BC_1F_{5-6} lines from backcrosses of PI 277012 (PI) with durum wheat (DW) and HRS wheat (SW) cultivars.

Line No.	1	2	3	4	5	6	9	10	11	12	13	14	16	17	18	19	20	21	26	28	29	30	27	32	33	34	38	PI	SW	DW
Xgwm129	2	1	2	1	1	2	1	2	1	1	2	2	1	1	2	1	2	2	2	2	2	0	1	1	1	2	1	0	2	2
Xwmc752	2	1	2	1	1	2	1	2	1	1	2	2	1	1	2	1	2	2	2	1	1	1	1	1	1	2	1	1	2	2
Xbarc40	1	1	2	2	1	2	1	2	1	1	2	2	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2
Xbarc165	1	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2
Xwmc795	1	h	h	h	h	h	1	h	h	1	h	h	h	h	h	h	h	0	1	1	1	1	1	1	1	1	1	1	2	2
Xcfa2185	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	1	2	2	h	h	2	2	2	2	1	2	2
Xgwm96	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	2	1	2	2
Xcfd39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	2	2	2	1	2	2
Xgwm179	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	h	2	1	1	1	2	2	0	2	1	2	2

Xbarc40



1-21: Russ/PI//Russ (BC_1F_6); Ru: Russ; P: PI 277012 (PI); Gr: Grandin; Re: Reeder; 22-23: Grandin/PI//Grandin (BC_1F_6); 24-26 and 28-30: Reeder/PI//Reeder (BC_1F_6); Le: Lebsock; Mo: Mountrail; Di, Divide; Be: Ben; 27and 32-34: Lebsock/PI//Lebsock (BC_1F_5); 35-36: Mountrail/PI//Divide (BC_1F_5); 38: Ben/PI//Ben BC_1F_5).

Current Work and Future Plans

- The durum line and five HRS wheat lines with both 5AS and 5AL QTLs will be further improved for agronomic performance by 2nd round of introgression by one more backcross with cultivars.
- These lines will be supplied to U.S. durum and wheat breeding programs. A small amount of seed samples will be available by February, 2011.
- The 5AS and 5AL QTLs in HRS wheat lines will be pyramided with *Fhb1* and other two QTLs mapped on 5A from *T. monococum* and *T. timopheevii.*
- The 5AS and 5AL QTLs in durum will be pyramided with *Fhb1* and three mapped QTLs (3AS, 6BS and 7AL) derived from wild emmer (3AS, 6BS and 7AL).
- Saturation mapping of chromosomal interval harboring 5AL QTL.

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