

Online Resource 1

Article title: Genetic mapping of the common and dwarf bunt resistance gene *Bt12* descending from the wheat landrace PI119333

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Table S1 Wheat genotypes used for KASP marker validation

Genotype Name	Category	Origin
Selection 2092	<i>Bt1</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
Selection 1102	<i>Bt2</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
Ridit	<i>Bt3</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
CI 1558B	<i>Bt4</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
Hohenheimer	<i>Bt5</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
Rio	<i>Bt6</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
Selection 50077	<i>Bt7</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
M82-2161	<i>Bt8</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
M90-387	<i>Bt9</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
M82-2102	<i>Bt10</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
M82-2123	<i>Bt11</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
Thule III	<i>Bt13</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
PI 119333 ¹	<i>Bt12</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
PI 173437	<i>PtP</i> bunt differential line	Blair Goates, USDA, Aberdeen, Idaho, USA
Rainer ²	Cultivar	Saatzucht Donau, Austria
Pannonikus ²	Cultivar	Saatzucht Donau, Austria
Midas ²	Cultivar	Saatzucht Donau, Austria
Adamus	Cultivar	KWS Lochow, Germany
Adesso	Cultivar	Saatzucht Donau, Austria
Alessio	Cultivar	Saatzucht Donau, Austria
Alicantus	Cultivar	Saatzucht Donau, Austria
Amicus	Cultivar	Saatzucht Donau, Austria
Annie	Cultivar	Selgen a.s., Czech Republic
Arminius	Cultivar	Saatzucht Donau, Austria
Arnold	Cultivar	Saatzucht Donau, Austria
Aurelius	Cultivar	Saatzucht Donau, Austria
Bernstein	Cultivar	Syngenta, Germany
Bill	Cultivar	Nordsaat, Germany
Blizzard	Cultivar	University Idaho, USA
Blasius	Cultivar	Saatzucht Donau, Austria
Bonneville	Cultivar	University Idaho, USA
Bruehl	Cultivar	Washington State University, USA
Capo	Cultivar	Probstdorfer Saatzucht, Austria
Christoph	Cultivar	Saatzucht Donau, Austria
DW-Red	Cultivar	University Idaho, USA
Ehogold	Cultivar	Saatzucht Edelhof, Austria
Estevan	Cultivar	Saatzucht Edelhof, Austria
Genius	Cultivar	Nordsaat, Germany
Globus	Cultivar	Nordsaat, Germany

Golden Spike	Cultivar	Utah State University, USA
Lewjain	Cultivar	Washington State University, USA
Lukullus	Cultivar	Saatzucht Donau, Austria
Mirastar	Cultivar	Saatzucht Donau, Austria
Mulan	Cultivar	Nordsaat, Germany
Quebon	Cultivar	Nordsaat, Germany
Tillexus	Cultivar	Saatzucht Donau, Austria
Tilliko	Cultivar	Getreidezüchtungsforschung Darzau, Germany
Tillstop	Cultivar	Saatzucht Donau, Austria
Tobias	Cultivar	Saatzucht Donau, Austria
Tommi	Cultivar	Nordsaat, Germany
Viki	Cultivar	InterSaatzucht GmbH, Germany
Weston	Cultivar	University Idaho, USA
PI 178383	Gene bank accession	USDA Genebank Aberdeen, Idaho, USA
PI 362695	Gene bank accession	USDA Genebank Aberdeen, Idaho, USA
PI 560795	Gene bank accession	USDA Genebank Aberdeen, Idaho, USA
PI 636156	Gene bank accession	USDA Genebank Aberdeen, Idaho, USA
PI 636165	Gene bank accession	USDA Genebank Aberdeen, Idaho, USA
PI 636170	Gene bank accession	USDA Genebank Aberdeen, Idaho, USA
PI 166910	Gene bank accession	USDA Genebank Aberdeen, Idaho, USA
1314.3.11_P1	Experimental line	BOKU, Austria
1325.1.10_P1	Experimental line	BOKU, Austria
1351.5.10_P2	Experimental line	BOKU, Austria
20568.1.2	Experimental line	BOKU, Austria
20812-2-2	Experimental line	BOKU, Austria
702-1102C	Experimental line	Nordic Seed, Denmark
W10.115.4.2.9	Experimental line	BOKU, Austria
W10.193.1.1.9	Experimental line	BOKU, Austria
W12.207.2.3.9	Experimental line	BOKU, Austria
W6.175.2.5.9	Experimental line	BOKU, Austria

¹ resistance donor of mapping and validation populations

² susceptible parent of mapping or validation populations

Table S2 Disease reaction of common bunt and dwarf bunt spore mixtures used for artificial inoculation of bunt differential lines *Bt1* to *Bt13* and *BtP*

	<i>Bt1</i>	<i>Bt2</i>	<i>Bt3</i>	<i>Bt4</i>	<i>Bt5</i>	<i>Bt6</i>	<i>Bt7</i>	<i>Bt8</i>	<i>Bt9</i>	<i>Bt10</i>	<i>Bt11</i>	<i>Bt12</i>	<i>Bt13</i>	<i>BtP</i>
Common bunt incidence (%)														
CB14	0	67.5	0	0	0	0	66	4.5	1	0	0	0.2	6	0
CB15	0	60.2	1.6	3.7	0	1.8	71.5	1.1	0	0	0	0	6.8	1.1
CB16	1.9	44.5	2	2.2	0	0.2	51.5	0.2	0	0.2	0.5	0.2	2.5	1
CB18	0	20	5.7	1.7	0	0	40.3	0	1	0	0	1	3.7	1
Dwarf bunt incidence (%)														
DB18	85.6	90	23.9	93.4	35.4	96.9	93.1	2.9	30.5	3.5	0	0	1.1	-

Table S3 Variance component estimates (σ^2) of genotype, environment, block, genotype by environment interaction and residual effects for all traits analysed in mapping population MP-PR

	Estimates				
	σ^2_{Gen}	σ^2_{Block}	σ^2_{Env}	$\sigma^2_{\text{GenxEnv}}$	σ^2_{Error}
Common bunt incidence (%)					
component	407.9	1.9	36.8	42.8	24.8
SE	66.33	1.54	31.37	5.15	1.9
z.ratio	6.15	1.22	1.17	8.3	13.05
component (%)	79.3***	0.36	7.16	8.3***	4.8***
Dwarf bunt incidence (%)					
component	375.4	1.8			32.8
SE	62.16	3.14			5.3
z.ratio	6.04	0.57			6.2
component (%)	91.6***	0.4			8.0***
Plant height (cm)					
component	45.97	4.55	87.61	7.15	38.03
SE	8.63	4.1	90.23	3.34	3.4
z.ratio	5.33	1.11	0.97	2.14	11.19
component (%)	25.08***	2.48	47.79	3.90***	20.75***
Lodging (1-9)					
component	1.28	0.02	0.09	0.15	0.29
SE	0.22	0.02	0.1	0.04	0.03
z.ratio	5.89	1.03	0.87	4.31	11.16
component (%)	69.70***	1.05	4.89	8.31***	16.05***
Heading date (days from Jan. 1st)					
component	2.35	1.48	0	0.23	0.97
SE	0.43	1.22	0	0.12	0.11
z.ratio	5.47	1.21	9.18	1.9	9.18
component (%)	46.73***	29.37	0.00***	4.66*	19.24***
Powdery mildew severity (1-9)					
component	0.17	0	0.42	0.03	0.16
SE	0.04	0	0.6	0.02	0.02
z.ratio	4.71	0.24	0.7	1.61	9.1
component (%)	21.99***	0.08	53.95	3.97**	20.01***
Stripe rust incidence (%)					
component	316.43	8.79	0	15.81	77.01
SE	54.23	8.01	0	9.53	8.51
z.ratio	5.83	1.1	9.05	1.66	9.05
component (%)	75.69***	2.1	0.00***	3.78**	18.42***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table S4 Pearson's correlation coefficients among RIL bunt incidence means for all common bunt and dwarf bunt environments analysed in mapping population MP-PR

	Common bunt experiments			Dwarf bunt experiment
	CB15	CB16	CB18	DB18
CB14	0.95***	0.87***	0.87***	0.81***
CB15		0.90***	0.88***	0.83***
CB16			0.71***	0.77***
CB18				0.77***

*** $p < 0.001$

Table S5 Pearson's correlation coefficients among RIL overall means for all traits analysed in mapping population MP-PR

	Dwarf bunt incidence	Plant height (cm)	Heading date	Lodging	Powdery mildew severity	Stripe rust severity (%)
Common bunt incidence	0.81 ***	-0.18	-0.03	0.09	-0.19	0.01
Dwarf bunt incidence		-0.21	-0.01	0	-0.13	-0.04
Plant height (cm)			0.33 *	0.57 ***	0.07	-0.02
Heading date				0.27 *	0.11	-0.03
Lodging (1-9)					-0.20	-0.11
Powdery mildew severity %						0.17

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table S6 Summary of chromosomal location and estimates of the QTL effects for plant height, lodging, and stripe rust severity detected with multiple QTL mapping of the overall mean performance of lines in mapping population MP-PR

	Chrom	Peak (cM)	Closest marker	Add ^a	%PV ^b	LOD ^c
Plant height	7B	69.0	wsnp_Ra_c12688_20260063	-3.3	22.2	4.3
Lodging	2D	33.0	BobWhite_c16917_732	-0.7	39.7	10.9
	4A	69.4	Kukri_c322_1394	-0.4	11.5	3.9
	7D	34.6	RAC875_c53629_483	-0.4	14.1	4.7
Heading date	2A	49.5	BS00085308_51	0.6	13.4	7.4
	3A	29.0	BS00074617_51	-0.6	13.7	7.5
	3B	45.8	BS00066797_51	-0.4	6.5	4.0
	4B	61.0	BS00063804_51	-0.5	10.0	5.8
	7B	19.0	Excalibur_c48448_279	0.7	16.2	8.6
	7B	78.2	RAC875_c26566_66	-0.5	9.2	5.4
Stripe rust severity	1A	50.0	IAAV5535	-5.7	10.9	5.1
	2A	2.0	TA002254-0660	-14.2	60.7	18.5
	6A	81.0	BS00026558_51	-4.6	7.2	3.6

^a Positive additive effects denote trait-decreasing effect of the PI 119333 allele

^b Percentage of phenotypic variance explained by the QTL

^c LOD (logarithm of the odds) above LOD threshold at the 0.05 level of probability obtained through a 1,000-iteration permutation test