

Table 1. Number and frequency (%) of virulence phenotypes of *Puccinia triticina* in the United States in 2011 identified by virulence to 19<sup>a</sup> lines of wheat with single genes for leaf rust resistance.

Phenotype	Virulences	Area 1 <sup>b</sup>		Area 2 <sup>c</sup>		Area 3 <sup>d</sup>		Area 4 <sup>e</sup>		Area 5 <sup>f</sup>		Area 6 <sup>g</sup>		Total	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
BBBDG	14a,28	1	1.1	0	0.0	0	0.0	0	0.0	3	3.8	2	1.5	6	1.4
LBBTG	1,B,10,14a,18,28	0	0.0	1	4.8	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
MBBJG	1,3,10,14a,28	0	0.0	0	0.0	1	2.5	0	0.0	0	0.0	1	0.7	2	0.5
MBDSD	1,3,17,B,10,14a,39/41	1	1.1	0	0.0	1	2.5	1	1.4	3	3.8	2	1.5	8	1.8
MBJJG	1,3,11,17,10,14a,28	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
MBPNB	1,3,3ka,17,30,B,14a	0	0.0	0	0.0	1	2.5	0	0.0	0	0.0	0	0.0	1	0.2
MBPSB	1,3,3ka,17,30,B,10,14a	0	0.0	0	0.0	0	0.0	0	0.0	2	2.6	1	0.7	3	0.7
MBTNB	1,3,3ka,11,17,30,B,14a	5	5.4	1	4.8	4	10.0	0	0.0	0	0.0	4	2.9	14	3.2
MBTSB	1,3,3ka,11,17,30,B,10,14a	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
MCDSB	1,3,26,17,B,10,14a	0	0.0	0	0.0	2	5.0	0	0.0	1	1.3	2	1.5	5	1.1
MCDSB	1,3,26,17,B,10,14a,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
MCGJG	1,3,26,11,10,14a,28	0	0.0	3	14.3	0	0.0	0	0.0	0	0.0	0	0.0	3	0.7
MCJSB	1,3,26,11,17,B,10,14a	0	0.0	0	0.0	2	5.0	0	0.0	0	0.0	0	0.0	2	0.5
MCLRG	1,3,26,3ka,B,10,18,28	0	0.0	1	4.8	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
MCPSB	1,3,26,3ka,17,30,B,10,14a	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
MCPSD	1,3,26,3ka,17,30,B,10,14a,39/41	0	0.0	0	0.0	0	0.0	0	0.0	2	2.6	0	0.0	2	0.5
MCPTB	1,3,26,3ka,17,30,B,10,14a,18	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
MCRGG	1,3,26,3ka,11,30,10,28	0	0.0	1	4.8	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
MCRKG	1,3,26,3ka,11,30,10,14a,18,28	1	1.1	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	2	0.5
MCTNB	1,3,26,3ka,11,17,30,B,14a	10	10.8	3	14.3	6	15.0	0	0.0	1	1.3	0	0.0	20	4.5
MCTQB	1,3,26,3ka,11,17,30,B,10	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
MCTSB	1,3,26,3ka,11,17,30,B,10,14a	2	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
MDDSB	1,3,24,17,B,10,14a	0	0.0	0	0.0	0	0.0	2	2.8	0	0.0	0	0.0	2	0.5
MDPSB	1,3,24,3ka,17,30,B,10,14a	1	1.1	0	0.0	0	0.0	0	0.0	3	3.8	2	1.5	6	1.4
MDTSB	1,3,24,3ka,11,17,30,B,10,14a	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
MFDSB	1,3,24,26,17,B,10,14a	2	2.2	0	0.0	0	0	10	13.9	3	3.8	6	4.4	21	4.8
MFGJG	1,3,24,26,11,10,14a,28	2	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
MFNSB	1,3,24,26,3ka,17,B,10,14a	4	4.3	0	0.0	0	0.0	2	2.8	0	0.0	7	5.1	13	3.0
MFNSL	1,3,24,26,3ka,17,B,10,14a,21	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
MFPSB	1,3,24,26,3ka,17,30,B,10,14a	5	5.4	0	0.0	0	0.0	0	0.0	1	1.3	4	2.9	10	2.3
MFQSB	1,3,24,26,3ka,11,B,10,14a	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
MFRJG	1,3,24,26,3ka,11,30,10,14a,28	5	5.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	1.1
MFTSB	1,3,24,26,3ka,11,17,30,B,10,14a	0	0.0	0	0.0	0	0.0	2	2.8	0	0.0	1	0.7	3	0.7
MGDSB	1,3,16,17,B,10,14a,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
MKDSB	1,3,16,24,26,17,B,10,14a	1	1.1	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	2	0.5
MLDSD	1,3,9,17,B,10,14a,39/41	10	10.8	3	14.3	0	0.0	8	11.1	2	2.6	10	7.4	33	7.5
MLNSD	1,3,9,3ka,17,B,10,14a,39/41	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
MLPSD	1,3,9,3ka,17,30,B,10,14a,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
MMDSB	1,3,9,26,17,B,10,14a,39/41	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
MMNSD	1,3,9,26,3ka,17,B,10,14a,39/41	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
MMPSD	1,3,9,26,3ka,17,30,B,10,14a,39/41	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
NBBRG	1,2c,B,10,18,28	3	3.2	1	4.8	0	0.0	2	2.8	1	1.3	2	1.5	9	2.0
NBBSG	1,2c,B,10,14a,28	0	0.0	2	9.5	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
NBBTG	1,2c,B,10,14a,18,28	0	0.0	2	9.5	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
SBBGG	1,2a,2c,10,28	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
TBBBG	1,2a,2c,3,28	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2

TBBBJ	1,2a,2c,3,28,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
TBBDJ	1,2a,2c,3,14a,28,39/41	0	0.0	0	0.0	1	2.5	0	0.0	0	0.0	0	0.0	1	0.2
TBBGD	1,2a,2c,3,10,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
TBBGG	1,2a,2c,3,10,28	0	0.0	0	0.0	0	0.0	0	0.0	3	3.8	1	0.7	4	0.9
TBBGJ	<b>1,2a,2c,3,10,28,39/41</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>3</b>	<b>7.5</b>	<b>12</b>	<b>16.7</b>	<b>16</b>	<b>20.5</b>	<b>20</b>	<b>14.7</b>	<b>51</b>	<b>11.6</b>
TBBJG	1,2a,2c,3,10,14a,28	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
TBBQJ	1,2a,2c,3,B,10,28,39/41	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
TBGJG	1,2a,2c,3,11,10,14a,28	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
TBHKG	1,2a,2c,3,11,30,10,14a,18,28	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
TBIJG	1,2a,2c,3,11,17,10,14a,28	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	2	0.5
TBMKG	1,2a,2c,3,3ka,30,10,14a,18,28	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
TBPSB	1,2a,2c,3,3ka,17,30,B,10,14a	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
TBRKG	1,2a,2c,3,3ka,11,30,10,14a,18,28	2	2.2	1	4.8	6	15.0	0	0.0	1	1.3	0	0.0	10	2.3
TCBGJ	1,2a,2c,3,26,10,28,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	2	1.5	3	0.7
TCBJG	1,2a,2c,3,26,10,14a,28	5	5.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	1.1
TCGJG	1,2a,2c,3,26,11,10,14a,28	0	0.0	1	4.8	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
TCJSB	1,2a,2c,3,26,11,17,B,10,14a	2	2.2	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	3	0.7
TCJSG	1,2a,2c,3,26,11,17,B,10,14a,28	2	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
TCRKG	1,2a,2c,3,26,3ka,11,30,10,14a,18,28	10	10.8	1	4.8	8	20.0	1	1.4	5	6.4	4	2.9	29	6.6
TCTBG	1,2a,2c,3,26,3ka,11,17,30,28	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
TCTSB	1,2a,2c,3,26,3ka,11,17,30,B,10,14a	0	0.0	0	0.0	3	7.5	0	0.0	0	0.0	0	0.0	3	0.7
TDBGG	1,2a,2c,3,24,10,28	0	0.0	0	0.0	0	0.0	1	1.4	5	6.4	13	9.6	19	4.3
TDBGJ	1,2a,2c,3,24,10,28,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
TDBGQ	1,2a,2c,3,24,10,21,28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	15	11.0	15	3.4
TDBJG	1,2a,2c,3,24,10,14a,28	1	1.1	0	0.0	2	5.0	0	0.0	3	3.8	4	2.9	10	2.3
TDBJQ	1,2a,2c,3,24,10,14a,21,28	0	0.0	0	0.0	0	0.0	3	4.2	0	0.0	1	0.7	4	0.9
TDDJG	1,2a,2c,3,24,17,10,14a,28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
TFBGG	1,2a,2c,3,24,26,10,28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5	2	0.5
TFBGJ	1,2a,2c,3,24,26,10,28,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	1	0.7	2	0.5
TFBGQ	1,2a,2c,3,24,26,10,21,28	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	5	3.7	6	1.4
TFBJG	1,2a,2c,3,24,26,10,14a,28	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
TFBJQ	1,2a,2c,3,24,26,10,14a,21,28	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	2	0.5
TFBKG	1,2a,2c,3,24,26,10,14a,18,28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
TFJGG	1,2a,2c,3,24,26,11,17,10,28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
TFLJJ	1,2a,2c,3,24,26,3ka,10,14a,28,39/41	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	1	0.2
TFPSB	1,2a,2c,3,24,26,3ka,17,30,B,10,14a	2	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
TFRJG	1,2a,2c,3,24,26,3ka,11,30,10,14a,28	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
TGBJG	1,2a,2c,3,16,10,14a,28	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	0.2
THBJG	1,2a,2c,3,16,26,10,14a,28	1	1.1	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	2	0.5
TJBGQ	1,2a,2c,3,16,24,10,21,28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5	2	0.5
TLBJJ	1,2a,2c,3,9,10,14a,28,39/41	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	1	0.7	2	0.5
TNBJG	1,2a,2c,3,9,24,10,28,39/41	0	0.0	0	0.0	0	0.0	8	11.1	12	15.4	6	4.4	26	5.9
TNBJJ	1,2a,2c,3,9,24,10,14a,28,39/41	3	3.2	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	4	0.9
TNGFJ	1,2a,2c,3,9,24,11,14a,18,28,39/41	0	0.0	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	1	0.2
TNRJJ	1,2a,2c,3,9,24,3ka,11,30,10,14a,28,39/41	3	3.2	0	0.0	0	0.0	3	4.2	0	0.0	0	0.0	6	1.4
TPBGJ	1,2a,2c,3,9,24,26,10,28,39/41	0	0.0	0	0.0	0	0.0	2	2.8	1	1.3	1	0.7	4	0.9
Total		93		21		40		72		78		136		440	

<sup>a</sup> Lines tested were Thatcher lines with genes *Lr1*, *Lr2a*, *Lr2c*, *Lr3a*, *Lr9*, *Lr16*, *Lr24*, *Lr26*, *Lr3ka*, *Lr11*, *Lr17*, *Lr30*, *LrB*, *Lr10*, *Lr14a*, *Lr18*, *Lr21*, *Lr28*, and winter wheat lines with gene *Lr41*.

<sup>b</sup> States of AR, DE, GA, LA, MD, MS, NC, VA

<sup>c</sup> State of NY

<sup>d</sup> States of IL, IN, eastern MO, WI

<sup>e</sup> States of OK, TX

<sup>f</sup> States of IA, KS, western MO

<sup>g</sup> States of MN, ND, SD

Table 2. Number and frequency (%) of isolates of *Puccinia triticina* in the United States in 2011 virulent to 19 lines of wheat with single resistance genes for leaf rust resistance.

Resistance gene	Area 1 <sup>a</sup>		Area 2 <sup>b</sup>		Area 3 <sup>c</sup>		Area 4 <sup>d</sup>		Area 5 <sup>e</sup>		Area 6 <sup>f</sup>		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lr1	92	98.9	21	100.0	40	100.0	72	100.0	96.2	134	98.5	434	98.6	
Lr2a	37	39.8	3	14.3	23	57.5	38	52.8	55	70.5	86	63.2	242	55.0
Lr2c	40	43.0	8	38.1	23	57.5	40	55.6	56	71.8	88	64.7	255	58.0
Lr3	89	95.7	15	71.4	40	100.0	70	97.2	73	93.6	132	97.1	419	95.2
Lr9	18	19.4	3	14.3	0	0	23	31.9	16	20.5	21	15.4	81	18.4
Lr16	2	2.2	0	0	0	0	3	4.2	1	1.3	2	1.5	8	1.8
Lr24	32	34.4	0	0	2	5.0	39	54.2	29	37.2	77	56.6	179	40.7
Lr26	60	64.5	10	47.6	21	52.5	24	33.3	15	19.2	45	33.1	175	39.8
Lr3ka	55	59.1	8	38.1	28	70.0	12	16.7	16	20.5	30	22.1	149	33.9
Lr11	48	51.6	11	52.4	29	72.5	10	13.9	10	12.8	13	9.6	121	27.5
Lr17	52	55.9	7	33.3	19	47.5	30	41.7	20	25.6	49	36.0	177	40.2
Lr30	50	53.8	7	33.3	28	70.0	9	12.5	17	21.8	20	14.7	131	29.8
LrB	53	57.0	14	66.7	19	47.5	33	45.8	21	26.9	48	35.3	188	42.7
Lr10	76	81.7	17	81.0	28	70.0	69	95.8	74	94.9	130	95.6	394	89.5
Lr14a	88	94.6	18	85.7	37	92.5	41	56.9	37	47.4	65	47.8	286	65.0
Lr18	17	18.3	7	33.3	14	35.0	5	6.9	8	10.3	8	5.9	59	13.4
Lr21	1	1.1	0	0	0	0	3	4.2	1	1.3	25	18.4	30	6.8
Lr28	45	48.4	14	66.7	21	52.5	40	55.6	59	75.6	90	66.2	269	61.1
Lr39/41	19	20.4	3	14.3	5	12.5	43	59.7	38	48.7	47	34.6	155	35.2
Total	93		21		40		72		78		136		440	

<sup>a</sup> States of AR, DE, GA, LA, MD, MS, NC, VA

<sup>b</sup> States of NY

<sup>c</sup> States of IL, IN, MO, WI

<sup>d</sup> States of OK, TX

<sup>e</sup> States of IA, KS, MO

<sup>f</sup> States of MN, ND, SD