

Table 1: Number and frequency (%) of virulence phenotypes of *Puccinia triticina* in the United States in 2016 identified by virulence to 20^a lines of wheat with single genes for leaf rust resistance.

Race	Virulence combination (ineffective Lr genes)	Southeast		Northeast		Ohio Valley		TX-OK		KS-NE		MN-SD-ND		WA		Total	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MBBJG	1,3,10,14a,28	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2
MBDSB	1,3,17,B,10,14a	1	1	0	0	0	0	2	2.1	0	0	1	0.8	0	0	4	0.8
MBDSD	1,3,17,B,10,14a,39	1	1	0	0	1	1.7	14	14.6	27	28.1	25	20.8	0	0	68	13.7
MBPSB	1,3,3ka,17,30,B,10,14a	2	2	0	0	0	0	9	9.4	0	0	0	0	0	0	11	2.2
MBTNB	1,3,3ka,11,17,30,B,14a	34	34.3	4	18.2	43	72.9	0	0	4	4.2	3	2.5	0	0	88	17.7
MBTSB	1,3,3ka,11,17,30,B,10,14a	3	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0.6
MCDSB	1,3,26,17,B,10,14a	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
MCDSD	1,3,26,17,B,10,14a,39	0	0	1	4.5	0	0	1	1	0	0	1	0.8	0	0	3	0.6
MCGJG	1,3,26,11,10,14a,28	0	0	1	4.5	0	0	0	0	0	0	2	1.7	0	0	3	0.6
MCPSB	1,3,26,3ka,17,30,B,10,14a	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
MCPSD	1,3,26,3ka,17,30,B,10,14a,39	0	0	0	0	0	0	0	0	3	3.1	2	1.7	0	0	5	1
MCTNB	1,3,26,3ka,11,17,30,B,14a	14	14.1	0	0	5	8.5	1	1	2	2.1	0	0	0	0	22	4.4
MCTQB	1,3,26,3ka,11,17,30,B,10	0	0	0	0	1	1.7	0	0	0	0	0	0	0	0	1	0.2
MCTSB	1,3,26,3ka,11,17,30,B,10,14a	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.4
MDBJG	1,3,24,10,14a,28	0	0	8	36.4	0	0	0	0	0	0	4	3.3	0	0	12	2.4
MDDSB	1,3,24,17,B,10,14a	0	0	1	4.5	0	0	0	0	0	0	2	1.7	0	0	3	0.6
MDJSB	1,3,24,11,17,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2
MDMJG	1,3,24,3ka,30,10,14a,28	0	0	2	9.1	0	0	0	0	0	0	1	0.8	0	0	3	0.6
MDNSJ	1,3,24,3ka,17,B,10,14a,21,39	0	0	0	0	0	0	0	0	0	0	2	1.7	0	0	2	0.4
MDTSB	1,3,24,3ka,11,17,30,B,10,14a	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
MFGJG	1,3,24,26,11,10,14a,28	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
MFPSB	1,3,24,26,3ka,17,30,B,10,14a	0	0	1	4.5	0	0	0	0	1	1	4	3.3	0	0	6	1.2
MGPSB	1,3,16,3ka,17,30,B,10,14a	0	0	0	0	0	0	2	2.1	0	0	0	0	0	0	2	0.4
MGPSD	1,3,16,3ka,17,30,B,10,14a,39	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
MJBJG	1,3,16,24,10,14a,28	0	0	0	0	0	0	0	0	0	0	10	8.3	0	0	10	2
MJDSB	1,3,16,24,17,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2
MJMGJ	1,3,16,24,3ka,30,10,28,39	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2
MLDSB	1,3,9,17,B,10,14a	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
MLDSD	1,3,9,17,B,10,14a,39	1	1	0	0	0	0	1	1	0	0	0	0	0	0	2	0.4
MLJSD	1,3,9,11,17,B,10,14a,39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
MLPSD	1,3,9,3ka,17,30,B,10,14a,39	2	2	0	0	0	0	9	9.4	11	11.5	2	1.7	0	0	24	4.8
MMDSB	1,3,9,26,17,B,10,14a,39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
MMNSD	1,3,9,26,3ka,17,B,10,14a,39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
MMPSD	1,3,9,26,3ka,17,30,B,10,14a,39	0	0	0	0	0	0	8	8.3	4	4.2	0	0	0	0	12	2.4
MNDSD	1,3,9,24,17,B,10,14a,39	0	0	0	0	0	0	1	1	1	1	0	0	0	0	2	0.4
MNKSB	1,3,9,24,11,17,30,B,10,14a	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2
MNMPS	1,3,9,24,3ka,30,B,14a,18,21,28,39	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2
MNPSD	1,3,9,24,3ka,17,30,B,10,14a,39	3	3	0	0	0	0	8	8.3	15	15.6	7	5.8	0	0	33	6.7
MPPSD	1,3,9,24,26,3ka,17,30,B,10,14a,39	0	0	0	0	0	0	4	4.2	4	4.2	2	1.7	0	0	10	2
MPTSD	1,3,9,24,26,3ka,11,17,30,B,10,14a 39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
PBDGG	1,2c,3,17,10,28	0	0	4	18.2	1	1.7	0	0	0	0	0	0	3	75	8	1.6
PBDGJ	1,2c,3,17,10,28,39	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2
PBDJJ	1,2c,3,17,10,14a,28,39	0	0	0	0	0	0	0	0	2	2.1	0	0	0	0	2	0.4
PBDQG	1,2c,3,17,B,10,28	0	0	0	0	2	3.4	0	0	0	0	0	0	0	0	2	0.4
PBDQJ	1,2c,3,17,B,10,28,39	0	0	0	0	0	0	1	1	7	7.3	0	0	1	25	9	1.8
PBJQJ	1,2c,3,11,17,B,10,28,39	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0.2
PCJQG	1,2c,3,26,11,17,B,10,28	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0.2

TBBGJ	1,2a,2c,3,10,28,39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
TBBGS	1,2a,2c,3,10,21,28,39	0	0	0	0	0	0	2	2.1	0	0	9	7.5	0	0	11	2.2
TBRKG	1,2a,2c,3,3ka,11,30,10,14a,18,28	1	1	0	0	0	0	0	0	0	0	2	1.7	0	0	3	0.6
TBRKJ	1,2a,2c,3,3ka,11,30,10,14a,18,28,39	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
TBTNB	1,2a,2c,3,3ka,11,17,30,B,14a	4	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0.8
TCGKG	1,2a,2c,3,26,11,10,14a,18,28	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0.2
TCRFG	1,2a,2c,3,26,3ka,11,30,14a,18,28	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
TCRKG	1,2a,2c,3,26,3ka,11,30,10,14a,18,28	12	12.1	0	0	0	0	0	0	1	1	0	0	0	0	13	2.6
TCTKG	1,2a,2c,3,26,3ka,11,17,30,10,14a,18,28	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
TCTNB	1,2a,2c,3,26,3ka,11,17,30,B,14a	3	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0.6
TCTSB	1,2a,2c,3,26,3ka,11,17,30,B,10,14a	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
TDBJQ	1,2a,2c,3,24,10,14a,21,28	0	0	0	0	0	0	0	0	0	0	5	4.2	0	0	5	1
TDRJG	1,2a,2c,3,24,3ka,11,30,10,14a,28	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
TDTSB	1,2a,2c,3,24,3ka,11,17,30,B,10,14a	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.4
TFBJJ	1,2a,2c,3,24,26,10,14a,28,39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
TFBJQ	1,2a,2c,3,24,26,10,14a,21,28	0	0	0	0	0	0	0	0	0	0	4	3.3	0	0	4	0.8
TFPSB	1,2a,2c,3,24,26,3ka,17,30,B,10,14a	0	0	0	0	3	5.1	0	0	0	0	0	0	0	0	3	0.6
TFTSB	1,2a,2c,3,24,26,3ka,11,17,30,B,10,14a	0	0	0	0	3	5.1	0	0	0	0	0	0	0	0	3	0.6
TLPSD	1,2a,2c,3,9,3ka,17,30,B,10,14a,39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
TNBJG	1,2a,2c,3,9,24,10,28,39	5	5.1	0	0	0	0	8	8.3	5	5.2	4	3.3	0	0	22	4.4
TNBJJ	1,2a,2c,3,9,24,10,14a,28,39	1	1	0	0	0	0	14	14.6	2	2.1	18	15	0	0	35	7.1
TNRJJ	1,2a,2c,3,9,24,3ka,11,30,10,14a,28,39	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.2
TPBGJ	1,2a,2c,3,9,24,26,10,28,39	0	0	0	0	0	0	0	0	4	4.2	2	1.7	0	0	6	1.2
TPDGJ	1,2a,2c,3,9,24,26,17,10,28,39	0	0	0	0	0	0	0	0	0	0	1	0.8	0	0	1	0.2

Total		99		22		59		96		96		120		4		496	
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Table 2. Number and frequency (%) of isolates of *Puccinia triticina* in the United States in 2016 virulent to 20 lines of wheat with single resistance genes for leaf rust resistance.

Resistance gene	Southeast		Northeast		Ohio Valley		TX-OK		KS-NE		MN-SD-ND		WA		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lr1	99	100.0	22	100.0	59	100.0	96	100.0	96	100.0	120	100.0	4	100.0	496	100.0
Lr2a	33	33.3	0	0	6	10.2	28	29.2	13	13.5	45	37.5	0	0	125	25.2
Lr2c	33	33.3	4	18.2	9	15.3	29	30.2	24	25.0	46	38.3	4	100.0	149	30.0
Lr3	99	100.0	22	100.0	59	100.0	96	100.0	96	100.0	120	100.0	4	100.0	496	100.0
Lr9	13	13.1	0	0	0	0	59	61.5	46	47.9	38	31.7	0	0	156	31.5
Lr16	1	1.0	0	0	0	0	2	2.1	0	0	12	10.0	0	0	15	3.0
Lr24	13	13.1	12	54.5	6	10.2	39	40.6	32	33.3	71	59.2	0	0	173	34.9
Lr26	35	35.4	3	13.6	12	20.3	20	20.8	21	21.9	18	15.0	0	0	109	22.0
Lr3ka	88	88.9	7	31.8	55	93.2	47	49.0	45	46.9	27	22.5	0	0	269	54.2
Lr11	81	81.8	5	22.7	52	88.1	5	5.2	10	10.4	9	7.5	0	0	162	32.7
Lr17	76	76.8	11	50.0	59	100.0	69	71.9	83	86.5	56	46.7	4	100.0	358	72.2
Lr30	88	88.9	7	31.8	55	93.2	46	47.9	45	46.9	26	21.7	0	0	267	53.8
LrB	75	75.8	7	31.8	58	98.3	69	71.9	81	84.4	55	45.8	1	25.0	346	69.8
Lr10	43	43.4	18	81.8	11	18.6	95	99.0	90	93.8	116	96.7	4	100.0	377	76.0
Lr14a	94	94.9	18	81.8	55	93.2	84	87.5	78	81.3	102	85.0	0	0	431	86.9
Lr18	16	16.2	0	0	0	0	0	0	2	2.1	3	2.5	0	0	21	4.2
Lr21	0	0	0	0	0	0	2	2.1	0	0	21	17.5	0	0	23	4.6
Lr28	24	24.2	15	68.2	3	5.1	28	29.2	24	25.0	66	55.0	4	100.0	164	33.1
Lr39	15	15.2	1	4.7	1	1.7	79	82.3	86	89.6	78	65.0	1	25.0	261	52.6
Lr42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	99		22		59		96		96		120		4		496	