Supplemental Table 1.

Isolates of *Puccinia triticina* genotyped for SNP variation with Sequence by Genotype method and phenotyped for virulence on 20 Thatcher wheat differential lines

Continental Population	Country	Number of isolates	Years	Collector
North America (NA)	USA	58	1984-2005	D. Long, J. Kolmer
	Canada	12	1959-1997	D. J. Samborski, J. Kolmer
	Mexico	3	2005	J. Huerta
Central Asia (CA)	Azerbaijan	4	2003	A. Morgounov
	Kazakhstan	36	2002, 2004	A. Morgounov, J. Kolmer
	Uzbekistan	6	2003	A. Morgounov
	Armenia	2	2003	A. Morgounov
	Tajikistan	9	2003	A. Morgounov
	Kyrgyzstan	3	2003	A. Morgounov
	Georgia	1	2003	A. Morgounov
New Zealand (NZ)	-	10	1997	R. McKenzie
South Africa (SAF)	-	21	1996, 1998, 2012	Z. Pretorius
Russia (RU)	-	44	2006-2010	M. A. Mustafina, N. S. Zhemchuzhina
China (CN)	-	65	2009, 2010	College of Plant Protection, Agricultural University of Hebei
Pakistan (PK)		38	2010, 2011, 2013, 2014	J. Mirza
Europe (EU)	Czech Republic - Slovakia	17	1994, 2009	A.Hanzalova, P. Bartos
	United Kingdom	30	1980-2009	R. Johnson, R. Bayles
	Turkey	30	2009	J. Kolmer, A. Morgounov, Z. Mert
	Ukraine	1	2009	A. Morgounov
	France	10	2004	H. Goyeau
	Spain	12	1994, 2016	D. Rubiales, M. Aoun, F. Martinez-Moreno
	Italy	12	1994, 2006	F. Cassulli, P. Mantovani, Produttori Sementi Bologna
	Germany	2	1994	U. Walther
	Hungary	3	1994	K. Manninger
Middle East (ME)	Egypt	28	1998-2000	D. Long, D. McVey

	Israel	18	1994, 2000, 2009	J. Manisterski
	Turkey	6	1988, 1989	J. Huerta
South America (SA)	Uruguay	33	1985, 1996, 2004-2006	S. German
	Brazil	7	1996	A. Barcellos
	Argentina	4	2004, 2006	S. German
	Peru	5	1981, 1982, 1987	D. Long
	Chile	14	1981, 1984, 1988, 2008	D. Long, R. Madariaga
East Africa (EA)	Ethiopia	18	1989, 2011, 2012	J. Huerta, M. Acevedo
	Kenya	7	2010, 2011	R. Wanyera

Supplemental Table 2. Jost's *D* (top diagonal) and F_{ST} values (bottom diagonal) between 11 regional populations of *Puccinia triticina*.

	Central Asia	China	East Africa	Europe	Middle East	North America	New Zealand	Pakistan	Russia	South Africa	South America
Central Asia		3.0×10^{-4}	6.0×10^{-4}	1.0×10^{-4}	4.0×10^{-4}	6.0×10^{-4}	3.0×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	2.0×10^{-4}	6.0×10^{-4}
China	0.0653		5.0×10^{-4}	2.0×10^{-4}	3.0×10^{-4}	6.0×10^{-4}	2.0×10^{-4}	2.0×10^{-4}	5.0×10^{-4}	2.0×10^{-4}	6.0×10^{-4}
East Africa	0.1297	0.0940		2.0×10^{-4}	1.0×10^{-4}	5.0×10^{-4}	1.0×10^{-4}	2.0×10^{-4}	1.1×10^{-3}	2.0×10^{-4}	4.0×10^{-4}
Europe	0.0351	0.0494	0.0539		1.0×10^{-4}	4.0×10^{-4}	1.0×10^{-4}	0.0	5.0×10^{-4}	1.0×10^{-4}	4.0×10^{-4}
Middle East	0.0868	0.0677	0.0275	0.0326		3.0×10^{-4}	0.0	1.0×10^{-4}	8.0×10^{-4}	1.0×10^{-4}	3.0×10^{-4}
North America	0.1483	0.1285	0.1055	0.0963	0.0697		1.0×10^{-4}	3.0×10^{-4}	7.0×10^{-4}	3.0×10^{-4}	0.0
New Zealand	0.1103	0.0763	0.0537	0.0473	0.0305	0.0706		1.0×10^{-4}	7.0×10^{-4}	0.0	2.0×10^{-4}
Pakistan	0.0362	0.0550	0.0613	0.0102	0.0294	0.0926	0.0582		4.0×10^{-4}	1.0×10^{-4}	3.0×10^{-4}
Russia	0.0466	0.1106	0.2112	0.0897	0.1692	0.1937	0.1828	0.1043		6.0×10^{-4}	7.0×10^{-4}
South Africa	0.1033	0.0786	0.0610	0.0459	0.0510	0.1246	0.0215	0.06303	0.1800		4.0×10^{-4}
South America	0.1505	0.1319	0.1030	0.0963	0.0743	0.0124	0.0756	0.0909	0.1984	0.1322	

Supplemental Table 3. Frequency (%) of isolates in SBG groups with virulence to 20 Thatcher lines of wheat with single genes for leaf rust resistance.

	SBG Group[a]														
Virulence	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Lr1	2.6	0	0.0	0.0	35.3	88.5	100	100.0	49.2	31.6	86.5	42.9	96.0	82.4	50.0
Lr2a	0.0	0	0.0	0.0	20.6	48.1	98.0	100.0	16.9	15.3	52.7	0.0	6.7	0.0	0.0
Lr2c	28.9	0	68.4	100.0	91.2	82.7	98.0	100.0	94.9	85.7	56.8	28.6	12.0	88.2	50.0
Lr3	7.9	0	0.0	100.0	55.9	88.5	98.0	42.9	100.0	96.9	86.5	28.6	97.3	64.7	50.0
Lr9	0.0	0	0.0	0.0	0.0	0.0	19.6	0.0	0.0	0.0	12.2	0.0	6.7	5.9	0.0
Lr16	7.9	0	36.8	7.7	17.6	0.0	5.9	14.3	30.5	27.6	16.2	14.3	8.0	0.0	25.0
Lr24	0.0	0	0.0	0.0	11.8	0.0	0.0	14.3	0.0	1.0	36.5	0.0	21.3	0.0	0.0
Lr26	0.0	0	42.1	84.6	20.6	100.0	25.5	14.3	64.4	64.3	51.4	0.0	61.3	5.9	25.0
Lr3ka	0.0	0	15.8	0.0	8.8	7.7	98.0	28.6	72.9	74.5	27.0	0.0	49.3	41.2	50.0
Lr11	2.6	0	47.4	0.0	8.8	46.2	39.2	57.1	10.2	6.1	43.2	14.3	5.3	35.3	25.0
Lr17	2.6	0	26.3	38.5	5.9	42.3	98.0	100.0	100.0	69.4	27.0	28.6	90.7	23.5	50.0
Lr30	0.0	0	0.0	0.0	8.8	7.7	92.2	28.6	96.6	65.3	28.4	0.0	46.7	23.5	25.0
LrB	71.1	0	78.9	100.0	85.3	86.5	58.8	28.6	88.1	95.9	20.3	14.3	92.0	64.7	75.0
Lr10	89.5	0	89.5	100.0	79.4	44.2	56.9	14.3	81.4	84.7	81.1	42.9	88.0	76.5	100.0
Lr14a	13.2	0	31.6	0.0	44.1	50.0	39.2	57.1	91.5	74.5	90.5	85.7	97.3	35.3	75.0
Lr18	0.0	0	0.0	0.0	5.9	0.0	11.8	0.0	8.5	3.1	18.9	14.3	2.7	35.3	0.0
Lr3bg	10.5	0	5.3	100.0	41.2	86.5	84.3	42.9	100.0	78.6	39.2	28.6	90.7	17.6	50.0
Lr14b	97.4	0	89.5	100.0	97.1	65.4	70.6	57.1	76.3	88.8	95.9	71.4	93.3	88.2	100.0
Lr20	84.2	0	10.5	0.0	55.9	63.5	96.1	57.1	28.8	26.5	73.0	100.0	73.3	100.0	50.0
Lr28	5.3	0	0.0	0.0	23.5	5.8	0.0	71.4	0.0	2.0	93.2	42.9	10.7	94.1	25.0
N	38	6	19	13	34	52	51	7	59	98	74	7	75	17	4

[a] Group A = NA Durum, SA Durum, EA Durum, EU Durum, ME Durum
Group B = ETH EEEEE
Group C = EU1
Group D = CN3
Group E = EU5, SAF, NZ
Group F = CN1, CN2
Group G= CA2, RU1, EU6

Group H = NA4, SA1
Group I = CA1, EU2, PK3, RU2
Group J = EU7, ME2, EA2, PK1, CA3, CA4, EU4
Group K = ME1, SA2, NA5
Group L = NA1
Group M = EU8, PK2, EA1, SA3, NA3
Group N = NA2
Group O = SA4

Supplemental Table 4. Isolates in SSR-MLG and SBG groups across regions

SSR-MLG#	SBG Groups (number of isolates)
6	EU4(7) ME2(1) CA4(1)
7	CN1(1) EU7(1)
9	PK1(1)
25	CN1(1) ME2(1) CA1(3) RU2(5) EU2(7)
33	NA3(5) EU8 (2) SA3 (4)
35	NA3(1)
36	NA3(1) PK2(1) SA3(2) EA1(4) EU8(2)
39	NZ(1) SAF(1)
41	NA5(2)
42	NA5(2) ME1(1) SA2(1)
46	NA5(15) ME1(10)
49	NA5(2) NZ(1) SA2(1) ME(1)
52	EU8(1) EA(1)
58	NA1(2) SA2(1) NZ(1)
59	EU5(2)
65	CN3(2) EU5(3)
67	PK2(1)
72	EA Durum(4) EU Durum(1) ME Durum(1)
75	EA Durum (1) NA Durum(2)
77	ME2(1) EU7(2)
79	NA4(1)
82	SA1(1)
83	PK3(1) EU2(2)
84	CA1(1) EU2(4)
92	ME2(1)
99	ME2(13) EA2(3)