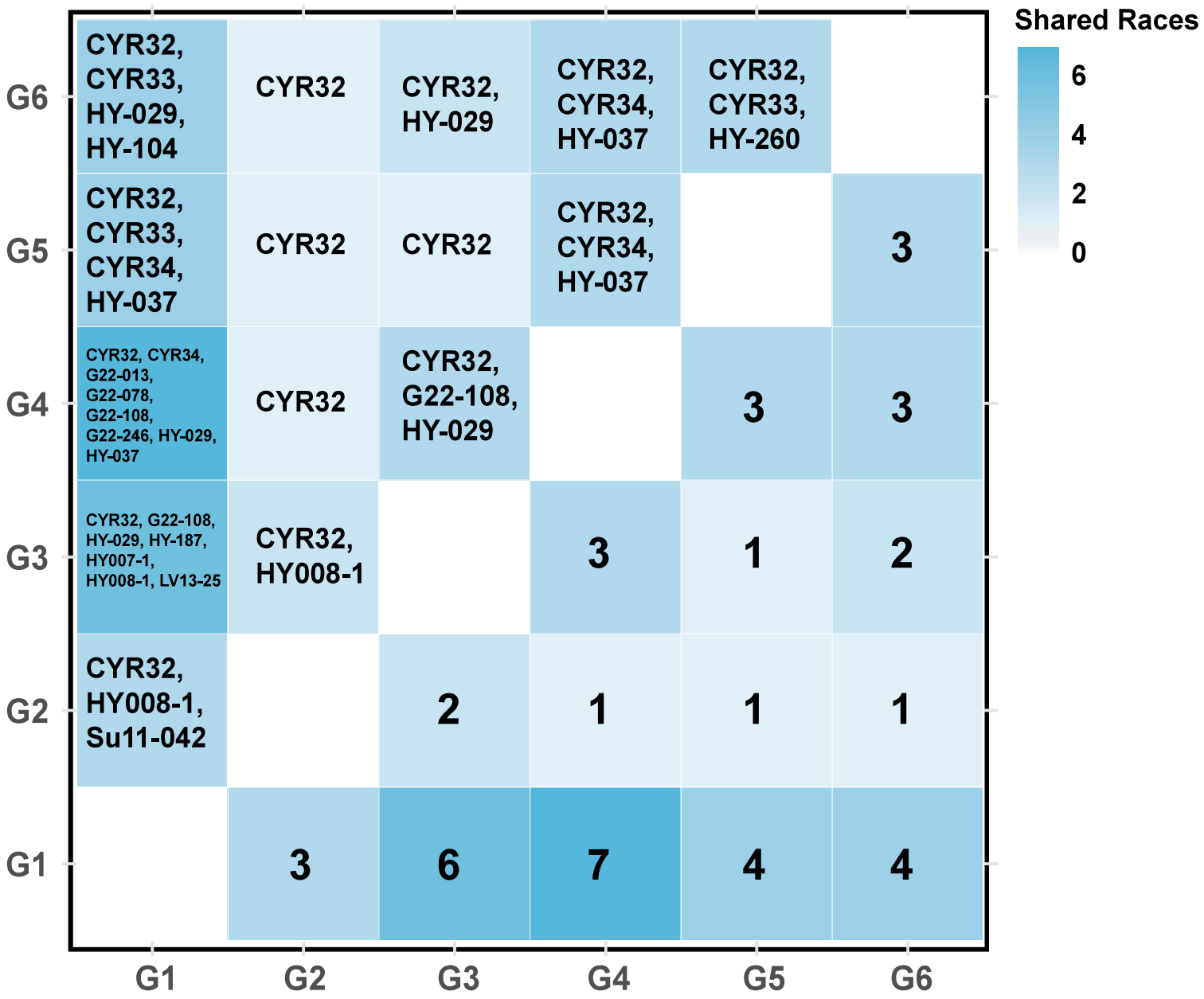

Fig. S1 Shared *Puccinia striiformis* f. sp. *tritici* races identified between pairs of geographic regions.

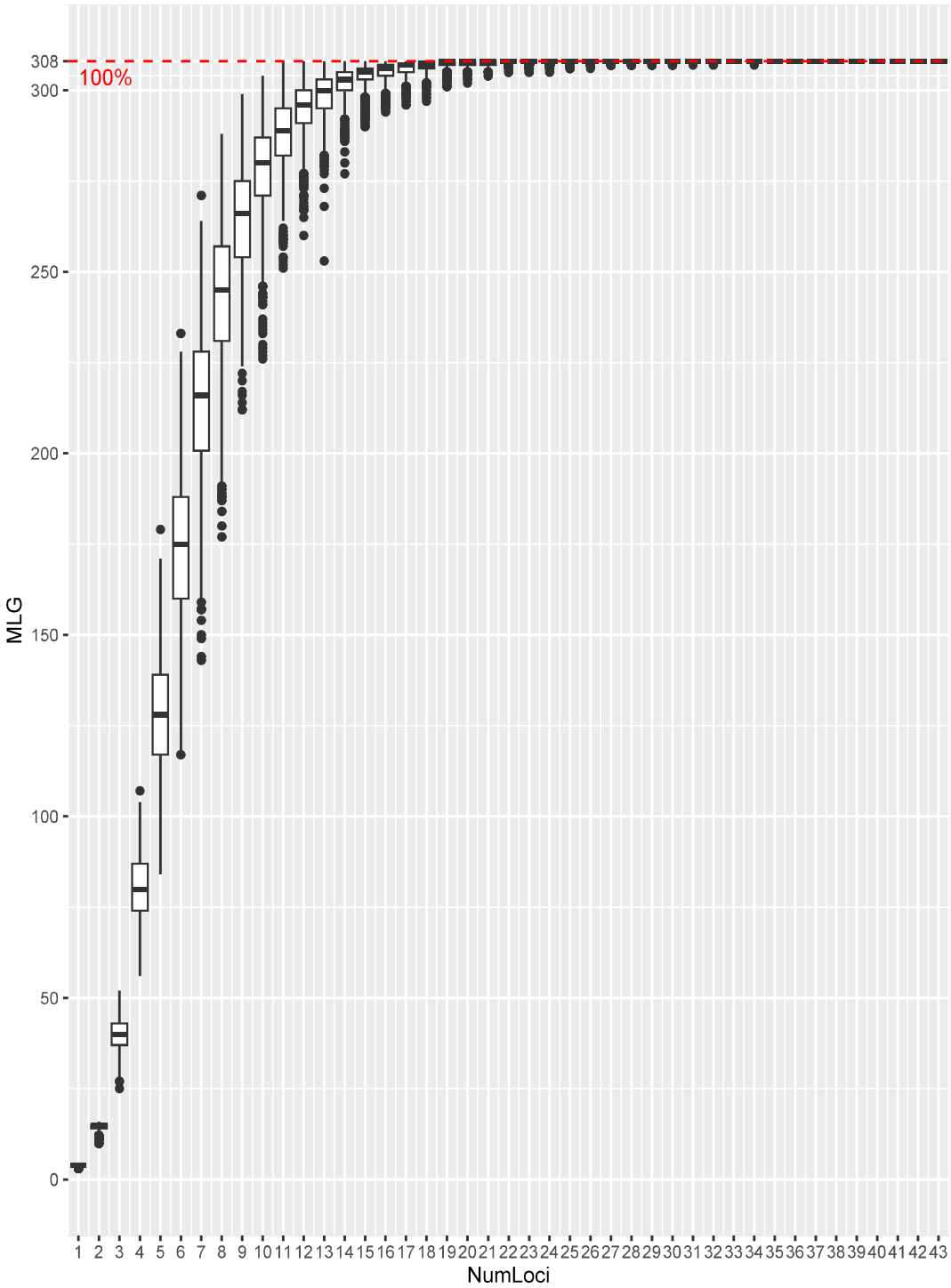

Fig. S2 Genotype accumulation curve of 37 polymorphic loci for genetic characterization.

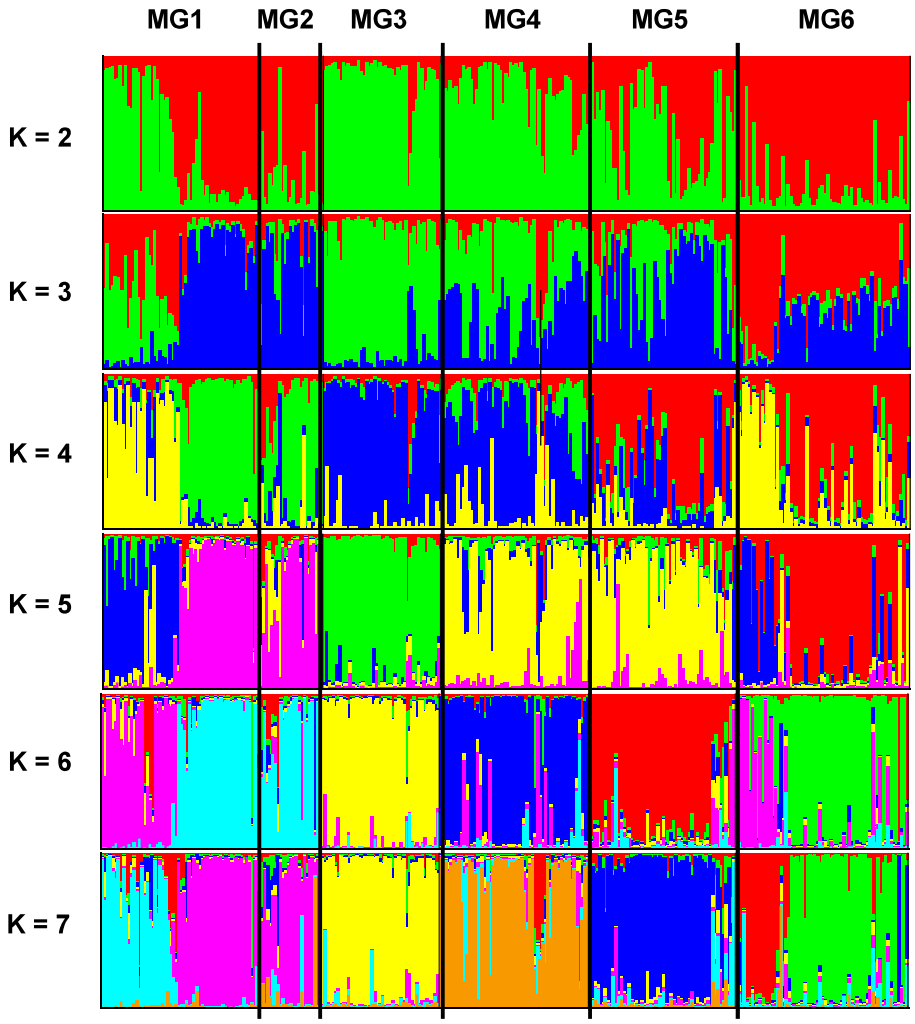

Fig. S3 Ancestry coefficient analysis of 308 *Pst* isolates across molecular groups with K values ranging from 2 to 7.

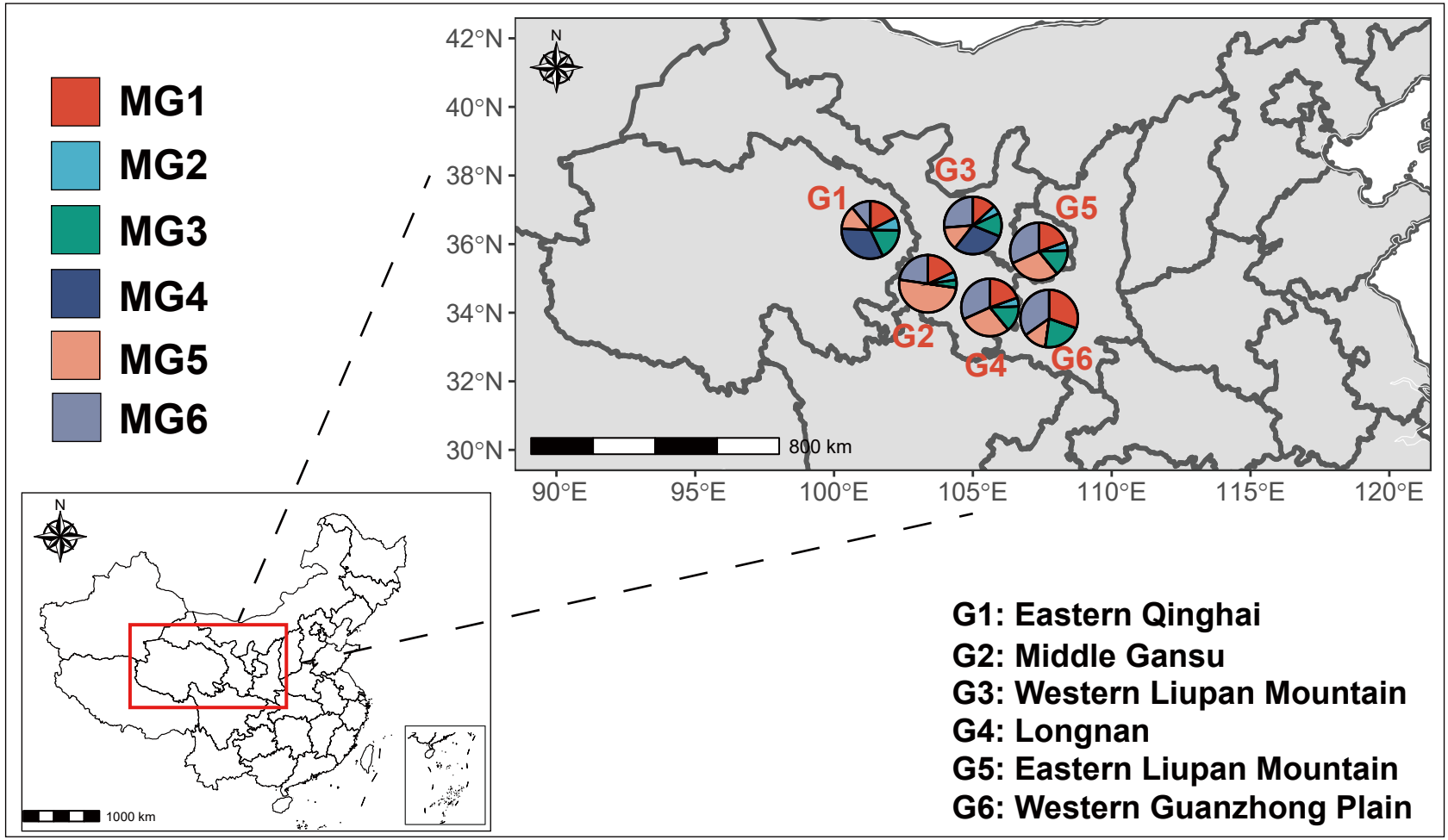

Fig. S4 Composition of *Puccinia striiformis* f. sp. *tritici* isolates from molecular groups in each geographic region.

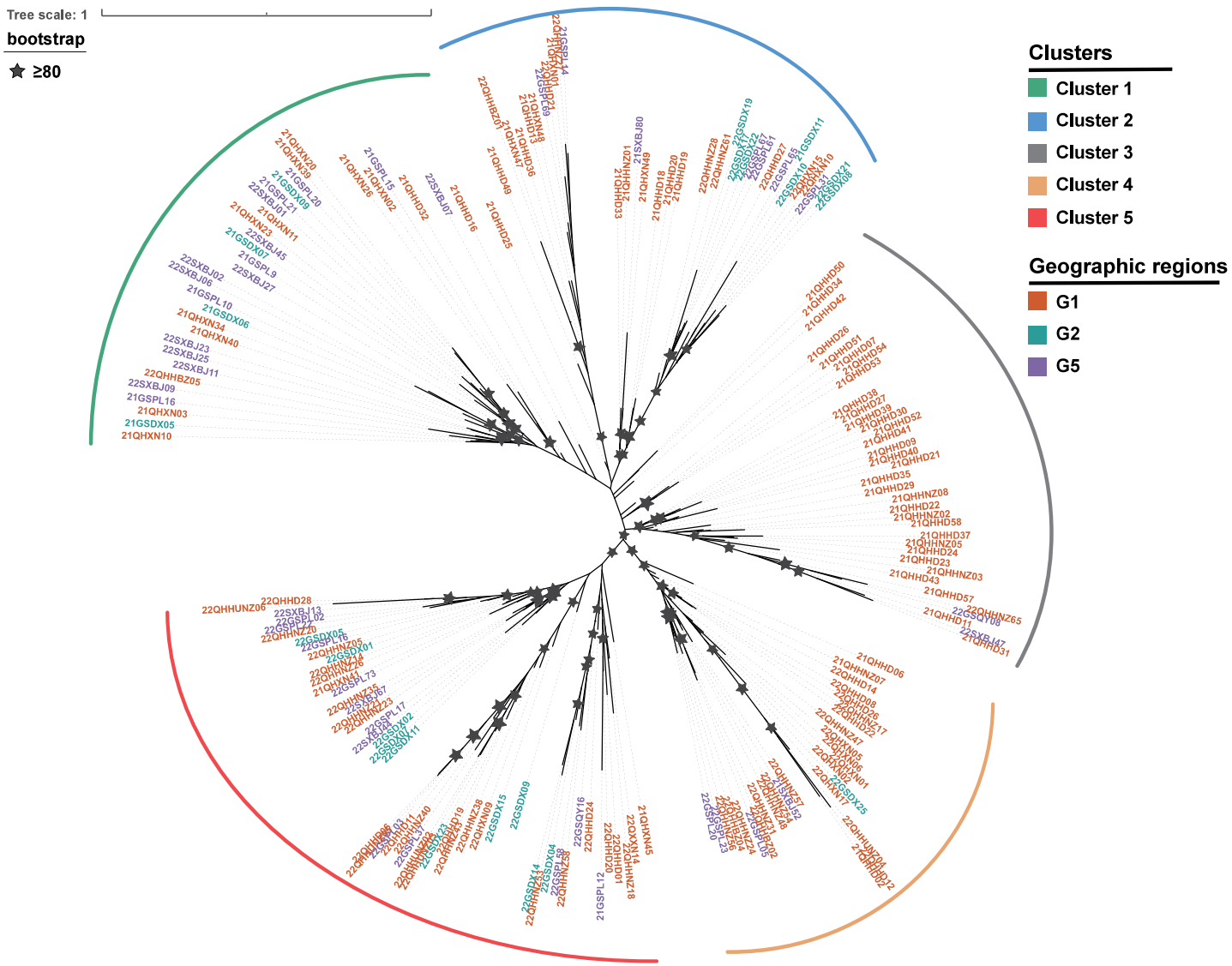

Fig. S5 Phylogenetic tree of *Puccinia striiformis* f. sp. *tritici* isolates from G1, G2 and G5 populations based on the genotyping with 37 markers. Asterisks represent bootstrap values of 80 or higher.

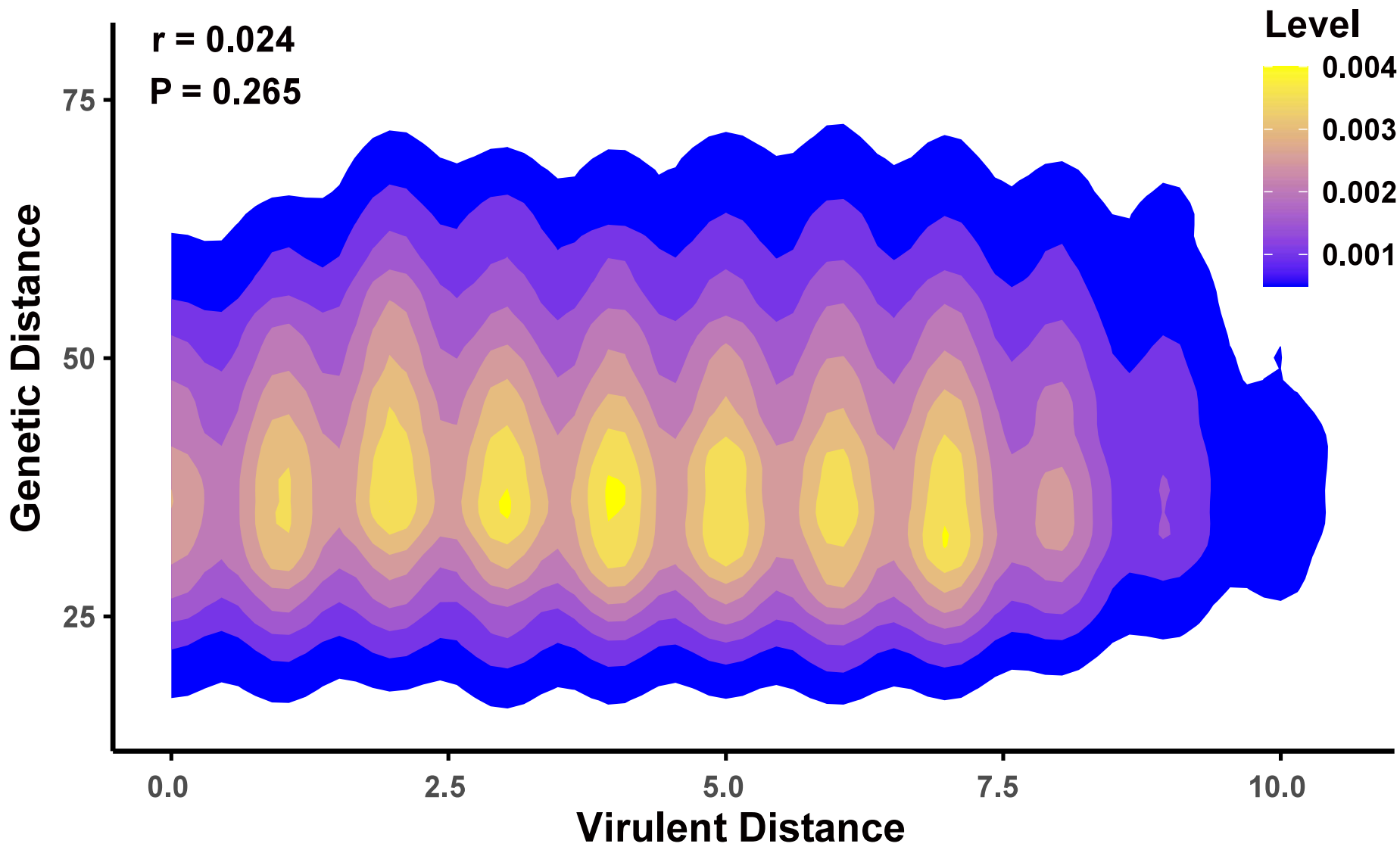

Fig. S6 Correlation analysis between virulent and genetic distances.

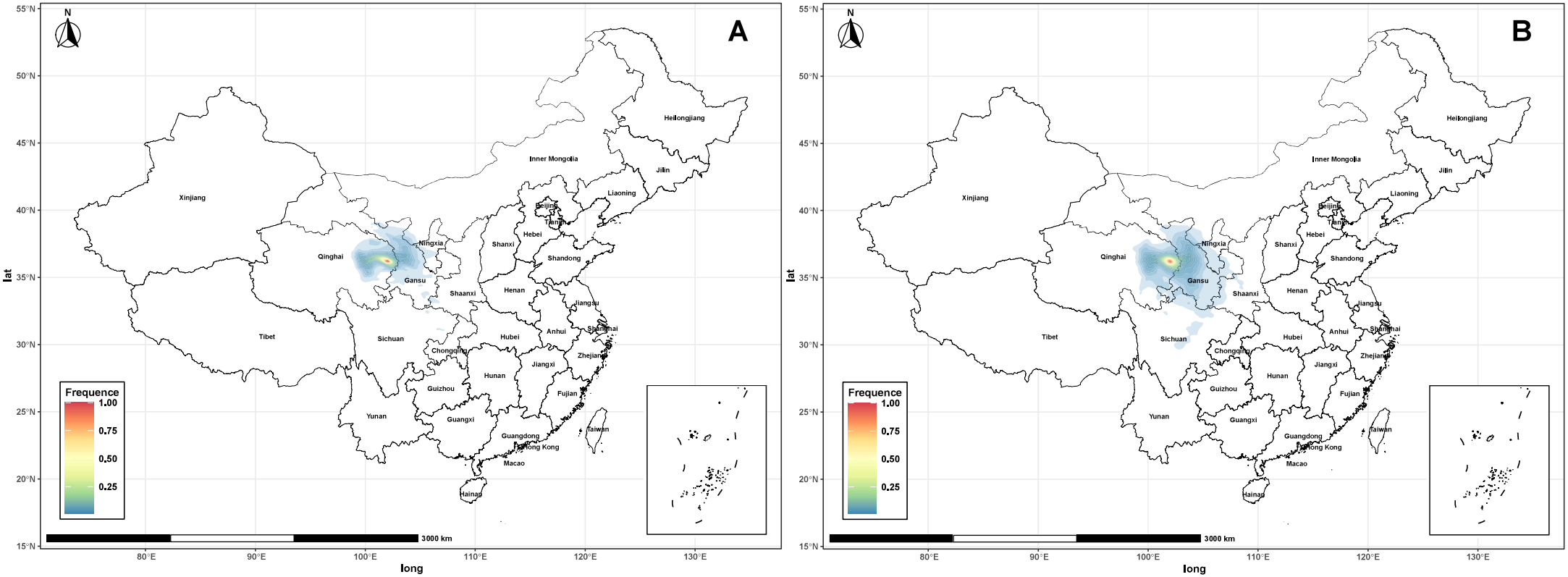

Fig. S7 The frequencies of air trajectory analysis deriving from eastern Qinghai in autumn and spring.

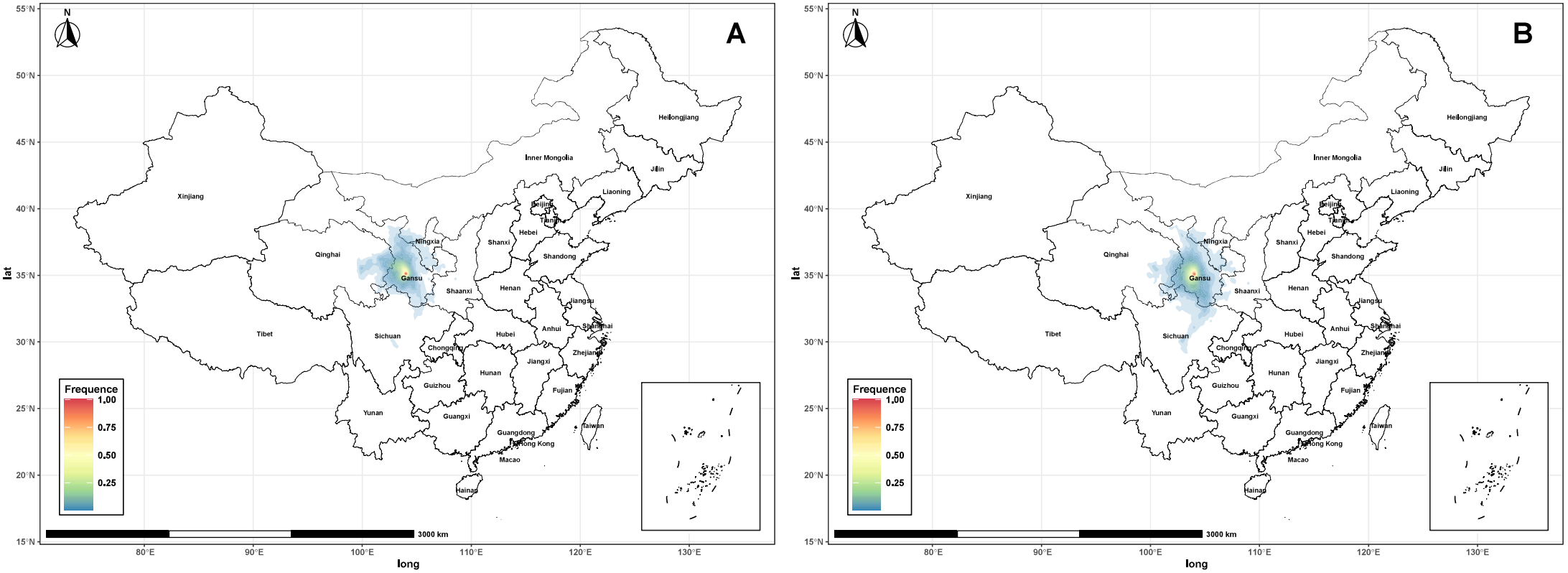

Fig. S8 The frequencies of air trajectory analysis originating from middle Gansu in autumn and spring.

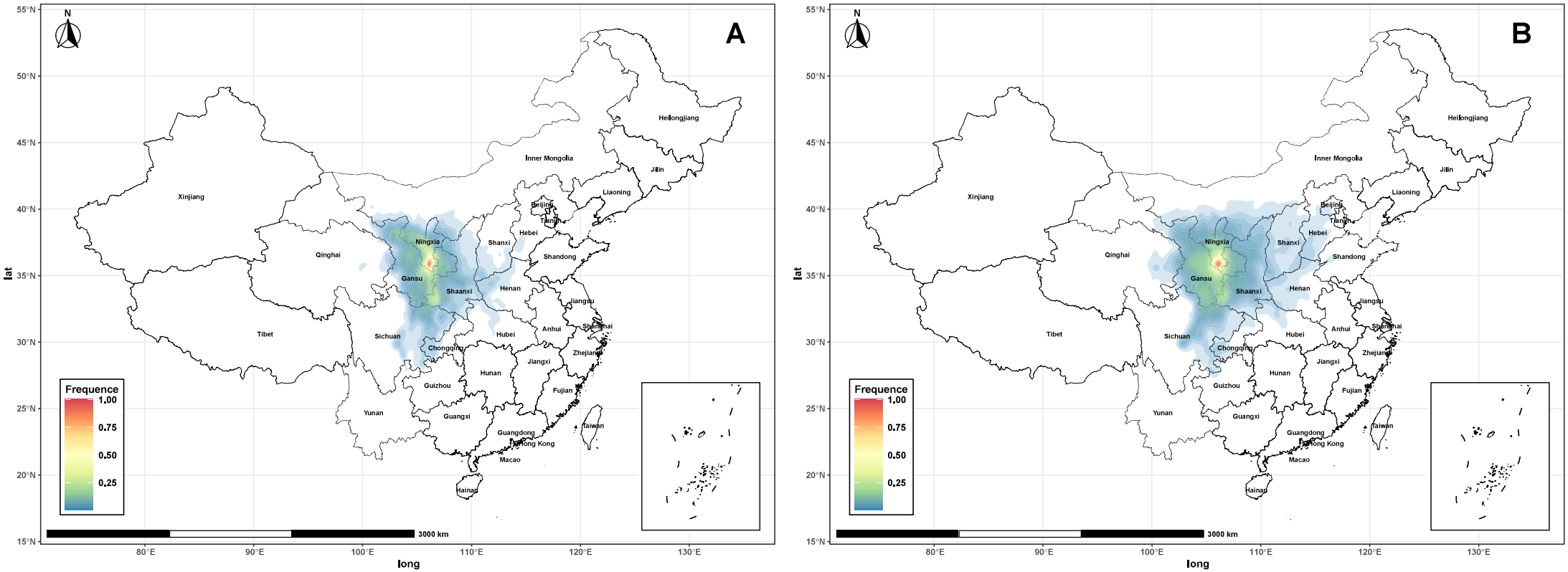

Fig. S9 The frequencies of air trajectory analysis starting from western Liupan Mountain in autumn and spring.

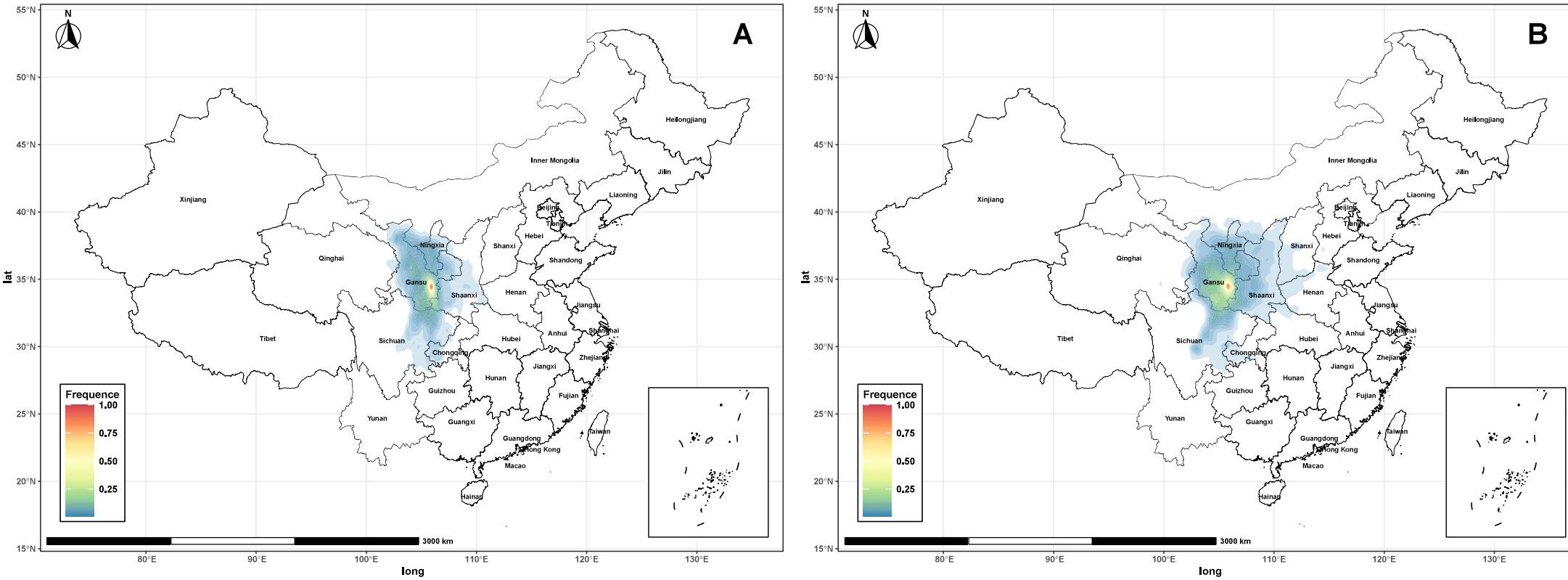

Fig. S10 The frequencies of air trajectory analysis initiating from Longnan in autumn and spring.

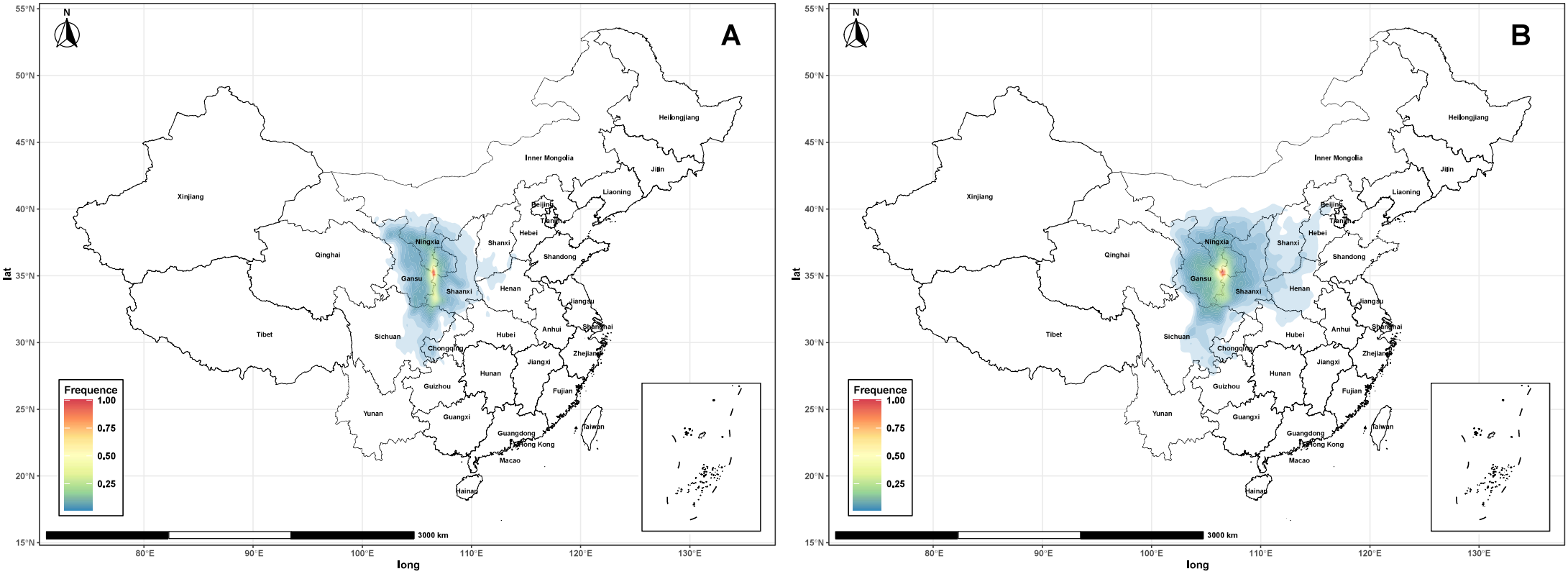

Fig. S11 The frequencies of air trajectory analysis originating from eastern Liupan Mountain in autumn and spring.

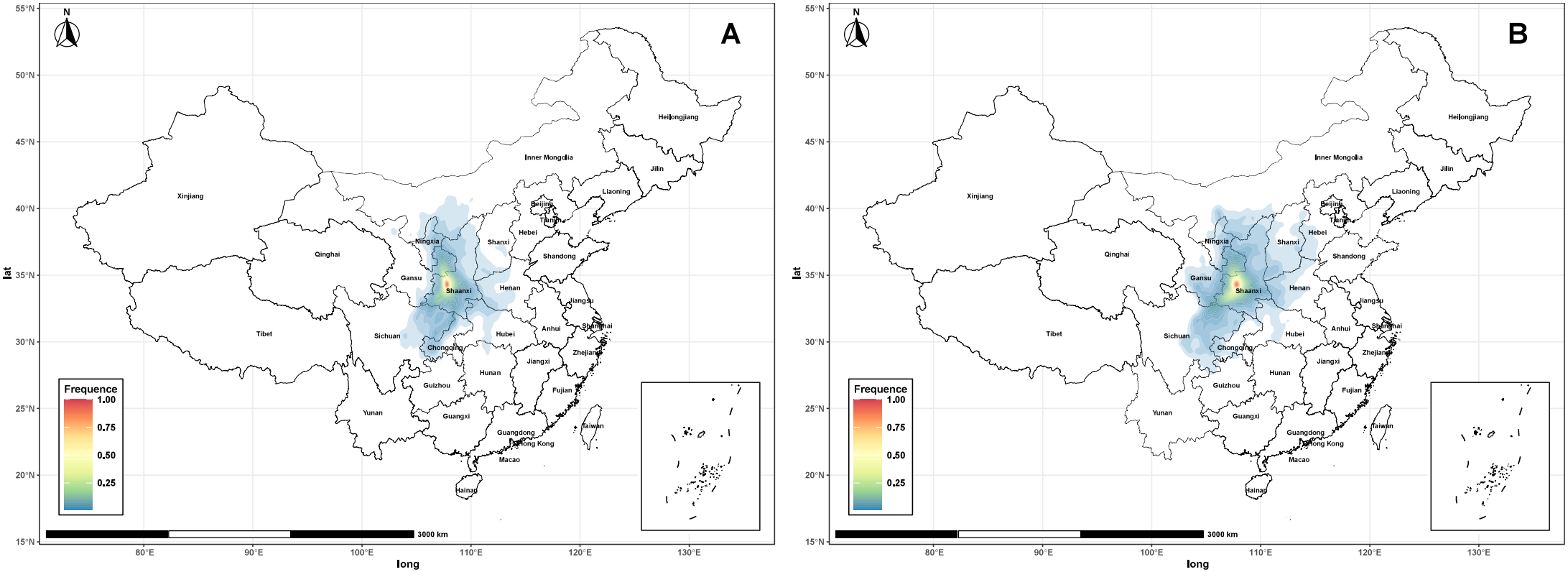

Fig. S12 The frequencies of air trajectory analysis deriving from western Guanzhong Plain in autumn and spring.

Table S1 Sampling information of 308 *Puccinia striiformis* f. sp. *tritici* isolates from six geographic regions

Number	Isolates	Province	City	County/ District	Sampling sites	Latitude	Longitude	Altitude (m)	Geographic population
1	21-GS-BY-01	Gansu	Baiyin	Huining	Dashanchuan Village, Yangyaji Town	35.6914	105.3969	1932	G3
2	21-GS-BY-02	Gansu	Baiyin	Huining	Dashanchuan Village, Yangyaji Town	35.6914	105.3969	1932	G3
3	21-GS-BY-06	Gansu	Baiyin	Huining	Dashanchuan Village, Yangyaji Town	35.6914	105.3969	1932	G3
4	21-GS-BY-09	Gansu	Baiyin	Huining	Dashanchuan Village, Yangyaji Town	35.6914	105.3969	1932	G3
5	21-GS-BY-13	Gansu	Baiyin	Huining	Dashanchuan Village, Yangyaji Town	35.6914	105.3969	1932	G3
6	21-GS-PL-09	Gansu	Pingliang	Kongtong	Tugudui Village, Dazhai Town	35.3556	106.7808	1680	G5
7	21-GS-PL-10	Gansu	Pingliang	Kongtong	Tugudui Village, Dazhai Town	35.3556	106.7808	1680	G5
8	21-GS-PL-12	Gansu	Pingliang	Kongtong	Tugudui Village, Dazhai Town	35.3556	106.7808	1680	G5
9	21-GS-PL-14	Gansu	Pingliang	Kongtong	Xinzhuang Village, Dazhai Town	35.3853	106.8075	1700	G5
10	21-GS-PL-15	Gansu	Pingliang	Kongtong	Tugudui Village, Dazhai Town	35.3556	106.7808	1680	G5
11	21-GS-PL-16	Gansu	Pingliang	Kongtong	Xinzhuang Village, Dazhai Town	35.3853	106.8075	1700	G5
12	21-GS-PL-20	Gansu	Pingliang	Huating	Liangbeihou Village, Handian Town	35.1906	106.2425	1300	G5
13	21-GS-PL-21	Gansu	Pingliang	Huating	Liangbeihou Village, Handian Town	35.1906	106.2425	1300	G5
14	21-GS-TS-03	Gansu	Tianshui	Maiji	Qujiaping Village, Ganquan Town	34.4719	105.9300	1223	G4
15	21-GS-TS-04	Gansu	Tianshui	Maiji	Qujiaping Village, Ganquan Town	34.4719	105.9300	1223	G4
16	21-GS-TS-07	Gansu	Tianshui	Maiji	Qujiaping Village, Ganquan Town	34.4719	105.9300	1223	G4
17	21-GS-TS-09	Gansu	Tianshui	Maiji	Qujiaping Village, Ganquan Town	34.4719	105.9300	1223	G4
18	21-GS-TS-10	Gansu	Tianshui	Maiji	Qujiaping Village, Ganquan Town	34.4719	105.9300	1223	G4
19	21-GS-TS-12	Gansu	Tianshui	Maiji	Qujiaping Village, Ganquan Town	34.4719	105.9300	1223	G4
20	21-GS-TS-19	Gansu	Tianshui	Maiji	Qujiaping Village, Ganquan Town	34.4719	105.9300	1223	G4
21	21-GS-TS-17	Gansu	Tianshui	Qingshui	Zhangshan Village, Jinji Town	34.6089	105.9092	1609	G4
22	21-GS-DX-05	Gansu	Dingxi	Weiyuan	Shenjiatan Village, Huichuan Town	35.0539	103.9800	2397	G2
23	21-GS-DX-06	Gansu	Dingxi	Weiyuan	Shenjiatan Village, Huichuan Town	35.0539	103.9800	2397	G2
24	21-GS-DX-07	Gansu	Dingxi	Weiyuan	Qiaojiazui Village, Huichuan Town	35.0883	104.0303	2310	G2
25	21-GS-DX-09	Gansu	Dingxi	Weiyuan	Qiaojiazui Village, Huichuan Town	35.0883	104.0303	2310	G2
26	21-GS-DX-11	Gansu	Dingxi	Weiyuan	Qiaojiazui Village, Huichuan Town	35.0883	104.0303	2310	G2
27	21-GS-LN-10	Gansu	Longnan	Hui	Xingshu Village, Liucun Town	33.8819	106.2358	1206	G4
28	21-QH-XN-1	Qinghai	Xining	Datong	Wangzhuang Village, Taer Town	37.0425	101.6600	2666	G1
29	21-QH-XN-2	Qinghai	Xining	Datong	Wangzhuang Village, Taer Town	37.0425	101.6600	2666	G1
30	21-QH-XN-3	Qinghai	Xining	Datong	Wangzhuang Village, Taer Town	37.0425	101.6600	2666	G1
31	21-QH-XN-10	Qinghai	Xining	Datong	Natan Village, Taer Town	37.0458	101.6919	2850	G1
32	21-QH-XN-11	Qinghai	Xining	Datong	Natan Village, Taer Town	37.0458	101.6919	2850	G1
33	21-QH-XN-20	Qinghai	Xining	Datong	Huakezhuang Village, Diaogou Town	36.9672	101.8067	2776	G1
34	21-QH-XN-23	Qinghai	Xining	Huangzhong	Ladong Village, Wushi Town	36.7719	102.1433	2732	G1
35	21-QH-XN-26	Qinghai	Xining	Huangzhong	Ladong Village, Wushi Town	36.7719	102.1433	2732	G1
36	21-QH-XN-34	Qinghai	Xining	Huangzhong	Zhujiazhuang Village, Lushaer Town	36.4553	101.4706	2924	G1
37	21-QH-XN-39	Qinghai	Xining	Huangzhong	Diaozhuang Village, Dacai Town	36.4658	101.5019	2837	G1
38	21-QH-XN-40	Qinghai	Xining	Huangzhong	Diaozhuang Village, Dacai Town	36.4658	101.5019	2837	G1
39	21-QH-XN-41	Qinghai	Xining	Huangzhong	Diaozhuang Village, Dacai Town	36.4658	101.5019	2837	G1
40	21-QH-XN-45	Qinghai	Xining	Huangzhong	Xiagu Village, Qunjia Town	36.2958	101.6719	2892	G1
41	21-QH-XN-47	Qinghai	Xining	Huangzhong	Xiagu Village, Qunjia Town	36.2958	101.6719	2892	G1
42	21-QH-XN-48	Qinghai	Xining	Huangzhong	Xiagu Village, Qunjia Town	36.2958	101.6719	2892	G1
43	21-QH-XN-49	Qinghai	Xining	Huangzhong	Xiagu Village, Qunjia Town	36.2958	101.6719	2892	G1
44	21-QH-HD-02	Qinghai	Haidong	Hualong	Xiaduoba Village, Yashinan Town	36.0544	101.9403	2042	G1
45	21-QH-HD-06	Qinghai	Haidong	Xunhua	Atanhe Village, Chahandusi Town	35.8725	102.3728	1889	G1
46	21-QH-HD-07	Qinghai	Haidong	Xunhua	Atanhe Village, Chahandusi Town	35.8725	102.3728	1889	G1
47	21-QH-HD-09	Qinghai	Haidong	Huzhu	Magouhuahai, Nanmenxia Town	36.9650	101.8561	2941	G1
48	21-QH-HD-11	Qinghai	Haidong	Huzhu	Moergou Village, Nanmenxia Town	36.9753	101.8708	2786	G1
49	21-QH-HD-13	Qinghai	Haidong	Huzhu	Moergou Village, Nanmenxia Town	36.9753	101.8708	2786	G1
50	21-QH-HD-16	Qinghai	Haidong	Huzhu	Liushuzhuang Village, Nanmenxia Town	36.9900	101.9214	2844	G1
51	21-QH-HD-18	Qinghai	Haidong	Huzhu	Liushuzhuang Village, Nanmenxia Town	36.9900	101.9214	2844	G1
52	21-QH-HD-19	Qinghai	Haidong	Huzhu	Liushuzhuang Village, Nanmenxia Town	36.9900	101.9214	2844	G1
53	21-QH-HD-20	Qinghai	Haidong	Huzhu	Liushuzhuang Village, Nanmenxia Town	36.9900	101.9214	2844	G1
54	21-QH-HD-21	Qinghai	Haidong	Huzhu	Liushuzhuang Village, Nanmenxia Town	36.9900	101.9214	2844	G1
55	21-QH-HD-22	Qinghai	Haidong	Huzhu	Liushuzhuang Village, Nanmenxia Town	36.9900	101.9214	2844	G1
56	21-QH-HD-23	Qinghai	Haidong	Huzhu	Nanmen Village, Nanmenxia Town	36.9981	101.9875	2912	G1
57	21-QH-HD-24	Qinghai	Haidong	Huzhu	Nanmen Village, Nanmenxia Town	36.9981	101.9875	2912	G1
58	21-QH-HD-25	Qinghai	Haidong	Huzhu	Nanmen Village, Nanmenxia Town	36.9981	101.9875	2912	G1
59	21-QH-HD-26	Qinghai	Haidong	Huzhu	Nanmen Village, Nanmenxia Town	36.9981	101.9875	2912	G1
60	21-QH-HD-27	Qinghai	Haidong	Huzhu	Shigangzi Village, Nanmenxia Town	36.9639	101.9853	2801	G1
61	21-QH-HD-29	Qinghai	Haidong	Huzhu	Shigangzi Village, Nanmenxia Town	36.9639	101.9853	2801	G1
62	21-QH-HD-30	Qinghai	Haidong	Huzhu	Shigangzi Village, Nanmenxia Town	36.9639	101.9853	2801	G1
63	21-QH-HD-31	Qinghai	Haidong	Huzhu	Shigangzi Village, Nanmenxia Town	36.9639	101.9853	2801	G1
64	21-QH-HD-32	Qinghai	Haidong	Huzhu	Kazigou Village, Donggou Town	36.8019	102.0514	2681	G1
65	21-QH-HD-33	Qinghai	Haidong	Huzhu	Kazigou Village, Donggou Town	36.8019	102.0514	2681	G1
66	21-QH-HD-34	Qinghai	Haidong	Huzhu	Kazigou Village, Donggou Town	36.8019	102.0514	2681	G1
67	21-QH-HD-35	Qinghai	Haidong	Huzhu	Kazigou Village, Donggou Town	36.8019	102.0514	2681	G1

68	21-QH-HD-36	Qinghai	Haidong	Huzhu	Kazigou Village, Donggou Town	36.8019	102.0514	2681	G1
69	21-QH-HD-37	Qinghai	Haidong	Huzhu	Kazigou Village, Donggou Town	36.8019	102.0514	2681	G1
70	21-QH-HD-38	Qinghai	Haidong	Huzhu	Kazigou Village, Donggou Town	36.8019	102.0514	2681	G1
71	21-QH-HD-39	Qinghai	Haidong	Huzhu	Labulong Village, Donggou Town	36.7908	102.0669	2760	G1
72	21-QH-HD-40	Qinghai	Haidong	Hualong	Xitan Village, Zaba Town	36.2553	101.9311	3097	G1
73	21-QH-HD-41	Qinghai	Haidong	Hualong	Xitan Village, Zaba Town	36.2553	101.9311	3097	G1
74	21-QH-HD-42	Qinghai	Haidong	Hualong	Xitan Village, Zaba Town	36.2553	101.9311	3097	G1
75	21-QH-HD-43	Qinghai	Haidong	Hualong	Hongtupo Village, Zhaba Town	36.2431	101.9683	2873	G1
76	21-QH-HD-49	Qinghai	Haidong	Hualong	Xianglihula Village, Ertang Town	36.1283	102.2178	2888	G1
77	21-QH-HD-50	Qinghai	Haidong	Hualong	Xianglihula Village, Ertang Town	36.1283	102.2178	2888	G1
78	21-QH-HD-51	Qinghai	Haidong	Hualong	Xianglihula Village, Ertang Town	36.1283	102.2178	2888	G1
79	21-QH-HD-52	Qinghai	Haidong	Hualong	Xianglihula Village, Ertang Town	36.1283	102.2178	2888	G1
80	21-QH-HD-53	Qinghai	Haidong	Hualong	Xianglihula Village, Ertang Town	36.1283	102.2178	2888	G1
81	21-QH-HD-54	Qinghai	Haidong	Hualong	Juankeng Village, Xiejiatan Town	36.0892	102.2406	2894	G1
82	21-QH-HD-57	Qinghai	Haidong	Hualong	Zangtan Village, Bayan Town	36.1403	102.2544	2918	G1
83	21-QH-HD-58	Qinghai	Haidong	Hualong	Zangtan Village, Bayan Town	36.1403	102.2544	2918	G1
84	21-QH-HNZ-01	Qinghai	Hainanzhou	Guide	Dashijia Village, Heyin Town	36.0239	101.4150	2238	G1
85	21-QH-HNZ-02	Qinghai	Hainanzhou	Guide	Dashijia Village, Heyin Town	36.0239	101.4150	2238	G1
86	21-QH-HNZ-03	Qinghai	Hainanzhou	Guide	Dashijia Village, Heyin Town	36.0239	101.4150	2238	G1
87	21-QH-HNZ-05	Qinghai	Hainanzhou	Guide	Qianhu Village, Garang Town	36.2992	101.5344	3121	G1
88	21-QH-HNZ-07	Qinghai	Hainanzhou	Guide	Qianhu Village, Garang Town	36.2992	101.5344	3121	G1
89	21-QH-HNZ-08	Qinghai	Hainanzhou	Guide	Qianhu Village, Garang Town	36.2992	101.5344	3121	G1
90	21-NX-GY-06	Ningxia	Guyuan	Yuanzhou	Gude Village, Touying Town	36.1628	106.2233	1532	G3
91	21-NX-GY-08	Ningxia	Guyuan	Yuanzhou	Gude Village, Touying Town	36.1628	106.2233	1532	G3
92	21-NX-GY-12	Ningxia	Guyuan	Yuanzhou	Erying Village, Touying Town	36.1672	106.2497	1594	G3
93	21-NX-GY-26	Ningxia	Guyuan	Longde	Shangbao Village, Shatang Town	35.8042	106.0956	2053	G3
94	21-NX-GY-27	Ningxia	Guyuan	Longde	Shangbao Village, Shatang Town	35.8042	106.0956	2053	G3
95	21-NX-GY-29	Ningxia	Guyuan	Longde	Shangbao Village, Shatang Town	35.8042	106.0956	2053	G3
96	21-NX-GY-32	Ningxia	Guyuan	Longde	Shangbao Village, Shatang Town	35.8042	106.0956	2053	G3
97	21-NX-GY-35	Ningxia	Guyuan	Longde	Shangbao Village, Shatang Town	35.8042	106.0956	2053	G3
98	21-NX-GY-39	Ningxia	Guyuan	Longde	Hongzhuang Village, Zhangyi Town	35.9008	106.1017	2187	G3
99	21-NX-GY-43	Ningxia	Guyuan	Longde	Diwan Village, Zhangyi Town	35.7450	106.1603	2297	G3
100	21-NX-GY-51	Ningxia	Guyuan	Longde	Diwan Village, Zhangyi Town	35.7450	106.1603	2297	G3
101	21-NX-GY-52	Ningxia	Guyuan	Longde	Diwan Village, Zhangyi Town	35.7450	106.1603	2297	G3
102	21-NX-GY-54	Ningxia	Guyuan	Longde	Diwan Village, Zhangyi Town	35.7450	106.1603	2297	G3
103	21-NX-GY-55	Ningxia	Guyuan	Longde	Diwan Village, Zhangyi Town	35.7450	106.1603	2297	G3
104	21-NX-GY-56	Ningxia	Guyuan	Longde	Diwan Village, Zhangyi Town	35.7450	106.1603	2297	G3
105	21-NX-GY-57	Ningxia	Guyuan	Longde	Diwan Village, Zhangyi Town	35.7450	106.1603	2297	G3
106	21-NX-GY-71	Ningxia	Guyuan	Xiji	Nanchuan Village, Lujiagou Town	35.9358	105.8033	1875	G3
107	21-NX-GY-78	Ningxia	Guyuan	Xiji	Nanchuan Village, Lujiagou Town	35.9358	105.8033	1875	G3
108	21-NX-ZW-01	Ningxia	Zhongwei	Haiyuan	Shuigou Village, Xi'an Town	36.4997	105.8431	1774	G3
109	21-NX-ZW-14	Ningxia	Zhongwei	Haiyuan	Shuigou Village, Xi'an Town	36.4997	105.8431	1774	G3
110	21-NX-ZW-20	Ningxia	Zhongwei	Haiyuan	Huangping Village, Xi'an Town	36.4972	105.8056	1808	G3
111	21-NX-ZW-21	Ningxia	Zhongwei	Haiyuan	Huangping Village, Xi'an Town	36.4972	105.8056	1808	G3
112	21-NX-ZW-24	Ningxia	Zhongwei	Haiyuan	Huangping Village, Xi'an Town	36.4972	105.8056	1808	G3
113	21-NX-ZW-28	Ningxia	Zhongwei	Haiyuan	Xuping Village, Xi'an Town	36.5144	105.7083	1917	G3
114	21-NX-ZW-29	Ningxia	Zhongwei	Haiyuan	Xuping Village, Xi'an Town	36.5144	105.7083	1917	G3
115	21-SX-BJ-04	Shaanxi	Baoji	Jintai	Yuanpingzhuang Village, Qianhe Town	34.3811	107.2611	738	G6
116	21-SX-BJ-52	Shaanxi	Baoji	Qianyang	Xinxi Village, Nanzhai Town	34.6528	107.1586	880	G5
117	21-SX-BJ-80	Shaanxi	Baoji	Fufeng	Zhaiban Village, Qianhe Town	34.3746	107.8810	575	G6
118	21-SX-BJ-81	Shaanxi	Baoji	Qishan	Yifeng Village, Yidian Town	34.4038	107.7515	648	G6
119	21-SX-BJ-TB-03	Shaanxi	Baoji	Taibai	Shangdian Village, Zuitou Town	34.0519	107.3069	1540	G6
120	21-SX-BJ-TB-06	Shaanxi	Baoji	Taibai	Shangdian Village, Zuitou Town	34.0519	107.3069	1540	G6
121	21-SX-BJ-TB-09	Shaanxi	Baoji	Taibai	Shangdian Village, Zuitou Town	34.0519	107.3069	1540	G6
122	21-SX-BJ-TB-11	Shaanxi	Baoji	Taibai	Shangdian Village, Zuitou Town	34.0519	107.3069	1540	G6
123	22-QH-HNZ-05	Qinghai	Hainanzhou	Guide	Qianhu Village, Garang Town	36.3003	101.5357	3088	G1
124	22-QH-HNZ-14	Qinghai	Hainanzhou	Guide	Gamatang Village, Xinjie Town	35.7310	101.3718	2833	G1
125	22-QH-HNZ-17	Qinghai	Hainanzhou	Guide	Gamatang Village, Xinjie Town	35.7310	101.3718	2833	G1
126	22-QH-HNZ-18	Qinghai	Hainanzhou	Guide	Gamatang Village, Xinjie Town	35.7310	101.3718	2833	G1
127	22-QH-HNZ-20	Qinghai	Hainanzhou	Guide	Gamatang Village, Xinjie Town	35.7310	101.3718	2833	G1
128	22-QH-HNZ-21	Qinghai	Hainanzhou	Guide	Gamatang Village, Xinjie Town	35.7310	101.3718	2833	G1
129	22-QH-HNZ-23	Qinghai	Hainanzhou	Guide	Huancang Village, Changmu Town	35.9179	101.3890	2410	G1
130	22-QH-HNZ-24	Qinghai	Hainanzhou	Guide	Huancang Village, Changmu Town	35.9179	101.3890	2410	G1
131	22-QH-HNZ-26	Qinghai	Hainanzhou	Guide	Huancang Village, Changmu Town	35.9179	101.3890	2410	G1
132	22-QH-HNZ-27	Qinghai	Hainanzhou	Guide	Huancang Village, Changmu Town	35.9179	101.3890	2410	G1
133	22-QH-HNZ-28	Qinghai	Hainanzhou	Guide	Huancang Village, Changmu Town	35.9179	101.3890	2410	G1
134	22-QH-HNZ-31	Qinghai	Hainanzhou	Guide	Douhoulang Village, Laxiwa Town	36.1663	101.2120	2686	G1
135	22-QH-HNZ-35	Qinghai	Hainanzhou	Guide	Douhoulang Village, Laxiwa Town	36.1663	101.2120	2686	G1
136	22-QH-HNZ-38	Qinghai	Hainanzhou	Guide	Douhoulang Village, Laxiwa Town	36.1663	101.2120	2686	G1
137	22-QH-HNZ-40	Qinghai	Hainanzhou	Guide	Latang Village, Laxiwa Town	36.2021	101.2256	2932	G1
138	22-QH-HNZ-43	Qinghai	Hainanzhou	Guide	Latang Village, Laxiwa Town	36.2021	101.2256	2932	G1

139	22-QH-HNZ-47	Qinghai	Hainanzhou	Gonghe	Houjvhua Village, Tiegai Town	36.1931	100.7648	2606	G1
140	22-QH-HNZ-48	Qinghai	Hainanzhou	Gonghe	Houjvhua Village, Tiegai Town	36.1931	100.7648	2606	G1
141	22-QH-HNZ-53	Qinghai	Hainanzhou	Gonghe	Qitai Village, Tiegai Town	36.1923	100.6566	2818	G1
142	22-QH-HNZ-54	Qinghai	Hainanzhou	Gonghe	Qitai Village, Tiegai Town	36.1923	100.6566	2818	G1
143	22-QH-HNZ-56	Qinghai	Hainanzhou	Gonghe	Qitai Village, Tiegai Town	36.1923	100.6566	2818	G1
144	22-QH-HNZ-57	Qinghai	Hainanzhou	Gonghe	Qitai Village, Tiegai Town	36.1923	100.6566	2818	G1
145	22-QH-HNZ-58	Qinghai	Hainanzhou	Gonghe	Qitai Village, Tiegai Town	36.1923	100.6566	2818	G1
146	22-QH-HNZ-61	Qinghai	Hainanzhou	Gonghe	Shayou Village, Tiegai Town	36.2254	100.6116	2737	G1
147	22-QH-HNZ-65	Qinghai	Hainanzhou	Gonghe	Shayou Village, Tiegai Town	36.2254	100.6116	2737	G1
148	22-QH-XN-01	Qinghai	Xining	Huangyuan	Sitan Village, Riyue Town	36.5239	101.1300	3094	G1
149	22-QH-XN-02	Qinghai	Xining	Huangyuan	Sitan Village, Riyue Town	36.5239	101.1300	3094	G1
150	22-QH-XN-05	Qinghai	Xining	Huangyuan	Huajian Village, Bayan Town	36.7376	101.0446	3012	G1
151	22-QH-XN-06	Qinghai	Xining	Huangyuan	Huajian Village, Bayan Town	36.7376	101.0446	3012	G1
152	22-QH-XN-09	Qinghai	Xining	Huangyuan	Xiafu Village, Shenzhong Town	36.7300	101.1915	2686	G1
153	22-QH-XN-10	Qinghai	Xining	Huangzhong	Shala Village, Minxia Town	36.7519	101.4328	2602	G1
154	22-QH-XN-14	Qinghai	Xining	Datong	Benwagou Village, Taar Town	37.0439	101.6909	2818	G1
155	22-QH-XN-15	Qinghai	Xining	Datong	Benwagou Village, Taar Town	37.0439	101.6909	2818	G1
156	22-QH-XN-17	Qinghai	Xining	Datong	Benwagou Village, Taar Town	37.0439	101.6909	2818	G1
157	22-QH-HUNZ-02	Qinghai	Huangnanzhou	Jianzha	Nandang Village, Jiajia Town	36.0019	101.8859	2695	G1
158	22-QH-HUNZ-03	Qinghai	Huangnanzhou	Jianzha	Nandang Village, Jiajia Town	36.0019	101.8859	2695	G1
159	22-QH-HUNZ-04	Qinghai	Huangnanzhou	Jianzha	Nandang Village, Jiajia Town	36.0019	101.8859	2695	G1
160	22-QH-HUNZ-05	Qinghai	Huangnanzhou	Jianzha	Nandang Village, Jiajia Town	36.0019	101.8859	2695	G1
161	22-QH-HUNZ-06	Qinghai	Huangnanzhou	Jianzha	Nandang Village, Jiajia Town	36.0019	101.8859	2695	G1
162	22-QH-HD-01	Qinghai	Haidong	Hualong	Baituzhuang Village, Angsiduo Town	36.1781	102.0729	2667	G1
163	22-QH-HD-06	Qinghai	Haidong	Hualong	Gongbuang Village, Angsiduo Town	36.1867	102.1121	2803	G1
164	22-QH-HD-08	Qinghai	Haidong	Hualong	Gongbuang Village, Angsiduo Town	36.1867	102.1121	2803	G1
165	22-QH-HD-11	Qinghai	Haidong	Hualong	Gongbuang Village, Angsiduo Town	36.1867	102.1121	2803	G1
166	22-QH-HD-12	Qinghai	Haidong	Hualong	Zhabayi Village, Zhaba Town	36.2275	101.9784	2747	G1
167	22-QH-HD-14	Qinghai	Haidong	Hualong	Zhabayi Village, Zhaba Town	36.2275	101.9784	2747	G1
168	22-QH-HD-19	Qinghai	Haidong	Hualong	Zhabayi Village, Zhaba Town	36.2275	101.9784	2747	G1
169	22-QH-HD-20	Qinghai	Haidong	Ledu	Dongmen Village, Gaodian Town	36.4849	102.2138	2014	G1
170	22-QH-HD-21	Qinghai	Haidong	Ledu	Dongmen Village, Gaodian Town	36.4849	102.2138	2014	G1
171	22-QH-HD-22	Qinghai	Haidong	Ledu	Dongmen Village, Gaodian Town	36.4849	102.2138	2014	G1
172	22-QH-HD-24	Qinghai	Haidong	Ledu	Dongmen Village, Gaodian Town	36.4849	102.2138	2014	G1
173	22-QH-HD-26	Qinghai	Haidong	Huzhu	Moergou Village, Nanmenxia Town	36.9935	101.9126	2842	G1
174	22-QH-HD-27	Qinghai	Haidong	Huzhu	Moergou Village, Nanmenxia Town	36.9935	101.9126	2842	G1
175	22-QH-HD-28	Qinghai	Haidong	Huzhu	Moergou Village, Nanmenxia Town	36.9935	101.9126	2842	G1
176	22-QH-HBZ-01	Qinghai	Haibeizhou	Menyuan	Deqian Village, Xianmi Town	37.2686	101.9865	2635	G1
177	22-QH-HBZ-02	Qinghai	Haibeizhou	Menyuan	Deqian Village, Xianmi Town	37.2686	101.9865	2635	G1
178	22-QH-HBZ-04	Qinghai	Haibeizhou	Menyuan	Qianhetan Village Dongchuan Town	37.3077	101.8852	2666	G1
179	22-QH-HBZ-05	Qinghai	Haibeizhou	Menyuan	Qianhetan Village Dongchuan Town	37.3077	101.8852	2666	G1
180	22-GS-LN-01	Gansu	Longnan	Cheng	Yangshibawan Village, Shaba Town	33.7285	105.5419	1403	G4
181	22-GS-LN-02	Gansu	Longnan	Cheng	Yangshibawan Village, Shaba Town	33.7285	105.5419	1403	G4
182	22-GS-LN-03	Gansu	Longnan	Cheng	Yangshibawan Village, Shaba Town	33.7285	105.5419	1403	G4
183	22-GS-LN-05	Gansu	Longnan	Cheng	Zhaoba Village, Shaba Town	33.7248	105.5408	1379	G4
184	22-GS-LN-06	Gansu	Longnan	Cheng	Zhaoba Village, Shaba Town	33.7248	105.5408	1379	G4
185	22-GS-LN-07	Gansu	Longnan	Cheng	Zhaoba Village, Shaba Town	33.7248	105.5408	1379	G4
186	22-GS-LN-09	Gansu	Longnan	Xihe	Jiangyao Village, Jiangxi Town	33.9951	105.2411	1628	G4
187	22-GS-LN-10	Gansu	Longnan	Xihe	Jiangyao Village, Jiangxi Town	33.9951	105.2411	1628	G4
188	22-GS-LN-12	Gansu	Longnan	Xihe	Jiangyao Village, Jiangxi Town	33.9951	105.2411	1628	G4
189	22-GS-LN-34	Gansu	Longnan	Xihe	Yangshan Village, Luhe Town	33.9682	105.4193	1749	G4
190	22-GS-LN-35	Gansu	Longnan	Xihe	Yangshan Village, Luhe Town	33.9682	105.4193	1749	G4
191	22-GS-LN-49	Gansu	Longnan	Li	Fengyayi Village, Baiguan Town	33.9809	104.9362	2006	G4
192	22-GS-LN-50	Gansu	Longnan	Li	Fengyaer Village, Baiguan Town	33.9793	104.9346	2012	G4
193	22-GS-LN-51	Gansu	Longnan	Li	Fengyaer Village, Baiguan Town	33.9793	104.9346	2012	G4
194	22-GS-LN-52	Gansu	Longnan	Li	Fengyaer Village, Baiguan Town	33.9793	104.9346	2012	G4
195	22-GS-LN-53	Gansu	Longnan	Li	Fengyaer Village, Baiguan Town	33.9793	104.9346	2012	G4
196	22-GS-LN-61	Gansu	Longnan	Xihe	Wujiawan Village, Luhe Town	33.9764	105.2962	1664	G4
197	22-GS-PL-01	Gansu	Pingliang	Zhuanglang	Shangyangjia Village, Liangyi Town	35.2705	106.0848	1681	G5
198	22-GS-PL-02	Gansu	Pingliang	Kongtong	Jingpo Village, Dazhai Town	35.3635	106.7831	1616	G5
199	22-GS-PL-03	Gansu	Pingliang	Kongtong	Jingpo Village, Dazhai Town	35.3635	106.7831	1616	G5
200	22-GS-PL-05	Gansu	Pingliang	Kongtong	Jingpo Village, Dazhai Town	35.3635	106.7831	1616	G5
201	22-GS-PL-06	Gansu	Pingliang	Zhuanglang	Guanlu Village,Liuliang Town	35.2309	106.0665	1609	G5
202	22-GS-PL-10	Gansu	Pingliang	Zhuanglang	Guanlu Village,Liuliang Town	35.2309	106.0665	1609	G5
203	22-GS-PL-14	Gansu	Pingliang	Zhuanglang	Guanlu Village,Liuliang Town	35.2309	106.0665	1609	G5
204	22-GS-PL-16	Gansu	Pingliang	Kongtong	Panling Village,Dazhai Town	35.3639	106.7831	1626	G5
205	22-GS-PL-17	Gansu	Pingliang	Kongtong	Panling Village,Dazhai Town	35.3639	106.7831	1626	G5
206	22-GS-PL-20	Gansu	Pingliang	Kongtong	Xinzhuang Village,Dazhai Town	35.3853	106.8089	1551	G5
207	22-GS-PL-22	Gansu	Pingliang	Kongtong	Xinzhuang Village,Dazhai Town	35.3853	106.8089	1551	G5
208	22-GS-PL-23	Gansu	Pingliang	Kongtong	Xinzhuang Village,Dazhai Town	35.3853	106.8089	1551	G5
209	22-GS-PL-31	Gansu	Pingliang	Chongxin	Kangjiagou Village, Huanghua Town	35.2321	106.9910	1467	G5

210	22-GS-PL-37	Gansu	Pingliang	Huangting	Hongya Village, Xihua Town	35.1976	106.5503	1555	G5
211	22-GS-PL-45	Gansu	Pingliang	Jingning	Qicha village,Caowu Town	35.4410	105.8560	1693	G5
212	22-GS-PL-46	Gansu	Pingliang	Jingning	Qicha village,Caowu Town	35.4410	105.8560	1693	G5
213	22-GS-PL-52	Gansu	Pingliang	Zhuanglang	Dashanpo Village, Nanhu Town	35.3328	105.9503	1709	G5
214	22-GS-PL-53	Gansu	Pingliang	Zhuanglang	Dashanpo Village, Nanhu Town	35.3328	105.9503	1709	G5
215	22-GS-PL-58	Gansu	Pingliang	Kongtong	Zengjiawan Village, Zhaihe Town	35.6715	106.7534	1576	G5
216	22-GS-PL-61	Gansu	Pingliang	Kongtong	Kangzhaizi Village,Zhaihe Town	35.6715	106.7534	1576	G5
217	22-GS-PL-65	Gansu	Pingliang	Kongtong	Kangzhaizi Village,Zhaihe Town	35.6715	106.7534	1576	G5
218	22-GS-PL-67	Gansu	Pingliang	Kongtong	Kazi Village, Zhaihe Town	35.6359	106.8093	1536	G5
219	22-GS-PL-69	Gansu	Pingliang	Kongtong	Kazi Village, Zhaihe Town	35.6359	106.8093	1536	G5
220	22-GS-PL-73	Gansu	Pingliang	Kongtong	Maowa village, Caofeng Town	35.6235	106.8339	1528	G5
221	22-GS-TS-02	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
222	22-GS-TS-03	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
223	22-GS-TS-04	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
224	22-GS-TS-05	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
225	22-GS-TS-06	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
226	22-GS-TS-07	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
227	22-GS-TS-08	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
228	22-GS-TS-09	Gansu	Tianshui	Qinchuan	Wanjiazhuang Village, Pingnan Town	34.3921	105.7006	1678	G4
229	22-GS-TS-15	Gansu	Tianshui	Qinchuan	Chunguan Village, Pingnan Town	34.3726	105.6978	1680	G4
230	22-GS-TS-17	Gansu	Tianshui	Qinchuan	Chunguan Village, Pingnan Town	34.3726	105.6978	1680	G4
231	22-GS-TS-18	Gansu	Tianshui	Qinchuan	Chunguan Village, Pingnan Town	34.3726	105.6978	1680	G4
232	22-GS-TS-21	Gansu	Tianshui	Qinchuan	Qujiaping Village, Ganquan Town	34.4722	105.9255	1143	G4
233	22-GS-TS-24	Gansu	Tianshui	Qinchuan	Qujiaping Village, Ganquan Town	34.4722	105.9255	1143	G4
234	22-GS-TS-33	Gansu	Tianshui	Qingshui	Tieliu Village, Jinji Town	34.6598	105.8649	1650	G4
235	22-GS-TS-36	Gansu	Tianshui	Qingshui	Leijiayao Village, Qinting Town	34.7175	106.3378	1561	G4
236	22-GS-DX-01	Gansu	Dingxi	Weiyuan	Qiaoyu Village, Qiaoyu Town	35.0767	104.2006	2159	G2
237	22-GS-DX-02	Gansu	Dingxi	Weiyuan	Qiaoyu Village, Qiaoyu Town	35.0767	104.2006	2159	G2
238	22-GS-DX-04	Gansu	Dingxi	Weiyuan	Qiaoyu Village, Qiaoyu Town	35.0767	104.2006	2159	G2
239	22-GS-DX-05	Gansu	Dingxi	Weiyuan	Qiaoyu Village, Qiaoyu Town	35.0767	104.2006	2159	G2
240	22-GS-DX-07	Gansu	Dingxi	Weiyuan	Kangjiazhuang Village, Huichuan Town	35.0859	104.0376	2306	G2
241	22-GS-DX-08	Gansu	Dingxi	Weiyuan	Liujia village, Qiaoyu Town	35.0868	104.2182	2106	G2
242	22-GS-DX-09	Gansu	Dingxi	Weiyuan	Liujia village, Qiaoyu Town	35.0868	104.2182	2106	G2
243	22-GS-DX-10	Gansu	Dingxi	Weiyuan	Liujia village, Qiaoyu Town	35.0868	104.2182	2106	G2
244	22-GS-DX-11	Gansu	Dingxi	Weiyuan	Liujia village, Qiaoyu Town	35.0868	104.2182	2106	G2
245	22-GS-DX-14	Gansu	Dingxi	Weiyuan	Liujia village, Qiaoyu Town	35.0868	104.2182	2106	G2
246	22-GS-DX-15	Gansu	Dingxi	Lintao	Dahucha village, Zhantan Town	35.4773	104.2223	2394	G2
247	22-GS-DX-17	Gansu	Dingxi	Lintao	Dahucha village, Zhantan Town	35.4773	104.2223	2394	G2
248	22-GS-DX-19	Gansu	Dingxi	Lintao	Laodigou Village, Zhantan Town	35.4830	104.2340	2359	G2
249	22-GS-DX-21	Gansu	Dingxi	Lintao	Laodigou Village, Zhantan Town	35.4830	104.2340	2359	G2
250	22-GS-DX-22	Gansu	Dingxi	Lintao	Laodigou Village, Zhantan Town	35.4830	104.2340	2359	G2
251	22-GS-DX-23	Gansu	Dingxi	Lintao	Laodigou Village, Zhantan Town	35.4830	104.2340	2359	G2
252	22-GS-DX-25	Gansu	Dingxi	Weiyuan	Xujiabao Village, Luyuan Town	35.0711	104.3547	1942	G2
253	22-GS-QY-08	Gansu	Qingyang	Zhenyuan	Lujialing Village, Tunyu Town	35.5342	107.3341	1407	G5
254	22-GS-QY-16	Gansu	Qingyang	Qingcheng	Shangzhuang Village, Yima Town	35.9146	107.6369	1459	G5
255	22-NX-GY-02	Ningxia	Guyuan	Yuanzhou	Hongzhuang Village, Piancheng Town	35.9010	106.1012	2165	G3
256	22-NX-GY-03	Ningxia	Guyuan	Yuanzhou	Hongzhuang Village, Piancheng Town	35.9010	106.1012	2165	G3
257	22-NX-GY-04	Ningxia	Guyuan	Yuanzhou	Hongzhuang Village, Piancheng Town	35.9010	106.1012	2165	G3
258	22-NX-GY-08	Ningxia	Guyuan	Yuanzhou	Hongzhuang Village, Piancheng Town	35.9010	106.1012	2165	G3
259	22-NX-GY-12	Ningxia	Guyuan	Xiji	Chenjiawan Village, Jiangtaibao Town	35.8979	105.8426	1782	G3
260	22-NX-GY-13	Ningxia	Guyuan	Xiji	Chenjiawan Village, Jiangtaibao Town	35.8979	105.8426	1782	G3
261	22-NX-GY-15	Ningxia	Guyuan	Xiji	Chenjiawan Village, Jiangtaibao Town	35.8979	105.8426	1782	G3
262	22-NX-GY-20	Ningxia	Guyuan	Yuanzhou	Xigou Village, Zhangyi Town	35.8700	106.1095	2107	G3
263	22-NX-GY-21	Ningxia	Guyuan	Yuanzhou	Xigou Village, Zhangyi Town	35.8700	106.1095	2107	G3
264	22-NX-GY-22	Ningxia	Guyuan	Yuanzhou	Xigou Village, Zhangyi Town	35.8700	106.1095	2107	G3
265	22-NX-GY-26	Ningxia	Guyuan	Yuanzhou	Gude Village, Pengbao Town	36.1684	106.2327	1551	G3
266	22-NX-GY-27	Ningxia	Guyuan	Yuanzhou	Gude Village, Pengbao Town	36.1684	106.2327	1551	G3
267	22-NX-GY-30	Ningxia	Guyuan	Yuanzhou	Gude Village, Pengbao Town	36.1684	106.2327	1551	G3
268	22-NX-GY-33	Ningxia	Guyuan	Yuanzhou	Gude Village, Pengbao Town	36.1684	106.2327	1551	G3
269	22-NX-GY-36	Ningxia	Guyuan	Yuanzhou	Gude Village, Pengbao Town	36.1684	106.2327	1551	G3
270	22-NX-GY-38	Ningxia	Guyuan	Yuanzhou	Shibei Village, Pengbao Town	36.0792	106.2279	1714	G3
271	22-NX-GY-40	Ningxia	Guyuan	Yuanzhou	Lijiabaozi Village, Touying Town	36.1517	106.2401	1603	G3
272	22-NX-GY-41	Ningxia	Guyuan	Yuanzhou	Lijiabaozi Village, Touying Town	36.1517	106.2401	1603	G3
273	22-NX-GY-42	Ningxia	Guyuan	Yuanzhou	Yimin Village, Touying Town	36.1584	106.2201	1552	G3
274	22-NX-GY-43	Ningxia	Guyuan	Yuanzhou	Yimin Village, Touying Town	36.1584	106.2201	1552	G3
275	22-NX-GY-44	Ningxia	Guyuan	Yuanzhou	Yimin Village, Touying Town	36.1584	106.2201	1552	G3
276	22-NX-GY-49	Ningxia	Guyuan	Yuanzhou	Nanchuan Village, Lujiagou Town	36.1919	106.2193	1532	G3
277	22-NX-GY-52	Ningxia	Guyuan	Yuanzhou	Nanchuan Village, Lujiagou Town	36.1919	106.2193	1532	G3
278	22-SX-BJ-01	Shaanxi	Baoji	Long	Shijiawan Village, Dongfeng Town	34.8004	106.9507	296	G5
279	22-SX-BJ-02	Shaanxi	Baoji	Long	Shijiawan Village, Dongfeng Town	34.8004	106.9507	296	G5
280	22-SX-BJ-06	Shaanxi	Baoji	Long	Shijiawan Village, Dongfeng Town	34.8004	106.9507	296	G5

281	22-SX-BJ-07	Shaanxi	Baoji	Long	Shijiawan Village, Dongfeng Town	34.8004	106.9507	296	G5
282	22-SX-BJ-09	Shaanxi	Baoji	Long	Shijiawan Village, Dongfeng Town	34.8004	106.9507	296	G5
283	22-SX-BJ-11	Shaanxi	Baoji	Long	Liangfu Village, Southeast Town	34.8584	106.9081	901	G5
284	22-SX-BJ-13	Shaanxi	Baoji	Long	Liangfu Village, Southeast Town	34.8584	106.9081	901	G5
285	22-SX-BJ-23	Shaanxi	Baoji	Long	Liangfu Village, Southeast Town	34.8584	106.9081	901	G5
286	22-SX-BJ-25	Shaanxi	Baoji	Long	Liangjia Village, Southeast Town	34.8654	106.8654	889	G5
287	22-SX-BJ-27	Shaanxi	Baoji	Long	Liangjia Village, Southeast Town	34.8654	106.8654	889	G5
288	22-SX-BJ-44	Shaanxi	Baoji	Long	Duyang Village, Dongfeng Town	34.8359	106.9303	893	G5
289	22-SX-BJ-45	Shaanxi	Baoji	Long	Duyang Village, Dongfeng Town	34.8359	106.9303	893	G5
290	22-SX-BJ-47	Shaanxi	Baoji	Long	Duyang Village, Dongfeng Town	34.8359	106.9303	893	G5
291	22-SX-BJ-49	Shaanxi	Baoji	Taibai	Zaoyuan Village, Yingge Town	34.0626	107.5439	920	G6
292	22-SX-BJ-51	Shaanxi	Baoji	Taibai	Zaoyuan Village, Yingge Town	34.0626	107.5439	920	G6
293	22-SX-BJ-52	Shaanxi	Baoji	Taibai	Zaoyuan Village, Yingge Town	34.0626	107.5439	920	G6
294	22-SX-BJ-53	Shaanxi	Baoji	Taibai	Maershan Village, Yingge Town	34.0659	107.6363	913	G6
295	22-SX-BJ-54	Shaanxi	Baoji	Taibai	Maershan Village, Yingge Town	34.0659	107.6363	913	G6
296	22-SX-BJ-58	Shaanxi	Baoji	Mei	Chenjiabao Village, Xiashi Town	34.3057	107.1738	449	G6
297	22-SX-BJ-60	Shaanxi	Baoji	Mei	Chenjiabao Village, Xiashi Town	34.3057	107.1738	449	G6
298	22-SX-BJ-61	Shaanxi	Baoji	Mei	Chenjiabao Village, Xiashi Town	34.3057	107.1738	449	G6
299	22-SX-BJ-65	Shaanxi	Baoji	Mei	Dujiayuan Village, Changxing Town	34.2928	107.7972	601	G6
300	22-SX-BJ-66	Shaanxi	Baoji	Mei	Dujiayuan Village, Changxing Town	34.2928	107.7972	601	G6
301	22-SX-BJ-67	Shaanxi	Baoji	Fufeng	Luojia Village, Jiangzhang Town	34.2450	107.9601	416	G6
302	22-SX-BJ-71	Shaanxi	Baoji	Mei	Xinzhuang Village, Shoushan Town	34.2686	107.7275	486	G6
303	22-SX-BJ-72	Shaanxi	Baoji	Mei	Xinzhuang Village, Shoushan Town	34.2686	107.7275	486	G6
304	22-SX-BJ-75	Shaanxi	Baoji	Mei	Shilongmiao Village, Qi Town	34.1850	107.6742	643	G6
305	22-SX-BJ-78	Shaanxi	Baoji	Taibai	Liushaya Village,Yingge Town	34.0797	107.6325	892	G6
306	22-SX-BJ-80	Shaanxi	Baoji	Taibai	Liushaya Village,Yingge Town	34.0797	107.6325	892	G6
307	22-SX-BJ-81	Shaanxi	Baoji	Taibai	Liushaya Village,Yingge Town	34.0797	107.6325	892	G6
308	22-SX-BJ-82	Shaanxi	Baoji	Taibai	Liushaya Village,Yingge Town	34.0797	107.6325	892	G6

Table S2 Summary of 19 Chinese wheat differentials, associated resistance genes and susceptibility rates against 308 *Pst* Isolates

Name	Chinese WDs	*Yr* gene	Percentage of susceptible response
WD1	Trigo-Eureka	*Yr6*	67.21%
WD2	Fulhard	Unknown	69.48%
WD3	Lutescens 128	Unknown	82.79%
WD4	Mentana	Unknown	94.16%
WD5	Virgilio	*YrVir1* , *YrVir2*	87.66%
WD6	Abbondanza	Unknown	94.48%
WD7	Early Premium	Unknown	69.16%
WD8	Funo	*YrA* , +	88.31%
WD9	Danish 1	*Yr3*	85.06%
WD10	Jubilejina Ⅱ	*YrJu1* , *YrJu2* , *YrJu3* , *YrJu4*	82.47%
WD11	Fengchan 3	*Yr1*	93.51%
WD12	Lovrin 13	*Yr9* , +	87.66%
WD13	Kangyin 655	*Yr1* , *YrKy1* , *YrKy2*	61.04%
WD14	Suwon 11	*YrSu*	90.58%
WD15	Zhong 4	Unknown	0.32%
WD16	Lovrin 10	*Yr9*	93.83%
WD17	Hybrid 46	*Yr3b* , *Yr4b*	73.05%
WD18	*Triticum spelta* Album	*Yr5*	0.32%
WD19	Guinong 22	*Yr10* , *Yr26*	13.96%

Table S3 Races, proportion of race and pathogenic groups of *Puccinia striiformis* f. sp. *tritici* isolates identified

Number	Isolate	Race	Proportion of race (%)	Pathogenic group
1	21-GS-LN-10	CYR34	2.92	Guinong 22
2	21-GS-TS-04	CYR34		Guinong 22
3	21-GS-PL-20	CYR34		Guinong 22
4	21-QH-XN-41	CYR34		Guinong 22
5	21-QH-HD-23	CYR34		Guinong 22
6	21-QH-HD-41	CYR34		Guinong 22
7	22-GS-PL-73	CYR34		Guinong 22
8	22-QX-XN-14	CYR34		Guinong 22
9	22-GS-TS-33	CYR34		Guinong 22
10	21-GS-TS-19	G22-013	0.65	Guinong 22
11	21-QH-HD-57	G22-013		Guinong 22
12	21-QH-XN-45	G22-014	0.65	Guinong 22
13	22-QH-HD-20	G22-014		Guinong 22
14	21-GS-TS-09	G22-078	0.65	Guinong 22
15	21-QH-XN-10	G22-078		Guinong 22
16	22-GS-PL-05	G22-107	0.32	Guinong 22
17	21-GS-TS-10	G22-108	2.27	Guinong 22
18	21-NX-GY-78	G22-108		Guinong 22
19	21-QH-XN-47	G22-108		Guinong 22
20	21-QH-XN-48	G22-108		Guinong 22
21	21-QH-HD-40	G22-108		Guinong 22
22	22-QH-HNZ-18	G22-108		Guinong 22
23	22-QH-HBZ-04	G22-108		Guinong 22
24	21-GS-TS-07	G22-205	0.32	Guinong 22
25	21-QH-XN-40	G22-238	0.65	Guinong 22
26	21-QH-HD-42	G22-238		Guinong 22
27	22-QH-HNZ-47	G22-246	0.65	Guinong 22
28	22-GS-TS-15	G22-246		Guinong 22
29	21-GS-PL-15	CYR32	27.60	Hybrid 46
30	21-GS-PL-10	CYR32		Hybrid 46
31	21-GS-PL-KT-1	CYR32		Hybrid 46
32	21-GS-BY-13	CYR32		Hybrid 46
33	21-GS-PL-12	CYR32		Hybrid 46
34	21-GS-PL-16	CYR32		Hybrid 46
35	21-GS-BY-02	CYR32		Hybrid 46
36	21-GS-DX-06	CYR32		Hybrid 46
37	21-GS-PL-21	CYR32		Hybrid 46
38	21-GS-DX-09	CYR32		Hybrid 46
39	21-NX-GY-08	CYR32		Hybrid 46
40	21-NX-GY-35	CYR32		Hybrid 46
41	21-NX-GY-71	CYR32		Hybrid 46
42	21-NX-ZW-20	CYR32		Hybrid 46
43	21-NX-ZW-29	CYR32		Hybrid 46
44	21-NX-GY-55	CYR32		Hybrid 46
45	21-SX-BJ-04	CYR32		Hybrid 46
46	21-SX-BJ-81	CYR32		Hybrid 46
47	21-QH-HNZ-01	CYR32		Hybrid 46
48	21-QH-HNZ-02	CYR32		Hybrid 46
49	21-QH-HNZ-03	CYR32		Hybrid 46
50	21-QH-HNZ-05	CYR32		Hybrid 46
51	21-QH-HNZ-07	CYR32		Hybrid 46
52	21-QH-HNZ-08	CYR32		Hybrid 46
53	21-QH-XN-2	CYR32		Hybrid 46

54	21-QH-XN-03	CYR32	Hybrid 46
55	21-QH-XN-34	CYR32	Hybrid 46
56	21-QH-HD-06	CYR32	Hybrid 46
57	21-QH-HD-07	CYR32	Hybrid 46
58	21-QH-HD-13	CYR32	Hybrid 46
59	21-QH-HD-16	CYR32	Hybrid 46
60	21-QH-HD-21	CYR32	Hybrid 46
61	21-QH-HD-24	CYR32	Hybrid 46
62	21-QH-HD-26	CYR32	Hybrid 46
63	21-QH-HD-29	CYR32	Hybrid 46
64	21-QH-HD-33	CYR32	Hybrid 46
65	21-QH-HD-38	CYR32	Hybrid 46
66	21-QH-HD-49	CYR32	Hybrid 46
67	21-QH-HD-50	CYR32	Hybrid 46
68	21-QH-HD-51	CYR32	Hybrid 46
69	21-QH-HD-52	CYR32	Hybrid 46
70	21-QH-HD-53	CYR32	Hybrid 46
71	21-QH-HD-54	CYR32	Hybrid 46
72	22-QH-HNZ-17	CYR32	Hybrid 46
73	22-QH-HNZ-31	CYR32	Hybrid 46
74	22-QH-HNZ-40	CYR32	Hybrid 46
75	22-QH-HNZ-48	CYR32	Hybrid 46
76	22-QH-HNZ-54	CYR32	Hybrid 46
77	22-QH-HNZ-57	CYR32	Hybrid 46
78	22-QH-HNZ-65	CYR32	Hybrid 46
79	22-QH-XN-01	CYR32	Hybrid 46
80	22-QH-XN-15	CYR32	Hybrid 46
81	22-QH-HUNZ-02	CYR32	Hybrid 46
82	22-QH-HD-01	CYR32	Hybrid 46
83	22-QH-HD-06	CYR32	Hybrid 46
84	22-QH-HD-11	CYR32	Hybrid 46
85	22-QH-HD-14	CYR32	Hybrid 46
86	22-QH-HD-19	CYR32	Hybrid 46
87	22-QH-HD-26	CYR32	Hybrid 46
88	22-QH-HD-27	CYR32	Hybrid 46
89	22-GS-LN-34	CYR32	Hybrid 46
90	22-GS-LN-53	CYR32	Hybrid 46
91	22-GS-PL-03	CYR32	Hybrid 46
92	22-GS-PL-10	CYR32	Hybrid 46
93	22-GS-DX-01	CYR32	Hybrid 46
94	22-GS-DX-05	CYR32	Hybrid 46
95	22-GS-DX-14	CYR32	Hybrid 46
96	22-GS-DX-19	CYR32	Hybrid 46
97	22-GS-DX-22	CYR32	Hybrid 46
98	22-GS-DX-23	CYR32	Hybrid 46
99	22-GS-QY-16	CYR32	Hybrid 46
100	22-NX-GY-20	CYR32	Hybrid 46
101	22-NX-GY-26	CYR32	Hybrid 46
102	22-NX-GY-33	CYR32	Hybrid 46
103	22-NX-GY-36	CYR32	Hybrid 46
104	22-NX-GY-38	CYR32	Hybrid 46
105	22-NX-GY-40	CYR32	Hybrid 46
106	22-SX-BJ-09	CYR32	Hybrid 46
107	22-SX-BJ-25	CYR32	Hybrid 46
108	22-SX-BJ-52	CYR32	Hybrid 46
109	22-SX-BJ-58	CYR32	Hybrid 46
110	22-SX-BJ-65	CYR32	Hybrid 46
111	22-SX-BJ-66	CYR32	Hybrid 46

112	22-SX-BJ-67	CYR32		Hybrid 46
113	22-SX-BJ-72	CYR32		Hybrid 46
114	22-GS-LN-35	HY-004-1	0.65	Hybrid 46
115	21-NX-GY-57	HY-004-2		Hybrid 46
116	21-NX-GY-39	HY-007-1	1.95	Hybrid 46
117	21-QH-XN-20	HY-007-1		Hybrid 46
118	21-QH-XN-26	HY-007-1		Hybrid 46
119	21-QH-HD-20	HY-007-1		Hybrid 46
120	21-QH-HD-22	HY-007-1		Hybrid 46
121	21-NX-ZW-01	HY-007-1		Hybrid 46
122	21-GS-BY-06	HY-008-1	3.57	Hybrid 46
123	21-GS-DX-11	HY-008-1		Hybrid 46
124	21-NX-GY-29	HY-008-1		Hybrid 46
125	21-NX-GY-06	HY-008-1		Hybrid 46
126	21-QH-HD-25	HY-008-1		Hybrid 46
127	21-QH-HD-35	HY-008-1		Hybrid 46
128	22-GS-TS-07	HY-008-1		Hybrid 46
129	22-NX-GY-13	HY-008-1		Hybrid 46
130	22-NX-GY-43	HY-008-1		Hybrid 46
131	22-SX-BJ-75	HY-008-1		Hybrid 46
132	22-SX-BJ-78	HY-008-1		Hybrid 46
133	21-QH-HD-02	HY-019	0.65	Hybrid 46
134	21-QH-HD-09	HY-019		Hybrid 46
135	21-QH-HD-27	HY-029	2.27	Hybrid 46
136	21-QH-HD-36	HY-029		Hybrid 46
137	22-QH-HD-24	HY-029		Hybrid 46
138	22-GS-PL-14	HY-029		Hybrid 46
139	22-GS-TS-24	HY-029		Hybrid 46
140	22-SX-BJ-80	HY-029		Hybrid 46
141	22-SX-BJ-82	HY-029		Hybrid 46
142	21-GS-PL-9	HY-037	1.30	Hybrid 46
143	21-GS-TS-03	HY-037		Hybrid 46
144	21-QH-XN-49	HY-037		Hybrid 46
145	22-SX-BJ-11	HY-037		Hybrid 46
146	21-NX-ZW-24	HY-100	0.32	Hybrid 46
147	21-QH-XN-1	HY-102	0.32	Hybrid 46
148	21-QH-HD-19	HY-103	0.65	Hybrid 46
149	21-QH-HD-34	HY-103		Hybrid 46
150	21-SX-BJ-TB-09	HY-104	0.65	Hybrid 46
151	22-QH-HD-21	HY-104	0.32	Hybrid 46
152	21-QH-HD-58	HY-108	0.32	Hybrid 46
153	21-QH-HD-31	HY-147	0.32	Hybrid 46
154	21-NX-GY-26	HY-152	0.32	Hybrid 46
155	21-GS-DX-05	HY-156	0.32	Hybrid 46
156	21-NX-GY-43	HY-168	0.32	Hybrid 46
157	21-NX-GY-27	HY-177	0.65	Hybrid 46
158	21-NX-GY-32	HY-177		Hybrid 46
159	21-GS-BY-09	HY-187	0.65	Hybrid 46
160	21-QH-HD-43	HY-187	0.32	Hybrid 46
161	21-SX-BJ-52	HY-188	0.32	Hybrid 46
162	22-SX-BJ-06	HY-189	0.32	Hybrid 46
163	21-NX-GY-54	HY-192	0.32	Hybrid 46
164	21-NX-ZW-14	HY-193	0.32	Hybrid 46
165	22-GS-PL-67	HY-260	0.65	Hybrid 46
166	22-SX-BJ-61	HY-260		Hybrid 46
167	21-GS-DX-07	LV13-03	0.32	Lovrin 13
168	21-NX-GY-56	Lv13-24	0.32	Lovrin 13
169	21-NX-ZW-21	LV13-25	0.97	Lovrin 13

170	21-NX-ZW-28	LV13-25		Lovrin 13
171	21-QH-XN-39	LV13-25		Lovrin 13
172	21-SX-BJ-80	LV13-26	0.32	Lovrin 13
173	21-SX-BJ-TB-11	CYR33	2.27	Su11
174	22-QH-HNZ-56	CYR33		Su11
175	22-QH-HBZ-01	CYR33		Su11
176	22-GS-PL-20	CYR33		Su11
177	22-GS-DX-25	CYR33		Su11
178	22-SX-BJ-27	CYR33		Su11
179	22-SX-BJ-47	CYR33		Su11
180	22-SX-BJ-71	Su11-007-1	0.32	Su11
181	22-GS-DX-09	Su11-035	0.32	Su11
182	21-NX-GY-51	Su11-041	0.65	Su11
183	22-GS-PL-23	Su11-041	0.65	Su11
184	21-QH-HD-32	Su11-042	0.65	Su11
185	22-GS-DX-11	Su11-042	0.65	Su11
186	22-QH-HUNZ-04	Su11-192	0.32	Su11
187	21-QH-HD-37	Su11-208	0.65	Su11
188	21-QH-HD-39	Su11-208		Su11
189	21-QH-XN-23	Su11-267	0.32	Su11
190	22-GS-LN-05	Su11-362	0.32	Su11
191	22-SX-BJ-07	Su11-382	0.32	Su11
192	21-GS-TS-17	Sull-271	0.32	Su11
193	22-GS-TS-08	Yr5-15	0.32	Yr5

Table S4 New races with octal codes and corresponding resistant or susceptible responses of 19 wheat differentials

Number	Isolate	Race	WD 1	WD 2	WD 3	WD 4	WD 5	WD 6	WD 7	WD 8	WD 9	WD 10	WD 11	WD 12	WD 13	WD 14	WD 15	WD 16	WD 17	WD 18	WD 19	Octal code
1	22-QH-HNZ-05	New_Race_1	0	0	0	1	1	1	0	1	0	0	1	1	0	1	0	1	0	0	0	0723240
2	22-QH-HNZ-14	New_Race_2	0	0	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	0	0	0523240
3	22-QH-HNZ-61	New_Race_2	0	0	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	0	0	0523240
4	22-QH-HNZ-20	New_Race_3	0	0	0	1	1	1	0	1	0	0	1	1	0	1	0	1	1	0	0	0723260
5	22-QH-HNZ-21	New_Race_4	0	1	1	1	1	1	0	1	0	1	0	0	0	1	0	1	0	0	0	0724240
6	22-QH-HNZ-23	New_Race_5	0	0	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1	0	0	0733260
7	22-QH-HNZ-53	New_Race_5	0	0	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1	0	0	0733260
8	22-GS-TS-21	New_Race_5	0	0	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1	0	0	0733260
9	22-QH-HNZ-24	New_Race_6	0	0	0	1	0	1	0	1	1	0	1	1	0	1	0	1	0	0	0	0533240
10	22-QH-HNZ-26	New_Race_7	0	0	1	1	1	0	1	0	0	0	1	1	0	1	0	1	1	0	0	1643260
11	22-QH-HNZ-27	New_Race_8	0	1	1	1	1	1	0	0	0	1	1	1	0	1	0	1	1	0	0	3707260
12	22-QH-HNZ-28	New_Race_9	0	0	0	1	1	0	0	1	1	1	1	1	0	1	0	1	1	0	0	0637260
13	22-QH-HNZ-35	New_Race_10	0	1	0	1	0	1	0	1	1	0	1	1	0	1	0	1	1	0	0	2533260
14	22-QH-HNZ-38	New_Race_11	0	0	1	0	1	1	0	1	0	0	0	1	0	0	0	1	1	0	0	1321060
15	22-QH-HNZ-43	New_Race_12	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	0	0	2727240
16	22-GS-PL-17	New_Race_12	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	0	0	2727240
17	22-GS-PL-52	New_Race_12	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	0	0	2727240
18	22-QH-HNZ-58	New_Race_13	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	7737260
19	22-QH-XN-02	New_Race_14	0	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	0	2776660
20	22-QH-XN-05	New_Race_15	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	3737660
21	22-GS-DX-02	New_Race_15	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	3737660
22	22-QH-HUNZ-06	New_Race_15	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	3737660
23	22-NX-GY-03	New_Race_15	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	3737660
24	21-QH-HD-11	New_Race_15	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	3737660
25	22-QH-XN-06	New_Race_16	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	6777240
26	22-SX-BJ-13	New_Race_16	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	6777240
27	22-QH-XN-09	New_Race_17	0	0	1	1	1	1	0	1	0	0	1	0	0	1	0	1	0	0	0	1722240
28	22-QH-XN-10	New_Race_18	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	0	0	3737240
29	22-GS-LN-06	New_Race_18	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	0	0	3737240
30	22-QH-XN-17	New_Race_19	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0501240
31	22-QH-HUNZ-03	New_Race_20	0	0	0	1	1	0	0	1	1	0	1	1	0	1	0	1	1	0	0	0633260
32	22-QH-HUNZ-05	New_Race_21	1	0	1	1	0	1	0	1	0	1	1	0	0	1	0	1	0	0	1	5526241
33	22-QH-HD-08	New_Race_22	0	0	1	1	0	1	0	0	0	1	1	1	1	1	0	1	0	0	0	1507640
34	22-QH-HD-12	New_Race_23	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1	0	0	7736660
35	22-QH-HD-22	New_Race_24	0	0	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	0737640
36	22-GS-DX-07	New_Race_24	0	0	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	0737640
37	22-QH-HD-28	New_Race_25	1	1	1	1	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	7413060
38	22-QH-HBZ-02	New_Race_26	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	0	1	3727661
39	22-QH-HBZ-05	New_Race_27	1	0	1	1	1	0	1	0	1	1	0	0	1	0	0	1	1	0	0	5654460
40	22-GS-LN-01	New_Race_28	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	1	0	0	3736060
41	22-GS-LN-02	New_Race_29	0	0	1	1	1	1	0	1	0	1	1	1	0	1	0	1	1	0	0	1727260
42	22-GS-LN-10	New_Race_29	0	0	1	1	1	1	0	1	0	1	1	1	0	1	0	1	1	0	0	1727260
43	22-GS-LN-03	New_Race_30	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0	7757620
44	22-GS-LN-07	New_Race_31	0	1	0	1	1	1	0	1	1	1	1	1	0	1	0	1	1	0	1	2737261

45	22-GS-LN-09	New_Race_32	0	0	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	0	0	0727240
46	22-GS-LN-12	New_Race_33	0	0	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	0	0	1715660
47	22-GS-LN-49	New_Race_34	0	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1737661
48	22-GS-LN-50	New_Race_35	0	0	1	1	0	0	0	1	1	0	1	1	0	1	0	1	1	0	0	1433260
49	22-GS-LN-51	New_Race_36	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	0	0	0	3737200
50	22-GS-LN-52	New_Race_37	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	3737640
51	22-GS-LN-61	New_Race_37	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	3737640
52	22-GS-PL-01	New_Race_38	0	0	0	1	0	1	0	0	1	1	1	0	0	1	0	1	0	0	0	0516240
53	22-GS-PL-02	New_Race_39	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0	1776640
54	22-GS-PL-06	New_Race_40	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0777040
55	22-GS-PL-16	New_Race_41	1	0	1	1	1	1	1	1	0	1	0	0	1	1	0	1	0	0	0	5764640
56	22-GS-PL-22	New_Race_42	0	0	1	1	0	1	1	0	0	0	1	1	0	1	0	1	1	0	0	1543260
57	22-GS-PL-31	New_Race_43	0	0	0	1	0	1	0	1	0	1	1	1	0	1	0	1	0	0	0	0527240
58	22-GS-PL-37	New_Race_44	0	0	0	1	0	1	0	1	0	0	1	1	0	1	0	1	1	0	0	0523260
59	22-GS-PL-45	New_Race_45	0	1	0	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	2522200
60	22-GS-PL-46	New_Race_46	0	1	0	1	0	1	0	1	0	1	1	1	0	1	0	1	0	0	0	2527240
61	22-GS-TS-36	New_Race_46	0	1	0	1	0	1	0	1	0	1	1	1	0	1	0	1	0	0	0	2527240
62	22-GS-PL-53	New_Race_47	0	1	0	1	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	2502240
63	22-GS-PL-58	New_Race_48	0	0	1	1	0	1	0	1	1	0	1	1	0	1	0	1	1	0	0	1533260
64	22-GS-PL-61	New_Race_49	1	0	1	1	1	1	0	1	1	0	1	1	0	1	0	1	1	0	0	5733260
65	22-GS-PL-65	New_Race_50	0	0	0	1	1	1	0	1	1	0	1	1	0	1	0	1	0	0	0	0733240
66	22-NX-GY-44	New_Race_50	0	0	0	1	1	1	0	1	1	0	1	1	0	1	0	1	0	0	0	0733240
67	22-GS-PL-69	New_Race_51	0	1	0	1	0	1	0	0	0	0	1	1	0	1	0	1	0	0	0	2503240
68	22-GS-TS-02	New_Race_52	1	1	1	1	0	1	0	0	1	1	1	1	0	0	0	0	1	0	1	7517021
69	22-GS-TS-03	New_Race_53	0	0	1	1	1	1	0	1	0	0	1	1	0	1	0	1	0	0	0	1723240
70	22-GS-TS-04	New_Race_54	0	0	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	0	0	1734660
71	22-GS-TS-05	New_Race_55	1	0	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	5774661
72	22-GS-TS-06	New_Race_56	0	0	0	1	1	1	0	1	0	0	1	1	1	1	0	1	0	0	0	0723640
73	22-GS-TS-09	New_Race_57	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	0	1	2727241
74	22-GS-TS-17	New_Race_58	0	0	1	1	1	1	0	1	1	0	1	1	0	1	0	1	1	0	0	1733260
75	22-GS-TS-18	New_Race_59	0	0	0	0	1	1	0	1	1	0	1	1	0	1	0	1	1	0	0	0333260
76	22-GS-DX-04	New_Race_60	0	0	0	1	0	1	0	1	0	0	1	0	0	1	0	1	0	0	0	0522240
77	22-GS-DX-08	New_Race_61	1	1	0	1	0	1	1	1	1	1	1	1	0	0	0	0	1	0	1	6577021
78	22-GS-DX-10	New_Race_62	0	0	1	1	1	1	0	1	0	1	1	0	0	1	0	0	0	0	0	1726200
79	22-GS-DX-15	New_Race_63	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	0	0	1677260
80	22-GS-DX-17	New_Race_64	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1776641
81	22-GS-DX-21	New_Race_65	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0	7777020
82	22-GS-QY-08	New_Race_66	1	1	1	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	7720200
83	22-NX-GY-02	New_Race_67	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	1	1	0	0	0057660
84	22-NX-GY-04	New_Race_68	0	1	1	1	1	1	0	1	1	1	0	1	0	0	0	1	0	0	0	3735040
85	22-NX-GY-08	New_Race_69	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	0	6757660
86	22-NX-GY-12	New_Race_70	0	0	1	1	1	1	0	1	0	0	1	1	0	0	0	1	1	0	0	1723060
87	22-NX-GY-15	New_Race_71	0	1	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1	0	0	2733260
88	22-NX-GY-21	New_Race_72	0	0	0	1	1	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0623220
89	22-NX-GY-22	New_Race_73	0	0	1	1	1	0	0	0	1	0	1	1	0	1	0	1	1	0	0	1613260
90	22-NX-GY-27	New_Race_74	0	0	0	1	0	1	0	0	0	1	1	1	0	0	0	1	1	0	0	0507060
91	22-NX-GY-30	New_Race_75	1	0	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	0	5774640
92	22-NX-GY-41	New_Race_76	0	0	1	1	1	1	0	0	1	0	1	0	0	1	0	1	1	0	0	1712260

93	22-NX-GY-42	New_Race_77	1	0	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	0	0	5773260
94	22-NX-GY-49	New_Race_78	0	0	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	0	0776660
95	22-NX-GY-52	New_Race_79	0	0	1	1	1	1	0	0	0	0	1	1	0	1	0	1	1	0	0	1703260
96	22-SX-BJ-01	New_Race_80	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	7775660
97	22-SX-BJ-02	New_Race_81	1	0	1	1	0	1	1	1	1	1	1	0	0	1	0	1	1	0	0	5576260
98	21-QH-HD-18	New_Race_82	0	0	1	1	0	1	0	0	1	1	1	1	1	1	0	1	0	0	0	1517640
99	22-SX-BJ-23	New_Race_83	0	0	0	1	1	0	0	1	1	0	1	1	0	0	0	1	1	0	0	0633060
100	22-SX-BJ-44	New_Race_84	0	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	1737640
101	22-SX-BJ-45	New_Race_85	1	1	0	1	1	1	0	1	1	1	1	1	0	1	0	1	0	0	0	6737240
102	22-SX-BJ-49	New_Race_86	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	3737260
103	22-SX-BJ-51	New_Race_87	1	0	0	1	0	1	1	1	1	0	1	0	0	1	0	1	1	0	0	4572260
104	22-SX-BJ-53	New_Race_88	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	0	1	7773061
105	22-SX-BJ-54	New_Race_89	1	0	0	1	1	1	1	1	1	0	1	1	0	1	0	1	1	0	0	4773260
106	22-SX-BJ-60	New_Race_90	1	1	1	1	0	0	1	0	1	1	1	1	1	1	0	1	0	0	0	7457640
107	22-SX-BJ-81	New_Race_91	0	0	1	1	1	1	1	1	0	0	1	1	0	1	0	1	1	0	0	1763260
108	21-NX-GY-12	New_Race_92	0	1	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	0	1	3717361
109	21-SX-BJ-TB06	New_Race_93	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	5377640
110	21-GS-BY-01	New_Race_94	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0204200
111	21-GS-TS-12	New_Race_95	0	1	1	1	1	1	0	0	1	0	1	1	0	1	0	1	1	0	1	3713261
112	21-NX-GY-52	New_Race_96	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1	1	0	0	1112060
113	21-SX-BJ-TB03	New_Race_97	1	1	1	1	1	0	0	0	0	0	1	1	0	1	0	1	0	0	0	7603240
114	21-QH-XN-11	New_Race_98	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	6777601
115	21-QH-HD-30	New_Race_99	1	0	1	0	0	1	1	1	0	1	1	1	1	1	0	1	0	0	0	5167640

Table S5 Proportion of *Puccinia striiformis* f. sp. *tritici* races in different geographic populations

Geographic population	Race	Count	Proportion
G1	**CYR32**	**42**	**35.29%**
G1	G22-108	5	4.20%
G1	CYR34	4	3.36%
G1	HY007-1	4	3.36%
G1	HY-029	3	2.52%
G1	CYR33	2	1.68%
G1	G22-014	2	1.68%
G1	G22-238	2	1.68%
G1	HY008-1	2	1.68%
G1	HY-019	2	1.68%
G1	HY-103	2	1.68%
G1	Su11-208	2	1.68%
G1	G22-013	1	0.84%
G1	G22-078	1	0.84%
G1	G22-246	1	0.84%
G1	HY-037	1	0.84%
G1	HY-102	1	0.84%
G1	HY-104	1	0.84%
G1	HY-108	1	0.84%
G1	HY-147	1	0.84%
G1	HY-187	1	0.84%
G1	LV13-25	1	0.84%
G1	Su11-042	1	0.84%
G1	Su11-192	1	0.84%
G1	SU11-267	1	0.84%
G1	New race	34	28.57%
G2	**CYR32**	**8**	**36.36%**
G2	CYR33	1	4.54%
G2	HY008-1	1	4.54%
G2	HY156	1	4.54%
G2	LV13-03	1	4.54%
G2	Su11-035	1	4.54%
G2	Su11-042	1	4.54%
G2	New races	8	36.36%
G3	**CYR32**	**15**	**24.59%**
G3	HY008-1	5	8.19%
G3	HY007-1	2	3.28%
G3	HY-177	2	3.28%
G3	LV13-25	2	3.28%
G3	G22-108	1	1.63%
G3	HY-004-2	1	1.63%
G3	HY-029	1	1.63%
G3	HY-100	1	1.63%
G3	HY-152	1	1.63%
G3	HY-168	1	1.63%
G3	HY-187	1	1.63%
G3	HY-192	1	1.63%
G3	HY-193	1	1.63%
G3	LV13	1	1.63%
G3	Lv13-24	1	1.63%
G3	SU11-041	1	1.63%
G3	New races	23	37.70%
G4	**CYR34**	**3**	**7.31%**
G4	CYR32	2	4.88%

G4	G22-013	1	2.44%
G4	G22-078	1	2.44%
G4	G22-108	1	2.44%
G4	G22-205	1	2.44%
G4	G22-246	1	2.44%
G4	HY-004-1	1	2.44%
G4	HY-008-1	1	2.44%
G4	HY-037	1	2.44%
G4	Sull-271	1	2.44%
G4	Su11-362	1	2.44%
G4	Yr5-15	1	2.44%
G4	HY-029	1	2.44%
G4	New races	24	58.53%
G5	**CYR32**	**11**	**26.19%**
G5	CYR33	3	7.14%
G5	CYR34	2	4.76%
G5	HY-037	1	2.38%
G5	G22-107	1	2.38%
G5	Su11-041	1	2.38%
G5	HY-260	1	2.38%
G5	HY-188	1	2.38%
G5	LV13-26	1	2.38%
G5	HY-189	1	2.38%
G5	Su11-382	1	2.38%
G5	HY-037	1	2.38%
G5	New races	17	40.47%
G6	**CYR32**	**7**	**30.43%**
G6	HY-008-1	2	8.69%
G6	HY-029	2	8.69%
G6	CYR33	1	4.34%
G6	HY-104	1	4.34%
G6	HY-260	1	4.34%
G6	Su11-007−1	1	4.34%
G6	New races	8	34.78%

Table S6 Virulence diversity of *Puccinia striiformis* f. sp. *tritici* isolates in different geographic populations

Geographic population	Parameters							
	Hs	*Si*	*Sh*	*K*	*St*	*SH*	*E*	*G*
G1	0.186	0.876	0.675	0.229	8.078	3.228	0.795	11.927
G2	0.200	0.868	0.800	0.264	7.563	2.472	0.892	4.853
G3	0.276	0.924	0.816	0.389	13.148	3.354	0.886	10.460
G4	0.240	0.968	0.951	0.346	31.717	3.532	0.986	9.425
G5	0.228	0.909	0.802	0.307	11.025	2.998	0.890	7.491
G6	0.168	0.892	0.812	0.222	9.281	2.548	0.919	4.784

Table S7 Position and quality of 113 SNPs from the genomic alignment and filtering

Order	Chromosome	Position	Reference site	Alternative site	Quality
1	Chr1	277111	G	A	4694.17
2	Chr1	342625	G	C	1611.03
3	Chr1	1214543	C	T	6263.86
4	Chr1	1446867	T	C	1419.83
5	Chr1	1514334	G	T	1274.03
6	Chr1	3359239	T	G	4497.23
7	Chr1	5151405	C	G	3013.16
8	Chr2	279415	G	A	1796.30
9	Chr2	896156	A	G	17827.90
10	Chr2	968698	C	T	1975.06
11	Chr2	977524	C	T	1325.05
12	Chr2	998173	C	T	883.32
13	Chr2	1041509	G	C	1885.73
14	Chr2	2527688	C	T	1534.24
15	Chr2	2943256	T	C	1475.79
16	Chr2	5049929	A	G	21133.20
17	Chr2	5553647	A	G	1142.15
18	Chr3	1237489	A	C	1394.04
19	Chr3	2205441	C	T	1004.16
20	Chr3	2224909	C	T	454.76
21	Chr3	2255578	A	T	1725.08
22	Chr3	2269449	C	T	1800.07
23	Chr3	2513606	C	T	4264.04
24	Chr3	3970574	G	A	1334.04
25	Chr3	4565597	G	A	1800.04
26	Chr4	172	A	G	17015.90
27	Chr4	60415	G	A	1555.27
28	Chr4	676371	G	T	1433.04
29	Chr4	2956131	C	T	2861.80
30	Chr4	3402226	C	T	5679.26
31	Chr4	5392145	C	T	2990.75
32	Chr5	1499190	G	A	1586.16
33	Chr5	1958112	G	A	4719.94
34	Chr5	3881454	C	T	2959.53
35	Chr5	3971185	G	C	3378.46
36	Chr5	4024508	G	A	13576.90
37	Chr5	4486978	G	A	1078.77
38	Chr5	4544872	A	G	1607.79
39	Chr6	278430	C	T	1978.08
40	Chr6	749630	G	A	1342.05
41	Chr6	838867	C	T	4278.53
42	Chr6	1887440	G	A	1476.17
43	Chr6	1939399	C	T	941.32
44	Chr6	2032412	C	T	7364.51
45	Chr6	2040846	G	C	1604.88
46	Chr6	2044078	G	A	1842.28
47	Chr6	2130703	C	T	1906.02
48	Chr6	2733230	A	T	1103.02
49	Chr6	2891956	C	T	4973.27
50	Chr6	3676971	C	T	1404.53
51	Chr6	3733946	C	T	4253.26
52	Chr6	4057892	G	A	1800.04
53	Chr7	717077	C	T	4201.31
54	Chr7	1259836	T	G	1738.13
55	Chr7	1271484	C	T	1303.67

56	Chr7	2276040	G	C	4212.12
57	Chr7	2289317	G	A	1875.13
58	Chr7	2957243	T	A	9397.26
59	Chr7	3763260	G	A	1627.04
60	Chr7	4281621	C	T	1043.10
61	Chr8	2620534	A	G	4008.21
62	Chr8	4900555	C	T	1206.03
63	Chr9	84008	A	C	1632.05
64	Chr9	201188	C	T	2585.42
65	Chr9	843505	T	A	5497.67
66	Chr9	1370829	G	A	3473.17
67	Chr9	1381122	C	T	2000.05
68	Chr9	2425411	G	A	1018.00
69	Chr9	3149493	G	A	1425.79
70	Chr9	3176525	A	G	4372.26
71	Chr9	3180636	A	G	2602.39
72	Chr9	3797252	G	A	1483.89
73	Chr9	4058533	G	A	3256.04
74	Chr10	214187	A	G	5448.53
75	Chr10	230077	C	T	1352.65
76	Chr10	1964239	C	T	1335.27
77	Chr10	3437996	C	T	1080.52
78	Chr10	3531594	T	C	565.87
79	Chr11	931816	A	G	9602.82
80	Chr11	2276336	G	A	3297.14
81	Chr11	2646514	C	T	1226.03
82	Chr11	3340616	C	T	1319.55
83	Chr11	3949794	A	C	6447.58
84	Chr11	3983590	A	C	17227.50
85	Chr11	3985371	C	T	3534.73
86	Chr12	23929	T	C	1879.63
87	Chr12	1383739	C	A	2068.44
88	Chr12	2246788	C	T	2232.67
89	Chr12	2805263	A	G	2648.10
90	Chr13	985302	G	T	1607.67
91	Chr13	2492912	G	A	1111.05
92	Chr14	680601	C	T	1281.08
93	Chr14	1389679	A	C	1716.05
94	Chr14	1480452	G	T	4829.26
95	Chr14	2943033	A	G	1648.04
96	Chr14	3096987	T	C	1323.05
97	Chr15	388046	G	A	2669.04
98	Chr15	2962112	G	A	1652.63
99	Chr15	3002242	G	A	4492.89
100	Chr16	106435	C	T	2224.93
101	Chr16	1260316	G	A	4473.23
102	Chr16	1855070	G	T	4149.74
103	Chr16	2291472	G	A	1333.04
104	Chr16	2338504	T	C	1855.04
105	Chr16	2390327	C	T	1676.05
106	Chr16	2481069	G	A	1852.05
107	Chr16	3053830	C	T	782.88
108	Chr17	724947	G	C	1709.03
109	Chr17	1200207	C	T	8175.26
110	Chr17	1279204	G	A	665.09
111	Chr17	3208878	C	G	3517.49
112	Chr18	30688	G	T	1058.38
113	Chr18	1671227	A	G	18492.00

Table S8 The information of position, polymorphism, diversity, heterozygosity, and flanking sequence of 57 SNPs and primers developed

Number	Name	Chromosome	Position	Minor allele frequency	Gene diversity	PIC	Heterozygosity	Sequence	Wildtype Forward	Mutant Forward	Common Reverse
1	**Chr1_277111**	Chr1	277111	0.25	0.38	0.30	0.00	CGCCAGTGAAAAAACCCCCAACATCCCTAAACCTTTCATGGCACCCGAAACCTCTTGTCGGATGTTACCATGTGAGATGATTACGTGGTTATCATCCG[G/A]TGGGATAGGGCTCATTTGGGTGGGTCCTGAGCAAGGATGCCTAGATTGGGAGCCTACATCGGATATTCAGCAATGGGGGAACCTCCATTCGGACAGGGATGATCGTTCCCTGGCTAGTGGGTGCACCACAAACAACAAATTTCTCAATGTACCGCTCTCCTGAGGACGAGGGCAACCTACAAAGGTGTACTACATGCTCT	GATGATTACGTGGTTATCATCCGG	GATGATTACGTGGTTATCATCCGA	GACCCACCCAAAATGAGCCC
2	**Chr1_1514334**	Chr1	1514334	0.11	0.19	0.17	0.00	TTTTGGGGAGTCGGAACTCCAAAACCCGCAGGTTGTTTGGGAGTCGGAACTCCAAGACCCGCAGTTTGTTTGGGAGTCGGCCCCCCAATTCCAAAAATAATAAAATATTATTTTTCCCGCAGGTGCACCGCAAAGGCTGCCAAGATTGACAGCCATAAGAACAAGATGAAATTCTCTCAATAAGTGGACGAGTTAAAGAATAAAATAATAAATCAATTTTAAAGAGAGCTAGTTAATGATTAGATT[G/T]CCAAGGAATAAAGAGAGCTAGTTAATGATTAGATTGTCAAGGAAAGGGAGCTAGTTAATGACTAGTTAATGATTAAACTGGTGAATAAAATGTTAATGAGATGAAATAAACCAATAAACTCTCAAGAAACAATTGATTAACGAATGAATTGATGAATAAAATTTGGGACTTACTTCGCGCCACATCAAAAACT	TTAAAGAGAGCTAGTTAATGATTAGATTG	TTAAAGAGAGCTAGTTAATGATTAGATTT	TTGATGTGGCGCGAAGTAAG
3	Chr1_3359239	Chr1	3359239	0.25	0.38	0.30	0.00	TCTTGTGTATTTCCTCGTTCGAATTTCGTTCCTCCGAGAGTGTGAGTTAAACTTTGAGAAATCGTCCCTT[T/G]GAGGTTGTTTCCTTGGATTTGTGTGCCTCTTGACGGAGCGCGGTTGGGCCAGCCATCCCCCGGGCCACAAGCCCGCTCCACACACATCACGGGCCCCGGTCTTTTCTCTTCATCGGTGTGTTGTTGAGTGGCGAGTGCACTCATTTTGAAAAGTAGTTCTTCACCATTGGTCGGTGAGATGTGTTCTTTCGAACAGTTAATTATTTTACAAATCTCATGAAATAGCTTGAGCAATTC	TGAGTTAAACTTTGAGAAATCGTCCCTTT	TGAGTTAAACTTTGAGAAATCGTCCCTTG	GCTCCGTCAAGAGGCACACA
4	**Chr1_5151405**	Chr1	5151405	0.25	0.38	0.30	0.00	TTCTGAAATGAAAGTGTCCAACGTGGGGACATGAGTCTGAAGATATTCATATCCTAGT[C/G]GATCTTGGGATACTTTTTCAGCAATACCAGTGGTAGCAATTGTAGTATCTTCTTCATAACCCTTGCGCCAGCCAAGACTAAACATTTTACCGGAGATCGCCGGTCCATTAGATTTATTGGGATTTTGAAAAGAAGATTGAG	ATGAGTCTGAAGATATTCATATCCTAGTC	ATGAGTCTGAAGATATTCATATCCTAGTG	TGCTACCACTGGTATTGCTGA
5	**Chr2_279415**	Chr2	279415	0.11	0.19	0.17	0.00	GATATTTCTACTTATGTATGGTATTTATATTATTACTATTTATGTACATACTTACTATCTAGTTGTGTTTATGTCTTCTCTATCCTTAATCATCTGCTAAACTAATA[G/A]AGCTAAGGTAGTGGTTGAAGTGAGTGACTATGGGTTATTTTGTCCGTAGAGTTCAATTCTGCAATAATATCTTCAAATATGTGAGTGGTTTAGCTTATAGGATGAGGTTTTTGTGCATTTTGTTGCATGTAACAGAAACAGAG	CCTTAATCATCTGCTAAACTAATAG	CCTTAATCATCTGCTAAACTAATAA	GCTAAACCACTCACATATTTG
6	**Chr2_896156**	Chr2	896156	0.36	0.46	0.35	0.00	GGATTCAAAGTAGAATTTCCCGTGCATGCAATCCATTTTGCATACTTGTTTGCCTCCCGCAAAAGTTGGAAGTTACCTTGAGCCCCCCGCATCGGACAAATACCTTGCATTTCTCCAATTGGCTCTCATAGTCCCTCGCTAGTCTCTGATTGGAGACCTCCAACAGGCTACC[A/G]ATACTCATCTCCACCACCATAACAGCAACATCACTACACAATGCCACGACACACTGAACGAGGATCAACCATAGCCCAAATGACAGGTCTGATTCGTCAACACGTGCACGGAGCAATGATAGGCTCGGCAATGAATGACGAGAGTGGTGATTCTAGCGAGGACAGCGACTTGGAGGACCTCATCGTAGCTTTGATTATACTCAAGAAGAATCGATACCTTGCACCTCGTGTACAAATTGGACGTGCTCCGGACATCACCA	ATTGGAGACCTCCAACAGGCTACCA	ATTGGAGACCTCCAACAGGCTACCG	CATTCATTGCCGAGCCTATCATTG
7	**Chr2_998173**	Chr2	998173	0.11	0.19	0.17	0.00	GTTCGCCCAACCGTCTCAATGTTGGCCTCACCCCTGACCCAACAACAATGCTTGGTTGGGCAAACAGTTGGAGGTTGGTTGAACCACCAGTCAGTCCTCCCTCTACCTGAGGTTAGAACAACATTGGCAATGGCCGCCAACGTTGAATGCGAGCGAGATTGCCCGTTTCAAACTCGCCCATCTCAACCTTGTACCAATGGTGGACAAAGGTTCCCCCCAACGTTGCTGCCTCCGTTGGGCCAATGTTGAGGATAGATTTTTTGCCACTGCAACATGATCCCGTCATCTCGGATCAGTTGTAAGCGTTTGAAAAAAAAAAAAATCAAGTCAAAAAATGACTTGAATGATAAATAATCTTTGCAAGGCCGAAGGCTCAGCTTGATATACGTCTTTGTCTCCATCTCTGTTAAGCAGCAATGGTGCAACTGCATATGAGTTCCATTGCAATTGTTAGTGGACAGGTCGCAGGATCAATCCATGTGGGGGTCTTTCATTGCACACTTTTGCTTGGTGCTTAACTGGGGACATCGGCGGTGCGCCGATCAAGCCTTTTGCTTGGTTCCGTGTGAGTAACATTGAATCAACCACGGTTCGACGGTGGGCACACGTTCGGAGGAACCGGCGACCCCACTGACCTCAGACCTGAGTTGGTGGAAGGTTGAGCATCTGATGAGCGCTCGGAGTTTCATGGTTACACCAACCGTGCAGGTTTTGCAGGATGACCTAGACCTGAAAGCTCAACGTTGGCAACCAAGCCAAAGCGCATGGTTGCTCAAACCTTGAGCCCTTGGTTGGGTGACCGTTTGGGTGGCCCGGTGGTGTAATCAAGTCGGTCTCAGCCACCTGTTTCTTTTCTCCTTTTTGGAGTCTGGACAACTCACCTGGCTCCTTCCTTTCTGGTTGGGCCGGTTGGTTCCTTGTGCACTGAGACTACAAGAGAACACAAGACAGGCTAATGTTAGCCTCTGTTTCTTGGAGATCTGACTGGCCGAGTTCTATCGTACTCACCTTTGTGGTTGTCAAGATTTGGTCCAGTAATTTCAGAGGATCGGTGTTTGCTTTGATCTGGTTCATGAGTGCTGTACCTGATATTGTCCGAAGACGCATCAGTTTTCCGACCTCAGAACTTGGTTTGCTTTGCTTACCTTGTCCCGCGGATCTTAGAACCTTCCTTATCTTGTGAGTACGGAACCGTCTGTTTAGGCCCATATTCTGACAAGATACTCTTCAATTGAATAAGAGTCAAGTTCCACCTTGCCCTGACGTTGCGTTGTGGTCGTCAAAAACCGTCCGGCACTAGAAAATTCAAAGTTTTCTCTATATCTCTTTCTCATAGCTTCTCACTTAGTTCGCAGGGGTTTCACAAACACAAATTCAACTGCAAGCACCTCTCCAACTCAGATTGCGCTCACATAAGCAGGAACCCCAAATCAGTTACCATAGTTCCCAATTACCAGGCGCCCTAGCAACCAATGCACAGCCTCACCATACACTAGCACAGCCTCAGAATAGCCATCATACTAGTTCAGCATAGCCTCTCCAAACAAAGCACAGCTTCAACATAGCAACAGCATAGCCCCTTTATTTATACACAGCCACCAGAAGAAAATATGTACTAAATTACCTCAGGAGGCAGTGTTCCTGCAGCACAGCCACTAATGCCCTATTTTTGTTTTTGCAGAGGAATTGAGCTCACCTTGGAGCTAAAATCCCTCACTGTTGTATATCTAAGAGGCTCTCCTCCCAGTTGTTCTGCCCTCTCCTCATCAGATCATCTGCAAAGCCAATCCCCCATAACAGAACATAACTGGTCACTCCTACATATTATTAGTCAACCAAGATTTAGGTTTTAGCATCATAACACCCTCTTATTCTCATTATAAATATATTTGTTGAAATTTCATTCCTCTTCTTCCTCTCAGTACAAAACCACCCTGATCCTTTTGCCTTTTCAATAAATGTTTAGCTAATAAATTCTAGTGTTGTCATGGTAATGTTGTCTGAGTGGTATCTTGTTATGTAGTCTAGTGCTCAATCCTTGTAGTCTTGAACCCTGGTAGAAGTCTTTATCTACTTCCATTTACTCCTGTTGTCTATTATTCATTATCAATCTGGCTTTTATCTTTTGTCTATGCATTTTTCTCCTCAACCACAACTCGACCAACTTGTAGTAGCTTATTTAACACATGTGCTCTGCCTGGTAAATCAAAGTCATTGGTTCTCCTCCTTTTGCCATTTTGAGTCCCTTTGAGACATCTCTAGTCCCCTCTGAGTGCCTTGAGATCCTTTCAAGAAACCCCTCTCCGCTCCTCTTGTCACGCTTTTCTCGCCCACAGAATCTGGTGTGGAGTCAAAACTCAACAATATTAGCACCCTGAAATATAACATATAATCTCTCACCACCTGCCACACTTAGGTGTCTGGACCAAGTCCCCTGTTCCATCCCTGGTTGACGCATAGTGCTCCCAAAACCCATCTCACTCTCTTCTCTTTTAACCTTATATATCCAGCCCTTGAGGTCACAAGTTCAATACCCACCTAAGACATTACTCATAAATCATGTCATGTCAGCCACCTGGCACATGTCACAGTACCTGACATGTGCTCAGTAACTGCAAGAACTTACATCCATCCTAAGATAACACTAACCCTCTCCCTGTTGTTATCTTTATCCTAAGTTATTATATTCATTATTTATTATTCATTTATTTACTTATGTATTTACTATTACCCTTGACATCACATAAAACATACTATCTTTATTTGTGCCAAACATTGATGTCATAAACTAGTCCAGGAGGATCAGCAATAGCTCCACTTTAGAGGATCAATCCTTAGCACTGCCAAGACTAGTGCCAAACCTCTGATCATGACCTCACTAGTACATTACTGATCCCTCCAGGGATTAGCTCTAGACTGATCATTACTTGTTCATCACTCCTTCCCCATTCCTGAGTGCGCACACAGTCCCTCAATATCCCCTTTGATATTTAAAGGACTGTTCCCCCCACTTCTTCCTTCCTCAGAATTAATTACGCCATTGAAGTTATAATACCACAAGAGTATTTATAACCCTCAATCTTATTAGTCT[C/T]ACCCCTTTTGCCCTTCTACAATAAGCCATCAAATATCCATAATCTTGATAACCTTTTGCCTTATTGTTAACCTGTCCTTCCCCAAGTGAGTACCTCCTTGGATGCCTATTAACACCTTGTGTTGATCTGGATGCGCTGAAATACTGCAAGCCTCTCAGTTCCCTTACTGATTGAGTGTGTTCCCCCCCACAGGAACTTTAACCATCAACCCTTGAAGCATTACCCC	CCCTCAATCTTATTAGTCTC	CCCTCAATCTTATTAGTCTT	CAACACAAGGTGTTAATAGG
8	**Chr2_1041509**	Chr2	1041509	0.11	0.19	0.17	0.00	GTATCTTTCTTCCAGGTCTTCCACCAAGCTGTATCAGCTACTCTCTCCAAAGTTCTATCTTCAGACAGGTGACCAGAGTACACCGTATCATGGCATTCATGGAGGAT[G/C]GTGTTAATATTATGTCTATCTACCAAAACTAGGACTGATACATGTTTCTCTCTGTGATACAACAATTCATCAAAAATAGAGAATCTTCCTGA	TATCATGGCATTCATGGAGGATG	TATCATGGCATTCATGGAGGATC	GAGAGAAACATGTATCAGTCCTAG
9	Chr2_5049929	Chr2	5049929	0.11	0.19	0.17	0.00	GTTCGAATGCATGATGATGAAAGCATGATTGATATACTGAGTTCGAATGTTCGATGA[A/G]TGTCTTCGAAGTGGTTTTTAGGTTCGTCGTATGACAAGAATGCAATAAAAGATGTGTTTGTTGTGGGTAGCTTGCATCTTAT	ACTGAGTTCGAATGTTCGATGAA	ACTGAGTTCGAATGTTCGATGAG	CGACGAACCTAAAAACCACTTCG
10	**Chr3_2205441**	Chr3	2205441	0.11	0.19	0.17	0.00	TGCCTTGTGTTCTGCTGGGCCTTTCATCAAGTAGTCTACCATTCCTAAGACGTCTTGTAGTCCGGCGGCCTTCTTCTTCGGTTTGGCTGGAGTGCTCGCAT[C/T]GGCTCTGGCCGAAGATTTGATCAGAATACCCACCTTCTGTTTTGTGTCCGGGTATTTGGTCTCGTGATACAGGTGCCACGCTTGTAACCCAGATAGGTACTTAACCAGGGTATTGGCGGCTATGTCGTGACCTGTGGGTGAGTCGGCGTTCCTTCCGGTGTGGAACTACTCAAAAGTGAGTTAGAGCTTGGAAGGGAAATAGACAATGAACACTAATGATAATGCTCTTTGAACTACAGGTGCTGATGGAGCTGCCTTCCTGACTAATACTGAGGATGGAGAGTTGCACTAAGAATTATTTAAAGGTGTGGCAATTATCTCTTTATAATTCTTAGTAGCAGTCTTGGATTTATTACTGAGGCTGGATTATTTTCCTACAGCAGAGAGG	TTGGCTGGAGTGCTCGCATC	TTGGCTGGAGTGCTCGCATT	CGGACACAAAACAGAAGGTGGG
11	**Chr3_2269449**	Chr3	2269449	0.11	0.19	0.17	0.00	GATTCTGGAAGTTGGGACAGAAATATACCTGTTCCCATAGTGGGTTGTTCAGATAGATCTCAGGACTGAGGTAGACAAATTGGTATTCCCCGTTAGCAATTTTGTTGGCCTCTGTTT[C/T]GTTGAAGGAAAGCTTGGTCAAGTTGATTGCGGTAAATCCAGCCGCTTCCTTTTCCGCAACCTGATTGTTGCCCAGGGCATCAAGTGGATTCAACACGAGTACGACACCGCGAGAGGTTCTGGGAAGCATCTTGAAATACATTTCAGGAATTCTAGATTTACCAAAGCCTGTGCCAGCAAGCAAGAAAGTGTTCTTCCCTCGCAAGAGATCAAAGACCGCCTCGATTTGGAGCGGCTTGGCCGGTTGTCCGTAGTGGAGAAGGGCAGCCGCGGCTATGGCAGCCTTCAAC	AGCAATTTTGTTGGCCTCTGTTTC	AGCAATTTTGTTGGCCTCTGTTTT	CGGCTGGATTTACCGCAATCA
12	**Chr3_3970574**	Chr3	3970574	0.11	0.19	0.17	0.00	AAGACAAGAGAGATAATTAAACGATCACAAATTTCCACGCTTTTGATATTCTGTTGGTTATTCGGCCCTTCTAAGAGACGGGTCACAAGCCACGAC[G/A]AGGACTCCTGGTGGTTGTGGTTTGGTATCCTGGACCCGAGTCTTCACAGGAAGAGGATCAGCATTGCTACGAGGATAGCCATGCTCAACGCAAAAAGACAAACGGCCGCGATTAGACCCCTGGTCCCACAATCCAGGCCGTCACGAGTCCGAGTGATTGCTAGGTCCGATGAGATTGGA	GGGTCACAAGCCACGACG	GGGTCACAAGCCACGACA	TGTGAAGACTCGGGTCCAGG
13	**Chr4_2956131**	Chr4	2956131	0.22	0.35	0.29	0.00	CGGTCTCTTAAGAGCCATGCGTACCTGCAGAGGAATGAGCACACCAGCGGGTCTGGAGCCTTAGAGCATTCAGATTC[C/T]GGGAGCATGTTAGATTATGAATCTGACTGCATCAGGCTTTGGAGCTTAGTGGTAAAGCAGGCACCTAGAGTTAGCCCTTCCCGGGTTCGAGTCCTGGTGGAGCCATTTCTTTTCTGACACGATCGAGCACAACAAGCCATAC	GGAGCCTTAGAGCATTCAGATTCC	GGAGCCTTAGAGCATTCAGATTCT	GCTCCAAAGCCTGATGCAGT
14	**Chr4_3402226**	Chr4	3402226	0.25	0.38	0.30	0.00	CGCTTCACTAACTGAATTGTTTATTTGGGACGTAACAAGATTTTGTTCAGTCCTCGGAAGACAAAAGAAATGATTAGTTTGAGAGATCACTGTGCACCTTTTTTGACTGATCTTGCCAACTATCTCTTCAAGTTCTCCTACCTTTGTCAAGACAACTACGACATCAAGGACTGCATCATTCTCGACATTGTTCAACTCGCTTAATTTAGTCAACTTATGCAACGTTATTTTGGAAGTATCAGCGCTATCTTCACACTATAAACCAGAAAGAAGAGAGTCAGTTTGTGAATTTT[C/T]GCTGGATACAGAACAAGAGAGATCGAAACAGAGGTGAAGTTACTTCTTTGAATTCAGTAGTAGTTTCAAATGAGATTTCATAGTCATCACCTGTAGTGTTATATTGTTTTTTAGCGATATTGACTTGGTTTTTTTTGGCTGATATGGATGTAAAGATCAAATCAATGAGTATTCTGAGAAGTTGAAGACAGTGATGAATGTGGACTTACTTGTTGGCAAGAGGACTGAGTCCAGCAATCACGATATGATACCAGTACAATGGGTTTTTTGAGCTTTGAGGGTTGGGCTGGGCACGTAGTAACGATAGAGGCGGGAAATTGAGGCACACTGGGTGTCAACCATTATCCAATCAGCATGCGGTCAACACAAGAACAAGGTTGTAGAAACTTCAACTTTGTACGCTCCCATGGATCTTAACGCTGTTCAGGCGTTTCAACAACAACAGGGCAAGTACATTCACCCTAATCAGCGAAACTCTCCCACTCAGTCCAGTCAAGGTCCAGCCCCCCAACGCCAACCACAACTATCAGTAGAGAAGGCGTCGTTCTATCGAGGACAACCACCACCAAGCGAACCCCTCAAACAGAAATATGGGGCTTGGTGCTTTGTTTGCAAGTCAGACCAGCACTGGTACAACAACTGTGACCAGTACTGGGATTTCGTTTGCAATGGCGTCTATGAACCACCACCCAAGACATTCAGGGACGCTAATTCAACATATAAACCTACTCTTGTCT	AGAAGAGAGTCAGTTTGTGAATTTTC	AGAAGAGAGTCAGTTTGTGAATTTTT	TCACCTCTGTTTCGATCTCTCT
15	**Chr4_5392145**	Chr4	5392145	0.25	0.38	0.30	0.00	CGGACTCCTCATTTTGGTGCTGAGAGGAACTCCCAAGGGTTGCTGCTGAGGTTCGACCAGCAGTAGCTTGCTTGCCTTGCGATTTCCGTTGAGGGGGTTGAGATGACGAAGTAGAGTTATTACGAGACTTTTGATT[C/T]GCTTTGTGATCTCGAATAAGCTGCCTCGTGTTGTTGCAGTGATTGAGATCATGACTGTTGACATTGCAGAGGGGGGCAATAGCGGTTGGTGTTGCCCGCGTTATTATCTGTGGACGACTGATGCTTGCGGTTCTTGTTGGTGGAACCGGAGGAGTTAGAATTAGCGTTGGTTGACGCTACT	AAGTAGAGTTATTACGAGACTTTTGATTC	AAGTAGAGTTATTACGAGACTTTTGATTT	ACACGAGGCAGCTTATTCGA
16	**Chr5_1499190**	Chr5	1499190	0.11	0.19	0.17	0.00	ATGTGGCATGTTCAGATGCAGGGTAAACTCCGTCCTTGACCACCAGTAAGGTCTGCCTGAAATCACCTGCAAACAC[G/A]ATTGATTTCCCTCCAAAAGGCCTGTCGTCCTCCATGAGTTTTTTTAGTGACCTGTCAACCGCTTCTATGGCGTACTTATGCACAGCCACAGCCTCATCCCACAAAATCACCCGCGTGTTTGCCAACCTCTGACCCATTCGATTTTCCCTTGTGAATTTACATTTGGACTCCAGTGTCAATTTAATCGGAATACCCAGACCTGAGTGCGCTGTTTGCCCCCCAGACAATAGGAGAGCCGCAACCCCAGTCGGAGCTACTACAACAGGATGCTTGCCTGCCACTACTAAAGAATCTACCAAGGTGTTCAATAAAAACGTCTTGCCTGC	CCTGAAATCACCTGCAAACACG	CCTGAAATCACCTGCAAACACA	CGACAGGCCTTTTGGAGGGA
17	Chr5_3971185	Chr5	3971185	0.19	0.31	0.26	0.00	GTCGAAGACTTAGAAGAAGAGGAGGAAGAATCAGAAAAGGAGGGAAACGTTGTAGGACTCCTGTGGGACAAATGTTATAATATATTTGGTGAAGGTTCCCTGAGGGGGAAATATAAACTGCAAAAGGTGAAAAGCTATTACAACTTAAGGGTGGTTTGAAAGACCTGCCCCTCTGAGTACTAAACAAATATGTAAGGAATCTTATAATCAATTATTTATTATGGTGGTTGATGTATAAGATAGAGTCTACTAGTATAGTAATCCTATCTCAGACCTAGATCAATCAGTTCAATACGCTTTGAGACCTGTTACAGCAATAT[G/C]TTACGCAGATAATACAATCCAGTGGGATTGCTTATGTGAGATACAAATGACAAACACTAACTCACTTATATATAAATGTGCGTACAAAGACTTACTGATACTTGAATACTTAGAGTTTAAACCCTCCTCAACTTACTTGTTATACCTGATGATCTTCTTGATTCTTCTTCTTGTTGAGTTGATGTTCCTGCTGTGTTGAGTTGATGAGATGAAGTACTGTCCGCGTAAATATTGACTGACTCTTGGTTGATACCGCTGTCACTAACTC	GCTTTGAGACCTGTTACAGCAATATG	GCTTTGAGACCTGTTACAGCAATATC	TCTCACATAAGCAATCCCACTGG
18	Chr5_4024508	Chr5	4024508	0.39	0.48	0.36	0.00	ACACTTTTTGGAGTGATATTGTGGGATGTACAGTTCCAGAGGACCGCTTGCTGCCACTCGTTAGCGGGGGCTAAAATTTGTT[G/A]CAGTGGATAAACTCAACGAGTTGATGTGATCTATACTTACGGAATGTGACACTTTATGACTCAAGAGGAGCTGGGCCAATAAGTGGGGGTGGGGGTGCGTGCGTTCAGGGAGGACTTCCCGTTGTCTGAATTTGTTAATCTGGACAGAAAGGCTAGAGCATATTTGCCGATGAAAATAAGAATTCGCCAGCAAACAAAGTTAAGCCGGTCCGTGTAAATCAAGGAATCTGGGCGACGGGAATGGGGGTGTTGTGCGCTTTATGTCCACGTGATCTATCACCACGGT	AGCGGGGGCTAAAATTTGTTG	AGCGGGGGCTAAAATTTGTTA	TCCGTAAGTATAGATCACATCAACTCGT
19	**Chr5_4544872**	Chr5	4544872	0.11	0.20	0.18	0.00	AATCGTTCCACATGTGAAATGTAACAAGTAAAATCAAATAAAACATGTTGATAATTGAGATGATGAGCATAAAAATGAAACATTGAGAACCAAGTGAGAAGCACCGAAACAAACAATCAGGATTACGTGATGGATTGATTGATGAGGATTGGATGAACAACTAGAGAAAGTGTTGATTGATAAGATAAATCACCAATCGTGATCGCAAGAGAGACCACCAATCGTGATTGCAATAGACACCACCAATCACAAGATAAACAGCAATCGCAACCACAAGAGAACCCACCAATTGCGATCACAAGAGAAACTATCGATCACCATCGCAAAAGAAAATTAAACCACCGATCTAGATTGCAAGAAAAACCATTCGGGGGAGGAGTATACAGAGGTTGGCTATCTTTGAGAGCAGTGCTGCTGGTATTGATTCCACATTTTTTCAGACATACGGTTCTGCTTGGAGACCTGGGCTGCATCTTCCGCGCGCGATCGTCGAAAGCGTTTGCCTGGTGCGTTAGGACTTCTGTCTTCATC[A/G]ATTTCCTCATCAGAATCTTCTCGTTCTTCTAGATCAGGAATTTCTTCATATTGATCATGGTGCCGTAAAAAATTCCACAGCATAGTGATTGCATAAACTAGCTGGACCTGACTGTGAATATTATGTTCTGATGGTGTGGTGAGGATCTTGAATTTAGATTTCAAACAACCAAAGATCCTTTCGACGACGTTGCGTAGGGAGGCGTGACGCAGATTGAAGAGCTCTTTGGGATTGGCAGGTTTCAAACTACATGTCGCTTGTTCTTTCAAGTGGTACCA	GCGTTAGGACTTCTGTCTTCATCA	GCGTTAGGACTTCTGTCTTCATCG	AGAACGAGAAGATTCTGATGAGGA

20	Chr6_278430	Chr6	278430	0.11	0.19	0.17	0.00	TGACCCAGCCAATCAATGGTGTTGCCATCACTAACAAAGTGTTTGGTCTCAGATACTCAGAGGGTGTCTTGGTTTGTTGCCCTTGGGTCACATGGAAAGGGGACCACTTAGGGCAACGGGTTCAGAGACTGGTGACCAGCAAAACAATA ACACTGCCCCTTGCACTACATACATTTGGCTGTTGCTGACATGTCCTGTCGCAGCCAATCTGCTGCAACACGGGGGTCACAACAATGGGCTGCACCAGCCAAATGGCCTGCCAGGCTGTCACAGCAGTCTGCTGTGACACCGGTGTTGC AACCAATGTGGTCAAACAGGATGTCACATTGGGATGATGTGACAGCCATAGTGTTGGCACACCATGCACCCCAGTGCTGCTATGACTCACACAGCTGCACTCCTGGGCAGAATGGGGTTCACGGCAAGGCAACCACCCGCTCCAGTGA CCCACCACTTGCATGAGACCCTGCCAGAAGCTT[C/T]GGTGACTGAGGTGTTGCAAGAGCCAGCTACTCAACGCTATAAGACTCAAAAGGTGTTTGTGAAAACCCTTTTGCTGAAAACCTTTTGCTGAGAAGGGGATGATGGACCAAACTCTG CCCTTCTATGCTATCAGAAAACAAGACCCACCAAGCTCAGCTTGGCAAGCTTTATTAAGTGATAGAGTCAAGTTTGAGTTGAACTGTTTGATGACACAGTACATAAGACTGTAGTTACAGGGGAGCAATCACCAGGGGAGTTTGCTCAG CACTTGAC	TGAGACCCTGCCAG AAGCTTC	TGAGACCCTGCCAGAA GCTTT	GCTGGCTCTTGCAA CACCTC
21	**Chr6_749630**	Chr6	749630	0.11	0.19	0.17	0.00	TGGTCGCCCATGTGACCATCAGCCGCTGATGTTCTGGTAACAAAGCAGTCACAATTTTCCTTTCATTGATGTGAAGGTGGGTAGGATATTCCCTTGAAGGTCACAGGTCCGGGTACCCGCAACTAGGTACCTGG TGCCATCTTTAATCGTTGGTGTCAGTCTTCTCCAAAGCCTCTCAAACTTGATCCTCCCACTGTGACCTGAAAAATACAACCGTGTGGTCTGATCGTCTAGTGGTGTTGGGATT[G/A]AGGGTCTGGGCTAGCTCGCTGATGACTGCCTTCT CCAGATCACAACAAACAAGCGCTTGCTCAAATTTTTTCCGCAACCAGCAGCTGTAAAAAATCAACTGTGCATGCAAAGTAAGTTTGAGCAAG AGGCCTGAAGTTGAACCCACTAACTCAGCTGCCACCGAAAATTGCAGTTGCAACTTCCATGCCATGGCTTGCTCGATGTCGACCCCCTCCGCCACTCCATCCACTCCAACACCTCACTCAGCGGATACATCTCTATCACTATTGACTCAG TCTTCCATCTCACTCAATTCAACTTTGACTGATCGAGACAGCACTGGCGGATTACAACTACAAAGCAAGAAAACCAAGAGGGGCCGGTCTGGGTCACGCAGTGAGGTATGGGGGCACTATATAACAGAAGGTACTTAATCTATTTTTAC CATACCATGAGTCCTCAAAGTGTTCATTTCAATCACTGTTTTGTTAAGGAGCCGGAAAGGATAAGCAGG[C/T]AACATGCAAATATTGCGGACAAACTTTCAATGCATCCACCTCTAATGGGACCACTACCCTTCACCGCCATTTACATCA ATGCAAAGCAATAGAGAAAACAATCAAAGAGGCCCTTGGTAGCTACGACAATACATCACCCAATTTTGAGTTCTCGCAAGAAGCTTCAAGGGAGCTGCTGGCCACAATGATGATCGTCCACGAATATGCTTTTCGGATGGTCGAACATA CCTTTTTCCGTAAATTTGTTGCCTCATTACAGCCCCATTTCACCCTGATTGGACGACACACGGTGCGGGAGGACTGTATGAAGATTTATGCCCAAACG	TCGTCTAGTGGTGTT GGGATTG	TCGTCTAGTGGTGTTGG GATTA	GTCATCAGCGAGCT AGCCCA
22	Chr6_838867	Chr6	838867	0.27	0.39	0.32	0.00	TGGTAAGCCAAACAATGTCACCAGCAACCCAAAGTAGTGTGCAATCACACTAGGATCACAGGCCCCAGGACTCAGAACCCAGCAATCACCAAGAATAAAGGTATCACCAACTTAGACACAGTTCACACATGGTATCACAGTTCCCCCTT CCACATCATCACACACCCCAGTCTCTTTGTCTTTTCCCTTTGCCACACCCCAGGTCTCACCATATCCAACATGTCTCAGCCCTCTTTCTTGTAACCAGTTGCTGCCACACTCCTTG GGCTTACCCACCATGTTCCCCTTGTTACAGATAAGCCACCCTTGTTCCCTTCCAACACCTCAGAATGTTTCAGGCCCTTGTCAACTCACCAGCAGACTATCCCCCCCTTATGTTTTTCACCTCTTCACTATACAAGGAGCATGTTCCTCCCC TCTTCATTTGTTCCCATCAGATCCTGCAACCAGACAGTCAGTACCACCTGGTCAGTTATCATCAGTCAAATATTAGCCCATCAGCATTTGGGATATCTTATTTAGAAAGATTCCCTATCATCATCAGCAGA	GCATAGCCAGTATCC TCATGACAC	GCATAGCCAGTATCCTC ATGACAT	TAAGCCCAAGGAG TGTGGCA
24	Chr6_2130703	Chr6	2130703	0.11	0.20	0.18	0.00	GGGGGGTATGCCTGGTGGCATGGAGGGTGGAATTTGTGTTCTGTCTTGAGAGAAGGGAGTATGTTTTATGGAGTGGGGATATGGAGGGGTGAACTTTTTCTTGGAAAATTTGATGTGATTTGTTACAGAACTGAAACAATTGCACCGTT GGCAGGACCAGCCCAATCACATACTCATAGCACCTGAAACCATACTTAGTCTCTGGCCATTTCCAATTCCTAGCCTGGTAGCAATCTATCTCTGTACGCTTCCATTGCTAAGTGAGTTCTTTGTAACAAGCGACCAAGACAGATGACG[C/T]CTGATGAAGAGACATGAATAACAATGAGTTATCACAAAGAGACTCAGTGGACTCAAAG GCTTTCTGGTGTTCAAAGTTTTATCGATTGCTCTTTCCTTTTTCATATTTTTTTCTTCTCTCAGGTGTTTGTTGGGGCTTGACATTGATTGATTGGACCAAGACCAAAGACATACTTGGATTGAAAACCACTTTCAAATTATCAGAGGACAT TTTGACCAGATCGCTTGCTGAATATGGTGGATGGTGATGGTGTGATATACCAAGAATGGCGGAAATTGACGGGATGACAGACGACGTGGCG[A/T]CGCCAGGCTAGTTTGTCGGGTTGGAGCAGACTCGCCAAATGTTGAGGGATGTG GCGGGTTTGGTCAACCCTGGATCTGTTTAGCGAGTC	GCGACCAAGACAGA TGACGC	GCGACCAAGACAGATG ACGT	CCACTGAGTCTCTT TGTGATAACTCA
25	**Chr6_2733230**	Chr6	2733230	0.11	0.19	0.17	0.00	CTTTCAACATTCCAACAACAAGACCCCACCCTGCTCCCTGCACAAAAATGCCTCATCAGTTTTTAGCCTTAGAGATGAGTTACTTTGTGTTCCATGCCACATGCCACGAGGCACCCAACCTACCTAACCTGTCTCCAGCTGGAGAGGATG CAAGTTTGTGATTTGAGAATTTTCCCCAGCAAAGGATGCAACTGTAAATGCACTTAATACTGGTCTTTTGCCAAGGCACATGATTGGATGGCTCACTACTCTTAGGAGCTTGATTGCTGTTACACAAGTTCAAGGAATACATATGTGGCT CCAGGTAGACTGGAAAACACAGCCTCACATTGATCACTTATACTATAATTTTGTAGACCATCCTCAGCTCTAAAAAGATTTCCTTGGGTCATGGGCAGCTCAATCCCTGACCCCTCCTGTCCTTGACAAGGGTGATCAAGCTGTTCAAGG CTGTGTAGCAAAGAAGATGTCGGAATTCCGTTTTCTCAGACAATTTCTCTAGGATCTTCCACTCCGCTCCCAAATTTCATGATTCCTTTCTCTATTTCCCTTTTTCTCTCCAACATTGGTCTTCCACAATCACTGATTGGTGTAAT[C/T]GC TGCACTTGTGGCCCTCTCTCTTTATCATTCAATTTGGTGAGAAAAGACTTTCAAATCAACATCAACTATTCCCTTCTCTCCTACTTGAAAATATAGTTAAAAAAGATCAAAGCTAACTCTTGTCATTTTACAATTCATTGTTCTTCTTTTAGT GTGTCTAAACTTACTTTTTTTGCATTTCACAATATTGCTCTGAGCATCTCATTTTATTAGTCTCCTTGGGTATACTAGTTCTTTCAAATTATTTCAATCACCATGTTTTTCTGTTGTTCATATATCTGTACTTTCCTGTGTCATTTCTAATGT CTCTCCTATTTTTAGTTTTGA	AGGAGTTCATGGTG AGCCCG	AGGAGTTCATGGTGAG CCCA	TGAGTGCAATCGGT AACAAAATGTCA
27	Chr6_4057892	Chr6	4057892	0.11	0.19	0.17	0.00	GACTATTGCATCCGACAATCGTCAAGCACCTACCAAGTCGCAAGATGGTATCAAAGGCAATACACATCTTATACATGTGTGTTCAGGAACAATTCCTTCAGGAGTTCATGGTGAGCCC[G/A]ATTTTCTTCAGTTTTGACATTTTGTTACC GATTGCACTCATACTTTTTGTCCTGTTTAGACCCACGAGGGGGCAATCTACCTGGGGGTTGATGCATGGCAGACCTCCAATGGGTTTGATGTCATTGGCGTGGTGATCTACCGACTCTTGAATGACGGGAAGGGTAAATTTTATTCTTCC GCAATGCCCCTCG	AGGAGTTCATGGTG AGCCCG	AGGAGTTCATGGTGAG CCCA	TGAGTGCAATCGGT AACAAAATGTCA
28	**Chr7_717077**	Chr7	717077	0.25	0.38	0.30	0.00	ATACTACTACTCTTTGCCATCAATAAGAAACTTCCTGTACGGCAATTCAACATCAAAAGTGCCTTCCTATACGCTT[C/T]GTTAAAAGAAACCATCTATATAAAAACTCCAGAAGGGTCTAAACGTAAATCTCGGTACCTCAAACTAAATC TCTCACTCTATGGCTTGAAACAGGCTCCAGCCAACTGGTTCAAGACTCTCACCGCTGGTTTGTACAGATCGAATTTCACAACGTCAGTGCATAGCTATTCTTACACCGCAACAAGAATACTTTCATTTTTTTTCACAAC TGAGGACTTGCTGGCGACTACTTCAGCAAGCTGAGGACTCGCTGGCGACTACTTCAGCAAGCTGAGGACTCGCTGGCGACTACTTCAGCAAGCTGAGGACTCGCTGGCGACTACTTCAGCAAGCTGTGAGCTCGCTGGCCACTCCAAT GACTGAGGTCTCCTGATCAAACTAATATAACCATGAAGCCAGTACCACAGCGGGATGACAACCAGATGGAGCGGTGTGAGTAACAATTCCAAATGAAAATGAGGAAAAAGTCCAGTGAAGGGATTGCTTTGAGAACACTCTTTTTTCT GCTAGGCCGATCTGTGATGCGAATAATTCAAATGACTACTGGATAAGATGTTCAAGAACTGCAACTCATACAGCTGGGGTCGATTTCATGTCAGTGGTGCGTCAATATAACCTCAAAACCATCATTTTTTCCATCCCCTCTTGTAATGAGCTC TATGATTCAATTAGATCTGCAATTTATTTGAAAGATTCTCAAATAAGTGGAATGTGAAGTAAGTCTTGCATCATACTGCTTATCTCATTTTTTAGATAAGGGGAGAGCCCTTTGAGATGCCCCAAACCATTTGCATGCTGCCCCATTTGGC ACTTGTGAAGTTGTAAGGGTTGAATTTCCCGACAACTGGCTGTCTGTCTCTCCAGTTTGACACTGCAGGGCATTAGCTTTGAGTCTGAAGGGCTTGCCAAAAAATTTCTCAAAGTCAAATTGTTAAGTCTGCGAACTTAACACAAGT CCCTGGCTGCAGAGGGCGTAGTGGTTCAAAATTGTGAAGTGACCCTGGGTAGCAGGGACTTGGGAGGTAGCTCTCAAAACTCGTATGCCATGATTCTGGATTTGGCTGGGGGGAATCTTCAAAACAGCACATTTTGTTGCCTTCAAACC CTGGGTTGGATCAAAATAGCTGTGGTTATAGCCCAGATTTTTCTCTTCCACTCCATAGAATTCAAGACACTTGACCAGAATTCTGCCACTCTCAAAAAATCATCAAGATCCTCTAACTCACGGATTTGCCAACAGCTGTATACTTAAGGG CCCACACTTGGCAGCTTGTGCACACATTTTGAGGTTGATTTTTGTGTAGCTTCCTTGCACAGTTAGGTACTATTTTACAACACCATTATCATGTACAGCTTCTCAACATGGCGGCGTGAAAATTCAATCAGAGTTGAACTCACCACACGCC AGTTTGGGGAGGTATGGTGTAAGTCCCTCCTGACGGAGGCTCGCTTTGCGAGTTCAGCTCTACCCCCCGGGGCCTGTAGTCTCAAGGGACTTTGCTCATGAAGAGTTGAATCCCTCCTCCAGGGGGTCAC AAGTTTGTTCCCCTGTTCTCTTAGATGAGTTTGTACATGCTCCATGATCAGCATTACCTCCACTTTTTTTCAGACCTCAACTGCCCATAATCATTATGACTAGCCCTGAAGTGGAATTGTGGCGGTTGACAGCCTTCAAGAAGTGCTTGTG AAGGCTAACATTATTGTGTGAAGCACCAGCTTGAGAGGGGCGAGCTGCTCTGAGTGCTCAGCAAGAGATCAAGTATTATTTTCCCTTTGGTTTGCCAGGTTCTTGAGCCATTA[G/C]TTTTGACTGCGACAACTAAGAGTACAGCGGCG CAGCCCCTTTCAACTCTCAGTTCTT	TGCCAGGTTCTTGAG CCATTAG	TGCCAGGTTCTTGAGCC ATTAC	TGCGCCGCTGTACT CTTAGT
30	**Chr7_3763260**	Chr7	3763260	0.11	0.19	0.17	0.00	GATCACGATTGAAGCTCTGAGTGGACGGGATCAAATGCAGGTGGGGGTAAGTCAAACAGCTATTGAGTGGAGAATACTTTAATGAAACTGATATACCAATCTGGACAAAAACGTTC[G/A]ATAACTTGTGCCCATCCGCATCTTCTAAG TAATTCCCAGTCCTTTGCGGATAATCATC	ACCAATCTGGACAAA AACGTTCG	ACCAATCTGGACAAAA ACGTTCA	ACTTAGAAGATGC GGATGGGC
31	Chr7_4281621	Chr7	4281621	0.11	0.19	0.17	0.00	CGACTACACCTGGGAAGCAGCGGTGTTGGAAGGAACTCCTTTTTCCTCATCCTTCCAACACACTCACCACCTCGTGCCACTGCTTTCCAGGTA[C/T]GTTCTTTTCCTTCTTTCTCCTTTCTTTTTCTCATTGTCTCTATGTTGAAACCACAT CCTTCCAACACACTCACCACCTCGTGCCACTGCTTTCCAGCTCAACAGTTTGCTGATTGAAAAGCTGAAAATATGACTTTCAGTGGAAAATGCACGACCATTGACATAATGTGGCCCATGCCAAACCTTACTTATTTGAAAAGGGATTCT CATAATTTTTGATTTGGGCAAGATCCAGCCGTCAGTTGACAGCCTTGTTTGGGTAGCTCGACAATGTTCAGCTGCATAGATTCATCG	TGCCACTGCTTTCCA GGTAC	TGCCACTGCTTTCCAGG TAT	TGAGAAAAAGAAA GGAGAAAGAAGGA
32	Chr8_2620534	Chr8	2620534	0.25	0.38	0.30	0.00	GACTCGATGTATGGTGTCTGGTCGCTGCTGGGCACAGGCCCAAGTTTGGCCAAAAATGAGGAAAGCGCGCTGGGCCAATCCCAAAGCCCGCGTGGCACATTCTAAACCAAACTTGGCACATTGCCAACCCCCGCTTGGCACCTCCCA AAGTTGGAGGGGGTCGGGTCCAAACCACGCTTGGCCGAGCCCAAGCGAGTGTGCCACGCACACCAGAGCCCGCTGGTGGGGTTCATGACTCGCAGCTGCATGTATGTAGGGCCCGGGTACAGAGGTGGGCTCCGATCGGCCCAGAGC TTGGGTTCGGCCAAGCCAGACTTGGGCTTGTGACAAGATCAGAGCCCCGCGCGGCCTGCCCAATCAGGCCCCGTGGCGCTCGGCCACGCGGGACTTGCGATTGTGCCCACGTGGATTGATACACC ATACATGCCGAGTTGGGTTGGGTCAGATATGATATTTGTCTGCCCGAACCCGAACCCAGTTATGGAGGGCTCCGGGTTTGGGTTGGGTCCGGGTCAACCCGGGAGGACCCGAGCTTTTTGGCTGCACAAGCGTTGTTTCTGGGATCGCCG AGGAGCAAGCTAACTACTCTATATGTACTTCATCCGTACTTTATTTTTATCATATTTTATTTCTTCTTGTTTTGATGGCTTTTTTGGGGGGCATAGGGTTTGTCCCACTTGAATTGAGGCTTTCATCCTTCACATCTTTCAAAAATCAAATA CTGAAACAGTGTTAAGTCAACTCAAGATCCAAAACGTACTCCTGTGACCAAGGTTTGCAAGAATCACAAATTTTAATAATGACTGGCAAAAAAGAGCAAGATAGTAACATATATGTTGAGGATAGATTTGAGTCAAAATTAATTAGGAA GAGTTGGAGGCCATGGAAGCAAAGGCGATTGAATTACATCGACCAATGAGTCCTACCATGACTGAAATCCAAACAGCGATTATCA[A/G]ATCTTTGGATGCCACTCTAGCCAAAATTAGGATGGGCGAGGTGGAGGTGAGTTGTTGGTT GGGCAGCAATGAAAGAATTGAACCT	TCGTTGAGCAGTTAC TTTGTTGCG	TCGTTGACAGTTACTT TGTTGCA	TCCACCTCGCCCAT CCTAAT
33	Chr9_84008	Chr9	84008	0.14	0.25	0.23	0.00	CCTCAGCCATGCTCTTTTGTCATAGTCACAGGCATAGCGCACCACACCGGGGAGACAAGTTAATTCACTTCTTGCGCCATCAGCTCATGGTTTTCGATGACTCAACCTTCCGAAATAGTAAACTGTTTCGGCCTC[A/C]AACAGGAACCTT GTCAGACAACAACGCAGTAGAAAAAGAAGCGTCGACAATGAGTCAGGACAACTTTATCCCGGGCTGCTGACCTGGCTCTTTTTTTACTTCTGCTCTTAAAGTTACAAAACCTTTTCTCAATTTGCAGGGTGAGCTTATCCGCATTTGGC TGGGTACTGTTCTTTTTTTCCTTCTTTGGCCAAGGGTACATCTTCATCTTTGTATTCACATCTTTGGCGTCTGCTTCATCATTCTGTCTAAGAAATTTTTTTATCCGACGATTTGCTATCAATACGTGAAACAAAGGGTTCAAGGGGCCTTC TAGCAAACAGGGTTTTTGTTTTTGGAAACTCTGCCCTCTTT	AGTAAACTGTTTCGG CCTCA	AGTAAACTGTTTCGGCC TCC	TGCGTTGTTGTCTG ACAAGG
34	**Chr9_201188**	Chr9	201188	0.18	0.29	0.25	0.00	CATACCCCCCCCATAATATCACCCAATCCATAGCAAGCTCTCCCAGTAAATGATT[C/T]TGTAAGTTCCTCTGGTGACGGTGGTAGGCCAGCATCCCTAATGGTTACTTTATTTAATTTCTGGAGGTCATGGACTATTCTGAGCTTACCATC CTGCTTTTTGACACAGAAAACTGGGCTGGAGTAGCTATAAAATGAGGGTTCATAGAGGCCAGTCTTCAGCCTTTCTCTGATCAGTTCTATATACTGTTCTTTGATGGGGCCAGGAATGGGGATGGGTTTCTGCTGCCAAGGTTCATGGG GGATGATTGGTATATTGTAGGGCTGTCCATAGGTGTGTTTGAGTAGTCCTCTCTCCTCTTCAGTGAATGCTAGAGCTCCTTGCCTTAGAATTATAATATAACACATTAATTTGAATTCCTCTTCTGTTAACCATCCAGCAGGTCCAAAATT AATTAAATCCAGCCTTTCTTGAGTGACCTTTTCAGTTGGAACATATGGTGGGTGGTAGGGGTCAGAGGAGTGAGATAAGGGTCTCTGGAAAGAGGTGGATTGAAGGCAAGGGGCATAGGTTGGTTCACTGGC AGCAAGCTCTCCCAG TAAATGATTC	AGCAAGCTCTCCCAGT AAATGATTT	GCCTACCACCGTCA CCAGAG
35	**Chr9_843505**	Chr9	843505	0.25	0.38	0.30	0.00	TTAATCTTCTTTGCTACTGATTTATATTTAGCTGCATTGGATGAAAGGGTTGAGGGCATGGTTGCAAGGAGTGGTCTGTCTTCAAGGATTGGTGGCATAGAAGTGATAGAGGGCATAGGCAAGTCTATTTTTTTTAATTGTTTCCAATTTA TATCTTGATGTTGCTGAGTAAGAGATAG	TCAGATTACCTGTAG TCCAGTGACT	TCAGATTACCTGTAGTC CAGTGACA	GGATTGATGAGGA GATTTCGGGG
36	**Chr9_1370829**	Chr9	1370829	0.25	0.38	0.30	0.00	CGATCCGAACCAAAAAATTCCAGAAGGCTTCTAGATCAGATTACCTGTAGTCCAGTGAC[T/A]TCCCCGAAATCTCCTCATCAATCCAAGCCAAAAAATTGAATTTCACTGTGATTTTGATGCTGTGAAGTGAAAGGAAAAAGAGATCAAG TGTTTATACATTTATTTATTTTGTGTTTATTTATTATTTTTATCTGTTTTTATCTAGAAATATATTCCCCCTCCCCCAAC	GTCCTTGACAGTTAC TTGGTGCA	GTCCTTGACAGTTACTT TGTTGCA	AGTAATGGTAATCT GAGAGTGGTACA
37	**Chr9_1381122**	Chr9	1381122	0.11	0.19	0.17	0.00	CCCAATGGTGTATCAAAAGTCGTCAACAGTCTAGAAATTGGATCCAGCGCGCGCTCATTGTAGCCGCCCATAATGTCTCCCAGCCCATAGCACGCAGAACCAGAAAAGGATTCAACAAAATCTTCAGTGGCCGGCGGAACGCCGGCGT CCTTGACAGTTACTTTGTTGC[G/A]AGGTTTAAGATCGTGTACCACTCTCAGATTACCATTACTTTTCAGTACACAAAACACAGGACTAGAATAACTTGACGTCGACTGTTTGTAAAGGCCAGTCCTAACACGCTCCCTGATTAACCTAGT GAACTCTTCCAACTTTGCTGCAGGTATCGGTATCTTCTTCTTTTGCCCAAGGCTCATGTTCGACGACCGGAATGATGTACGGCAAACCATATGACTCCTTCAATAAGCCGCGCTGCCCTTCGTGAAACGCAATTGACCCATTCCTGTTGGC TTGTACATTCTTGATCACATTCAATTCCGCTGGGTACAACCAGTCATCCGGTCCAAAATTGACCACCTTCAACTTTCCTCCGTCACTCGTCCTTTAGATGTAAACGGGTGGGCCATGGATAGGGATTGGGGCG TTGTTGCG	GTCCTTGACAGTTAC TTGGTGCA	GTCCTTGACAGTTACTT TGTTGCA	AGTAATGGTAATCT GAGAGTGGTACA
38	Chr9_2425411	Chr9	2425411	0.11	0.19	0.17	0.00	GATGGAACCCAATATAACCTACCAAAAACGGATACCACTTGGCGGGACAGTCTGAAAATTATCCATTTGATACCGGACCTGAAAGAGCACTTAAACTCAGAGCAAAGTGGACAAATTGCCAAGGCGGTGGTTTTTTCTCAGTGGACTTC CTTCCTGGAGATGTGAGTGATTTCAATGATGAAAAATGTCTACCTGTGATATCTCAATCCGTTGCTGAGACTTCTTTGCAGTGTGGGTGTTGGACTTGTTGCAGAAGGAATTAACTTTGAACAACTAGATGGCAGCCGCTCATTACAGCA GAGGGAAAAGAGCTTAGAAAGAATTAGGCACGAACCTAATGTTACAGTGCTTTTGCCCACAATGGGGGCAGGTGGAGTGAGGATTGACCTGACGTCTACACAGAAAGTTTACTTGATGGTGAGTCCGGTATACACAGAATTATAAACT CTTATATTGACGGCAACACGGCTCAAGGACCCTTGTTGGAATCTGAGCGTGGAAGACCAGGCAACGGAT[C/T]GCGCCTATCGTCTAGGCCAACACTGCACTACACAGATCATTCATTACTTCATAGAAGGGAGCATTGAAGTAAACAT GATAGAGGTGCGCTACATACATGACTCCTCTCAATTGTGGGTTGAAATAAGTGATGAATACGTACATGGCAACATTTATAGATACAGAAAGGAAAAAAGGAGCTAGCCCAGTAAGAGATTTTTATGTACATATACCAAAGAAAATCC CACGCCAATGAGAGTGATTGCACAGTTTAGTGTTCAATCAAACCAGTGGCATAACGAGGGAGGTTGTAAAGATCATGATGGAATCCATTCATCGACAACACCAGGAAGAAATCAGATGGCAGGGAATTCAAAGGGTTCAACCTGAGTA TTCAAGACTTGCTGTGCAATTTGGCCTCTGGATTGGAGGAATATTCGAGCATAGAAGTTGTGAGGGAAACTGATGGGAACTGTAACAACCCGGGGTATGTTGATAGGATCACGTCGACACAATTCAAGTAACTTTGTCCTTTGCACGTA TCGAGATCCTTTTTCCTTGCGCAAACGTTCCACGGTGGCTTTGTCCAATTTGTGAGCAAGTTGAGTTAATTCCGGAGAGCGCCACGGCACGTGCATGCGATAGAGGTTCCCTTCATT	GCAGACCAGGCAA CGGATC	GGAAGACCAGGCAACG GATT	TGCAGTGTTGGCCT AGACGA
38	Chr9_2425411	Chr9	2425411	0.11	0.19	0.17	0.00	GGTGCATCTCGAACTAGCTTAATCATAAACACGACGTCCTCGTCTGATAGGTGGCTCCGTCGACCTAGTCAAGCGTATTCAAGCGGGTCTCGTACAAC[G/A]GCTTGGGTTTCATCATACAATGGAAGCCACCGGTCAAAAGATTGCCTG GAGATAGCCATTCCGAGGGCATCACAGACAAACCGTTGCGAGTTGCCCCCAATGATCATTCGGACGGCCGCAATCTTGGTCGCTGGTGCATACTTGACGAAAACCATCGGCGTAATCGACTCAGTTGATCAGAGTGGGGAAGAGATTA ATGTGGCGATGATGGTAAGTGACCTGGTCAGGAGCAAATCAAGCGTTCCAGGTGTTCAGTTCAGTTTTT	CAAGCGGGTCTCGTA CAACG	CAAGCGGGTCTCGTAC AACA	TGACCGGTGGCTTC CATTGT

39	**Chr9_3149493**	Chr9	3149493	0.11	0.19	0.17	0.00	GCATGGATTTCATTTTCAGTGAATTTTGAGTAATTATCACCAACCCCTTAGGCCTAATCAAATGTCCCAGCAACTTCTGGATCTTCTCTGAGCCCCAGGTGGCTTGCGGCTGGCTCTGCTTGTGTTATCAGCTCACTATTCTGGTGTTATTGATGGGCTAATTTACCCCTACAATGGATGTTATTTGCCAGTTTTCCAAGTGGTATCTATGTGTATTGTTGGGTGTTATTGTAGTACAGTGTTAGTCCGGATGGATACACTAACAGATATTATCCATCCTGTTATTT[G/A]AAAAAAAAATACCATAACTGTTAGTGTATTCCAACTAAAAGTCAGTTAACACTACCCAGCTGTGCCAGAACAAGCAAACCAATACAATAACCGTTAGTGTATTGGGTTAAAATTGCCACTAACAATACTCAATTTGGCCACACTATACACTCGGATACACTAACGTGTATTGCCCTGTGTCAGGATGTTGACAATAATTACATTCCGGCCAGAAATCTATAG	GATATTATCCATCCTGTTATTTG	GATATTATCCATCCTGTTATTTA	GTTGGAATACACTAACAGTTATGG
40	Chr9_3797252	Chr9	3797252	0.11	0.20	0.18	0.00	GAGATTGTAGATTGCTACAGCTAGCTCTGACATTGTTGTTGATGGCTGAGATTGGGTAATGAGCATTAGTAAAATTGCCTTGAGATGTCTTGGAAGCTGGTAGACGTACAAAGTTGGCTGATGCTTAGTCACATCCAGAAGGAACTTCCAGGACCATTCTGCAATGACGAAGGAAGGACCATCATCAAAGTACGTCAGAGAGCTTGCAGACGACGTTCAGGGCCATTTTTTATAAGGCAAGCCATTGGGCCGTTGTTGTTTTGCAAAAGGAGAATCCAAGTATTATACCAAGGTGATTAGTTTGTTGTTAACAATGGATAACAGTCTGTGTGTTAGAGTACGGGATGTTAGTTTAGAGTTGACATTAGTTTTACTCGATTATAAACCTTTATTTCAGTATTCTTCTATCCCCTGTATATGTTAGTTCACATTCACATACATATATTCATTATAGAACTGTAGTAGCTGTGGCGCATAACTTGTATTTAGTCGCCGGTACCGGCCTCTCTCTCTCTCTTCACCGAGTTTGGGACCAATACCGGACGTGCAGGAGTTTACCAGCGTTGTGACTTTGGTGTCCAGATCCTGAGGATCTTATACTGTGAATGAACATACCTGGCTACAATTGATTTTCTTTGTGAAAGCAATGGC[G/A]ATGCGGATGGGTGGTGTCAATTATTGAAGGGAATGGGTCAGATGGATGGGGTCAATGGGGTGGGATGGGTGGTGCCTGGTGGGCTGTGGGCAGCTGTGGGCATGATGTGGCTACACAGCTGGGTTTTGGCTTTGTTGGAGGTTCACCCGGTGAATGGATTGTATGTCAAAGAGCGTACGACACAAAAATCTGAACGAATGTATTGGGTTGTTGATTTTGTTGTAGTACGGTACGTAATCATTACACACAATTACCCCATATTACATTATGTGCTCGACTCTTCCGTACTTTCCCTTTCTCACTCTCTTTCTTGTTATGTGATTGTGTAGTATATTTACCTTGTACGAGCTGGACCATTGGATTCCTCTTGCTTTTGGTGTCCGGAAGCCCATCTCATGTGGGGTCCAACCTATGCCGGGCCAAACCGCGCCCAGCCTCTTGAGGTTCGGGGGGGAGACCAAGCGACAGGATTGAGGGCTGTACAGCCTCATGTACAGCTCTTGAGGCGCAATACTGGT	TGATTTTCTTTGTGAAAGCAATGGCG	TGATTTTCTTTGTGAAAGCAATGGCA	ATTGACACCACCCATCCGCA
41	**Chr10_230077**	Chr10	230077	0.11	0.19	0.17	0.00	CGAGACCGGCAGGCACAGGCTCTCTTGTCAACTACCGGCCGATTTGGTTTTAGGCTAGTTTCTCCAAAGCAAGTCCCCACCTTCTTCTCGAGAACGGGCAACGGCTTTACTATTGACCTCACCTGGGCCAACTTCCTGGCGTCCAAGCT[C/T]GTCTCATTCTCAACAATTGCAGAAGACAATCACAGCTCTGACCATCAGGCCATTGAACTCCACCTGAATATCGGCAAGCCACATCTGAAAAAGCGGCTGGTTCTTCCTGCCTGGAAAGATCTTGACCAAGCTGATGCCCTGACG	ACTTCCTGGCGTCCAAGCTC	ACTTCCTGGCGTCCAAGCTT	CAGAGCTGTGATTGTCTTCTGCA
42	Chr11_3340616	Chr11	3340616	0.14	0.24	0.21	0.00	GGTCTGGGTGAGAACGTTGCGTCGGTATGAGCTGATGACCGGAGGAGGATGGTGACTCGAGCGTCGGTTTCGCTGAAAGGATATTGTCTGCGGTGATATAGGTGCCACATTTGAAGACCATAGAGGTACTTTGCCACCGTTGCTGCTGAGACGTCGTGGTCCGTCGGTTCCCCTTCGACCCTACCGGCCCAGTAACAGAAACCGAATATATCATCTGGAGTAGCTGGGAGGACAAATGAGGTTACGTTGACCGATTCTAGGTACTTCAGGAATTTATTTATCCCAGCATTGTAAGTCGCTAGGGTATTTATCTTGTATCCTTTTAGGAAATGGACGTCTTCTGATGTAGTCGTGACCGGTTCGGTGCCGTCCCTAAGGATGCTAGGTATCCTCTTGAGTTCTACCATCTTAAATTGGACGGTTGAAGTCTTTCTGGGTTCAGGGGTGGGCGACATGGAAAAGCTTCTGGGAGTACCAAGGTGCTGTAGTACCCAAAGGTCTTTAAATTTCAAATTGGTGTTGTCTCTCTCATCAACAAAGGAACGCAGTGGGAGAGCCCTTGGCAATGGTGGGATTACAAACAATTTGGATAGCCCGTCTCAAAAGGGGGTACGACTTTAGTAGGATTGGAACATCCTGTTCTCGAGGTCGGGTGGTAACTCTATGACCACCATGTCTCCAGGTCGGTGCCTGGATCTGTCGCCTCGAGACAGCGCGTCTGCCGCGTTCGAGTTTGATGTAACTCGCTTGGATACAATGTCTATTTGCATTTTTACTAATAAGGCTTGAATCGTCTTCCACTCTTTGTTGGCGTGGCTATGTTTGGATTTCCTCTTCTTGATTAGGTTCTCTGTGGTCGTGTTGTCGGTCCAGACTATGAATTGTTTTCCTGGTAGTGCGCCTAGTTTGGCCAGTACCAGTAGGCCTAGGCGTACTGCTACTGTCTCTAGCCAGCCTATGTCTTGGTCTGATCCTGGACCAAACCGCCACTCTTT[C/T]GTTAGTTGGAATTGGGCCCATCTACTGCCGACGAGGATTCCAATCCCGAAACCTGTTGATGCATCACCCACCCACCCAATTTCGGTTGGACTTGGGGATCGGATGATCCTAGTTTCGTCGTACGAGAGTAACG	GGACCAAACCGCCACTCTTTC	GGACCAAACCGCCACTCTTTT	CCTCGTCGGCAGTAGATGGG
43	**Chr12_23929**	Chr12	23929	0.15	0.27	0.25	0.00	GGCGGTGTGGTGCTCTGTTTCTGTTACATGCAACAAAATGCACAAAACCTCATCCTATAAGCTAAACCACTCACATATTTGAAGATATTATCGCAGAATTGAACTC[T/C]ACGGACAAAATAACCCATAGTCACTCACTTCAACCACTACCAACGGTGAAAAAATTACCGTATAGGCAATGTATCTGCATGTATCATTCAATGTATCAGCATCCCATGAAGCAATTGTATCAGTGCAACATGG	TGAAGATATTATCGCAGAATTGAACTCT	TGAAGATATTATCGCAGAATTGAACTCC	TGGTAGTGGTTGAAGTGAGTGAC
44	**Chr12_2805263**	Chr12	2805263	0.25	0.38	0.30	0.00	GAACTACTATCCGCCTACCATCACATCATTCTACTCGACTGCACATACAAAACGAACAAATACCGCATGCCTTTGCTCCACGTCTCTGGAATCACCGGCACCAACAAAACCTTCAGTATTGCCTTCTGTTTTATGGCCGAAGAAACCGAAACTTCCTACGATTGGGCGCTTCAAGCTTTGGTCACTATCTTCGAAGCGCACAAGATCCCTCTTCCGGCTGTTGTGATCACTGATCGTGAACAAGCTTTGATTAATTCCCTCTCAACAAACTTCCCAGACGCCGACCACATGCTGTGTGCATGGCATATCCAGAAGAACCTCCTATCAAAGGC[A/G]TCCAAATTAATCCAAGATCAAGCAAAAGAAAAGGACATGCTCCAATACTGGTCAAATCTGGTCAAGATTCG	CAGAAGAACCTCCTATCAAAGGCA	CAGAAGAACCTCCTATCAAAGGCG	GGAGCATGTCCTTTTCTTTTGCT
45	Chr13_2492912	Chr13	2492912	0.11	0.19	0.17	0.00	TGAGAGGATATTCCTGCGCCACCCCCTGGTTTTTACCAAGAAATAGAGGATTGTGAGACTGCAATCAAGGAATTTGCTATATTGCATCACTATGCAATTGTCAGAAGATCTACACGGGGAAAATGTGTCTTTTATAAATGTGACAGGCATGTGTTTTTGTTTTTTTCTCTCTTCTTCATGTCTTTTTTCCTTCATCCTTTTTGTGATATAATTTATACTGACTATTCTTCACTTTTATCTTTTCTTTTCAATTATATAGGGGTGGAAATGCTAAAAGTAATAAGCGGAAAGGAGATACTCAAGAAACTAAAGTCACCCGCCTAGTGAACTGTCCCTTC[G/A]AAGCCACATTGTACTATCACAAGAAAGAAAACCACTGGAAATTTGTAATTAAGAATTCTAGCCATAATCATCACCCTTCTGGATCAGCCGCCGCCCACACCGCGAACCGCAAACTCTCAGCTGGACTCTATCAAGAAATGAATCAACTCAGTGACGCTGGATTGAAACCCGCTAGAACTCTGGAAGCTCTCAAGAGATTACACCCGGACGAGATGATACTGGCAACAATTACAACAATTTACTCTGCTAGAAAGAAAGCTGCCGCACAGTCACTTCAATCACTCAACCCAATCATTCAACTACACGAAGCACTTCCCCAATCAGATTACACAACTAGAACCAAAGTAGACAAATCTGGCG	GCCTAGTGAACTGTCCCTTCG	GCCTAGTGAACTGTCCCTTCA	TCCAGTGGTTTTCTTTCTTGTGA
46	Chr14_1389679	Chr14	1389679	0.11	0.19	0.17	0.00	ACTGGGTCGCTACTTACGCTACATTATCTGCATTATCTCAGTAAAGTAGTGGTCTTGATTCCTTCCCCGCTACTTTACCATTATCCGTAGTGGGAAGTTTTTCCCTCAGTCTGTAGTGTAATGACGAAGTTTCTGGAAGCCTGAAGTGGAT[A/C]AAGTAATGTATTTTCACATTATTTGGAGGCCAAACGGCCCCAATGGCAAAACCACATGAAGTGGAAGAAAGCCCCTCTTTTTGGGTTTTGGCAGCATCAGATGCCACAATTTTTCAAAAATCATAAGTAATGCACAAAAACTGCCCCAAAATCCTGAGGAAAGTAATGTAATGAGTGAAAAATTGCTACTTTACCATTACACTATCATTACAAGTAATGTAACTACCCAGTGTTGCTCCATACTGTCTCTGACATCGAGATCAATCACAGTTCTTCTTGCTTGTTCTCTGGTGACGGTCGTGGTGTAACGTTTTCTCGTTACCAAAGCGGAAACCATAATTAATTATGACATTCTCTTGAAGTTATGCGTATTAATTATGATGTCATCCGGATTTCCTATCATAATGAAATGATGTCATGATCGCGTCACAACTTGGGATGTGCAAGCGTTGTTACTTTAGATCTCCGCTCTTTCTTTCCTTCTCCCCCTTTTCCTTTTCCTTATCGTATTATCTTTGTTTATTACAATTTCATTACGAATCAGAATTACTATTTGTAATAAATCCGTACAAAATAAAAATATAGATATCCACCTCATCTTTTATTGTTCGTTATCAAGCGTAACAACGCTTTGAAACGTTCAGTACCTCTTTTCCATATACTCAAGATCGACGAACCCTCCTCTTGGAAAGGTTTCATAGTCAATGATCTTGTGTATAGTAGGACGGCCCTCACACGTGGCGCCTCTGATCAGCTCTGAC	TCTGGAAGCCTGAAGTGGATA	TCTGGAAGCCTGAAGTGGATC	TGGCCTCCAAATAATGTGAAAATACA
47	Chr14_2943033	Chr14	2943033	0.25	0.38	0.30	0.00	TCCACTCCCCCTTGTACTTTGACGCAGATTGTATTCCTCTTCATGAGTGCCCCTCACCCCTTGATATCGAATGCAATTTGTGAGCCTGCAGACTTGTATTGTATCAGCGATACAGCTCATATACACATCACAA[A/G]CAGACCTGTAACGTATTGGCTAGCCAATACGTTACAGGTTTTCCGTTTTTGCTGCATGTGGAAAAGTGATACAATACACAGTATCACCCGATACTGGATCGTATTGTATCACTTACAGTGTTGGTTACAA	GCGATACAGCTCATATACACATCACAAA	GCGATACAGCTCATATACACATCACAAG	TGGCTAGCCAATACGTTACAGGT
48	**Chr14_3096987**	Chr14	3096987	0.11	0.19	0.17	0.00	CGGGGATTAGATCGTTTGGTTGGAAAGTAGAATTCGAGTGACTTGACTGAGGAGTAGAAGTTCTAGATTGTATAAGGGGTTTGTCTTCGTGCTCAGTGGAAGAACCGGTGGTAGGATCAGTGGCAGGATCAGGGGTGGCTTCGGGAGTGGTGAGTCCGAAGTCACCAGGAATCTTGGGATGATCCGCCAGGGTACGAGGAGTTTTCCGTTTTGTTGGTATCGTCTAGTCTTGGGTCTTATTTCAATCCTATGCTCAATAGCGCTGGGCTCATAACCTGTGAAACACCAGATGATGGCGGTGAGCAAATGAGGAGAATTGACTCCGAGAGTAGCGAGACGAACAAAGGAAAAGACTTGTACCTGTGAAACACCAGATGATGGCGGTGAGCAAATGAGGAGAATTGACTCCGAGAGTAGCGAGACGAACAAAGGAAAAGACTTGTACCTAAACGAGGTACAGGTGAATGACACGGTGAGATGAGTGTGTGATTACTTATCGAGCAGAGAGAAAAGATGAAGAGGAGAAAGAAATAAAGTGAGATGATGGAATCGAACCTGTGAAACACCAGATGATGGCGGTGAGCAAATGAGGAGAATTGACTCCGAGAGTAGCGAGACGAACAAAGGAAAAGACTTGTACCTAAACGAGGTACAGGTGAATGACACGGTGAGATGAGTGTGTAAGGAAAGGAAAAGAAAGAAAGAGAAGGGAGAAACAAGGTTTATAGAGAGGAAACCTAATCTAGCTATACACCCTCTGGTTCGACCGATCCTTTTCAGAACCCTAACCGCTCAAGTCACCTGTGACATCTCCGGTTCAT[T/C]GTCACATCAGGTGGTTTGAAAGAGGTGTTGAGTAAGTCATTTACCAGCACATGTGGCATCCTGGGGCTGTAACCTACCAGACTGCAGATTGTCCACCCACCAAGCCAAACCAATTTTGGGTTTGATTTTTTTGTTTCATTTGATATCATTCTTTGCACATTCTATACTTGCTTTCTGTCTATTTCATTTGCCCTCAAACATCTTTTACAGCTTTCCAAAAAAAAGTTGAGTTTTTCTTCATTTTTAGAAAATTCATGGTTTCATTTTTTTGTTCTACTTCATTTGTGTTCATTTTGAGAAGCCCACTTTTTATCATTCCACCAATTCCTTTGATTTTGAACCGGTTGGCCAAGTTTCCAGAGCCAGAAACAGTGTGGTGAAAACTTTTGTCTACCCACTGTACATGACCATTTTGCAGTTTGGATACTTATTTTGTTTCAGACAAACAACAAAACTTGTATGTACCAGTTCCAAATTGGCTTATCTTTTATATTTTGAGATGATTATCTCAGCTTGATTGATCTGAACCTCATATATACACTCCCATCAGATTTGATAAGGATGATCTGAGGTGTATAATGAGTATCTAATC	ACCTGTGACATCTCCGGTTCATT	ACCTGTGACATCTCCGGTTCATC	ACTCAACACCTCTTTCAAACCACC
49	**Chr16_106435**	Chr16	106435	0.14	0.24	0.21	0.00	AATATCCATTGGTATAGCGTGTTCAATTTCATCTAATAAGATCGAGATTCCTGCGAGGACTTGACAGCTGTCCGATAACGCTATGTATTCTGATGCACAAGT[C/T]GAGAGCAGCAATTGTGTTAAGATTTAACTCTCAGAGATTTAGGTTGAGTACCGGGGAATTGCTGACTGTTTTGAGTGGGTCAGGAACAAGGAGCGGGAGCAGGGTGGCACTGGAGTTTTAGAGCTCTGACTTGATGATGAATTTCTCCTGACAAAGAGGCAGGTTAAGTAGACTACTACAAGAGGTTCAAAATGTGGTTGAGCTAGACAAACAGGATAAAAGCATGAACTACTGAATATAGAAGCATACTAGTGACATGTGAATAAAACTACTGAAAGTAGAGTGACATAGATAAAACTTCCAAAACTGAAAGAGTGATAAATAAAACTGGAAATTACCAGAGTGAATATTAAACTACCAGACTGTAGAGAGACATGAAACAAGTTAACTTGAGTGATTTGATACTCAAAACTACTCTTGATAGAGGAGAGTGTCACAATGAAAGAAAAGAAAAAGATGTGAGCGGAATTTGAGACTAGAATTCTGACAAATTGTTTGCCGTTTCGCACTCCATGCTATTGAATCACCCAGATACTTTACTACATAAC	ACGCTATGTATTCTGATGCACAAGTC	ACGCTATGTATTCTGATGCACAAGTT	AGTTAAATCTTAACACAATTGCTGCTCT
50	**Chr16_1855070**	Chr16	1855070	0.26	0.38	0.31	0.00	AATCGATAAAATGCCAGAACCAAGCTCTACCCCAATCAGCATCGGGTAGCCTGATGGCATTCAATTCCGCTCTGATCTTCTCGTAGATGGTTCGTAGTAGTACCAGGTCGTCATCGATGATGTCGCCGACCCACACGGGACGTCTGCTGAAAGACGCATCTATGCTAAGTATTCTCTGACGTTTTCTTATATATATATATATGGAAATTCAGAGGGCGATAATTTTTGTGATAAGATGGTAGCTTTCAAGGTCCGAAGTCATCATT[G/T]GCACTGAGCCCTTGATGCCTCATCTGATCGATCAAATGCAAGACCTAATCTCTACC	TCAAGGTCCGAAGTCATCATTG	TCAAGGTCCGAAGTCATCATTT	TCAGATGAGGCATCAAGGGC
51	Chr16_2338504	Chr16	2338504	0.11	0.19	0.17	0.00	TGTTTCACAAGTAGTCCATCAGGCGAGTTGAATAAGAGTAAATATGTCAGCAACCCGCACACCAAACCATCCCGTAA[T/C]TGTTTCTGGGCATTTCAAACCCCTCTCTCCTGTCAGTCGAAATTACGTCAATCGTCCTGCAAGAAGAAGTTTTCACTAATGTCTATTCTTTTAGTCTGTGCCCGAATCAGTTCGTGGCAATCAATACGGTTTTGTTTCTACCCCCAGTTATTTTCAATGCGCTGGGATTGGAGGAAATAAGTCGGATGTGTTTGAGGTTCTCCTCAAGACAAATACTATCCTCACACACTCCCTCGATGTCGGATCAGTATACTACCTCAGCGGCAAATTGATAGCTATGAATGACGGATCCACACCTGTCCTTACTTACTTTGAAAGCTCCTTGATCAAAATAGGTCCGGCTGGCGACAATCAACCTGACTTCAAAAACAAGACATCTATTGTTGGGTTGGGTCATGTCGCCAAACGCGAGGAATTAATTGGTAATGACGGTGATAGCGGGAACAGATTAGAAGTGGAAATAGTTCATCACGATTGGGACGTACAAGTAAGCTGTCTCTCTTCAATTGCTTTATTAAATACTTATCTGTATCCCTAGGAGCGTTGTCACCGGTGATTTCTCGTTAAATACATTATT	GCACACCAAACCATCCCGTAAT	GCACACCAAACCATCCCGTAAC	CGACTGACAGGAGAGAGGGG
52	Chr16_2390327	Chr16	2390327	0.11	0.19	0.17	0.00	AACAAGACGATGGTCCAGGGTGTTGGATTGGTCGTGTCTCATGGTCCGGAGAAGGTTGATGAAGACGCTCCACCTACTGGTGCAATGTCCATTGGGGTGGCTCACCGCGATTGGGACGCAAATGTGAGTCGCACAGGAAGTAGCTCTCTTCAAATCTATAATG[C/T]GTCGGACTGTGATGCTGACATATAGGCTGATGGTTGTTGCAGAGTCGTTCTATCAAGGTATTCAATGTCAACTACATCTTGCCTGCTTCGCCTCGATTGATCAACAAGCATCCCATGATCCGTCCCAATCACAAAAATCCATCTCTATGGGTTTCTCTCGGGTCA	GGAAGTAGCTCTCTTCAAATCTATAATGC	GGAAGTAGCTCTCTTCAAATCTATAATGT	ATGTCAGCATCACAGTCCGA
53	**Chr16_2481069**	Chr16	2481069	0.11	0.19	0.17	0.00	GGAGTGTCTGAAGAAATAAGTTGAATTTGTTTGAAATAAACTTGCCACTGTTGGACCTTATGCACAATACATTGTGGCTTGAGTTTGTGTTGCACTTTTCAATCTAGTTCATGACTTCCTGCGCCGCATTGGACTTGGCCTTAAGACCTATGACTCACGTCATTTGGGAGTATATGTCATGGACGATCAGCCCATATTTACTGCCATTTAGAGCTGGTGGAAAAGGCCCAACCAGGTCCACCACAACTATTGCACCAGGTTTGGTTGCTAGTTCTCTCGAAAACGTAGCCACTGGAGAATGTGTACTCTTTGAAAGAGAGCACGAGTCGCACTTGCCTGCATAAGACTCAATTTTTCTTCTCACGAAGACCAAAAACACATTGCTCAGCTATTGTTCTATTGATTGATCTGATTGCATGGTGTCCCAATCTGAAGTGCCAGAGATGAGATGAGATGGAACACAAGGATGATGTTTGTTTGGAAGGGGAAACTTTGGAGTGAGAAACAGATAGGAATCTTGGGCAGGTTGGGATGAACCATTGGTAGTTTGAAGAGTGAGAGGGGGAACAAAGCAAATTTTGCAAGAAAACAAACAAGCCATTATCAAACAATACCTCGCTATCCCATTGATCAAAGAAGCCAACCGATAGTACC[G/A]AACCTTCAACTCGCGGACAGAGGAGAATATTGGATGGTCGGAGATCGCTGAATCGTGTGGGAATGATTGCGTCGCCAATTCCCTCTACGGGAAGGCATTCTTGAGACGCCACACGTAGCCTGATGTTAGTTGGCTGAATGTTAATGAAAAAGTTGGAGCACAACGTTACATGGTTGGTCCCTCCACTATCCACTAGAACATTGGCTTGACTCTTCGGCGTAGCAGTTACC	AGAAGCCAACCGATAGTACCG	AGAAGCCAACCGATAGTACCA	CTCCTCTGTCCGCGAGTTGA
54	**Chr17_724947**	Chr17	724947	0.11	0.19	0.17	0.00	GGGCAAGGGCTGGAAGCCTAAGGAAAATTCTAGAACCAAAGTGGGATTCTATTTCAAAAGACTGGACAGTGGAGAGTGGAACTCTTGTTAGTATATACAATATGAGGAGAAATGAAAAGAAGAGAAAGATGAAAAAGGAAAATGATGAGAATGACCTACCTAGACAGTGGAGAGTGGAACTCTGCTGTCTAGGTAAAAGACAGAGGGGAGGACTAAGTACGAGTCCTGGCTTATGTAATCTGATCTGGGAGTCTTTGTGAAACTAACAAGTGAAGAGTTTCACAGTTGGTTACCCCATGACTGATTCATGGTCATCAATAGAAATTTTGGGCAGATGTGTTTCAAGAGGGAATCTGGATCAGAAGTCTTGGTTCTAAAGTCACAAACAAGAGTTGGAG[G/C]AAATGAAGTGTGACAGTTTGGGCAGGTGAAATTTAAACAACAGTTGAATTGTTTGCAGGCTTGCAAGGCACATTTGGACTTCAACAACAAAAAGCAAGAATAAAAAATGGATATTGACGGTCAGTTTTGGGATTGTTACTTATATCTTACCTGACACAAATCTGACGTTGCTTATTCTAGGTTTGATTCAACACCAGACAAACAAAGGCA	AAGTCACAAACAAGAGTTGGAGG	AAGTCACAAACAAGAGTTGGAGC	ACCTGCCCAAACTGTCACAC
55	**Chr17_1200207**	Chr17	1200207	0.25	0.38	0.30	0.00	GAGGTCGCTGCTGCCAGTCACACCGACACATGCCAGAGTGACGTTACCTTTCTCCTTTTGTTGCTTGCTGAAACATCGCCCGGCCTGGGTGAGAAGATTACTACACGATGAGTTGTAAGCGGGTCTATTGACATAATGACCACATCTAGCCACAGAAAGAAAAAGTCAGATGGCTTGGTATGGAATTGTT[C/T]GGAAAAACAATGGAGGACTCACATCTTGCACATCCAGGCAATCATACATTGGCCAAATTTATCCTTCTGATCCTTTGACAGCTC	TCAGATGGCTTGGTATGGAATTGTTC	TCAGATGGCTTGGTATGGAATTGTTT	TGCCTGGATGTGCAAGATGTG
56	**Chr17_1279204**	Chr17	1279204	0.11	0.19	0.17	0.00	CGCGAGGCCACATTGGAACACATGAGGTAGGTATTGTATTCAAATATCCCTTCCAATGTCGAATATCGAGTCCCCATTGACGTGTTAATGTTCTACAATCTCAACATGCGCCATCAGGACGCGATTGCGGAGTCCCAACATCTTTCTGGCCACAGCAGCC[G/A]AAGTGGAGGAACTTTTGGACTCAATCTTAGCTGAATCTGATGTGTTGTCCGCAGAATTGGTGGAATTGACAGGAGCGGGTTTAGCAGGCACCGGTATAGGAACAGGTGCGTAGAATTGTAGATCTTTAAAAAAAGACATCATTGACTGACCTTAGCAATAGACG	CTTTCTGGCCACAGCAGCAG	CTTTCTGGCCACAGCAGCAA	ACAATTCTACGCACCTGTTC
57	**Chr18_30688**	Chr18	30688	0.14	0.25	0.23	0.00	GATCACACTGATTTCGCCTTTTTCTGCAAGTGTCATTCATCCAGCCTGGTTTGGGGGCGCTGGACTCACAGTTTGGTAGCCTTGGCAT[G/T]TTTCTGCAAGTGTCATTCATCCAGCCTGGTTTGGGGGCGCTGGACTCACAGGTTGGTATCCTTGTTCGCCCAAAGCTTGGCATTCATATAGCACTCATACCTAACCAGACTCCACGTCCTTTTTGAGTGGTGCCCTACGCTGTAAGACTCAAAAGTGGTTGTGAAACCCTTTTGCTGAATGGAGAAGGGGATGGTGGAGTGCAGACTCTGCCCTTCTATGCTATCAGAAAAACAAGACCCACCAAGGTAAGCTTGGCAAGTTATATTATGTGATAGAGATAAGTTCAAGATGAAGTGTTTGATGTTATACGAGTTGAGAAACGGGTAATGAAGTGATGAAGTGATTGATGAGTGATGTCTCAGATGGGGATTGAACCTGTGACCTCAAGGGTAGAGTATATAAGAATAAAAGAGAAAAGAAAATGTGATGGGTTTGGGAGCACTATGC	ACAGTTTGGTAGCCTTGGCATG	ACAGTTTGGTAGCCTTGGCATT	CCCCAAACCAGGCTGGATGA
Mean	-	-	-	0.17	0.27	0.23	0.00	-			

Note: The SNPs in bold are the KASP-SNP markers used in the present study

Table S9 Frequency, polymorphism, and diversity of 37 markers tested on 308 *Puccinia striiformis* f. sp. *tritici* isolates

Marker	Frequency of major allele	Number of genotypes	Sample size	Number of allele	Availability	Gene diversity	Heterozygosity	PIC
Chr1_277111	0.62	3	308	2	0.95	0.47	0.55	0.36
Chr1_1514334	0.59	3	308	2	0.98	0.48	0.57	0.37
Chr1_5151405	0.62	3	308	2	1.00	0.47	0.43	0.36
Chr2_279415	0.56	3	308	2	0.96	0.49	0.55	0.37
Chr2_896156	0.75	3	308	2	0.99	0.37	0.36	0.30
Chr2_998173	0.51	3	308	2	0.95	0.50	0.55	0.37
Chr2_1041509	0.61	3	308	2	0.97	0.48	0.34	0.36
Chr3_2205441	0.60	3	308	2	0.95	0.48	0.50	0.36
Chr3_2269449	0.78	3	308	2	0.99	0.34	0.21	0.28
Chr3_3970574	0.52	3	308	2	0.93	0.50	0.62	0.37
Chr4_2956131	0.82	3	308	2	1.00	0.30	0.24	0.25
Chr4_3402226	0.50	3	308	2	0.99	0.50	0.40	0.37
Chr4_5392145	0.75	3	308	2	1.00	0.37	0.33	0.30
Chr5_1499190	0.64	3	308	2	0.99	0.46	0.38	0.35
Chr5_4544872	0.58	3	308	2	0.97	0.49	0.46	0.37
Chr6_749630	0.82	3	308	2	0.95	0.30	0.24	0.25
Chr6_1939399	0.68	3	308	2	0.96	0.44	0.39	0.34
Chr6_2733230	0.53	3	308	2	0.99	0.50	0.48	0.37
Chr7_717077	0.77	3	308	2	0.97	0.35	0.18	0.29
Chr7_2276040	0.87	3	308	2	0.97	0.22	0.11	0.20
Chr7_3763260	0.65	3	308	2	0.96	0.45	0.35	0.35
Chr9_201188	0.61	3	308	2	0.95	0.47	0.44	0.36
Chr9_843505	0.60	3	308	2	0.96	0.48	0.69	0.37
Chr9_1370829	0.56	3	308	2	0.97	0.49	0.61	0.37
Chr9_1381122	0.56	3	308	2	0.97	0.49	0.40	0.37
Chr9_3149493	0.57	3	308	2	0.96	0.49	0.51	0.37
Chr10_230077	0.52	3	308	2	0.99	0.50	0.71	0.37
Chr12_23929	0.53	3	308	2	0.94	0.50	0.38	0.37
Chr12_2805263	0.72	3	308	2	0.97	0.41	0.36	0.32
Chr14_3096987	0.78	3	308	2	0.95	0.34	0.16	0.28
Chr16_106435	0.55	3	308	2	0.97	0.50	0.21	0.37
Chr16_1855070	0.72	3	308	2	0.95	0.40	0.29	0.32
Chr16_2481069	0.72	3	308	2	0.96	0.40	0.25	0.32
Chr17_724947	0.73	3	308	2	0.97	0.39	0.13	0.31
Chr17_1200207	0.61	3	308	2	0.97	0.48	0.46	0.36

Chr17_1279204	0.65	3	308	2	0.97	0.46	0.51	0.35
Chr18_30688	0.57	3	308	2	0.98	0.49	0.23	0.37
Mean	0.64	3	308	2	0.97	0.44	0.39	0.34

Table S10 Hierarchical analysis of molecular variance of *Puccinia striiformis* f. sp. *tritici* isolates among and within geographic populations

Source of variation	Df	Sum of squares	Variance components	Percentage of variance (%)
Among Pops	5	210.059	0.455	2.163
Within Pops	302	6215.740	20.582	97.837
Total	307	6425.799	21.037	

Table S11 Pairwise fixation index and number of migrants of *Puccinia striiformis* f. sp. *tritici* isolates between different geographic populations

Geographic population	G1	G2	G3	G4	G5	G6
G1		11.953	31.251	18.730	18.455	8.927
G2	0.019		18.084	19.215	13.520	11.510
G3	0.008	0.012		33.174	23.551	17.661
G4	0.013	0.012	0.008		25.003	23.805
G5	0.014	0.017	0.010	0.010		21.463
G6	0.028	0.021	0.014	0.011	0.012	

Table S12 Onset date of wheat stripe rust occurrence in different geographic regions in 2021 and 2022

Onset date of disease	Geographic population	Ecological region	Host	City	Province	Longitude	Latitude
Aug. to Sep. 2021	G1	Eastern Qinghai	Spring and volunteer wheat	Haidong	Qinghai	102.83	36.33
9/10/2021	G2	Middle Gansu	Volunteer wheat	Dingxi	Gansu	103.76	35.25
11/7/2021	G3	Western Liupan Mountain	Winter wheat	Guyuan	Ningxia	106.24	36.00
11/22/2021	G4	Longnan	Winter wheat	Tianshui	Gansu	105.28	34.64
11/23/2021	G5	Eastern Liupan Mountain	Winter wheat	Pingliang	Gansu	105.56	35.18
3/18/2022	G6	Western Guanzhong Plain	Winter wheat	Baoji	Shaanxi	107.75	34.40
Aug. to Sep. 2022	G1	Eastern Qinghai	Spring and volunteer wheat	Haidong	Qinghai	102.21	36.12
9/8/2022	G2	Middle Gansu	Volunteer wheat	Dingxi	Gansu	104.63	35.58
10/3/2022	G3	Western Liupan Mountain	Volunteer wheat	Guyuan	Ningxia	106.24	36.00
10/1/2022	G4	Longnan	Volunteer wheat	Tianshui	Gansu	105.73	34.59
9/24/2022	G5	Eastern Liupan Mountain	Volunteer wheat	Pingliang	Gansu	106.68	35.54
3/20/2023	G6	Western Guanzhong Plain	Volunteer wheat	Baoji	Shaanxi	107.17	34.31

Table S13 Raw reads of *Puccinia striiformis* f. sp. *tritici* from previous publication used in the study

Number	Isolate	Country	Reference
1	PST-78	USA	Cuomo et al., 2017
2	93_210	USA	Xia et al., 2017
3	104E137A-	Australia	Schwessinger et al. 2018
4	134E16A+	Australia	Schwessinger et al., 2022
5	03_07	United Kingdom	Hubbard et al., 2015
6	11_140	United Kingdom	Hubbard et al., 2015
7	DK_0911	Denmark	Schwessinger et al., 2020
8	J0085F	France	Hubbard et al., 2015
9	j02-022	France	Hubbard et al., 2015
10	Race Yr9	India	Kiran et al., 2017
11	Race 31	India	Kiran et al. 2017
12	QH06	China	Li et al. 2023
13	SC01	China	Li et al. 2023
14	TB03	China	Li et al. 2023
15	GZ11	China	Li et al. 2023
16	GS08	China	Li et al. 2023

Table S14 Mapping information of raw reads for additional 12 *Puccinia striiformis* f. sp. *tritici* isolates sequenced in the study

Number	Isolate	Clean_reads	Mapped_reads	Mapping_rate	Average_depth	Coverage_1X	Coverage_4X	Province	City
1	add_1	35080198	32264598	91.97%	50.49	95.92%	94.74%	Gansu	Tianshu
2	add_2	34430048	32169762	93.44%	55.15	90.55%	88.33%	Guizhou	Guiyang
3	add_3	36943268	34837613	94.30%	55.93	95.15%	94.22%	Guizhou	Hezhang
4	add_4	33071260	30792670	93.11%	51.64	89.14%	87.58%	Hubei	Jingzhou
5	add_5	38862022	35821214	92.18%	53.06	95.09%	94.13%	Ningxia	Guyuan
6	add_6	39088444	35331820	90.39%	49.59	95.87%	94.68%	Qinghai	Hainanzhou
7	add_7	36101218	19575003	54.22%	32.57	95.89%	93.26%	Shaanxi	Baoji
8	add_8	39590624	37386536	94.43%	62.01	89.33%	87.95%	Sichuan	Guangyuan
9	add_9	38687008	35525044	91.83%	55.62	95.62%	91.82%	Tibet	Linzhi
10	add_10	49509266	46531008	93.98%	72.34	95.96%	94.85%	Xinjiang	Yili
11	add_11	42733368	38812713	90.83%	62.07	95.94%	95.00%	Yunnan	Chuxiong
12	add_12	42025690	37055014	88.17%	58.24	95.18%	94.27%	Yunnan	Kunming