Genome-Wide Association Mapping for Stomata and Yield Indices in Bread Wheat under Water Shortage Conditions

Table S1: Genotypes code, name and pedigree of 96 bread wheat genotypes

Code	Name	Pedigree	
G1	9493	LU26'S'/Pb96	PBG-UAF G1-G22 (Total 22 genotypes)
G2	9496	5039/Rawal87	
G3	9508	5039/Pb96	
G4	9515	4770/Pb76	
G5	9596	Rawal87/Pb76	
G6	9610	Pasban90/4943	
G7	9618	Pb96/Pasban90	
G8	9675	Pb76/Pb96	
G9	9707	8060/Rawal87	
G10	9736	Inq91/30th SAWSN 30 (1998-99)	
G11	9796	LU26'S'/PBW222	
G12	9797	Inq91/PBW222	
G13	9869	Parwaz94/Inq91	
G14	9870	9515/Parwaz94	
G15	9877	9244/PBW222	
G16	9883	9244/Iqbal2000	
G17	9930	4492/Parwaz94	
G18	9970	DN49/ Seher06	
G19	9889	9244/Parwaz94	
G20	9970	DN49/Seher06	
G21	9244	N/A	
G22	9764	WLRG 3 1-8 (1993-94)/5039	
G23	BWL-812	C 591/RN//JN/3/CHR/HD 1941	than Pakistan) G23-G46 (Total
G24	PBW-175	HD2160/4/JN/GAGE//JN/KALYANSONA/3/V-18/C-273; HD-2160/WG-1025;	
G25	Anza	LERMA-ROJO-64//NORIN-10/BREVOR/3/3*ANDES-ENANO	

G26	PBW 222	NP 890 /HD 2160	
G27	HD 2307	HD-2160/116-1-3	
G28	DPW-621-50	KAUZ//ALTAR-84/(AOS)AWNED-ONAS/3/MILAN/KAUZ/4/HUITES	
G29	PBW 343	Attila	
G30	HD 2967	ALD/COC//URES/HD2160M/HD2278	
G31	BWL-1793	ND/VG9144 //KAL/BB/3/YCO"S'/4/VEE#5 "S'	
G32	BWL-9022	N/A	
G33	BWL-0924	N/A	
G34	BWL-1771	N/A	
G35	C-10115	N/A	
G36	BWL-0814	N/A	
G37	Sonara-64	N/A	
G38	PBN-51	N/A	
G39	C-586642	N/A	
G40	Sakha	INIA-66(S)/NAPO-63	
G41	PBW 621	KAUZ//ALTAR-84/(AOS)AWNED-ONAS/3/MILAN/KAUZ/4/HUITES	
G42	C-10117	N/A	
G43	Bareukee	N/A	
G44	Redfiled	N/A	
G45	Gutha	GAMENYA//GABO*3/KHAPSTEIN(M-146)/3/FALCON*3/CHILE.	
G46	Sunstar	CONDOR,AUS/4/2*WW-15/3/STEINWEDEL/YAROSLAV-EMMER//LA-PREVISION	
G47	Watan	LU26/HD 2179	Historical Pakistani cultivated varieties G47-G96 (Total 50 genotypes)
G48	AARI-2011	SH-88/90A-204//MH97	
G49	Aas-2011	PRL/PASTOR//2236	
G50	Abadgar-93	PSN/BOW	
G51	Anmol-91	KVZ/TRM//PTM/ANA	
G52	Chakwal-86	FORLANI/ACC//ANA or Fln/ACS//ANA	
G53	Uqab-2000	CROW'S'/NAC//BOW'S'	
G54	Bahawal-97	PFAU'S'/SERI	
G55	Bwp-2000	AU/UP301//GLL/Sx/3/PEW S/4/MAI S/MAY A S//PEWS	

G56	Bakhtawar-94	Mentana/Mayo//4-11
G57	Bakhar-2002	P102/PIMA//F371/TTR/BOW/3/PVN
G58	Bakhtawar-93	AU/UP301//GLL/SX/3/PEW/4/MAI/MAYA//PEW
G59	Pasban-90	INIA F66/TH.DISTICHUM//INIAF66/3/GENARO T81 or INIA F66/A.DISTCHUM//INIA66/3/GEN
G60	Bathoor-2008	URES/JUN//KAUZ
G61	Chakwal-50	ATTILA/3/HUI/CARC//CHEN/CHTO/4/ATTILA
G62	AS-2002	KHP/D31708//CMH74A370/3/ENO79/4/R26043/*4NAC
G63	Chakwal-97	BUC'S'/FCT'S'
G64	Shafaq-2006	LU 26/HD 2179/ 2*INQALAB 91
G65	Fakhar-e-Sarhad	NORD-DESPREZ(ND)/VG-9144//KALYANSONA/BLUEBIRD/3/YACO/4/VEERY-5
G66	Fareed-2006	PT'S'/3/TOB/LFN//BB/4/BB/HD-832-5//ON/5/G-V/ALD'S'//HPO
G67	FSD-2008	PBW65/2*Pastor
G68	Millat-2011	CHENAB2000/INQ-91
G69	FSD-85	MAYA/MON//KVZ/TRM
G70	GA 2002	DWL5023/SNB//SNB
G71	Galaxy-2013	Pb96/Watan/MH-97
G72	Gomal-2008	Attila
G73	Hashim-2008	JUP/ALD'S'//KLT'S'/3/VEE'S'/6/BEZ//TOB/8156/4/ON/3/6*TH/KF//6*LEE/KF/---------
G74	Inq-91	WL 711/CROW "S"
G75	Iqbal-2000	BURGUS/SORT 12-13//KAL/BB/3/PAK 81
G76	Kaghan-93	TTR/JUN
G77	Khyber-87	KVZ/TRM//PTM/ANA
G78	Kohistan-97	V-1562//CHRC'S'/HORK/3/KUFRA-I/4/CARP'S'/BJY'S'
G79	Kohinoor-83	ORE F1 158/FDL//MFN/2*TIBA63/3/COC
G80	Kohsar-95	PSN/BOW
G81	Lasani-2008	LUAN/KOH-97
G82	Ufaq-2002	V.84133/V83150
G83	Marvi-2000	CMH-77A917/PKV 1600//RL6010/6*SKA
G84	Maxi-Pak 65	PJ/GB55

G85	Mehran-89	KVZ/BUHO//KAL/BB
G86	MH-97	Attila
G87	FSD-83	FURY//KAL/BB
G88	Mairaj-08	SPARROW/INIA//V.7394/WL711/3/BAUS
G89	Moomal-2002	BUC or BUCS/4/TZPP/IRN46
G90	Margalla-99	OPATA/BOW'S'
G91	NARC-2009	INQALAB 91*2/TUKURU
G92	Nifa-barsat 2010	FRET2
G93	Nowshera-96	BUC/FLK//MYNA/VUL
G94	Pak-81	VEERY.
G95	Parwaz-94	V.5648/PARULA or V.5648/PRL
G96	BARS-2009	PFAU/SERI//BOW

PBG-UAF (origin) = Department Plant Breeding and Genetics, University of Agriculture, Faisalabad Pakistan G1-G22 (Total 22 genotypes)

Exotic (origin) = Foreign (other than Pakistan) G23-G46 (Total 24 genotypes)

Indigenous (origin) = Historical Pakistani cultivated varieties (other than PBG-UAF), G47-G96 (Total 50 genotypes)

Table S2. GWAS Results under normal conditions.

	SNP	Chromosome	Position	P.value	FDR	R%
FLA	RAC875_s117925_244	5A	77.77	2.53E-05	0.046089	25.66
	RAC875_c16333_340	2A	427.05	7.99E-05	0.046089	24.70
	BS00110877_51	1A	333.28	0.000305	0.04667	23.88
	BS00084880_51	2D	222.41	0.000306	0.028842	22.97
	BobWhite_rep_c66990_294	3B	320.47	0.000348	0.029133	22.08
	RAC875_c33823_279	3D	245.89	0.000475	0.024017	21.19
	Excalibur_c34115_271	7A	103.7	0.000481	0.018901	20.30
	BS00037976_51	1A	337.41	0.000537	0.013785	19.41
	Excalibur_c65152_572	1B	344.72	0.000598	0.00867	18.52
	BobWhite_c15453_678	2D	208.94	0.000659	0.003554	17.63
	Excalibur_c8998_469	3B	320.47	0.000691	0.003554	16.74
	GENE-1934_501	3A	564.57	0.000737	0.003554	15.85
	BS00031266_51	2D	222.41	0.00075	0.003554	14.96
	Excalibur_c33683_104	2D	216.17	0.00077	0.003554	14.07
	RAC875_c701_88	7A	123.58	0.000898	0.003554	13.18
	wsnp_JD_c1549_2185341	4B	186.85	0.000905	0.003554	12.29
	BS00100539_51	2D	216.02	0.000938	0.003554	11.40
	wsnp_BE591290B_Ta_2_7	1A	411.61	0.000945	0.003554	10.51
	RFL_Contig5204_503	2D	213.63	0.000976	0.003554	9.62
SS	wsnp_Ex_c24167_33416760	7A	148.26	0.000121	0.028842	29.65
	IAAV4269	5B	126.02	0.000133	0.028842	28.80
	BS00038787_51	7A	369.49	0.000137	0.042546	28.10
	BobWhite_c23828_341	6B	150.07	0.000169	0.042546	27.90
	Tdurum_contig10598_304	6B	229.64	0.000215	0.042546	27.13
	BS00064602_51	1B	246.08	0.000268	0.042546	26.53
	Kukri_c22011_1447	1A	481.08	0.000303	0.042546	25.94
	Ra_c58279_684	2A	261.05	0.000325	0.042546	25.34
	Excalibur_s113695_111	6B	237.57	0.00033	0.042546	24.75
	RAC875_c14078_202	5B	620.71	0.000332	0.042546	24.15
	wsnp_Ku_c792_1635317	7A	123.58	0.000362	0.042546	23.56
	Excalibur_c35339_106	2A	220.48	0.000393	0.042546	22.96
	wsnp_Ex_c5412_9564046	2A	261.05	0.000475	0.018715	22.37
	BS00009791_51	2B	431.19	0.000484	0.042546	21.77
	Ra_c33766_656	3B	553.79	0.000519	0.042546	21.18
	wsnp_Ex_c8913_14881924	4B	173.63	0.000549	0.042546	20.58
	BobWhite_c44691_648	4B	173.63	0.000549	0.042546	19.99
	Tdurum_contig81797_369	4B	173.63	0.000549	0.042546	19.39
	BS00023431_51	4B	173.63	0.000549	0.042546	18.80
	Kukri_c27495_816	1B	206.01	0.000554	0.042546	18.20

	BS00076298_51	3D	1	0.000618	0.042546	17.61
	Kukri_c55051_414	5A	68.2	0.000619	0.042546	17.01
	RAC875_rep_c104914_222	5B	119.59	0.000723	0.042546	16.42
	BS00062122_51	1B	105.75	0.000857	0.042546	15.82
	Kukri_c28230_267	7A	371.96	0.000874	0.042546	15.23
	Excalibur_c76695_71	3B	578.89	0.000885	0.042546	14.63
	RAC875_c701_88	7A	123.58	0.000908	0.042546	14.04
	RAC875_c50245_765	2D	133.17	0.00094	0.018715	13.44
	Kukri_c28284_1132	6B	401.83	0.000956	0.042546	12.85
	BS00065784_51	1A	291.13	0.000977	0.042546	12.25
SF	wsnp_RFL_Contig2699_2402527	3A	321.73	3.87E-05	0.018715	29.30
	RAC875_c48445_317	7A	98.21	0.000115	0.020394	28.00
	Excalibur_rep_c71254_415	5A	423.48	0.000413	0.020394	27.00
	Excalibur_c5958_1398	1D	117.57	0.000425	0.020394	25.80
	Kukri_c55362_75	6D	41.68	0.00046	0.020394	24.65
	RAC875_c16333_340	2A	427.05	0.000465	0.020394	23.50
	Kukri_c4834_1883	6B	245.09	0.000556	0.020394	22.35
	Excalibur_c102781_70	7B	451.1	0.000584	0.020394	21.20
	Tdurum_contig30546_176	5A	506.47	0.000596	0.020394	20.05
	wsnp_JD_c16245_15468917	3B	323	0.000631	0.015273	18.90
	BS00030251_51	1B	250.98	0.000689	0.020394	17.75
	Ex_c14725_242	3B	323	0.000756	0.020394	16.60
	BS00010134_51	7B	458.56	0.000766	0.020394	15.45
	BS00102641_51	3B	323.92	0.000778	0.020394	14.30
	RAC875_c403_2247	3B	337.91	0.000861	0.020394	13.15
	BS00094471_51	1D	117.57	0.000915	0.020394	12.00
	Kukri_c49506_396	4B	117.43	0.000921	0.020394	10.85
	wsnp_Ku_c14875_23320708	3B	323.92	0.000923	0.015273	9.70
	Excalibur_c8998_469	3B	320.47	0.000973	0.020394	8.55
LV	wsnp_Ra_c3176_5975986	7B	246.93	3.50E-05	0.011287	29.50
	GENE-4367_562	4A	575.49	4.51E-05	0.011287	29.00
	BS00038787_51	7A	369.49	6.63E-05	0.011287	28.40
	IAAV8743	1A	311.34	0.00016	0.011287	28.10
	Excalibur_c17237_688	2D	222.41	0.000174	0.011287	27.55
	RAC875_c38307_91	2B	80.52	0.000197	0.011287	27.07
	Excalibur_c35339_106	4B	220.48	0.000239	0.022508	26.59
	BobWhite_c23828_341	6B	150.07	0.000261	0.022508	26.11
	Excalibur_c26971_1730	4A	598.31	0.000271	0.026592	25.63
	Excalibur_c24613_302	6B	408.89	0.000289	0.00671	25.15
	Kukri_c55051_414	5A	68.2	0.000334	0.00671	24.67
	RFL_Contig2531_2144	4A	567.81	0.000369	0.00671	24.19

	BobWhite_c41815_145	7A	371.18	0.000377	0.00671	23.71
	RAC875_c38193_187	7B	228.36	0.000379	0.00671	23.23
	IAAV4269	5B	126.02	0.000384	0.00671	22.75
	Ra_c4568_960	6A	338.95	0.000447	0.019639	22.27
	BS00067940_51	3A	433.76	0.000509	0.020868	21.79
	Tdurum_contig94033_487	5B	401.49	0.000538	0.020868	21.31
	Tdurum_contig11399_221	5B	401.49	0.000538	0.023877	20.83
	Excalibur_s113695_111	6B	237.57	0.000555	0.023877	20.35
	wsnp_Ex_c24167_33416760	7A	148.26	0.000572	0.023877	19.87
	Ku_c17871_1360	1B	287.03	0.000619	0.023877	19.39
	RFL_Contig2815_1764	6A	11.39	0.000627	0.023877	18.91
	Ra_c33766_656	3B	553.79	0.00063	0.023877	18.43
	Tdurum_contig46583_2203	4A	575.49	0.000667	0.023877	17.95
	Kukri_c4709_53	4A	598.31	0.00079	0.023877	17.47
	wsnp_Ex_c11120_18022932	5A	445.69	0.000791	0.023877	16.99
	Excalibur_c50999_269	4A	575.49	0.000853	0.023877	16.51
	Excalibur_c16798_281	2B	291.73	0.000876	0.023877	16.03
	Tdurum_contig42590_755	7A	103.7	0.000961	0.023877	15.55
	BS00109911_51	4A	603.44	0.000968	0.023877	15.07
	Kukri_c2101_1551	4A	575.49	0.000999	0.023877	14.59
NGS	Ra_c58279_684	2A	261.05	1.55E-05	0.011287	21.50
	wsnp_Ex_c5412_9564046	2A	261.05	1.58E-05	0.011287	21.10
	GENE-4367_562	4A	575.49	2.64E-05	0.011287	20.50
	BS00038787_51	7A	369.49	8.16E-05	0.011287	20.03
	BS00109911_51	4A	603.44	0.000112	0.011287	19.53
	wsnp_Ra_c3176_5975986	7B	246.93	0.000119	0.011287	19.03
	wsnp_Ex_c5412_9564550	2A	261.05	0.000186	0.011287	18.53
	wsnp_Ex_c5412_9564346	2A	257.26	0.00019	0.011287	18.03
	wsnp_Ex_c5412_9564478	2A	257.26	0.000208	0.011287	17.53
	Excalibur_c26971_1730	4A	598.31	0.000218	0.011287	17.03
	Tdurum_contig46583_2203	4A	575.49	0.000262	0.011287	16.53
	tplb0025h02_1383	6D	293.15	0.000309	0.011287	16.03
	wsnp_Ku_c10292_17066821	1A	261.32	0.00031	0.011287	15.53
	wsnp_Ex_c8913_14881924	4B	173.63	0.000331	0.011287	15.03
	BobWhite_c44691_648	4B	173.63	0.000331	0.011287	14.53
	Tdurum_contig81797_369	4B	173.63	0.000331	0.011287	14.03
	BS00023431_51	4B	173.63	0.000331	0.011287	13.53
	BobWhite_c26570_282	2A	410.9	0.000332	0.011287	13.03
	Kukri_c4709_53	4A	598.31	0.00037	0.011287	12.53
	BS00026471_51	3B	23.14	0.000397	0.011287	12.03
	wsnp_Ku_c792_1635317	7A	123.58	0.00042	0.011287	11.53

	D_GDEEGVY01EG2MJ_349	6D	50.3	0.000454	0.011287	11.03
	Excalibur_c50999_269	4A	575.49	0.000495	0.011287	10.53
	Excalibur_c24613_302	6B	408.89	0.000502	0.011287	10.03
	BobWhite_c41815_145	7A	371.18	0.000588	0.011287	9.53
	Excalibur_c34115_271	7A	103.7	0.000613	0.011287	9.03
	Kukri_c2101_1551	4A	575.49	0.000618	0.022508	8.53
	BobWhite_c27352_145	3B	121.32	0.000651	0.022508	8.03
	CAP8_c6370_254	6B	245.09	0.000684	0.026592	7.53
	wsnp_Ex_c24167_33416760	7A	148.26	0.000726	0.00671	7.03
	Tdurum_contig62155_325	6B	245.09	0.000728	0.00671	6.53
	Jagger_c342_119	3B	42.1	0.000758	0.00671	6.53
	BS00067430_51	4A	603.44	0.000759	0.00671	6.53
	RAC875_s117925_244	5A	77.77	0.000759	0.00671	6.53
	wsnp_Ex_c3854_7003482	6B	245.09	0.000793	0.00671	6.53
	BS00010134_51	7B	458.56	0.000806	0.019639	6.53
	D_GA8KES402GRIFZ_148	2A	213.37	0.000819	0.020868	6.53
	wsnp_Ex_rep_c66315_64480670	6B	245.09	0.000854	0.020868	6.53
	TA006249-0396	6B	245.09	0.000886	0.023877	6.53
	wsnp_Ex_c24766_34017588	6B	245.09	0.000886	0.026886	6.53
	wsnp_Ex_rep_c66315_64480362	6B	245.09	0.000886	0.029895	6.53
	wsnp_Ra_c35443_43984178	6B	245.09	0.000886	0.032904	6.53
	Excalibur_c98849_278	6B	245.09	0.000908	0.035914	6.53
	RFL_Contig1015_580	6B	245.8	0.000908	0.038923	6.53
	Tdurum_contig81414_256	6B	246.18	0.000908	0.041932	6.53
	wsnp_Ku_c15761_24469459	6B	245.09	0.000914	0.044941	6.53
	Excalibur_c53680_124	6D	50.3	0.000978	0.04795	6.53
GYP	BS00038787_51	7A	369.49	8.10E-05	0.011287	23.50
	wsnp_Ex_c24167_33416760	7A	148.26	9.49E-05	0.011287	23.40
	IAAV4269	5B	126.02	0.000181	0.011287	23.10
	Tdurum_contig10598_304	6B	229.64	0.000214	0.011287	22.60
	Ra_c58279_684	2A	261.05	0.000229	0.022508	22.40
	BobWhite_c23828_341	6B	150.07	0.000256	0.033729	22.10
	Kukri_c22011_1447	1A	481.08	0.000281	0.044949	21.80
	wsnp_Ex_c5412_9564046	2A	261.05	0.000309	0.05617	21.50
	Excalibur_c35339_106	4B	220.48	0.000338	0.067391	21.20
	RAC875_c14078_202	5B	620.71	0.000341	0.078612	20.90
	Ra_c33766_656	3B	553.79	0.000351	0.089833	20.60
	Excalibur_s113695_111	6B	237.57	0.000356	0.011287	20.30
	wsnp_Ku_c792_1635317	7A	123.58	0.000386	0.011287	20.00
	Kukri_c55051_414	5A	68.2	0.000399	0.011287	19.70
	BS00064602_51	1B	246.08	0.000433	0.011287	19.40

	RAC875_rep_c104914_222	5B	119.59	0.000488	0.011287	19.10
	Tdurum_contig81797_369	4B	173.63	0.000554	0.011287	18.80
	BS00023431_51	4B	173.63	0.000554	0.022508	18.50
	wsnp_Ex_c8913_14881924	4B	173.63	0.000554	0.022508	18.20
	BobWhite_c44691_648	4B	173.63	0.000554	0.026592	17.90
	Kukri_c27495_816	1B	206.01	0.000589	0.00671	17.60
	Tdurum_contig94033_487	5B	401.49	0.000644	0.00671	17.30
	Tdurum_contig11399_221	5B	401.49	0.000644	0.00671	17.00
	BS00009791_51	2B	431.19	0.000717	0.00671	16.70
	BS00010134_51	7B	458.56	0.000721	0.00671	16.40
	Kukri_c28230_267	7A	371.96	0.000758	0.00671	16.10
	BS00076298_51	3D	1	0.000764	0.00671	15.80
	Excalibur_c76695_71	3B	578.89	0.000768	0.00671	15.50
	Excalibur_rep_c71254_415	5A	423.48	0.00085	0.00671	15.20
	Excalibur_c17237_688	2D	222.41	0.000868	0.00671	14.90
	wsnp_Ex_c410_808465	7D	50.6	0.000929	0.00671	14.60

This table provides the SNP id, chromosome, position in cM, P-value, R% is R2 of the model with the SNP (phenotypic variation), and adjusted P-values following false discovery rate (FDR) under water shortage conditions, flag leaf area (FLA), stomata Size (SS), stomata Frequency (SF), leaf Venation (LEV), number of grain per spike (GPS) and grain yield per plant (GYP)

Table S3. GWAS Results under water shortage conditions.

	SNP	Chromosome	Position	P.value	FDR	R%
FLA	BS00038787_51	7A	369.49	2.78E-05	0.020394	23.40
	Ra_c58279_684	2A	261.05	3.06E-05	0.020394	22.90
	wsnp_Ex_c5412_9564046	2A	261.05	3.72E-05	0.020394	22.40
	GENE-4367_562	4A	575.49	5.33E-05	0.020394	21.90
	BobWhite_c41815_145	7A	371.18	0.000155	0.020394	21.40
	wsnp_Ex_c24167_33416760	7A	148.26	0.000189	0.020394	20.90
	Excalibur_c35339_106	4B	220.48	0.000195	0.020394	20.40
	Tdurum_contig10598_304	6B	229.64	0.000237	0.020394	19.90
	wsnp_Ex_c5412_9564478	2A	257.26	0.000261	0.020394	19.40
	wsnp_Ku_c10292_17066821	1A	261.32	0.000301	0.020394	18.90
	Excalibur_c17237_688	2D	222.41	0.000303	0.020394	18.40
	Tdurum_contig46583_2203	4A	575.49	0.000315	0.020394	17.90
	CAP8_c6370_254	6B	245.09	0.000341	0.020394	17.40
	wsnp_Ex_c3854_7003482	6B	245.09	0.00039	0.020394	16.90
	Tdurum_contig62155_325	6B	245.09	0.000393	0.020394	16.40
	BS00026471_51	3B	23.14	0.000394	0.020394	15.90
	Tdurum_contig81797_369	4B	173.63	0.000398	0.020394	15.40
	BS00023431_51	4B	173.63	0.000398	0.020394	14.90
	wsnp_Ex_c8913_14881924	4B	173.63	0.000398	0.020394	14.40
	BobWhite_c44691_648	4B	173.63	0.000398	0.0152734	13.90
	wsnp_Ex_c5412_9564550	2A	261.05	0.000401	0.0152734	13.40
	tplb0025h02_1383	6D	293.15	0.000419	0.0152734	12.90
	wsnp_Ra_c3176_5975986	7B	246.93	0.00046	0.0152734	12.40
	wsnp_Ex_c5412_9564346	2A	257.26	0.000482	0.0152734	11.90
	BS00109911_51	4A	603.44	0.000484	0.0152734	11.90
	BobWhite_c26570_282	2A	410.9	0.000497	0.0152734	11.90
	Excalibur_c24613_302	6B	408.89	0.000549	0.0152734	11.90
	Excalibur_c26971_1730	4A	598.31	0.000553	0.0152734	11.90
	Excalibur_c34115_271	7A	103.7	0.000558	0.0152734	11.90
	BS00010134_51	7B	458.56	0.000569	0.0152734	11.90
	Tdurum_contig62445_667	7A	98.21	0.000621	0.0152734	11.90
	wsnp_Ex_c5936_10411877	6B	245.09	0.000652	0.0152734	11.90
	IACX5724	4A	589.42	0.000746	0.0152734	11.90
	Excalibur_c1251_2031	2B	319.82	0.000783	0.0152734	11.90
	wsnp_Ku_c792_1635317	7A	123.58	0.000802	0.0152734	11.90
	RAC875_s117925_244	5A	77.77	0.000806	0.0152734	11.90
	RAC875_c5986_3670	6B	245.09	0.000814	0.0152734	11.90
	Excalibur_c98849_278	6B	245.09	0.000822	0.0152734	11.90
	RFL_Contig1015_580	6B	245.8	0.000822	0.0152734	11.90

	Tdurum_contig81414_256	6B	246.18	0.000822	0.0152734	11.90
	wsnp_Ku_c15761_24469459	6B	245.09	0.000838	0.0152734	11.90
	Excalibur_c76695_71	3B	578.89	0.000851	0.0152734	10.40
	wsnp_Ex_rep_c66315_64480670	6B	245.09	0.000852	0.0152734	10.40
	Jagger_c342_119	3B	42.1	0.000858	0.0152734	10.40
	TA006249-0396	6B	245.09	0.00086	0.0152734	10.40
	wsnp_Ex_c24766_34017588	6B	245.09	0.00086	0.0152734	10.40
	wsnp_Ex_rep_c66315_64480362	6B	245.09	0.00086	0.0152734	10.40
	wsnp_Ra_c35443_43984178	6B	245.09	0.00086	0.0152734	10.40
	wsnp_RFL_Contig2699_2402527	3A	321.73	0.000864	0.0152734	10.40
	wsnp_Ku_c4834_8676678	6B	245.09	0.000979	0.0152734	10.40
SS	Excalibur_c35339_106	4B	220.48	8.91E-05	0.0225076	21.09
	BS00038787_51	7A	369.49	9.80E-05	0.026592	20.57
	Tdurum_contig10598_304	6B	229.64	0.000109	0.0067095	20.19
	wsnp_Ex_c24167_33416760	7A	148.26	0.000169	0.0067095	19.71
	BobWhite_c23828_341	6B	150.07	0.000182	0.0067095	19.26
	IAAV4269	5B	126.02	0.000198	0.0067095	18.81
	BS00064602_51	1B	246.08	0.000342	0.0067095	18.36
	Excalibur_c76695_71	3B	578.89	0.000361	0.0067095	17.91
	BS00009791_51	2B	431.19	0.000374	0.0196389	17.46
	Excalibur_rep_c71254_415	5A	423.48	0.000405	0.0208676	17.01
	IAAV8743	1A	311.34	0.000471	0.0208676	16.56
	wsnp_Ra_c3176_5975986	7B	246.93	0.000618	0.0238768	16.11
	Excalibur_s113695_111	6B	237.57	0.00062	0.0238768	15.66
	GENE-4367_562	4A	575.49	0.000622	0.0252037	15.21
	Excalibur_c17237_688	2D	222.41	0.000687	0.0252037	14.76
	BS00065784_51	1A	291.13	0.000703	0.0238352	14.31
	BS00076298_51	3D	1	0.00071	0.0224667	13.86
	BS00105833_51	1B	142.58	0.000721	0.0210982	13.41
	IACX5724	4A	589.42	0.000739	0.0197297	12.96
	Ra_c33766_656	3B	553.79	0.000747	0.0183612	12.51
	CAP8_c6370_254	6B	245.09	0.000857	0.0169927	12.06
	BobWhite_rep_c62840_612	4A	259.21	0.000883	0.0156242	11.61
	Tdurum_contig29522_232	7B	232.89	0.000887	0.0142557	11.16
	wsnp_Ex_c3854_7003482	6B	245.09	0.000922	0.0128872	10.71
	Kukri_c55051_414	5A	68.2	0.000938	0.0115187	10.26
	RAC875_c57353_245	2B	431.19	0.000958	0.0101502	9.81
	Ra_c58279_684	2A	261.05	0.00099	0.0087817	9.36
	wsnp_Ex_c8913_14881924	4B	173.63	0.00101	0.0074132	8.91
	BobWhite_c44691_648	4B	173.63	0.00101	0.0060447	8.46
SF	BS00038787_51	7A	369.49	2.96E-05	0.0067095	24.08

	Ra_c58279_684	2A	261.05	4.45E-05	0.0196389	23.50
	wsnp_Ex_c5412_9564046	2A	261.05	5.37E-05	0.0325683	22.20
	GENE-4367_562	4A	575.49	9.31E-05	0.0454977	21.38
	Excalibur_c35339_106	4B	220.48	0.000145	0.0584271	20.43
	Tdurum_contig10598_304	6B	229.64	0.000167	0.0713565	19.49
	wsnp_Ex_c24167_33416760	7A	148.26	0.000175	0.0842859	18.55
	Excalibur_c17237_688	2D	222.41	0.000186	0.0972153	17.61
	BobWhite_c41815_145	7A	371.18	0.000247	0.1101447	16.66
	wsnp_Ex_c5412_9564478	2A	257.26	0.000259	0.1230741	15.72
	BS00010134_51	7B	458.56	0.000306	0.1360035	14.78
	CAP8_c6370_254	6B	245.09	0.000433	0.1489329	13.84
	tplb0025h02_1383	6D	293.15	0.000465	0.1618623	12.89
	BS00026471_51	3B	23.14	0.000493	0.1747917	11.95
	wsnp_Ex_c3854_7003482	6B	245.09	0.000493	0.1877211	11.01
	Tdurum_contig62155_325	6B	245.09	0.000503	0.0429996	10.07
	Tdurum_contig46583_2203	4A	575.49	0.000514	0.0364488	9.12
	wsnp_Ra_c3176_5975986	7B	246.93	0.000523	0.0368977	8.18
	Excalibur_c76695_71	3B	578.89	0.000535	0.0386242	8.18
	wsnp_Ex_c5412_9564550	2A	261.05	0.000566	0.0386242	8.18
	wsnp_Ex_c8913_14881924	4B	173.63	0.000592	0.0386242	8.18
	BobWhite_c44691_648	4B	173.63	0.000592	0.0117506	8.18
	Tdurum_contig81797_369	4B	173.63	0.000592	0.0117506	8.18
	BS00023431_51	4B	173.63	0.000592	0.0117506	8.18
	Excalibur_c34115_271	7A	103.7	0.000618	0.0117506	8.18
	RAC875_s117925_244	5A	77.77	0.000651	0.0117506	8.18
	wsnp_Ku_c10292_17066821	1A	261.32	0.000679	0.0117506	8.18
	wsnp_Ex_c5412_9564346	2A	257.26	0.000683	0.0117506	8.18
	Tdurum_contig62445_667	7A	98.21	0.000685	0.0117506	8.18
	wsnp_Ku_c792_1635317	7A	123.58	0.000691	0.0117506	8.18
	Excalibur_rep_c71254_415	5A	423.48	0.000705	0.0117506	8.18
	Excalibur_c24613_302	6B	408.89	0.00074	0.0117506	8.18
	BS00067526_51	1B	344.72	0.000764	0.0117506	8.18
	Excalibur_c1251_2031	2B	319.82	0.000788	0.0117506	8.18
	Excalibur_c26971_1730	4A	598.31	0.00082	0.0117506	8.18
	wsnp_Ex_c5936_10411877	6B	245.09	0.000847	0.0117506	8.18
	wsnp_RFL_Contig2699_2402527	3A	321.73	0.000859	0.0117506	8.18
	Tdurum_contig29522_232	7B	232.89	0.000874	0.0117506	8.18
	IACX5724	4A	589.42	0.00089	0.0117506	8.18
	BS00109911_51	4A	603.44	0.000915	0.0117506	8.18
	RAC875_rep_c104914_222	5B	119.59	0.000965	0.0117506	8.18
LV	BS00038787_51	7A	369.49	6.44E-05	0.0429996	28.10

	Excalibur_c35339_106	4B	220.48	0.000107	0.0364488	27.97
	wsnp_Ex_c24167_33416760	7A	148.26	0.000125	0.0364488	27.59
	Tdurum_contig10598_304	6B	229.64	0.000131	0.0364488	27.38
	IAAV4269	5B	126.02	0.000238	0.0364488	27.12
	BobWhite_c23828_341	6B	150.07	0.000257	0.0364488	26.87
	Excalibur_rep_c71254_415	5A	423.48	0.000339	0.0364488	26.61
	Excalibur_c76695_71	3B	578.89	0.000348	0.0364488	26.36
	GENE-4367_562	4A	575.49	0.000379	0.0364488	26.10
	Ra_c33766_656	3B	553.79	0.00043	0.0364488	25.85
	Excalibur_c17237_688	2D	222.41	0.00044	0.0364488	25.60
	Kukri_c55051_414	5A	68.2	0.000495	0.0364488	25.34
	BS00064602_51	1B	246.08	0.000498	0.0364488	25.09
	wsnp_Ra_c3176_5975986	7B	246.93	0.000503	0.0364488	24.83
	Excalibur_s113695_111	6B	237.57	0.000537	0.0364488	24.58
	BS00009791_51	2B	431.19	0.000557	0.0364488	24.32
	IAAV8743	1A	311.34	0.000622	0.0364488	24.07
	Ra_c58279_684	2A	261.05	0.000654	0.0364488	23.82
	RAC875_rep_c104914_222	5B	119.59	0.000671	0.0364488	23.56
	Kukri_c22011_1447	1A	481.08	0.000699	0.0364488	23.31
	Tdurum_contig29522_232	7B	232.89	0.000742	0.0364488	23.05
	wsnp_Ex_c5412_9564046	2A	261.05	0.000765	0.0364488	22.80
	RAC875_c14078_202	5B	620.71	0.000794	0.0364488	22.54
	IACX5724	4A	589.42	0.000799	0.0364488	22.29
	BobWhite_rep_c62840_612	4A	259.21	0.000806	0.0364488	22.04
	Tdurum_contig94033_487	5B	401.49	0.00081	0.0364488	21.78
	Tdurum_contig11399_221	5B	401.49	0.00081	0.0364488	21.53
	BS00076298_51	3D	1	0.000826	0.0364488	21.27
	CAP8_c6370_254	6B	245.09	0.000846	0.0364488	21.02
	BS00067526_51	1B	344.72	0.000879	0.0364488	20.76
	BS00105833_51	1B	142.58	0.000907	0.0364488	20.51
	wsnp_Ex_c3854_7003482	6B	245.09	0.000928	0.0364488	20.25
	Tdurum_contig62155_325	6B	245.09	0.000974	0.0364488	20.00
	wsnp_Ex_c8913_14881924	4B	173.63	0.00098	0.0364488	19.75
	BobWhite_c44691_648	4B	173.63	0.00098	0.0364488	19.49
	Tdurum_contig81797_369	4B	173.63	0.00098	0.0364488	19.24
	BS00023431_51	4B	173.63	0.00098	0.0364488	18.98
NGS	BS00038787_51	7A	369.49	2.79E-05	0.0364488	22.11
	Ra_c58279_684	2A	261.05	3.08E-05	0.0364488	22.08
	wsnp_Ex_c5412_9564046	2A	261.05	3.75E-05	0.0364488	20.64
	GENE-4367_562	4A	575.49	5.36E-05	0.0364488	20.15
	BobWhite_c41815_145	7A	371.18	0.000155	0.0364488	19.41

	wsnp_Ex_c24167_33416760	7A	148.26	0.00019	0.0364488	18.68
	Excalibur_c35339_106	4B	220.48	0.000196	0.0364488	17.95
	Tdurum_contig10598_304	6B	229.64	0.000237	0.0364488	17.21
	wsnp_Ex_c5412_9564478	2A	257.26	0.000263	0.0364488	16.48
	wsnp_Ku_c10292_17066821	1A	261.32	0.000302	0.0364488	15.75
	Excalibur_c17237_688	2D	222.41	0.000307	0.0364488	15.01
	Tdurum_contig46583_2203	4A	575.49	0.000317	0.0364488	14.28
	CAP8_c6370_254	6B	245.09	0.000342	0.0364488	13.55
	wsnp_Ex_c3854_7003482	6B	245.09	0.000391	0.0364488	12.81
	Tdurum_contig62155_325	6B	245.09	0.000395	0.0364488	12.08
	wsnp_Ex_c8913_14881924	4B	173.63	0.000395	0.0364488	11.35
	BobWhite_c44691_648	4B	173.63	0.000395	0.0364488	10.61
	Tdurum_contig81797_369	4B	173.63	0.000395	0.0364488	9.88
	BS00023431_51	4B	173.63	0.000395	0.0364488	9.15
	BS00026471_51	3B	23.14	0.000396	0.0364488	8.41
	wsnp_Ex_c5412_9564550	2A	261.05	0.000403	0.0364488	7.68
	tplb0025h02_1383	6D	293.15	0.000422	0.0364488	6.95
	wsnp_Ra_c3176_5975986	7B	246.93	0.000467	0.0364488	6.95
	wsnp_Ex_c5412_9564346	2A	257.26	0.000483	0.0364488	6.95
	BS00109911_51	4A	603.44	0.000483	0.0364488	6.95
	BobWhite_c26570_282	2A	410.9	0.000497	0.0364488	6.95
	Excalibur_c24613_302	6B	408.89	0.000549	0.0364488	6.95
	Excalibur_c26971_1730	4A	598.31	0.000555	0.0364488	6.95
	Excalibur_c34115_271	7A	103.7	0.000561	0.0364488	6.95
	BS00010134_51	7B	458.56	0.000568	0.0364488	6.95
	Tdurum_contig62445_667	7A	98.21	0.000625	0.0364488	6.95
	wsnp_Ex_c5936_10411877	6B	245.09	0.000655	0.0364488	6.95
	IACX5724	4A	589.42	0.000747	0.0364488	6.95
	Excalibur_c1251_2031	2B	319.82	0.000778	0.0364488	6.95
	wsnp_Ku_c792_1635317	7A	123.58	0.000796	0.0364488	6.95
	RAC875_s117925_244	5A	77.77	0.000811	0.0364488	6.95
	RAC875_c5986_3670	6B	245.09	0.000818	0.0364488	6.95
	Excalibur_c98849_278	6B	245.09	0.000826	0.0364488	6.95
	RFL_Contig1015_580	6B	245.8	0.000826	0.0364488	6.95
	Tdurum_contig81414_256	6B	246.18	0.000826	0.0364488	6.95
	wsnp_Ku_c15761_24469459	6B	245.09	0.000842	0.0364488	6.95
	Excalibur_c76695_71	3B	578.89	0.00085	0.0364488	6.95
	wsnp_Ex_rep_c66315_64480670	6B	245.09	0.000855	0.0364488	6.95
	Jagger_c342_119	3B	42.1	0.000862	0.0364488	6.95
	wsnp_Ex_rep_c66315_64480362	6B	245.09	0.000865	0.0364488	6.95
	wsnp_Ra_c35443_43984178	6B	245.09	0.000865	0.0364488	6.95

	TA006249-0396	6B	245.09	0.000865	0.0364488	6.95
	wsnp_Ex_c24766_34017588	6B	245.09	0.000865	0.0364488	6.95
	wsnp_RFL_Contig2699_2402527	3A	321.73	0.000871	0.0364488	6.95
	wsnp_Ku_c4834_8676678	6B	245.09	0.000984	0.0364488	6.95
GYP	BS00038787_51	7A	369.49	6.55E-05	0.0187155	23.46
	Excalibur_c35339_106	4B	220.48	0.000109	0.0187155	23.06
	Tdurum_contig10598_304	6B	229.64	0.000122	0.020394	22.98
	wsnp_Ex_c24167_33416760	7A	148.26	0.000124	0.020394	22.69
	IAAV4269	5B	126.02	0.000235	0.020394	22.45
	BobWhite_c23828_341	6B	150.07	0.000259	0.020394	22.21
	Excalibur_rep_c71254_415	5A	423.48	0.000342	0.020394	21.97
	GENE-4367_562	4A	575.49	0.000363	0.020394	21.73
	Excalibur_c76695_71	3B	578.89	0.000369	0.020394	21.49
	Ra_c33766_656	3B	553.79	0.000426	0.020394	21.25
	Excalibur_c17237_688	2D	222.41	0.000473	0.0152734	21.01
	Kukri_c55051_414	5A	68.2	0.000488	0.0190507	20.77
	wsnp_Ra_c3176_5975986	7B	246.93	0.000512	0.0189553	20.53
	BS00009791_51	2B	431.19	0.000543	0.0188599	20.29
	BS00064602_51	1B	246.08	0.000546	0.0187645	20.05
	Excalibur_s113695_111	6B	237.57	0.000556	0.0186691	19.81
	IAAV8743	1A	311.34	0.000586	0.0185736	19.57
	RAC875_rep_c104914_222	5B	119.59	0.000668	0.0184782	19.33
	Ra_c58279_684	2A	261.05	0.00067	0.0183828	19.09
	Kukri_c22011_1447	1A	481.08	0.000713	0.0182874	18.85
	Tdurum_contig29522_232	7B	232.89	0.000753	0.018192	18.61
	wsnp_Ex_c5412_9564046	2A	261.05	0.000781	0.0180965	18.37
	Tdurum_contig94033_487	5B	401.49	0.000795	0.0180011	18.13
	Tdurum_contig11399_221	5B	401.49	0.000795	0.0179057	17.89
	RAC875_c14078_202	5B	620.71	0.000799	0.0178103	17.65
	CAP8_c6370_254	6B	245.09	0.0008	0.0177148	17.41
	IACX5724	4A	589.42	0.000811	0.0176194	17.17
	BS00076298_51	3D	1	0.000835	0.017524	16.93
	BobWhite_rep_c62840_612	4A	259.21	0.000841	0.0174286	16.69
	wsnp_Ex_c3854_7003482	6B	245.09	0.000877	0.0173332	16.45
	BS00067526_51	1B	344.72	0.000899	0.0172377	16.21
	Tdurum_contig62155_325	6B	245.09	0.000918	0.0171423	15.97
	BS00105833_51	1B	142.58	0.000937	0.0170469	15.73
	Tdurum_contig81797_369	4B	173.63	0.000961	0.0169515	15.49
	BS00023431_51	4B	173.63	0.000961	0.0168561	15.25
	wsnp_Ex_c8913_14881924	4B	173.63	0.000961	0.0167606	15.02
	BobWhite_c44691_648	4B	173.63	0.000961	0.0166652	14.78

This table provides the SNP id, chromosome, position in cM, P-value, R% is R2 of the model with the SNP (phenotypic variation), and adjusted P-values following false discovery rate (FDR) under drought conditions, flag leaf area (FLA), stomata Size (SS), stomata Frequency (SF), leaf Venation (LEV), number of grain per spike (GPS) and grain yield per plant (GYP)

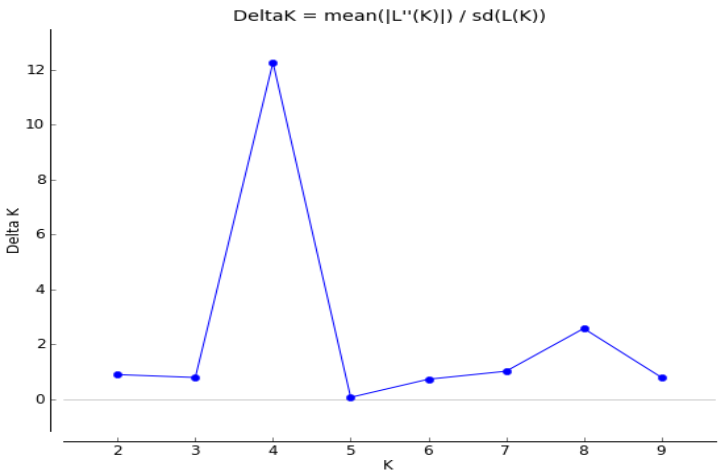

Figure S1. The result obtained of 96 spring wheat genotypes using studied SNPs from Structure Harvester analysis. It's based on the second order derivation on the variance of the maximum likelihood estimation of your model given a specific K. Delta K shows only the uppermost clustering level and number of subpopulations in main population.

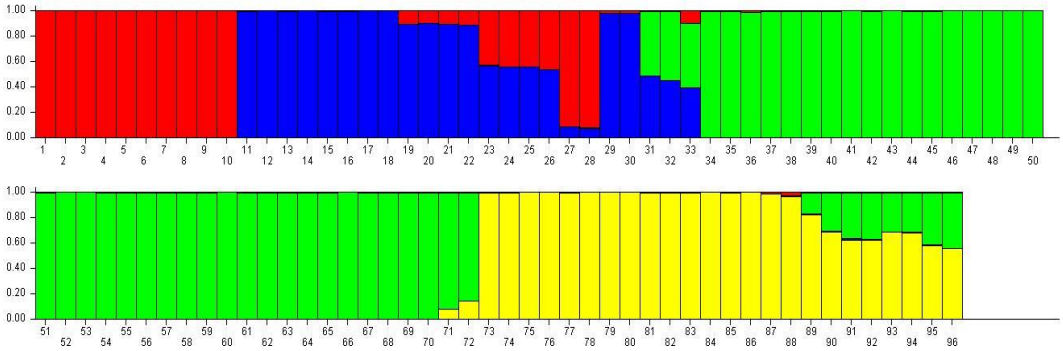

Figure S2. Population structure of 96 bread wheat accessions based on Bayesian methodology using 90K SNPS markers detecting four clusters, K=4. The dissimilar colors demonstrating the diverse clusters which having the studied genotypes corresponding to Table S1.

Figure S3-S14 Quantile-quantile (QQ) –plot of *P*-values

Quantile-quantile (QQ) –plot of *P*-values. The Y-axis is the observed negative base 10 logarithm of the *P*-values, and the X-axis is the expected observed negative base 10 logarithm of the *P*-values under the assumption that the *P*-values follow a uniform [0,1] distribution. The dotted lines show the 95% confidence interval for the QQ-plot under the null hypothesis of no association between the SNP and the trait.

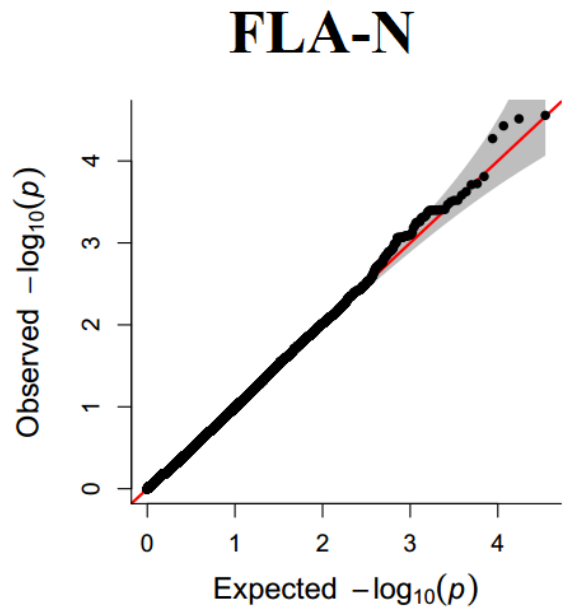

Figure S3

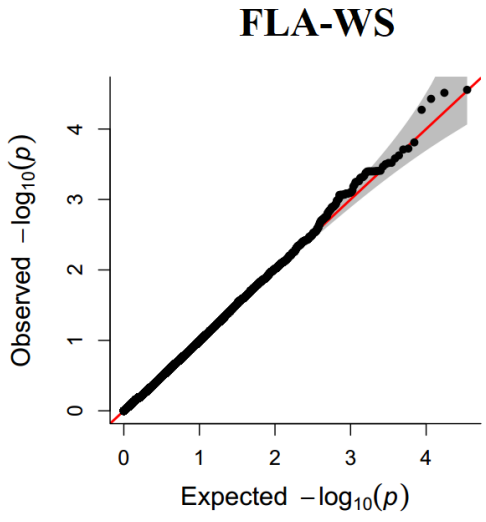

Figure S4

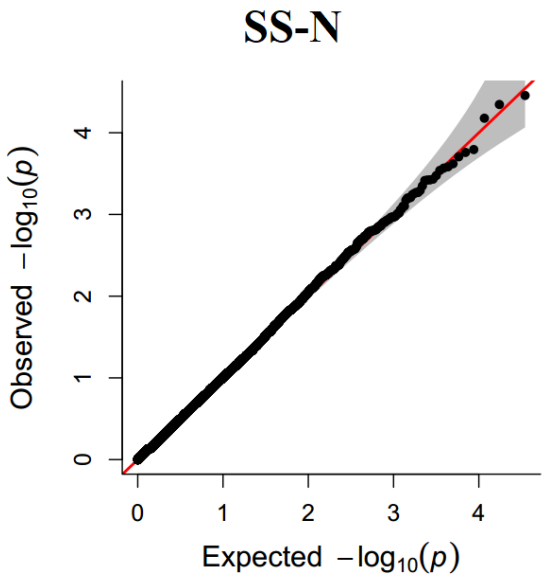

Figure S5

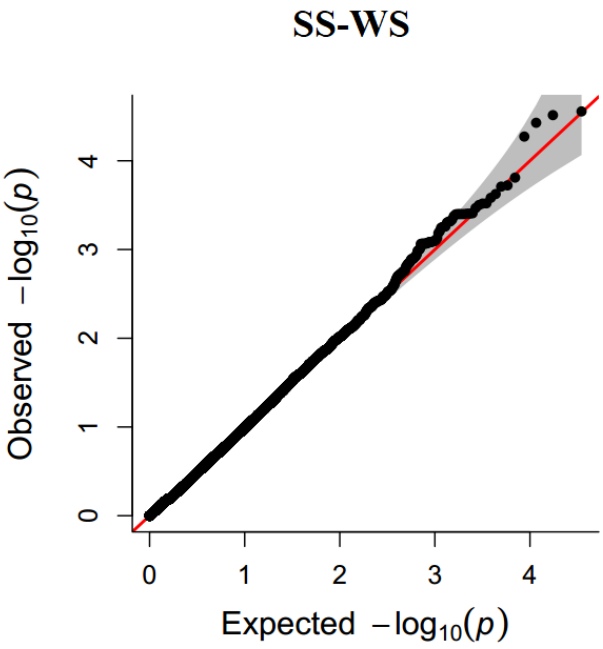

Figure S6

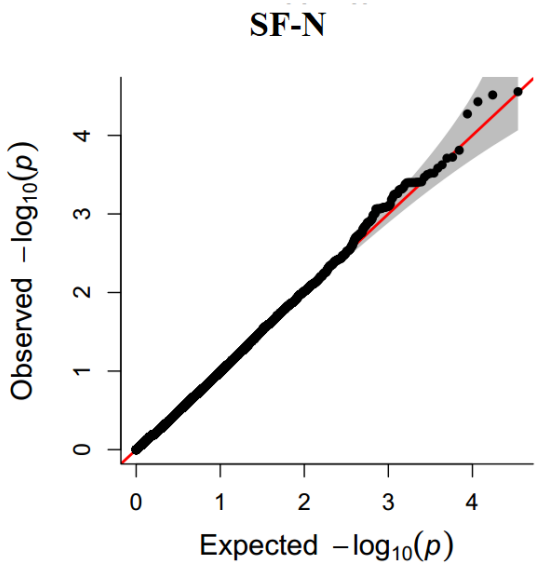

Figure S7

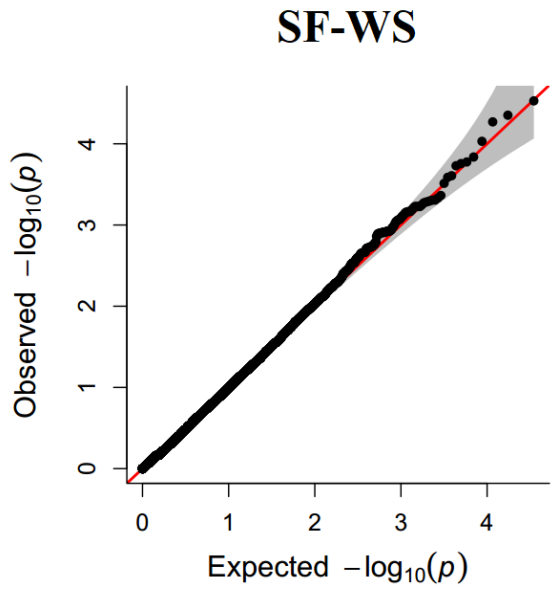

Figure S8

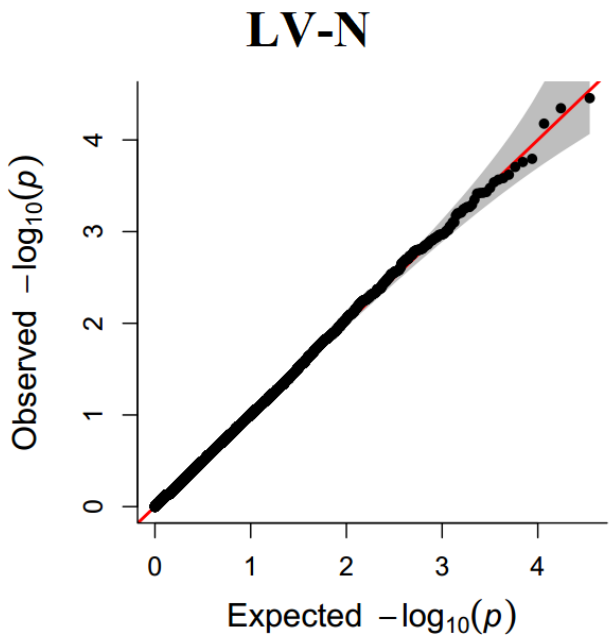

Figure S9

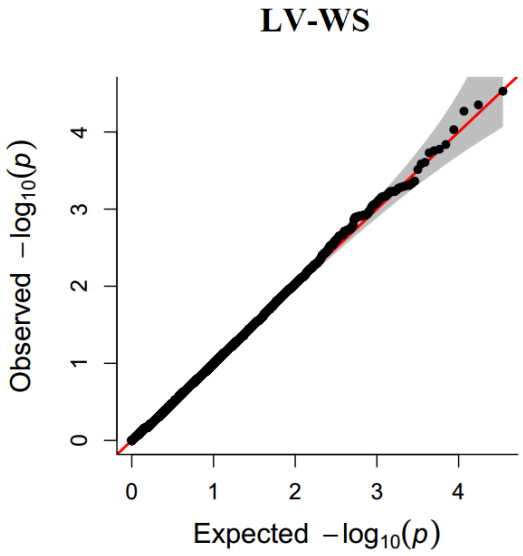

Figure S10

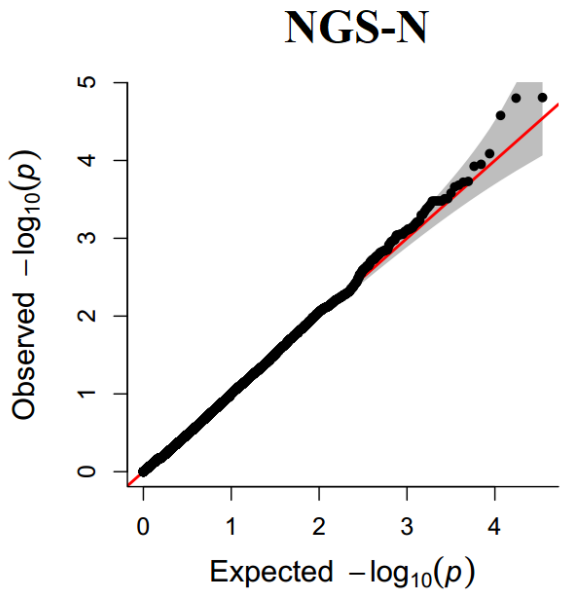

Figure S11

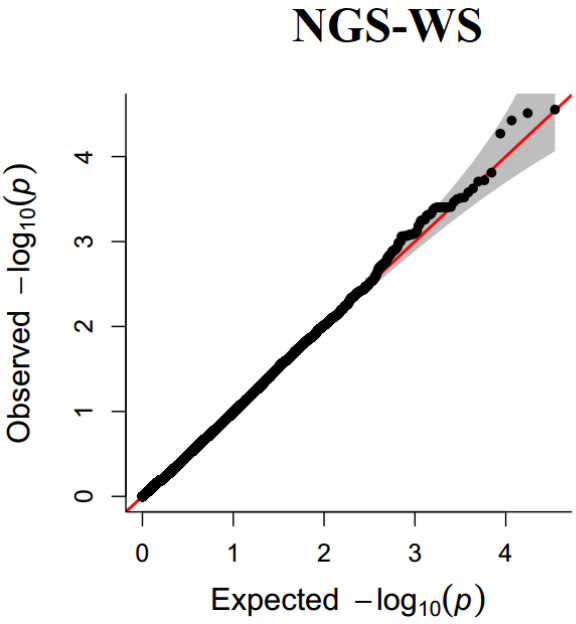

Figure 12

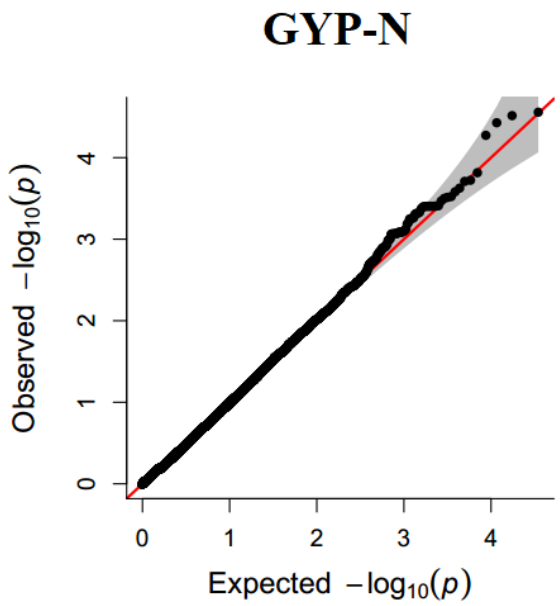

Figure S13

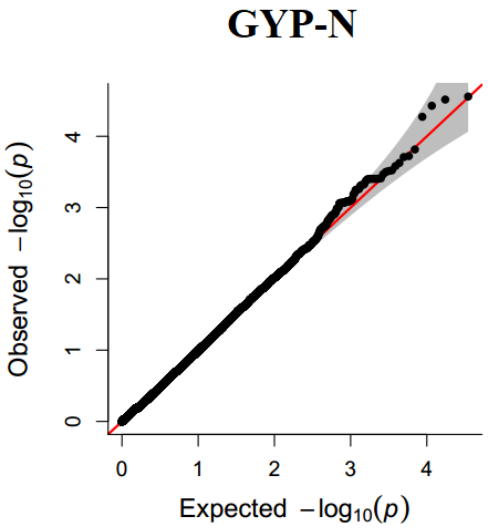

Figure S14