

Supplementary data:

Wheat kernel dimensions: how do they contribute to kernel weight at an individual QTL level?

Fa Cui, Anming Ding, Jun Li, Chunhua Zhao, Xingfeng Li, Deshun Feng, Xiuqin Wang, Lin Wang, Jurong Gao and Honggang Wang

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Table 1. Unconditional QTL with significant additive effects for thousand-kernel weight and kernel dimensions in the WJ population.

Trait ^a	QTL ^b	Interval ^c	En. ^d	LOD ^e	PVE% ^f	Add ^g	
TKW	<i>QTKw-WJ-1A.2</i>	<i>Xbarc176.1-Xwmc333</i>	E3/E4	6.75/6.46	8.10/7.91	1.39/1.41	
	<i>QTKw-WJ-1A.1</i>	<i>Xksun104-Xwmc781</i>	E3	2.62	4.30	0.91	
	<i>QTKw-WJ-2B.2</i>	<i>Xwmc617.1-Xmag3798</i>	E2/P	2.75/2.93	2.25/3.11	0.73/0.76	
	<i>QTKw-WJ-2D-2.1</i>	<i>Xwmc181.1-PPQ29.1</i>	E2	3.78	2.90	-0.90	
	<i>QTKw-WJ-3B.3</i>	<i>Xcfd3374.1-Xcfd3374.2</i>	E1/E2/P	5.63/3.05/2.78	4.58/2.26/2.67	1.20/0.74/0.71	
	<i>QTKw-WJ-3D.2</i>	<i>BE7905.1-BE7905.2</i>	E3/P	2.59/2.87	2.06/1.97	-0.65/-0.64	
	<i>QTKw-WJ-4A.5</i>	<i>Xpsp3029-Xwmc161</i>	E1/E2/E3/E4/P	6.20/3.01/3.02/3.85/5.61	5.29/2.36/2.59/4.00/4.55	1.27/0.75/0.69/0.89/0.87	
	<i>QTKw-WJ-5B.4</i>	<i>Xissr854.1-Xwmc73</i>	E1/E2/E4/P	4.22/5.98/5.97/5.61	3.35/4.22/4.75/4.00	-1.09/-1.09/-1.03/-0.91	
	<i>QTKw-WJ-5D-2.2</i>	<i>Xbarc133-Xcfe242.1</i>	E3/E4	3.64/3.68	2.93/5.57	-0.73/-1.04	
	<i>QTKw-WJ-6A.5</i>	<i>Xcfe273.2-Xcfe273.1</i>	E1/E2/E3/E4/P	6.57/6.16/2.94/6.13/6.98	5.94/5.46/2.32/5.77/4.82	-1.34/-1.14/-0.66/-1.06/-0.95	
	<i>QTKw-WJ-7A.2a</i>	<i>Xgwm473-Xedm16.1</i>	E2/E4	4.44/3.57	4.42/4.22	-1.05/-0.93	
	<i>QTKw-WJ-7A.2b</i>	<i>Xbarc176.2-Xcfe261</i>	E3/P	5.27/3.97	6.30/4.29	-1.10/-0.91	
	<i>QTKw-WJ-7A.3</i>	<i>ww160.2-Xbarc49.2</i>	E1/E4/P	2.91/3.38/6.28	2.20/2.56/4.24	0.84/0.72/0.91	
	<i>QTKw-WJ-7B-2.3</i>	<i>Xbarc65-Xcfe75</i>	E1/E2/P	3.90/2.87/3.59	3.50/3.09/2.74	1.72/1.35/1.16	
	KL	<i>QKI-WJ-1A.1</i>	<i>Xedm80.4-Glu-a1</i>	E1	6.84	11.99	0.012
		<i>QKI-WJ-1B.2</i>	<i>Xwmc134-Glu-b1</i>	E1/P	3.52/4.91	3.48/4.28	0.006/0.007
		<i>QKI-WJ-1D-2.3</i>	<i>Glu-d1-Xbarc346.1</i>	E2/E4/P	3.18/4.13/6.23	3.88/6.20/7.60	0.008/0.010/0.009
		<i>QKI-WJ-2A.1</i>	<i>Xdupw210-Xgwm382.1</i>	E2	2.52	4.03	-0.007
		<i>QKI-WJ-2D-2.3</i>	<i>Xcfd267-Xcfd44</i>	E1/E3/P	5.78/2.93/4.98	4.81/2.61/4.89	0.008/0.006/0.006
		<i>QKI-WJ-2D-2.1</i>	<i>PPQ29.1-Xmag633</i>	E1	3.29	3.97	-0.006
		<i>QKI-WJ-3B.5</i>	<i>Xbarc164-Xcfd53</i>	E1/E2/E3/E4/P	6.86/6.23/4.32/6.81/7.32	7.71/8.18/3.94/7.97/7.21	0.009/0.010/0.007/0.010/0.007
		<i>QKI-WJ-5A-1.2</i>	<i>Xbarc165-Xwmc216</i>	E3/P	4.40/5.87	4.26/9.03	0.008/0.008
		<i>QKI-WJ-5B.4</i>	<i>Xissr854.1-Xwmc73</i>	E1/E3/E4/P	3.49/7.19/3.82/8.33	3.51/5.97/4.64/6.36	-0.006/-0.010/-0.008/-0.007
<i>QKI-WJ-6A.1a</i>		<i>Xcfe87.1-Xswes123.2</i>	P	3.07	2.41	0.004	
<i>QKI-WJ-6A.1b</i>	<i>Xcfe273.2-Xcfe273.1</i>	P	3.29	2.57	-0.004		
<i>QKI-WJ-6D.1</i>	<i>Xcfa2114-Xswes123.1</i>	E3	3.60	4.87	-0.008		

Table 1 (contd.)

Trait ^a	QTL ^b	Interval ^c	En. ^d	LOD ^e	PVE% ^f	Add ^g	
KW	<i>QKw-WJ-1A.2</i>	<i>Glu-a1-Xwmc333</i>	E3/P	3.08/3.94	3.98/3.15	0.007/0.004	
	<i>QKw-WJ-1D-2.1</i>	<i>Glu-d1-Xbarc346.1</i>	E2	4.05	4.44	0.006	
	<i>QKw-WJ-2A.1</i>	<i>Xgwm382.3-Xbarc212</i>	E4	5.04	5.30	0.005	
	<i>QKw-WJ-2B.1</i>	<i>Xcfe230-Xwmc617.1</i>	E1	2.84	3.41	0.004	
	<i>QKw-WJ-2D-2.1</i>	<i>Xcfd168.1-STSO1</i>	E2	3.34	2.85	-0.004	
	<i>QKw-WJ-3A.1</i>	<i>Xswes185-Xmag896.1</i>	E3	4.77	4.62	-0.006	
	<i>QKw-WJ-3B.2</i>	<i>Xcfe3374.1-Xcfe3374.2</i>	E1/P	3.82/2.73	3.62/3.08	0.004/0.003	
	<i>QKw-WJ-3B.1</i>	<i>Xcfe3374.3-Xbarc164</i>	E3	2.63	2.39	0.004	
	<i>QKw-WJ-3D.1</i>	<i>BE7905.1-BE7905.2</i>	E2	3.37	2.92	-0.004	
	<i>QKw-WJ-5A-3.3</i>	<i>Xwmc524-Xcfe29</i>	E2/E4/P	5.43/3.55/5.17	7.83/5.62/5.17	0.006/0.004/0.004	
	<i>QKw-WJ-5D-2.1</i>	<i>Xbarc133-Xcfe242.1</i>	P	4.20	6.68	-0.005	
	<i>QKw-WJ-6A.4</i>	<i>Xcfe273.2-Xcfe273.1</i>	E1/E3/E4/P	3.33/3.79/3.95/6.93	3.45/4.09/4.02/6.56	-0.004/-0.006/-0.004/-0.004	
	<i>QKw-WJ-7B-1.1</i>	<i>Xcfe233-Xissr844.2</i>	E4	2.51	3.96	0.004	
	<i>QKdr-WJ-1D-2.1a</i>	<i>Xswes226.1-Xwmc429.4</i>	E2	2.52	2.97	0.040	
	<i>QKdr-WJ-1D-2.1b</i>	<i>Xwmc429.4-Xwmc429.3</i>	E3	3.27	4.32	-0.037	
	KDR	<i>QKdr-WJ-2A.4</i>	<i>Xgwm382.3-Xgwm558</i>	E1/E2/E4/P	2.84/2.90/3.26/3.67	3.95/2.96/4.19/4.02	-0.030/-0.030/-0.026/-0.024
		<i>QKdr-WJ-2D-2.3</i>	<i>Xcfd267-cfd44</i>	E1/E2/P	3.55/2.80/4.37	3.97/3.44/4.36	0.030/0.027/0.025
<i>QKdr-WJ-3A.3</i>		<i>Xmag896.2-Xmag896.1</i>	E1/E3/P	4.57/8.36/7.28	4.22/7.42/5.88	0.033/0.047/0.028	
<i>QKdr-WJ-3B.3</i>		<i>Xbarc164-Xcfe53</i>	E3/E4/P	2.79/6.72/4.78	2.47/6.63/4.00	0.027/0.031/0.032	
<i>QKdr-WJ-5A-1.4</i>		<i>Xbarc165-Xcwm216</i>	E1/E3/E4/P	6.70/4.05/4.00/7.51	14.94/13.49/14.96/15.08	0.057/0.042/0.050/0.045	
<i>QKdr-WJ-5A-3.3</i>		<i>Xwmc524-Xcfe29</i>	E2/E4/P	4.21/4.11/3.13	8.62/5.00/4.54	-0.042/-0.027/-0.024	
<i>QKdr-WJ-5B.1a</i>		<i>Xmag467-Xcfe74</i>	E2	2.55	3.80	-0.028	
<i>QKdr-WJ-5B.1b</i>		<i>Xissr854.1-wmc73</i>	E4	2.89	3.56	-0.024	
<i>QKdr-WJ-6B.2</i>		<i>Xswes131.4-Xswes131.3</i>	E3/P	5.72/3.94	5.48/3.45	-0.040/-0.021	
<i>QKdr-WJ-6D.1</i>		<i>Xissr844.1-Xissr817</i>	E4	2.88	3.28	-0.024	

^aTKW, thousand-kernel weight; KL, kernel length; KW, kernel width; KDR, kernel diameter ratio.

^bThe assignment of a QTL name is named according to the following rules: italic upper case 'Q' denotes 'QTL'; letters following it are the abbreviation of the corresponding trait; the next upper case letters sandwiched the two dashes '-' indicates the population in which the corresponding QTL was detected; next, a numeral plus an upper case letter, 'A', 'B' or 'D', indicates the wheat chromosome on which the corresponding QTL was detected; if a break occurred on a chromosome, a dash '-' plus a numeral are placed as suffixes to distinguish different segments of the corresponding chromosome; the last numeral after a period denotes the number of environments in which the corresponding QTL was detected; and if the name of two different QTL for the same trait look the same, a lower case letter is used to distinguish them. An unconditional QTL that still showed significance in conditional analysis in a trial, in which it did not show significance in unconditional analysis, is marked by bold typeface.

^cFlanking markers of the QTL.

^dEnvironments in which the corresponding QTL was detected; for additional details, see the notes in table 1. In addition, P represents the pooled environment in which the average data were calculated from the above four trials.

^eLOD value of the corresponding putative additive QTL.

^fPhenotypic variance explained by the corresponding putative additive QTL.

^gAdditive effect of the corresponding putative additive QTL; positive values indicate Weimai 8 alleles that increase the value of the corresponding trait, and conversely, negative values indicate Weimai 8 alleles decrease it.

Table 2. Unconditional QTL with significant additive effects for thousand-kernel weight and kernel dimensions in the WY population.

Trait ^a	QTL ^b	Interval ^c	En. ^d	LOD ^e	PVE% ^f	Add ^g	
TKW	QTKw-WY-2A.1	<i>Xissr848–Xgwm372</i>	E1	3.95	6.72	–1.32	
	<i>QTKw-WY-2A.3</i>	<i>Xcfd2263–Xpsp3029.1</i>	E3/E4/P	4.05/5.34/6.39	8.01/9.93/12.60	1.15/1.47/1.29	
	QTKw-WY-2B-1.3	<i>Xcinau119.1–Xcinau119.2</i>	E1/E3/P	2.67/2.76/4.22	8.36/9.21/14.79	–1.46/–1.23/–1.40	
	<i>QTKw-WY-6B.2</i>	<i>Lr9–Xcwm104</i>	E1/P	2.95/2.80	7.44/7.15	–1.38/–0.97	
	<i>QTKw-WY-6B.1</i>	<i>Xgwm88.2–Xswes131.2</i>	E2	2.65	6.05	0.95	
	<i>QTKw-WY-6D.2</i>	<i>Xcfe127–Xswes123.1</i>	E1/E2	3.02/2.88	5.48/5.98	–1.18/–0.94	
	QTKw-WY-7B.1a	<i>Xcau12.4–ww121</i>	E3	3.38	10.23	–1.29	
	<i>QTKw-WY-7B.1b</i>	<i>Xwmc338–Xswes209.1</i>	E4	2.87	5.11	–1.13	
	<i>QTKw-WY-7D.1</i>	<i>Xissr814.2–Xswm5.1</i>	E4	3.16	5.69	–1.15	
	KL	<i>QKI-WY-3A.1</i>	<i>Xme3em1.1–Xbarc1040</i>	P	3.11	4.00	–0.007
		<i>QKI-WY-6A.1a</i>	<i>Xwmc580.2–Xwmc580.1</i>	E3	3.98	6.95	–0.011
		<i>QKI-WY-6A.1b</i>	<i>Xme3em2.1–Xpsp3152</i>	P	3.32	4.28	–0.006
		<i>QKI-WY-6B.4</i>	<i>Xswes180.1–Xmag3469</i>	P	5.78/5.12/5.64/4.51	10.87/11.64/10.58/7.78	–0.012/–0.014/–0.013/–0.009
		<i>QKI-WY-6B.2</i>	<i>Xbarc146–Xgwm88.1</i>	E3/P	7.94/5.25	12.95/6.80	–0.013/–0.008
		<i>QKI-WY-6D.3</i>	<i>Xswes123.6–Xswes123.2</i>	E1/E2/P	3.38/3.43/5.43	5.90/6.70/7.08	–0.009/–0.010/–0.008
		<i>QKI-WY-6D.1</i>	<i>Xswes123.9–Xcfe87.2</i>	E3	4.35	7.79	–0.011
		<i>QKw-WY-1A.1a</i>	<i>Be470813.3–Xbarc176</i>	P	5.28	11.89	0.005
<i>QKw-WY-1A.1b</i>		<i>Glu-a1–Xgdm93</i>	E2	4.02	10.08	–0.007	
<i>QKw-WY-1A.1c</i>		<i>Xcfe26.3–Xcwm109.5</i>	E4	2.82	17.29	0.008	
KDR	<i>QKw-WY-1A.2</i>	<i>ww114.2–Xwmc120</i>	E3/P	3.62/4.46	7.43/9.17	0.005/0.004	
	<i>QKw-WY-4B-1.1</i>	<i>Xgwm66.2–Xgwm66.1</i>	E2	2.95	5.61	–0.006	
	<i>QKw-WY-5D.1</i>	<i>Xbarc130–Xbarc144</i>	E3	4.63	11.01	–0.006	
	<i>QKw-WY-6A.1</i>	<i>Xswes123.2–Xcfe179.2</i>	E1	2.65	6.29	0.005	
	<i>QKw-WY-6B.1a</i>	<i>Xwmc473–Xbarc146</i>	P	2.59	4.71	0.003	
	<i>QKw-WY-6B.1b</i>	<i>Xwmc737–Xcwm29.1</i>	E2	4.11	9.09	0.006	
	<i>QKdr-WY-1A.1a</i>	<i>Glu-a1–Xgdm93</i>	E2	2.66	6.19	0.042	
	<i>QKdr-WY-1A.1b</i>	<i>ww127.3–ww114.2</i>	E3	3.72	5.36	–0.035	
	<i>QKdr-WY-1A.1c</i>	<i>Xbarc28.1–Xcfe257.4</i>	P	4.42	7.05	–0.032	
	<i>QKdr-WY-1D.2</i>	<i>Xmag3478–Xme3em2.4</i>	E2/P	4.72/3.31	8.91/5.20	–0.055/–0.032	
	<i>QKdr-WY-2A.2</i>	<i>Xwmc453–Xbarc212</i>	E1/P	5.20/2.69	8.96/5.16	–0.050/–0.031	
	<i>QKdr-WY-2D.1</i>	<i>Xbarc228–Xwmc181.1</i>	E3	3.01	4.53	0.034	
	<i>QKdr-WY-5A-1.1</i>	<i>Xcwm17.1–Xmag3273</i>	P	3.27	4.05	–0.025	
	<i>QKdr-WY-6A.1</i>	<i>Xswes123.2–Xcfe179.2</i>	E1	5.52	17.78	–0.060	
	<i>QKdr-WY-6B.1</i>	<i>Xwmc517.3–Xbarc153</i>	E2	2.83	7.78	0.045	
	<i>QKdr-WY-6B.5</i>	<i>Xbarc146–Xgwm88.1</i>	E1/E2/E3/E4/P	2.84/3.22/9.53/4.51/5.94	5.24/5.25/13.97/7.69/7.60	–0.037/–0.043/–0.066/–0.052/–0.039	
	<i>QKdr-WY-6D.3</i>	<i>Xswes123.6–Xswes123.2</i>	E2/E4/P	4.91/3.65/5.81	7.42/6.34/7.71	–0.049/–0.044/–0.038	
<i>QKdr-WY-7B.1</i>	<i>BF–Xwmc76</i>	E4	3.93	7.64	0.044		
<i>QKdr-WY-7D.1</i>	<i>Xcfd4–Xgwm44</i>	E3	4.54	6.56	0.039		

See table 1 in electronic supplementary material for title descriptions.