

Tables

Table S1. Names and origins of 173 rice accessions used for association mapping.

Code	Germplasm name	Origin	Latitude	Longitude	Germplasm ID ^a	Subpopulation	region
1	Longjing 22	Haerbin, Heilongjiang, China	44.04	125.42	HS2008010	Japonica	NEC
2	Longjing 28	Haerbin, Heilongjiang, China	44.04	125.42	HS2009011	Japonica	NEC
3	Longjing 27	Haerbin, Heilongjiang, China	44.04	125.42	HS2009010	Japonica	NEC
4	24248	Nanjing, Jiangsu, China	32.04	118.78		Japonica	EC
5	Tijin	Japan	35.68	139.69	H1706	Japonica	JP
6	Zhongguo 91	Japan	35.68	139.69	NL274	Japonica	JP
7	Kangbingyueguang	Japan	35.68	139.69	H1524	Japonica	JP
8	Sihao 4385	Sihong, Jiangsu, China	33.46	118.23	H1315	Japonica	EC
9	Nannongjing 1R	Nanjing, Jiangsu, China	32.04	118.78	H1372	Japonica	EC
10	Hongmangshajing	Kunshan, Jiangsu, China	31.39	120.95	T630	Indica	EC
11	Wanhuangdao	Wuxian, Jiangsu, China	31.32	120.62	T815	Japonica	EC
12	Xudao 3hao	Haerbin, Heilongjiang, China	34.26	117.2	SS200306	Japonica	NEC
13	Youzhiyueguang	Japan	35.68	139.69	Y1A01876	Japonica	JP
14	Yuedao 68	Vietnam	10.22	106.01	Y1A02418	Indica	SEA
15	Longdao 8hao	Haerbin, Heilongjiang, China	44.04	125.42	HS2008019	Japonica	NEC
16	Longdao 6hao	Haerbin, Heilongjiang, China	44.04	125.42	HS2006004	Japonica	NEC
17	Qiutianxiaoding	Japan	35.68	139.69	H1654	Japonica	JP
18	Zhenghan 2hao	Zhengzhou, Henan, China	34.76	113.65	GS2003031	Japonica	CC
19	Xiangjing 9407	Nanjing, Jiangsu, China	32.04	118.78	LS891061	Japonica	EC
20	Nongxiang 21	Changsha, Hunan, China	28.21	113	CNA200802496	Indica	CC
21	Fengyouwan 8hao	Changsha, Hunan, China	28.21	113	YS2009001	Indica	CC

22	Xiangwanxian 17	Changsha, Hunan, China	28.21	113	XS2008035	Indica	CC
23	Yuedao 37	Vietnam	10.22	106.01	Y1A02397	Indica	SEA
24	Sujing 353	Suzhou, Jiangsu, China	31.32	120.62	C1511	Japonica	EC
25	Zhen9424	Zhenjiang, Jiangsu, China	32.12	119.27	ZD-05658	Japonica	EC
26	Baikenuo	Wujiang, Jiangsu, China	31.16	120.63	T354	Indica	EC
27	Diantun502xuanzao	Kunming, Yunnan, China	25.04	102.73	ZD-05551	Indica	SWC
28	Yuedao 41	Vietnam	10.22	106.01	Y1A02328	Indica	SEA
29	Longnuo 3hao	Haerbin, Heilongjiang, China	44.04	125.42	HS2009015	Japonica	NEC
30	Mudanjiang 28	Mudanjiang, Heilongjiang, China	44.58	129.6	HS2006006	Japonica	NEC
31	Yujing 6hao	Zhengzhou, Henan, China	34.76	113.65	GS980002	Japonica	CC
32	Shengdao808	Haerbin, Heilongjiang, China	44.04	125.42		Japonica	NEC
33	Yuedao 32	Vietnam	10.22	106.01	Y1A02326	Indica	SEA
34	Yuedao 107	Vietnam	10.22	106.01	Y1A02368	Indica	SEA
35	Yuedao 61	Vietnam	10.22	106.01	Y1A02413	Indica	SEA
36	Yuedao 50	Vietnam	10.22	106.01	Y1A02331	Indica	SEA
34	Yuedao 109	Vietnam	10.22	106.01	Y1A02356	Indica	SEA
38	Yuedao 62	Vietnam	10.22	106.01	Y1A02414	Indica	SEA
39	Yuedao 66	Vietnam	10.22	106.01	Y1A02417	Indica	SEA
40	Hongnong 5hao	Wujiang, Jiangsu, China	31.16	120.63	T757	Japonica	EC
41	Suyunuo	xuzhou, Jiangsu, China	34.26	117.2	T832	Japonica	EC
42	Shenlenuo	Kunshan, Jiangsu, China	31.39	120.95	T691	Japonica	EC
43	Hongjiaozhan	Wuxian, Jiangsu, China	31.32	120.62	T888	Indica	EC
44	Wanjingnuo	Hefei, Anhui, China	31.86	117.27	H1653	Japonica	EC
45	Nongxiang26	Changsha, Hunan, China	28.21	113		Indica	CC
46	Yuedao 9	Vietnam	10.22	106.01	Y1A02373	Indica	SEA
47	M1004	Japan	35.68	139.69	Y1A01861	Japonica	JP

48	Nongxiang 25	Changsha, Hunan, China	28.21	113	GS2001021	Indica	CC
49	Longjing 20	Haerbin, Heilongjiang, China	44.04	125.42	HS2007004	Japonica	NEC
50	Xiangchuanwuxinbaimi	Japan	35.68	139.69	H1655	Japonica	JP
51	Jindao 1007	Dongli, Tianjin, China	39.14	117.13	GS2004043	Japonica	EC
52	Zaijinjing	Songhuajiang, Heilongjiang, China	41.42	119.52	H1614	Japonica	NEC
53	Malaihong	Nanjing, Jiangsu, China	32.04	118.78	T050	Japonica	EC
54	Nannongjing3786	Haerbin, Heilongjiang, China	44.04	125.42		Japonica	NEC
55	Wuyunjing 8hao	Wujin, Jiangsu, China	31.78	119.95	SZS313	Japonica	EC
56	Yuzhenxiang	Changsha, Hunan, China	28.21	113	XS2009038	Indica	CC
57	Yuedao24(LCV18)	Vietnam	10.22	106.01		Indica	SEA
58	Yuedao 3	Vietnam	10.22	106.01	Y1A02370	Indica	SEA
59	Yuedao 43	Vietnam	10.22	106.01	Y1A02404	Indica	SEA
60	Yuedao 48	Vietnam	10.22	106.01	Y1A02407	Indica	SEA
61	Yuedao 49	Vietnam	10.22	106.01	Y1A02408	Indica	SEA
62	Yuedao 13	Vietnam	10.22	106.01	Y1A02320	Indica	SEA
63	Wumangyedao	Jinshan, Shanghai, China	30.75	121.33	T335	Japonica	EC
64	Haobuqia	Wuxian, Jiangsu, China	31.32	120.62	21-00357	Indica	EC
65	Yuedao 22	Vietnam	10.22	106.01	Y1A02382	Indica	SEA
66	Dongzhengwuyunjing 21	Hongze, Jiangsu, China	33.28	118.85	SS200705-1	Japonica	EC
67	Yandao 8hao	Yancheng, Jiangsu, China	33.38	120.13	SS200307	Japonica	EC
68	Huaidao 11hao	Huaian, Jiangsu, China	33.5	119.15	SS200805	Japonica	EC
69	Nannongjing 004	Nanjing, Jiangsu, China	32.04	118.78	T248	Japonica	EC
70	Zhongzuo 93	Mudanjiang, Heilongjiang, China	44.6	129.58	JS1995001	Japonica	NEC
71	Xudao 5hao	Xuzhou, Jiangsu, China	34.15	117.11	GS2006059	Japonica	EC

72	Digludao	Sihong, Jiangsu, China	33.46	118.23	H1312	Japonica	EC
73	Huaidao 8hao	Huaian, Jiangsu, China	33.5	119.15	SS200410	Japonica	EC
74	Dongzheng 1640	Hongze, Jiangsu, China	33.28	118.85	C1515	Japonica	EC
75	Yanjing 8hao	Yancheng, Jiangsu, China	33.38	120.13	ZD-05649	Japonica	EC
76	Huifeng 2	Yancheng, Jiangsu, China	33.38	120.13	C1509	Japonica	EC
77	Yandao 9hao	Yancheng, Jiangsu, China	33.38	120.13	SS200506	Japonica	EC
78	Lianjing 4hao	Lianyungang, Jiangsu, China	34.59	119.16	SS200704	Japonica	EC
79	Huifeng 1	Yancheng, Jiangsu, China	33.38	120.13	C1508	Japonica	EC
80	Sihao 4280	Sihong, Jiangsu, China	33.46	118.23	H1705	Japonica	EC
81	Sihao 4330	Sihong, Jiangsu, China	33.46	118.23	H1704	Japonica	EC
82	Sihao 4259	Sihong, Jiangsu, China	33.46	118.23	H1334	Japonica	EC
83	Zhengdao 18	Zhengzhou, Henan, China	34.76	113.65	GS2007033	Japonica	CC
84	Jingnuo 330	Hefei, Anhui, China	31.86	117.27	H1346	Japonica	EC
85	Zhongjing 212	Nanjing, Jiangsu, China	32.04	118.78	WS891061	Japonica	EC
86	Wuyunjing 21hao	Wujin, Jiangsu, China	31.78	119.95	SS200705-2	Japonica	EC
87	Huajing 6hao	Huaian, Jiangsu, China	33.5	119.15	SS200706	Japonica	EC
88	Yangfujing 8hao	Yancheng, Jiangsu, China	33.38	120.13	SS200608	Japonica	EC
89	Zhendao 99	Zhenjiang, Jiangsu, China	32.12	119.27	SS200106	Japonica	EC
90	Ningjing 2hao	Nanjing, Jiangsu, China	32.04	118.78	WPS05010476	Japonica	EC
91	Huajing 5hao	Huaian, Jiangsu, China	33.5	119.15	SS200505	Japonica	EC
92	Zhongjing 9677	Nanjing, Jiangsu, China	32.04	118.78	C1512	Japonica	EC
93	Yangfujing 7hao	Yangzhou, Jiangsu, China	32.24	119.26	SS200413	Japonica	EC
94	Yuedao 12	Vietnam	10.22	106.01	Y1A02375	Indica	SEA
95	Jianongnuo 2hao	Haerbin, Heilongjiang, China	44.04	125.42	H1600	Japonica	NEC
96	Xudao 4hao	Xuzhou, Jiangsu, China	34.15	117.11	CNA20040007.X	Japonica	EC
97	Sihao 4040	Sihong, Jiangsu, China	33.46	118.23	H1703	Japonica	EC

98	Yanjing 9hao	Yancheng, Jiangsu, China	33.38	120.13	SS200707	Japonica	EC
99	Sihao 4081	Sihong, Jiangsu, China	33.46	118.23	H1337	Japonica	EC
100	Sihao 4041	Sihong, Jiangsu, China	33.46	118.23	H1338	Japonica	EC
101	Sihao 4031	Sihong, Jiangsu, China	33.46	118.23	H1340	Japonica	EC
102	Wandao 68	Hefei, Anhui, China	31.86	117.27	WPS03010384	Japonica	EC
103	Wuxiang99-8	Suihua, Heilongjiang, China	46.63	126.98		Japonica	NEC
104	Zhongjing 131	Haerbin, Heilongjiang, China	44.04	125.42	H1620	Japonica	NEC
105	Ningjinghui 260	Nanjing, Jiangsu, China	32.04	118.78	H1371	Japonica	EC
106	Ningjinghui 237	Nanjing, Jiangsu, China	32.04	118.78	H1374	Japonica	EC
107	Wunuoyihao	Haerbin, Heilongjiang, China	44.04	125.42	H1611	Japonica	NEC
108	Sihao 4029	Sihong, Jiangsu, China	33.46	118.23	H1333	Japonica	EC
109	Ludao	Nanjing, Jiangsu, China	32.04	118.78	H1508	Japonica	EC
110	Wanqu 429bp	Haerbin, Heilongjiang, China	44.04	125.42	HS2013003	Japonica	NEC
111	Yangfujing 4901	Yangzhou, Jiangsu, China	32.24	119.26	SS200811	Japonica	EC
112	Yandao 6hao	Yancheng, Jiangsu, China	33.38	120.13	SS200205	Japonica	EC
113	Cbao	Hefei, Anhui, China	31.86	117.27	H1661	Japonica	EC
114	Zhengdao 10hao	Zhenjiang, Jiangsu, China	32.2	119.44	SS200710	Indica	EC
115	Baoxintaihuqing	Wujiang, Jiangsu, China	31.16	120.63	T834	Japonica	EC
116	Huaidao 9hao	Huaian, Jiangsu, China	33.5	119.15	SS200607	Japonica	EC
117	Xiaobaidao	Wuxian, Jiangsu, China	31.32	120.62	T208	Japonica	EC
118	Yaxuenuo	Wuxian, Jiangsu, China	31.26	121.63	T480	Japonica	EC
119	Yangguang 200	Xuzhou, Jiangsu, China	34.15	117.11	GS2008043	Japonica	EC
120	Zaoshirihuangdao	Wuxian, Jiangsu, China	31.32	120.62	T728	Japonica	EC
121	Luohanhuang	Jiangyin, Jiangsu, China	31.92	120.29	T560	Japonica	EC
122	Xudao2hao	Xuzhou, Jiangsu, China	34.15	117.11		Japonica	EC
123	Xudao9201B	Xuzhou, Jiangsu, China	34.15	117.11		Japonica	EC

124	Ebusinuodao	Suihua, Heilongjiang, China	46.63	126.98	T386	Japonica	NEC
125	Yueguang	Japan	35.68	139.69	H1660	Japonica	JP
126	Yimuhu	Japan	35.68	139.69	Y1A01857	Indica	JP
127	Qingkong	Nanjing, Jiangsu, China	32.04	118.78	Y1A01858	Japonica	EC
128	RT61	Japan	35.68	139.69	Y1A01863	Japonica	JP
129	IL38	Japan	35.68	139.69	ZD-05554	Japonica	JP
130	Liuyezhan	Hubei, China	30	114	17-00524	Indica	CC
131	Zaoxian 14	Anhui, China	37.51	117.18	11-00670	Indica	EC
132	Xu91075	Xuzhou, Jiangsu, China	34.26	117.2	H1418	Indica	EC
133	Xudao 25-7	Xuzhou, Jiangsu, China	34.26	117.2	H1419	Japonica	EC
134	Qing 7	Yancheng, Jiangsu, China	33.38	120.13	H1471	Indica	EC
135	Sihao 4141	Sihong, Jiangsu, China	33.46	118.23	H1332	Japonica	EC
136	SH189	Sihong, Jiangsu, China	33.46	118.23	Y1A01866	Japonica	EC
137	SHN1	Sihong, Jiangsu, China	33.46	118.23	Y1A01867	Indica	EC
138	Suwujing	Wujin, Jiangsu, China	31.78	119.95	SS201009	Indica	EC
139	9522B	Changzhou, Jiangsu, China	31.79	119.95	GS20000008	Japonica	EC
140	863B	Nanjing, Jiangsu, China	32.04	118.78	H1425	Japonica	EC
141	Biaojiyongzijing	Nanjing, Jiangsu, China	32.04	118.78	H1427	Japonica	EC
142	Zigu	Nanjing, Jiangsu, China	32.04	118.78	H1437	Indica	EC
143	Jiangpuchangliheimidao	Nanjing, Jiangsu, China	32.04	118.78	H1492	Indica	EC
144	A7444	Nanjing, Jiangsu, China	32.04	118.78	H1476	Japonica	EC
145	Xiepihuang	Taicang, Jiangsu, China	31.45	121.1	T203	Japonica	EC
146	Shengtangqing	Changshu, Jiangsu, China	31.64	120.74	T759	Japonica	EC
147	Chuan 6xian	Chengdu, Sichuan, China	30.67	104.06	H1506	Indica	SWC
148	Chuan 5xian	Chengdu, Sichuan, China	30.67	104.06	H1507	Indica	SWC
149	Shufeng 101	Sichuan, China	30.39	104.05	ZD-00760	Indica	SWC

150	Chengnongshuijing	Sichuan, China	30.39	104.05	ZD-03386	Indica	SWC
151	Xiangxiandao 10hao	Changsha, Hunan, China	28.21	113	H1486	Indica	CC
152	II-32B	Changsha, Hunan, China	28.21	113	A0050	Indica	CC
153	Chenwan 3hao	Hunan, China	28.11	113	ZD-00358	Indica	CC
154	Xiangaizao 10hao	Hunan, China	28.11	113	ZD-01402	Indica	CC
155	Yuetai B	Fogang, Guangdong, China	23.86	113.52	H1493	Indica	SC
156	Qimiaoixiang 2hao	Qingyuan, Guangdong, China	23.7	113.01	H1496	Indica	SC
157	Shengyou 2hao	Gaoyao, Guangdong, China	23.05	112.44	YS1994004	Indica	SC
158	Guichao 2hao	Guangdong, China	23.08	113.15	H1645	Indica	SC
159	Minghui63	Sanmingshi, Fujian, China	25.3	116.22		Indica	EC
160	LongtepuB	Fuzhou, Fujian, China	26.08	119.3	H1490	Indica	EC
161	Hainanxian R	Hainan, China	19.52	109.57	H1504	Indica	SC
162	Zajiaohaigu	Changjiang, Hainan, China	19.25	109.03	H1510	Indica	SC
163	Nuohangu	Kunming, Yunnan, China	25.04	102.73	H1434	Japonica	SWC
164	Lincangwazuhangu	Kunming, Yunnan, China	25.04	102.73	H1435	Japonica	SWC
165	Yuedao 55	Vietnam	10.22	106.01	Y1A02409	Indica	SEA
166	Yuedao 108	Vietnam	10.22	106.01	Y1A02355	Indica	SEA
167	IR112	Philippines	14.6	121	H1501	Indica	SEA
168	IR64	Philippines	14.6	121	H1502	Indica	SEA
169	Arias	Indonesia	6.08	94.45	H1339	Indica	SEA
170	CAMOR	Indonesia	6.08	94.45	10861	Japonica	SEA
171	Gendjah Gempol	Indonesia	6.08	94.45	12483	Japonica	SEA
172	BULUH BAWU	Indonesia	6.08	94.45	16481	Japonica	SEA
173	Shengdao 14	Jinan, Shandong, China	36.4	117	H1701	Japonica	EC

^a The word in black type indicated that these materials were saved by our lab; **T** showed the materials were from Taihu Lake; **H** showed that the materials were introduced by Hong; **C** showed that the materials were always saved by the lab. The word in blue type indicated that these materials were the approved variety; **CNA**

indicated the No. of variety right. **GS**, the abbreviation of guoshendao. **HS**, the abbreviation of heishendao. These indicated that the accessions were approved by Heilongjiang province. **JS**, the abbreviation of jishendao. These indicated that the accessions were approved by Jilin province. **LS**, the abbreviation of liaoshendao. These indicated that the accessions were approved by Liaoning province. **SS**, the abbreviation of sushendao. These indicated that the accessions were approved by Jiangsu province. **SZS**, the abbreviation of suzhongshen. These indicated the accessions were approved by Jiangsu province. **WPS**, the abbreviation of wanpinshen. These indicated that the accessions were approved by Anhui province. **WS**, the abbreviation of wanshendao. These indicated that the accessions were approved by Anhui province. **XS**, the abbreviation of xiangshendao. These indicated that the accessions were approved by Hunan province. **YS**, the abbreviation of yueshendao. These indicated that the accessions were approved by Guangdong province. SC, southern China; CC, central China; EC, eastern China; NEC, northeastern China; SWC, southwest China; JP, Japan; SEA, southeast Asia.

Table S2. Results of variance analysis for the flag leaf shape.

Characteristics	Source of variation	df	SS	MS	F-value	P-value
FLL/cm	Among genotypes	172	64790	376.7	36.62 **	P<0.0001
FLW/cm	Among genotypes	172	122.4	0.7114	70.07 **	P<0.0001
FLR/cm	Among genotypes	172	28424	165.3	41.15 **	P<0.0001
FLA/cm	Among genotypes	172	173265	1007	42.86 **	P<0.0001

df, degrees of freedom; SS, sum of squares; MS, mean square. ** Significant differences at $P < 0.01$. FLL, flag leaf length; FLW, flag leaf width; FLR, flag leaf length–width ratio; FLA, flag leaf area.

Table S3. Names and origins of 173 rice accessions used for association mapping and the corresponding Q values calculated by the STRUCTURE software.

Code	Germplasm name	Q1	Q2
1	Longjing 22	0.005	0.995
2	Longjing 28	0.051	0.949
3	Longjing 27	0.019	0.981
4	24248	0.204	0.796
5	Tijin	0.124	0.876
6	Zhongguo 91	0.0793333	0.9206667
7	Kangbingyueguang	0	1
8	Sihao 4385	0	1
9	Nannongjing 1R	0.299	0.701
10	Hongmangshajing	0.968	0.032
11	Wanhuangdao	0.114	0.886
12	Xudao 3hao	0	1
13	Youzhiyueguang	0	1
14	Yuedao 68	1	0
15	Longdao 8hao	0.058	0.942
16	Longdao 6hao	0.057	0.943
17	Qiutianxiaoding	0.002	0.998
18	Zhenghan 2hao	0	1
19	Xiangjing 9407	0.035	0.965
20	Nongxiang 21	1	0
21	Fengyouwan 8hao	1	0
22	Xiangwanxian 17	0.121	0.879
23	Yuedao 37	1	0
24	Sujing 353	0.014	0.986
25	Zhen9424	0	1
26	Baikenuo	0.981	0.019
27	Diantun502xuanzao	1	0
28	Yuedao 41	1	0
29	Longnuo 3hao	0.047	0.953
30	Mudanjiang 28	0.077	0.923
31	Yujing 6hao	0.002	0.998
32	Shengdao808	0.024	0.976
33	Yuedao 32	1	0
34	Yuedao 107	0.953	0.047
35	Yuedao 61	1	0
36	Yuedao 50	1	0
37	Yuedao 109	1	0
38	Yuedao 62	1	0
39	Yuedao 66	1	0
40	Hongnong 5hao	0.003	0.997
41	Suyunuo	0	1
42	Shenlenuo	0.078	0.922
43	Hongjiaozhan	0.973	0.027

44	Wanjingnuo	0.001	0.999
45	Nongxiang26	1	0
46	Yuedao 9	1	0
47	M1004	0.106	0.894
48	Nongxiang 25	1	0
49	Longjing 20	0.039	0.961
50	Xiangchuanwuxinbaimi	0.949	0.051
51	Jindao 1007	0.038	0.962
52	Zaijinjing	0.049	0.951
53	Malaihong	0.782	0.218
54	Nannongjing3786	0.028	0.972
55	Wuyunjing 8hao	0	1
56	Yuzhenxiang	0.651	0.349
57	Yuedao24(LCV18)	1	0
58	Yuedao 3	1	0
59	Yuedao 43	0.98	0.02
60	Yuedao 48	1	0
61	Yuedao 49	1	0
62	Yuedao 13	1	0
63	Wumangyedaο	0.056	0.944
64	Haobuqia	1	0
65	Yuedao 22	1	0
66	Dongzhengwuyunjing 21	0.088	0.912
67	Yandao 8hao	0	1
68	Huaidao 11hao	0	1
69	Nannongjing 004	0.002	0.998
70	Zhongzuo 93	0	1
71	Xudao 5hao	0	1
72	Digludao	0.014	0.986
73	Huaidao 8hao	0	1
74	Dongzheng 1640	0.017	0.983
75	Yanjing 8hao	0	1
76	Huifeng 2	0	1
77	Yandao 9hao	0	1
78	Lianjing 4hao	0.038	0.962
79	Huifeng 1	0	1
80	Sihao 4280	0	1
81	Sihao 4330	0	1
82	Sihao 4259	0.06	0.94
83	Zhengdao 18	0	1
84	Jingnuo 330	0.026	0.974
85	Zhongjing 212	0.063	0.937
86	Wuyunjing 21hao	0	1
87	Huajing 6hao	0.025	0.975
88	Yangfujing 8hao	0	1
89	Zhendao 99	0	1

90	Ningjing 2hao	0	1
91	Huajing 5hao	0.199	0.801
92	Zhongjing 9677	0.013	0.987
93	Yangfujing 7hao	0	1
94	Yuedao 12	1	0
95	Jianongnuo 2hao	0.005	0.995
96	Xudao 4hao	0.001	0.999
97	Sihao 4040	0.015	0.985
98	Yanjing 9hao	0	1
99	Sihao 4081	0.072	0.928
100	Sihao 4041	0.043	0.957
101	Sihao 4031	0.34	0.66
102	Wandao 68	0.103	0.897
103	Wuxiang99-8	0.001	0.999
104	Zhongjing 131	0	1
105	Ningjinghui 260	0.026	0.974
106	Ningjinghui 237	0.129	0.871
107	Wunuoyihao	0.002	0.998
108	Sihao 4029	0.024	0.976
109	Ludao	0.1686667	0.8313333
110	Wanqu 429bp	0.006	0.994
111	Yangfujing 4901	0	1
112	Yandao 6hao	0.072	0.928
113	Cbao	0.128	0.872
114	Zhengdao 10hao	1	0
115	Baoxintaihuqing	0.765	0.235
116	Huaidao 9hao	0.071	0.929
117	Xiaobaidao	0.081	0.919
118	Yaxuenuo	0.096	0.904
119	Yangguang 200	0	1
120	Zaoshirihuangdao	0.151	0.849
121	Luohanhuang	0.07	0.93
122	Xudao2hao	0.163	0.837
123	Xudao9201B	0.009	0.991
124	Ebusinuodao	0.082	0.918
125	Yueguang	0	1
126	Yimuhu	1	0
127	Qingkong	0.001	0.999
128	RT61	0	1
129	IL38	0	1
130	Liuyezhan	1	0
131	Zaoxian 14	0.991	0.009
132	Xu91075	1	0
133	Xudao 25-7	0	1
134	Qing 7	1	0
135	Sihao 4141	0	1

136	SH189	0.481	0.519
137	SHN1	1	0
138	Suwujing	0.999	0.001
139	9522B	0	1
140	863B	0.056	0.944
141	Biaojiyongzijing	0.191	0.809
142	Zigu	0.974	0.026
143	Jiangpuchangliheimidao	0.874	0.126
144	A7444	0.42	0.58
145	Xiepihuang	0.065	0.935
146	Shengtangqing	0.821	0.179
147	Chuan 6xian	0.992	0.008
148	Chuan 5xian	0.993	0.007
149	Shufeng 101	1	0
150	Chengnongshuijing	1	0
151	Xiangxiandao 10hao	0.976	0.024
152	II-32B	0.98	0.02
153	Chenwan 3hao	1	0
154	Xiangaizao 10hao	1	0
155	Yuetai B	0.992	0.008
156	Qimiauxiang 2hao	1	0
157	Shengyou 2hao	0.98	0.02
158	Guichao 2hao	1	0
159	Minghui63	1	0
160	LongtepuB	1	0
161	Hainanxian R	0.996	0.004
162	Zajiaohaigu	1	0
163	Nuohangu	0.4056667	0.5943333
164	Lincangwazuhangu	0.409	0.591
165	Yuedao 55	1	0
166	Yuedao 108	0.953	0.047
167	IR112	1	0
168	IR64	1	0
169	Arias	0.981	0.019
170	CAMOR	0.471	0.529
171	Gendjah Gempol	0.512	0.488
172	BULUH BAWU	0.449	0.551
173	Shengdao 14	0	1

Table S4. SNP Position for FLL, FLW, FLR and FLW identified by GWAS in 2019 or 2020.

Trait	QTLs	Chr	SNP	Allele	P-value	FDR	PVE(%)	Model	Year
FLR	<i>qFLR3</i>	3	15068252	C/G	5.12×10^{-6}	9.10×10^{-6}	15.14	MLM	2019
	<i>qFLR9</i>	9	15134940	C/A	9.58×10^{-6}	9.89×10^{-6}	14.30	MLM	2019
		9	15134940	C/A	1.06×10^{-8}	2.56×10^{-8}	18.76	GLM	2019
	<i>qFLR11.1</i>	11	14965952	C/T	4.46×10^{-6}	8.83×10^{-6}	12.99	MLM	2019
		11	14965952	C/T	2.23×10^{-9}	9.7×10^{-9}	18.27	GLM	2019
	<i>qFLR11.2</i>	11	15298215	G/A	4.46×10^{-6}	8.83×10^{-6}	12.99	MLM	2019
		11	15298215	G/A	2.23×10^{-9}	9.53×10^{-9}	18.27	GLM	2019
	<i>qFLR12.1</i>	12	19498080	A/G	9.89×10^{-6}	9.9×10^{-6}	11.99	MLM	2019
		12	19498080	A/G	1.55×10^{-11}	8.05×10^{-10}	22.60	GLM	2019
	<i>qFLL10.1</i>	10	19957979	T/G	5.56×10^{-6}	8.53×10^{-6}	14.68	MLM	2020
FLL		10	19957979	T/G	9.42×10^{-10}	5.06×10^{-9}	16.35	GLM	2020
FLR	<i>qFLR12.2</i>	12	21026552	G/A	1.35×10^{-6}	7.68×10^{-6}	14.52	MLM	2020
		12	21026552	G/A	2.75×10^{-9}	9.44×10^{-9}	18.16	GLM	2020
FLA	<i>qFLA10</i>	10	19957979	T/G	9.56×10^{-6}	9.6×10^{-6}	13.86	MLM	2020
		10	19957979	T/G	2.78×10^{-8}	3.07×10^{-8}	11.99	GLM	2020

PVE, phenotypic variation explanation ratio.

Table S5. Candidate gene annotation in the LD region 34.5-35.2Mb associated with FLW

Number	Gene ID	MSU ID	Position(bp)	Annotation
1	<i>Os02g0811400</i>	<i>LOC_Os02g56680</i>	34742561-34743972	dehydrogenase
2	<i>Os02g0811600</i>	<i>LOC_Os02g56690</i>	34757658-34759138	dihydroflavonol-4-reductase
3	<i>Os02g0811800</i>	<i>LOC_Os02g56700</i>	34764348-34766529	dehydrogenase
4	<i>Os02g0812000</i>	<i>LOC_Os02g56720</i>	34769644-34771168	cinnamoyl CoA reductase
5	<i>Os02g0812400</i>	<i>LOC_Os02g56740</i>	34784179-34793387	translation initiation factor eIF-2B subunit epsilon
6	<i>Os02g0812500</i>	<i>LOC_Os02g56750</i>	34794245-34796635	OsFBX65 - F-box domain containing protein
7	<i>Os02g0812600</i>	<i>LOC_Os02g56760</i>	34798281-34801473	OsFBX66 - F-box domain containing protein
8	<i>Os02g0812700</i>	<i>LOC_Os02g56770</i>	34802001-34814925	OsFBX67 - F-box domain containing protein
9	<i>Os02g0812700</i>	<i>LOC_Os02g56800</i>	34802001-34814925	F-box protein PP2-B2
10	<i>Os02g0813083</i>	<i>LOC_Os02g56810</i>	34819425-34819769	OsFBX68 - F-box domain containing protein
11	<i>Os02g0813166</i>	<i>LOC_Os02g56820</i>	34824765-34825820	OsFBX69 - F-box domain containing protein
12	<i>Os02g0813350</i>	<i>LOC_Os02g56840</i>	34833967-34835972	OsFBX70 - F-box domain containing protein
13	<i>Os02g0813500</i>	<i>LOC_Os02g56850</i>	34837853-34843851	glutathione reductase
14	<i>Os02g0813600</i>	<i>LOC_Os02g56860</i>	34853787-34855494	3-ketoacyl-CoA synthase
15	<i>None</i>	<i>LOC_Os02g56870</i>	34862140-34861776	DEFL38 - Defensin and Defensin-like DEFL family
16	<i>Os02g0813800</i>	<i>LOC_Os02g56880</i>	34862555-34872880	transcriptional corepressor LEUNIG
17	<i>None</i>	<i>LOC_Os02g56890</i>	34877844-34877599	CXXXC10 - Cysteine-rich protein with paired CXXXC motifs precursor
18	<i>Os02g0814000</i>	<i>LOC_Os02g56900</i>	34879586-34880996	thioredoxin family protein
19	<i>Os02g0814100</i>	<i>LOC_Os02g56910</i>	34883096-34885449	lecithine cholesterol acyltransferase
20	<i>Os02g0814200</i>	<i>LOC_Os02g56920</i>	34889675-34893873	WAX2
21	<i>Os02g0814700</i>	<i>LOC_Os02g56960</i>	34911047-34913456	ribosomal protein
22	<i>Os02g0814800</i>	<i>LOC_Os02g56970</i>	34913714-34915475	uncharacterized protein yqjG
23	<i>Os02g0814900</i>	<i>LOC_Os02g56980</i>	34916323-34917986	cytidyltransferase domain containing protein
24	<i>Os02g0815000</i>	<i>LOC_Os02g56990</i>	34918065-34919918	ribosomal protein L37
25	<i>Os02g0815100</i>	<i>LOC_Os02g57000</i>	34920542-34921736	C2 domain containing protein

26	<i>Os02g0815200</i>	<i>LOC_Os02g57010</i>	34922504-34924759	RNA recognition motif containing protein
27	<i>Os02g0815300</i>	<i>LOC_Os02g57020</i>	34925371-34926093	YCF37
28	<i>Os02g0815500</i>	<i>LOC_Os02g57040</i>	34930323-34934022	dehydrogenase
29	<i>Os02g0815600</i>	<i>LOC_Os02g57050</i>	34934560-34936977	diphthamide biosynthesis protein
30	<i>Os02g0815700</i>	<i>LOC_Os02g57060</i>	34937314-34941399	OsCttP2 - Putative C-terminal processing peptidase homologue
31	<i>Os02g0815800</i>	<i>LOC_Os02g57070</i>	34941327-34944075	3-5 exoribonuclease CSL4
32	<i>Os02g0815900</i>	<i>LOC_Os02g57080</i>	34945082-34952009	serine/threonine-protein kinase

Table S6. SNP information in 34.5-35.2Mb candidate region for FLW

MSU ID	Gene ID	SNP Location	Reference	Alternative	Region	Variation type
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34741992	G	T	upstream	
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34742385	C	G	upstream	
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34742482	A	T	upstream	
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34742671	T	C	exonic	
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34742674	C	G	exonic	
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34742741	T	A	intronic	
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34743982	T	A	downstream	
<i>LOC_Os02g56680</i>	<i>Os02g0811400</i>	2_34744233	T	C	downstream	
<i>LOC_Os02g56690</i>	<i>Os02g0811600</i>	2_34756724	C	T	upstream	
<i>LOC_Os02g56691</i>	<i>Os02g0811600</i>	2_34756739	A	G	upstream	
<i>LOC_Os02g56692</i>	<i>Os02g0811600</i>	2_34756838	T	G	upstream	
<i>LOC_Os02g56693</i>	<i>Os02g0811600</i>	2_34756932	C	T	upstream	
<i>LOC_Os02g56694</i>	<i>Os02g0811600</i>	2_34757015	A	G	upstream	
<i>LOC_Os02g56695</i>	<i>Os02g0811600</i>	2_34757017	A	G	upstream	
<i>LOC_Os02g56696</i>	<i>Os02g0811600</i>	2_34757036	C	T	upstream	
<i>LOC_Os02g56697</i>	<i>Os02g0811600</i>	2_34757187	A	G	upstream	
<i>LOC_Os02g56698</i>	<i>Os02g0811600</i>	2_34757227	C	G	upstream	
<i>LOC_Os02g56699</i>	<i>Os02g0811600</i>	2_34757255	T	C	upstream	
<i>LOC_Os02g56700</i>	<i>Os02g0811600</i>	2_34757256	G	A	upstream	
<i>LOC_Os02g56701</i>	<i>Os02g0811600</i>	2_34757263	A	T	upstream	
<i>LOC_Os02g56702</i>	<i>Os02g0811600</i>	2_34757518	C	T	upstream	
<i>LOC_Os02g56690</i>	<i>Os02g0811600</i>	2_34758013	T	A	intronic	
<i>LOC_Os02g56700</i>	<i>Os02g0811800</i>	2_34766110	T	C	exonic	
<i>LOC_Os02g56700</i>	<i>Os02g0811800</i>	2_34766146	C	T	exonic	
<i>LOC_Os02g56700</i>	<i>Os02g0811800</i>	2_34766191	A	G	exonic	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34770862	G	T	exonic	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34770924	A	C	intronic	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34770943	T	C	intronic	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771083	C	T	exonic	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771134	A	G	UTR3	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771214	T	A	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771234	A	G	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771290	C	T	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771422	A	G	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771463	T	A	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771576	C	T	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771603	G	A	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771647	C	T	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771691	T	C	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34771755	G	A	downstream	
<i>LOC_Os02g56720</i>	<i>Os02g0812000</i>	2_34772118	C	T	downstream	
<i>LOC_Os02g56740</i>	<i>Os02g0812400</i>	2_34783226	C	T	upstream	
<i>LOC_Os02g56740</i>	<i>Os02g0812400</i>	2_34783281	G	A	upstream	
<i>LOC_Os02g56740</i>	<i>Os02g0812400</i>	2_34783388	T	C	upstream	

LOC_Os02g56740	Os02g0812400	2_34783577	G	C	upstream
LOC_Os02g56740	Os02g0812400	2_34783778	A	G	upstream
LOC_Os02g56740	Os02g0812400	2_34783805	C	T	upstream
LOC_Os02g56740	Os02g0812400	2_34783899	G	A	upstream
LOC_Os02g56740	Os02g0812400	2_34783927	G	A	upstream
LOC_Os02g56740	Os02g0812400	2_34783936	T	A	upstream
LOC_Os02g56740	Os02g0812400	2_34783997	C	T	upstream
LOC_Os02g56740	Os02g0812400	2_34784022	C	G	upstream
LOC_Os02g56740	Os02g0812400	2_34784065	C	T	upstream
LOC_Os02g56740	Os02g0812400	2_34784617	G	A	exonic
LOC_Os02g56740	Os02g0812400	2_34784688	C	T	exonic
LOC_Os02g56740	Os02g0812400	2_34784783	A	G	intronic
LOC_Os02g56740	Os02g0812400	2_34784820	A	G	intronic
LOC_Os02g56740	Os02g0812400	2_34784920	T	G	intronic
LOC_Os02g56740	Os02g0812400	2_34785330	C	T	exonic
LOC_Os02g56740	Os02g0812400	2_34785364	T	C	exonic
LOC_Os02g56740	Os02g0812400	2_34785444	G	A	exonic
LOC_Os02g56740	Os02g0812400	2_34785512	A	T	intronic
LOC_Os02g56740	Os02g0812400	2_34785801	A	G	intronic
LOC_Os02g56740	Os02g0812400	2_34785995	A	G	exonic
LOC_Os02g56740	Os02g0812400	2_34786098	G	T	intronic
LOC_Os02g56740	Os02g0812400	2_34787139	A	G	intronic
LOC_Os02g56740	Os02g0812400	2_34787881	T	C	intronic
LOC_Os02g56740	Os02g0812400	2_34787894	T	C	intronic
LOC_Os02g56740	Os02g0812400	2_34788348	C	T	intronic
LOC_Os02g56740	Os02g0812400	2_34788369	A	T	intronic
LOC_Os02g56740	Os02g0812400	2_34788411	C	G	intronic
LOC_Os02g56740	Os02g0812400	2_34788474	A	C	intronic
LOC_Os02g56740	Os02g0812400	2_34788709	C	T	intronic
LOC_Os02g56740	Os02g0812400	2_34788784	C	G	intronic
LOC_Os02g56740	Os02g0812400	2_34788835	A	C	intronic
LOC_Os02g56740	Os02g0812400	2_34788864	T	A	intronic
LOC_Os02g56740	Os02g0812400	2_34789050	A	T	intronic
LOC_Os02g56740	Os02g0812400	2_34789358	G	A	intronic
LOC_Os02g56740	Os02g0812400	2_34789361	G	A	intronic
LOC_Os02g56740	Os02g0812400	2_34789636	C	G	exonic
LOC_Os02g56740	Os02g0812400	2_34790439	T	C	intronic
LOC_Os02g56740	Os02g0812400	2_34790479	A	G	intronic
LOC_Os02g56740	Os02g0812400	2_34790789	C	T	intronic
LOC_Os02g56740	Os02g0812400	2_34791152	C	T	intronic
LOC_Os02g56740	Os02g0812400	2_34791393	G	T	intronic
LOC_Os02g56740	Os02g0812400	2_34791395	G	T	intronic
LOC_Os02g56740	Os02g0812400	2_34791432	G	T	intronic
LOC_Os02g56740	Os02g0812400	2_34792163	T	C	exonic
LOC_Os02g56740	Os02g0812400	2_34792275	T	A	intronic
LOC_Os02g56740	Os02g0812400	2_34793112	C	A	UTR3

LOC_Os02g56750	Os02g0812500	2_34794308	T	A	UTR5	
LOC_Os02g56750	Os02g0812500	2_34795012	G	C	intronic	
LOC_Os02g56750	Os02g0812500	2_34795072	T	C	intronic	
LOC_Os02g56750	Os02g0812500	2_34795259	G	C	intronic	
LOC_Os02g56750	Os02g0812500	2_34795309	T	C	intronic	
LOC_Os02g56750	Os02g0812500	2_34795437	C	T	intronic	
LOC_Os02g56750	Os02g0812500	2_34796411	G	T	UTR3	
LOC_Os02g56750	Os02g0812500	2_34796440	G	C	UTR3	
LOC_Os02g56750	Os02g0812500	2_34796640	A	G	downstream	
LOC_Os02g56750	Os02g0812500	2_34796652	T	C	downstream	
LOC_Os02g56750	Os02g0812500	2_34796776	C	T	downstream	
LOC_Os02g56750	Os02g0812500	2_34796780	G	A	downstream	
LOC_Os02g56750	Os02g0812500	2_34796861	T	C	downstream	
LOC_Os02g56750	Os02g0812500	2_34797004	C	T	downstream	
LOC_Os02g56750	Os02g0812500	2_34797007	C	T	downstream	
LOC_Os02g56750	Os02g0812500	2_34797169	G	A	downstream	
LOC_Os02g56750	Os02g0812500	2_34797180	A	G	downstream	
LOC_Os02g56750	Os02g0812500	2_34797243	G	A	downstream	
LOC_Os02g56760	Os02g0812600	2_34798618	C	G	intronic	
LOC_Os02g56760	Os02g0812600	2_34798854	A	C	intronic	
LOC_Os02g56760	Os02g0812600	2_34798895	T	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34798977	T	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34799006	G	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34799092	G	T	intronic	
LOC_Os02g56760	Os02g0812600	2_34799113	A	T	intronic	
LOC_Os02g56760	Os02g0812600	2_34799418	C	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34799532	A	C	intronic	
LOC_Os02g56760	Os02g0812600	2_34799607	A	C	intronic	
LOC_Os02g56760	Os02g0812600	2_34799617	C	T	intronic	
LOC_Os02g56760	Os02g0812600	2_34799877	T	C	exonic	synonymous
LOC_Os02g56760	Os02g0812600	2_34799960	A	G	exonic	nonsynonymous
LOC_Os02g56760	Os02g0812600	2_34800034	G	T	exonic	nonsynonymous
LOC_Os02g56760	Os02g0812600	2_34800081	T	C	exonic	synonymous
LOC_Os02g56760	Os02g0812600	2_34800278	G	A	exonic	synonymous
LOC_Os02g56760	Os02g0812600	2_34800452	T	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34800604	C	G	intronic	
LOC_Os02g56760	Os02g0812600	2_34800719	C	G	intronic	
LOC_Os02g56760	Os02g0812600	2_34800733	G	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34800741	T	C	intronic	
LOC_Os02g56760	Os02g0812600	2_34800789	C	T	intronic	
LOC_Os02g56760	Os02g0812600	2_34800799	G	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34800812	T	G	intronic	
LOC_Os02g56760	Os02g0812600	2_34800888	C	A	intronic	

LOC_Os02g56760	Os02g0812600	2_34801004	G	A	intronic	
LOC_Os02g56760	Os02g0812600	2_34801161	T	C	exonic	synonymou s
LOC_Os02g56760	Os02g0812600	2_34801168	A	C	exonic	synonymou s
LOC_Os02g56760	Os02g0812600	2_34801266	A	C	exonic	synonymou s
LOC_Os02g56770	Os02g0812700	2_34814272	G	A	intronic	
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LOC_Os02g56770	Os02g0812700	2_34814328	T	C	UTR3	
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LOC_Os02g56810	Os02g0813083	2_34819500	G	A	exonic
LOC_Os02g56820	Os02g0813166	2_34824327	A	G	upstream
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LOC_Os02g56840	Os02g0813350	2_34833904	A	C	upstream
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LOC_Os02g56920	Os02g0814200	2_34889018	G	T	downstream
LOC_Os02g56920	Os02g0814200	2_34889026	T	C	downstream

LOC_Os02g56920	Os02g0814200	2_34889057	C	T	downstream
LOC_Os02g56920	Os02g0814200	2_34889071	T	A	downstream
LOC_Os02g56920	Os02g0814200	2_34889126	C	T	downstream
LOC_Os02g56920	Os02g0814200	2_34889128	C	T	downstream
LOC_Os02g56920	Os02g0814200	2_34889269	C	T	downstream
LOC_Os02g56920	Os02g0814200	2_34889417	C	T	downstream
LOC_Os02g56920	Os02g0814200	2_34889429	G	A	downstream
LOC_Os02g56920	Os02g0814200	2_34889460	C	A	downstream
LOC_Os02g56920	Os02g0814200	2_34889619	G	A	downstream
LOC_Os02g56920	Os02g0814200	2_34890123	G	A	intronic
LOC_Os02g56920	Os02g0814200	2_34890145	C	T	intronic
LOC_Os02g56920	Os02g0814200	2_34890393	A	G	intronic
LOC_Os02g56920	Os02g0814200	2_34890763	G	A	exonic
LOC_Os02g56920	Os02g0814200	2_34891312	C	T	intronic
LOC_Os02g56920	Os02g0814200	2_34891437	C	T	intronic
LOC_Os02g56920	Os02g0814200	2_34891457	G	A	intronic
LOC_Os02g56920	Os02g0814200	2_34891534	G	A	intronic
LOC_Os02g56920	Os02g0814200	2_34891596	G	A	intronic
LOC_Os02g56920	Os02g0814200	2_34892656	G	A	exonic
LOC_Os02g56920	Os02g0814200	2_34893339	T	C	intronic
LOC_Os02g56920	Os02g0814200	2_34893344	G	A	intronic
LOC_Os02g56920	Os02g0814200	2_34893485	A	C	exonic
LOC_Os02g56920	Os02g0814200	2_34893738	T	G	exonic
LOC_Os02g56920	Os02g0814200	2_34893909	C	G	upstream
LOC_Os02g56920	Os02g0814200	2_34893924	C	A	upstream
LOC_Os02g56920	Os02g0814200	2_34894120	T	C	upstream
LOC_Os02g56920	Os02g0814200	2_34894397	T	C	upstream
LOC_Os02g56920	Os02g0814200	2_34894441	A	C	upstream
LOC_Os02g56920	Os02g0814200	2_34894475	A	G	upstream
LOC_Os02g56920	Os02g0814200	2_34894547	A	G	upstream
LOC_Os02g56920	Os02g0814200	2_34894644	T	C	upstream
LOC_Os02g56920	Os02g0814200	2_34894662	T	C	upstream
LOC_Os02g56920	Os02g0814200	2_34894794	G	T	upstream
LOC_Os02g56960	Os02g0814700	2_34912429	G	T	intronic
LOC_Os02g56960	Os02g0814700	2_34912592	A	G	intronic
LOC_Os02g56960	Os02g0814700	2_34912977	C	T	intronic
LOC_Os02g56960	Os02g0814700	2_34913411	G	C	UTR3
LOC_Os02g56960	Os02g0814700	2_34913436	A	G	UTR3
LOC_Os02g56970	Os02g0814800	2_34913741	A	C	UTR5
LOC_Os02g56970	Os02g0814800	2_34914583	G	T	intronic
LOC_Os02g56970	Os02g0814800	2_34914674	C	T	intronic
LOC_Os02g56970	Os02g0814800	2_34914699	A	G	intronic
LOC_Os02g56970	Os02g0814800	2_34914839	A	C	exonic
LOC_Os02g56980	Os02g0814900	2_34916538	T	C	exonic
LOC_Os02g56980	Os02g0814900	2_34916620	G	A	exonic
LOC_Os02g56990	Os02g0815000	2_34918769	T	C	intronic

LOC_Os02g56990	Os02g0815000	2_34919103	G	A	intronic
LOC_Os02g56990	Os02g0815000	2_34919113	G	C	intronic
LOC_Os02g56990	Os02g0815000	2_34919216	A	G	intronic
LOC_Os02g56990	Os02g0815000	2_34919467	G	T	intronic
LOC_Os02g56990	Os02g0815000	2_34919721	G	A	UTR3
LOC_Os02g57010	Os02g0815200	2_34923193	T	C	intronic
LOC_Os02g57010	Os02g0815200	2_34923463	C	T	intronic
LOC_Os02g57040	Os02g0815500	2_34930470	A	G	intronic
LOC_Os02g57040	Os02g0815500	2_34931185	G	A	intronic
LOC_Os02g57040	Os02g0815500	2_34931234	T	C	intronic
LOC_Os02g57040	Os02g0815500	2_34931353	T	C	intronic
LOC_Os02g57040	Os02g0815500	2_34932025	C	A	intronic
LOC_Os02g57040	Os02g0815500	2_34933329	A	C	intronic
LOC_Os02g57040	Os02g0815500	2_34933339	C	T	intronic
LOC_Os02g57040	Os02g0815500	2_34933471	C	T	intronic
LOC_Os02g57040	Os02g0815500	2_34933663	A	T	intronic
LOC_Os02g57040	Os02g0815500	2_34933900	G	A	UTR3
LOC_Os02g57050	Os02g0815600	2_34934829	A	G	intronic
LOC_Os02g57050	Os02g0815600	2_34934889	C	A	intronic
LOC_Os02g57050	Os02g0815600	2_34935044	T	C	intronic
LOC_Os02g57050	Os02g0815600	2_34935194	G	A	intronic
LOC_Os02g57050	Os02g0815600	2_34935226	A	G	intronic
LOC_Os02g57050	Os02g0815600	2_34935248	A	T	intronic
LOC_Os02g57050	Os02g0815600	2_34935733	C	G	exonic
LOC_Os02g57050	Os02g0815600	2_34935771	G	A	exonic
LOC_Os02g57050	Os02g0815600	2_34936153	G	A	exonic
LOC_Os02g57050	Os02g0815600	2_34936209	G	A	exonic
LOC_Os02g57050	Os02g0815600	2_34936329	C	T	exonic
LOC_Os02g57060	Os02g0815700	2_34937546	C	T	intronic
LOC_Os02g57060	Os02g0815700	2_34938131	G	A	exonic
LOC_Os02g57060	Os02g0815700	2_34938215	C	T	exonic
LOC_Os02g57060	Os02g0815700	2_34938460	C	T	exonic
LOC_Os02g57060	Os02g0815700	2_34938470	A	G	exonic
LOC_Os02g57060	Os02g0815700	2_34938638	C	A	intronic
LOC_Os02g57060	Os02g0815700	2_34938739	G	T	intronic
LOC_Os02g57060	Os02g0815700	2_34939293	C	T	exonic
LOC_Os02g57060	Os02g0815700	2_34939509	C	T	intronic
LOC_Os02g57060	Os02g0815700	2_34939632	G	T	intronic
LOC_Os02g57060	Os02g0815700	2_34941190	A	T	UTR3
LOC_Os02g57060	Os02g0815700	2_34941191	T	A	UTR3
LOC_Os02g57060	Os02g0815700	2_34941211	C	G	UTR3
LOC_Os02g57060	Os02g0815700	2_34941245	T	G	UTR3
LOC_Os02g57060	Os02g0815700	2_34941267	A	G	UTR3
LOC_Os02g57070	Os02g0815800	2_34942095	G	A	exonic
LOC_Os02g57070	Os02g0815800	2_34942994	T	C	intronic
LOC_Os02g57070	Os02g0815800	2_34943062	G	T	intronic

<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943106	T	A	intronic
<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943107	A	T	intronic
<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943172	T	C	intronic
<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943400	C	T	intronic
<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943466	C	T	intronic
<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943572	C	T	intronic
<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943576	G	A	intronic
<i>LOC_Os02g57070</i>	<i>Os02g0815800</i>	2_34943606	C	T	intronic
<i>LOC_Os02g57080</i>	<i>Os02g0815900</i>	2_34946013	C	T	exonic
<i>LOC_Os02g57080</i>	<i>Os02g0815900</i>	2_34947002	G	A	exonic
<i>LOC_Os02g57080</i>	<i>Os02g0815900</i>	2_34948707	G	A	exonic
<i>LOC_Os02g57080</i>	<i>Os02g0815900</i>	2_34952741	G	A	upstream
<i>LOC_Os02g57080</i>	<i>Os02g0815900</i>	2_34952859	T	A	upstream
<i>LOC_Os02g57080</i>	<i>Os02g0815900</i>	2_34952953	C	T	upstream
<i>LOC_Os02g57080</i>	<i>Os02g0815900</i>	2_34952987	C	T	upstream

Table S7. Candidate gene annotation in the LD region 20.3-20.6 Mb associated with FLL and FLR

Number	Gene ID	MSU ID	Position (bp)	Annotation
1	<i>Os05g0416400</i>	<i>LOC_Os05g34380</i>	20379467-20381121	cytochrome P450
2	<i>Os05g0416500</i>	<i>LOC_Os05g34390</i>	20384039-20390785	protein kinase domain containing protein
3	<i>Os05g0417000</i>	<i>LOC_Os05g34450</i>	20417514-20418507	DUF260 domain containing protein
4	<i>Os05g0417100</i>	<i>LOC_Os05g34460</i>	20433366-20437932	OsDegp7 - Putative Deg protease homologue
5	<i>Os05g0417800</i>	<i>LOC_Os05g34520</i>	20461728-20467798	ulp1 protease family protein
6	<i>Os05g0417900</i>	<i>LOC_Os05g34530</i>	20471167-20471460	auxin-inducible protein
7	<i>Os05g0418000</i>	<i>LOC_Os05g34540</i>	20477376-20483599	rab GDP dissociation inhibitor alpha
8	<i>Os05g0418100</i>	<i>LOC_Os05g34550</i>	20484964-20490119	MLO domain containing protein
9	<i>Os05g0418500</i>	<i>LOC_Os05g34570</i>	20498729-20500703	pentatricopeptide
10	<i>Os05g0418800</i>	<i>LOC_Os05g34600</i>	20516577-20519072	no apical meristem protein
11	<i>Os05g0419000</i>	<i>LOC_Os05g34630</i>	20536382-20539797	hydrolase, alpha/beta fold family domain containing protein
12	<i>Os05g0419100</i>	<i>LOC_Os05g34640</i>	20542371-20546991	PHD finger protein
13	<i>Os05g0419200</i>	<i>LOC_Os05g34650</i>	20548402-20553184	DUF647 domain containing protein

Table S8. SNP information in 20.3-20.6 Mb associated with FLL and FLR

MSU ID	Gene ID	SNP Location	Reference	Alternative	Region	Variation type
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20378488	T	C	upstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20379974	T	A	intronic	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20380333	T	C	exonic	nonsynonymous
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20380446	A	G	exonic	synonymous
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20380460	A	G	exonic	nonsynonymous
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20380862	C	T	exonic	nonsynonymous
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381034	C	T	exonic	synonymous
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381117	C	T	exonic	nonsynonymous
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381221	C	T	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381243	T	C	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381264	A	G	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381567	C	T	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381621	T	C	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381631	C	T	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381919	G	A	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20381943	G	A	downstream	
<i>LOC_Os05g34380</i>	<i>Os05g0416400</i>	5_20382082	C	G	downstream	
<i>LOC_Os05g34450</i>	<i>Os05g0417000</i>	5_20418989	G	A	upstream	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20432746	G	A	upstream	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20433009	T	C	upstream	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20433030	A	G	upstream	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20434078	T	G	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20434133	A	G	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20434181	T	G	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20434346	C	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20434409	A	G	exonic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20434800	T	C	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20434873	A	G	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20435032	C	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20435048	A	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20435196	A	G	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20435364	T	C	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20435690	C	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20436036	G	A	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20436358	A	G	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20436385	C	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20436587	C	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20436630	C	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20436684	A	C	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20436871	C	G	exonic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20437009	C	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20437119	A	T	intronic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20437214	A	G	exonic	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20437498	C	T	UTR3	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20437508	C	T	UTR3	
<i>LOC_Os05g34460</i>	<i>Os05g0417100</i>	5_20437782	A	G	UTR3	

LOC_Os05g34530	Os05g0417900	5_20470248	G	A	downstream
LOC_Os05g34530	Os05g0417900	5_20470271	A	T	downstream
LOC_Os05g34530	Os05g0417900	5_20470272	G	A	downstream
LOC_Os05g34530	Os05g0417900	5_20470353	G	A	downstream
LOC_Os05g34530	Os05g0417900	5_20470376	T	C	downstream
LOC_Os05g34530	Os05g0417900	5_20470534	A	C	downstream
LOC_Os05g34530	Os05g0417900	5_20470703	A	G	downstream
LOC_Os05g34530	Os05g0417900	5_20470781	A	G	downstream
LOC_Os05g34530	Os05g0417900	5_20470960	A	C	downstream
LOC_Os05g34530	Os05g0417900	5_20471019	G	C	downstream
LOC_Os05g34530	Os05g0417900	5_20471094	G	A	downstream
LOC_Os05g34530	Os05g0417900	5_20471839	C	A	upstream
LOC_Os05g34530	Os05g0417900	5_20471977	A	G	upstream
LOC_Os05g34530	Os05g0417900	5_20471999	G	T	upstream
LOC_Os05g34530	Os05g0417900	5_20472254	T	A	upstream
LOC_Os05g34530	Os05g0417900	5_20472297	G	A	upstream
LOC_Os05g34530	Os05g0417900	5_20472420	G	A	upstream
LOC_Os05g34540	Os05g0418000	5_20476474	C	T	upstream
LOC_Os05g34540	Os05g0418000	5_20476558	G	A	upstream
LOC_Os05g34540	Os05g0418000	5_20476570	C	T	upstream
LOC_Os05g34540	Os05g0418000	5_20476671	G	A	upstream
LOC_Os05g34540	Os05g0418000	5_20476875	C	T	upstream
LOC_Os05g34540	Os05g0418000	5_20476898	G	A	upstream
LOC_Os05g34540	Os05g0418000	5_20476905	C	T	upstream
LOC_Os05g34540	Os05g0418000	5_20477930	T	G	intronic
LOC_Os05g34540	Os05g0418000	5_20479623	C	T	intronic
LOC_Os05g34540	Os05g0418000	5_20479665	T	A	intronic
LOC_Os05g34540	Os05g0418000	5_20479779	A	G	intronic
LOC_Os05g34540	Os05g0418000	5_20480235	C	T	exonic
LOC_Os05g34540	Os05g0418000	5_20480238	T	C	exonic
LOC_Os05g34540	Os05g0418000	5_20480502	G	T	intronic
LOC_Os05g34540	Os05g0418000	5_20480595	T	A	intronic
LOC_Os05g34540	Os05g0418000	5_20480710	T	C	intronic
LOC_Os05g34540	Os05g0418000	5_20480754	G	C	intronic
LOC_Os05g34540	Os05g0418000	5_20481773	C	T	exonic
LOC_Os05g34540	Os05g0418000	5_20481830	G	A	intronic
LOC_Os05g34540	Os05g0418000	5_20481895	A	G	exonic
LOC_Os05g34540	Os05g0418000	5_20481991	A	G	intronic
LOC_Os05g34540	Os05g0418000	5_20482305	T	C	intronic
LOC_Os05g34540	Os05g0418000	5_20482502	T	G	intronic
LOC_Os05g34540	Os05g0418000	5_20483013	A	T	intronic
LOC_Os05g34540	Os05g0418000	5_20483165	C	T	intronic
LOC_Os05g34540	Os05g0418000	5_20483442	T	C	UTR3
LOC_Os05g34540	Os05g0418000	5_20483757	C	T	downstream
LOC_Os05g34540	Os05g0418000	5_20483844	A	T	downstream
LOC_Os05g34540	Os05g0418000	5_20483957	T	C	downstream
LOC_Os05g34550	Os05g0418100	5_20484701	G	A	downstream
LOC_Os05g34550	Os05g0418100	5_20484738	A	G	downstream

LOC_Os05g34550	Os05g0418100	5_20485258	A	G	UTR3	
LOC_Os05g34550	Os05g0418100	5_20485366	T	A	UTR3	
LOC_Os05g34550	Os05g0418100	5_20485378	C	T	UTR3	
LOC_Os05g34550	Os05g0418100	5_20485399	C	T	UTR3	
LOC_Os05g34550	Os05g0418100	5_20485926	T	C	UTR3	
LOC_Os05g34550	Os05g0418100	5_20485982	G	A	intronic	
LOC_Os05g34550	Os05g0418100	5_20486258	G	T	intronic	
LOC_Os05g34550	Os05g0418100	5_20486522	G	T	intronic	
LOC_Os05g34550	Os05g0418100	5_20486572	T	C	intronic	
LOC_Os05g34550	Os05g0418100	5_20486861	A	G	intronic	
LOC_Os05g34550	Os05g0418100	5_20487255	G	A	intronic	
LOC_Os05g34550	Os05g0418100	5_20487629	G	T	intronic	
LOC_Os05g34550	Os05g0418100	5_20487962	G	A	UTR3	
LOC_Os05g34550	Os05g0418100	5_20488369	T	G	UTR3	
LOC_Os05g34550	Os05g0418100	5_20488405	G	A	UTR3	
LOC_Os05g34550	Os05g0418100	5_20488515	A	C	UTR3	
LOC_Os05g34550	Os05g0418100	5_20488692	T	C	UTR3	
LOC_Os05g34550	Os05g0418100	5_20488939	C	A	exonic	
LOC_Os05g34550	Os05g0418100	5_20489533	T	C	intronic	
LOC_Os05g34550	Os05g0418100	5_20489581	C	T	intronic	
LOC_Os05g34550	Os05g0418100	5_20489924	A	T	intronic	
LOC_Os05g34550	Os05g0418100	5_20490138	G	C	upstream	
LOC_Os05g34550	Os05g0418100	5_20490805	T	C	upstream	
LOC_Os05g34570	Os05g0418500	5_20497932	T	C	downstream	
LOC_Os05g34570	Os05g0418500	5_20498064	G	A	downstream	
LOC_Os05g34570	Os05g0418500	5_20498449	A	G	downstream	
LOC_Os05g34570	Os05g0418500	5_20498475	G	C	downstream	
LOC_Os05g34570	Os05g0418500	5_20498835	G	C	UTR3	
LOC_Os05g34570	Os05g0418500	5_20499975	A	G	exonic	
LOC_Os05g34600	Os05g0418800	5_20515645	A	G	downstream	
LOC_Os05g34600	Os05g0418800	5_20515662	A	G	downstream	
LOC_Os05g34600	Os05g0418800	5_20515680	A	T	downstream	
LOC_Os05g34600	Os05g0418800	5_20515733	C	T	downstream	
LOC_Os05g34600	Os05g0418800	5_20515734	C	T	downstream	
LOC_Os05g34600	Os05g0418800	5_20515763	C	T	downstream	
LOC_Os05g34600	Os05g0418800	5_20515859	G	A	downstream	
LOC_Os05g34600	Os05g0418800	5_20516161	T	C	downstream	
LOC_Os05g34600	Os05g0418800	5_20516261	T	A	downstream	
LOC_Os05g34600	Os05g0418800	5_20516318	A	G	downstream	
LOC_Os05g34600	Os05g0418800	5_20516436	C	T	downstream	
LOC_Os05g34600	Os05g0418800	5_20517660	T	C	intronic	
LOC_Os05g34600	Os05g0418800	5_20518209	A	G	intronic	
LOC_Os05g34600	Os05g0418800	5_20518215	T	C	intronic	
LOC_Os05g34600	Os05g0418800	5_20518230	A	G	intronic	
LOC_Os05g34600	Os05g0418800	5_20518499	T	A	exonic	nonsynonymous
LOC_Os05g34630	Os05g0419000	5_20535489	C	T	downstream	
LOC_Os05g34630	Os05g0419000	5_20535628	T	C	downstream	
LOC_Os05g34630	Os05g0419000	5_20535643	C	T	downstream	

LOC_Os05g34630	Os05g0419000	5_20535695	T	C	downstream
LOC_Os05g34630	Os05g0419000	5_20535718	A	G	downstream
LOC_Os05g34630	Os05g0419000	5_20535757	C	T	downstream
LOC_Os05g34630	Os05g0419000	5_20535796	A	C	downstream
LOC_Os05g34630	Os05g0419000	5_20535840	C	T	downstream
LOC_Os05g34630	Os05g0419000	5_20536241	A	T	downstream
LOC_Os05g34630	Os05g0419000	5_20536530	T	G	UTR3
LOC_Os05g34630	Os05g0419000	5_20536631	T	C	UTR3
LOC_Os05g34630	Os05g0419000	5_20536638	A	T	UTR3
LOC_Os05g34630	Os05g0419000	5_20536881	G	T	exonic
LOC_Os05g34630	Os05g0419000	5_20537310	G	A	intronic
LOC_Os05g34630	Os05g0419000	5_20537615	A	G	intronic
LOC_Os05g34630	Os05g0419000	5_20537617	C	T	intronic
LOC_Os05g34630	Os05g0419000	5_20537627	C	T	intronic
LOC_Os05g34630	Os05g0419000	5_20537644	C	T	intronic
LOC_Os05g34630	Os05g0419000	5_20537708	A	G	intronic
LOC_Os05g34630	Os05g0419000	5_20537717	G	A	intronic
LOC_Os05g34630	Os05g0419000	5_20537761	A	G	intronic
LOC_Os05g34630	Os05g0419000	5_20537780	G	A	intronic
LOC_Os05g34630	Os05g0419000	5_20537808	G	A	intronic
LOC_Os05g34630	Os05g0419000	5_20538467	T	C	intronic
LOC_Os05g34630	Os05g0419000	5_20538655	C	T	intronic
LOC_Os05g34630	Os05g0419000	5_20538798	C	A	intronic
LOC_Os05g34630	Os05g0419000	5_20538919	A	G	intronic
LOC_Os05g34630	Os05g0419000	5_20540056	T	A	upstream
LOC_Os05g34630	Os05g0419000	5_20540167	G	A	upstream
LOC_Os05g34630	Os05g0419000	5_20540174	T	C	upstream
LOC_Os05g34630	Os05g0419000	5_20540294	A	C	upstream
LOC_Os05g34630	Os05g0419000	5_20540312	T	C	upstream
LOC_Os05g34630	Os05g0419000	5_20540329	A	C	upstream
LOC_Os05g34630	Os05g0419000	5_20540361	A	G	upstream
LOC_Os05g34630	Os05g0419000	5_20540420	A	C	upstream
LOC_Os05g34630	Os05g0419000	5_20540492	T	C	upstream
LOC_Os05g34630	Os05g0419000	5_20540503	A	T	upstream
LOC_Os05g34630	Os05g0419000	5_20540767	T	C	upstream
LOC_Os05g34630	Os05g0419000	5_20540793	C	T	upstream
LOC_Os05g34640	Os05g0419100	5_20543169	T	G	intronic
LOC_Os05g34640	Os05g0419100	5_20543411	C	T	intronic
LOC_Os05g34640	Os05g0419100	5_20544908	C	T	intronic
LOC_Os05g34640	Os05g0419100	5_20544958	C	T	intronic
LOC_Os05g34640	Os05g0419100	5_20544980	T	C	intronic
LOC_Os05g34640	Os05g0419100	5_20545683	A	C	intronic
LOC_Os05g34640	Os05g0419100	5_20545769	A	G	intronic
LOC_Os05g34640	Os05g0419100	5_20545799	G	A	intronic
LOC_Os05g34640	Os05g0419100	5_20546172	A	G	intronic
LOC_Os05g34640	Os05g0419100	5_20546268	C	T	intronic
LOC_Os05g34640	Os05g0419100	5_20546460	G	A	intronic
LOC_Os05g34640	Os05g0419100	5_20547229	A	G	downstream

<i>LOC_Os05g34640</i>	<i>Os05g0419100</i>	5_20547347	G	T	downstream
<i>LOC_Os05g34640</i>	<i>Os05g0419100</i>	5_20547372	G	A	downstream
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548111	G	A	downstream
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548132	T	C	downstream
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548361	A	T	downstream
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548606	A	G	UTR3
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548680	C	G	UTR3
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548693	C	T	intronic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548891	C	T	UTR3
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20548903	A	T	UTR3
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20549117	G	C	intronic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20549464	T	C	exonic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20551103	T	C	intronic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20551255	A	C	intronic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20551787	A	T	intronic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20551884	A	G	intronic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20552442	T	A	intronic
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20553973	T	A	upstream
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20554039	T	C	upstream
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20554133	A	G	upstream
<i>LOC_Os05g34650</i>	<i>Os05g0419200</i>	5_20554176	A	G	upstream

Table S9. Haplotype analysis of three candidate genes in 3K rice genome.

Gene	Haplot ype	SNPs	Total number of accession s	The accession number of different subgroups	Flag Leaf Length(cm)	Flag Leaf Width(cm)
<i>LOC_Os02g56760</i>	Hap1	AACGGCCAAC TGATAGTGT TATCCAA	868	Aus: 69; Bas: 5; GJ: 121; XI: 652; admix: 21	32.518	1.433
	Hap2	GGCGGCCAACTGACGGCGATATCCAA	419	Aus: 1; GJ: 7; XI: 402; admix: 9	31.616	1.414
	Hap3	GGAGGCCAACTGATAGTATCCCTTCA	232	Aus: 1; Bas: 1; GJ: 229; admix: 1	29.368	1.534
	Hap4	GGAGGCCAACTGATAGTATCCTTTCA	201	Aus: 2; GJ: 197; admix: 2	28.748	1.543
	Hap5	AACGGCCAAC TGATATTGT TATCCAA	198	GJ: 6; XI: 189; admix: 3	28.964	1.445
	Hap6	AACGGCCAAC GTTAGTGT TATCCAA	132	Aus: 78; Bas: 11; XI: 28; admix: 15	31.953	1.337
<i>LOC_Os05g34380</i>	Hap1	GCTGGTCACAATGCGCGGGTTC	646	Aus: 9; GJ: 3; XI: 623; admix: 11	31.750	1.403
	Hap2	CCGGGTCAAACCACGTGAACCT	398	Aus: 5; Bas: 46; GJ: 324; XI: 7; admix: 16	28.566	1.474
	Hap3	GCTGGTCACAATGCACGGGTTC	150	GJ: 146; admix: 4	30.502	1.675
	Hap4	GCTGRTCACAATGCGCGGGTTC	150	Aus: 2; GJ: 1; XI: 145; admix: 2	31.222	1.418
	Hap5	-----ATGCGCGGGTTC	123	XI: 119; admix: 4	32.488	1.401
	Hap6	CCGGGTCAAACCACGTGAACCC	88	Bas: 16; GJ: 68; XI: 1; admix: 3	27.475	1.358
<i>LOC_Os05g34600</i>	Hap1	CCCCCGCAGGAG	606	Aus: 10; GJ: 6; XI: 576; admix: 14	31.438	1.393
	Hap2	CC-----AGGAG	153	Aus: 2; GJ: 2; XI: 148; admix: 1	30.155	1.381
	Hap3	CCCCC--AGGAG	151	Aus: 3; XI: 145; admix: 3	31.386	1.399

Hap4	TCCCTGCAGGTG	117	GJ: 101; XI: 14; admix: 2	31.357	1.655	XI:	<i>Oryza</i>
Hap5	TCCCCCCCAGTG	106	Bas: 8; GJ: 68; XI: 24; admix: 6	29.179	1.466		
Hap6	CCCC---AGGAG	104	XI: 101; admix: 3	31.843	1.402		

sativa L. indica; GJ: *Oryza sativa* L. japonica; admix: admixed subpopulation

Table S10. Gene haplotype distribution of 173 accessions

No.	Accession	FLL					FLW			
		<i>LOC_Os05g34380</i>			<i>LOC_Os05g34600</i>		<i>LOC_Os02g56760</i>			
		HapA	HapB	HapC	HapA	HapB	HapA	HapB	HapC	HapD
		3.17	0.96	-3.56	2.96	-1.78	0.12	-0.11	0.08	0.09
1	Longjing 22		✓			▲			✓	
2	Longjing 28		✓			▲		▲		
3	Longjing 27		✓			▲		▲		
4	24248	✓			✓			▲		
5	Tijin	✓			✓					✓
6	Zhongguo 91			▲		▲			✓	
7	Kangbingyueguang		✓			▲		▲		
8	Sihao 4385			▲		▲				✓
9	Nannongjing 1R	✓			✓		✓			
10	Hongmangshajing	✓				▲	✓			
11	Wanhuangdao		✓			▲		▲		
12	Xudao 3hao			▲		▲		▲		
13	Youzhiyueguang		✓			▲		▲		
14	Yuedao 68	✓			✓		✓			
15	Longdao 8hao	✓			✓			▲		
16	Longdao 6hao	✓			✓			▲		
17	Qiutianxiaoding			▲		▲		▲		
18	Zhenghan 2hao	✓				▲		▲		
19	Xiangjing 9407	✓			✓					✓
20	Nongxiang 21	✓			✓				✓	
21	Fengyouwan 8hao	✓				▲			✓	
22	Xiangwanxian 17	✓			✓			▲		

23	Yuedao 37	✓			✓		✓		
24	Sujing 353		✓			▲		▲	
25	Zhen9424			▲		▲		▲	
26	Baikenuo	✓			✓				✓
27	Diantun502xuanzao	✓			✓				✓
28	Yuedao 41	✓			✓		✓		
29	Longnuo 3hao		✓			▲		▲	
30	Mudanjiang 28		✓			▲		▲	
31	Yujing 6hao			▲		▲		▲	
32	Shengdao808			▲		▲		▲	
33	Yuedao 32	✓			✓		✓		
34	Yuedao 107	✓			✓		✓		
35	Yuedao 61	✓			✓		✓		
36	Yuedao 50	✓			✓				✓
37	Yuedao 109	✓			✓				✓
38	Yuedao 62	✓			✓		✓		
39	Yuedao 66	✓			✓				✓
40	Hongnong 5hao			▲		▲		▲	
41	Suyunuo			▲		▲		▲	
42	Shenlenuo			▲		▲		▲	
43	Hongjiaozhan	✓				▲	✓		
44	Wanjingnuo			▲		▲		▲	
45	Nongxiang26	✓			✓				✓
46	Yuedao 9	✓			✓		✓		
47	M1004	✓			✓			▲	
48	Nongxiang 25	✓			✓				✓
49	Longjing 20			▲		▲		▲	

50	Xiangchuanwuxinbaimi	✓		✓		✓	
51	Jindao 1007		▲		▲		✓
52	Zaijinjing		▲		▲	▲	
53	Malaihong	✓			▲	✓	
54	Nannongjing3786		▲		▲		✓
55	Wuyunjing 8hao		▲		▲		✓
56	Yuzhenxiang	✓		✓		▲	
57	Yuedao24(LCV18)		▲		▲	✓	
58	Yuedao 3	✓		✓		✓	
59	Yuedao 43	✓		✓		✓	
60	Yuedao 48	✓		✓			✓
61	Yuedao 49	✓		✓			✓
62	Yuedao 13	✓		✓		✓	
63	Wumangyedao		▲		▲	▲	
64	Haobuqia	✓		✓		✓	
65	Yuedao 22	✓		✓			✓
66	Dongzhengwuyunjing 21		▲		▲		✓
67	Yandao 8hao		▲		▲	▲	
68	Huaidao 11hao		▲		▲		✓
69	Nannongjing 004		▲		▲	▲	
70	Zhongzuo 93		▲		▲	▲	
71	Xudao 5hao		▲		▲	▲	
72	Digludao		▲		▲	▲	
73	Huaidao 8hao		▲		▲		✓
74	Dongzheng 1640		▲		▲		✓
75	Yanjing 8hao		▲		▲	▲	
76	Huifeng 2		▲		▲	▲	

77	Yandao 9hao		▲		▲		▲		
78	Lianjing 4hao		▲		▲				✓
79	Huifeng 1		▲		▲		▲		
80	Sihao 4280		▲		▲		▲		
81	Sihao 4330		▲		▲		▲		
82	Sihao 4259	✓			▲		▲		
83	Zhengdao 18		▲		▲		▲		
84	Jingnuo 330		▲		▲				✓
85	Zhongjing 212		▲		▲				✓
86	Wuyunjing 21hao		▲		▲		▲		
87	Huajing 6hao		▲		▲		▲		
88	Yangfujing 8hao		▲		▲		▲		
89	Zhendao 99		▲		▲		▲		
90	Ningjing 2hao		▲		▲				✓
91	Huajing 5hao	✓			▲				✓
92	Zhongjing 9677	✓			▲		▲		
93	Yangfujing 7hao		▲		▲		▲		
94	Yuedao 12	✓		✓				✓	
95	Jianongnuo 2hao		▲		▲		▲		
96	Xudao 4hao		▲		▲		▲		
97	Sihao 4040		▲		▲		▲		
98	Yanjing 9hao		▲		▲				✓
99	Sihao 4081	✓		✓			▲		
100	Sihao 4041		▲		▲				✓
101	Sihao 4031		▲		▲		▲		
102	Wandao 68		▲		▲				✓
103	Wuxiang99-8		▲		▲				✓

104	Zhongjing 131			▲		▲		▲	
105	Ningjinghui 260			▲		▲			✓
106	Ningjinghui 237			▲		▲		▲	
107	Wunuoyihao			▲		▲		▲	
108	Sihao 4029			▲		▲			✓
109	Ludao			▲		▲		▲	
110	Wanqu 429bp			▲		▲			✓
111	Yangfujing 4901			▲		▲			✓
112	Yandao 6hao	✓			✓			▲	
113	Cbao	✓			✓			▲	
114	Zhengdao 10hao	✓			✓		✓		
115	Baoxintaihuqing	✓				▲		▲	
116	Huaidao 9hao	✓			✓			▲	
117	Xiaobaidao			▲		▲		▲	
118	Yaxuenuo		✓			▲		▲	
119	Yangguang 200			▲		▲		▲	
120	Zaoshirihuangdao		✓			▲		▲	
121	Luohanhuang			▲		▲		▲	
122	Xudao2hao	✓			✓			▲	
123	Xudao9201B			▲		▲		▲	
124	Ebusinuodao			▲		▲		▲	
125	Yueguang		✓			▲		▲	
126	Yimuhu	✓				▲	✓		
127	Qingkong		✓			▲		▲	
128	RT61		✓			▲		▲	
129	IL38		✓			▲		▲	
130	Liuyezhan	✓			✓		✓		

131	Zaoxian 14	✓		✓		✓		
132	Xu91075	✓		✓		✓		
133	Xudao 25-7		▲		▲			✓
134	Qing 7	✓		✓			✓	
135	Sihao 4141		▲		▲			✓
136	SH189		✓		▲			
137	SHN1	✓		✓		✓		
138	Suwujing	✓		✓		✓		
139	9522B		▲		▲			✓
140	863B		▲		▲		▲	
141	Biaojiyongzijing		▲		▲		▲	
142	Zigu	✓			▲	✓		
143	Jiangpuchangliheimidao		▲		▲			✓
144	A7444		▲		▲		▲	
145	Xiepihuang		▲		▲		▲	
146	Shengtangqing	✓		✓				✓
147	Chuan 6xian	✓			▲		✓	
148	Chuan 5xian	✓			▲		✓	
149	Shufeng 101	✓		✓		✓		
150	Chengnongshuijing	✓		✓				✓
151	Xiangxiandao 10hao	✓		✓				✓
152	II-32B	✓		✓			✓	
153	Chenwan 3hao	✓		✓		✓		
154	Xiangaizao 10hao	✓		✓			✓	
155	Yuetai B	✓		✓		✓		
156	Qimiaoxiang 2hao	✓		✓				✓
157	Shengyou 2hao	✓		✓			✓	

158	Guichao 2hao	✓		✓		✓			
159	Minghui63	✓		✓				✓	
160	LongtepuB	✓			▲	✓			
161	Hainanxian R	✓		✓				✓	
162	Zajiaohaigu	✓		✓					✓
163	Nuohangu		▲		▲		▲		
164	Lincangwazuhangu		▲		▲		▲		
165	Yuedao 55	✓		✓		✓			
166	Yuedao 108	✓		✓		✓			
167	IR112	✓		✓					✓
168	IR64	✓		✓		✓			
169	Arias	✓		✓				✓	
170	CAMOR	✓			▲		▲		
171	Gendjah Gempol	✓			▲		▲		
172	BULUH BAWU	✓			▲		▲		
173	Shengdao 14		▲		▲				✓

✓ indicates the favorable haplotypes; ▲ indicates the non-favorable haplotypes

Figures



Figure S1. Geographic distribution map of 173 rice accessions used in this study.

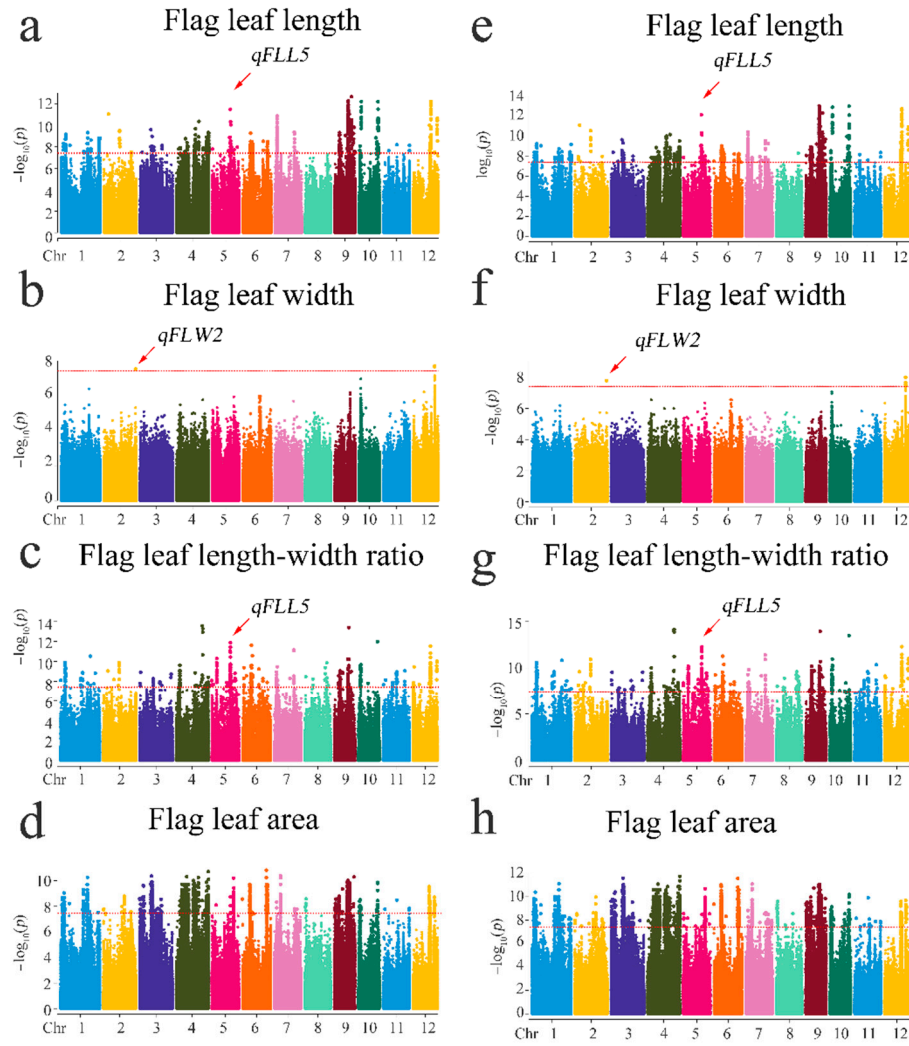


Figure S2. Manhattan plots of genome-wide association studies for the FLL, FLW, FLR and FLA with GLM. (a) Manhattan plot for FLL in 2019; (b) Manhattan plot for FLW in 2019; (c) Manhattan plot for FLR in 2019; (d) Manhattan plot for FLA in 2019; (e) Manhattan plot for FLL in 2020; (f) Manhattan plot for FLW in 2020; (g) Manhattan plot for the FLR in 2020; (h) Manhattan plot for the FLA in 2020.