Table 2 Digenic epistasis identified for rice grain size related traits in Ce253/NYZ F2 population

TraitID	TraitName	Chromosome1	Position1	Marker interval	QTL[a]	Chromosome2	Position2	Marker interval	QTL[a]	LOD	PVE(%)[b]	A1[c]	A2[c]	D1[d]	D2[d]	AA[e]	AD[f]	DA[g]
1	GL	4	35	M038-04M23.61		10	85	RM25539-M098		5.17	30.06	-0.321	0.093	0.1013	0.1275	0.1645	0.7824	-0.2454
1	GL	10	45	10M12.66-RM25425		11	95	11M11.16-11M20.77		5.84	30.99	-0.019	-0.0744	0.3964	0.316	0.2619	-0.0717	0.5939
1	GL	6	0	RM19234-6M4.57		12	35	M04442-12M13.05		5.36	12.42	0.2474	0.0448	-0.3134	-0.1396	0.0379	-0.4194	-0.3084
1	GL	8	75	RM8271-RM23469		12	85	M110-12M27.47[h]	*qLWR-12*	6.04	34.17	-0.096	-0.4776	0.3154	-0.0835	0.026	0.1728	1.0598
1	GL	7	125	M070-M063		12	95	M110-12M27.47[h]	*qLWR-12*	5.29	46.17	-0.129	0.5436	-0.2108	-0.2078	-0.1879	0.0791	-1.1609
2	GW	1	135	M008-RM11258[h]	*qGL-1*	2	155	02M11.16-M018		5.58	24.61	-3E-04	-0.1331	-0.0258	-0.0176	0.1828	-0.0445	0.2292
2	GW	7	0	RM21309-07M20.11		8	85	RM8271-RM23469		6.38	17.53	-0.021	0.0114	-0.0447	-0.1312	-0.1174	0.1518	-0.0085
2	GW	1	30	M001-M004		8	160	08M21.03-08M25.57		5.08	41.88	0.1066	0.0133	-0.3311	-0.4814	0.0452	-0.2254	0.003
2	GW	9	10	09M22.81-RM201		11	40	M04308-M101		5.86	16.41	0.017	-0.1154	0.0882	-0.0018	0.1287	-0.0215	0.1778
2	GW	6	55	6M4.57-M051		11	50	M101-11M11.16		5.28	23.23	0.0721	-0.188	0.1259	0.1064	-0.1049	-0.0339	0.253
2	GW	2	240	M20-RM250		12	110	M110-12M27.47[h]	*qLWR-12*	5.87	27.85	-0.057	-0.0733	0.0857	0.0727	0.007	0.2399	0.2643
3	GT	1	25	M001-M004		2	185	RM1211-RM13429		5.70	21.28	-0.098	-0.1106	0.1051	0.038	-0.1305	0.0785	0.1493
3	GT	1	155	RM488-M012		3	140	RM5488-RM15247		6.22	21.92	0.0732	-0.0658	0.0572	0.0583	0.0364	-0.1125	0.0528
3	GT	3	205	03M10.75-03M6.79		4	80	RM16943-M09496[h]	*qGL-4*	6.61	21.82	-0.101	-0.056	0.0667	0.0806	-0.071	0.154	0.0592
3	GT	3	150	RM15247-RM6929		5	150	M040-M09668[h]	*qTGW-5*	5.01	30.27	-0.011	0.0514	-0.0387	-0.0932	-0.0083	-0.0459	-0.0692
3	GT	3	225	03M10.75-03M6.79		7	105	07M15.3-M070		5.85	33.84	-0.031	-0.0905	-0.014	0.0405	-0.1323	0.0757	0.0859

3	GT	2	185	RM1211-RM13429		9	10	09M22.81-RM201		6.24	26.86	-0.068	-0.1354	0.1042	0.1115	-0.1226	0.0788	0.1945
3	GT	10	25	RM25146-M095		10	45	10M12.66-RM25425		5.30	18.73	0.1388	-0.1202	0.051	0.0523	0.0914	-0.1785	0.1166
3	GT	2	175	RM1211-RM13429		10	65	RM25425-RM25539		5.44	28.53	-0.122	-0.1196	0.0839	0.0954	-0.0903	0.1719	0.1569
4	LWR	1	140	M008-RM11258[h]	*qGL-1*	2	155	02M11.16-M018		5.14	20.72	-0.063	0.0641	-0.1207	-0.0244	-0.2242	0.1613	-0.1688
4	LWR	2	185	RM1211-RM13429		3	175	RM6929-03m10.75		8.44	37.16	-0.194	0.046	-0.2369	-0.1199	0.1969	0.2748	-0.0512
4	LWR	5	35	05M10.24-RM17836		8	85	RM8271-RM23469		5.45	37.00	-0.032	-0.1865	-0.4206	-0.3883	0.1517	0.0525	0.2103
4	LWR	3	90	03M33.1-M033		8	140	08M18.41-08M21.03		5.66	40.41	-0.092	-0.3553	-0.1335	0.0898	0.1248	0.0682	0.5607
4	LWR	1	260	RM11865-RM12021		8	150	08M21.03-08m25.57		5.11	33.88	-0.248	0.0178	-0.3139	-0.1538	0.1698	0.3383	-0.0558
4	LWR	7	185	M063-07M24.3		8	150	08M21.03-08m25.57		5.29	38.01	0.1781	-0.1794	0.0779	0.273	-0.2469	-0.201	0.3289
4	LWR	2	45	RM12678-M05076		11	90	11M11.16-11m20.77		6.56	31.69	-0.148	0.0575	0.2884	0.2512	0.0121	0.2777	0.1361
4	LWR	2	90	M05076-02M11.16		12	50	12M13.05-M09955		5.81	32.37	0.1001	-0.15	0.2435	0.1144	-0.0833	-0.3786	0.3789
4	LWR	3	90	03M33.1-M033		12	65	M109-M110		5.65	38.91	0.1794	-0.1604	0.314	0.2856	-0.0617	-0.2792	0.3702
4	LWR	6	5	RM19234-6M4.57		12	70	M109-M110		6.13	19.69	0.1199	0.0497	-0.3929	-0.333	0.1242	-0.0513	-0.1446
4	LWR	8	145	08M21.03-08m25.57		12	85	M110-12M27.47[h]	*qLWR-12*	6.42	29.92	-0.082	-0.359	0.1652	-0.077	0.0716	0.135	0.4154
4	LWR	11	55	M101-11M11.16		12	85	M110-12M27.47[h]	*qLWR-12*	5.26	36.58	0.222	-0.1016	-0.3155	-0.3312	0.0554	-0.2424	-0.0706
5	TGW	3	35	03M36.3-03M33.1[h]	*qGL-3*	3	255	03M6.79-RM14391		5.46	54.30	-2.851	3.223	-0.6486	0.7182	-4.5978	3.4013	-3.0804
5	TGW	3	235	03M10.75-03M6.79		5	40	05M10.24-RM17836		5.03	49.55	2.8798	-4.5397	0.7818	-0.558	-3.0531	-2.0193	4.3409
5	TGW	3	250	03M6.79-RM14391		7	45	RM21309-07M20.11		6.65	64.09	3.0318	-2.3645	-8.5348	-6.0651	-2.6947	-3.2387	0.4764

5	TGW	2	55	RM12678-M05076	10	40	M095-10M12.66	5.03	25.18	-2.486	1.3303	-3.4703	-4.3023	-3.1331	4.048	-0.9622
5	TGW	2	100	M05076-02M11.16	11	65	M101-11M11.16	5.40	57.11	-3.791	-0.5883	-3.7901	-4.0206	4.9031	3.9678	-0.85
5	TGW	3	235	03M10.75-03M6.79	11	85	11M11.16-11M20.77	5.54	45.69	1.921	-3.6135	-5.8151	-1.9318	-4.4511	-0.3955	4.3383

Note: [a] Main effect QTLs, identified at the threshold of LOD≥2.5 in this study, involve in degenic interaction for the variation of rice grain size related traits; [b] The percentage of phenotypic variation of epistatic QTL explained; [c] The additive effects of epistatic QTLs at position 1 and 2, respectively; [d] The dominant effects of epistatic QTLs at postition 1 and 2, respectively; [e] The epistatic effects of two QTL positions in additive×additive model; [f] The epistatic effects of two QTL positions in additive × dominant model; [g] The epistatic effects of two QTL positions in domanint×additive model; [h] The epistatic effects of two QTL positions in domanint × dominant model.