

QTL-seq identifies cooked grain elongation QTLs near *soluble starch synthase* and *starch branching enzymes* in rice (*Oryza sativa* L.)

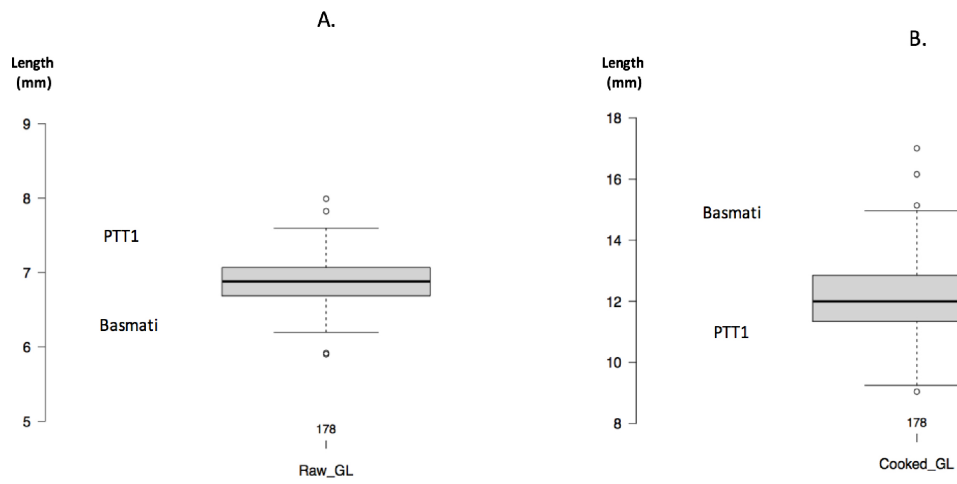
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Supplementary Fig. S1

Box plots of average raw grain length (A.) and cooked grain length (B.) among 178 F2 lines. The positions of the grain lengths in Pathum Thani1 (PTT1) and Basmati are presented with their names.



Supplementary Table S1 Phenotypic data analyses of grain elongation ratio for 178 F₂ individuals.

Trait	PTT1	Basmati	F2 Population				
			Mean	Max	Min	Skewness	Kurtosis
GE	1.50	2.26	1.76	2.37	1.35	0.46	3.8

Supplementary Table S2 Forty selected F₂ lines used to generate high GE bulk and low GE bulk.

Low GE bulk		High GE bulk	
Line number	Average GE	Line number	Average GE
56	1.46	37	1.88
168	1.49	71	1.88
100	1.51	98	1.9
25	1.53	79	1.91
108	1.53	35	1.93
19	1.54	8	1.93
184	1.55	52	1.94
156	1.56	179	1.95
40	1.57	95	1.95
6	1.57	137	1.96
120	1.58	101	1.98
169	1.58	126	1.99
176	1.58	148	2.03
177	1.6	89	2.03
83	1.6	149	2.04
196	1.61	73	2.05
22	1.61	139	2.08
153	1.62	5	2.1
161	1.63	130	2.13
18	1.64	118	2.18

Supplementary Table S3 List of predicted candidate genes in 1-Mb intervals of the qGE6.1 region.

Chr	Start	Stop	Gene Name	Putative Function
6	5497369	5498771	LOC_Os06g10590	expressed protein
6	5499342	5502411	LOC_Os06g10600	homeobox and START domains containing protein, putative, expressed
6	5522553	5523176	LOC_Os06g10610	expressed protein
6	5523780	5528576	LOC_Os06g10620	transcription elongation factor SPT5 homolog 1, putative, expressed
6	5555007	5559140	LOC_Os06g10650	tyrosine phosphatase family protein, putative, expressed
6	5559909	5563097	LOC_Os06g10660	lysM domain-containing GPI-anchored protein 1 precursor, putative,
6	5569910	5571471	LOC_Os06g10670	aspartic proteinase nepenthesin-1 precursor, putative, expressed
6	5572599	5573850	LOC_Os06g10680	expressed protein
6	5575867	5584373	LOC_Os06g10690	PHD-finger domain containing protein, putative, expressed
6	5586611	5586901	LOC_Os06g10700	expressed protein
6	5588196	5594757	LOC_Os06g10710	expressed protein
6	5597520	5597825	LOC_Os06g10720	expressed protein
6	5601748	5604984	LOC_Os06g10730	expressed protein
6	5613999	5617153	LOC_Os06g10750	integral membrane protein DUF6 containing protein, expressed
6	5619105	5621750	LOC_Os06g10760	emp24/gp25L/p24 family protein, putative, expressed
6	5621926	5625701	LOC_Os06g10770	peptidase, putative, expressed
6	5629416	5631997	LOC_Os06g10780	AP2 domain containing protein, expressed
6	5633354	5635721	LOC_Os06g10790	lectin-like receptor kinase, putative, expressed
6	5636936	5637931	LOC_Os06g10800	zinc finger family protein, putative, expressed
6	5638272	5641660	LOC_Os06g10810	phosphate carrier protein, mitochondrial precursor, putative, expressed
6	5642245	5642880	LOC_Os06g10820	helix-loop-helix DNA-binding domain containing protein, expressed
6	5653538	5653942	LOC_Os06g10840	expressed protein
6	5657850	5661265	LOC_Os06g10850	lipase, putative, expressed
6	5663968	5665309	LOC_Os06g10860	glucosyltransferase, putative, expressed
6	5677080	5682126	LOC_Os06g10880	bZIP transcription factor, putative, expressed
6	5688535	5689411	LOC_Os06g10890	sterol carrier protein-2, putative, expressed
6	5693807	5694649	LOC_Os06g10900	DELLA protein RGL3, putative, expressed

6 5701639 5704991 LOC_Os06g10910 xyloglucan fucosyltransferase, putative, expressed
6 5705127 5707910 LOC_Os06g10920 xyloglucan fucosyltransferase, putative, expressed
6 5712154 5714660 LOC_Os06g10930 xyloglucan fucosyltransferase, putative, expressed
6 5717068 5717478 LOC_Os06g10940 expressed protein
6 5718733 5720698 LOC_Os06g10950 xyloglucan fucosyltransferase, putative, expressed
6 5721756 5726745 LOC_Os06g10960 xyloglucan fucosyltransferase, putative, expressed
6 5732121 5734237 LOC_Os06g10970 xyloglucan fucosyltransferase, putative, expressed
6 5734288 5736153 LOC_Os06g10980 xyloglucan fucosyltransferase, putative, expressed
6 5745188 5747209 LOC_Os06g10990 DnaK family protein, putative, expressed
6 5759685 5761518 LOC_Os06g11010 eukaryotic aspartyl protease domain containing protein, expressed
6 5775433 5777316 LOC_Os06g11020 tic22-like family domain containing protein, expressed
6 5778761 5779333 LOC_Os06g11030 EF hand family protein, putative, expressed
6 5784166 5788998 LOC_Os06g11040 expressed protein
6 5791466 5795810 LOC_Os06g11050 cyclin-dependent kinase inhibitor, putative, expressed
6 5800188 5800857 LOC_Os06g11060 expressed protein
6 5807269 5811211 LOC_Os06g11070 expressed protein
6 5812591 5813000 LOC_Os06g11080 hypothetical protein
6 5813468 5815196 LOC_Os06g11090 CXE carboxylesterase, putative, expressed
6 5830906 5833223 LOC_Os06g11120 expressed protein
6 5835562 5837122 LOC_Os06g11130 gibberellin receptor GID1L2, putative, expressed
6 5837564 5838523 LOC_Os06g11135 gibberellin receptor GID1L2, putative, expressed
6 5840075 5844550 LOC_Os06g11140 pyridine nucleotide-disulphide oxidoreductase domain containing
6 5847981 5849957 LOC_Os06g11150 DUF1645 domain containing protein, putative, expressed
6 5854313 5854669 LOC_Os06g11160 expressed protein
6 5857235 5861126 LOC_Os06g11170 formin-binding protein-related, putative, expressed
6 5862163 5869596 LOC_Os06g11180 OsPOP12 - Putative Prolyl Oligopeptidase homologue, expressed
6 5869895 5876421 LOC_Os06g11190 OsPOP13 - Putative Prolyl Oligopeptidase homologue, expressed
6 5878572 5880549 LOC_Os06g11200 12-oxophytodienoate reductase, putative, expressed
6 5884474 5886141 LOC_Os06g11210 12-oxophytodienoate reductase, putative, expressed
6 5892688 5894037 LOC_Os06g11230 expressed protein

6 5894721 5896352 LOC_Os06g11240 12-oxophytodienoate reductase, putative, expressed
6 5905264 5906018 LOC_Os06g11260 12-oxophytodienoate reductase 2, putative, expressed
6 5908095 5909468 LOC_Os06g11270 anthocyanidin 3-O-glucosyltransferase, putative, expressed
6 5912374 5914368 LOC_Os06g11280 12-oxophytodienoate reductase, putative, expressed
6 5918106 5919690 LOC_Os06g11290 12-oxophytodienoate reductase, putative, expressed
6 5921695 5923664 LOC_Os06g11300 CRR4, putative, expressed
6 5921977 5925597 LOC_Os06g11304 expressed protein
6 5927194 5928879 LOC_Os06g11308 hypothetical protein
6 5930399 5931984 LOC_Os06g11310 plastocyanin-like domain containing protein, putative, expressed
6 5933788 5939645 LOC_Os06g11320 peptidyl-prolyl cis-trans isomerase CYP40, putative, expressed
6 5953593 5963184 LOC_Os06g11330 OsMADS55 - MADS-box family gene with MIKc type-box, expressed
6 5975645 5976459 LOC_Os06g11360 expressed protein
6 5977297 5980829 LOC_Os06g11370 mediator of RNA polymerase II transcription subunit 6, putative,
6 5982669 5987671 LOC_Os06g11380 geminivirus Rep-interacting motor protein, putative, expressed
6 6003866 6004179 LOC_Os06g11390 expressed protein
6 6007444 6010097 LOC_Os06g11400 expressed protein
6 6019597 6021861 LOC_Os06g11410 cyclin, putative, expressed
6 6027823 6029445 LOC_Os06g11420 SKIP/SNW domain containing protein, expressed
6 6032410 6035429 LOC_Os06g11430 GRAM domain containing protein, expressed
6 6058726 6060541 LOC_Os06g11450 zinc finger, C3HC4 type domain containing protein, expressed
6 6081889 6083447 LOC_Os06g11480 hypothetical protein
6 6086289 6097662 LOC_Os06g11500 MCM9 - Putative minichromosome maintenance MCM family subunit 9,
6 6086798 6088248 LOC_Os06g11490 plastocyanin-like domain containing protein, putative, expressed
6 6101061 6102117 LOC_Os06g11510 expressed protein
6 6102123 6108979 LOC_Os06g11520 LMBR1 integral membrane protein, putative, expressed
6 6141610 6142769 LOC_Os06g11580 expressed protein
6 6144586 6145404 LOC_Os06g11590 expressed protein
6 6146721 6150348 LOC_Os06g11600 growth regulator related protein, putative, expressed
6 6152018 6153438 LOC_Os06g11610 heat shock 22 kDa protein, mitochondrial precursor, putative, expressed
6 6155940 6159888 LOC_Os06g11620 RNA recognition motif containing protein, putative, expressed

6 6160326 6163685 LOC_Os06g11630 OsFBX192 - F-box domain containing protein, expressed
6 6171585 6176329 LOC_Os06g11640 serine/threonine-protein phosphatase 2A activator 2, putative, expressed
6 6177853 6179163 LOC_Os06g11650 phosphate-induced protein 1 conserved region domain containing
protein, expressed
6 6180308 6181639 LOC_Os06g11660 phosphate-induced protein 1 conserved region domain containing
protein, expressed
6 6189101 6189358 LOC_Os06g11670 expressed protein
6 6191531 6192496 LOC_Os06g11680 phosphate-induced protein 1 conserved region domain containing
protein, expressed
6 6199474 6200741 LOC_Os06g11700 phosphate-induced protein 1 conserved region domain containing
protein, expressed
6 6202140 6202790 LOC_Os06g11710 cytokinin-O-glucosyltransferase 2, putative, expressed
6 6205607 6207653 LOC_Os06g11720 cytokinin-O-glucosyltransferase 2, putative, expressed
6 6208293 6214438 LOC_Os06g11730 RNA recognition motif containing protein, putative, expressed
6 6222556 6224681 LOC_Os06g11740 OsAPRL2 adenosine 5'-phosphosulfate reductase-like OsAPRL2, expressed
6 6227813 6229557 LOC_Os06g11750 hypothetical protein
6 6233100 6233579 LOC_Os06g11760 expressed protein
6 6237708 6238080 LOC_Os06g11770 hypothetical protein
6 6240043 6241172 LOC_Os06g11780 MYB family transcription factor, putative, expressed
6 6243660 6247719 LOC_Os06g11790 TLD family protein, putative, expressed
6 6250717 6253708 LOC_Os06g11800 annexin, putative, expressed
6 6253188 6254517 LOC_Os06g11812 wound/stress protein, putative, expressed
6 6255755 6256752 LOC_Os06g11820 expressed protein
6 6277593 6281865 LOC_Os06g11840 trehalose phosphatase, putative, expressed
6 6295652 6299080 LOC_Os06g11850 expressed protein
6 6304588 6306661 LOC_Os06g11860 ethylene-responsive transcription factor, putative, expressed
6 6309925 6310281 LOC_Os06g11870 hypothetical protein
6 6333934 6334978 LOC_Os06g11900 expressed protein
6 6344013 6347676 LOC_Os06g11910 expressed protein

6 6349120 6352936 LOC_Os06g11920 endonuclease/exonuclease/phosphatase family domain containing protein, expressed

6 6355145 6355981 LOC_Os06g11930 SNARE domain containing protein, putative, expressed

6 6358046 6358855 LOC_Os06g11940 dehydration-responsive element binding protein, putative, expressed

6 6369182 6370694 LOC_Os06g11960 2,3-bisphosphoglycerate-dependent phosphoglycerate mutase, putative,

6 6372353 6376374 LOC_Os06g11970 OsMADS63 - MADS-box family gene with MIKC* type-box, expressed

6 6395388 6397221 LOC_Os06g11980 DUF581 domain containing protein, expressed

6 6401419 6407785 LOC_Os06g11990 expressed protein

6 6419602 6420378 LOC_Os06g12000 expressed protein

6 6424294 6424808 LOC_Os06g12010 hypothetical protein

6 6435824 6439822 LOC_Os06g12020 membrane-anchored ubiquitin-fold protein, putative, expressed

6 6440428 6447606 LOC_Os06g12030 glutaredoxin domain containing protein, putative, expressed

6 6452737 6454454 LOC_Os06g12040 mTERF family protein, expressed

6 6458283 6459567 LOC_Os06g12050 mTERF family protein, expressed

6 6461154 6465270 LOC_Os06g12060 mTERF family protein, expressed

6 6465597 6468062 LOC_Os06g12070 mTERF family protein, expressed

6 6472151 6473692 LOC_Os06g12080 mTERF family protein, expressed

6 6475161 6479073 LOC_Os06g12090 miro, putative, expressed

6 6479283 6480980 LOC_Os06g12100 mTERF family protein, expressed

6 6482366 6485677 LOC_Os06g12110 mTERF family protein, expressed

6 6484043 6488553 LOC_Os06g12120 BRASSINOSTEROID INSENSITIVE 1-associated receptor kinase 1 precursor, putative, expressed

6 6489414 6491711 LOC_Os06g12129 expressed protein

6 6492884 6494714 LOC_Os06g12140 expressed protein

6 6495000 6497910 LOC_Os06g12150 shikimate kinase, putative, expressed

6 6503735 6514399 LOC_Os06g12160 AAA-type ATPase family protein, putative, expressed

6 6515548 6519199 LOC_Os06g12170 expressed protein

6 6521987 6523338 LOC_Os06g12180 jacalin-like lectin domain containing protein, expressed

6 6534746 6535897 LOC_Os06g12190 glutaredoxin, putative, expressed

6 6537949 6538677 LOC_Os06g12200 hypothetical protein

6 6556802 6557319 LOC_Os06g12210 helix-loop-helix DNA-binding domain containing protein, expressed
6 6559753 6563394 LOC_Os06g12220 HVA22, putative, expressed
6 6570778 6572727 LOC_Os06g12230 TCP-domain protein, putative, expressed
6 6584405 6585965 LOC_Os06g12240 hypothetical protein
6 6589792 6591799 LOC_Os06g12250 sphingolipid C4-hydroxylase SUR2, putative, expressed
6 6595940 6602476 LOC_Os06g12260 N-rich protein, putative, expressed
6 6603975 6604635 LOC_Os06g12270 hypothetical protein
6 6605479 6608454 LOC_Os06g12280 glycosyl transferase 8 domain containing protein, putative, expressed
6 6612661 6613440 LOC_Os06g12290 glutathione S-transferase GSTU6, putative, expressed
6 6643235 6643552 LOC_Os06g12300 expressed protein
6 6648387 6653005 LOC_Os06g12310 aquaporin protein, putative, expressed
6 6678245 6680864 LOC_Os06g12320 transmembrane amino acid transporter protein, putative, expressed
6 6682411 6685947 LOC_Os06g12330 amino acid transporter, putative, expressed
6 6686569 6687306 LOC_Os06g12340 expressed protein
6 6691061 6695070 LOC_Os06g12350 amino acid transporter, putative, expressed
6 6696666 6700782 LOC_Os06g12360 pentatricopeptide, putative, expressed
6 6701247 6704416 LOC_Os06g12370 OsFtsH6 FtsH protease, homologue of AtFtsH6, expressed
6 6712478 6713221 LOC_Os06g12380 expressed protein
6 6715886 6722017 LOC_Os06g12390 galactosyltransferase family protein, putative, expressed
6 6725306 6734446 LOC_Os06g12400 Homeobox domain containing protein, expressed
6 6736053 6737803 LOC_Os06g12410 GDSL-like lipase/acylhydrolase, putative, expressed
6 6741342 6741945 LOC_Os06g12430 expressed protein
6 6743783 6744849 LOC_Os06g12440 LTPL60 - Protease inhibitor/seed storage/LTP family protein precursor,
putative, expressed
6 6748358 6753338 LOC_Os06g12450 soluble starch synthase 2-3, chloroplast precursor, putative, expressed
6 6754294 6755541 LOC_Os06g12455 expressed protein
6 6758181 6762995 LOC_Os06g12460 CSLA3 - cellulose synthase-like family A; mannan synthase, expressed
6 6782326 6783880 LOC_Os06g12490 expressed protein
6 6788986 6790050 LOC_Os06g12500 membrane associated DUF588 domain containing protein, putative,
6 6790516 6792069 LOC_Os06g12510 pentatricopeptide, putative, expressed

6 6793120 6793387 LOC_Os06g12520 hypothetical protein
6 6794150 6796570 LOC_Os06g12530 CS domain containing protein, putative, expressed
6 6796598 6798469 LOC_Os06g12539 expressed protein
6 6801945 6802405 LOC_Os06g12550 expressed protein
6 6809574 6811963 LOC_Os06g12560 zinc finger, C3HC4 type, domain containing protein, expressed
6 6814708 6815190 LOC_Os06g12570 expressed protein
6 6816402 6819861 LOC_Os06g12580 pro-resilin precursor, putative, expressed
6 6822979 6832750 LOC_Os06g12590 protein kinase, putative, expressed
6 6842811 6848564 LOC_Os06g12600 kinase, pfkB family, putative, expressed
6 6866393 6869521 LOC_Os06g12610 auxin efflux carrier component, putative, expressed
6 6878753 6879729 LOC_Os06g12620 expressed protein
6 6892489 6895644 LOC_Os06g12630 glutathione S-transferase, N-terminal domain containing protein,
6 6905844 6908028 LOC_Os06g12649 expressed protein
6 6915783 6916582 LOC_Os06g12660 NHL repeat-containing protein, putative, expressed
6 6923215 6924997 LOC_Os06g12680 RING-H2 finger protein, putative, expressed
6 6928341 6932490 LOC_Os06g12690 DCN1-like protein 2, putative, expressed
6 6937045 6937368 LOC_Os06g12700 conserved hypothetical protein
6 6950487 6950999 LOC_Os06g12730 expressed protein
6 6953695 6956088 LOC_Os06g12740 expressed protein
6 6963552 6963960 LOC_Os06g12760 hypothetical protein
6 6980031 6986313 LOC_Os06g12780 OsDegp10 - Putative Deg protease homologue, expressed
6 6990939 6994556 LOC_Os06g12790 ras-related protein, putative, expressed
6 6995343 6996671 LOC_Os06g12800 expressed protein
6 7000436 7004404 LOC_Os06g12810 proteins of unknown function domain containing protein, expressed
6 7005872 7008652 LOC_Os06g12820 proteins of unknown function domain containing protein, expressed
6 7019819 7022061 LOC_Os06g12830 expressed protein
6 7025603 7027002 LOC_Os06g12840 expressed protein
6 7031413 7032804 LOC_Os06g12850 expressed protein
6 7037048 7038406 LOC_Os06g12860 proteins of unknown function domain containing protein, putative,
6 7043611 7045679 LOC_Os06g12870 leaf senescence related protein, putative, expressed

6 7047258 7052772 LOC_Os06g12876 expressed protein
6 7053689 7056223 LOC_Os06g12882 S phase cyclin A-associated protein in the ER, putative, expressed
6 7059669 7060522 LOC_Os06g12890 expressed protein
6 7067117 7069522 LOC_Os06g12910 XPA-binding protein 2, putative, expressed
6 7072753 7073191 LOC_Os06g12920 hypothetical protein
6 7076782 7078024 LOC_Os06g12930 expressed protein
6 7079677 7082435 LOC_Os06g12940 expressed protein
6 7085090 7088528 LOC_Os06g12950 expressed protein
6 7093925 7096207 LOC_Os06g12960 expressed protein
6 7102791 7106821 LOC_Os06g12980 cyclin, putative, expressed
6 7118829 7120448 LOC_Os06g12990 tRNA methyltransferase, putative, expressed
6 7121120 7123026 LOC_Os06g13000 ankyrin repeat domain-containing protein, chloroplast precursor,
6 7128352 7133515 LOC_Os06g13020 DNA polymerase lambda, putative, expressed
6 7133789 7140003 LOC_Os06g13030 OsLIM - LIM domain protein, putative actin-binding protein and
transcription factor, expressed
6 7144204 7146074 LOC_Os06g13040 glycosyl hydrolases family 16, putative, expressed
6 7148961 7158822 LOC_Os06g13050 peroxidase family protein, expressed
6 7159988 7164156 LOC_Os06g13060 heat shock protein DnaJ, putative, expressed
6 7169830 7172482 LOC_Os06g13070 hhH-GPD superfamily base excision DNA repair protein, putative,
6 7181648 7183586 LOC_Os06g13080 spotted leaf 11, putative, expressed
6 7186601 7188076 LOC_Os06g13090 armadillo/beta-catenin repeat family protein, putative, expressed
6 7188393 7191451 LOC_Os06g13100 CREG1 precursor, putative, expressed
6 7201591 7203994 LOC_Os06g13120 expressed protein
6 7205227 7205817 LOC_Os06g13130 expressed protein
6 7209516 7212490 LOC_Os06g13140 WD domain, G-beta repeat domain containing protein, expressed
6 7216473 7217001 LOC_Os06g13150 hypothetical protein
6 7218853 7220283 LOC_Os06g13160 viral-response family protein, expressed
6 7221749 7224410 LOC_Os06g13170 expressed protein
6 7224942 7226417 LOC_Os06g13180 metalloendoproteinase 1 precursor, putative, expressed
6 7230154 7230942 LOC_Os06g13190 expressed protein

6 7231572 7235608 LOC_Os06g13200 proton-dependent oligopeptide transport, putative, expressed
6 7247729 7251058 LOC_Os06g13210 peptide transporter PTR2, putative, expressed
6 7256821 7259221 LOC_Os06g13215 growth regulator related protein, putative, expressed
6 7260407 7264016 LOC_Os06g13220 expressed protein
6 7267160 7269232 LOC_Os06g13230 expressed protein
6 7278365 7282975 LOC_Os06g13240 BURP domain containing protein, expressed
6 7293011 7296554 LOC_Os06g13250 hypothetical protein
6 7306306 7307547 LOC_Os06g13280 O-methyltransferase, putative, expressed
6 7318599 7323201 LOC_Os06g13310 SAM dependent carboxyl methyltransferase, putative, expressed
6 7325614 7327449 LOC_Os06g13320 protein kinase, putative, expressed
6 7333278 7335741 LOC_Os06g13330 expressed protein
6 7338076 7339727 LOC_Os06g13340 expressed protein
6 7341809 7344913 LOC_Os06g13350 SAM dependent carboxyl methyltransferase, putative, expressed
6 7367791 7368195 LOC_Os06g13380 expressed protein
6 7369137 7371782 LOC_Os06g13390 SAM dependent carboxyl methyltransferase, putative, expressed
6 7376286 7376932 LOC_Os06g13410 OsSCP33 - Putative Serine Carboxypeptidase homologue, expressed
6 7378698 7380890 LOC_Os06g13420 OsSCP34 - Putative Serine Carboxypeptidase homologue, expressed
6 7397012 7397462 LOC_Os06g13440 expressed protein
6 7401127 7404267 LOC_Os06g13450 cystathionine beta-lyase, putative, expressed
6 7406037 7408609 LOC_Os06g13460 SAM dependent carboxyl methyltransferase family protein, putative,
6 7417633 7422147 LOC_Os06g13470 SAM dependent carboxyl methyltransferase, putative, expressed
6 7423689 7424045 LOC_Os06g13480 expressed protein
6 7429730 7433791 LOC_Os06g13490 SAM dependent carboxyl methyltransferase domain containing protein,
6 7455885 7456584 LOC_Os06g13510 SAM dependent carboxyl methyltransferase family protein, putative
6 7459467 7461720 LOC_Os06g13520 SAM dependent carboxyl methyltransferase domain containing protein,
6 7468750 7469413 LOC_Os06g13530 benzoate carboxyl methyltransferase, putative, expressed
6 7474908 7475598 LOC_Os06g13550 SAM dependent carboxyl methyltransferase family protein, putative,
6 7480067 7482194 LOC_Os06g13560 SAM dependent carboxyl methyltransferase, putative, expressed
6 7488066 7496669 LOC_Os06g13570 expressed protein
6 7498331 7500517 LOC_Os06g13580 expressed protein

6 7519619 7520480 LOC_Os06g13590 PE-PGRS family protein, putative, expressed
6 7530834 7534857 LOC_Os06g13600 HEAT repeat family protein, putative, expressed
6 7540774 7541864 LOC_Os06g13610 expressed protein
6 7544706 7545167 LOC_Os06g13620 expressed protein
6 7555463 7558367 LOC_Os06g13640 expressed protein
6 7564755 7571033 LOC_Os06g13650 alpha-mannosidase 2, putative, expressed
6 7574978 7581553 LOC_Os06g13660 alanyl-tRNA synthetase, putative, expressed
6 7584780 7590605 LOC_Os06g13670 E2F family transcription factor protein, putative, expressed
6 7591912 7593109 LOC_Os06g13680 B12D protein, putative, expressed
6 7595183 7595952 LOC_Os06g13690 expressed protein
6 7596393 7597214 LOC_Os06g13700 hypothetical protein
6 7600956 7601522 LOC_Os06g13710 glycosyltransferase, putative, expressed
6 7602364 7605812 LOC_Os06g13720 dehydrogenase E1 component domain containing protein, expressed
6 7607108 7607939 LOC_Os06g13730 glutamate receptor precursor, putative, expressed
6 7619834 7623919 LOC_Os06g13750 expressed protein
6 7629547 7631705 LOC_Os06g13760 glycosyl transferase 8 domain containing protein, putative, expressed
6 7642070 7644455 LOC_Os06g13780 expressed protein
6 7647852 7648414 LOC_Os06g13800 expressed protein
6 7648922 7653701 LOC_Os06g13810 pyrophosphate--fructose 6-phosphate 1-phosphotransferase subunit
beta, putative, expressed
6 7661691 7670034 LOC_Os06g13820 dynamin, putative, expressed

Supplementary Table S4 List of predicted candidate genes in 1-Mb intervals of the qGE6.2.1 and qGE6.2.2 regions.**qGE6.2.1**

Chr	Start	Stop	Gene Name	Putative Function
6	12931779	12934695	LOC_Os06g22290	legume lectins beta domain containing protein, expressed
6	12962817	12966525	LOC_Os06g22330	expressed protein
6	12967302	12969111	LOC_Os06g22340	cytochrome P450, putative, expressed
6	12973921	12978456	LOC_Os06g22350	expressed protein
6	12983166	12983888	LOC_Os06g22360	hypothetical protein
6	12988184	12990508	LOC_Os06g22370	expressed protein
6	12990974	13000940	LOC_Os06g22380	expressed protein
6	13003028	13003793	LOC_Os06g22390	expressed protein
6	13009938	13010619	LOC_Os06g22394	expressed protein
6	13019641	13021760	LOC_Os06g22400	expressed protein
6	13029814	13030182	LOC_Os06g22410	expressed protein
6	13031173	13032066	LOC_Os06g22420	ZOS6-04 - C2H2 zinc finger protein, expressed
6	13041900	13044183	LOC_Os06g22440	SAM dependent carboxyl methyltransferase, putative, expressed
6	13052769	13053171	LOC_Os06g22450	expressed protein
6	13055162	13058027	LOC_Os06g22460	disease resistance protein RPM1, putative, expressed
6	13061315	13062206	LOC_Os06g22470	hypothetical protein
6	13070021	13070935	LOC_Os06g22490	sphingolipid C4-hydroxylase SUR2, putative, expressed
6	13094272	13095005	LOC_Os06g22530	hypothetical protein
6	13097662	13098133	LOC_Os06g22540	expressed protein
6	13101544	13112981	LOC_Os06g22550	transducin family protein, putative, expressed
6	13117696	13120470	LOC_Os06g22560	formyl transferase, putative, expressed
6	13143806	13146070	LOC_Os06g22600	aluminum-activated malate transporter, putative, expressed
6	13148277	13148889	LOC_Os06g22610	heat shock factor protein HSF8, putative, expressed
6	13152632	13154262	LOC_Os06g22620	hypothetical protein
6	13161181	13161417	LOC_Os06g22640	expressed protein
6	13162901	13171017	LOC_Os06g22650	VHS and GAT domain containing protein, expressed

6 13172164 13175101 LOC_Os06g22654 expressed protein
6 13177537 13181742 LOC_Os06g22660 EMB1303, putative, expressed
6 13182291 13189126 LOC_Os06g22670 tesmin/TSO1-like CXC domain containing protein, expressed
6 13193616 13194239 LOC_Os06g22680 hypothetical protein
6 13196296 13198641 LOC_Os06g22690 bundle sheath defective protein 2, putative, expressed
6 13200907 13202281 LOC_Os06g22700 zinc finger family protein, putative, expressed
6 13244910 13245626 LOC_Os06g22760 OsMADS71 - MADS-box family gene with M-alpha type-box, expressed
6 13278774 13279302 LOC_Os06g22800 hypothetical protein
6 13297087 13301279 LOC_Os06g22810 TKL_IRAK_CrRLK1L-1.14 - The CrRLK1L-1 subfamily has homology to the CrRLK1L homolog, expressed
6 13302546 13306574 LOC_Os06g22820 cyclin-dependent kinase F-1, putative, expressed
6 13316042 13318310 LOC_Os06g22829 expressed protein
6 13327566 13332005 LOC_Os06g22850 microfibrillar-associated protein 1, putative, expressed
6 13335912 13337355 LOC_Os06g22860 expressed protein
6 13345333 13349182 LOC_Os06g22870 OsIAA21 - Auxin-responsive Aux/IAA gene family member, expressed
6 13362903 13363249 LOC_Os06g22880 DEFL8 - Defensin and Defensin-like DEFL family
6 13375503 13390470 LOC_Os06g22919 DEFL9 - Defensin and Defensin-like DEFL family, expressed
6 13379395 13379731 LOC_Os06g22925 expressed protein
6 13391513 13393025 LOC_Os06g22940 hypothetical protein
6 13394969 13397303 LOC_Os06g22950 hypothetical protein
6 13407319 13408859 LOC_Os06g22960 aquaporin protein, putative, expressed
6 13411095 13414131 LOC_Os06g22970 expressed protein
6 13414641 13418309 LOC_Os06g22980 CSLD5 - cellulose synthase-like family D, expressed
6 13428642 13431616 LOC_Os06g23010 conserved hypothetical protein
6 13434831 13435939 LOC_Os06g23020 expressed protein
6 13439148 13439922 LOC_Os06g23030 ZF-HD protein dimerisation region containing protein, expressed
6 13440852 13442506 LOC_Os06g23040 expressed protein
6 13444113 13444616 LOC_Os06g23050 expressed protein
6 13447099 13447755 LOC_Os06g23060 DEFL11 - Defensin and Defensin-like DEFL family
6 13472782 13473249 LOC_Os06g23100 expressed protein

6	13476487	13485209	LOC_Os06g23114	copper methylamine oxidase precursor, putative, expressed
6	13498672	13501214	LOC_Os06g23140	copper methylamine oxidase precursor, putative, expressed
6	13510344	13510755	LOC_Os06g23150	hypothetical protein
6	13514667	13521729	LOC_Os06g23160	bacterial transferase hexapeptide domain containing protein, expressed
6	13538870	13540416	LOC_Os06g23180	expressed protein
6	13541654	13544834	LOC_Os06g23190	receptor-like protein kinase 5 precursor, putative, expressed
6	13554710	13555313	LOC_Os06g23210	ribosomal protein L30 containing protein, expressed
6	13557094	13559144	LOC_Os06g23220	GRF zinc finger family protein, expressed
6	13584733	13591992	LOC_Os06g23274	zinc finger, C3HC4 type, domain containing protein, expressed
6	13601951	13604917	LOC_Os06g23290	phosphatidylinositol 3- and 4-kinase family protein, putative, expressed
6	13610067	13610641	LOC_Os06g23300	expressed protein
6	13616319	13616866	LOC_Os06g23310	expressed protein
6	13622966	13623430	LOC_Os06g23330	expressed protein
6	13630101	13631415	LOC_Os06g23350	late embryogenesis abundant protein D-34, putative, expressed
6	13631703	13632940	LOC_Os06g23360	LTPL70 - Protease inhibitor/seed storage/LTP family protein precursor, expressed
6	13635895	13640070	LOC_Os06g23370	expressed protein
6	13647634	13648352	LOC_Os06g23380	IQ calmodulin-binding motif family protein, putative, expressed
6	13649910	13652229	LOC_Os06g23390	IQ calmodulin-binding motif family protein, putative, expressed
6	13669056	13671846	LOC_Os06g23410	expressed protein
6	13674054	13676418	LOC_Os06g23420	exostosin family domain containing protein, expressed
6	13677506	13681875	LOC_Os06g23430	signal recognition particle 19 kDa protein, putative, expressed
6	13685422	13686180	LOC_Os06g23440	eukaryotic translation initiation factor 1A, putative, expressed
6	13690553	13697926	LOC_Os06g23460	KH domain containing protein, putative, expressed
6	13699712	13700325	LOC_Os06g23470	hypothetical protein
6	13701072	13701446	LOC_Os06g23480	expressed protein
6	13704784	13722973	LOC_Os06g23504	DTW domain containing protein, putative, expressed
6	13738447	13739456	LOC_Os06g23540	expressed protein
6	13743329	13745442	LOC_Os06g23560	anthocyanidin 5,3-O-glucosyltransferase, putative, expressed
6	13750549	13751946	LOC_Os06g23570	expressed protein
6	13755124	13755576	LOC_Os06g23590	expressed protein

6	13762013	13767164	LOC_Os06g23600	expressed protein
6	13775352	13775953	LOC_Os06g23620	expressed protein
6	13786384	13788325	LOC_Os06g23640	expressed protein
6	13804017	13805815	LOC_Os06g23650	no apical meristem protein, putative, expressed
6	13835593	13839057	LOC_Os06g23684	tyrosine aminotransferase, putative, expressed
6	13871663	13873423	LOC_Os06g23740	expressed protein
6	13877622	13878188	LOC_Os06g23750	expressed protein
6	13883250	13884184	LOC_Os06g23760	acyl-CoA oxidase, putative, expressed
6	13885410	13888877	LOC_Os06g23770	expressed protein
6	13888924	13889646	LOC_Os06g23775	expressed protein
6	13892471	13897688	LOC_Os06g23780	glutaryl-CoA dehydrogenase, mitochondrial precursor, putative, expressed
6	13900584	13901962	LOC_Os06g23790	expressed protein
6	13905082	13909018	LOC_Os06g23800	flavin-containing monooxygenase family protein, putative, expressed
6	13915101	13915751	LOC_Os06g23810	expressed protein
6	13937872	13938395	LOC_Os06g23850	expressed protein
6	13949417	13951281	LOC_Os06g23870	acyl-CoA dehydrogenase domain protein, putative, expressed
6	13956961	13959295	LOC_Os06g23880	hypothetical protein

qGE6.2.2

Chr	Start	Stop	Gene Name	Putative Function
6	16052471	16056775	LOC_Os06g28250	expressed protein
6	16058398	16060555	LOC_Os06g28260	expressed protein
6	16070798	16072705	LOC_Os06g28300	zinc knuckle family protein, expressed
6	16168793	16169592	LOC_Os06g28420	expressed protein
6	16195179	16195513	LOC_Os06g28470	expressed protein
6	16198162	16200384	LOC_Os06g28480	polygalacturonase inhibitor 1 precursor, putative, expressed
6	16217263	16219073	LOC_Os06g28520	expressed protein
6	16224024	16225310	LOC_Os06g28524	expressed protein
6	16245674	16247171	LOC_Os06g28550	nmrA-like family domain containing protein, expressed
6	16251104	16252882	LOC_Os06g28560	expressed protein

6 16264254 16270836 LOC_Os06g28590 bg55, putative, expressed
6 16276332 16278036 LOC_Os06g28600 expressed protein
6 16302034 16305078 LOC_Os06g28630 expressed protein
6 16329395 16331464 LOC_Os06g28670 polygalacturonase, putative, expressed
6 16335038 16335905 LOC_Os06g28680 expressed protein
6 16339515 16340768 LOC_Os06g28690 expressed protein
6 16352388 16353257 LOC_Os06g28720 expressed protein
6 16353727 16354521 LOC_Os06g28730 expressed protein
6 16363079 16366463 LOC_Os06g28740 expressed protein
6 16381270 16382990 LOC_Os06g28760 hypothetical protein
6 16385565 16387434 LOC_Os06g28770 expressed protein
6 16400699 16432410 LOC_Os06g28820 cycloartenol synthase, putative, expressed
6 16440845 16444414 LOC_Os06g28840 expressed protein
6 16481194 16485465 LOC_Os06g28890 expressed protein
6 16502251 16503405 LOC_Os06g28940 hypothetical protein
6 16504514 16505369 LOC_Os06g28950 expressed protein
6 16506995 16507947 LOC_Os06g28960 expressed protein
6 16509328 16512902 LOC_Os06g28970 bolA, putative, expressed
6 16534747 16535159 LOC_Os06g29010 expressed protein
6 16579007 16583086 LOC_Os06g29080 expressed protein
6 16588693 16590109 LOC_Os06g29100 expressed protein
6 16593797 16599300 LOC_Os06g29110 MLO domain containing protein, putative, expressed
STE_PAK_Ste20_STLK.5 - STE kinases include homologs to sterile 7, sterile 11 and
6 16604790 16616264 LOC_Os06g29120 sterile 20 from yeast, expressed
6 16649544 16653296 LOC_Os06g29180 erythronate-4-phosphate dehydrogenase domain containing protein, expressed
6 16658542 16658778 LOC_Os06g29190 expressed protein
6 16676478 16683139 LOC_Os06g29220 erythronate-4-phosphate dehydrogenase domain containing protein, expressed
6 16687151 16687942 LOC_Os06g29240 expressed protein
6 16693757 16694669 LOC_Os06g29250 expressed protein
6 16719384 16719848 LOC_Os06g29290 pentatricopeptide, putative, expressed

6 16732924 16745662 LOC_Os06g29310 ulp1 protease family protein, putative, expressed
6 16774133 16785410 LOC_Os06g29350 myosin, putative, expressed
6 16785962 16787113 LOC_Os06g29360 expressed protein
6 16791220 16793141 LOC_Os06g29370 expressed protein
6 16793634 16799776 LOC_Os06g29380 phospholipid-transporting ATPase, putative, expressed
6 16810191 16810436 LOC_Os06g29390 expressed protein
6 16825601 16836210 LOC_Os06g29400 surp module family protein, putative, expressed
6 16852004 16858873 LOC_Os06g29430 cytidine and deoxycytidylate deaminase zinc-binding region family protein, expressed
6 16862021 16864413 LOC_Os06g29440 expressed protein
6 16877329 16878690 LOC_Os06g29450 expressed protein
6 16879347 16881668 LOC_Os06g29460 expressed protein
6 16896515 16897661 LOC_Os06g29470 peroxidase precursor, putative, expressed
6 16910985 16916624 LOC_Os06g29490 expressed protein
6 16927219 16928806 LOC_Os06g29540 expressed protein
6 16933182 16936296 LOC_Os06g29560 expressed protein
6 16960716 16961852 LOC_Os06g29590 expressed protein
6 16983848 16984156 LOC_Os06g29620 hypothetical protein
6 17003628 17010230 LOC_Os06g29650 CDP-diacylglycerol--inositol 3-phosphatidyltransferase 1, putative, expressed
6 17020710 17021075 LOC_Os06g29670 expressed protein
6 17029405 17030321 LOC_Os06g29679 expressed protein
6 17035080 17036915 LOC_Os06g29690 dynein light chain type 1 domain containing protein, expressed
6 17044170 17046351 LOC_Os06g29700 OsFBD11 - F-box and FBD domain containing protein, expressed
6 17054545 17066625 LOC_Os06g29710 OsFBD12 - F-box and FBD domain containing protein, expressed
6 17066919 17068618 LOC_Os06g29730 RALFL28 - Rapid ALkalinization Factor RALF family protein precursor, expressed
6 17077761 17080192 LOC_Os06g29740 OsFBX197 - F-box domain containing protein, expressed

Supplementary Table S5 List of predicted candidate genes in 1-Mb intervals of the qGE4.1 region.

Chr	Start	Stop	Gene Name	Description
4	19651659	19656024	LOC_Os04g32620	ethylene-responsive transcription factor ERF114, putative, expressed
4	19669788	19670995	LOC_Os04g32640	hypothetical protein
4	19677039	19682186	LOC_Os04g32650	tRNA synthetase class II core domain containing protein, expressed cytochrome b-c1 complex subunit Rieske, mitochondrial precursor, putative, expressed
4	19684934	19688086	LOC_Os04g32660	exostosin family domain containing protein, expressed
4	19690552	19694678	LOC_Os04g32670	POEI20 - Pollen Ole e I allergen and extensin family protein precursor, expressed protein
4	19693409	19694678	LOC_Os04g32680	LEM13 - Anther-specific LEM1 family protein precursor, expressed
4	19695368	19709974	LOC_Os04g32690	40S ribosomal protein S27, putative, expressed
4	19710889	19711503	LOC_Os04g32700	hydrolase, NUDIX family, domain containing protein, expressed
4	19712823	19714034	LOC_Os04g32710	hypothetical protein
4	19735871	19740198	LOC_Os04g32740	AP2 domain containing protein, expressed
4	19773223	19773949	LOC_Os04g32780	basic proline-rich protein, putative, expressed
4	19790424	19791835	LOC_Os04g32790	expressed protein
4	19796270	19798423	LOC_Os04g32800	expressed protein
4	19812328	19814330	LOC_Os04g32810	expressed protein
4	19819398	19820459	LOC_Os04g32820	expressed protein
4	19822056	19822949	LOC_Os04g32830	expressed protein
4	19826312	19827902	LOC_Os04g32840	formin-like protein 20, putative, expressed
4	19835131	19836871	LOC_Os04g32850	basic proline-rich protein, putative, expressed
4	19841565	19844276	LOC_Os04g32860	expressed protein
4	19849118	19850578	LOC_Os04g32870	pentatricopeptide repeat-containing protein, putative, expressed
4	19850971	19859052	LOC_Os04g32880	CBS domain containing membrane protein, putative, expressed
4	19886676	19892492	LOC_Os04g32920	potassium transporter, putative, expressed
4	19893384	19896711	LOC_Os04g32930	DNA cross-link repair 1A protein, putative, expressed
4	19899895	19903657	LOC_Os04g32940	Leucine Rich Repeat family protein, expressed
4	19913228	19916749	LOC_Os04g32950	calreticulin precursor protein, putative, expressed
4	19920789	19929902	LOC_Os04g32960	TUDOR protein with multiple SNc domains, putative, expressed

4 19933108 19937566 LOC_Os04g32970 OTU-like cysteine protease family protein, putative, expressed
4 19940102 19942156 LOC_Os04g32980 protein binding protein, putative, expressed
4 19984084 19984644 LOC_Os04g33020 expressed protein
4 19994476 19996281 LOC_Os04g33030 protein binding protein, putative, expressed
4 20006128 20009276 LOC_Os04g33040 alpha-amylase precursor, putative, expressed
4 20009913 20015529 LOC_Os04g33050 HIRAN domain containing protein, putative, expressed
4 20015750 20019634 LOC_Os04g33060 NAD dependent epimerase/dehydratase family protein, putative,
4 20020086 20020355 LOC_Os04g33070 expressed protein
4 20021233 20025228 LOC_Os04g33080 protein phosphatase 2C, putative, expressed
4 20038759 20039182 LOC_Os04g33100 hypothetical protein
4 20045882 20046918 LOC_Os04g33110 expressed protein
4 20047507 20048091 LOC_Os04g33115 expressed protein
4 20057589 20058305 LOC_Os04g33130 expressed protein
4 20061940 20064227 LOC_Os04g33140 expressed protein
4 20065193 20066677 LOC_Os04g33150 desiccation-related protein PCC13-62 precursor, putative, expressed
4 20067814 20068212 LOC_Os04g33160 hypothetical protein
4 20072917 20073300 LOC_Os04g33170 hypothetical protein
4 20074215 20074457 LOC_Os04g33180 expressed protein
4 20077759 20083076 LOC_Os04g33190 AMP-binding enzyme, putative, expressed
4 20083916 20086861 LOC_Os04g33200 heparan-alpha-glucosaminide N-acetyltransferase, putative, expressed
4 20094182 20099729 LOC_Os04g33210 ERD1 protein, chloroplast precursor, putative, expressed
4 20099031 20103020 LOC_Os04g33220 SAM domain family protein, expressed
4 20105082 20108469 LOC_Os04g33230 hypothetical protein
4 20109574 20110741 LOC_Os04g33240 sex determination protein tasselseed-2, putative, expressed
4 20114964 20115457 LOC_Os04g33250 conserved hypothetical protein
4 20117269 20122227 LOC_Os04g33260 expressed protein
4 20124675 20131224 LOC_Os04g33280 expressed protein
4 20134769 20135921 LOC_Os04g33290 cysteine protease, putative, expressed
4 20138880 20141866 LOC_Os04g33300 amino acid kinase, putative, expressed
4 20144021 20145529 LOC_Os04g33310 expressed protein

4 20158993 20161450 LOC_Os04g33320 expressed protein
4 20169585 20171246 LOC_Os04g33390 prephenate dehydratase domain containing protein, expressed
4 20187930 20189402 LOC_Os04g33330 expressed protein
4 20190337 20190988 LOC_Os04g33340 expressed protein
4 20195358 20196213 LOC_Os04g33350 expressed protein
4 20200072 20201885 LOC_Os04g33360 gibberellin 2-beta-dioxygenase 7, putative, expressed
4 20211340 20213320 LOC_Os04g33370 cytochrome P450, putative, expressed
4 20214939 20215652 LOC_Os04g33380 expressed protein
4 20221253 20223074 LOC_Os04g33450 expressed protein
4 20224555 20226415 LOC_Os04g33440 DNA-binding protein S1FA, putative, expressed
4 20226884 20227249 LOC_Os04g33430 expressed protein
4 20229222 20230813 LOC_Os04g33420 DNA-binding protein S1FA, putative, expressed
4 20236216 20238126 LOC_Os04g33400 OsFBLD2 - F-box, LRR and FBD domain containing protein, expressed
4 20239790 20243460 LOC_Os04g33460 1,4-alpha-glucan-branching enzyme 2, chloroplast precursor, putative,
4 20245217 20249961 LOC_Os04g33470 Ser/Thr protein phosphatase family protein, putative, expressed
4 20250089 20255825 LOC_Os04g33480 histone deacetylase, putative, expressed

Supplementary Table S6 Plants with high grain elongation ratio and low grain elongation ratio.

The letters A and a represent Basmati's and PTT1's marker alleles, respectively.

No.	SSIIa	SBEIII	SBEIIa	GE ratio
118	Aa	AA	Aa	2.37
5	Aa	Aa	aa	2.30
89	Aa	Aa	Aa	2.29
95	AA	Aa	AA	2.29
148	Aa	AA	AA	2.24
73	AA	Aa	Aa	2.15
101	Aa	Aa	aa	2.11
179	AA	Aa	aa	2.08
71	Aa	Aa	aa	2.06
35	AA	Aa	Aa	2.04
126	AA	Aa	AA	2.04
149	Aa	Aa	Aa	2.01
137	AA	AA	Aa	2.00
130	AA	Aa	Aa	2.00
139	Aa	Aa	AA	1.99
52	AA	Aa	Aa	1.98
98	AA	Aa	AA	1.96
8	AA	Aa	AA	1.95
79	Aa	Aa	Aa	1.95
37	Aa	Aa	aa	1.93
18	Aa	Aa	Aa	1.64
196	Aa	Aa	Aa	1.63
153	Aa	Aa	Aa	1.63
177	aa	aa	Aa	1.62
176	aa	aa	aa	1.62
161	Aa	Aa	Aa	1.62
40	aa	aa	Aa	1.61
83	aa	aa	aa	1.61
19	Aa	aa	aa	1.60
168	aa	aa	aa	1.59
120	Aa	aa	aa	1.57
169	aa	aa	Aa	1.56
22	aa	Aa	aa	1.55
156	aa	aa	aa	1.55
6	aa	aa	AA	1.47
184	Aa	Aa	aa	1.44
100	Aa	aa	aa	1.39
25	aa	aa	aa	1.39
108	aa	aa	Aa	1.39
56	aa	aa	Aa	1.35

Supplementary Table S7 Grain elongation ratios and marker genotypes for Wx, SSI, SSIIa, SBEIII and SBEIIa among 170 F2 plants

Sample Name	Wx	SSI	SSIIa	SBEIII	SBEIIa	Phenotype (GE ratio)
1	B	B	B	B	A	1.87
2	H	H	H	H	H	1.78
4	H	H	H	B	A	1.78
5	H	H	H	H	A	2.30
6	A	A	A	A	B	1.47
7	B	B	B	H	H	1.89
8	B	B	B	H	B	1.95
10	B	B	B	H	H	1.81
11	H	H	H	H	H	1.67
12	B	B	H	H	A	1.96
13	H	H	H	H	B	1.83
14	H	H	H	H	H	1.86
15	B	B	B	B	H	1.69
16	H	B	B	H	A	1.39
17	B	B	H	A	B	1.77
18	H	H	H	H	H	1.83
19	H	H	H	A	A	1.60
21	H	H	H	H	A	1.80
22	A	A	A	H	A	1.55
23	H	B	H	B	B	1.85
25	H	H	A	A	A	1.39
26	H	H	H	B	B	1.63
27	A	A	A	H	H	1.91
28	H	H	H	B	H	1.80
31	H	H	A	A	H	1.66
32	A	A	H	H	A	1.78
33	H	H	B	B	H	1.65
34	A	A	A	A	B	1.99
35	B	B	B	H	H	2.04
36	H	H	H	H	A	1.73
37	H	H	H	H	A	1.93
38	H	H	H	A	A	1.42
39	H	A	A	A	A	1.41
40	B	H	A	A	H	1.61
41	H	H	H	H	H	1.70
42	B	B	B	B	H	1.79
43	A	A	A	A	A	1.76
44	H	A	H	H	H	1.53
45	H	H	H	H	A	1.79
46	B	B	H	H	H	1.82
47	A	A	H	A	H	1.70
48	A	H	H	H	B	1.66
49	A	A	A	A	A	1.90
50	H	H	H	H	H	1.55
51	H	H	H	H	H	1.62
52	H	H	B	H	H	1.98
54	H	B	B	B	H	1.91
55	H	H	H	H	A	1.82
56	A	A	A	A	H	1.35
57	H	B	B	B	A	1.71
59	B	B	H	H	H	1.51
60	A	H	H	H	H	1.86

62	A	A	A	A	A	2.09
63	A	H	H	H	A	1.78
64	H	H	H	H	B	1.65
65	H	B	H	H	H	1.63
66	H	H	H	H	A	1.78
67	H	H	H	H	B	1.88
69	H	H	H	A	A	1.60
70	H	H	H	A	H	1.70
71	A	H	H	H	A	2.06
73	A	H	B	H	H	2.15
74	H	H	A	H	H	1.91
75	H	H	H	B	B	1.87
76	A	A	A	A	A	1.70
78	H	H	B	B	H	1.88
79	H	H	H	H	H	1.95
80	A	A	H	H	H	1.66
82	A	A	A	A	A	1.51
83	H	H	A	A	A	1.61
84	H	H	A	A	A	1.77
85	H	H	B	H	A	1.83
87	H	H	B	B	B	1.86
88	B	B	B	B	H	1.78
89	A	H	H	H	H	2.29
90	H	H	A	A	A	1.61
91	A	H	A	A	H	1.76
92	B	B	H	H	H	1.83
93	A	A	A	A	A	1.74
94	H	A	A	A	H	1.50
95	A	A	B	H	B	2.29
96	H	B	H	H	A	1.63
97	H	H	A	A	A	1.73
98	B	B	B	H	B	1.96
99	A	A	H	H	A	1.86
100	A	A	H	A	A	1.39
101	A	H	H	H	A	2.11
102	A	A	A	H	H	1.72
103	B	B	H	H	B	1.72
104	H	B	H	H	B	1.66
105	H	H	H	H	H	1.74
106	B	H	H	A	A	1.72
108	A	A	A	A	H	1.39
110	H	H	H	H	B	1.74
111	H	H	H	H	H	1.87
113	H	H	H	H	B	1.82
114	H	H	H	H	H	1.83
115	A	A	H	B	H	1.72
117	H	B	B	B	H	1.88
118	B	B	H	B	H	2.37
119	B	B	H	A	B	1.68
120	H	H	H	A	A	1.57
121	H	H	H	H	A	1.77
122	A	A	B	H	A	1.68
124	H	B	H	H	B	1.87
125	A	H	B	B	H	1.65
126	B	B	B	H	B	2.04
127	H	H	H	H	H	1.62
129	A	A	H	H	H	1.66
130	B	B	B	H	H	2.00
131	A	A	A	A	A	1.71
132	H	H	H	H	A	1.82

133	A	H	H	B	A	1.75
134	A	H	H	H	B	1.79
135	A	A	B	H	H	1.65
136	B	B	B	B	A	1.76
137	B	B	B	B	H	2.00
139	H	H	H	H	B	1.99
140	H	H	A	A	H	1.73
141	H	H	H	A	H	1.82
142	B	B	B	H	H	1.90
143	H	H	H	H	H	1.61
144	B	H	H	H	H	1.83
145	H	H	A	A	B	1.49
146	A	A	A	A	H	1.90
147	B	B	B	B	H	1.66
148	A	H	H	B	B	2.24
149	H	H	H	H	H	2.01
150	B	B	B	B	H	1.92
151	H	H	H	H	H	1.57
152	B	B	B	B	H	1.76
153	B	H	H	H	H	1.63
154	A	A	H	H	H	1.58
155	A	A	A	H	A	1.51
156	A	A	A	A	A	1.55
157	H	H	H	H	H	1.69
158	H	A	H	H	H	1.92
159	H	H	B	B	H	1.45
160	A	B	B	B	H	1.67
161	A	H	H	H	H	1.62
162	H	H	H	A	A	1.73
164	H	H	H	H	H	1.76
167	B	B	B	B	B	1.93
168	A	A	A	A	A	1.59
169	A	A	A	A	H	1.56
170	A	A	A	A	H	1.84
171	B	B	B	B	H	1.84
172	H	H	H	H	A	1.89
173	H	H	H	H	B	1.75
174	A	H	A	A	H	1.73
175	A	H	H	H	H	1.64
176	H	H	A	A	A	1.62
177	A	A	A	A	H	1.62
178	H	H	H	H	A	1.88
179	H	H	B	H	A	2.08
180	B	H	H	H	H	1.94
181	A	A	H	H	A	1.87
183	H	H	H	H	H	1.88
184	A	H	H	H	A	1.44
185	A	H	H	H	A	1.94
186	A	H	H	H	H	1.89
187	B	B	H	H	A	1.89
188	A	A	H	H	A	1.80
189	B	B	B	B	A	1.76
190	B	B	H	H	A	1.65
191	A	A	H	H	H	1.65
193	H	H	H	H	A	1.67
194	H	H	B	H	B	1.85
195	B	H	H	H	H	1.73
196	H	H	H	H	H	1.63
