**Table S11. Genomic locations of genes and mutants related to tiller development, photoperiod sensitivity, circadian clock, and spike morphology in barley compiled for candidate gene analysis.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Gene ID | Gene/Mutant Name | Protein Annotation | Chr | Gene/  Interval  Start (bp)*a* | POPSEQ  Pos (cM)*a* | References |
| Tillering Genes | | | | | | |
| HORVU2Hr1G011730 | *ELIGULUM-A* (*ELI-A*) | Putative transposon with RNase H domain | 2 | 24295416 | 15.52 | (Okagaki et al., 2018) |
| Not applicable (NA) | *many noded dwarf1 (mnd1)* | NA | 2 | 100641977 | 52.61- 56.77 | (Druka et al., 2011) |
| NA | *absent lower laterals (als)* | NA | 3 | 601474414 | 86.44- 109.61 | (Druka et al., 2011) |
| HORVU3Hr1G085720 | *JUBEL2* or *LOW NUMBER OF TILLERS 1* (*LNT1*) | BEL1-like homeodomain transcription factor | 3 | 613897933 | 92.71 | (Dabbert et al., 2010) |
| HORVU3Hr1G106880 | *UNICULME4* (*CUL4*) | BLADE-ON-PETIOLE (BOP) 1/2-like BTB-ankyrin repeat containing protein | 3 | 671495852 | 137.71 | (Tavakol et al., 2015) |
| HORVU4Hr1G007040 | *INTERMEDIUM-C* (*INT-C*)/*HvTEOSINTE-BRANCHED 1* (*HvTB1*) | TCP transcription factor | 4 | 17599033 | 32.04 | (Ramsay et al., 2011) |
| HORVU5Hr1G081060 | *MANY NODED DWARF* (*MND*) | Cytochrome P450 homologous to rice PLASTOCHRON 1 | 5 | 562934361 | 97.09 | (Mascher et al., 2014) |
| NA | *uniculm2* (*cul2*) | NA | 6 | 423193924 | 60.19- 60.72 | (Druka et al., 2011; Okagaki et al., 2013) |
| NA | *granum-a* (*gra-a*) | NA | 7 | 636617013 | 126.2 | (Druka et al., 2011) |
| Circadian Clock and Flowering Genes | | | | | | |
| HORVU1Hr1G076430 | *PHOTOPERIOD-H2* (*PPD-H2*) | FLOWERING LOCUS T-like | 1 | 514098182 | 94.01 | (Faure et al., 2007; Laurie et al., 1995) |
| HORVU1Hr1G094980 | *praematurum.a-8* (*mat.a-8*)/ *early maturity 8* (*eam8*) | EARLY FLOWERING3-like - Nuclear protein involved in phytochrome B signaling | 1 | 556900385 | 132.54 | (Boden et al., 2014) |
| HORVU2Hr1G013400 | *PHOTOPERIOD-H1* | Two-component pseudo response regulator | 2 | 29123785 | 19.15 | (Turner et al., 2005) |
| HORVU2Hr1G023180 | *FLOWERING LOCUS T 4*-like (*FT4*) | FLOWERING LOCUS T-like | 2 | 68833704 | 47.46 | (Faure et al., 2007) |
| HORVU2Hr1G063800 | *HvMADS15* | APETALA1-like MADS box transcription factor | 2 | 432051592 | 58.76 | (Kobayashi et al., 2012; Schmitz et al., 2000) |
| HORVU2Hr1G072750 | *CENTRORADIALIS* (*CEN*) | Phosphatidylethanolamine-binding protein | 2 | 523377523 | 58.7 | (Comadran et al., 2012) |
| HORVU2Hr1G085910 | *CONSTANS 4*-like (*CO4*) | Transcription factor with a CCT domain | 2 | 620631167 | 65.61 | (Griffiths et al., 2003) |
| HORVU3Hr1G021140 | *GIGANTEA* (*GI*) | Nuclear protein involved in phytochrome B signaling | 3 | 67421434 | 45.8 | (Russell et al., 2016) |
| HORVU3Hr1G027590 | *FLOWERING LOCUS T 2*-like (*FT2*) | *FLOWERING LOCUS T-like* | 3 | 119252011 | 45.5 | (Russell et al., 2016) |
| HORVU3Hr1G079640 | *FLOWERING LOCUS D 4-*like (*FDL4*) | bZIP transcription factor | 3 | 584357437 | 76.45 | (Li et al., 2015) |
| HORVU3Hr1G086000 | *LUX ARRHYTHMO*-like (*LUX*)/ *early maturity 10* (*eam10*) | Myb family transcription factor | 3 | 615106969 | 92.71 | (Campoli et al., 2013) |
| HORVU4Hr1G021010 | PSUEDO RESPONSE REGULATOR 59-like (PRR59) | Two-component pseudo response regulator | 4 | 105940577 | 51.3 | (Campoli et al., 2012) |
| HORVU4Hr1G039300 | *FLAVIN-BINDING, KELCH REPEAT, F-BOX 1*-like (*FKF1*) | Flavin-Binding, Kelch Repeat, F-Box protein | 4 | 300696992 | 52.5 | (Calixto et al., 2015) |
| AK361423*b* | *FLOWERING LOCUS D 5*-like (*FDL5*) | bZIP transcription factor | 4 | 427458289 | 51.51 | (Li et al., 2015) |
| HORVU4Hr1G090390 | *FLOWERING LOCUS T 5*-like (*FT5*) | *FLOWERING LOCUS T-like* | 4 | 645064417 | 116.98 | (Faure et al., 2007) |
| HORVU5Hr1G060000 | *EARLY FLOWERING 4-like* (*ELF4*) | Nuclear protein involved in phytochrome B signaling | 5 | 469024048 | 48.4 | (Russell et al., 2016) |
| HORVU5Hr1G081620 | PSUEDO RESPONSE REGULATOR 95-like (PRR95) | Two-component pseudo response regulator | 5 | 565156282 | 97.1 | (Calixto et al., 2015) |
| HORVU5Hr1G095630 | *VERNALIZATION-H1* (*VRN-H1*) | MADS box transcription factor | 5 | 599122941 | 126.01 | (Fu et al., 2005) |
| HORVU6Hr1G022330 | *ZEITLUPEb* (*ZTLb*) | F-box protein, part of SCF complex that degrades TOC1 | 6 | 70576253 | 49.32 | (Calixto et al., 2015) |
| HORVU6Hr1G057630 | *TIMING OF CHLOROPHYLL A/B BINDING PROTEIN 1* (*TOC1*) | Two-component pseudo response regulator | 6 | 374866560 | 55.4 | (Calixto et al., 2015) |
| MLOC\_75496† | *CONSTANS 2*-like (*CO2*) | Transcription factor with a CCT domain | 6 | 504463498 | 68.23 | (Calixto et al., 2015) |
| HORVU7Hr1G024610 | *HvFLOWERING LOCUS T-LIKE (HVFT1) /VERNALIZATION-H3* (*VRN-H3*) | FLOWERING LOCUS T-like | 7 | 39679905 | 33.67 | (Yan et al., 2006) |
| HORVU7Hr1G043030 | *CONSTANS 1*-like (*CO1*) | Transcription factor with a CCT domain | 7 | 127667781 | 67.91 | (Calixto et al., 2015) |
| HORVU7Hr1G070870 | *HvCIRCADIAN CLOCK ASSOCIATED 1 (HvCCA1)/HvLATE ELONGED HYPOCOTYL*-like (*HvLHY-like*) | Myb family transcription factor | 7 | 385861846 | 70.8 | (Campoli et al., 2012; Ford et al., 2016; Russell et al., 2016) |
| HORVU7Hr1G099010 | *ZEITLUPEa* (*ZTLa*) | F-box protein, part of SCF complex that degrades TOC1 | 7 | 599452510 | 97.3 | (Calixto et al., 2015) |
| Spike Morphology Genes | | | | | | |
| HORVU1Hr1G051010 | *SIX-ROWED SPIKE 3* (*VRS3*) | Histone demethylase | 1 | 378411487 | 49.02 | (van Esse et al., 2017) |
| HORVU2Hr1G092290 | *SIX-ROWED SPIKE 1* (*VRS1*) | Homeodomain leucine zipper protein | 2 | 652031057 | 80.22 | (Komatsuda et al., 2007) |
| HORVU2Hr1G113880 | *ZEOCRITON* (*ZEO*) | APETALA2-like ethylene-responsive element binding protein | 2 | 730026693 | 127.08 | (Houston et al., 2013) |
| HORVU3Hr1G016690 | *SIX-ROWED SPIKE 4* (*VRS4*) | RAMOSA2-like lateral organ boundary (LOB) domain protein | 3 | 40939171 | 41.71 | (Koppolu et al., 2013) |
| MLOC\_61451.6*c* | *laxatum-a* (*lax-a*) | BOP1/2-like BTB-ankyrin repeat containing protein | 5 | 332395826 | 44.09 | (Jost et al., 2016) |
| HORVU5Hr1G061840 | *DENSE AND ERECT PANICLE 1* (*DEP1*)/ *Breviaristatum-e* (*ari-e*) | DEP1/ari-e | 5 | 482214542 | 53.36 | (Huang et al., 2009) |
| NA | *intermedium-b* (*int-b*) | NA | 5 | 556603279 | 91- 139.11 | (Druka et al., 2011) |
| NA | *intermedium-m* (*int-m*) | NA | 5 | 640705320 | 150.7- 158.23 | (Druka et al., 2011) |

*a*References for positions (Beier et al., 2017; Mascher et al., 2013, 2017)

*b*Aligned to 2016 low confidence gene annotated as "undescribed"

*c*Aligned to 2016 high confidence gene but gene was annotated improperly

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