

0.1

Supplemental Figure S1. Phylogeny of the human and tomato UBC domaincontaining proteins. Phylogenetic analysis of the human and tomato UBC domaincontaining proteins was performed using the same method and bootstrap trials as described for Figure 1. The phylogenetic tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree. Accession numbers of the tomato and human UBC domain-containing proteins are shown in the Supplemental Table I.

Chromosome	Gene	Domain	
locus	name	organization	
			 100 aa
Solyc06g070980.2.1	UBC1		_ 100 aa
Solyc03g113100.2.1	UBC2		
Solyc02g06/420.2.1	UBC3		
Solyc10g012240.2.1	UBC4		
Solyc01g094810.2.1	UBC5		
Solyc08g081270.2.1	UBC6		
Solyc05g054550.2.1	UBC/		
Solyc12g056100.1.1	UBC8		
Solycu8gu08220.2.1	UBC9		
Solycu5gu5u23u.2.1			
Solycu3gu33410.2.1			
Solyc0/g000000.2.1	UDCIZ		
Solycu5gu54540.2.1			
Solyc04g011430.2.1			
Solyc11g0/10/0.1.1			
Solyc04g060610.2.1			
Solyc02g064760.2.1			
Solve12e080020 1 1			
Solyc12g069030.1.1	UDC19		
Solve11e071260 1 1	UBC20		
Solve10g071200.1.1	UBC21		
Solve01a111680.2.1	UBC22		
Solve02g078210.2.1	UBC23		
Solve10g007000 2 1	UBC24		
Solve01a079290 1 1	UBC25		
Solvc06d072570.2.1	UBC20		
Solvc10g011740 2 1	UBC28		
Solvc02d083570 2 1	UBC29		
Solvc03q007470 2 1	UBC30		
Solvc01d095490 2 1	UBC31		
Solvc12d099310 1 1	UBC32		
Solvc03g123660.2.1	UBC33		
Solvc06g063100.2.1	UBC34		
Solvc07g062570.2.1	UBC13		
Solvc10a007260.2.1	UBC13-2		
Solvc07a024070.1.1	UBC37		
Solvc08a081950.2.1	UBC38		
Solvc06a082600.2.1	UBC39		
Solvc06a007510.2.1	UBC40		
Solvc02a087750.2.1	UBC41		
Solvc09q009720.1.1	UBC36		
Solvc03q112720.2.1	UBC43		
Solyc02g093110.2.1	UBC44		
Solýc04ğ078620.2.1	UBC45		
Solyc12g088680.1.1	UBC46		
Solyc03g044260.2.1	UBC47		
Solyc04g007970.2.1	Uev1B		
Solyc01g007860.2.1	Uev1C		
Solyc10g083120.1.1	Uev1D		
Solyc01g005840.2.1	COP10		
-			

Supplemental Figure S2. Schematic representation of domain organization in the tomato UBC domain-containing proteins. The chromosomal loci and given gene names encoding the UBC domain-containing proteins are shown on the left side. The UBC fold and the extension of the UBC domain-containing proteins are represented as dark ellipse and light-gray line, respectively, both of which are drawn in scale to their length in the number of amino acids. The UBA domain of SI-UBC27 is indicated as a dark-gray rectangle. The scale bar represents length of protein in amino acids.



Supplemental Figure S3. The tomato ubiquitin E2 enzymes are classified into thirteen subgroups. Numbering of the groups was based on both the phylogenetic analysis of tomato ubiquitin E2s and the previously reported classification of Arabidopsis ubiquitin E2s (Zhao et al., 2013). Phylogenetic analysis of the forty tomato ubiquitin E2s using the amino acid sequence of core UBC domain was performed using the same method and bootstrap trials as described for Figure 1. The Roman numerals designate the different E2 groups.









Supplemental Figure S4. Purified tomato E2 proteins as shown by SDS-PAGE. Approximately 3 μ g of thirty-five purified E2 proteins were separated by 10% SDS-PAGE and stained with Coomassie Brilliant Blue. The Roman numerals designate the group into which the E2s are classified. M represents the molecular weight markers. The numbers on the right denote the molecular mass of marker proteins in kD. The asterisks denote the band of corresponding purified E2 proteins. Except for UBC12, 14 and 36 that are 6xHis-tagged, all E2s are fused to GST.









α-FLAG





Supplemental Figure S5. Examination of the ubiquitin-conjugating activity of tomato E2s by thioester formation assay. (A) Anti-FLAG Western blots were performed following thioester assay of different tomato ubiquitin E2s. The reactions of the assay were terminated by adding SDS sample loading buffer in the presence of 100 mM DTT (DTT +) or 4M Urea (DTT –). The formation of DTT-sensitive ubiquitin adducts by tomato E2s is shown as charged E2. The numbers on the right denote the molecular mass of marker proteins in kD. The experiment was repeated two times with similar results. (B) Tomato E2 mutants in which the cysteine residue at the active site mutated lost ubiquitin E2s and E2 mutants. The reactions of the assay were terminated by adding SDS sample loading buffer in the presence of 4M Urea (DTT–). The numbers on the right denote the molecular mass of marker proteins in the presence of 4M Urea (DTT–). The numbers on the right denote the molecular mass of marker proteins in the presence of 4M. The experiment was repeated two times with similar results.



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Supplemental Figure S6. AvrPtoB shows no specificity towards the tomato ubiquitin E2 enzymes SI-UBC16, and 17. (A) AvrPtoB shows no specificity towards the tomato E2s SI-UBC16 and 17 in *in vitro* ubiquitination assay. The E2s SI-UBC16 and 17 demonstrated auto-ubiquitin-conjugation activity in the absence of an E3 ligase (lane 3 and 5). The presence of AvrPtoB enhanced their conjugation activity but did not alter the pattern of conjugates formed (lane 4 and 6). SI-UBC28 was included as a control. The numbers on the top mark the lanes/reactions. (B) The enhancement of the conjugation activity of SI-UBC16 by AvrPtoB is non-specific. The presence of a non-E3 ligase protein, GST-Fen also enhanced the auto-ubiquitin-conjugation activity of SI-UBC16 (lane 5, as compared to lane 2), which is comparable to the effect of AvrPtoB (lane 1). In the absence of SI-UBC16, no ubiquitin conjugation was observed (lane 3). The numbers on the right denote the molecular mass of marker proteins in kD.



	FL	Chl.	Bright	Merged
UBC25-cYFP + AvrPtoB-nYFP	_	\bigcirc	0	
UBC16-cYFP + AvrPtoB-nYFP	_	\bigcirc	0	0
UBC21-cYFP + AvrPtoB-nYFP		٥	0	
cYFP-EV + AvrPtoB-nYFP	_	9	0	\bigcirc
UBC25-cYFP + UBA1-nYFP	۲	۵.	*	¢.
UBC16-cYFP + UBA1-nYFP	•	Q		
UBC21-cYFP + UBA1-nYFP		Ś.		()
cYFP-EV + UBA1-nYFP		\bigcirc		

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Supplemental Figure S7. AvrPtoB interacts with tomato group III E2 members but not with E2s from other groups in BiFC assays. (A) Members of the group III E2s interact with AvrPtoB in *N. benthamiana* protoplasts. (B) Members of group VII, X, and XI tomato E2 did not interact with AvrPtoB in the BiFC assay. Tomato ubiquitin E1 enzyme UBA1 was used as positive control. Different construct pairs were transiently coexpressed in protoplasts isolated from *N. benthamiana* leaves. Cells were viewed with a confocal microscope under bright or laser light to detect cells and green fluorescence, respectively. The empty vector expressing N- and C-terminus of YFP (nYFP-EV and cYFP-EV) were used as negative control. EV, empty vector; FL, fluorescence; Chl., chlorophyll autofluorescence; Bright, bright field image. Scale bar = 20 µm.



Supplemental Figure S8. Members of Group III E2 interacted with AvrPtoB in coimmunoprecipitation (Co-IP) assay. Group III members Ubc29 and 30 were randomly selected for the assay. AvrPtoB-HA and 10Myc-tagged E2s were transiently co-expressed in *N. benthamiana* leaves. The Co-IP was carried out with an anti-HA antibody (IP: anti-HA). The presence of corresponding proteins (Top panel) and the input (bottom panel) were detected by Western blot using anti-HA antibody for AvrPtoB-HA and anti-Myc antibody for 10Myc-tagged E2s.



UBC38 UBC39 UBC40 UBC16 UBC17

0.02

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TRV TRV-group III



Supplemental Figure S9. Knocking down group III E2 genes in *N. benthamiana* by Virus-Induced Gene Silencing (VIGS). (A) The *N. benthamiana* group III E2 genes are highly homologous to their counterparts in tomato. The DNA sequences of N. benthamiana and tomato group III E2 genes' open reading frame (ORF) were used to generate the phylogenies. The same method and bootstrap trials as described for Figure 1 were employed for the phylogenetic analysis. The sequence IDs of the N. benthamiana ubiquitin E2 genes identified from the Sol Genomics Network database (SGN; http://solgenomics.net/) are shown in Supplemental Table I. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) is shown next to the branches. (B) Phenotypes of the *N*. benthamiana plants in which the group III E2 genes are silenced. The non-silenced TRV empty-vector (TRV) was used as a control. Photographs were taken 4 weeks after the approximately 3-week old seedlings were infiltrated with TRV or TRV-group III E2 genes constructs. The upper panel shows the top view of the plants while the lower panel shows the side view. (C) The group III ubiquitin E2 genes are efficiently and specifically silenced in *N. benthamiana* using the TRV vector. The transcript level of group III E2 genes and closely related E2 genes Nb-UBC16 and 17 (outside the group III) in non-silenced TRV control (TRV) and group III ubiquitin E2 genes-silenced (TRV-group III) N. benthamiana plants was examined as described (Mural et al., 2013). Nb-EF1 α was used as an internal reference for the determination of the amount of cDNA template to be used. Experiments in (B) and (C) were repeated at least two times with similar results.

Supplemental Fig S10 CAAGGAT Nb-UBC8 ATGGCATCCAAACGGA SI-UBC8 ATGGCATCCAAGCGGA CATTGGC 100 Nb-UBC8 CAGAAAGA AGGATCTCCAGAAAGATCCTCCTACCTCTTGCAG GCTGAAG 100 Nb-UBC8 200 ND-UBC8 AAGCAACAATTATGGGTCC SI-UBC8 AAGCAACAATCATGGGTCC CCCTATTCTGG AGGT 200 Nb-UBC8 300 TGCCT ATCTCC CAATAGCAATGGCAGCATT SI-UBC8 TGAAGGAACAGTGGAG 300 400 Nb-UBC8 SI-UBCS AAGGTACTGCTCTCTCTGTTCTCTGTT ATGA TGGTGCCGGAGATTGCTCATA G AGCAAGT 400 Nb-UBC8 447 TIGCCATGGG ACAACTGCCCGGAGCTGGACTCAAAA GA 447 100 Nb-UBC9 ATGGCATCCAAGAG<mark>G</mark>ATTCTGAAAGAGCTCAAGGATCT<mark>C</mark>CAGAAAGATCCTCCTACC GCTGGCCCAGTTGCG GAAGATATGTTTCACTGGC 100 SI-UBC9 200 Nb-UBC9 AAGCGACACTTATGGGTCC ATGCTGG AAGCCTCCAAAGGT 200 SI-UBC9 Nb-UBC9 AAACA AAGGAACA GAGCO 300 ATTTCC TTTCACCCAAACATCAACAGCAATGG<mark>C</mark>AGCATTTGCCTCGACATT<mark>C</mark>TGAAGGAACA<mark>A</mark>TGGAGCCCGGCACT SI-URCO AGCTTTTAGGACAAA 300 CTAACAGACCCAAATCCTGATGATCCTT CTAACAGACCCTAATCCCGATGATCCTT <u>Λ</u> AAGA CATAAAACCAA 400 Nb-UBC9 AAGGTGTGTGCTGTC AAGGTGCTGCTGTC SI-UBC9 TGGTGCC GAGATTGCTCATATGTACAAGACTGATAAAAGCAAGT 400 ACGAAGC Nb-UBC9 AAAA GGGI 447 TATGCCATGGGTTAG SI-UBC9 ACGAAGCA ACTGCTCGGAGCTGGAC CAAAA 447 100 Nb-UBC10 A T G G C T T C G AA AC G A A T A T T G A A G G A G C T G A A G G T C T C C C A A A A A G A T C C T C C T A C C A T G G C T T C G A A A C G A A T A T T G A A G G A G C T G A A G G A T C T C C A G C A G C G C G C G C G C G C CCTGTTGGAGAGGACATGTTTCACTGGC 100 SI-UBC10 200 Nb-UBC10 SI-UBC10 AGGCTACAATAATGGGGCCCTCTGA<mark>T</mark>AGCCCCTTA<mark>T</mark>GCTGGGGGTGTTT TCAC ATCCATTTTCCTCC<mark>G</mark>GATTATCCATTCAA<mark>G</mark>CCTCCTAAGGT 200 TAGGACAAAAGTT TTCCATCCAAATATCAA AATGGGAG CATATGCTTGGACATACTGAAGGAGCAGTGGAGCCC Nb-UBC10 AG TAAC 300 SI-UBC10 T G C T T T A G G A C A A A G T T T C C A T C C A A T A T C A A T G G G G G <mark>T</mark> A T A T G C T T G G A C A T A G C A G T G G A G C A C T G C A T T A A C T A T T C C 300 AAGGTTTTGCTTTCAAT<mark>C</mark>TGCTCACTTTTGACGGA<mark>T</mark>CCAAACCCTGA AAGGTTTTGCTTTCAATTTGCTCACTTTTGACGGA<mark>C</mark>CCAAACCCTGA CCTGAGATTGCTCACATGTACAAGAC 400 GACCO ACAAG Nb-UBC10 GTTCCTGAGATTGCTCACATGTACAAGAC SI-UBC10 GACCCC TGACAAGTCCAAAT 400 Nb-UBC10 A SI-UBC10 A AACCGCCAGGAGTTGGACCCAGAAGTA<mark>C</mark>GCCATGGG AACCGCCAGGAGTTGGACCCAGAAGTATGCCATGGG 447 Nb-UBC10

CAGGAGAATTCACAAGGAACTAAGGGAGTTGCAAAGAGACCCTCCTACTTCATGCAGTGCAGGTCCGGTGGCACAGGATAT AAGGAGAATTCAAAAGGAACTAAGGGAGTTGCAAAGAGACCCTCCTACTTCATGTAGTGCAGGTCCTGTGGCTCAGGATAT ATGGCAT 100 Nb-UBC11 ATGGCATC ATTGGC SI-UBC11 100 TCAAACC AGCCCTT AAGGT 200 Nb-UBC11 GCAGGTGGTG AAGCTACCATTAT TTGCAGGTGGTGTTTT CAAATGA TCA SI-UBC11 GIGGCCATCCATIT ACCCTTTCAAACC 200 Nb-UBC11 300 CAAGACCAAAG CCAAATA TAAATAATAATGGAAAATAI GGATCAATGGAGTCCTGC AGATCAATGGAGTCCTGC GATCAATGGAGT ATCC ATCC CATCCAAATATAAATAATAATGGAAATATTTGTTTGGACATTCTTAA GGCTTTCAAGACCAAAGT 300 SI-UBC11 TT CCATATGTTCACTACTAACAGATCCAAATCCAGATGATCCATTGGT AT C<mark>G</mark>ATATGTTCACTACTAACAGATCCAAATCCAGA<mark>C</mark>GATCCATTGGT AAAT AAGT Nb-UBC11 400 400 SI-UBC11 447 Nb-UBC11 TTGGACCCAAAAGTTTGCTATGAATTGA TTGGACCCAAAAATATGCTATGAATTGA 447 SI-UBC11

447

GAAG

ATGGCTTCAAAGAGGATTCAGAAGGAA<mark>C</mark>TGAAGGACTTGCAGAAAGACCCCCCTGCTTC ATGGCTTCAAAGAGGATTCAGAAGGAA<mark>T</mark>TGAAGGACTTGCAGAAAGACCCCCCTGCTTC 100 Nb-UBC12 GCAGT SI-UBC12 100 Nb-UBC12 200 TTTTCTGGGGGGTGTTTTCCTTGTGTC TTTTCTGGGGGGTGTTTTCCTTGCATC SI-UBC12 TCAAGCCCCCAAAGGT 200 Nb-UBC12 300 ATCCTAAAGAACAATGGAGCCCTGC ATCCTAAAGGAACAATGGAGCCCTGC TGTATCC CTCTTTC GA SI-UBC12 TAATGGTAG 300 400 Nb-UBC12 TTTGCTTACTGATCCCAAATCCAGATGATCCTTTAGTGCCAGAGATTGCTCACATGTACAAGACGGATAGACCGGATAGACCGAGAG AAGGTGCTGCTTTCTATTTGCTC 400 SI-UBC12 ATGAGAGTACTGC ATGAGAGTACTGC TAGATCTTGGACCCAGAAATATGCCATGGGTTAG CAGATCATGGACCCAGAAATACGCAATGGGTTGA 447 Nb-UBC12 SI-UBC12 447

100 Nb-I/RC28 A T G G C T T C G A A A C G G A T A T T G A A G G A G C T T A A G G A A T G G C T T C T A A G C G G A T A T T G A A G G A G C T T A A G G A CAGAAAGATCCTCCTAC GGCCCCGTCGGAGAGGACATGTTTCACTGGC 100 SI-UBC28 Nb-UBC28 200 TCCCTATGCTGGGGGGGGTGTATTTTTAGTCACTAT SI-UBC28 AAGCTACAATAATGGGCCCTCCAGATAG CATTTTCCTCCTGATTATCCATTTAAACCTCCTAAGGT 200 Nb-UBC28 TACCACAAAACT CATCCAAATAT TAATAGCAATGG ACTATATCC GGACATAT TGAAGGAGCAATGGAGCCCTGCC 300 AGTATATGCTTGGACATATTGAAGGAGCAATGGAGCCCTGCCTTGACTATTTCC SI-UBC28 TGCTTTTAGGACAAAAGTTTTCCATCCAAATATTAATAGCAATGG 300 Nb-UBC28 GAGATIGCTCATATGTACAAGAC GACAGGGCAAAAT GACAGGGCAAAAT 400 AAGGTTTTGCT TIGACGGATCC TGGTGCCTGAGATTGCTCATATGTACAAGAC SI-UBC28 400 Nb-UBC28 447 CCCGGAGTTGGACCCAGAAGTATGC CCCGGAGTTGGACCCAGAAGTATGC 447 SI-UBC28

Nb-UBC29 SI-UBC29	A TGG CATC CAGGAGAA TTC TCAAGGAG CTAAGGGACTTG CAAAGAGACCCTC CCCC TTCATGCAG TGCAGGTCCAGTAG CTCAGGATATG TTC CATTGGC A TGG CATC CAGGAGAA TTCAAAAGGAG CTAAAAGACTTG CAAAGAGACCCTC CCCC TTCATGC AG TGCAGGTCC AGTAG CTCAGGATATG TTCATTGGC	100 100
Nb-UBC29 SI-UBC29	AAGCAACTATAATTGGTCCAAATGATAGCCCTTATGCTGGTGGTGTGTTTTCCAAGTCACCATCCAT	200 200
Nb-UBC29 SI-UBC29	GGCTTT <mark>T</mark> AGGAC <mark>A</mark> AGAGTTTTCCATCCAAATATAAACAATAATGGAAATATTTGTTTG	300 300
Nb-UBC29 SI-UBC29	AAGGTTTTGCT <mark>C</mark> TCCATATGTTC <mark>G</mark> CTGCTAACAGATCCAAATCCAGATGATCCA <mark>T</mark> TGGTTCCAGA <mark>G</mark> ATTGCTCATATGTGCAAGACTGATA <mark>GGA</mark> ACAAGT AAGGTTTTGCT <mark>G</mark> TCCATATGTTC <mark>A</mark> CTGCTAACAGATCCAAATCCAGATGATCCA <mark>C</mark> TGGTTCCAGA <mark>A</mark> ATTGCTCATATGTGCAAGACTGATA <mark>AAA</mark> CCAAGT	400 400
Nb-UBC29 SI-UBC29	A <mark>T</mark> GAA <mark>T</mark> CAATGGCTCGTAGTTGGACTCAAAAGTATGC <mark>T</mark> ATGAACTGA A <mark>C</mark> GA <mark>G</mark> TCAATGGCTCGTAGTTGGACTCAAAAGTATGC <mark>C</mark> ATGAACTGA	447 447
Nb-UBC30 SI-UBC30	A TGGCTTCA <mark>AAGCGGATCTTGAAGGAGCTCAAAGATCTTCAAAAGGATCCTCCA</mark> ACTTCTTG <mark>C</mark> AGTGCTGGACCTGTTGCTGAGGACATGTTTCATTGGC A TGGCTTC <mark>C</mark> AAGCGGATCTTGAAGGAGCTCAAAGATCTTCAAAAGGATCCTCC <mark>TACTTCTTG</mark> TAGTGCTGGACCTGTTGCTGAGGACATGTTTCATTGGC	100 100
Nb-UBC30 SI-UBC30	AAGCAACGATAATGGGTCCTCCAGACAGTCCTTTTTTCTGGTGGTGGTGTTTTTCTGGTGACGAT AAGCAACGATCATGGGTCCTCCAGACAGTCCTTATTCCGGGGGGAGATTTCCTGGTGACAATCCATTTTCCTCCAGATTATCCATTCAAGCCACCTAAGGT	200 200
Nb-UBC30 SI-UBC30	GGCTTTCAGGACAAAAGTTTTCCACCCAAACATAAACAG <mark>T</mark> AACGG <mark>G</mark> AGCATATG <mark>C</mark> CTTGACATTTTAAAGGAGCAGTGGAGCCCTGC <mark>C</mark> CTAAC <mark>G</mark> ATTTCC GGCTTTCAGGACAAAAGTTTTCCACCCAAACATAAACAG <mark>G</mark> AACGG <mark>A</mark> AGCATATG <mark>T</mark> CTTGACATTTTAAAGGAGCAGTGGAGCCCTGC <mark>T</mark> CTAAC <mark>A</mark> ATTTCC	300 300
Nb-UBC30 SI-UBC30	AAGGTGTTGCTTTCAATATGTTCTCTTTTTGACGGATGCTAATCCTGACGATCCTTTGGTCCCGGAGATTGCACACATGTACAAGACAGAC	400 400
Nb-UBC30 SI-UBC30	ATGAGACAACTGCAAGGAGCTGGACCCAGAAGTATGCCATGGGCTAA A <mark>G</mark> GAGA <mark>GT</mark> ACTGCAAGGAGCTGGACCCAGAAGTATGCCATGGGCTAA	447 447
Nb-UBC31 SI-UBC31	A T G G C T T C G A A T A T T G A A G G G C T G A A G G A T C T C C A A A A G A T C C T C C T G C A C C C G T C C T G C A G A G G A C T C A C C A C C C C T G C A C C C G T C C T G C A G A G G A C T G T T C A C C G C C C C T G T G C A G A G G A C T G T T C A C C G C C C C C T G C G C C C C T G T G	100 100
Nb-UBC31 SI-UBC31	AAGC <mark>T</mark> ACAATAATGGGGCCCTCTGACAGCCCTTACGCTGGGGGGTGTATTTTTAGTCACTATCCATTTTCCTCCAGATTATCCATTCAAACCTCCTAAGGT A <mark>GGGC</mark> ACAATTATGGGTCCCCCAGACAGTCCTTATACTGGTGGTGTGTATTTTTAGTCACTATCCATTTTCCTCC <mark>T</mark> GACTATCCATTCAAGCCTCCTAAGGT	200 200
Nb-UBC31 SI-UBC31	TGCTTTTAGGACAAAAGTTTTCCATCCAAATATCAACAGTAATGGGAGCATATGCTTGGACATACTGAAGGAGCAGTGGAGCCCCGGCCTTAACTATTCC TGCTTTTAGGACAAAAGTTTTCCATCCAAAATATTAACAGTAATGGCAGTATATGCCTCGACATATTGAAGGAGCAGTGGAGCCCTGCCTTAACTATC	300 300
Nb-UBC31 SI-UBC31	AAGGTTTTGCTTTCAATCTGCTCACTTTTGACGGACCCAAACCCCGATGATCCCCTGGTTCCTGAGATTGCTCACATGTACAAGACAGAC	400 400
Nb-UBC31 SI-UBC31	ATGAAGCAACTGCCAGGAGTTGGACCCAGAAGTATGCCATGGGCTAA ACGAATCAACTGCCGGGGTTTGGACCCAGAAATATGCAATGGGTTAA	447 447
Nb-UBC31 SI-UBC31	ATGAAGCAACTGCCAGGAGTTGGACCCAGAAGTATGCCATGGGCTAA ACGAATCAACTGCCCGGGTTTGGACCCAGAAATATGCAATGGGTTAA	447 447
Nb-UBC31 SI-UBC31 Nb-UBC38 SI-UBC38	ATGAAGCAACTGCCAGGAGTTGGACCCAGAAGTATGCCATGGGCTAA ACGAATCAACTGCCCGGGTTTGGACCCAGAAATATGCAATGGGTTAA ATGGCATCCAAACGGATTCTCAAAGAGCTCAAAGATCTCCAGAAAGATCCTCCTACCTCTTGCAGCGCTGGCCCAGTTGCTGAAGACATGTTTCATTGGC ATGGCGTCCAAGCGGATTCTGAAAGAGCTCAAGGATCTCCAGAAAGATCCTCCTACTTCTGCAGCGCTGGCCCAGTTGCTGAAGACATGTTTCATTGGC	447 447 100 100
Nb-UBC31 SI-UBC31 Nb-UBC38 SI-UBC38 Nb-UBC38 SI-UBC38	ATGGAAGCAACTGCCAGGAGTTGGACCCAGAAGTATGCCATGGGCTAA ACGAATCAACTGCCCGGGTTTGGACCCAGAAATATGCAATGGGTTAA ATGGCATCCAAACGGATTCTCAAAGAGCTCAAAGATCTCCAGAAAGATCCTCCTACCTCTTGCAGCGCTGGCCCAGTTGCTGAAGACATGTTTCATTGGC ATGGCGTCCAAGCGGATTCTGAAAGAGCTCAAGGATCTGCAGAAAGATCCTCCTACTTCTTGCAGTGCCGCCCAGTTGCCGAAAGACATGTTTCACTGGC AAGCAACAATTATGGGTCCACCTGACAGCCCTTATGCTGGCGGAGGTGTTTCTTGTTACCATTCATT	447 447 100 100 200 200
Nb-UBC31 SI-UBC33 Nb-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38	ATGGCATCCAAACGGGAGTTGGACCCAGAAGTATGCCATGGGCTAA ACGAATCAACTGCCCGGGTTTGGACCCAGAAATATGCAATGGGTTAA ATGGCATCCAAACGGATTCTCAAAGAGCTCAAAGATCTCCAGAAAGATCCTCCTACCTCTTGCAGCGCCCAGTTGCTGAAGACATGTTTCATTGGC ATGGCGTCCAAGCGGATTCTGAAAGAGCTCAAGGATCTGCAGAAAGATCCTCCTACTTCTTGCAGTGCCGGTCCAGTTGGCGAAGAATATGTTTCACTGGC AAGCAACAATTATGGGGTCCACCTGACAGCCCTTATGCTGGCGGAGGGGGTGTTTCTTGTTACCATTCACTTGCCGTCCAGTTGGCGAAAGATATGTTTCACTGGC AAGCAACAATTATGGGGTCCACCTGACAGCCCTTATGCTGGCGGAGGGGGGGG	447 447 100 100 200 200 300 300
Nb-UBC31 SI-UBC31 Nb-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38	ATGAAGCAACTGCCAGGAGTTGGACCCAGAAGTATGCCATGGGCTAA ACGAATCAACTGCCGGGGTTTGGACCCAGAAATATGCAATGGGTTAA ATGGCATCCAAACGCGGATTCTCAAAGAGCCCAAAGAGTCTCCCAGAAAGATCCTCCTACCTCTGCAGCGCGCCAGGTGCCCAGTTGCTGAAGACAATGTTTCATTGGC ATGGCGTCCAAGCCGGATTCTGAAAGAGCTCAAGGATCTGCAGAAAGATCCTCCTACTTCTTGTTACCATTGGCGCCAGTTGGCGAAGATATGTTTCACTGGC AAGCAACAATTATGGGTCCACCTGACAGCCCTTATGCTGGCGGAGATGCTCTCTTGTTACCATTCATT	447 447 100 100 200 200 300 300 400 400
Nb-UBC31 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38	ATGAACCAACTGCC GGG TTTGGACCCAGAAGTATGCCATGGC TAA ACGAATCAACTGCC GGG TTTGGACCCAGAAGTATGCAATGGC TAA ACGAATCAACTGCC GGG TTTGGACCCAGAAATATGCAATGGC TAA ATGGC TCCAAACGGGATTCTC AAAGAGCTCAAAGATCTCCCAGAAAGATCCTCCTAC TTCTTGCAGC GCCCAGTTGCT GAAGACATGTTTCATTGGC ATGGC GTCCAAGCGGATTCT GAAAGAGCTCAAGGATCTCCCAGAAAGATCCTCCTAC TTCTTGCAGC GCCCAGTTGC GAAGACATGTTTCACTGGC AAGCCAACAATTATGGGTCCACCTGACAGCCCTTATGCT GGCGGAGGTGTTTCTTGTTACCATTCATTTCCACCTGAC TATCCTATTAAGCCACC GAAGGT AAGCCAACAATCATGGGGTCCACCTGACAGCCCTTATGCTGGCGGAGGTGTTTCTTGTTACCATTCATT	447 447 100 100 200 200 300 300 400 400 447 447
Nb-UBC31 SI-UBC33 Nb-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38	ATGAAGCAACTGCC AGGAGTTGGACCCAGAAGTATGCCATGGG CTAA ACGAATCAACTGCC CGGGTTTGGACCCAGAAATATGCAATGGGTTAA ATGGCATCCAAACGCGGATTCTCAAAGAGCTCAAAGATCTCCAGAAAGATCCTCCTACGTCTTGCAGCGCGCCAGTTGCTGAAGACATGTTTCATTGGC ATGGCGTCCAAACGGGATTCTCAAAGAGCTCAAAGGATCTCCCAGAAAGATCCTCCTACTTCTTGCAGCGCGCCAGTTGCTGCAGAGACATGTTTCACTGGC AAGCCAACAATTATGGGTCCACCTGACAGCCCTTATGCTGGCGGGAGTGTTTCTTGTACCATTCATT	447 447 100 100 200 200 300 300 400 400 447 447
Nb-UBC31 SI-UBC31 Nb-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC39 SI-UBC39	ATGGCAACTGCCAGG AG TTGGCACCCAGAAG TATGCCATGGG TAA ACGAATCAACTGCCCGG ATTCTCAAAGAGCTCAAAGGTTTGCCAATGGG TAA ATGGCGTCCAAACGGCATTCTCAAAGAGCTCAAAGGATCTCCCAGAAGGATCCTCCTACCTCTTGCAGCGCGCCCAGGTGCTGCAGGAGCAAGTTTGCTTGC	447 447 100 100 200 200 300 300 400 440 447 447
Nb-UBC31 SI-UBC33 Nb-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39	A TGAAC CAACTGCC AGGAC TTGGACCCCAGAAC TATGC ATGGC TAGGG TAA A CGAAT CAACTGCC CGG T TTGGACCCAGAAA TATGC ATGGG TAA A TGGAC CAACTGCC CGG T TTGGACCCAGAAA TATGC ATGGG TAA A TGGAC TCCAA CGGATTCT CAAAGAG CTCAA GATCT CCAGAAAGAT CCTCC TAC T TCTTG CAG TCCGG TCCAGTTG C TGAAGAC ATGTTTCA TGGC A TGGC TCCAA CGGATTCT CAAAGAG CTCAA GGATCT CCAGAAAGAT CCTCC TAC T TCTTG CAG TCCTGG TCCAGTTG C CAGTTG C CAAGAA TG TTTCACTGGC A AGCAACAATTATGGG TCCACCTGACAGCCC TTATGC TGGC GGGAG TG TTTCT TGTTACCATTCATTTTCCACCTGAC A AGCAACAATCATGGGG TCCACCTGACAGCCC TTATGC TGGC GGGAG TG TTTCT G TTACCATTCATTTTCCACCTGAC A AGCAACAATCATGGG TCCACCTGACAGTCC C TATGC TGGC GGGAG TG TTTCT G TTACCATTCATTTTCCACCTGA A AGCATTCAGGG TCCACCTGACAGTCC C TATGC TGGC GGGAG TG TTTCT G TTACCATTCATTTTCCACCTGA A AGCATTCAGGG TCCACCTGACAGTCC C TATGC TGGC GGGAG TG TTTCT G TTACCATTCACTTCAC	447 447 100 100 200 200 300 300 400 400 447 447 447
Nb-UBC31 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39	A TEGAA CAACTECE A GEAG TITEGAACCAAAA GITTEGCATEGEG TAA A GEAA TCAACTECE GEGET TITEGAACCAAAA GATCT CAAGAACTC CAAAAGATCCTCCTAC CICTEGCAGC GCTEGC CCAGTTEG CAAGACATETTCATEGEG A TEGEG TCCAAACGEGATTCT CAAAGAACCCAAAGATCT CAAGAACTC CCAGAAAGATCCTCCTAC TICTTEGAAGCGCTEGC CCAGTTEG CAAAGATATETTCACTEGEG A TEGEG TCCAAACGEGATTCT CAAAGAAGCCCAAAGATCT CAAGAAGATCCTCCTAC TICTTEGAAGCGCTEGC CCAGTTEG CAAAGATATETTCACTEGEG A TEGEG TCCAAACGEGTCCACCTEAACAGCCCT TATECT GCAGAAAGATCCTCCTACT TCTTTCTCATTTCCACTEG TATCCATTTAAGCCACCGAAGGT A TEGEG TCCAACTEGACAGTEGC TATECTEGC GEGGEGGG TEGATTTCT GTTACCATTCATTTTCCACTEG TATCCATTTAAGCCACCGAAGGT A AGCAACAAT CATEGGTCCACCTEGACAGTEGC TATECTGEGEGEGGGAGTTTCTC GTTACCATTCATTTTCCACCTGAC TATCCACTTTAAGCCACCGCAGG A GCTTT CAGGAACAAAGGTTTTCCACCCAAACAACAACAACAGCAATGGTAGCATTTGCCT GAACATTCCTCAATTTTAAGCCACCGCAGGGCCCAGGG TCTTTAAGCAACCGCAAGGTTTTCCCATTTAAGCCACCGAAGGTTTTCCACTCC GCTTT TAGGAACAAAGGTTTTCCACCCGAACATCAACAGCCAATGGTAGCATTTGCCT GGACATTTCTCAATGTACAAGGACCCGAGG TCTTTAAGCAACCGCAAGGT A AGGTAACAAC GCCCCGGAAGCTTGTCCTCTGTGTAACAACCCCTAATCCTGATGATGCGGTTGGCCGGAGATTGCTCATATGTACAAGACCGAACGAA	447 447 100 100 200 200 200 300 300 400 400 400 447 447 100 100 200 200 200 300 300 300
Nb-UBC31 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39	A TGGAA CTGCC AGG CG TTGGACCCCAGAA TATGC ATGC	447 447 100 100 200 200 200 300 400 447 447 447 100 100 200 200 300 300 300 300 400 440 440
Nb-UBC31 SI-UBC33 Nb-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 Nb-UBC38 SI-UBC38 Nb-UBC38 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39	A TGGAA CCAACTGCC A GGA GT TGCAACCAGAAA GTATGCC ATGGG CTAA A CGAA TCAACTGCC GGG TT IT GGACCCAGAAA TATGCC ATGGG CTAA A TGGGA TCCAAACGGG TTCT GAAAGAGCTCAAA GATTT CCAGAAAGATCCTCCTAG GT CTTGCAG GGCGGG CCAGTTGC TGAAGAC ATGTTTCAT TGGGA TCCAAACGGG TTCT GAAAGAGCTCAAA GATTT CCAGAAAGATCCTCCTAG GT CTTGCAG GGCGG GCCAGTTGG CGAAGATATTTCATTGGC A TGGGA TCCAAACGGG TTCTGAAAGAGCTCAAAGGATCCTCCAGAAGATCCTCCTAG GT CTTGCAG GGCGG GCCAGTTGG CGAAGATATTTCACTGG A TGGGA TCCAACGGG TCCAACGGG TTATGG GGC GGAG GT TTTCT CATTACCATTCATTTTCCACCTGAG TTTCCATTTAAGCCACG GAAGAT A TGGAACAAAT TATGGG TCCAACCTGACAG TCC TTTGC GGC GGAG GT TTTCT CATTACCATTCATTTTCCACCTGAT TTTCCACCTGACAGT TTTCCACCTGACAG TCCACCG AACGAT A GCTTTC A GGACAAAGGTTTTCCACCG GAACATCAACAGCAATGG TAGCATTTGCC TGACAATT TGAAGGAAGCAGTGGAGCCCG GG GT TGACATTCC GCTTT TAGGACCAAAGGTTTTCCACCG GAACATCAACAGCAATGG TAGCATTTGCC TGACAATTG TACCACTGCACGGAGGCCCG GG GT TGACATTCC GCTTT TAGGACCAAAGGTTTTCCACCG GAACATCAACAGCAATGG TAGCATTGCC TGGACATTG TCCAAGGAGGACCCCG GG GT TGACATTCC GCTTTT TAGGACCAAAGGTTTTCCACCG GAACATCAACAGCCAATGG TAGCATTGCC TGGACATTG TCCAAGGAGGACCCCG GG GCT TGCAATGATCCAATGCAACGCC GAGATTGCT CATAGTACAAGACCG GAGCTGGATGC CAAAGTAGCGAACGC TATGTTCCACG GAACAACGC GT TGCTGAAGAACAACG GACCG GAGATTGCT CATAGTACAAGCCG GAGATTGCT CATAGTACAAGACCG GAGCTGAACAACGCG CG AAGCAACAACG GC CAAAAGTACCGCC AAAGTACCCC TATGCTAGGGATTGCT CATAGTACAAGACCG TGATGATGC CAAAAGTACGCC TATGTTCCACCAGGATTGCT CAAAGAACAACG GC CAAAAGTACGCC TATGCTAAGGAATCCCC TATGCTAGGATTGCC CAAGGAATCGT CCAAGGAACTGATGC GAAACAACG GC CAAAAGTACGCCC TATGCAAGAGGATCCTCCC GAAGCG TGATGCT CAAAGAACCAGTGG TCCAGG TTGCT AAAGAACCAG GC TATGTTCCACAAGAGCG TATGTTCCACCAAGGAACGATCCTCC GAAGCG TATGTTCCACAAGGACGGATATGTTCCA A TGGAACCAACG TCCAAGGG TCCAAAGCCCCT TATGCAGGAGGGG TGTATTTTGGT TCCAGGCG TCCAGGT TCCAGGGATTGCCCAAGGGCCCAAGGT A TGGAACCAACGT ACAAGGCCT AAGCCCCT TATGCAGGAGGGG TGTATTTTTGGT TCCAAGCGGCG TCCAGGT TCCAGGGATTGCCAATGCCCAAGGGCCAAGGT A CGAACGAACAAACAACGG CTAAGCCCCT TATGCACGAGGGGGGG TGTATTTTTGGT TCCAAGGCGCCGCG CTAAGGCCAAGGGCCAAGGT A CGAACGAACGAACAAAGCGG ACAAGGCCCCAATGGAAGGGAGGGT TAT	447 447 100 100 200 200 300 400 400 400 447 447 100 100 200 200 300 300 400 440 400 440 447
Nb-UBC31 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39	ATGCAACTGCC ACCTGCACCTGCACACTGCACAGAACTATGCC ATGCG TATGCC ATGGG TAA ATGGCATCCAAACGCGC GG GTTTCTCAAAGGCCCCAAAGGATCTCTCCAAAGGATCCTCCTCACCTCTTGCCAGCGCCTGGC CCACGTGC TGAAGGCAATGTTTCATTGGC ATGGCATCCAACGCGCATTCTCAAAGGACCTCAACGCACTGCAAAGGATCCTCCTCACCTCTTGCCAGCGCCTGGC CCACGTGGC GAAGGATATGTTCATCTGGC ATGGCGTCCAACGCGCACCTGAAGGCCG TATGCTGCGCGGAGGTGTTTCTTGTTTGCATTGCA	447 447 100 100 200 300 200 400 400 447 447 100 100 200 200 300 300 300 300 400 447 447
Nb-UBC31 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39 SI-UBC39	ATGECA CAACTEGE CAAGTEGE AGE TIGGAACCCAAGAAGTATGECATGGE TAA ATGECA CAACTGCE CGG TITGGAACCCAAGAAGTATGECAAGGET TAG ATGECA CAACTGCE CGG TITGGAACCCAAGAAGTATGECAAGGET TAG ATGECA CAACTGCE CGG TITGGAACCCAAGAAGTATGECAAGGET TAG ATGECA CAACTGCE CGG TITGGAACCCAAGAAGTATGECAAGGATCCTCCTACCTCCTACCTCTTGCAGCCACGC CAACTGACAACAATGTTTCA ATGECA CAACTGCE CAACTGCE CAACGGE TITGGAACGAAGGATCCTCCTCCTACCTCTTGCAGCGCCGCCGCAGTGCCAACTGACAGCCAACGGAAGAATGTTTCA AGCAACAATTATGGGTCCAACTGAACGGE TITGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG	447 447 100 200 200 300 300 400 400 400 447 447 447 100 200 200 200 300 300 300 400 447 447
Nb-UBC31 SI-UBC33 Nb-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC38 SI-UBC39 SI-UBC39 Nb-UBC39 SI-UBC39 Nb-UBC39 SI-UBC30 SI-UBC40 SI-UBC40 SI-UBC40 SI-UBC40	ATGCA CARACTEGE AGE TEGAACCCAGAA TATEGE ATGCE TAA A GAA TOALTEGE GEG ATTEGE ACCCAGAA TATEGE ATGCE TAA A GEAA TOALTEGE GEG ATTEGE ACCCAGAA TATEGE ATGCE TAA A GEAA TOALTEGE GEG ATTEGE ACCCAGAA TATEGE ATGCE ATGCE TAA A GEAA TOALTEGE TEGAACCCAGAA TOTEGAAGAACATEGAAGAACCTECTACE FETTEGAE GETEGE CCAGTTEGE CAAGAACAATTATEGE A GEAA CAACTEGE CCACCTEALCACE COL TATEGE GEG GEG ACTETTICT TO TTAGCAGT CAATTATTTCCACCTEAL TATEGE CAAGAACAATTATTCCACCTEAL ATTEGE CAACTEGE ACCACTEAL AAGE ATTEGE TEGACAACATEGAAGAACAATCATEGE TETTICT TO TTAGCAGT CAATTATTCCACCTEAL TATEGE ACCACTEAL AAGE ATTEGE TEGACATTATTTCCACCTEAL TATEGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL TATEGE TEGACATTATTTCCACCTEAL TATEGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL TATEGE TEGACATTATTTCCACCTEAL TATEGE ACCACTEAL AAGE ACCACTEAL AAGE ACCACTEAL TATEGE ACCACTEAL TATEGAAGAAGCACCTEAG TATEACACTEACE AAGE ACCACTEAL AAGE ACCACTEAL AAGAACACTEG TEGACATTATTTCCACTEAL TATEGAAGAACCACCE GAACTTATCATEAL AAGAACAATCACTEGE TEGACATTATTTCCACTEGAATGACACTEAL AAGAACATEGE ACCACTEAL AAAGAACTEGE TEGACATTATTTCCACTEGAAGAACAATGATATGTACAAAGAACTEGE TEGAAGACAATGATCCTGAAAGAATGATCCTGAAAGAATGATGCTGAAAGAACTEGE CGAAGAATTATTTCCACTEGAAGAACTATGTACCAACTATATGTACAAAGAACTEGE TEGAAGACACTEGAAGACTATATGTACAAAGAACTEGE TEGAAGACTEGAAGACTATATGTACAAAGAACTEGE TEAAAAGAACTEGE TEGAAGACATTGTACAAAGAACTEGE TEAAAAGAACTEGE TEAAAATATGTCCAACTAGE AAAGAACTEGE TEAAAAGAACTEGE TEAAATTGTATTAGTATTATGTATTATGTATTATGTATTATGTATTAT	447 447 100 200 200 300 400 400 400 447 447 100 100 200 300 300 300 400 447 447

 Nb-UBC40
 TGCCTTTAGAACTAAGGTTTTCCACCCTAACATCAATAGCAATGGAAGTATTTGTCTGGATATTCTAAAGAGAGCAGTGGAGTCCAGGGTTAACCATATCT
 300

 SI-UBC40
 TGCCTTCAGAACTAAGGTTTTCCATCCCAACATCAACAGCAATGGAAGTATTTGTCTGGATATTCTTAAGGAGCAGTGGAGTCCACGATTAACCATATCC
 300

 Nb-UBC40
 AAGGTCCTGCTCTCCCATCTGCCCCAACATCAACAGCAATGGAAGTCCCCCTTGTACCAGAAATTGCTCACATGAACAAGAGCGACAGGGCCAAAT
 400

 Nb-UBC40
 AAGGTCCTGCTGTCCATCTGCTCTCTGTTGACAGAGCCCAAATCCAGATGATCCCCTGTACCTGAAATTGCTCACATGTACAAGACGGACAGGGCCAAAT
 400

 Nb-UBC40
 ACGAGACCCCTGCTGCTCGTGGACTCAGAATATGCTATGGGATAAA
 400

 SI-UBC40
 ACGAGAACCACTGCTCGTAGCTGGACTCAGAAATATGCTATGGGATAAA
 447

 447
 ACGAGAACCACTGCTGCTGGTCGAGCTCAGAAATATGCTATGGGATAAA
 447

Supplemental Figure S10. Homologs of the group III E2 genes from *N. benthamiana* share high nucleotide sequence identity to their counterpart of tomato. The group III E2 genes from *N. benthamiana* were searched using the BLAST algorithm (Camacho et al., 2009) against the Sol Genomics Network (SGN, <u>http://solgenomics.net</u>) database with the counterparts from tomato as the queries. The Clustal X algorithm (Larkin et al., 2007) was used for the sequence alignment. The sequences underlined red were the fragments used for building the TRV-group III VIGS construct. The DNA fragment from Nb-UBC9 was designed for silencing Nb-UBC8, 9 and 38; the DNA fragment from Nb-UBC28 was designed for silencing Nb-UBC10, 28 and 31; the fragment from Nb-UBC11 for silencing Nb-UBC11 and 29; and the fragment from Nb-UBC39 for silencing Nb-UBC39 and 40. The blue-underlined were sequences that are putatively targeted in VIGS by the red-underlined sequence of the corresponding gene from the same clade in the phylogenetic tree (Figure S6A).



Supplemental Figure S11. Silencing group III E2 genes diminished AvrPtoBpromoted degradation of Fen in *N. benthamiana* **protoplasts.** AvrPtoB-HA and Fen-HA were transiently co-expressed in protoplasts isolated from leaves of group III E2 genes-silenced (TRV-*group III*) and non-silenced TRV control (TRV) *N. benthamiana* plants. Protoplasts were harvested and lysed at 21 h after the protoplasts were transfected with DNA carrying corresponding genes to isolate total proteins. Western blot was performed using anti-HA antibody for detecting Fen-HA and AvrPtoB-HA. Staining of ribulose 1, 5-bisphosphate carboxylase–oxygenase (Rubisco) subunits by Coomassie blue demonstrated equal loading. Marker minus (-) denotes the corresponding gene was not transfected into the protoplasts. The experiment was repeated two times with similar results.



Supplemental Figure S12. Silencing group III E2 genes does not influence multiple ET1 elicitors-triggered programmed cell death (PCD). *Agrobacterium*-mediated transient expression of Fen, AvrPto/Pto, Rx2/CP, RBP1/Gpa2, RPS2/AvrRpt2, AvrPtoB1-387/Pto, AvrPtoB1-387, BAX, avrB and Inf1 were performed in group III ubiquitin E2 genes-silenced (TRV-*group III*) and non-silenced TRV control (TRV) *N. benthamiana* plants as described (Mural et al., 2013). *Agrobacterium*-mediated transient expression of empty vector (EV) was performed as the control. At least three spots of infiltration were performed for each elicitor or EV on four different plants with typical result being shown. Photographs were taken on day four after infiltration. The experiment was repeated at least two times with similar results.





0 h

0 h

UBC28





Mock
DC3000ΔAvrPtoΔAvrPtoB+AvrPtoB

6 h

6 h

*

Supplemental Figure S13. Effect of AvrPtoB on the expression of group III E2 genes. Real time PCR analysis of the transcript level of group III E2 genes in *Pst*- or mocktreated tomato plants. Tomato RG-pto11 plants were inoculated with *Pst* strain $DC3000 \varDelta avrPto \varDelta avrPtoB$ expressing AvrPtoB or mock (10 mM MgCl₂). Samples were collected at 0 and 6 h post inoculation. The Y-axis depicts the relative expression of the gene being tested. The experiment was performed using three technical repeats in each of the three biological replicates. Asterisks denote significant difference (P<0.05) in the expression of the E2 gene on the plants inoculated with *Pst* strain $DC3000 \varDelta avrPto \varDelta avrPtoB$ expressing AvrPtoB compared with mock inoculation.







- 1. TRV
- 2. TRV-group III
- 3. TRV-NbUBC12
- 4. TRV-NbUBC10/28/31
- 5. TRV-NbUBC12/10/28/31

Supplemental Figure S14. Specific silencing of E2 genes Nb-UBC12 alone, Nb-UBC10, 28 and 31 together, or Nb-UBC10, 12, 28 and 31 together in N. benthamiana by Virus-Induced Gene Silencing. (A) Nb-UBC10, 12, 28 and 31 genes were specifically and efficiently silenced in N. benthamiana by TRV-based VIGS. The transcript level of group III E2 genes and a closely-related E2 gene outside the group III, Nb-UBC16 in various VIGS-treated N. benthamiana plants was examined as described (Mural et al., 2013). Nb-EF1 α was used as an internal reference for the determination of the amount of cDNA template to be used. The experiment was repeated three times with similar results. (B) Phenotypes of the N. benthamiana plants in which Nb-UBC12 alone, three E2 genes Nb-UBC10, 28 and 31, or Nb-UBC10, 12, 28 and 31 were specifically silenced. The non-silenced TRV-infected plant and group III-silenced plant were included as control. Photographs were taken 4 weeks after the \sim 3-week-old seedlings were infiltrated with TRV vector-based VIGS constructs. The upper panel shows the side view of the plants while the lower panel shows the top view.



В



Supplemental Figure S15. Specific silencing of E2 genes Nb-UBC11, 29, 39 and 40 together in N. benthamiana by Virus-Induced Gene Silencing. (A) Nb-UBC11, 29, 39 and 40 genes were efficiently silenced in N. benthamiana by TRV-based VIGS. The Nb-UBC8, 9 and 38 were also very slightly knocked down in the plants. The transcript level of group III E2 genes in VIGS-treated N. benthamiana plants was examined as described (Mural et al., 2013). Nb-EF1 α was used as an internal reference for the determination of the amount of cDNA template to be used. The experiment was repeated three times with similar results. (B) Phenotypes of the N. benthamiana plants in which Nb-UBC11, 29, 39 and 40 were silenced. The non-silenced TRV-infected plant and group III-silenced plant were included as control. Photographs were taken 4 weeks after the ~ 3-week-old seedlings were infiltrated with TRV vector-based VIGS constructs. The upper panel shows the side view of the plants while the lower panel shows the top view.

Α





В

D

Supplemental Figure S<mark>16</mark>. UBC11, 29, 39 and 40 of group III play a more important role in PTI. (A) Silencing the E2 genes UBC11, 29, 39 and 40 resulted in reduced ROS production induced by flg22 in a chemiluminescence assay. The diminishment of ROS on the UBC11/29/39/40-silenced plants was to a less extent than that on the group IIIknocked down plants. (B) Knocking down the E2 genes UBC11, 29, 39 and 40 downregulates the induction of PTI reporter gene Wrky28 by flg22. The expression of N. benthamiana PTI marker gene Wrky28 was performed as described in Figure 6. The experiment was performed with three technical repeats in each of the three biological replicates. Error bars indicate standard deviation. Asterisks mark significant reduction of the expression of Wrkv28in group III E2 genes-silenced and UBC11/29/39/40-silenced plants compared to non-silenced TRV control plants (P < 0.05). (C) Bacterial populations of the Pst strain DC3000/hopQ1-1 on leaves of various VIGS-treated plants. Experiments were performed as described in Figure 8D and repeated three times with similar results. Asterisks indicate significantly increased bacterial growth on group IIIsilenced plants compared to the non-silenced control plants based on the one-way ANOVA (P < 0.01). (**D**) No effect on the degradation of Fen caused by AvrPtoB was observed on N. benthamiana plants in which the expression of Nb-UBC11, 29, 39 and 40 was knocked down. The experiment was performed as shown in Figure 5B and was repeated two times with similar results.

Supplemental Table I. List of UBC domain-containing proteins from tomato, Arabidopsis, *N. benthamiana*, and human.

Supplemental Table II. List of primers used in this study.

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Supplemental Table I List of UBC domain-containing proteins from tomato, Arabidopsis, *N. benthamiana*, and human

Arabidopsis UBCs

NCBI Accession number of	Accession number of proteins	Gene locus	Protein name
genes	Accession number of proteins	Gene locus	i i otem name
NM_101307.4	NP_563951.1	AT1G14400	AtUBC1
NM_126331.3	NP_565289.1	AT2G02760	AtUBC2
NM_125648.3	NP_568956.1	AT5G62540	AtUBC3
NM_123499.4	NP_568589.1	AT5G41340	AtUBC4
NM_105055.2	NP_564817.2	AT1G63800	AtUBC5
NM_130166.3	NP_566062.1	AT2G46030	AtUBC6
NM_125320.1	NP_568902.1	AT5G59300	AtUBC7
NM_180783.1	NP_851114.1	AT5G41700	AtUBC8
NM_118934.2	NP_567791.1	AT4G27960	AtUBC9
NM_124709.2	NP_568788.1	AT5G53300	AtUBC10
NM_111703.3	NP_566331.1	AT3G08690	AtUBC11
NM_111704.1	NP_566332.1	AT3G08700	AtUBC12
NM_114513.5	NP_566884.1	AT3G46460	AtUBC13
NM_115396.3	NP_567020.1	AT3G55380	AtUBC14
NM_103582.3	NP_564493.1	AT1G45050	AtUBC15
NM_106198.4	NP_565110.1	AT1G75440	AtUBC16
NM_119804.2	NP_568004.1	AT4G36410	AtUBC17
NM_123665.5	NP_568619.1	AT5G42990	AtUBC18
NM_112897.3	NP_566653.1	AT3G20060	AtUBC19
NM_103932.3	NP_564572.1	AT1G50490	AtUBC20
NM_122477.2	NP_568476.1	AT5G25760	AtUBC21/PEX4
NM_120590.2	NP_568148.1	AT5G05080	AtUBC22
NM_127245.2	NP_179284.1	AT2G16920	AtUBC23
NM_179887.2	NP_850218.1	AT2G33770	AtUBC24/PHO2
NM_112402.2	NP_188154.1	AT3G15355	AtUBC25
NM_104180.1	NP_175710.1	AT1G53020	AtUBC26
NM_124465.5	NP_199900.1	AT5G50870	AtUBC27
NM_105097.8	NP_564828.1	AT1G64230	AtUBC28
NM_127226.2	NP_565391.1	AT4G27960	AtUBC29
NM_124997.3	NP_568835.1	AT5G56150	AtUBC30
NM_103322.2	NP_564472.1	AT1G36340	AtUBC31
NM_112576.2	NP_566563.1	AT3G17000	AtUBC32
NM_124425.3	NP_199854	AT5G50430	AtUBC33
NM_001084085.1	NP_001077554.1	AT1G17280	AtUBC34
NM_106535.3	NP_565192.1	AT1G78870	AtUBC35
NM_101550.3	NP_564011.1	AT1G16890	AtUBC36
NM_113362.1	NP_566751.1	AT3G24515	AtUBC37
NM_001160817.1	NP_001154289.1	AT4G36800	AtRCE1
NM_127416.3	NP_565440.1	AT2G18600	AtRCE2/AtUB12L
NM_112075.2	NP_566423.1	AT3G12400	AtELC

NM_121389.2	NP_196890.1	AT5G13860	AtELCL(ELC-Like)
NM_115649.2	NP_191346.1	AT3G57870	AtSCE1
NM_102517.4.	NP_564289.1	AT1G27530	AtUfc1
NM_128839.2	NP_565754.1	AT2G32790	AtUBCD/E
NM_112201.4	NP_566459.2	AT3G13550	AtCOP10
NM_180353.2	NP_850684.1	AT3G52560	AtUEV1D
NM_105734.3	NP_564994.1	AT1G70660	AtUEV1B
NM_129165.3	NP_565834	AT2G36060	AtUEV1C
NM_102175.3	NP_564191	AT1G23260	AtUEV1A

Tomato UBCs

Chromosome loci	Gene name
Solyc08g081270.2.1	SIUBC 6
Solyc05g054550.2.1	SIUBC 7
Solyc12g056100.1.1	SIUBC 8
Solyc08g008220.2.1	SIUBC 9
Solyc05g050230.2.1	SIUBC 10
Solyc03g033410.2.1	SIUBC 11
Solyc07g066080.2.1	SIUBC 12
Solyc07g062570.2.1	SIUBC 13
Solyc10g007260.2.1	SIUBC 13-2
Solyc04g011430.2.1	SIUBC 14
Solyc11g071870.1.1	SIUBC 15
Solyc04g080810.2.1	SIUBC 16
Solyc02g084760.2.1	SIUBC 17
Solyc04g079970.2.1	SIUBC 18
Solyc12g089030.1.1	SIUBC 19
Solyc11g065190.1.1	SIUBC 20
Solyc11g071260.1.1	SIUBC 21
Solyc10g081160.1.1	SIUBC 22
Solyc01g111680.2.1	SIUBC 23
Solyc02g078210.2.1	SIUBC 24
Solyc10g007000.2.1	SIUBC 25
Solyc01g079290.1.1	SIUBC 26
Solyc06g072570.2.1	SIUBC 27
Solyc10g011740.2.1	SIUBC 28
Solyc02g083570.2.1	SIUBC 29
Solyc03g007470.2.1	SIUBC 30
Solyc01g095490.2.1	SIUBC 31
Solyc12g099310.1.1	SIUBC 32
Solyc03g123660.2.1	SIUBC 33
Solyc06g063100.2.1	SIUBC 34
Solyc05g054540.2.1	SIUBC 35
Solyc09g009720.1.1	SIUBC 36
Solyc07g024070.1.1	SIUBC 37
Solyc08g081950.2.1	SIUBC 38

Solyc06g082600.2.1	SIUBC 39
Solyc06g007510.2.1	SIUBC 40
Solyc02g087750.2.1	SIUBC 41
Solyc03g112720.2.1	SIUBC 43
Solyc02g093110.2.1	SIUBC 44
Solyc04g078620.2.1	SIUBC 45
Solyc12g088680.1.1	SIUBC 46
Solyc03g044260.2.1	SIUBC 47
Solyc01g005840.2.1	SICOP 10
Solyc04g007970.2.1	SIUEV1B
Solyc01g007860.2.1	SIUEV1C
Solyc10g083120.1.1	SIUEV1D

N. benthamina ubiquitin E2s

Sequence ID in sol genomics network

(http://solgenomics.net/)	Gene name
Niben101Scf05166g02005.1	NbUBC1
Niben101Scf03194g01006.1	NbUBC2
Niben101Scf02253g03005.1	NbUBC3
Niben101Scf05118g08003.1	NbUBC4
Niben101Scf07327g02015.1	NbUBC5
Niben101Scf04988g01009.1	NbUBC6
Niben101Scf06359g00012.1	NbUBC7
Niben101Scf06668g00002.1	NbUBC8
Niben101Scf12932g00011.1	NbUBC9
Niben101Scf19214g00010.1	NbUBC10
Niben101Scf01664g02017.1	NbUBC11
Niben101Scf05528g01009.1	NbUBC12
Niben101Scf01002g13002.1	NbUBC13
Niben101Scf00398g00015.1	NbUBC13-2
Niben101Scf00449g06005.1	NbUBC14
Niben101Scf03817g13003.1	NbUBC15
Niben101Scf01701g12001.1	NbUBC16
Niben101Scf05764g03007.1	NbUBC17
Niben101Scf12320g03008.1	NbUBC20
Niben101Scf00961g02009.1	NbUBC21
Niben101Scf16833g00005.1	NbUBC22
Niben101Scf01718g01006.1	NbUBC23
Niben101Scf04899g03004.1	NbUBC24
Niben101Scf02507g04024.1	NbUBC25
Niben101Scf06412g04011.1	NbUBC26
Niben101Scf03886g02005.1	NbUBC27
Niben101Scf00470g04003.1	NbUBC28
Niben101Scf01664g02017.1	NbUBC29
Niben101Scf08278g00004.1	NbUBC30

NbUBC31
NbUBC32
NbUBC33
NbUBC34
NbUBC35
NbUBC36
NbUBC37
NbUBC38
NbUBC39
NbUBC40
NbUBC41

Human ubiquitin E2s

NCBI Accession number of	Protein name	
proteins	I fotem name	
P49459.2	UBE2A(hHR6A)	
CAG28562.1	UBE2B(hHR6B)	
CAG33269.1	UBE2C(UbcH10)	
NP_003329.1	UBE2D1(UbcH5A)	
P62837.1	UBE2D2(UbcH5B)	
CAG33197.1	UBE2D3(UbcH5C)	
Q9Y2X8.1	UBE2D4(HBUCE1)	
NP_003332.1	UBE2E1(UbcH6)	
CCQ43860.1	UBE2E2	
NP_872619.1	UBE2E3(UbcH9)	
Q5U203.2	UBE2F(NCE2)	
NP_003333.1	UBE2G1(UBE2G)	
NP_003334.2	UBE2G2(UBC7)	
NP_003335.1	UBE2H(UBCH)	
NP_919237.1	UBE2I(Ubc9)	
NP_057105.2	UBE2J1(NCUBE1)	
NP_919296.1	UBE2J2(NCUBE2)	
NP_005330.1	UBE2K(HIP2)	
CAG30492.1	UBE2L3(UbcH7)	
CAG33407.1	UBE2L6(UbcH8)	
NP_003960.1	UBE2M(Ubc12)	
NP_003339.1	UBE2N(Ubc13)	
NP_071349.3	UBE2O(E2-230K)	
Q7Z7E8.1	UBE2Q1(NICE-5)	
NP_775740.1	UBE2Q2	
P49427.2	UBE2R1(CDC34)	
Q6ZWZ2.1	UBE2R2(CDC34B)	
Q16763.2	UBE2S(E2-EPF)	
Q9NPD8.1	UBE2T(HSPC150)	
NP_689702.1	UBE2U	
NP_001244322.1	UBE2V1(UVE-1A)	

Q15819.4	UBE2V2(MMS2)
AAH10900.1	UBE2W
Q9H832.2	UBE2Z(Use1)
Q9NR09.2	BIRC6(apollon)

Supplemental Table II List of primers used in this study

Name

SI-UBC8-EcoRI-F SI-UBC8-XhoI-R SI-UBC14-GW-F SI-UBC14-GW-R SI-UBC31-EcoRI-F SI-UBC31-XhoI-R SI-UBC39-EcoRI-F SI-UBC39-XhoI-R SI-UBC40-EcoRI-E SI-UBC40-XhoI-R SI-UBC36-F-GW SI-UBC36-R SI-UBC3-EcoRI-F Sl-UBC3-XhoI-R SI-UBC5-EcoRI-F Sl-UBC5-XhoI-R SI-UBC6-EcoRI-F Sl-UBC6-XhoI-R SI-UBC12-F-GW SI-UBC12-R SI-UBC16-BamHI-F SI-UBC16-XhoI-R SI-UBC17-BamHI-F Sl-UBC17-XhoI-R SI-UBC20-BamHI-F Sl-UBC20-XhoI-R SI-UBC27-BamHI-F Sl-UBC27-XhoI-R SI-UBC32-BamHI-F SI-UBC32-XhoI-R SI-UBC1-EcoRI-F Sl-UBC1-XhoI-R SI-UBC2-EcoRI-F Sl-UBC2-XhoI-R SlUbc7-GW-F SlUbc7-GW-R SI-UBC15-EcoRI-F Sl-UBC15-XhoI-R SI-UBC21-EcoRI-F Sl-UBC21-XhoI-R SI-UBC22-EcoRI-F Sl-UBC22-XhoI-R SI-UBC41-EcoRI-F SI-UBC41-XhoI-R SI-UBC10-ORF-F SI-UBC10-ORF-R SI-UBC35-ORF-F SI-UBC35-ORF-R SI-UBC26-ORF-F SI-UBC26-ORF-R SI-UBC25-ORF-F SI-UBC25-ORF-R SI-UBC28-ORF-F SI-UBC28-ORF-R SI-UBC33-ORF-F SI-UBC33-ORF-R SI-UBC13-ORF-F SI-UBC13-ORF-R SI-UBC13-2-ORF-F SI-UBC13-2-ORF-R SI-UBC4-GW-F

Sequence(5'-3') ACGGATCCATGGCATCCAAGCGGATTC CGCTCGAGCTATCCCATGGCAAATTTTTG CACCATGGCTTCACAAGCTAGTC TTCTCGAGCTACATTTCTTGTGACCGTC TAGAATTCATGGCTTCGAAACGGATATT TTCTCGAGTTAACCCATTGCATATTTCTGG AGGAATTCATGGCGTCGAAGCGCATAT TGCTCGAGTTATCCCATCGCATATTTTTGA TTGAATTCATGGCGTCGAAGAGGATATT AACTCGAGTCATCCCATTGCATATTTCTGA CACCATGGCTTCTTCACAAGCCG CGCTCGAGTCACAACATCTCTTGTGATTTC AGGAATTCATGTCGACACCGGCGAAG CGCTCGAGTCAGTCTGCTGTCCAGCTT TAGGATCCATGTCTTCTCCAAGCAAACG TGCTCGAGTCATGGATCAACAGGGCCT CAGAATTCATGTCTTCCCCTAGCAAACG TGCTCGAGTTAGGGATCTGCTTTTCCAG CACCATGGCTTCAAAGAGGATTCAG CGCTCGAGTCAACCCATTGCGTATTTCT GAGGATCCATGACTAGTGCTTCTGCTTC CACTCGAGCTACACTTTATCGTCATGGAA AAGGATCCATGTCGGCCTCCTCTGCC TGCTCGAGTCACACCTTATCATCATGGAA GTGGATCCATGGCGACAATGAACAGTGG CGCTCGAGCTACACACTAGGCTTGTATAG GAGGATCCATGGTGGACTTGGCTAGGG CGCTCGAGTTAGCTGGACAACAGCTTTTC GTGGATCCATGGCGGAAGACAAGTATAAT CGCTCGAGTTACGATTCATCCATAAAGACA CGGAATTCATGTCGACTCCAGCT AACTCGAGTCAGTCAGCAGTCCA CGGAATTCATGTCAACTCCTTCA AACTCGAGTCAGTCTGCAGTCCA CACCATGGCTTCAACTTCTCCTTC TTACATCATTTCTTGAGACCG CGGAATTCATGTCTTCTCCAAGC AACTCGAGTCAAGGATCAGCATG CGGAATTCATGCAGGCTTCAAGG AACTCGAGTTAGCCCTTCTTGGG CGGAATTCATGGCAACTAATGAA CGCTCGAGTTATAATCTCTTCAA CGGAATTCATGTCGACGCCGGCT AACTCGAGTCAGTCCGCCGTCCA CACCATGGCTTCGAAACGAATATTGAA TTAACCCATGGCATACTTCTG CACCATGGCTTCAGCTTCTCCTTC TTACGTCATTTCTTGGGACCG CACCATGGATGAGGCAAACAAGAAC TTAACTAACCCTTGGCTGTTTGA CACCATGGAGACTCATAAACAAGTAG GCTACTCAGTCCCATTCTGT CACCATGGCTTCTAAGCGGATATTG TTAACCCATAGCATACTTCTG CACCATGGCAGAAAAAGCATGTGTAA TCAAAGCTGAAGCAGAGGCA CGGAATTCATGGCTAACAGC CCGCTCGAGTCATGCACCACTAG CGGAATTCATGGCTAACAGC CCGCTCGAGTCATGCACCACTAG CACCATGTCTTCCCCAAGCAAAAG

purpose

SI-UBC8 in the pGEX-4T-1 vector SI-UBC8 in the pGEX-4T-1 vector SI-UBC14 ORF gateway cloning in pDEST17 vector SI-UBC14 ORF gateway cloning in pDEST17 vector SI-UBC31 in the pGEX-4T-1 vector SI-UBC31 in the pGEX-4T-1 vector SI-UBC39 in the pGEX-4T-1 vector SI-UBC39 in the pGEX-4T-1 vector SI-UBC40 in the pGEX-4T-1 vector SI-UBC40 in the pGEX-4T-1 vector SI-UBC36 ORF gateway cloning in pDEST17 vector SI-UBC36 ORF gateway cloning in pDEST17 vector SI-UBC3 in the pGEX-4T-1 vector SI-UBC3 in the pGEX-4T-1 vector SI-UBC5 in the pGEX-4T-1 vector SI-UBC5 in the pGEX-4T-1 vector SI-UBC6 in the pGEX-4T-1 vector SI-UBC6 in the pGEX-4T-1 vector SI-UBC12 ORF gateway cloning in pDEST17 vector SI-UBC12 ORF gateway cloning in pDEST17 vector SI-UBC16 in the pGEX-4T-1 vector SI-UBC16 in the pGEX-4T-1 vector SI-UBC17 in the pGEX-4T-1 vector SI-UBC17 in the pGEX-4T-1 vector SI-UBC20 in the pGEX-4T-1 vector SI-UBC20 in the pGEX-4T-1 vector SI-UBC27 in the pGEX-4T-1 vector SI-UBC27 in the pGEX-4T-1 vector SI-UBC32 in the pGEX-4T-1 vector SI-UBC32 in the pGEX-4T-1 vector SI-UBC1 in the pGEX-4T-1 vector SI-UBC1 in the pGEX-4T-1 vector SI-UBC2 in the pGEX-4T-1 vector SI-UBC2 in the pGEX-4T-1 vector SI-UBC7ORF gateway cloning in pDEST15 vector SI-UBC7 ORF gateway cloning in pDEST15 vector SI-UBC15 in the pGEX-4T-1 vector SI-UBC15 in the pGEX-4T-1 vector SI-UBC21 in the pGEX-4T-1 vector SI-UBC21 in the pGEX-4T-1 vector SI-UBC22 in the pGEX-4T-1 vector SI-UBC22 in the pGEX-4T-1 vector SI-UBC41 in the pGEX-4T-1 vector SI-UBC41 in the pGEX-4T-1 vector SI-UBC10 ORF gateway cloning in pDEST15 vector SI-UBC10 ORF gateway cloning in pDEST15 vector SI-UBC35 ORF gateway cloning in pDEST15 vector SI-UBC35 ORF gateway cloning in pDEST15 vector SI-UBC26 ORF gateway cloning in pDEST15 vector SI-UBC26 ORF gateway cloning in pDEST15 vector SI-UBC25 ORF gateway cloning in pDEST15 vector SI-UBC25 ORF gateway cloning in pDEST15 vector SI-UBC28 ORF gateway cloning in pDEST15 vector SI-UBC28 ORF gateway cloning in pDEST15 vector SI-UBC33 ORF gateway cloning in pDEST15 vector SI-UBC33 ORF gateway cloning in pDEST15 vector SI-UBC13 in the pGEX-4T-1 vector SI-UBC13 in the pGEX-4T-1 vector SI-UBC13-2 in the pGEX-4T-1 vector SI-UBC13-2 in the pGEX-4T-1 vector SI-UBC4 ORF gateway cloning in pDEST15 vector

SI-UBC4-GW-R SI-UBC7-GW-F SI-UBC7-GW-R SI-UBC9-GW-F SI-UBC9-GW-R SI-UBC11-GW-F SI-UBC11-GW-R SI-UBC23-GW-1F SI-UBC23-GW-1R SI-UBC23-GW-2F SI-UBC23-GW-2R SI-UBC23-GW-3F SI-UBC23-GW23-3R SI-UBC24-GW-1F SI-UBC24-GW-1R SI-UBC24-GW-2F SI-UBC24-GW-2R SI-UBC29-GW-F SI-UBC29-GW-R SI-UBC30-GW-F SI-UBC30-GW-R SI-UBC34-GW-F SI-UBC34-GW-R SI-UBC37-GW-1F SI-UBC37-GW-1R SI-UBC37-GW-2F SI-UBC37-GW-2R SI-UBC38new-GW-F SI-UBC38-GW-R Nb-UBC9-GW-F Nb-UBC9-VIGS-R Nb-UBC28-VIGS-F Nb-UBC28-VIGS-R Nb-UBC11-VIGS-F Nb-UBC11-VIGS-R Nb-UBC39-VIGS-F Nb-UBC39-R Nb-UBC12-VIGS-F Nb-UBC12-VIGS-R Nb-UBC30-VIGS-F Nb-UBC30-VIGS-R Nb-UBC12VIGS-G-F Nb-UBC12VIGS-G-R Nb-UBC10VIGS-G-F Nb-UBC10VIGS-G-R Nb-UBC28VIGS-G-F Nb-UBC28VIGS-G-R Nb-UBC11VIGS-F Nb-UBC11VIGS-R Nb-UBC29VIGS-F

TTATGGATCAACAGGTCCTG CACCATGGCTTCAACTTCTCCTTC TTACATCATTTCTTGAGACCG CACCATGGCATCCAAGAGGATTCT CTAACCCATTGCATACTTTTG CACCATGGCATCAAGGAGAATTCAA TCAATTCATAGCATATTTTTGGG CACCATGGATGAGTCTGAGTCTAC TCCTGCCAAGCAACATCAAC AGATCCGCAAAGTTGTGGTT GCAGCAGGTAGCCTTGGA GATTCATGGTCCCAAAGGTC CTACAATTGGTGGAGATGTTG CACCATGGATACATCTCTAAGTGAC GCCAACAATAATACCGATACA CTGTTTAGGTGATGCGGTTT TTAATCGGACAACTGACTGC CACCATGGCATCCAGGAGAATTCA TCAGTTCATGGCATACTTTTG CACCATGGCTTCCAAGCGGATCT TTAGCCCATGGCATACTTCT CACCATGGCAGAAAAGGCATGTGT TCAAAGCTGAAGTAGCGGCA CACCATGGCTCAAGAGGCGCGG TGAAATCGGTTGACTGAAGC CAGGCTATAAGCAATTCAGG TCAAGATATTGGATAAAAAGATTG CACCATGGCGTCCAAGCGGATTCT CTAACCCATGGCGTACTTTT CACCATGGCATCCAAGAGGATTCT TGTAGCCTGCCAGTGAAACAT GAAGATATGTTTCACTGGCA TATTTATATTTGGATGGAAAACTTTTG CAAAAGTATTTCCATCCAAATATA TCGTCTGGATTTGGATCTGT ACAGATCCAAACCCAGACGA TGCTCGAGTTATCCCATCGCATATTTTTGA ATGGGATAACTCGAGCATCTATCCATTTCC TGCTGTTTATGTTTGGGTGG GGTTTTCCACCCAAACATAAACAGCA GATTAGGGTCCGTCAGAAGTG CACCAGTATTTGTCTGGACATCTTAAAAG AAGCAAAACCTTGGTGAGCAGCACCTTGGATACAGT CACCAAGGTTTTGCTTTCAATCTGC TTATTGTAGCTTGGTGGCAATCTCAGGAACAAGGGG CACCAAGCTACAATAATGGGCCC AATGGATAGTGACTAAAAATAC CACCGACAGCCCTTATGCAGGTGG

GAATTCTCCTCAGGAGGAAAATGGATGGCC

TTTCCTCCTGAGGAGAATTCTCAAGGAGC

Nb-UBC29VIGS-R CTACTGGACCTGCACTGCATGAAG SI-UBC4 ORF gateway cloning in pDEST15 vector SI-UBC7 ORF gateway cloning in pDEST15 vector SI-UBC7 ORF gateway cloning in pDEST15 vector SI-UBC9 ORF gateway cloning in pDEST15 vector SI-UBC9 ORF gateway cloning in pDEST15 vector SI-UBC11 ORF gateway cloning in pDEST15 vector SI-UBC11 ORF gateway cloning in pDEST15 vector SI-UBC23 ORF gateway cloning in pDEST15 vector SI-UBC24 ORF gateway cloning in pDEST15 vector SI-UBC29 ORF gateway cloning in pDEST15 vector SI-UBC29 ORF gateway cloning in pDEST15 vector SI-UBC30 ORF gateway cloning in pDEST15 vector SI-UBC30 ORF gateway cloning in pDEST15 vector SI-UBC34 ORF gateway cloning in pDEST15 vector SI-UBC34 ORF gateway cloning in pDEST15 vector SI-UBC37 ORF gateway cloning in pDEST15 vector SI-UBC38 ORF gateway cloning in pDEST15 vector SI-UBC38 ORF gateway cloning in pDEST15 vector Group III VIGS fragment Nb-UBC9 cloning Group III VIGS fragment Nb-UBC9 cloning Group III VIGS fragment Nb-UBC28 cloning Group III VIGS fragment Nb-UBC28 cloning Group III VIGS fragment Nb-UBC11 cloning Group III VIGS fragment Nb-UBC11 cloning Group III VIGS fragment Nb-UBC39 cloning Group III VIGS fragment Nb-UBC39 cloning Group III VIGS fragment Nb-UBC12 cloning Group III VIGS fragment Nb-UBC12 cloning Group III VIGS fragment Nb-UBC30 cloning Group III VIGS fragment Nb-UBC30 cloning VIGS fragment cloning forsilencing Nb-UBC12 alone or the four E2 genes Nb-UBC12, 10, 28 and 31. VIGS fragment cloning forsilencing Nb-UBC12 alone or the four E2 genes Nb-UBC12, 10, 28 and 31. VIGS fragment cloning for silencing the three E2 genes Nb-UBC10, 28 and 31 or the four E2 genes Nb-UBC12, 10, 28 and 31. VIGS fragment cloning for silencing the three E2 genes Nb-UBC10, 28 and 31 or the four E2 genes Nb-UBC12, 10, 28 and 31. VIGS fragment cloning for silencing the three E2 genes Nb-UBC10, 28 and 31 or the four E2 genes Nb-UBC12, 10, 28 and 31. VIGS fragment cloning for silencing the three E2 genes Nb-UBC10, 28 and 31 or the four E2 genes Nb-UBC12, 10, 28 and 31VIGS fragment cloning for silencing the three E2 genes Nb-UBC11, 29, 39 and 40. VIGS fragment cloning for silencing the three E2 genes Nb-UBC11, 29, 39 and 40.

VIGS fragment cloning for silencing the three E2 genes Nb-UBC11, 29, 39 and 40.

VIGS fragment cloning for silencing the three E2 genes Nb-UBC11, 29, 39 and 40.

Nb-UBC39VIGS-F	CACCTTATGCAGGAGGTGTATT	VIGS fragment cloning for silencing the three E2 genes Nb- UBC11 20 30 and 40
Nb-UBC39VIGS-R	TCCAGACAAAATCAGGAGGGAAATGAATTG	VIGS fragment cloning for silencing the three E2 genes Nb-
no obcorrido n		UBC11, 29, 39 and 40.
Nb-UBC40VIGS-F	CTCCTGATTTTGTCTGGATATTCTAAAAGAG	VIGS fragment cloning for silencing the three E2 genes Nb- URC/1 29 39 and 40
Nb-UBC40VIGS-R	AAGGGCTGTCGGTGGATTTGGGTCAGTCAATAGGGAG	VIGS fragment cloning for silencing the three E2 genes Nb- URC11 29 39 and 40
SI-06-ube1-1F	CACCATGCTTCCTAGAAAGAGAC	SI-UBA1 ORF gateway cloning in pDEST15 vector
SI-06-ube1-1R	GAATGCCAAATGTAGCAGAGG	SI-UBA1 ORF gateway cloning in pDEST15 vector
SI-06-ube1-2E		SI-UBAL ORE gateway cloning in pDEST15 vector
SI-06-ube1-2P	CATTCACTTCGGCTGGTGT	SI-UBA1 ORF gateway cloning in pDEST15 vector
SI-06-ube1-3E	CCAATGTGCACTTTGCATTC	SI-UBA1 ORF gateway cloning in pDEST15 vector
SI-00-ube1-31 SI-06 ube1-31	CATTACCAACAAAATTCAACCCA	SI-UBAL ORE gateway cloning in pDEST15 vector
SI-00-0001-3K		SI-UBAT OKF gateway clothing in pDES115 vector
SI-ОВСТО-Апот-крпт-г	GOLICOAGGIACCATGOLITCOAAACGAATATIG	UBC10 and pSPYCE(M)-SIUBC10
SI-UBC10-StuI-PstI-R	GGAGGCCTGCAGACCCATGGCATACTTCTGGG	SI-UBC10 ORF cloning for constructing pA7-nYFP-SI- UBC10 and pSPYCE(M)-SIUBC10
Sl-UBC12-KpnI-XhoI-F	GGTACCCTCGAGATGGCTTCAAAGAGGATTCAG	SI-UBC12 ORF cloning for constructing pA7-nYFP-SI- UBC12 and pSPYCE(M)-SIUBC12
SI-UBC12-PstI-R	GGGCTGCAGACCCATTGCGTATTTCTGGG	SI-UBC12 ORF cloning for constructing pA7-nYFP-SI- UBC12 and pSPYCE(M)-SUUBC12
SI-UBC25-XhoI-F	CACCTCGAGATGGAGACTCATAAACAAGTAG	SI-UBC25 ORF cloning for constructing pA7-nYFP-SI- UBC25
SI-UBC25-SmaI-R	CCCGGGCTCAGTCCCATTCTGTGTC	SI-UBC25 ORF cloning for constructing pA7-nYFP-SI-
Sl-UBC21-XhoI-F	CACCTCGAGATGCAGGCTTCAAGGGCAAGAC	UBC25 SI-UBC21 ORF cloning for constructing pA7-nYFP-SI- UBC21
SI-UBC21-SmaI-R	CCCGGGGCCCTTCTTGGGCATTGC	SI-UBC21 ORF cloning for constructing pA7-nYFP-SI- UBC21
Sl-UBC16-XhoI-F	CACCTCGAGATGACTAGTGCTTCTGCTTCATC	SI-UBC16 ORF cloning for constructing pA7-nYFP-SI- UBC16 and nSPYCF(M)-SUUBC16
SI-UBC16-SmaI-R	CCCGGGCACTTTATCGTCATGGAACC	SI-UBC16 ORF cloning for constructing pA7-nYFP-SI- UBC16 and nSPYCE(M)-SUUBC16
SI-UBA1-XhoI-F	CACCTCGAGATGCTTCCTAGAAAGAGACCGG	SI-UBA1 ORF cloning for constructing pA7-cYFP-SI-UBA1
SI-UBA1-SmaI-R	CCCGGGACGGAAGTATACAGACACCAG	SI-UBA1 ORF cloning for constructing pA7-cYFP-SI-UBA1
AvrptoB-XhoI-KpnI-F	GGCTCGAGGTACCATGGCGGGTATCAATAGAGC	AvrPtoB ORF cloning for constructing pA7-cYFP-AvrPtoB and pRTEX pYEP AvrPtoB
AvrptoB-StuI-PstI-R	GGAGGCCTGCAGGGGGGACTATTCTAAAAGCAT	<i>AvrPtoB</i> ORF cloning for constructing pA7-cYFP- <i>AvrPtoB</i> and pBTEX_nVEP. <i>AvrPtoB</i>
Nb-EF1a-F	AGCCTGGTATGGTTGTGACTTTTG	RT-PCR for reference gene Nh- <i>EF1a</i>
Nb-EF1a-R	CATGGGCTTGGTGGGAATC	RT-PCR for reference gene Nh- <i>EF1a</i>
Nb-UBC8-RT-F	CACCATGGCATCCAAACGGATTCTCAAAG	RT-PCR for Nb- <i>URC8</i>
Nb-UBC8-RT-R	AGCCCCTCCAGAGATGGTCACT	RT-PCR for Nb- <i>UBC8</i>
Nb-UBC9-RT-F	CACCATGGCATCCAAGAGAATTCTGAAAG	RT-PCR for Nb- <i>UBC9</i>
Nb-UBC9-RT-R	CCAAATATTTGTGTTTCAGCAACTAACCC	RT-PCR for Nb-UBC9
Nb-UBC10-RT-F		RT-PCR for Nh- <i>URC10</i>
Nb-UBC10-RT-R	CCGCCATAGGCAATATTTAGCCCA	RT-PCR for Nb- <i>UBC10</i>
Nb-UBC11-RT-F	CACCATGGCATCCAGGAGAATTCA	RT-PCR for Nb- <i>UBC11</i>
Nb-UBC11-RT-R	CAACTCAATTCATAGCAAACTTTTGG	RT-PCR for Nb-UBC11
Nb-UBC12-RT-F	TCTTACTGTATCCAAGGTGCTGCT	RT-PCR for Nb- <i>UBC</i> 12
Nb-UBC12-RT-R	CCAAATGTTTTCATCCCATGGCATAT	RT-PCR for Nb- <i>UBC12</i>
Nb-UBC28-RT-F	TAGAATTCATGGCTTCGAAACGGATATT	RT-PCR for Nb- <i>UBC</i> 28
Nb-UBC28-RT-R	CATEGETTAAACCETTACCTATEG	RT-PCR for Nh-URC28
Nb-UBC29-RT-F	CACCATGGCATCCAGGAGAATTCA	RT-PCR for Nb- <i>UBC29</i>
Nb-UBC29-RT-R	CTTCATGTCTTCAGACTCAGTTCATA	RT-PCR for Nh- <i>URC29</i>
Nb-UBC30-RT-F	CACCATGGCTTCCAAGCGGATCT	RT-PCR for Nb- <i>UBC30</i>
Nb-UBC30-RT-R	TTAGCCCATGCCATACTTCT	RT-PCR for Nb-URC30
Nb-UBC31-RT-F		RT-PCR for Nb- <i>UBC31</i>
Nb-UBC31-RT-R	GCCGCCATAGGCAATAGTTAGCCC	RT-PCR for Nb- <i>UBC31</i>
Nb-UBC38-RT-F		RT-PCR for Nh-URC38
Nh-UBC38-RT-R	CTAACCCATGGCGTACTTTT	RT-PCR for Nb-UBC38
Nh-UBC39-RT-F	AGGAATTCATGGCGTCGAAGCGCATAT	RT-PCR for Nb- <i>UBC</i> 39
Nh-UBC39-RT-R	GGACACTTTCCGCATCATCCCATA	RT-PCR for Nb- <i>UBC39</i>
Nb-UBC40-RT-F	TTGAATTCATGGCGTCGAAGAGGGATATT	RT-PCR for Nh- <i>URC40</i>
Nh-UBC40-RT-R	ΤCΑΤΤCΑCCACAAGCACAATAAGA	RT-PCR for Nb- <i>UBC40</i>
Nb-UBC16-RT-F	GGGCACCAGGAACTCTGTAT	RT-PCR for Nb-UBC16

TGGTATGGGAGTTGGAGTCA Nb-UBC16-RT-R RT-PCR for Nb-UBC16 Nb-UBC17-RT-F TGGGTGATTGAAGTGATTGGG RT-PCR for Nb-UBC17 RT-PCR for Nb-UBC17 Nb-UBC17-RT-R TCAAGGGTCAGAAGGACACC SI-EF1a-RT-F TCCAAAGATGGTCAGACCCGTGAA Real-time PCR for reference gene SI-EF1a ATACCTAGCCTTGGAGTACTTGGG Real-time PCR for reference gene SI-EF1a SI-EF1a-RT-R Real-time PCR for SI-UBC8 SI-UBC8-RT-F CATTTTGAAGGAACAGTGGAGC CTCCGGGCAGTTGTCTCATAC Real-time PCR for SI-UBC8 SI-UBC8-RT-R Real-time PCR for SI-UBC9 SI-UBC9-RT-F TTCCAAGGTGCTGCTGTCAATC Real-time PCR for SI-UBC9 SI-UBC9-RT-R ATGGGTCTGAGCAGCAACTAAC TGCTGGGGGGTGTTTTTTTGGTC Real-time PCR for SI-UBC10 SI-UBC10-RT-F AAGGGGTCGTCAGGGTTTGGGT Real-time PCR for SI-UBC10 SI-UBC10-RT-R SI-UBC11-RT-F AGGTCCTGTGGCTCAGGATATA Real-time PCR for SI-UBC11 SI-UBC11-RT-R CTTAGGGGGTTTGAAAGGGTAG Real-time PCR for SI-UBC11 SI-UBC12-RT-F TCTTACTGTATCCAAGGTGCTGCT Real-time PCR for SI-UBC12 GTGTTCAACCCATTGCGTATTTCT Real-time PCR for SI-UBC12 SI-UBC12-RT-R TACAAGACAGACAGGGCAAAATA Real-time PCR for SI-UBC28 SI-UBC28-RT-F SI-UBC28-RT-R GGGAAGGTAGAGGACAGAGAGAC Real-time PCR for SI-UBC28 CATGCAGTGCAGGTCCAGTAGC Real-time PCR for SI-UBC29 SI-UBC29-RT-F SI-UBC29-RT-R CTTGGGAGGTTTGAAAGGGTAA Real-time PCR for SI-UBC29 SI-UBC30-RT-F AGTCCTTATTCCGGTGGAGTTT Real-time PCR for SI-UBC30 SI-UBC30-RT-R CTTCCGTTGCTGTTTATGTTTG Real-time PCR for SI-UBC30 SI-UBC31-RT-F AGGTTTTGCTTTCAATTTGCTC Real-time PCR for SI-UBC31 SI-UBC31-RT-R GGCAGTTGATTCGTATTTGGC Real-time PCR for SI-UBC31 SI-UBC38-RT-F TCCTACTTCTTGCAGTGCTGGT Real-time PCR for SI-UBC38 SI-UBC38-RT-R CATTGCTGTTGATGTTCGGGTG Real-time PCR for SI-UBC38 SI-UBC39-RT-F TTTCCCCCCTGATTATCCTTTC Real-time PCR for SI-UBC39 SI-UBC39-RT-R GTGGTCTCGTATTTGGCCCTGT Real-time PCR for SI-UBC39 Real-time PCR for SI-UBC40 SI-UBC40-RT-F CCCTTATGCTGGAGGTGTATT Real-time PCR for SI-UBC40 SI-UBC40-RT-R ATCATCTGGGTTTGGGTCTGT Real-time PCR for reference gene Nb-EF1a Nb-EF1a-F TACTGGTGGTTTTTGAAGCTG ATACCTAGCCTTGGAGTACTTGGG Real-time PCR for reference gene Nb-EF1a Nb-EF1a-R Nb-Wrky28-F GCATTCATGACAAAGAGTGAGGTT Real-time PCR for Nb-Wrky28 Nb-Wrky28-R GACATTTTTGACTTGTGCACCTAT Real-time PCR for Nb-Wrky28 Nb-Pti5-F CCTCCAAGTTTGAGCTCAGATAGT Real-time PCR for Nb-Pti5 Nb-Pti5-R CCAAGAAATTCTCCATGTACTCTGTC Real-time PCR for Nb-Pti5 Nb-Acre31-F GAGAAACTGGGATTGCCTGAAGGA Real-time PCR for Nb-Acre31 Nb-Acre31-R AACTTGGCCATCGTGATCTTGGTC Real-time PCR for Nb-Acre31 Nb-Gras2-F TCATGAGGCGTTACTCGGAGCATT Real-time PCR for Nb-Gras2 Nb-Gras2-R TACCTAGCACCAAGCAGATGCAGA Real-time PCR for Nb-Gras2 AvrPtoB307-smaI-R CCCGGGTACATGTCTTTCAAGGGCCGTG AvrPtoB ORF cloning for constructing pSPYNE173-AvrPtoB1-307 Sl-UBC8-XhoI-F CACCCTCGAGATGGCATCCAAGCGGATTCTC SI-UBC8 ORF cloning for constructing pSPYCE(M)-SIUBC8 SI-UBC8-SmaI-R CCCGGGTCCCATGGCAAATTTTTGAGTC SI-UBC8 ORF cloning for constructing pSPYCE(M)-SIUBC8 Sl-UBC9-XhoI-F CACCCTCGAGATGGCATCCAAGAGGATTCTG SI-UBC9 ORF cloning for constructing pSPYCE(M)-SlUBC9 SI-UBC9-SmaI-R CCCGGGACCCATTGCATACTTTTGGG SI-UBC9 ORF cloning for constructing pSPYCE(M)-SIUBC9 SI-UBC11-XhoI-F CACCCTCGAGATGGCATCAAGGAGAATTCAAA SI-UBC11 ORF cloning for constructing pSPYCE(M)-SlUBC11 SI-UBC11-SmaI-R CCCGGGATTCATAGCATATTTTTGGGTC SI-UBC11 ORF cloning for constructing pSPYCE(M)-SlUBC11 SI-UBC28-XhoI-F CACCCTCGAGATGGCTTCTAAGCGGATATTG SI-UBC28 ORF cloning for constructing pSPYCE(M)-SlUBC28 SI-UBC28 ORF cloning for constructing pSPYCE(M)-SI-UBC28-SmaI-R CCCGGGACCCATAGCATACTTCTGGG SIUBC28 Sl-UBC29-XhoI-F CACCCTCGAGATGGCATCCAGGAGAATTCAAAAG SI-UBC29 ORF cloning for constructing pSPYCE(M)-SlUBC29 CCCGGGGTTCATGGCATACTTTTGAG SI-UBC29-SmaI-R SI-UBC29 ORF cloning for constructing pSPYCE(M)-SlUBC29 SI-UBC30-XhoI-F ggtaccctcgagATGGCTTCCAAGCGGATC SI-UBC30 ORF cloning for constructing pSPYCE(M)-SlUBC30 SI-UBC30-SmaI-R GGGctgcagGCCCATGGCATACTTCTGGG SI-UBC30 ORF cloning for constructing pSPYCE(M)-SlUBC30 SI-UBC31-XhoI-F CACCCTCGAGATGGCTTCGAAACGGATATTG SI-UBC31 ORF cloning for constructing pSPYCE(M)-SlUBC31

SI-UBC31-SmaI-R	CCCGGGACCCATTGCATATTTCTGGG	SI-UBC31 ORF cloning for constructing pSPYCE(M)-
		SIUBC31
SI-UBC38-Xhol-F	CACCCTCGAGATGGCGTCCAAGCGGATTCTG	SI- <i>UBC38</i> ORF cloning for constructing pSPYCE(M)-
		SIUBC38
SI-UBC38-SmaI-R	CCCGGGACCCATGGCGTACTTTTGGG	SI-UBC38 ORF cloning for constructing pSPYCE(M)-
		SIUBC38
Sl-UBC39-XhoI-F	CACCCTCGAGATGGCGTCGAAGCGCATATTG	SI-UBC39 ORF cloning for constructing pSPYCE(M)-
		SIUBC39
SI-UBC39-SmaI-R	CCCGGGTCCCATCGCATATTTTTGAG	SI-UBC39 ORF cloning for constructing pSPYCE(M)-
		SIUBC39
Sl-UBC40-XhoI-F	CACCCTCGAGATGGCGTCGAAGAGGATATTG	SI-UBC40 ORF cloning for constructing pSPYCE(M)-
		SIUBC40
SI-UBC40-SmaI-R	CCCGGGTCCCATTGCATATTTCTGAG	SI-UBC40 ORF cloning for constructing pSPYCE(M)-
		SIUBC40
SIUBC8C85G-F	GGCAGCATTgGCCTTGACATT	SI-UBC8C85G ORF gateway cloning in pDEST15 vector
SIUBC8C85G-R	AATGTCAAGGCcAATGCTGCC	SI-UBC10C85G ORF gateway cloning in pDEST15 vector
SIUBC10C85G-F	CAATGGGAGTATAgGCTTGGAC	SI-UBC10C85G ORF gateway cloning in pDEST15 vector
SIUBC10C85G-R	CAGTATGTCCAAGCcTATACTC	SI-UBC10C85G ORF gateway cloning in pDEST15 vector