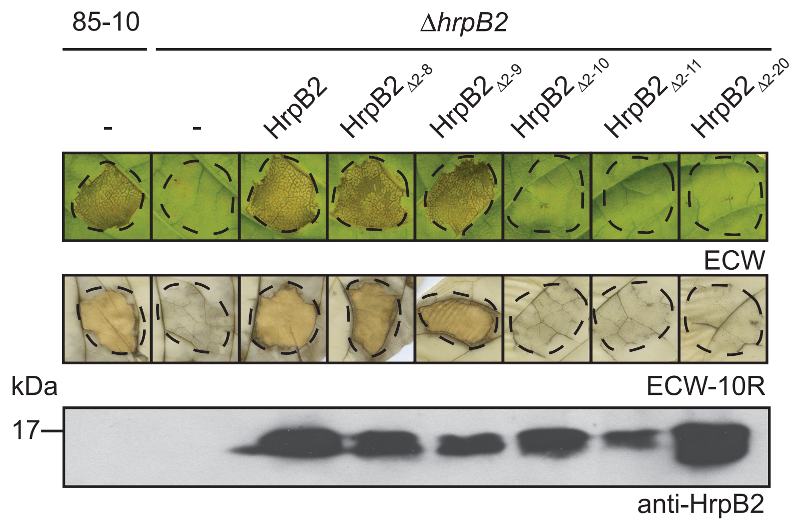
Supplemental material

Type III-dependent translocation of HrpB2 by a non-pathogenic *hpaABC* mutant of the plant-pathogenic bacterium *Xanthomonas*

Felix Scheibner, Steve Schulz[1], Jens Hausner, Sylvestre Marillonnet[2] and Daniela Büttner[#]

A



B

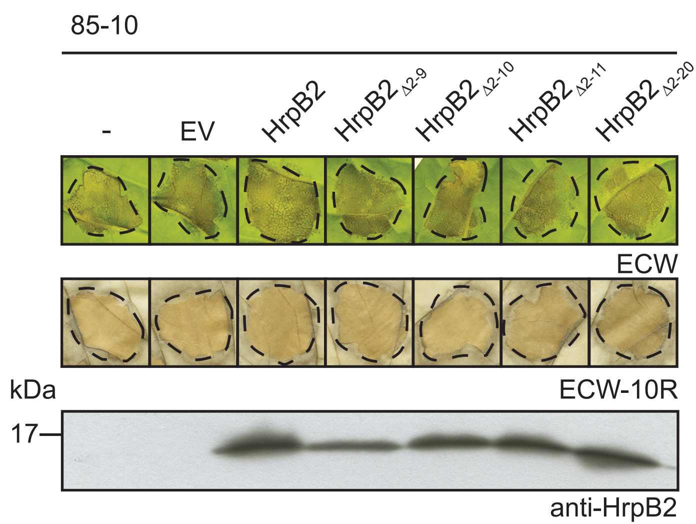


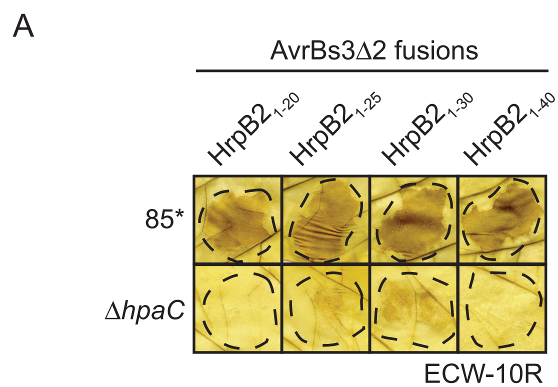
Figure S1
Scheibner *et al.*

Fig. S1 The N-terminal region of HrpB2 contributes to protein function.

(A) The N-terminal 10 amino acids of HrpB2 are essential for protein function. Strains 85-10 and 85-10Δ*hrpB2* (Δ*hrpB2*) without plasmid (-) or with expression constructs encoding HrpB2 or N-terminal deletion derivatives thereof as indicated were inoculated into leaves of susceptible ECW and resistant ECW-10R pepper plants. Disease symptoms were photographed 12 dpi. For the better visualization of the HR, infected leaves of ECW-10R plants were destained in ethanol 2 dpi. Dashed lines mark the infiltrated areas.

(B) HrpB2 derivatives do not exert a dominant-negative effect on pathogenicity of strain 85-10. Strain 85-10 with or without plasmid pBBRMCS-5 (EV, empty vector) or containing HrpB2 or HrpB2 derivatives as indicated was inoculated into leaves of susceptible ECW and resistant ECW-10R pepper plants. Disease symptoms were photographed 10 dpi. Leaves of ECW-10R pepper plants were destained in ethanol 2 dpi.

A



B

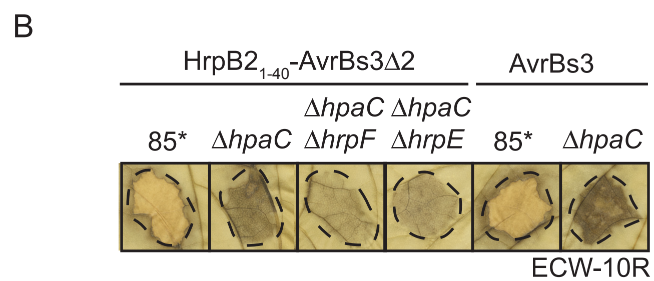


Figure S2
Scheibner *et al.*

Fig. S2 HR induction in AvrBs1-responsive pepper plants by *X. campestris* pv. *vesicatoria* strains containing HrpB2-AvrBs3Δ2 fusion proteins.

(A) HrpB2-AvrBs3Δ2 fusion proteins do not interfere with the interaction of *X. campestris* pv. *vesicatoria* with AvrBs1-responsive plants. Strains 85* and 85*Δ*hpaC* (Δ*hpaC*) containing HrpB2-AvrBs3Δ2 fusion proteins as indicated were inoculated into leaves of AvrBs1-repsonsive ECW-10R pepper plants. Leaves were destained in ethanol 2 dpi.

(B) Infection assays with *X. campestris* pv. *vesicatoria* strains containing $HrpB2_{1\text{-}40}$-AvrBs3Δ2 or AvrBs3. Strains 85*, 85*Δ*hpaC* (Δ*hpaC*), 85*Δ*hpaC*Δ*hrpF* (Δ*hpaC*Δ*hrpF*) and 85*Δ*hpaC*Δ*hrpE* (Δ*hpaC*Δ*hrpE*) containing $HrpB2_{1\text{-}40}$-AvrBs3Δ2, and 85* and 85*Δ*hpaC* delivering AvrBs3 were inoculated into leaves of ECW-10R pepper plants. Phenotypes were documented as described for panel A.

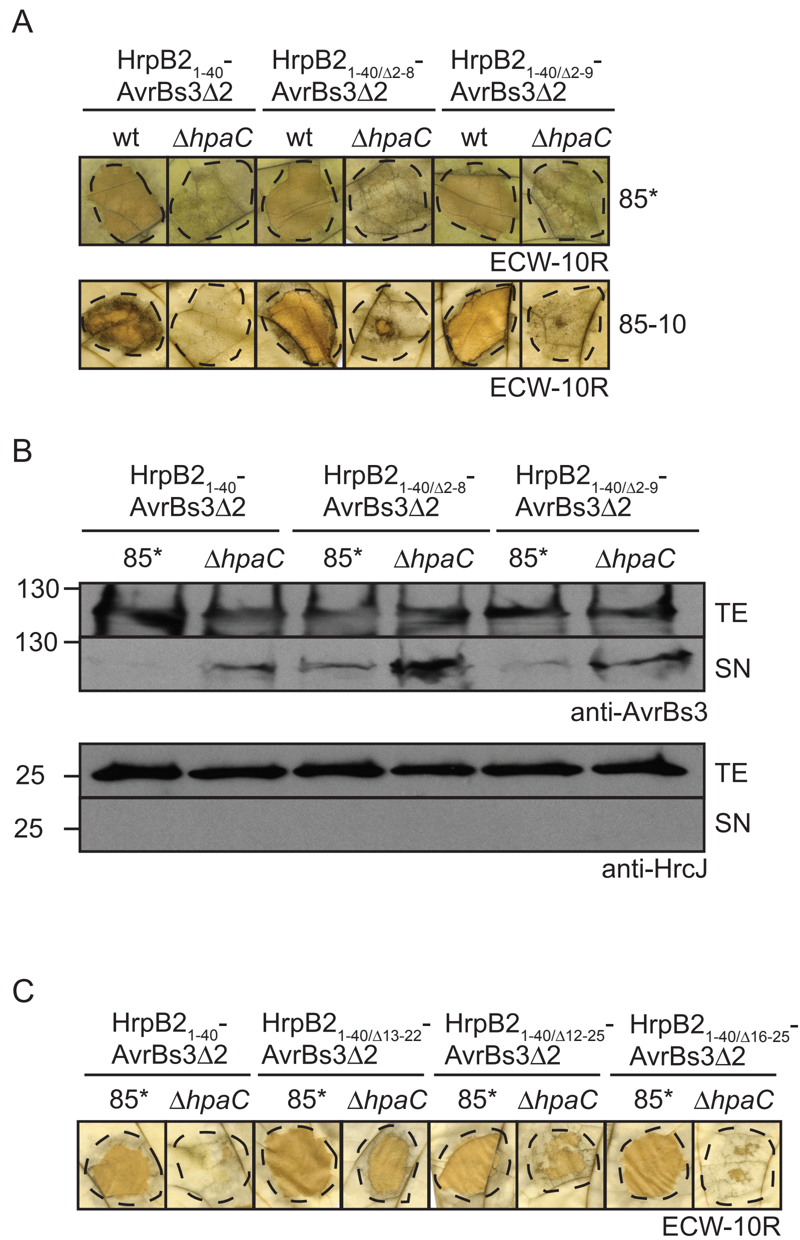


Figure S3
Scheibner *et al.*

Fig. S3 Analysis of HrpB2-AvrBs3Δ2 fusion proteins.

(A) Infection assays with *X. campestris* pv. *vesicatoria* wild-type and *hpaC* mutant strains containing HrpB2-AvrBs3Δ2 fusion proteins. Strains 85* (wt), 85-10 (wt), 85*Δ*hpaC* (Δ*hpaC*) and 85-10Δ*hpaC* (Δ*hpaC*) containing HrpB2-AvrBs3Δ2 fusion proteins as indicated were inoculated into leaves of AvrBs1-repsonsive ECW-10R pepper plants. Leaves were destained in ethanol 2 dpi. Dashed lines mark the infiltrated areas.

(B) The N-terminal nine amino acids are dispensable for secretion of $HrpB2_{1-40}$-AvrBs3Δ2. Strains 85* and 85*Δ*hpaC* (Δ*hpaC*) containing HrpB2-AvrBs3Δ2 fusion proteins as indicated were incubated in secretion medium. Total cell extracts (TE) and culture supernatants (SN) were analysed by immunoblotting using antibodies specific for AvrBs3 and HrcJ, respectively.

(C) Infection assays with *X. campestris* pv. *vesicatoria* strains containing HrpB2-AvrBs3Δ2 fusion proteins. Strains 85* and 85*Δ*hpaC* (Δ*hpaC*) containing HrpB2-AvrBs3Δ2 fusion proteins as indicated were inoculated into leaves of AvrBs1-repsonsive ECW-10R pepper plants. Leaves were destained in ethanol 2 dpi. Dashed lines mark the infiltrated areas.

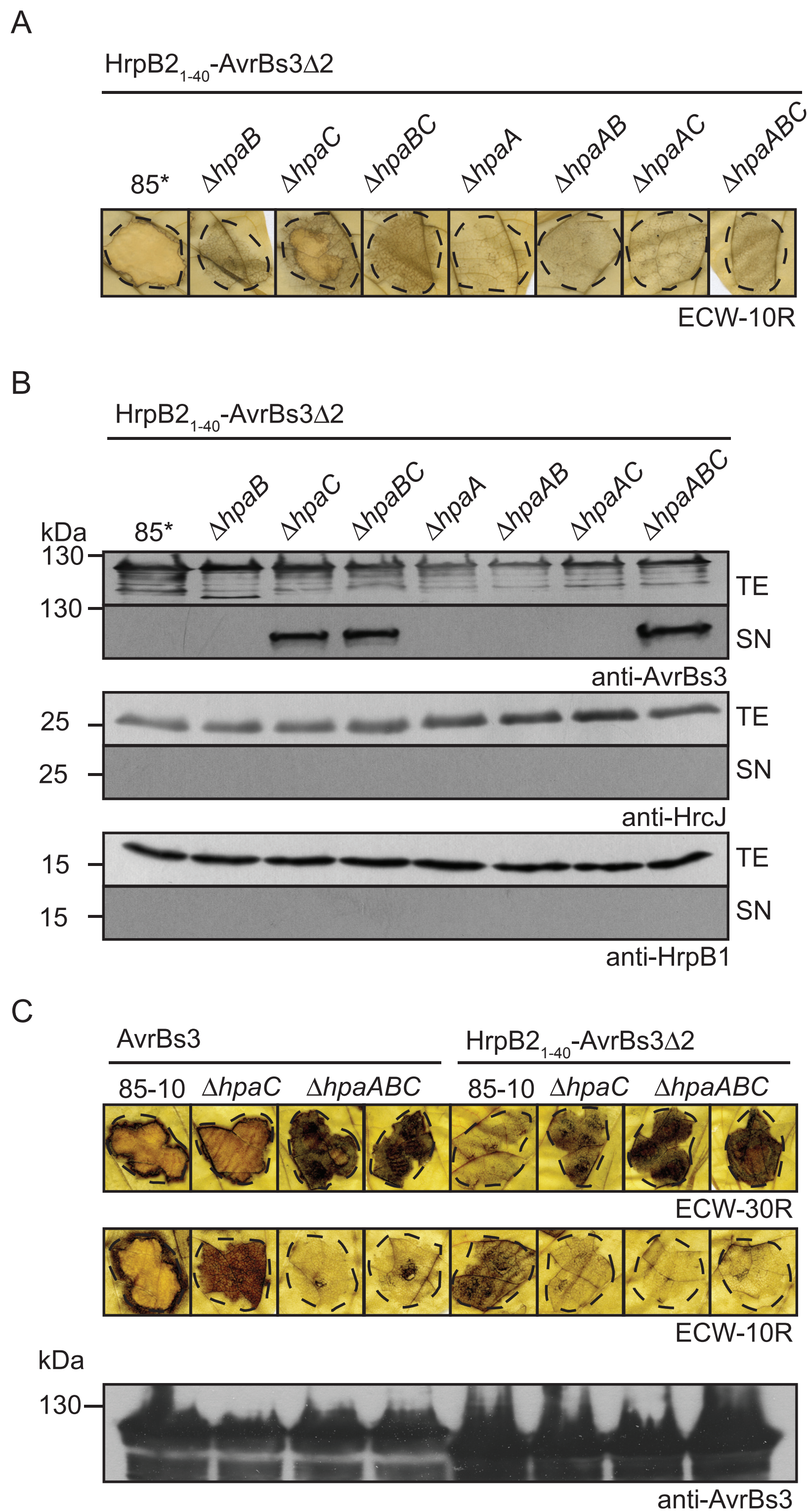


Figure S4
Scheibner *et al.*

Fig. S4 Analysis of HrpB2-AvrBs3Δ2 fusion proteins in double and triple *hpa* deletion mutants.

(A) Phenotypes of double and triple *hpa* deletion mutants containing $HrpB2_{1-40}$-AvrBs3Δ2 in AvrBs1-responsive pepper plants. Strains 85*, 85*Δ*hpaB* (Δ*hpaB*), 85*Δ*hpaC* (Δ*hpaC*), 85*Δ*hpaBC* (Δ*hpaBC*), 85*Δ*hpaA* (Δ*hpaA*), 85*Δ*hpaAB* (Δ*hpaAB*), 85*Δ*hpaAC* (Δ*hpaAC*) and 85*Δ*hpaABC* (Δ*hpaABC*) containing $HrpB2_{1-40}$-AvrBs3Δ2 were inoculated into leaves of AvrBs1-responsive ECW-10R pepper plants. Leaves were destained in ethanol 2 dpi. Dashed lines mark the inoculated areas.

(B) $HrpB2_{1-40}$-AvrBs3Δ2 is secreted by *hpaC*, *hpaBC* and *hpaABC* deletion mutants. *X. campestris* pv. *vesicatoria* strains as described in (A) were incubated in secretion medium. Total cell extracts (TE) and culture supernatants (SN) were analysed by immunoblotting using antibodies specific for AvrBs3, HrcJ and HrpB1, respectively.

(C) HR induction by AvrBs3 and $HrpB2_{1-40}$-AvrBs3Δ2 is comparable when both proteins are delivered by strain 85-10Δ*hpaABC.* Strains 85-10, 85-10Δ*hpaC* (Δ*hpaC*) and 85-10Δ*hpaABC* (Δ*hpaABC*) containing AvrBs3 or $HrpB2_{1-40}$-AvrBs3Δ2 as indicated were inoculated at a bacterial density of 8×10^8 CFU ml^{-1} into leaves of AvrBs3-responsive ECW-30R and AvrBs1-responsive ECW-10R pepper plants. Leaves were destained 2 dpi (ECW-10R plants) and 4 dpi (ECW-30R plants).

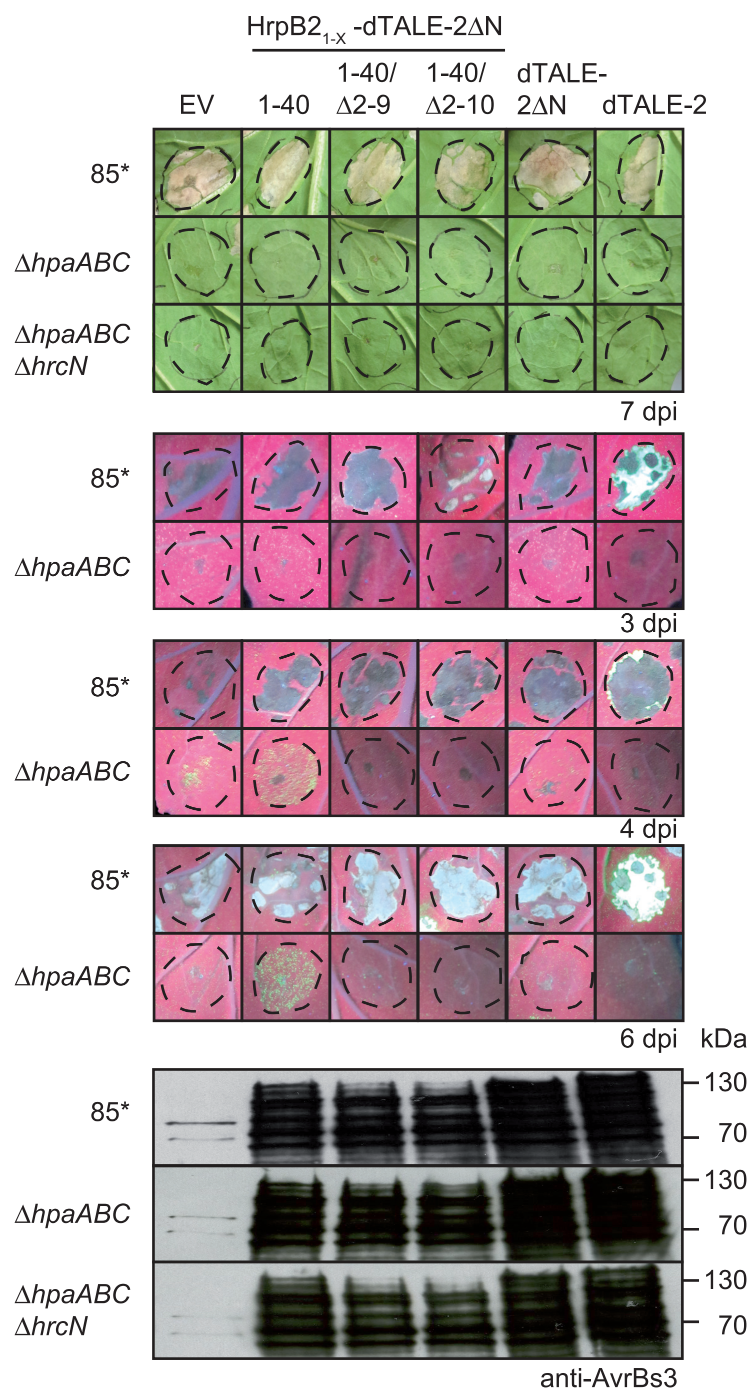


Figure S5
Scheibner *et al.*

Fig. S5 Analysis of dTALE-2 derivatives in *gfp*-transgenic *N. benthamiana* plants.

Strains 85*, 85*Δ*hpaABC* (Δ*hpaABC*) and 85*Δ*hpaABC*Δ*hrcN* (Δ*hpaABC*Δ*hrcN*) containing the empty vector (EV), $HrpB2_{1\text{-}40}$-dTALE-2ΔN, $HrpB2_{1\text{-}40/\Delta 2\text{-}9}$-dTALE-2ΔN, $HrpB2_{1\text{-}40/\Delta 2\text{-}10}$-dTALE-2ΔN, dTALE-2ΔN or dTALE-2 as indicated were inoculated at a density of 8×10^8 CFU ml^{-1} into leaves of *gfp*-transgenic *N. benthamiana* plants. Photographs of plant reactions were taken 7 dpi, photographs of GFP fluorescence 3, 4 and 6 dpi as indicated. Equal amounts of cell extracts (adjusted according to the cell density) were analysed by immunoblotting using AvrBs3-specific antibodies. The upper bands correspond to dTALE-2 and derivatives thereof, lower bands are degradation products.

Sequences of dTALE2 constructs

DNA sequences of constructs encoding dTALE-2, dTALE-2ΔN, $\text{HrpB2}_{1\text{-}40}$-dTALE-2ΔN, $\text{HrpB2}_{1\text{-}40/\Delta 2\text{-}9}$-dTALE-2ΔN and $\text{HrpB2}_{1\text{-}40/\Delta 2\text{-}10}$-dTALE-2ΔN. The *lac* promoter is shown in red, *hrpB2* sequences in green and dTALE-2 sequences in blue. DNA sequences were assembled from individual modules containing the *lac* promoter, *hrpB2* sequences and sequences encoding N-terminal, repeat and C-terminal regions of dTALE-2, respectively, using Golden Gate cloning. For the assembly of the construct encoding dTALE-2ΔN, an oligonucleotide linker (shown in bold) encoding two lysine residues was inserted upstream of the dTALE-2ΔN-encoding sequence.

dTALE-2

TGCCGCAGCTGGCACGACAGGTTTCCCGACTGGAAAGCGGGCAGTGAGCGCAACGCAATTAAT
GTGAGTTAGCTCACTCATTAGGCACCCCAGGCTTTACACTTTATGCTTCCGGCTCGTATGTTGTGT
GGAATTGTGAGCGGATAACAATTGCAATAAGGATTTTTTTAATGGATCCGATTCGTTCTCGGACAC
CTTCTCCCGCTCGAGAGCTCCTTCCTGGACCACAACCAGATGGAGTGCAACCAACAGCTGATAG
GGGTGTATCTCCTCCAGCCGGTGGACCTCTTGACGGCTTACCTGCAAGGCGCACAATGTCCCGT
ACCAGATTGCCCAGTCCACCAGCACCAAGTCCAGCGTTTTCAGCGGGCAGCTTCTCTGACCTCC
TGAGACAGTTTGATCCCTCTTTGTTCAACACCTCACTGTTTGACTCACTTCCGCCTTTTGGGGCTC
ACCATACTGAAGCCGCTACTGGTGAGTGGGATGAGGTGCAGTCAGGCTTAAGAGCAGCTGATGC
CCCACCACCTACGATGAGGGTGGCAGTAACTGCTGCTAGGCCACCGAGAGCTAAACCAGCTCCA
AGACGCAGAGCAGCACAACCTTCCGATGCATCTCCTGCTGCTCAAGTCGATCTTCGCACTTTAGG
GTATAGCCAGCAACAACAGGAGAAGATCAAACCTAAGGTCCGAAGTACAGTTGCGCAACACCAT
GAAGCCCTTGTTGGTCATGGGTTCACTCATGCCCACATAGTTGCACTATCCCAACATCCTGCTGC
TCTTGGAACTGTTGCGGTGAAGTACCAGGACATGATTGCTGCTTTACCTGAAGCAACACACGAGG
CAATAGTCGGTGTTGGCAAACAGTGGTCTGGCGCTAGGGCTCTAGAAGCCCTCCTTACAGTTGC
AGGAGAATTGCGGGGACCTCCCTTGCAGCTCGATACCGGACAATTGCTGAAGATTGCCAAACGT
GGTGGTGTTACGGCAGTAGAAGCAGTGCATGCTTGGAGGAATGCTCTAACTGGAGCACCCTTGA
ATCTCACGCCAGAACAAGTGGTCGCTATCGCCTCCCATGATGGTGGAAAACAAGCACTAGAAACT
GTCCAAAGATTATTGCCTGTTCTTTGTCAGGCACACGGACTTACCCCACAACAAGTCGTTGCTATA
GCCTCCCATGATGGAGGGAAGCAAGCGTTAGAAACAGTGCAGCGGCTACTCCCTGTATTATGCC
AGGCTCATGGTCTAACTCCACAACAAGTGGTGGCTATAGCCTCACACGATGGTGGTAAACAGGC
ACTTGAAACCGTCCAAAGACTCCTGCCGGTCCTCTGCCAGGCACACGGCCTCACCCCCGAACAA
GTGGTGGCTATTGCTTCGCATGATGGAGGTAAGCAGGCTTTAGAGACAGTCCAGAGACTACTAC
CCGTTCTATGCCAGGCCCATGGTTTGACCCCGGAACAGGTTGTTGCTATTGCGTCAAATAAGGGC
GGCAAGCAAGCGTTGGAAACCGTTCAAGCATTACTCCCTGTTCTCTGTCAAGCACATGGGCTAAC
GCCCGAGCAGGTTGTTGCAATTGCATCACATGATGGAGGAAAGCAGGCCTTAGAAACGGTACAG
GCACTTTTACCAGTCCTTTGCCAAGCACACGGGCTTACACCCGAACAAGTGGTCGCTATTGCAAG
TAATATAGGTGGAAAACAAGCACTGGAAACCGTGCAGGCGCTTTTGCCGGTATTATGCCAAGCTC
ACGGCCTAACTCCTGAACAGGTGGTTGCGATTGCCTCAAATGGTGGGGGTAAACAGGCACTGGA
GACTGTGCAGCGGCTTTTGCCTGTTTTGTGTCAAGCTCATGGATTGACACCAGAGCAGGTGGTC
GCTATAGCTAGTAACATTGGAGGTAAACAAGCGCTTGAAACCGTGCAACGTCTGCTGCCAGTTCT
ATGTCAAGCTCATGGGTTGACCCCACAACAGGTTGTAGCGATCGCTTCCAATAAAGGAGGAAAGC
AAGCTCTAGAAACGGTGCAGAGGCTCCTCCCGGTTCTTTGTCAGGCGCATGGATTGACCCCGGA
GCAGGTGGTCGCAATCGCCAGTCATGATGGAGGTAAGCAGGCCTTGGAAACCGTTCAGGCGTTA
CTCCCGGTTCTATGCCAGGCGCATGGCCTGACCCCTGAACAGGTTGTGGCGATAGCCAGTAACG
GCGGGGGAAAGCAGGCACTTGAAACCGTACAACGACTCCTCCCAGTCCTTTGTCAAGCCCACGG
ATTGACTCCAGAACAAGTAGTTGCTATAGCTTCGAATAAGGGAGGAAAGCAGGCCCTTGAAACAG
TTCAGCGTCTTTTGCCAGTGTTGTGTCAAGCACACGGATTGACTCCTGAACAGGTTGTCGCCATT
GCATCTAATATCGGTGGTAAGCAAGCTCTCGAAACCGTACAGCGACTCTTGCCTGTTCTATGCCA
AGCGCATGGCTTGACGCCGGAACAGGTGGTAGCCATAGCAAGCAACATAGGTGGCAAACAAGCT
CTTGAAACAGTTCAAAGGTTGTTACCTGTGCTTTGCCAAGCCCACGGTTTGACCCCTCAACAGGT
GGTTGCTATAGCATCACATGATGGGGGACGGCCTGCTCTTGAGACAGTGCAGCGCCTGTTGCCC
GTGTTGTGTCAAGCGCATGGCTTAACACCGGAACAGGTCGTGGCAATTGCGTCAAATATTGGCG
GCAAACAAGCGCTGGAAACCGTTCAGCGACTCTTGCCTGTTCTGTGCCAAGCTCACGGTCTGAC
GCCCCAACAGGTTGTTGCCATTGCTTCAAATGGAGGAGGGAGGCCAGCCCTTGAGTCGATTGTC
GCACAGCTATCTCGGCCCGACCCTGCTTTAGCCGCTCTGACAAATGATCATCTTGTGGCTCTCGC
CTGCTTAGGAGGTCGCCCAGCTTTAGACGCAGTAAAAAAGGGTCTACCTCATGCTCCGGCCTTAA
TCAAGAGGACGAATCGTAGAATCCCAGAACGAACGAGCCATCGCGTAGCCGATCACGCTCAAGT
TGTTAGGGTTTTAGGTTTTTTTCAGTGTCATTCACATCCGGCACAAGCTTTCGATGATGCCATGAC
CCAGTTTGGTATGTCAAGGCATGGATTACTGCAACTTTTCAGAAGAGTAGGAGTGACAGAGCTCG
AAGCCAGAAGCGGAACTCTGCCACCCGCTAGCCAAAGATGGGATAGGATATTGCAGGCGAGTGG
AATGAAGCGCGCGAAACCATCTCCAACAAGCACTCAAACCCCGGATCAAGCGAGTTTGCACGCT
TTCGCAGATTCTCTCGAACGAGATTTGGATGCCCCTTCTCCAATGCACGAAGGTGATCAAACTAG
GGCGAGTAGCAGGAAGAGGTCTAGGAGTGATCGTGCAGTTACGGGCCCCTCAGCACAACAGTCT
TTTGAGGTCAGGGTGCCAGAACAAAGGACGCTTTACATCTCCCATTGTCTTGGCGTGTAAAAAG
GCCGCGAACTAGTATTGGAGGGGGATTACCGGACCCAGGGACCCCCACTGCTGCTGATCTAGCT
GCTTCTAGTACGGTAATGCGCGAGCAAGACGAGGATCCATTTGCTGGGGCAGCTGATGACTTCC
CCGCATTCAACGAAGAAGAATTAGCATGGTTGATGGAGTTACTGCCACAGTAAGCGCTTACTAGC
TTTTAAGCCAGCCCCGACACCCGCCAACACCCGCTGACGCGCCCTGACGGGCTTGTCTGCTCCC
GGCATCCGCTTACAGACAAGCTGTGACCGGGA

dTALE-2ΔN

TGCCGCAGCTGGCACGACAGGTTTCCCGACTGGAAAGCGGGCAGTGAGCGCAACGCAATTAAT
GTGAGTTAGCTCACTCATTAGGCACCCCAGGCTTTACACTTTATGCTTCCGGCTCGTATGTTGTGT
GGAATTGTGAGCGGATAACAATTGCAATAAGGATTTTTTTAATG**AAAAAA**TCAGCGGGCAGCTTC
TCTGACCTCCTGAGACAGTTTGATCCCTCTTTGTTCAACACCTCACTGTTTGACTCACTTCCGCCT
TTTGGGGCTCACCATACTGAAGCCGCTACTGGTGAGTGGGATGAGGTGCAGTCAGGCTTAAGAG
CAGCTGATGCCCCACCACCTACGATGAGGGTGGCAGTAACTGCTGCTAGGCCACCGAGAGCTAA
ACCAGCTCCAAGACGCAGAGCAGCACAACCTTCCGATGCATCTCCTGCTGCTCAAGTCGATCTTC
GCACTTTAGGGTATAGCCAGCAACAACAGGAGAAGATCAAACCTAAGGTCCGAAGTACAGTTGC
GCAACACCATGAAGCCCTTGTTGGTCATGGGTTCACTCATGCCCACATAGTTGCACTATCCCAAC
ATCCTGCTGCTCTTGGAACTGTTGCGGTGAAGTACCAGGACATGATTGCTGCTTTACCTGAAGCA
ACACACGAGGCAATAGTCGGTGTTGGCAAACAGTGGTCTGGCGCTAGGGCTCTAGAAGCCCTCC
TTACAGTTGCAGGAGAATTGCGGGGACCTCCCTTGCAGCTCGATACCGGACAATTGCTGAAGATT
GCCAAACGTGGTGGTGTTACGGCAGTAGAAGCAGTGCATGCTTGGAGGAATGCTCTAACTGGAG
CACCCTTGAATCTCACGCCAGAACAAGTGGTCGCTATCGCCTCCCATGATGGTGGAAAACAAGCA
CTAGAAACTGTCCAAAGATTATTGCCTGTTCTTTGTCAGGCACACGGACTTACCCCACAACAAGTC
GTTGCTATAGCCTCCCATGATGGAGGGAAGCAAGCGTTAGAAACAGTGCAGCGGCTACTCCCTG
TATTATGCCAGGCTCATGGTCTAACTCCACAACAAGTGGTGGCTATAGCCTCACACGATGGTGGT
AAACAGGCACTTGAAACCGTCCAAAGACTCCTGCCGGTCCTCTGCCAGGCACACGGCCTCACCC
CCGAACAAGTGGTGGCTATTGCTTCGCATGATGGAGGTAAGCAGGCTTTAGAGACAGTCCAGAG
ACTACTACCCGTTCTATGCCAGGCCCATGGTTTGACCCCGGAACAGGTTGTTGCTATTGCGTCAA
ATAAGGGCGGCAAGCAAGCGTTGGAAACCGTTCAAGCATTACTCCCTGTTCTCTGTCAAGCACAT
GGGCTAACGCCCGAGCAGGTTGTTGCAATTGCATCACATGATGGAGGAAAGCAGGCCTTAGAAA
CGGTACAGGCACTTTTACCAGTCCTTTGCCAAGCACACGGGCTTACACCCGAACAAGTGGTCGC
TATTGCAAGTAATATAGGTGGAAAACAAGCACTGGAAACCGTGCAGGCGCTTTTGCCGGTATTAT
GCCAAGCTCACGGCCTAACTCCTGAACAGGTGGTTGCGATTGCCTCAAATGGTGGGGGTAAACA
GGCACTGGAGACTGTGCAGCGGCTTTTGCCTGTTTTGTGTCAAGCTCATGGATTGACACCAGAG
CAGGTGGTCGCTATAGCTAGTAACATTGGAGGTAAACAAGCGCTTGAAACCGTGCAACGTCTGCT
GCCAGTTCTATGTCAAGCTCATGGGTTGACCCCACAACAGGTTGTAGCGATCGCTTCCAATAAAG
GAGGAAAGCAAGCTCTAGAAACGGTGCAGAGGCTCCTCCCGGTTCTTTGTCAGGCGCATGGATT
GACCCCGGAGCAGGTGGTCGCAATCGCCAGTCATGATGGAGGTAAGCAGGCCTTGGAAACCGT
TCAGGCGTTACTCCCGGTTCTATGCCAGGCGCATGGCCTGACCCCTGAACAGGTTGTGGCGATA
GCCAGTAACGGCGGGGGAAAGCAGGCACTTGAAACCGTACAACGACTCCTCCCAGTCCTTTGTC
AAGCCCACGGATTGACTCCAGAACAAGTAGTTGCTATAGCTTCGAATAAGGGAGGAAAGCAGGC
CCTTGAAACAGTTCAGCGTCTTTTGCCAGTGTTGTGTCAAGCACACGGATTGACTCCTGAACAGG
TTGTCGCCATTGCATCTAATATCGGTGGTAAGCAAGCTCTCGAAACCGTACAGCGACTCTTGCCT
GTTCTATGCCAAGCGCATGGCTTGACGCCGGAACAGGTGGTAGCCATAGCAAGCAACATAGGTG
GCAAACAAGCTCTTGAAACAGTTCAAGGTTGTTACCTGTGCTTTGCCAAGCCCACGGTTTGACC
CCTCAACAGGTGGTTGCTATAGCATCACATGATGGGGGACGGCCTGCTCTTGAGACAGTGCAGC
GCCTGTTGCCCGTGTTGTGTCAAGCGCATGGCTTAACACCGGAACAGGTCGTGGCAATTGCGTC
AAATATTGGCGGCAAACAAGCGCTGGAAACCGTTCAGCGACTCTTGCCTGTTCTGTGCCAAGCTC
ACGGTCTGACGCCCCAACAGGTTGTTGCCATTGCTTCAAATGGAGGAGGGAGGCCAGCCCTTGA
GTCGATTGTCGCACAGCTATCTCGGCCCGACCCTGCTTTAGCCGCTCTGACAAATGATCATCTTG
TGGCTCTCGCCTGCTTAGGAGGTCGCCCAGCTTTAGACGCAGTAAAAAAGGGTCTACCTCATGCT
CCGGCCTTAATCAAGAGGACGAATCGTAGAATCCCAGAACGAACGAGCCATCGCGTAGCCGATC
ACGCTCAAGTTGTTAGGGTTTTAGGTTTTTTTCAGTGTCATTCACATCCGGCACAAGCTTTCGATG
ATGCCATGACCCAGTTTGGTATGTCAAGGCATGGATTACTGCAACTTTTCAGAAGAGTAGGAGTG
ACAGAGCTCGAAGCCAGAAGCGGAACTCTGCCACCCGCTAGCCAAAGATGGGATAGGATATTGC
AGGCGAGTGGAATGAAGCGCGCGAAACCATCTCCAACAAGCACTCAAACCCCGGATCAAGCGAG
TTTGCACGCTTTCGCAGATTCTCTCGAACGAGATTTGGATGCCCCTTCTCCAATGCACGAAGGTG
ATCAAACTAGGGCGAGTAGCAGGAAGAGGTCTAGGAGTGATCGTGCAGTTACGGGCCCCTCAGC
ACAACAGTCTTTTGAGGTCAGGGTGCCAGAACAAAGGGACGCTTTACATCTCCCATTGTCTTGGC
GTGTAAAAAGGCCGCGAACTAGTATTGGAGGGGGATTACCGGACCCAGGGACCCCCACTGCTG
CTGATCTAGCTGCTTCTAGTACGGTAATGCGCGAGCAAGACGAGGATCCATTTGCTGGGGCAGC
TGATGACTTCCCCGCATTCAACGAAGAAGAATTAGCATGGTTGATGGAGTTACTGCCACAGTAAG
CGCTTACTAGCTTTTAAGCCAGCCCCGACACCCGCCAACACCCGCTGACGCGCCCTGACGGGCT
TGTCTGCTCCCGGCATCCGCTTACAGACAAGCTGTGACCGGGA

HrpB2$_{1-40}$-dTALE-2ΔN

TGCCGCAGCTGGCACGACAGGTTTCCCGACTGGAAAGCGGGCAGTGAGCGCAACGCAATTAAT
GTGAGTTAGCTCACTCATTAGGCACCCCAGGCTTTACACTTTATGCTTCCGGCTCGTATGTTGTGT
GGAATTGTGAGCGGATAACAATTGCAATAAGGATTTTTTTAATGACGCTCATTCCTCCTGTCCAAG
CGATTGCCGGCACCAGTGCTGCCGCGACCCAAGCGCTGTCGCCGGTGGCAACGCCCAACCAAG
CGCTGGTGAATCGCTTTCAAGCGCTGATGCAATCAGCGGCAGCTTCTCTGACCTCCTGAGACA
GTTTGATCCCTCTTTGTTCAACACCTCACTGTTTGACTCACTTCCGCCTTTTGGGGCTCACCATAC
TGAAGCCGCTACTGGTGAGTGGGATGAGGTGCAGTCAGGCTTAAGAGCAGCTGATGCCCCACCA
CCTACGATGAGGGTGGCAGTAACTGCTGCTAGGCCACCGAGAGCTAAACCAGCTCCAAGACGCA
GAGCAGCACAACCTTCCGATGCATCTCCTGCTGCTCAAGTCGATCTTCGCACTTTAGGGTATAGC
CAGCAACAACAGGAGAAGATCAAACCTAAGGTCCGAAGTACAGTTGCGCAACACCATGAAGCCC
TTGTTGGTCATGGGTTCACTCATGCCCACATAGTTGCACTATCCCAACATCCTGCTGCTCTTGGAA
CTGTTGCGGTGAAGTACCAGGACATGATTGCTGCTTTACCTGAAGCAACACACGAGGCAATAGTC
GGTGTTGGCAAACAGTGGTCTGGCGCTAGGGCTCTAGAAGCCCTCCTTACAGTTGCAGGAGAAT
TGCGGGGACCTCCCTTGCAGCTCGATACCGGACAATTGCTGAAGATTGCCAAACGTGGTGGTGT
TACGGCAGTAGAAGCAGTGCATGCTTGGAGGAATGCTCTAACTGGAGCACCCTTGAATCTCACG
CCAGAACAAGTGGTCGCTATCGCCTCCCATGATGGTGGAAAACAAGCACTAGAAACTGTCCAAAG
ATTATTGCCTGTTCTTTGTCAGGCACACGGACTTACCCCACAACAAGTCGTTGCTATAGCCTCCCA
TGATGGAGGGAAGCAAGCGTTAGAAACAGTGCAGCGGCTACTCCCTGTATTATGCCAGGCTCAT
GGTCTAACTCCACAACAAGTGGTGGCTATAGCCTCACACGATGGTGGTAAACAGGCACTTGAAAC
CGTCCAAAGACTCCTGCCGGTCCTCTGCCAGGCACACGGCCTCACCCCCGAACAAGTGGTGGCT
ATTGCTTCGCATGATGGAGGTAAGCAGGCTTTAGAGACAGTCCAGAGACTACTACCCGTTCTATG
CCAGGCCCATGGTTTGACCCCGGAACAGGTTGTTGCTATTGCGTCAAATAAGGGCGGCAAGCAA
GCGTTGGAAACCGTTCAAGCATTACTCCCTGTTCTCTGTCAAGCACATGGGCTAACGCCCGAGCA
GGTTGTTGCAATTGCATCACATGATGGAGGAAAGCAGGCCTTAGAAACGGTACAGGCACTTTTAC
CAGTCCTTTGCCAAGCACACGGGCTTACACCCGAACAAGTGGTCGCTATTGCAAGTAATATAGGT
GGAAAACAAGCACTGGAAACCGTGCAGGCGCTTTTGCCGGTATTATGCCAAGCTCACGGCCTAA
CTCCTGAACAGGTGGTTGCGATTGCCTCAAATGGTGGGGGTAAACAGGCACTGGAGACTGTGCA
GCGGCTTTTGCCTGTTTTGTGTCAAGCTCATGGATTGACACCAGAGCAGGTGGTCGCTATAGCTA
GTAACATTGGAGGTAAACAAGCGCTTGAAACCGTGCAACGTCTGCTGCCAGTTCTATGTCAAGCT
CATGGGTTGACCCCACAACAGGTTGTAGCGATCGCTTCCAATAAAGGAGGAAAGCAAGCTCTAG
AAACGGTGCAGAGGCTCCTCCCGGTTCTTTGTCAGGCGCATGGATTGACCCCGGAGCAGGTGGT
CGCAATCGCCAGTCATGATGGAGGTAAGCAGGCCTTGGAAACCGTTCAGGCGTTACTCCCGGTT
CTATGCCAGGCGCATGGCCTGACCCCTGAACAGGTTGTGGCGATAGCCAGTAACGGCGGGGGA
AAGCAGGCACTTGAAACCGTACAACGACTCCTCCCAGTCCTTTGTCAAGCCCACGGATTGACTCC
AGAACAAGTAGTTGCTATAGCTTCGAATAAGGGAGGAAAGCAGGCCCTTGAAACAGTTCAGCGTC
TTTTGCCAGTGTTGTGTCAAGCACACGGATTGACTCCTGAACAGGTTGTCGCCATTGCATCTAATA
TCGGTGGTAAGCAAGCTCTCGAAACCGTACAGCGACTCTTGCCTGTTCTATGCCAAGCGCATGG
CTTGACGCCGGAACAGGTGGTAGCCATAGCAAGCAACATAGGTGGCAAACAAGCTCTTGAAACA
GTTCAAAGGTTGTTACCTGTGCTTTGCCAAGCCCACGGTTTGACCCCTCAACAGGTGGTTGCTAT
AGCATCACATGATGGGGGACGGCCTGCTCTTGAGACAGTGCAGCGCCTGTTGCCCGTGTTGTGT
CAAGCGCATGGCTTAACACCGGAACAGGTCGTGGCAATTGCGTCAAATATTGGCGGCAAACAAG
CGCTGGAAACCGTTCAGCGACTCTTGCCTGTTCTGTGCCAAGCTCACGGTCTGACGCCCCAACA
GGTTGTTGCCATTGCTTCAAATGGAGGAGGGAGGCCAGCCCTTGAGTCGATTGTCGCACAGCTA
TCTCGGCCCGACCCTGCTTTAGCCGCTCTGACAAATGATCATCTTGTGGCTCTCGCCTGCTTAGG
AGGTCGCCCAGCTTTAGACGCAGTAAAAAAGGGTCTACCTCATGCTCCGGCCTTAATCAAGAGGA
CGAATCGTAGAATCCCAGAACGAACGAGCCATCGCGTAGCCGATCACGCTCAAGTTGTTAGGGT
TTTAGGTTTTTTTCAGTGTCATTCACATCCGGCACAAGCTTTCGATGATGCCATGACCCAGTTTGG
TATGTCAAGGCATGGATTACTGCAACTTTTCAGAAGAGTAGGAGTGACAGAGCTCGAAGCCAGAA
GCGGAACTCTGCCACCCGCTAGCCAAAGATGGGATAGGATATTGCAGGCGAGTGGAATGAAGCG
CGCGAAACCATCTCCAACAAGCACTCAAACCCCGGATCAAGCGAGTTTGCACGCTTTCGCAGATT
CTCTCGAACGAGATTTGGATGCCCCTTCTCCAATGCACGAAGGTGATCAAACTAGGGCGAGTAG
CAGGAAGAGGTCTAGGAGTGATCGTGCAGTTACGGGCCCCTCAGCACAACAGTCTTTTGAGGTC
AGGGTGCCAGAACAAAGGGACGCTTTACATCTCCCATTGTCTTGGCGTGTAAAAAGGCCGCGAA
CTAGTATTGGAGGGGGATTACCGGACCCAGGGACCCCCACTGCTGCTGATCTAGCTGCTTCTAG
TACGGTAATGCGCGAGCAAGACGAGGATCCATTTGCTGGGGCAGCTGATGACTTCCCCGCATTC
AACGAAGAAGAATTAGCATGGTTGATGGAGTTACTGCCACAGTAAGCGCTTACTAGCTTTTAAGC
CAGCCCCGACACCCGCCAACACCCGCTGACGCGCCCTGACGGGC

HrpB2$_{1\text{-}40/\Delta 2\text{-}9}$-dTALE-2ΔN

TGCCGCAGCTGGCACGACAGGTTTCCCGACTGGAAAGCGGGCAGTGAGCGCAACGCAATTAAT
GTGAGTTAGCTCACTCATTAGGCACCCCAGGCTTTACACTTTATGCTTCCGGCTCGTATGTTGTGT
GGAATTGTGAGCGGATAACAATTGCAATAAGGATTTTTTTAATGATTGCCGGCACCAGTGCTGCC
GCGACCCAAGCGCTGTCGCCGGTGGCAACGCCCAACCAAGCGCTGGTGAATCGCTTTCAAGCG
CTGATGCAATCAGCGGGCAGCTTCTCTGACCTCCTGAGACAGTTTGATCCCTCTTTGTTCAACAC
CTCACTGTTTGACTCACTTCCGCCTTTTGGGGCTCACCATACTGAAGCCGCTACTGGTGAGTGGG
ATGAGGTGCAGTCAGGCTTAAGAGCAGCTGATGCCCCACCACCTACGATGAGGGTGGCAGTAAC
TGCTGCTAGGCCACCGAGAGCTAAACCAGCTCCAAGACGCAGAGCAGCACAACCTTCCGATGCA
TCTCCTGCTGCTCAAGTCGATCTTCGCACTTTAGGGTATAGCCAGCAACAACAGGAGAAGATCAA
ACCTAAGGTCCGAAGTACAGTTGCGCAACACCATGAAGCCCTTGTTGGTCATGGGTTCACTCATG
CCCACATAGTTGCACTATCCCAACATCCTGCTGCTCTTGGAACTGTTGCGGTGAAGTACCAGGAC
ATGATTGCTGCTTTACCTGAAGCAACACACGAGGCAATAGTCGGTGTTGGCAAACAGTGGTCTGG
CGCTAGGGCTCTAGAAGCCCTCCTTACAGTTGCAGGAGAATTGCGGGGACCTCCCTTGCAGCTC
GATACCGGACAATTGCTGAAGATTGCCAAACGTGGTGGTGTTACGGCAGTAGAAGCAGTGCATG
CTTGGAGGAATGCTCTAACTGGAGCACCCTTGAATCTCACGCCAGAACAAGTGGTCGCTATCGC
CTCCCATGATGGTGGAAAACAAGCACTAGAAACTGTCCAAAGATTATTGCCTGTTCTTTGTCAGG
CACACGGACTTACCCCACAACAAGTCGTTGCTATAGCCTCCCATGATGGAGGGAAGCAAGCGTT
AGAAACAGTGCAGCGGCTACTCCCTGTATTATGCCAGGCTCATGGTCTAACTCCACAACAAGTGG
TGGCTATAGCCTCACACGATGGTGGTAAACAGGCACTTGAAACCGTCCAAAGACTCCTGCCGGT
CCTCTGCCAGGCACACGGCCTCACCCCCGAACAAGTGGTGGCTATTGCTTCGCATGATGGAGGT
AAGCAGGCTTTAGAGACAGTCCAGAGACTACTACCCGTTCTATGCCAGGCCCATGGTTTGACCCC
GGAACAGGTTGTTGCTATTGCGTCAAATAAGGGCGGCAAGCAAGCGTTGGAAACCGTTCAAGCA
TTACTCCCTGTTCTCTGTCAAGCACATGGGCTAACGCCCGAGCAGGTTGTTGCAATTGCATCACA
TGATGGAGGAAAGCAGGCCTTAGAAACGGTACAGGCACTTTTACCAGTCCTTTGCCAAGCACAC
GGGCTTACACCCGAACAAGTGGTCGCTATTGCAAGTAATATAGGTGGAAAACAAGCACTGGAAAC
CGTGCAGGCGCTTTTGCCGGTATTATGCCAAGCTCACGGCCTAACTCCTGAACAGGTGGTTGCG
ATTGCCTCAAATGGTGGGGGTAAACAGGCACTGGAGACTGTGCAGCGGCTTTTGCCTGTTTTGT
GTCAAGCTCATGGATTGACACCAGAGCAGGTGGTCGCTATAGCTAGTAACATTGGAGGTAAACAA
GCGCTTGAAACCGTGCAACGTCTGCTGCCAGTTCTATGTCAAGCTCATGGGTTGACCCCACAACA
GGTTGTAGCGATCGCTTCCAATAAAGGAGGAAAGCAAGCTCTAGAAACGGTGCAGAGGCTCCTC
CCGGTTCTTTGTCAGGCGCATGGATTGACCCCGGAGCAGGTGGTCGCAATCGCCAGTCATGATG
GAGGTAAGCAGGCCTTGGAAACCGTTCAGGCGTTACTCCCGGTTCTATGCCAGGCGCATGGCCT
GACCCCTGAACAGGTTGTGGCGATAGCCAGTAACGGCGGGGGAAAGCAGGCACTTGAAACCGT
ACAACGACTCCTCCCAGTCCTTTGTCAAGCCCACGGATTGACTCCAGAACAAGTAGTTGCTATAG
CTTCGAATAAGGGAGGAAAGCAGGCCCTTGAAACAGTTCAGCGTCTTTTGCCAGTGTTGTGTCAA
GCACACGGATTGACTCCTGAACAGGTTGTCGCCATTGCATCTAATATCGGTGGTAAGCAAGCTCT
CGAAACCGTACAGCGACTCTTGCCTGTTCTATGCCAAGCGCATGGCTTGACGCCGGAACAGGTG
GTAGCCATAGCAAGCAACATAGGTGGCAAACAAGCTCTTGAAACAGTTCAAAGGTTGTTACCTGT
GCTTTGCCAAGCCCACGGTTTGACCCCTCAACAGGTGGTTGCTATAGCATCACATGATGGGGGA
CGGCCTGCTCTTGAGACAGTGCAGCGCCTGTTGCCCGTGTTGTGTCAAGCGCATGGCTTAACAC
CGGAACAGGTCGTGGCAATTGCGTCAAATATTGGCGGCAAACAAGCGCTGGAAACCGTTCAGCG
ACTCTTGCCTGTTCTGTGCCAAGCTCACGGTCTGACGCCCCAACAGGTTGTTGCCATTGCTTCAA
ATGGAGGAGGGAGGCCAGCCCTTGAGTCGATTGTCGCACAGCTATCTCGGCCCGACCCTGCTTT
AGCCGCTCTGACAAATGATCATCTTGTGGCTCTCGCCTGCTTAGGAGGTCGCCCAGCTTTAGACG
CAGTAAAAAAGGGTCTACCTCATGCTCCGGCCTTAATCAAGAGGACGAATCGTAGAATCCCAGAA
CGAACGAGCCATCGCGTAGCCGATCACGCTCAAGTTGTTAGGGTTTTAGGTTTTTTTCAGTGTCA
TTCACATCCGGCACAAGCTTTCGATGATGCCATGACCCAGTTTGGTATGTCAAGGCATGGATTAC
TGCAACTTTTCAGAAGAGTAGGAGTGACAGAGCTCGAAGCCAGAAGCGGAACTCTGCCACCCGC
TAGCCAAAGATGGGATAGGATATTGCAGGCGAGTGGAATGAAGCGCGCGAAACCATCTCCAACA
AGCACTCAAACCCCGGATCAAGCGAGTTTGCACGCTTTCGCAGATTCTCTCGAACGAGATTTGGA
TGCCCCTTCTCCAATGCACGAAGGTGATCAAACTAGGGCGAGTAGCAGGAAGAGGTCTAGGAGT
GATCGTGCAGTTACGGGCCCCTCAGCACAACAGTCTTTTGAGGTCAGGGTGCCAGAACAAAGGG
ACGCTTTACATCTCCCATTGTCTTGGCGTGTAAAAAGGCCGCGAACTAGTATTGGAGGGGGATTA
CCGGACCCAGGGACCCCCACTGCTGCTGATCTAGCTGCTTCTAGTACGGTAATGCGCGAGCAAG
ACGAGGATCCATTTGCTGGGGCAGCTGATGACTTCCCCGCATTCAACGAAGAAGAATTAGCATG
GTTGATGGAGTTACTGCCACAGTAAGCGCTTACTAGCTTTTAAGCCAGCCCCGACACCCGCCAAC
ACCCGCTGACGCGCCCTGACGGGC

HrpB2$_{1\text{-}40/\Delta 2\text{-}10}$-dTALE-2ΔN

TGCCGCAGCTGGCACGACAGGTTTCCCGACTGGAAAGCGGGCAGTGAGCGCAACGCAATTAAT
GTGAGTTAGCTCACTCATTAGGCACCCCAGGCTTTACACTTTATGCTTCCGGCTCGTATGTTGTGT
GGAATTGTGAGCGGATAACAATTGCAATAAGGATTTTTTTAATGGCCGGCACCAGTGCTGCCGCG
ACCCAAGCGCTGTCGCCGGTGGCAACGCCCAACCAAGCGCTGGTGAATCGCTTTCAAGCGCTGA
TGCAATCAGCGGGCAGCTTCTCTGACCTCCTGAGACAGTTTGATCCCTCTTTGTTCAACACCTCA
CTGTTTGACTCACTTCCGCCTTTTGGGGCTCACCATACTGAAGCCGCTACTGGTGAGTGGGATGA
GGTGCAGTCAGGCTTAAGAGCAGCTGATGCCCCACCACCTACGATGAGGGTGGCAGTAACTGCT
GCTAGGCCACCGAGAGCTAAACCAGCTCCAAGACGCAGAGCAGCACAACCTTCCGATGCATCTC
CTGCTGCTCAAGTCGATCTTCGCACTTTAGGGTATAGCCAGCAACAACAGGAGAAGATCAAACCT
AAGGTCCGAAGTACAGTTGCGCAACACCATGAAGCCCTTGTTGGTCATGGGTTCACTCATGCCCA
CATAGTTGCACTATCCCAACATCCTGCTGCTCTTGGAACTGTTGCGGTGAAGTACCAGGACATGA
TTGCTGCTTTACCTGAAGCAACACACGAGGCAATAGTCGGTGTTGGCAAACAGTGGTCTGGCGC
TAGGGCTCTAGAAGCCCTCCTTACAGTTGCAGGAGAATTGCGGGGACCTCCCTTGCAGCTCGAT
ACCGGACAATTGCTGAAGATTGCCAAACGTGGTGGTGTTACGGCAGTAGAAGCAGTGCATGCTT
GGAGGAATGCTCTAACTGGAGCACCCTTGAATCTCACGCCAGAACAAGTGGTCGCTATCGCCTC
CCATGATGGTGGAAAACAAGCACTAGAAACTGTCCAAAGATTATTGCCTGTTCTTTGTCAGGCAC
ACGGACTTACCCCACAACAAGTCGTTGCTATAGCCTCCCATGATGGAGGGAAGCAAGCGTTAGA
AACAGTGCAGCGGCTACTCCCTGTATTATGCCAGGCTCATGGTCTAACTCCACAACAAGTGGTGG
CTATAGCCTCACACGATGGTGGTAAACAGGCACTTGAAACCGTCCAAAGACTCCTGCCGGTCCTC
TGCCAGGCACACGGCCTCACCCCCGAACAAGTGGTGGCTATTGCTTCGCATGATGGAGGTAAGC
AGGCTTTAGAGACAGTCCAGAGACTACTACCCGTTCTATGCCAGGCCCATGGTTTGACCCCGGA
ACAGGTTGTTGCTATTGCGTCAAATAAGGGCGGCAAGCAAGCGTTGGAAACCGTTCAAGCATTAC
TCCCTGTTCTCTGTCAAGCACATGGGCTAACGCCCGAGCAGGTTGTTGCAATTGCATCACATGAT
GGAGGAAAGCAGGCCTTAGAAACGGTACAGGCACTTTTACCAGTCCTTTGCCAAGCACACGGGC
TTACACCCGAACAAGTGGTCGCTATTGCAAGTAATATAGGTGGAAAACAAGCACTGGAAACCGTG
CAGGCGCTTTTGCCGGTATTATGCCAAGCTCACGGCCTAACTCCTGAACAGGTGGTTGCGATTG
CCTCAAATGGTGGGGGTAAACAGGCACTGGAGACTGTGCAGCGGCTTTTGCCTGTTTTGTGTCA
AGCTCATGGATTGACACCAGAGCAGGTGGTCGCTATAGCTAGTAACATTGGAGGTAAACAAGCG
CTTGAAACCGTGCAACGTCTGCTGCCAGTTCTATGTCAAGCTCATGGGTTGACCCCACAACAGGT
TGTAGCGATCGCTTCCAATAAAGGAGGAAAGCAAGCTCTAGAAACGGTGCAGAGGCTCCTCCCG
GTTCTTTGTCAGGCGCATGGATTGACCCCGGAGCAGGTGGTCGCAATCGCCAGTCATGATGGAG
GTAAGCAGGCCTTGGAAACCGTTCAGGCGTTACTCCCGGTTCTATGCCAGGCGCATGGCCTGAC
CCCTGAACAGGTTGTGGCGATAGCCAGTAACGGCGGGGGAAAGCAGGCACTTGAAACCGTACAA
CGACTCCTCCCAGTCCTTTGTCAAGCCCACGGATTGACTCCAGAACAAGTAGTTGCTATAGCTTC
GAATAAGGGAGGAAAGCAGGCCCTTGAAACAGTTCAGCGTCTTTTGCCAGTGTTGTGTCAAGCAC
ACGGATTGACTCCTGAACAGGTTGTCGCCATTGCATCTAATATCGGTGGTAAGCAAGCTCTCGAA
ACCGTACAGCGACTCTTGCCTGTTCTATGCCAAGCGCATGGCTTGACGCCGGAACAGGTGGTAG
CCATAGCAAGCAACATAGGTGGCAAACAAGCTCTTGAAACAGTTCAAAGGTTGTTACCTGTGCTT
TGCCAAGCCCACGGTTTGACCCCTCAACAGGTGGTTGCTATAGCATCACATGATGGGGGACGGC
CTGCTCTTGAGACAGTGCAGCGCCTGTTGCCCGTGTTGTGTCAAGCGCATGGCTTAACACCGGA
ACAGGTCGTGGCAATTGCGTCAAATATTGGCGGCAAACAAGCGCTGGAAACCGTTCAGCGACTC
TTGCCTGTTCTGTGCCAAGCTCACGGTCTGACGCCCCAACAGGTTGTTGCCATTGCTTCAAATGG
AGGAGGGAGGCCAGCCCTTGAGTCGATTGTCGCACAGCTATCTCGGCCCGACCCTGCTTTAGCC
GCTCTGACAAATGATCATCTTGTGGCTCTCGCCTGCTTAGGAGGTCGCCCAGCTTTAGACGCAGT
AAAAAAGGGTCTACCTCATGCTCCGGCCTTAATCAAGAGGACGAATCGTAGAATCCCAGAACGAA
CGAGCCATCGCGTAGCCGATCACGCTCAAGTTGTTAGGGTTTTAGGTTTTTTTCAGTGTCATTCAC
ATCCGGCACAAGCTTTCGATGATGCCATGACCCAGTTTGGTATGTCAAGGCATGGATTACTGCAA
CTTTTCAGAAGAGTAGGAGTGACAGAGCTCGAAGCCAGAAGCGGAACTCTGCCACCCGCTAGCC
AAAGATGGGATAGGATATTGCAGGCGAGTGGAATGAAGCGCGCGAAACCATCTCCAACAAGCAC
TCAAACCCCGGATCAAGCGAGTTTGCACGCTTTCGCAGATTCTCTCGAACGAGATTTGGATGCCC
CTTCTCCAATGCACGAAGGTGATCAAACTAGGGCGAGTAGCAGGAAGAGGTCTAGGAGTGATCG
TGCAGTTACGGGCCCCTCAGCACAACAGTCTTTTGAGGTCAGGGTGCCAGAACAAAGGGACGCT
TTACATCTCCCATTGTCTTGGCGTGTAAAAAGGCCGCGAACTAGTATTGGAGGGGGATTACCGGA
CCCAGGGACCCCCACTGCTGCTGATCTAGCTGCTTCTAGTACGGTAATGCGCGAGCAAGACGAG
GATCCATTTGCTGGGGCAGCTGATGACTTCCCCGCATTCAACGAAGAAGAATTAGCATGGTTGAT
GGAGTTACTGCCACAGTAAGCGCTTACTAGCTTTTAAGCCAGCCCCGACACCCGCCAACACCCG
CTGACGCGCCCTGACGGGC