

Characterization of 25 full-length *S-RNase* alleles, including flanking regions, from a pool of resequenced apple cultivars

Plant Molecular Biology

Paolo De Franceschi¹, Luca Bianco, Alessandro Cestaro, Luca Dondini, Riccardo Velasco

¹ Corresponding author. Dipartimento di Scienze Agrarie, Università degli Studi di Bologna, Bologna, Italy – email paolo.defranceschi2@unibo.it

Online resource 6 Alignment of 5' flanking regions from 25 *S-RNase* alleles; positions numbered 1-3 in all sequences correspond to the start codon. Conserved positions are highlighted in black background (threshold: 90%).

S1	-----	-1167
S2	-----	-877
S3	-----	-747
S4	-----	-912
S5	-----	-536
S6	-----	-274
S7	-----	-571
S8	-----	-1077
S9	-----	-1084
S10	-----	-766
S11	-----	-363
S16b	GTGTGTGTGTGTGTGTGTGTTCGAGAGTGAGAGAGAGTGTTCAGACATGAGAGAGAAGGACCGAGAGTGGTGATGTAATCCCACTTAAGGTTTGA	-1175
S17	-----	-273
S20	-----	-750
S23	-----	-882
S24	-----	-1013
S25	-----	-1323
S26	-----AATTTGAATAAAAAAATATGGGGTATTATTGAAAATTATGTGGGATGCCAGTCCCATATATATCAAAACCTTTA	-1091
S28	-----	-813
S32	-----	-901
S33	-----	-990
S39	-----	-360
S46	-----	-541
S50	-----	-343
S58	-----	-436
S1	-----	-1167
S2	-----	-877
S3	-----	-747
S4	-----	-912
S5	-----	-536
S6	-----	-274
S7	-----	-571
S8	-----	-1077
S9	-----	-1084
S10	-----	-766
S11	-----	-363
S16b	GG-----GTAATTTACAATTAAGCCCTCGAGGCTTCGTTTATAATTTTCGTTTTTGAACCTAACGTACGAGAATAGAATTATGAAACTTGAGAAAAGTATAA	-1080
S17	-----	-273
S20	-----	-750
S23	-----	-882
S24	-----	-1013
S25	-----	-1323
S26	GGAACCAAGGCTTTATAAGTGAGGCCCTCGCTATAATTAATA-----TGATTTAAAGCCTACCTATAGACCTTTTGACCTTGGG-----	-1011
S28	-----	-813
S32	-----	-901
S33	-----	-990
S39	-----	-360
S46	-----	-541
S50	-----	-343
S58	-----	-436
S1	-----	-1167
S2	-----	-877
S3	-----	-747
S4	-----	-912
S5	-----	-536
S6	-----	-274
S7	-----	-571
S8	-----	-1077
S9	-----	-1084
S10	-----	-766
S11	-----	-363
S16b	GAGATTCTAATTTTCAATTAAGAATTGAAAATTAATTAAGACACCCATTCAAGGGTAAAATGGTCATCTCACATGTTTTAGAATGAAAATACAAAATTTT	-980
S17	-----	-273
S20	-----	-750
S23	-----	-882
S24	-----	-1013
S25	-----	-1323
S26	-----CTTGGGCTTGGGCTTGGACTTGAGGATATAGTAATATATTAATATATCAAAGATGGGCGGGTTCTTGGGCTTGAGTAGATGACTTAAGAATTGA	-916
S28	-----	-813
S32	-----	-901
S33	-----	-990
S39	-----	-360
S46	-----	-541
S50	-----	-343
S58	-----	-436

S1 ----- -1167
S2 ----- -877
S3 ----- -747
S4 -----GAAAATGAGAAGATCAAAAGGCCAACTCATGGCCTTTAAATCTTCACATAAATT -857
S5 ----- -536
S6 ----- -274
S7 ----- -571
S8 ----- -1077
S9 ----- -1084
S10 -----CTATAACATAGGGA -752
S11 ----- -363
S16b AATGAACAGGTTGT-----AACACTTGTTTACAAAAAGAGAAGGGAAAATAAGAAGATCAAAAGGTAA-CTCATGGCCTTTAAATCTTCACATAAATT -887
S17 ----- -273
S20 ----- -750
S23 ----- -882
S24 ----- -1013
S25 ----- -1323
S26 GTTCACGTTTTTGTGTTTTTGGATTTCAGTTTTCCGAAAGGATAAAATTGCTTCAGTCGACGGTCAAAAACA-ATTATGAATCTCCGAAATCAAGTCAATGA -817
S28 ----- -813
S32 ----- -901
S33 ----- -990
S39 ----- -360
S46 ----- -541
S50 ----- -343
S58 ----- -436

S1 -----GTCTCTTGAAAACGAACCGGCATGCTTCTGCCCGCCGAT -1128
S2 ----- -877
S3 ----- -747
S4 ACACTTGTGTTCTTAAAAGGAATAAAAGGCATCTTCATGGCTTTTAAAT-----TTCTT----- -804
S5 ----- -536
S6 ----- -274
S7 ----- -571
S8 ----- -1077
S9 -----GAATGA----- -1078
S10 CCATTTTGACATTTAAG-----CCTTATCCACTTCTTTTCATTCAATCTCTTTCTT----- -701
S11 ----- -363
S16b AGACTTGTGTTTCATAAAAGGAATAAAAGGCCTTTCATGTTTTTTCATTCAATCTCTTTCTT----- -825
S17 ----- -273
S20 ----- -750
S23 ----- -882
S24 ----- -1013
S25 -----GAGCATTTTTCCCACTAAGTTT -1301
S26 TAATTGTTGTGATTAA-----TTATTCATATTGTGGTTTAATC----- -778
S28 -----AAGTATTTTTAAGTATTTTTAAGTATTTTTATCCAT----- -777
S32 ----- -901
S33 ----- -990
S39 ----- -360
S46 ----- -541
S50 ----- -343
S58 ----- -436

S1 AGTTTATTTCTCGAGTATGACTGTTCTCTGCAACAAAATTTTCTTCGACATAGGTCGAGATTCGGAGCCGACATTTAAATTTAAGGAAAACATAATGAAA -1028
S2 ----- -877
S3 ----- -747
S4 -----GTGTTAAGTGGCTTTAGTATTCACACTA -776
S5 ----- -536
S6 ----- -274
S7 ----- -571
S8 ----- -1077
S9 -----CAAGCTATGGAAGGTTGATGTAAGGTGAATGACA----- -1043
S10 -----GTGTTAAGTGACTTTAGTAATCACGCTA -673
S11 ----- -363
S16b -----GTGTTAAGTGGCTTTAGTATTCACATTA -797
S17 ----- -273
S20 ----- -750
S23 ----- -882
S24 -----CTAAATGCATTTTCACTAGCAACAGTAGAAGT-----GGGGTTACAAAAGATATTTTGGCTATTTGTGAAA -947
S25 TTGCTACCTAACTAGGTTTTAACGAGGCACCCATCTGGGCTGATCATACCCTTTTGGACTCTTCTACTTGCATCTAAAAGACATATAATTTTACTTAA -1201
S26 -----ATGTATAGGGGAATTATATTTCAATACA -750
S28 -----ATTTTTGCAAGTGGTAACAATC----- -755
S32 -----TTGACTGGAAGCCTCAAGGCCTACACCT -865
S33 -----GTAGTTA-----TACTTTAGTGTATA-----ATATTGTTTTTTCAA -961
S39 ----- -360
S46 -----TGAAAAAGTGAATAATATTAATAATA -514
S50 ----- -343
S58 ----- -436

S1 AGGGTTTGAAAATTTGGGTTTTAATGATAAGAACAAAATAAAGGGTAAAGTGAATAGTACCAGGATTGACTTTTTAGTGTAAAAATATGGTTTTTCGTT -928
S2 ----- -877
S3 -----ACACTAGTATTCCTCTTAAATCTTTTCTTCTAATAGCTA-CT----- -704
S4 GGTGGGTATTCATTATAGCTTTGTGTCTTTACTTGTATTCCTCTTAAATATTTCTTGTAAATGCTA-CT----- -704
S5 ----- -536
S6 ----- -274
S7 ----- -571
S8 ----- -1077
S9 AGCTATGGAAAGTGACTTTAGCCTATGACTTAGCTAAAGTGAGGATGACAACCTACATACACAACCCATC-----CATACAAACTGGTTTCAATAGT -951
S10 GAAGGGTATTCGTTATAGCTTTGTGTCTTTACAAATATTCCTCTTAAATCTTTTCTTCTAATAGCTA-CT----- -601
S11 ----- -363
S16b GGAGGGTATTCATTATAGCTTTGTGTCTTTACGAGTATTCCTCTTAAATATTTCCCTTGTAAATAGCTA-CT----- -725
S17 ----- -273
S20 ----- -750
S23 ----- -882
S24 GAATTAGGAACTCTTTTGTGTTGATTTCCACAATTTTA-AGAGATCAAAGTCACCAACAACAATGCTAA-----TATAAGTAGGGTTTTATTTT -858
S25 TACAACTTCTCACTTTTCTCCTTACTCTATGTGTTTCTCCACCTTAGGTTTTATCATAGCAAGGTTTT----- -1131
S26 AACTGTTAATTATATATATATATG-----ATTCTTATTTGATTGGTT--CTAACAATAGCTA----- -693
S28 -----CTATCAGTATTACTCTTAAATCTTTCTCTTGTAAATAGCTA-CT----- -712
S32 AAGGCCCCACGAAGGCACCTTTCAAAGTTAACTATGTCCTTCTCTTTCAGCTTTTCCCGACAAGCCTTGC-----CCGATAAGC----- -786
S33 AAACAATTATCATTGTTTTTTGG----- -937
S39 ----- -360
S46 ----- -514
S50 ----- -343
S58 ----- -436

S1 AAAGTGAACAGTACCGGGAGTTTTTCGTTAAAGTTCCTAAAATTTTCTTTGGGTGAGGACTCTTGTGCCTACAAAATATGGTTTTATCGACTTGGATT -828
S2 ----- -877
S3 ----- -704
S4 ----- -704
S5 ----- -536
S6 ----- -274
S7 ----- -571
S8 -----CTTTGTTGAAAAAGATTGTGCGACTA-----CT -1049
S9 GGTGAAATAAATTTGGGAAATTTGGGCTTATGTACTACCCCGCCAGACGACAGAGAAAG-----GTTGGAGGAGAAGTGGGTGGCACCAGTGGATGAG -857
S10 ----- -601
S11 ----- -363
S16b ----- -725
S17 ----- -273
S20 -----AAAAAAAAAATATATATAT----- -729
S23 ----- -882
S24 CAAATTA-----TTGGAATATTATAAATATGTGTTATATAAATTATGTATTATATAA-----ATTATAAATTATATATATTTTTGGTAT -779
S25 -----GTGAGTTTTACCTTTTTATGCATTCTTTCATTGATATGAGACTTGCATTTCGCTCATTGTGCCGATGAATTCATCAACTATACTTGGCT -1044
S26 ----- -693
S28 ----- -712
S32 -----CCTCCAGTAAAGCAGAAGCTCGACCAAAAAG----- -756
S33 -----TATAACTGAATGCTTTAATATATTAACATGAAGATGGT-----AATTTTGAAATAGTAATAAATTTCTATGGGAACC -865
S39 ----- -360
S46 ----- -514
S50 ----- -343
S58 ----- -436

S1 TTATTGGCAAAATGATGTTTAGAATAATAAAATTCAGTGTGCTTTTGTAAAT-----AAAACAAATACATACATAGTCTTCTTTGAAATATATATA -736
S2 ----- -877
S3 ----- -704
S4 ----- -704
S5 ----- -536
S6 ----- -274
S7 ----- -571
S8 TGCGCGTAGAGATTCCGATGTACCTC----- -1023
S9 ACCATGGCAGAAGCAAGGAGGAGAGAGG----- -829
S10 ----- -601
S11 ----- -363
S16b ----- -725
S17 ----- -273
S20 -----ATATATA----- -722
S23 ----- -882
S24 GGTACGGTAATACCGTGGTAATGGTATCCATTACCAATACCGTACCATGAAATTTTCGGTACGGTACAATACCGTACCATTACCAATGGTACAAAAAATT -679
S25 TCATCACTGAAAACCTGATGCACCGTTTACTTGAGTATTGACACACT----- -997
S26 ----- -693
S28 ----- -712
S32 ----- -756
S33 TTGTAGTTGAAGTAGTAAAGTGTATT-----AA----- -837
S39 ----- -360
S46 ----- -514
S50 ----- -343
S58 ----- -436

S1 TATA-TCACAGTGAATCTGACATTCCTGACGTTCTCCTAA-----TCCACGGGAATAAGGAAAATTATTGATCAACATCGCTGGATTGGT -650
S2 -----GAA -874
S3 -----TGTTTTTCAGTACAATGTCTCTTAGAATCGTTATGG----- -668
S4 -----TGTATTTCAATACAATTTCTCTTTGAATCGTTGTGC----- -668
S5 -----AGCACTGTAGCTCCGTGTGCTTTGAAA----- -508
S6 ----- -274
S7 ----- -571
S8 -----GGGTATTTTGGTCTTTTCATCCAACAAT----- -993
S9 -----CTGGAAGGATCCCTATTTTCTTCTCTCCGTGCGC-----AATCATCTTCTCTGAGAAGAAG -771
S10 -----TGTTTTTCAGTACAATGTCTCTTTGAATCGTTATGG----- -565
S11 ----- -363
S16b -----TGTTTGTCTATCAATTTCTCTTTGAATCGTTGTGG----- -689
S17 ----- -273
S20 TATCATCACAGTGAATCTGACATTCCTGACGTTCTCCTAA-----TCCACGGGAAT-----TCTTGGTCAACATCGTTGGATTGGT -644
S23 TTTG-TGAGACTTAGTCCATATGCAAGTTCCTTTGCCTGA--GACTAG-----CGTGTCCCAGAATTAGT -818
S24 TGGC-ACAAAATCGGTATGGCAGGTTGGCAATTCGGTTGA-----CACGGCAATTTGGCAAA----- -622
S25 -----CAAGGGGGAGTGTTCAGTCTATTAATAGGAATGTGATTGTGTAAATCCAAGTAGATATAGAAATATCTTTATATTCTATTAGGAGTTGA -902
S26 -----TGTATTTCAATACAATCTCTCTTTGAATCATTATGG----- -657
S28 -----TGTATTTCAATACAATCTCTCTTTGTATCGCCGTGG----- -676
S32 -----CATCAACCGACGCCAACCTCTCGGGGAGCTGTGTGC-----TCGTCGGCTAGGAA -706
S33 -----AAGGAGGATGTATTATAAATCTGTAAATCATTACG-----ATTATTTTTGAAATGTAA -783
S39 ----- -360
S46 ----- -514
S50 ----- -343
S58 ----- -436

S1 GCAAACAATAAGCCTTAATAAAAACCCAGAAGT----- -618
S2 AAAAAAAAAAAAAAGGGGAGAGAATCC----- -848
S3 ----- -668
S4 ----- -668
S5 -----AAAGCCAGTT -498
S6 ----- -274
S7 ----- -571
S8 ----- -993
S9 ACAGCCACTACAACCTGCAACCTGCAACCTAC----- -739
S10 ----- -565
S11 ----- -363
S16b ----- -689
S17 ----- -273
S20 GCAAACAATAGGTCTTAATAAAAATCTAGAAAT----- -612
S23 GCCGACGAGTCGACTTCTCAACTGTACCTGA-TGAAGAATCTGCCTGA----- -770
S24 -----AAAATCCACCCT----- -609
S25 TTACATATTAAGAGTTTGTAAATCCTAAAAGGGTAAGGATTTTACCTATTTTACTACTGTAAATAAAGGCATGATGGGGTGAATAGAACACATCCACAA -802
S26 ----- -657
S28 ----- -676
S32 ACTTCCCCAACAGAAAATCTAACCACAAACAC-----CA----- -672
S33 TCTTATTAATAATCCTGTTTTGGGCTTGAAAGGTTGAAAGTTGCGTTAATCCGTACACTTTGAACAGTCCAAA-----ACATCCAGTT -700
S39 ----- -360
S46 ----- -514
S50 ----- -343
S58 ----- -436

S1 -----GTCGCTCA-----TAGTTAAATAGTATTTTC--TCAT-----TTAAAAATAAGAAATT -572
S2 -----TACTTCCAAGATTTTTCC-----AGGACTG -823
S3 -----TCATCTCA-----ATAAAAAGCACAAGCA -644
S4 -----TCATCTCA-----ATACAAAGTACAAGCC -644
S5 TTCCAAAGTT-----ACAAATAG-----CAGCTTCAGCTTTTTCCT--TTGA-----TT -456
S6 ----- -274
S7 ----- -571
S8 -----CCACGTGT-----CGCCTTATGATTATTTTT--TGGC-----TCCACAATGAAAGTA -948
S9 -----AACCTGCATAGACCTCAT--TGGC-----GC-----TTGAGTACGAGGGGTC -703
S10 -----TCATCTCA-----ATACAAAGCACAAGCA -541
S11 ----- -363
S16b -----TCATCTCA-----ACACAAAGCACAAGCC -665
S17 ----- -273
S20 -----GTTACTCAGTACTATGGTCTAGTGTATTCTCTTTTAT-----TTGAAAGTCAGAAGTT -558
S23 -----GTATTTAC--A--CACTCAAGGAGGAGTGT--ATAGA--TATTATATTTAAATAT -722
S24 -----AAGTATTA-----TAGTTTGGTGATATTTTCTTTCAC-----TTAAAAATTGAAAGATC -561
S25 TTACAGATCTCTCTCTTCTCTCTATGCCG-----CAACTTCCATCTCTCTC--TGACATTCATAATGTTTCAGTAAATATGCATACAATAAGTA -710
S26 -----TCATCTCA-----ATACAAAGAACTAGCA -633
S28 -----TCATCTCA-----ATACAAGGCACAATCA -652
S32 -----GAAGCTCG-TC--AGCCCTTGGGGAATTCAT--TAAC-AGCTCG-----TGCATTAACATTCCAA -618
S33 CTG-----AAATGTGA-----CAGCAACGAATAATCTTT--TAAC-----CTTTAAATTACCAATT -651
S39 ----- -360
S46 ----- -514
S50 ----- -343
S58 -----AA -434

S1	-----	-433
S2	-----	-773
S3	ATTTTTTTGGGTTTGAATCAATT-----AAGCACAATCTCT-----	-456
S4	AGTGTGTTT-GGTTTGAAGTCAATT-----ATGCACAATCTCC-----	-455
S5	GTGCTTTT-TTTTTA-----	-354
S6	-----	-274
S7	TTTGTTTT-----T--GCCATAATCTCA-----	-454
S8	TTGGATTT-GATCCATTGGCTGGCATTGACTGATTATTAAGTTTTTTTTTCCAGGATTGCGTGGTCTACATGGGTCAAGGATTGTCTGACCTTCCACT	-641
S9	TCGGATTA-GATCCAATGGCTGTT-----TATTGAGATTTTT-----CACGACCGCGTGGTCCAGGA-----	-453
S10	-----	-417
S11	-----	-363
S16b	ATCGTTTT-GATTTGAAGTCAATT-----ACGCGCAATTTCT-----	-476
S17	-----	-273
S20	-----	-422
S23	TTGGATTG-AGTCCAATGATTCAT-----TATAAAGATTTTT-----GCAGGCCGCGTGGTCCAGGA-----	-421
S24	-----	-422
S25	TTGGATTT-GATCCATTGACTGTC-----TATCAAGATTTTT-----CCAGGACTGCGTGGTCTAGAT-----	-444
S26	ATCATTTA-AAT-----GCAATCTCC-----	-455
S28	ATCTTTTT-GGTATGAAGTCAATA-----AAGCGCAATCTCC-----	-464
S32	ATCTTTTT-GGTTTGAAGTCAATT-----AAGCACAATATCC-----	-415
S33	--GAATGT-GATATGCCAGTGATC-----	-432
S39	-----	-360
S46	----TTA-GATCCAATGGCTGTT-----TATTGAGATTTTT-----CACGACCGCGTGGTCAAGGA-----	-463
S50	-----	-343
S58	-----	-387
S1	-----	-433
S2	-----	-773
S3	-----ATAGCTCAAATCCC-----	-442
S4	-----ATCACTCAAATCCC-----	-441
S5	-----	-354
S6	-----	-274
S7	-----AATCCT-----	-448
S8	TTCGGTGCCTTTCCATGTCCTTCTATTTTGTATGGTCACGGTTAAATCACGTCAACATTTATATTATTTTTTTATAGAGATAAATAAGACAAAAATAAAT	-541
S9	-----	-453
S10	-----AAATCCC-----	-410
S11	-----	-363
S16b	-----ATTACTCAAATCTT-----	-462
S17	-----	-273
S20	-----	-422
S23	-----	-421
S24	-----	-422
S25	-----	-444
S26	-----AACACTCAAATCTT-----	-441
S28	-----AATGCTCAAATCCC-----	-450
S32	-----ATTACCCAAATCC-----	-401
S33	-----	-432
S39	-----	-360
S46	-----	-463
S50	-----	-343
S58	-----	-387
S1	-----	-433
S2	-----	-773
S3	-----	-442
S4	-----	-441
S5	-----	-354
S6	-----	-274
S7	-----	-448
S8	AGTAATATAAAATATTAGCGTGGCTTAACTGTGACCACACAACAGAAGAAAACGGGAGGGGCACTAGAAATGAGAGGGCAGACAATCCTTGTCGGTCTAC	-441
S9	-----	-453
S10	-----	-410
S11	-----	-363
S16b	-----	-462
S17	-----	-273
S20	-----	-422
S23	-----	-421
S24	-----	-422
S25	-----	-444
S26	-----	-441
S28	-----	-450
S32	-----	-401
S33	-----	-432
S39	-----	-360
S46	-----	-463
S50	-----	-343
S58	-----	-387

S1 -----CCGACCTGCCGGGCCGCCCAACGGTGCAAACGATAAGAGTATAATAGAACATG-TCAGATTTT -369
S2 -----TGCCG-----AAAACGTG-CTAGATTTA -751
S3 --GT-----CTAGTAGTGTATGCT-----CCCAATCTC -415
S4 --GTATACTAACAGTAATTAGTAGTGACATGCC-----CACAATCTC -401
S5 ----- -354
S6 ----- -274
S7 --GTCTACTAGCGTAACCTAGTAATGACACACT-----CACAATCTC -408
S8 AGGAACCCGACTAGTGAACATGGGGATATGATATACACGTGTGCCG-----GAAACGGG-CTAAATTTA -377
S9 --GAATGCGACTGGTCGTATATGAACATATGAT--ACACCTATGTGT--G--CCG-----GAAACGTG-CTAGATTTA -389
S10 --GTCTAGTAGCAGTAACCTAGTAGTGTGCGAG-----CGCAATCTC -370
S11 ----- -363
S16b --GTCTACTAGAGGTAACCTAGTGGTGATATGCC-----CACAATATC -422
S17 ----- -273
S20 -----CCTACCCTGCC-----AACGGTGCAAACGA--AGTCTAATAGAACATG-TCAGATTTT -371
S23 --CAACGCTACTGATCGAATATGAATATATGAT--ACACGTGTGCCG-----GAAACGTG-CTAGGTTTA -361
S24 -----CCTACCCTGCCA-----AACGGTGCAAACGA--AGTCTAATAAACATGTTTCAGATTTT -370
S25 --GAACGCGACTAGTCGTATATGAACATATGAT--ACACGTGTGCCG-----GAAACGTG-CTAAATTTA -384
S26 --GCCTTCAAGTGGTAACCTAGTTGTGACACATT-----CTCAATCTC -401
S28 --ATTTGCTAGTGGTAACCTAGTAATGACATGCT-----CGTAGTCTC -410
S32 --ATCTACTAGC-----TGAAAGTATAGT-----GGCGCACACACAGACTC -362
S33 --AAATATGAAACATATGATACGC-----ATCTATGTGCCG-----GAAACGTG-CTAGATTTA -381
S39 ----- -360
S46 --TAATGCGACTGATCGAATATGAAAATATGAT--ACACCTATGTGT--GTGCTG-----GAGACGTA-CTAGATTTA -397
S50 ----- -343
S58 -----AATCTC -381

S1 TAT----TTATTTATTT--ATCAAAAGATAGAATTTTTT-TACT-AAGAA-----AAACGG -321
S2 TAT----TTATTT--ATTAGAAGATAAAAATTTTAT-TACTGAAAAA-----ACATGG -706
S3 TAA-----TTTTTTT-GTTCAATTAATTTCTTGCC-TACC-CGCAAGGCCCATAGGGAACTTAGGGGTCGAACATGATCAACTAGGGGTCGAATAG -326
S4 TAA-----TTTTTTTGTTCGAGTAAATTTCCCGACC-TACA--GCAAGGCCCATAGGGAAATTTAGGGGAC-----GAATAG -333
S5 -----AGCACCTCAC-TCCC-AAATC-----A----- -334
S6 ----- -274
S7 CAA-----TTTCAT--GTCCAAGTAAATTAGCGGCC-TACC-ATAAAGACTCATGGCGAATTTAGGGGAC-----GGACAG -341
S8 GAT-----TTATTT--ATCAGTAGATAGAATTTTAT-TACT-AAATA-----ACATAG -333
S9 TAT-----TTATTT--ATCAGAACACAGAATTTGAT-TACT-AAAA-----ACATGG -345
S10 TAA-----TTTTTTT-GTTCAGGTAAATTTCTGGCC-TACC-CGCAAGGCCCATAGGGAACTTAGGGGTC-----GAATAG -302
S11 ---C-----TTGTTG--AATAAACACCAAATGCCAC-----AA-----TCCTTG -328
S16b TAA-----TTTTTT-GTTCAGTAAATTTCCCAAC-TACC-CGCAAGGCCCATGAGGAATTTAGGGGAC-----GAATAG -355
S17 ----- -273
S20 TATTTATTTATTTATTT--ATCAGAAGATAGAATTTTAT-TACT-AAGAA-----ATATGG -319
S23 CAT-----T--ATCAGAAGATGAATTTTAT-TACT-AAAA-----ACGTGG -322
S24 TAT----TTATTTATTT--GTCAGAAGATAGAATTTTAT-TACT-AAGAA-----ATATGG -322
S25 TAT-----TTATTT--ATCAGAAGATAGAATTTTAT-TACT-AAAA-----ACATAG -340
S26 TAA-----TTTGAT--GTTCAAGTAAATTTCCGGCT-TACC-CTCAAGGTTGATGACGAATTTAGGGGCC-----GAACA- -335
S28 TAA-----TTTCAT--GTTCAAAAAATTTGCTGCC-TACT-GCAAGACCCATGGCGAATTTAGGTGGC-----AAACTG -343
S32 CAA-----TTTCAT--GCTCAAGTACATTTCCAGCA-TACT-TGCAAGGCCCATGGCAATTTAGGGC-----GAGTAG -297
S33 TAT-----TTATTT--ACCAGAAGATAGAATTTTAT-TACT-AAAA-----A--TTG -339
S39 -----GATAGAATTTTATATAAA-AAAA-----ACATGG -331
S46 TAT-----TTATTT--ATCAGAACACATAATTTGAT-AACT-AGAAA-----ACATGT -353
S50 -----TTAGGGGGC-----GAACAG -328
S58 TAA-----TTTCAT--GTTCAAGTAAATTTCTTGCC-TACC-CACAAGGCTCATGGTGAATTTAGGGGGC-----GAACAG -314

S1 TTGCTTTGCT-----CCATCACTTAGAAA--CACACATATGATCAAAATACATGTGATCAAGATGATCAAATCAGGSCATTCGCACATGA -237
S2 TTGCTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGACCAAGATGATCAAATAAGGSCATTCGCACATGA -623
S3 TTGCTTAGC-----CCATCACTTAGAAA--CAAACATATGATCAAA-TACATTTGATCAATATGATCAAATAAGGSCATTCGCACATGA -243
S4 TTGCTTTGCT-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGATCAAGATGATCAAATAAGGSCATTCGCACATGA -248
S5 -TCCCTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGACCAAGATGATCAAATAAGGSCATTCGCACATGA -252
S6 ----- -274
S7 TTGCTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGATCAAGATGATCAAATAAGGSCATTCGCACATGA -258
S8 TTGCTTTATC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGACCAAGATGATCAAATAAGGSCATTCGCACATGA -250
S9 TTGCTTAGC-----CCATCACTTAGAAA--CAGAACATGATCAAA-TACATGTGACCAAGATGATCGCATAAGGSCATTCGCACATGA -262
S10 TTGCTTAGC-----CCATCACTTAGAAA--AC-ACATATGATCAATATGATCAAATAAGGSCATTCGCACATGA -233
S11 TTGCTTTAAC-----CCATCGCTTAGAAA--CACACATATGATCAAA-TACATGTGACCAATATTTAAATAAGGSCATTCGCACATGA -245
S16b TTGCTTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGATTAAGATGATCAAATAAGGSCATTCGCACATGA -270
S17 ----- -273
S20 TTGCTTTGGT-----CCATCACTTAGAAA--CACACATATGATCAAAATACATGTGATCAAGATGATCAAATAAGGSCATTCGCACATGA -235
S23 TTGCTTTATC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGAGACCAGATGATCAAATAAGGSCATTCGCACATGA -239
S24 TTGCTTTGGT-----CAATACTTAGAAA--CACACATATGATCAAAATACATGTGATCAAGATGATCAAATAAGGSCATTCGCACATGA -238
S25 TTGCTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGACCAAGATGATGACATAAGGSCATTCGCACATGA -261
S26 TTGCTTAGC-----CCATCACTTAGAAA--ACGTGACCAAAA-TACAT-TGATCAAGATGATCAAATAAGGSCATTCGCACATGA -258
S28 TTGCTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGATCAAGATGATCAAATAAGGSCATTCGCACATGA -260
S32 TTGCTTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACTTGGCCCAAGATGATCAAATAAGGSCATTCGCACATGA -214
S33 TTGCTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGGCCAGATGATCAAATAAGGSCATTCGCACATGA -256
S39 TTGCTTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACATGTGACCAAGATGATCAAATAAGGSCATTCGCACATGA -248
S46 TTGCTTTAGC-----CCATCACTTTGAAA--CAGAACATGATGATAAGA-TACACGTGACCAAGATGATCAAATAAGGSCATTCGCACATGA -270
S50 TTGCTTTAGCCCATCCACTTAGAAA--CCATCACTTAGAAA--CACACATATGATCAAA-TACCCTTGTCAAGATGATCAAATAAGGSCATTCGCACATGA -231
S58 TTGCTTTAGC-----CCATCACTTAGAAA--CACACATATGATCAAA-TACTTTGATCAAGATGATCAAATAAGGSCATTCGCACATGA -232

S1 CTAGTTTGAA TAGAAATATTG--GAGCGA AAAA--TGCT-TGAATTGTTAGAACCTCTGATCAAGCACA CGTGATCATGGATGATCAATTAGAGCTATT -143
S2 CTAGTTTGAA GAGAAATATTA--GAGAAAAAATTGCTATAGATTATAGAACCTGTGATCAAATACA CGTGATCTTGTATGATCAATTAGAGCTATT -526
S3 TCAGTTTGAA TAGAAATATGGAAGGATAAAAA--TGCTATAAATCTATAGAACCTGTGATCAAATACA CGTGATCA----- -167
S4 CTAGTTTGAA TAGAAATATC-----ATTTATTTGAAAACGTAGTCAAATACA CGTGATCATGGATGATCAATTAGAGCTATT -172
S5 CTAGTTTGAA TTTAAATATGGAAGGAGAAAA--TGCTATAAATTTATAAAAACCGTG-----ATCAGGGATGATCGATCAATTAGAGCTATT -164
S6 CTAGTTTGAA TAGAAATACCGAAGGAGCAAAAT--TGCCATAAATTTATTTGAACTGTGATCAAATACA CGTGATCATGGATGTTCAATTAGAGATATT -176
S7 CTAGTTTGCA TAGAAATATGGAGGACAACTCT--CTGCTATAAATTTATAGAACCTGTGATCAA--A CGTGATATTGGATGATCAATTAGAGCTATT -163
S8 CTAGTTTGAA GAGAAATATGGAAGGAGAAAA--TGCAATAGATTATAGAACCTGTG-----CGTGATCATGGATGATAAATTAGAGCTATT -161
S9 CTAGTTTGAA GATAAATATGGAAGGACAAAA--TGCAATAGATTATAGAACCTATGATCAAATACA CGTGATCATGGATGATCAATTAGAGCTATT -163
S10 CTAGTTTGAA TAGAAATAT--AGGAGTAAAA--GTTCTATA-----AGAACCTGTGATCCAATACA CGTGATCA----- -167
S11 CTATTTTGAA TA-----GAGGAAAA--TGCTACAAATTTATAGAACCTGTGATCAAATACA CGTGATCATGGATGATCAATTAGAGCTTTT -158
S16b CTAGTTTGAA TAGAAATATGGAGGATCAAAAT--TGCTATAAATTTATTTGAACTGTAAATCAAATACA CGTGATCAAGGATGACCAATTAGAGCTACT -172
S17 CTAGTTTGAA TAGAAATACGGAAGGAGAAAA--TGCTATAAATTTATTTGAACTGTGATCAAATACA CGTGATCATGGATGTTCAATTAGAGGTATT -175
S20 CTAGTTTGAA TAGAAATATTG--GAGGAAAA--TGCTATAAATTTATAGAACCTCTGATCAAGCACA CGTGATCACGGATGATCAATTAGAGCTATT -140
S23 CAAGTTTGAA T----ATATGAAAGGAAAAAAA--TGAAATAGATTATAGAACCTGTGATCAAATACA CGTGTAAACGGATGACCAA----- -156
S24 CTAGTTGAAA AAGAAATATTG--GAGGAAAA--TGCTATAAATTTATAGAACCTCTGATCAAGCACA CGTGATCATGGATGATCAATTATAGCTATT -143
S25 CTAGTTTGAA TAGAAATATGGAAGGAGAAAAAG--TGCAATAGATTGTTAGAACCTGTG-----CGTGATCATGGATGATCAATTAGAGCTATT -172
S26 TTAGTTGAAA AAGAAATATGGAGGAGAAAA--TGCTATAAATTTATCGCACTGTGATCA-ATACA CGTGATCATGGATGGTCAATTGGAGCTATT -161
S28 CTAGTTTGAA GATAAATATTGAAGGAGAAAA--TGCTATAAATTTATAGAACCTGTGATCA-ATACA CGTGATCATGGATT-TCAATTAGAGGTATT -176
S32 CTAGTTGGAAGG--AGGAGAAAA--TGCTGTAGATTATAGGGCACTGTGATCAAATACA CGTGATCA----- -148
S33 CTAGTTTGAA GAGAAATATCGAAGGAGGAAAA--TGCAATAGATTATAGAACCTGTGGTCAAATACA CGTGATCATGGATGATCAATTAGAGCTATT -157
S39 TTAGTTTGAA TTTAAATGTTGAAGGAGGAAAA--TGCTATAAATTTATAGAAC--CGTGATCAGGGATAATCAATTAGAGTTATT -164
S46 CTAGTTTGAA GATAAATATTGAAGGACAAAA--TGCAATATATTTATAGAACCTGTGATCAAATACA CGTGATCATGGATGATCAATTAGAGCTATT -171
S50 CTAGTTTGAA TAGACATATTGGAGGAGAAAA--TGCTATAAATCAAAGAACCTGTGATCAAGTACA CGTGATCA----- -155
S58 CTAGTTTGAA TAGAAATATTGGAGGAGAAAA--TGCTATAAATCTATAGAACCTGTGATCAAGTACA CGTGATCA----- -156

S1 TGATCAA CCCCTTATTTATTCATGCATGTA----- -113
S2 TGATCAA CCCCT-ATTTATGCATGCATGTGACCTGGTATTTGGACCCGATCCGTTAATCTAATTTGACCTGACCTGTTAATATTAGTATTTGGGTAGAT -427
S3 -----ACCCCTTATTTATGCATGCATGTA----- -142
S4 TGATCAA CCACTTATTCATCCCTGCATATA----- -142
S5 TGATCAA CCCCTTATTTAATGCATGCACGCA----- -134
S6 TGATGGA CCCCTTATTTATGCATGCATGTA----- -146
S7 TGGTCAA CCCCTACTTTATGCATGCATGTA----- -133
S8 TGATGAA CCCCTCATTTATGCATGCATGTA----- -131
S9 TGATCAA CCCCTTATTTATGCATGCATGTA----- -133
S10 -----ACCCCTTATTTATGCATGCCTGTA----- -142
S11 TGATCAA CCCCTTCTTTATGCATGCATGTA----- -128
S16b TGATCAA CCACTTATTTATGCATGCATGTA----- -142
S17 TGATGGA CCCCTTATTTATGCATGCATGTA----- -145
S20 TGATCAA CCCCTTCTTTATGCATGCATGTA----- -110
S23 -----CCCCTTTATGCATGCATGTA----- -135
S24 TGATCAA CCCCTTATTTATGCATGCATATA----- -113
S25 TGATCAA CCCCTCATTTATGCATGCATGTA----- -142
S26 TGATCAA CCCCTTATTTATGCATGCATGTA----- -131
S28 TGATGAA CCCCTTATTTATGCATGCATGTA----- -146
S32 -----ACCCATCATTTATGCCTACAATA----- -124
S33 TGATCAA CCCCTTATTTATGCATGCATGTA----- -127
S39 TGATCAA CCCCTTATTTTTCATGCATGCATGCA----- -134
S46 TGATGAA CCCCTTATTTATGCATGCATGTA----- -141
S50 -----ACCCCTTATTTATGCATGCATGTA----- -131
S58 -----ACCCCTTATTTATGCATGCATGTA----- -132

S1 ----- -113
S2 GCTTAACTGGTTCGGATTGCTAACGGGTGAATTCGTTAAACAACCCGTTAAATAACGGTTCATTTTAGGTCAACCCGTTAGCACCCGTTAGTTGAGGATGTT -327
S3 ----- -142
S4 ----- -142
S5 ----- -134
S6 ----- -146
S7 ----- -133
S8 ----- -131
S9 ----- -133
S10 ----- -142
S11 ----- -128
S16b ----- -142
S17 ----- -145
S20 ----- -110
S23 ----- -135
S24 ----- -113
S25 ----- -142
S26 ----- -131
S28 ----- -146
S32 ----- -124
S33 ----- -127
S39 ----- -134
S46 ----- -141
S50 ----- -131
S58 ----- -132

S1 ----- -113
S2 TTAGTAATTTTCAGTAAAGTCTTAAGAACAAAAATAAAATCTATGCAAAATAATAATAATAATAATGTTAACAAGTATTACGGGTGGGTTCGGG -227
S3 ----- -142
S4 ----- -142
S5 ----- -134
S6 ----- -146
S7 ----- -133
S8 ----- -131
S9 -----CGCA----- -129
S10 ----- -142
S11 ----- -128
S16b ----- -142
S17 ----- -145
S20 ----- -110
S23 ----- -135
S24 ----- -113
S25 ----- -142
S26 ----- -131
S28 ----- -146
S32 -----GTTG----- -120
S33 ----- -127
S39 ----- -134
S46 -----CGCA----- -137
S50 ----- -131
S58 ----- -132

S1 ----- -113
S2 TGATCTGTTAATTTAACGGGTGGGATTGAACCCGATCCAAACCCGATAAACCCGACCCGTTTACATGTCTAAATGCATATGCGATATGCGCTACAACACTAGT -127
S3 -----CGCATATGCCTACAACACTAGT -122
S4 -----CGCATATGCCTACAACACTAGT -122
S5 -----CGCATATGCCTACAACACTAGT -114
S6 -----CGCATATGCCTACAACACTAGT -126
S7 -----AGCATATGCCTACAACACTAGT -113
S8 -----CGCATATGCCTACAACACTAGT -111
S9 -----TATGCGAAGCTACAACATA-- -111
S10 -----CGCATATGCCTACAACACTAGT -122
S11 -----CGTATATGCCTACAAGTAGC -108
S16b -----CGCATATGCCTACAACACTAGT -122
S17 -----CACATATGCCTACAACGAGT -125
S20 ----- -110
S23 -----CACATTTGCCTACAACCA-- -117
S24 ----- -113
S25 -----CGCATATGCCTACAACACTAGT -122
S26 -----CCCACATGCCTACTACTAGT -111
S28 -----CGCATATGCCTACAACACTAGT -126
S32 ----- -120
S33 -----CGCATATGCCTAGAAATAGT -107
S39 -----CACTTATGCCTACAACACTAGT -114
S46 -----TATGCGTGGCTACAACATA-- -119
S50 -----CACATATGCCTACAAC--T -114
S58 -----CACATATGCCTACAACACTACT -112

S1 -----CTATAAATATAAAGCTTACCTGATCTCAAATGATCCACACCACCAAC-ACCACTAC-----TTGAAATG-----GATCAAAT -39
S2 AGTCTAGTCTATAAATATAAGAGCTTA--ATCTCAAATGATCCACACCACCTACC-ACTACTAC-----TTCAAAGTCCAAATCGATCATATT -40
S3 ACTCTAGTCTTTAAATATAAGAGCTTCAATTGATCTCAAATGATCCACACTACCAAC-ACTACTAC-----TTCTAATG-----GATCAAAT -39
S4 AGTCTAGTCTATAAATAAGAGCTTAAATTGATCTCAAATGATCCACACCACCAAC-TCTACTAC-----TTCAAATG-----GATCAAAT -39
S5 -----ACTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACATCACCAC-ACTACTAC-----TTGAGATC-----AATCTAAT -39
S6 A-----CTATAAATATAATAGCTTAAATTGATCTCAAATGATCCACACCACCAAC-TATTCTACTTCAAAGTTCAAATC-----GATATAAT -43
S7 AATCTAGTCTATAAATATAAGAGCTTAAATTGCTCTCAAATGATCCACACCACCAAC-----TTCGAATC-----GATCAAAT -39
S8 AGTCCAGCACTATAAATATAAGAGCTTAACTGATCTCAAATGATCCACACCACCAAC-ACC-ACTACTCC-----TTCAAATC-----GATCTAATA -31
S9 -----AGTACTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACATCAGCAAC-ACTACTAC-----TTCAAATC-----GATCTGAT -33
S10 ACTCTAGTCTTTAAATATAAGAGCTTAAATTGATCTCAAATGATCCACACTACCAAC-ACTACTAC-----TTCAAATG-----GATCAAAT -39
S11 -----ACTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCAC-----AGT-ACTACTAC-----TTCAAATC-----GATCAAAT -39
S16b AATCTAGTCTATAAATAAGAGCTTAAATTGATCTCAAATGATCCACACCACCAAC-ACTACTAC-----TTCAAATA-----GATCAAATG -39
S17 A-----CTATAAATATAATAGCTTAAATTGATCTCAAATGATCCAGACCGCCAAC-TATACTACTTCAAAGTTCAAATC-----AATCTAAT -42
S20 -----CTATAAATATAAGAGCTTACTTATGATCTCAAATGATCCACACCACCAAC-A--CTAC-----TTGAAATG-----GATCAAAT -39
S23 -----AGTACTATAAAGATAGAGCTTAAATTGATCTCAAATGATCCACACCACCAAC-ACTACTAC-----TTCAAATC-----AATCTAAT -39
S24 -----CTATAAATATAAGAGCTTACTTATGATCTCAAATGATCCACACCACCAAC-ACTACTAC-----TTCAAATG-----GATCAAAT -39
S25 AGTCTAGTCTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACACCACCAAC-ACTACTCC-----TTCAAATC-----GATCTAATA -39
S26 A-----CTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACACCAC--C-AGTACTAC-----TTCAAATG-----GATCAAAT -39
S28 A-----CTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACTCCACCAAC-TCTACTACTCAAAGTTCAAATC-----GATCTAAT -43
S32 --TCAAGTACTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACACCACCAAC-ACTGCTAC-----TTGAAATC-----GATATAAT -39
S33 -----ACTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCAC-----ACC-ACCACCAAC-----TTCAAATC-----GATCTAAT -39
S39 G-----CTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACACCACCAAC-ACTACTAC-----TTGAGATC-----GATCTAAT -39
S46 -----AGTACTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACATCAGCAAC-ACTACTAC-----TTCAAATC-----GATCTGAT -41
S50 A-----CTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACACCACCAACCTTACAACTAC-----TTCAAATG-----GATCAAAT -39
S58 A-----CTATAAATATAAGAGCTTAAATTGATCTCAAATGATCCACACCACCTTCTACAACTAC-----TTCAAATG-----GATC--AAT -39

S1 C-GTAAT--TAATCTGCCTCGCACTTGAAACAAT---ATTATTCAATG 3
S2 AAGTAAT--TGATCTGCCTCGCTCTTGAAACAAT---ATTATTCAATG 3
S3 A-GTAAT--TAATCTGCCTCGCTGTTGAAACAAC---ATTATTCAATG 3
S4 A-GTAAT--TAATTTGCCTCGCTCTTGAAACAAT---ATTATTCAATG 3
S5 A-GTAAT--TTATCTGCCTCGCTATTGAAACAAT---ATTATTCAATG 3
S6 T-GTAAT--TAATCGGCCACGCTACAGAAACAATTAATATTATTCAATG 3
S7 A-GTAAT--TAATCTGCCTCGCTCTTGAACAAT---ATTATTCAATG 3
S8 A-----TCGGTCTGTCCTTGAAACAAT---ATTATTCAATG 3
S9 -----TAATCTGCCTCGCACTTGAAACAAT---ATTATTCAATG 3
S10 A-GTAAT--TAATCTGCCTCGCTGTTGAAACAAC---ATTATTCAATG 3
S11 A-CTAAT--TAATCTGCCTCGCTCTTAAACAAC---ATTATTCAATG 3
S16b A-GTAAT--TAATTTGCCTCGCTCTTGAAACAAC---ATTATTCAATG 3
S17 A-GTAAT--TAATCTGCCTCGCTACCGAAACAATTAATATTATTCAATG 3
S20 A-GTAAT--TAATCTGCCTCGCTCTTGAAACAAT---ATTATTCAATG 3
S23 A-GTAAT--TAATCTGCCTCGCCCTTGAAACAAT---ATTATTCAATG 3
S24 A-GTAAT--TAATCTGCCTCGCTCTTGAAACAAT---ATTATTCAATG 3
S25 A-GTAAT--TAATCGGCCCTCGCCCTTGAAACAAT---ATTATTCAATG 3
S26 A-GTAAT--TAATCTGCCTCGTCTTGAAACAAT---ATTATTCAATG 3
S28 A-GTAAT--TAATCTGCCTCGCTCTTGAAACAATTAATATTATTCAATG 3
S32 A-GTAAT--TAATCTGCCTCGCTCTTGAAACAAT---ATTATTCAATG 3
S33 A-GTAAT--TAATCTGCCTCGCTCTTGAAACAAT---ATTATTCAATG 3
S39 A-GTAAT--TGATCTGCCTCGCTCTTGAAACAAT---ATTATTCAATG 3
S46 A-GTAATTAATCTGCCTCGCACTTGAAACAAT---ATTATTCAATG 3
S50 A-AATAAT--TAATATGCCTCGGTCTTAAACAAT---ATTATTCAATG 3
S58 A-AATAAT--TAATATGCCTCGGTCTTGAAACAAT---ATTATTCAATG 3