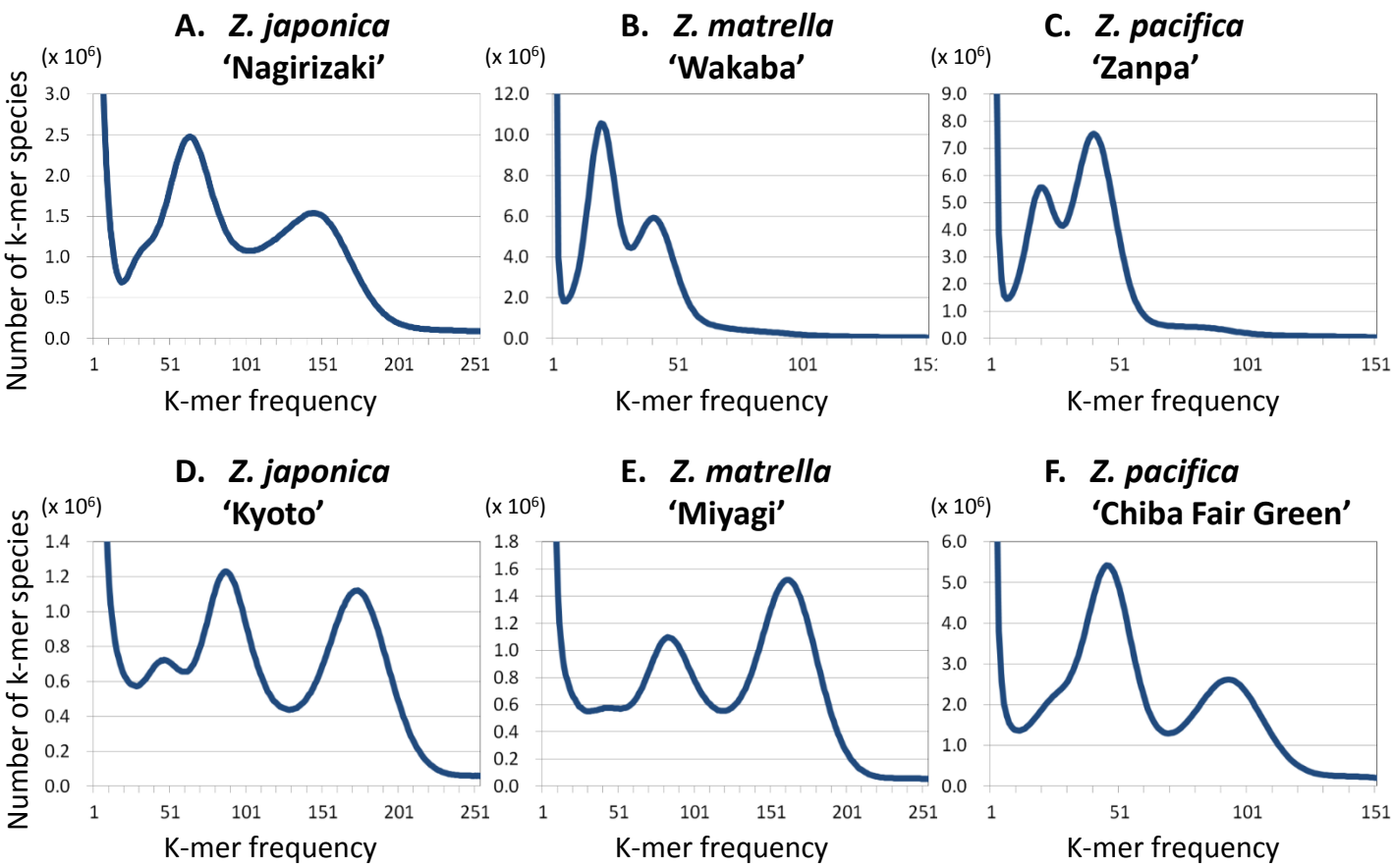
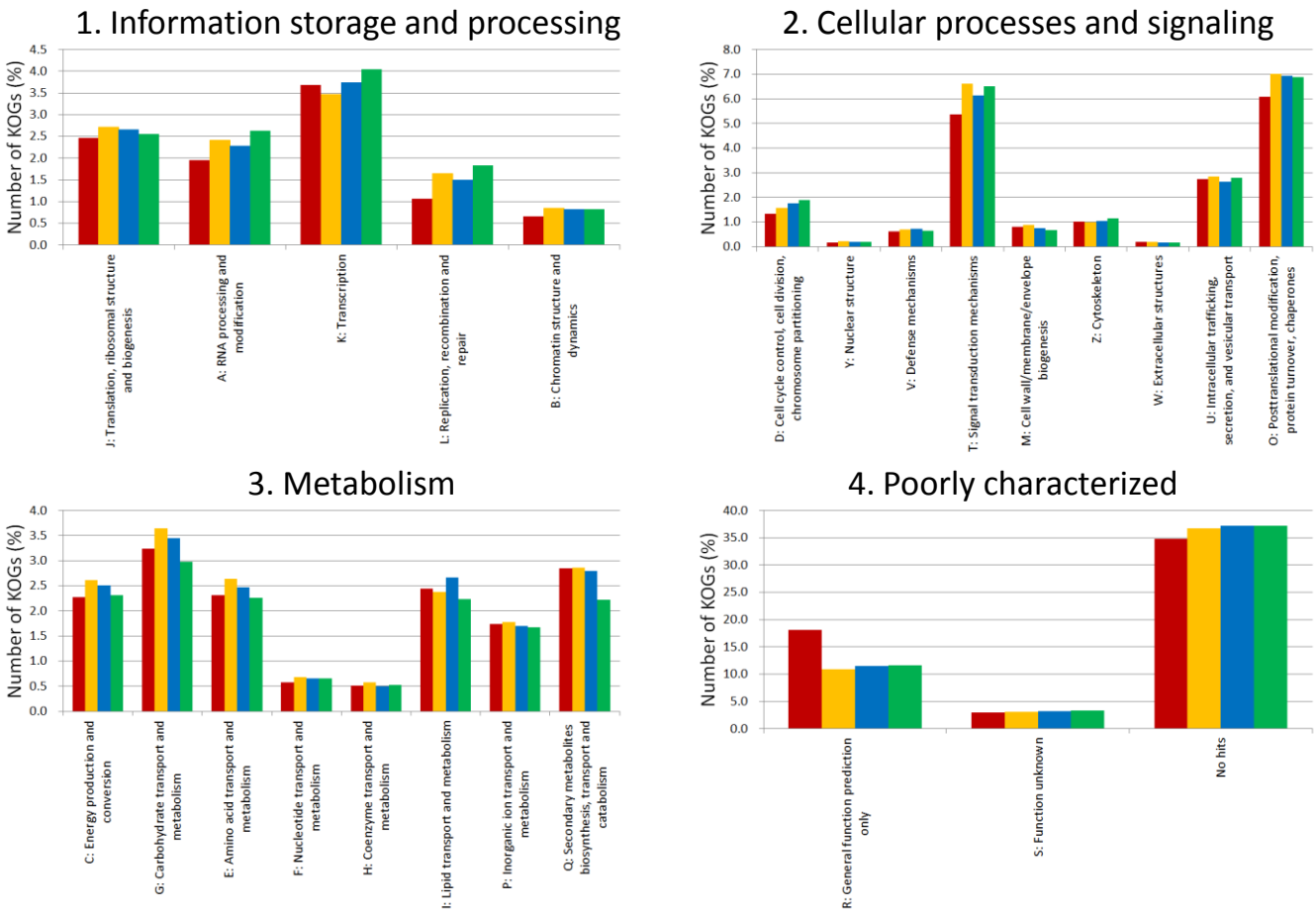
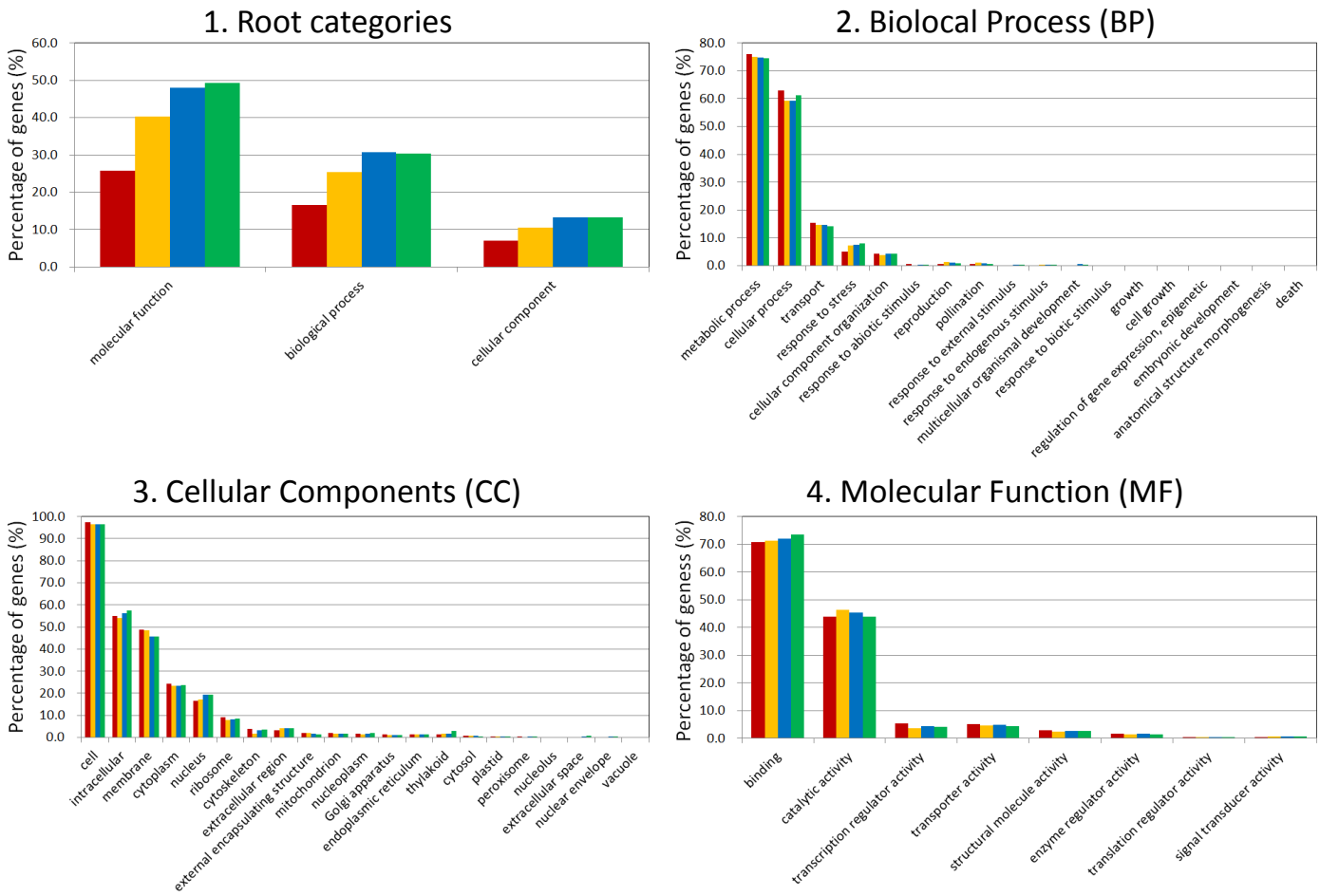


Supplementary Figure S1. K-mer analysis of each sequenced Zoysia species.
The k-mer frequency and the number of corresponding k-mer species were calculated using Jellyfish with k-mer size 17. (A) *Z. japonica* 'Nagirizaki' (B) *Z. matrella* 'Wakaba' (C) *Z. pacifica* 'Zanpa' (D) *Z. japonica* 'Kyoto' (E) *Z. matrella* 'Miyagi' (F) *Z. pacifica* 'Chiba Fair Green'



Supplementary Figure S2. KOG distributions of *Z. japonica*, *O. sativa*, *S. bicolor*, and *B. distachyon*. The percentages of proteins in each KOG category for *Z. japonica* 'Nagirizaki', *O. sativa*, *S. bicolor*, and *B. distachyon* are shown using red, orange, blue, and green bars, respectively.



Supplementary Figure S3. Classification of genes in the GO slim categories.
The genes were classified into GO slim categories using the map2slim program, based on the results of the InterProScan searches. The percentages of genes in each GO slim category for *Z. japonica* 'Nagirizaki', *O. sativa*, *S. bicolor*, and *B. distachyon* are shown using red, orange, blue, and green bars, respectively.

```
Zjn_sc00013.1.g08180.1      MTMGTAVRRERDAEAELNLPPGFRFHPTDDELVEHYLCRKAAGQRLPVPI 50
Zmw_sc04858.1.g00100.1      MTMGTAVRRERDAEAELNLPPGFRFHPTDDELVEHYLCRKAAGQRLPVPI 50
Zpz_sc00127.1.g00380.1      MTMGTAVRRERDAEAELNLPPGFRFHPTDDELVEHYLCRKAAGQRLPVPI 50
Zjn_sc00014.1.g08280.1      MTKAMAVRRERDAEAELNLPPGFRFHPTDDELVEHYLCRKAAGQRLPVPI 50
Zmw_sc02298.1.g00200.1      MTKAMAVRRERDAEAELNLPPGFRFHPTDDELVEHYLCRKAAGQRLPVPI 50
Zmw_sc02531.1.g00150.1      MTKAMAVRRERDAEAELNLPPGFRFHPTDDELVEHYLCRKAAGQRLPVPI 50
Zpz_sc01716.1.g00180.1      MTKAMAVRRERDAEAELNLPPGFRFHPTDDELVEHYLCRKAAGQRLPVPI 50
                            **  . *********************************************

Zjn_sc00013.1.g08180.1      IAEVDLYKFDPWDLPERALFGTREWYFFTPRDRKYPNGSRPNRAAGDGYW 100
Zmw_sc04858.1.g00100.1      IAEVDLYKFDPWDLPERALFGTREWYFFTPRDRKYPNGSRPNRAAGDGYW 100
Zpz_sc00127.1.g00380.1      IAEVDLYKFDPWDLPERALFGTREWYFFTPRDRKYPNGSRPNRAAGDGYW 100
Zjn_sc00014.1.g08280.1      IAEVDLYKFDPWDLPERALFGTREWYFFTPRDRKYPNGSRPNRAAGNGYW 100
Zmw_sc02298.1.g00200.1      IAEVDLYKFDPWDLPERALFGTREWYFFTPRDRKYPNGSRPNRAAGNGYW 100
Zmw_sc02531.1.g00150.1      IAEVDLYKFDPWDLPERALFGTREWYFFTPRDRKYPNGSRPNRAAGNGYW 100
Zpz_sc01716.1.g00180.1      IAEVDLYKFDPWDLPERALFGTREWYFFTPRDRKYPNGSRPNRAAGNGYW 100
                            ************************************************:***

Zjn_sc00013.1.g08180.1      KATGADKPVAPGGRTLGIKKALVFYAGKAPRGVKTDWIMHEYRLADAGRA 150
Zmw_sc04858.1.g00100.1      KATGADKPVAPRGRTLGIKKALVFYAGKAPRGVKTDWIMHEYRLADAGRA 150
Zpz_sc00127.1.g00380.1      KATGADKPVAPRGRTLGIKKALVFYAGKAPRGVKTDWIMHEYRLADAGRA 150
Zjn_sc00014.1.g08280.1      KATGADKPVAPRGRTLGIKKALVFYAGKAPRGVKTDWIMHEYRLADAGRA 150
Zmw_sc02298.1.g00200.1      KATGADKPVAPRGRTLGIKKALVFYAGKAPRGVKTDWIMHEYRLADAGRA 150
Zmw_sc02531.1.g00150.1      KATGADKPVAPRGRTLGIKKALVFYAGKAPRGVKTDWIMHEYRLADAERA 150
Zpz_sc01716.1.g00180.1      KATGADKPVAPRGRTLGIKKALVFYAGKAPRGVKTDWIMHEYRLADAGRA 150
                            *********** ********************************** **

Zjn_sc00013.1.g08180.1      AAAKKGSLRLDDWVLCRLYNKKNEWEKMRMKKAAAAATAAKEEAGDMTT- 199
Zmw_sc04858.1.g00100.1      AAAKKGSLRLDDWVLCRLYNKKNEWEKMQMKKAAAAATAAKEEAGDMTT- 199
Zpz_sc00127.1.g00380.1      AAAKKGSLRLDDWVLCRLYNKKNEWEKMQMKKAAAAATAAKEAAGDMTT- 199
Zjn_sc00014.1.g08280.1      AAAKKGSLRLDDWVLCRLYNKKNEWEKMQMKKAAAAAK--DEAGGEMTTS 198
Zmw_sc02298.1.g00200.1      AAAKKGSLRLDDWVLCRLYNKKNEWEKMQMKKAAAAAK--DEAGGDMTTS 198
Zmw_sc02531.1.g00150.1      AAAKKGSLRLDDWVLCRLYNKKNEWEKMQMKKAAAAAK--DEAGGEMTTS 198
Zpz_sc01716.1.g00180.1      AAAKKGSLRLDDWVLCRLYNKKNEWEKMQMKKAAAAAK--DEAGGDMTTS 198
                            ****************************:********.  .* .*:***

Zjn_sc00013.1.g08180.1      YSHSQSWGETRTPESEILDNDTFPTFLDPEAQMMAPKKEKVDDAAAKN-- 247
Zmw_sc04858.1.g00100.1      YSHSQSWGETRTPESEILDNDTFPTFLDPEAQMMAPKKEKVDDAAAKN-- 247
Zpz_sc00127.1.g00380.1      YSHSQSWGETRTPESEILDNDTFPTFLDPEAQMMAPKKEKVDDAAAKN-- 247
Zjn_sc00014.1.g08280.1      YSHSHSWGETRTPESEIVDNDPFPAFQDPAAHMMVPKKEEVDDAGAANRN 248
Zmw_sc02298.1.g00200.1      YSHSHSWGETRTPESEIVDNDPFPAFQDPAAQMMVPKKEEVDDAGAANRN 248
Zmw_sc02531.1.g00150.1      YSHSHSWGETRTPESEIVDNDPFPAFQDPAAQMMVPKEEKVDEAGAANRN 248
Zpz_sc01716.1.g00180.1      YSHSHSWGETRTPESEIVDNDPFPAFQDPAAQMMVPKKEEVDDAGAANRN 248
                            ****:************:***.**:* ** *:**.**:*:**:*.* *

Zjn_sc00013.1.g08180.1      NLFVDLSYDDIQSMYNGLDMLPTPGEDFYSSLFASLRVKGNQSA---GMA 294
Zmw_sc04858.1.g00100.1      NLFVDLSYDDIQSMYNGLDMLPTPGEDFYSSLFASLRVKGNQSA---GMA 294
Zpz_sc00127.1.g00380.1      NLFVDLSYDDIQSMYNGLDMLPTPGEDFYSSLFASLRGKGNQSA---GMA 294
Zjn_sc00014.1.g08280.1      DLFVDLSYDDIQSMYSGLDMLPPSGEDFYSSLFASPRVKGNQPAGAGGLA 298
Zmw_sc02298.1.g00200.1      DLFVDLSYDDIQSMYSGLDMLPPSGEDFYSSLFASPRVKGNQPAGAGGLA 298
Zmw_sc02531.1.g00150.1      DLFVDLSYDDIQSMYSGLDMLPPSGEDFYSSLFASPRVKGNQAAGAGGLA 298
Zpz_sc01716.1.g00180.1      DLFVDLSYDDIQSMYSGLDMLPPSGEDFYSSLFASPRVKGNQPAGAGGLA 298
                            :**************.******..*********** * ****.*   *:*

Zjn_sc00013.1.g08180.1      LF 296
Zmw_sc04858.1.g00100.1      LF 296
Zpz_sc00127.1.g00380.1      LF 296
Zjn_sc00014.1.g08280.1      PF 300
Zmw_sc02298.1.g00200.1      PF 300
Zmw_sc02531.1.g00150.1      PF 300
Zpz_sc01716.1.g00180.1      PF 300
                             *
```

Supplementary Figure S4. Sequence alignment of predicted ANAC102 proteins in *Zoysia* species. Sequence names starting with Zjn, Zmw, and Zpz represent sequences from *Z. japonica* 'Nagirizaki', *Z. matrella* 'Wakaba', and *Z. pacifica* 'Zanpa', respectively. Asterisk (*) indicates identical sequence, colon (:) indicates fully conserved "strong groups", and period (.) indicates fully conserved "weak groups". The boxes represent the key residual variants for the distinction of ANAC102 proteins in these three *Zoysia* species.

```
Zjn_sc00014.1.g08280.1      AACACGGTTGTTGTTGTATTCCAGTGTTTTAAACGTGACGAAATCGTGAAAAAGTTAAA- -539
Zmw_sc02531.1.g00150.1      AACACGGTTGTTGTTGTATTCCAGTGTTTTAAACGTGACGAAATCGTGAAAAAGTTAAA- -538
Zmw_sc02298.1.g00200.1      AACACGGTAGTTGTTGTATTCCAGTGTTTTAAACGTGACGAAATCGTGAAAAAGTTAAAA -502
Zpz_sc01716.1.g00180.1      AACACGGTAGTTGTTGTATTCCAGTGTTTTAAACGTGACGAAATCGTGAAAAAGTTAAAA -502
                            ******** ***************************************************

Zjn_sc00014.1.g08280.1      GTGAAAAAAATCACCCGCTGCCACTCGTGACACACACAC--TCCTAATCACCGACAGCGC -481
Zmw_sc02531.1.g00150.1      GTGAAAAAAATCACCCGCTGCCACTCGTGACACACACAC--TCCTAATCACCGACAGCGC -480
Zmw_sc02298.1.g00200.1      GCGAAAAAAATCACCCGCTGCCACTCGTGACACACACACACTCCTAATCACCGACAGCGC -442
Zpz_sc01716.1.g00180.1      GTGAAAAAAATCACCCGCTGCCACTCGTGACACACACACACTCCTAATCACCGACAGCGC -442
                            * ************************************  *******************

Zjn_sc00014.1.g08280.1      AGAGGGGCATCTGTCTAGCTAGTCCCGCGTTCACCTCCGGTATGTCTGGAGACATCTGCA -421
Zmw_sc02531.1.g00150.1      AGAGGGGCATCTGTCTAGCTAGTCCCGCGTTCACCTCCGGTATGTCTGGAGACATCTGCA -420
Zmw_sc02298.1.g00200.1      AGAGGGGCATCTGTCTAGCTAGTCCCGCGTTCACCTCCGGTATGTCCGGAGACATCTGCA -382
Zpz_sc01716.1.g00180.1      AGAGGGGCATCTGTCTAGCTAGTCCCGCGTTCACCTCCGGTATGTCCGGAGACATCTGCA -382
                            ********************************************* *************

Zjn_sc00014.1.g08280.1      CAGTTCACTTCCATCCCGTGACGTCGCGGAACAACCACCACGCCTGCCCCGCCCGCGCCG -361
Zmw_sc02531.1.g00150.1      CAGTTCACTTCCATCCCGTGACGTCGCGGAACAACCACCACGCCTGCCCCGCCCGCGCCG -360
Zmw_sc02298.1.g00200.1      CAGTGCACTTCCATCCCGTGACGTCGCGGAACGACCACCACGCCTGCCCCGCCCGCGC-- -324
Zpz_sc01716.1.g00180.1      CAGTGCACTTCCATCCCGTGACGTCGCGGAACGACCACCACGCCTGCCCCGCCCGCGC-- -324
                            **** *************************** *************************

Zjn_sc00014.1.g08280.1      CACCGCAGAAAGCCGGGCGGGTGGCCGCCCGCGCGCATCCAATTCTGCTGAGGTCGGCGA -301
Zmw_sc02531.1.g00150.1      CACCGCCGAAAGCCGGGCGGGTGGCCGCCCGCGCGCATCCAATTCTGCTGAGGTCGGCGA -300
Zmw_sc02298.1.g00200.1      -------------------------------GCATCCAATTCTGCTGAGGTCGGCGA -298
Zpz_sc01716.1.g00180.1      -------------------------------GCATCCAATTCTGCTGAGGTCGGCGA -298
                                                            **************************

Zjn_sc00014.1.g08280.1      TGACCTCAACGGGAGCGGTCCCGTCCAATCCCGGCGCGCCGAGGTGGCCGGCCACGAGCC -241
Zmw_sc02531.1.g00150.1      TGACCTCAACGGGAGCGGTCCCGTCCAATCCCGGCGCGCCGAGGTGGCCGGCCACGAGCC -240
Zmw_sc02298.1.g00200.1      TGACCTCAGCGGGAGCGGTCCCGTTCAATCCCGGCGCGCCGAGGGGGCCGGCCACGAGCC -238
Zpz_sc01716.1.g00180.1      TGACCTCAGCGGGAGCGGTCCCGTTCAATCCCGGCGCGCCGAGGGGGCCGGCCACGAGCC -238
                            ******** *************** ******************* ***************

Zjn_sc00014.1.g08280.1      TCGCCCACCTCCTCGAACCCACCACCTCAGCCCGCTCCCCCGCCACACGTGCCCACGCCC -181
Zmw_sc02531.1.g00150.1      TCGCCCACCTCCTCGAACCCACCACCTCAGCCCGCTCCCCCGCCACACGTGCCCACGCCC -180
Zmw_sc02298.1.g00200.1      TCGCCCACCTCCTCGAACCCACCACCTCAGCCCGCTCCCC-GCCACACGTGCCCACGCCC -179
Zpz_sc01716.1.g00180.1      TCGCCCACCTCCTCGAACCCACCACCTCAGCCCGCTCCCC-GCCACACGTGCCCACGCCC -179
                            ************************************** *******************

Zjn_sc00014.1.g08280.1      CGCCCTCCGCCCCCTTTCCCGCAGCCGCCGACTGGTATTGACCCCTCCCTCCCAACCCTG -121
Zmw_sc02531.1.g00150.1      CGCCCTCCGCCCCCTTTCCCGCAGCCGCCGACTGGTATTGACCCCTCCCTCCCAACCCTG -120
Zmw_sc02298.1.g00200.1      TGCCCTCCGCCCCCTTTCCCGCAGCCGCCGACTGGTATTGACCCCTCCCTCCCAACCCTG -119
Zpz_sc01716.1.g00180.1      TGCCCTCCGCCCCCTTTCCCGCAGCCGCCGACTGGTATTGACCCCTCCCTCCCAACCCTG -119
                             ************************************************************

Zjn_sc00014.1.g08280.1      TTTCCCCGGCCGAACTTTCCAGACCGCCGCCTATCCTATCCGCTACCCCCCCCCTGCGCG  -61
Zmw_sc02531.1.g00150.1      TTTCCCCGGCCGAACTTTCCAGACCGCCGCCTATCCTATCCGCTACCCCCCCC-TGCGCG  -61
Zmw_sc02298.1.g00200.1      TTTCCCCGGCCGAACTTTCCAGACCGCCGCCTATCCTATCCGCTACCCCCCC--TGCGCG  -61
Zpz_sc01716.1.g00180.1      TTTCCCCGGCCGAACTTTCCAGACCGCCGCCTATCCTATCCGCTACCCCCCC--TGCGCG  -61
                            ****************************************************  ******

Zjn_sc00014.1.g08280.1      GCGGCCTCTATATATCCAGCTCCCCGCCGCGGTGCTCACCTTCAAGAACATCGCGGAATA   -1
Zmw_sc02531.1.g00150.1      GCGGCCTCTATATATCCAGCTCCCCGCCGCGGTGCTCACCTTCAAGAACATCGCGGAATA   -1
Zmw_sc02298.1.g00200.1      GCGGCCTCTATATATCCAGCTCCCCGCCGCGGTGCTCACCTTCAAGAACATCGCGGAATA   -1
Zpz_sc01716.1.g00180.1      GCGGCCTCTATATATCCAGCTCCCCGCCGCGGTGCTCACCTTCAAGAACATCGCGGAATA   -1
                            ************************************************************
```

Supplementary Figure S5. Sequence alignment of the upstream regions of the *ANAC102* genes in *Zoysia* species. Sequence names starting with Zjn, Zmw, and Zpz represent sequences from *Z. japonica* 'Nagirizaki' , *Z. matrella* 'Wakaba' , and *Z. pacifica* 'Zanpa' , respectively. Asterisk (*) indicates identical sequence. Mutations are enclosed within a box and the two colors (red or green) indicate the presence of two types of *ANAC102* genes in these three *Zoysia* species.

```
Zjn_sc00056.1.g01120.1      MRIQCDACGAAAAAVVCCADEAALCARCDVEIHAANKLAGKHQRLPLGGG 50
Zmw_sc05442.1.g00010.1      MRIQCDACGAAAAAVVCCADEAALCARCDVEIHAANKLAGKHQRLPLGGG 50
Zmw_sc03211.1.g00190.1      MRIQCDACGAAAAAVVCCADEAALCARCDVEIHAANKLAGKHQRLPLGGG 50
Zpz_sc01838.1.g00080.1      MRIQCDACGAAAAAVVCCADEAALCARCDVEIHAANKLAGKHQRLPLGGG 50
                            **************************************************

Zjn_sc00056.1.g01120.1      ETAAALPRCDVCQERPAFIFCVEDRALLCRDCDEPIHVPGTLSGNHQRFL 100
Zmw_sc05442.1.g00010.1      ETAAALPRCDVCQERPAFIFCVEDRALLCRDCDEPIHVPGTLSGNHQRFL 100
Zmw_sc03211.1.g00190.1      ETAAALPRCDVCQERPAFIFCVEDRALLCRDCDEPIHVPGTLSGNHQRFL 100
Zpz_sc01838.1.g00080.1      ETAAALPRCDVCQERPAFIFCVEDRALLCRDCDEPIHVPGTLSGNHQRFL 100
                            **************************************************

Zjn_sc00056.1.g01120.1      ATGIRVGFSSVCSKPPSTGGATKAPAPAPQEVPSPPFLPPPSGWAVEDLL 150
Zmw_sc05442.1.g00010.1      ATGIRVGFSSVCSKPPSTGGATKAPAPAPQEVPSPPFLPPPSGWAVEDLL 150
Zmw_sc03211.1.g00190.1      ATGIRVGFSSVCSKPPSTGGATKAPAPAPQEVPSPPFLPPPSGWAVEDLL 150
Zpz_sc01838.1.g00080.1      ATGIRVGFSSVCSKPPSTGGATKAPAPAPQEVPSPPFLPPPSGWAVEDLL 150
                            **************************************************

Zjn_sc00056.1.g01120.1      QLSDYESRDKLPSVCVVSLQKDSPLGFKELDWFADIDLLHGHEAAEVPEL 200
Zmw_sc05442.1.g00010.1      QLSDYESRDKLPSVCVVSLQKDSPLGFKELDWFADIDLLHGHEAAEVPEL 200
Zmw_sc03211.1.g00190.1      QLSDYESSDKLPSVCVVSLQKDSPLGFKELDWFADIDLLHGHEAAEVPEL 200
Zpz_sc01838.1.g00080.1      QLSDYESSDKLPSVCVVSLQKDSPLGFKELDWFADIDLLHGHEAAEVPEL 200
                            ******* ****************************************

Zjn_sc00056.1.g01120.1      FASPQPAADAGFYKSSSAHQSKKPRLELPDDDEDYFIVPDLG 242
Zmw_sc05442.1.g00010.1      FASPQPAADAGFYKSSSAHQSKKPRLELPDDDEDYFIVPDLG 242
Zmw_sc03211.1.g00190.1      FASPQPAADAGFYKSSSAHQSKKPRLELPDDDEDYFIVPDLG 242
Zpz_sc01838.1.g00080.1      FASPQPAADAGFYKSSSAHQSKKPRLELPDDDEDYFIVPDLG 242
                            ******************************************
```

Supplementary Figure S6. Sequence alignment of predicted STO/BBX24 proteins in *Zoysia* species. Sequence names starting with Zjn, Zmw, and Zpz represent sequences from *Z. japonica* 'Nagirizaki' , *Z. matrella* 'Wakaba' , and *Z. pacifica* 'Zanpa' , respectively. Asterisk (*) indicates identical sequence. Mutations are enlosed within a box and the two colors (red or green) indicate two types of STO/BBX24 proteins in these three *Zoysia* species.

```
Zjn_sc00056.1.g01120.1      GATCGGTTTTTAAGACCAAACCGGTTTTCAGAAACCTTGTTGCTGACTCC -896
Zmw_sc05442.1.g00010.1      -ATCGGTTTTTAAGACCAAACCGGTTTTCAGAAACCTTGTTGCTGACTCC -896
Zmw_sc03211.1.g00190.1      ---CGGTTTTCAAAACC---CCGGTTTT-AGAAACCTTGTTGCTGACTTT -958
Zpz_sc01838.1.g00080.1      -----GTTTTCAAAACC---CCGGTTTT-AGAAACCTTGTTGCTGACTTT -959
                                 ***** ** ***   ******** ******************

Zjn_sc00056.1.g01120.1      GCCATCGAGATCTTGTTGCAGTCACTCCTGTTGCGTCAAGCTGTTAGGGC -846
Zmw_sc05442.1.g00010.1      GCCATCGAGATCTTGTTGCAGTCACTCCTGTTGCGTCAAGCTATTAGGGC -846
Zmw_sc03211.1.g00190.1      GCCATCGAGATCTTGTTGCAGTCACTCCTGCTGCGTCAAGCTGTTAGGGC -908
Zpz_sc01838.1.g00080.1      GCCATCGAGATCTTGTTGCAGTCACTCCTGCTGCGTCAAGCTGTTAGGGC -909
                            ****************************** *********** *******

Zjn_sc00056.1.g01120.1      TCATGTCGACACAGTGACACATCCTTGAAGCAAAAGGGCCACACTGGCGG -796
Zmw_sc05442.1.g00010.1      TCATGTCGACACAGTGACACATCCTTGAAGCAAAAGGGCCACACTGGCGG -796
Zmw_sc03211.1.g00190.1      TCATGTCGACACAGTGACACATCCTTGAAGCAAAAGGGCCACACTGGCGG -858
Zpz_sc01838.1.g00080.1      TCATGTCGACACAGTGACACATCCTTGAAGCAAAAGGGCCACACTGGCGG -859
                            **************************************************

Zjn_sc00056.1.g01120.1      ATGCTATGCAAGTTGCAGCCTCCCAGCCCTCGCACTGAAAACAGTACGAA -746
Zmw_sc05442.1.g00010.1      ATGCTATGCAAGTTGCAGCCTCCCAGCCCTCGCACTCAAAACAGTACGGA -746
Zmw_sc03211.1.g00190.1      ATGCTATGCAAGTTGCAGCCTCCCAGCCCTCGCACTGAAAACAGTA---A -811
Zpz_sc01838.1.g00080.1      ATGCTATGCAAGTTGCAGCCTCCCAGCCCTCGCACTGAAAACAGTA---A -812
                            ************************************ *********   *

Zjn_sc00056.1.g01120.1      AATTTCTCATTCTACTGGGTTTTGTTTATTTTTTTT-TATTATAGATGAA -697
Zmw_sc05442.1.g00010.1      AATTTCTCATTCTACTGGGTTTTGTTTATTTTTTTTCTATTATAGATGAA -696
Zmw_sc03211.1.g00190.1      AATTTCTCATTCTACTCCGTTTTGTTTATTTTTTCT--ATTATAGATGAA -763
Zpz_sc01838.1.g00080.1      AATTTCTCATTCTACTCCGTTTTGTTTATTTTTTCT--ATTATAGATGAA -764
                            ****************  **************** *  ************

Zjn_sc00056.1.g01120.1      AAAATAAAAATAATA----------TGATTTTTTTTTCCGACCGTTTCAG -657
Zmw_sc05442.1.g00010.1      AAAATAAAAATAATA----------TGATTTTTTCTTC-GACCGTTTCAG -657
Zmw_sc03211.1.g00190.1      AAAATAAAAATAGTAATAAAAATAATGACTTTTTTT----ACTGTTTCA- -718
Zpz_sc01838.1.g00080.1      AAAATAAAAATAGTAATAAAAATAATGACTTTTTTTT---ACTGTTTCA- -718
                            ************ **          *** ***** *    ** ******

Zjn_sc00056.1.g01120.1      TATAATTTTGTTTTCAATGAAATTTTTCTATTTTTTTACCTTTTTC-CAA -608
Zmw_sc05442.1.g00010.1      TATAATTTTGTTTTCAATGAAATTTTTCTATTTTTTTACCTTTTTC-CAA -608
Zmw_sc03211.1.g00190.1      ----ATTTT-TTTT-A---------------TTTTTTACCGTTTTCTCAA -689
Zpz_sc01838.1.g00080.1      ----ATTTT-TTTTTA---------------TTTTTTACCGTTTTCTCAA -689
                                ***** **** *               ********* ***** ***

Zjn_sc00056.1.g01120.1      ATATAGAGACATATTTTATTAAAAATAAAAATTAAAAGTTATAAGTCAAA -558
Zmw_sc05442.1.g00010.1      ATATGGAGATATATTTTATTAAAAATAAAAATTAAAAGTTATGAGCCAAA -558
Zmw_sc03211.1.g00190.1      ATACGAAGACATGTTTTATTAAAAATAAAAATTAAAAGTTATGAGCCAAA -639
Zpz_sc01838.1.g00080.1      ATACGAAGACATGTTTTATTAAAAATAAAAATTAAAAGTTATGAGCCAAA -639
                            ***   *** ** ***************************** ** ****

Zjn_sc00056.1.g01120.1      CAACTTATTATTAAC------------------------------------ -543
Zmw_sc05442.1.g00010.1      CAACTTATTATTAAC------------------------------------ -543
Zmw_sc03211.1.g00190.1      CAACTTATTATTAGCATATGTTATTAAGTTGTATATTATAAATTTAATTG -589
Zpz_sc01838.1.g00080.1      CAATTTATTATTAGCATATGTTATTAAGTTGTATATTATAAATTTAATTG -589
                            *** ********* *

Zjn_sc00056.1.g01120.1      -----------------CTTTAATCATACAGTGAATGTTCAATATTTATT -510
Zmw_sc05442.1.g00010.1      -----------------CTCTAATCATACAGTGAATGTTCAATATTTATT -510
Zmw_sc03211.1.g00190.1      TAACTTATATAGTAAAACTCGAATCATACAGTAAATATTCGATATTTATT -539
Zpz_sc01838.1.g00080.1      CAACTTATATAGTAAAACTCAAATCATACAGTAAATATTCGATATTTATT -539
                                            **  *********** *** *** *********

Zjn_sc00056.1.g01120.1      TTATCCATATTTTTGATGTTTTTAACATCTTTTTCAAGTTACCGATCGTT -460
Zmw_sc05442.1.g00010.1      TTATCCATATTTTTGATGTTTTTAACATATTTTTCAAGTTACCGATCGTT -460
Zmw_sc03211.1.g00190.1      TTATTTATATTTTTAATATTTTTAATATCTTTTTCAA-TTACCGATCAAT -490
Zpz_sc01838.1.g00080.1      TTATTTATATTTTTAATATTTTTAATATCTTTTTCAA-TTACCGATCAAT -490
                            ****  ******** ** ******* ** ******** *********  *
```

```
Zjn_sc00056.1.g01120.1      TTTTTTATTTCATATTTCTTTATTTATTTTTGTTTTCAACTTTTTTTTAT -410
Zmw_sc05442.1.g00010.1      TTTTT-ATTTCATATTTCTTTATTTATTTTTGTTTTCAACTTTTTTTTAT -410
Zmw_sc03211.1.g00190.1      TTTTTTATTTCATATTTCTTCATTTATTTTTGTTTTCAA---------AT -449
Zpz_sc01838.1.g00080.1      TTTTTTATTTCATATTTCTTCATTTATTTTTGTTTTCAA---------AT -449
                            ***** ************** ******************         **

Zjn_sc00056.1.g01120.1      CTTCGTTTGATGTTATTAATATAAAAATAAAAATAATTAAGATGTTTTCG -360
Zmw_sc05442.1.g00010.1      CTTCGTTTGATGTTATTAATATAAAAATAAAAATAATTAAGATGTTTTCG -360
Zmw_sc03211.1.g00190.1      CTTCGTTTGATATTATTAATATAAAAATAAAAATAATTAAGATATTTTCG -399
Zpz_sc01838.1.g00080.1      CTTCGTTTGATATTATTAATATAAAAATAAAAATAATTAAGATATTTTCG -399
                            *********** ****************************** ******

Zjn_sc00056.1.g01120.1      ACA----------------------------------------AATTCC -351
Zmw_sc05442.1.g00010.1      ACA----------------------------------------AATTCC -351
Zmw_sc03211.1.g00190.1      ACCGTTTTCAACCCTATCCAAGTGGCCACCATTTCCTCGTCTCCAATTCC -349
Zpz_sc01838.1.g00080.1      ACCGTTTTCAACCCTATCCAAGTGGCCACCATTTCCTCGTCTCCAATTCC -349
                            **                                        ******

Zjn_sc00056.1.g01120.1      ACGGGATGGGATGGGACGGGCCTGCACGGCCGGGCCGACGGAGAAGCCAT -301
Zmw_sc05442.1.g00010.1      ACGGGATGGGATGGGACGGGCCTGCACGGCCGGGCCGACGGAGAAGCCAT -301
Zmw_sc03211.1.g00190.1      ACGGGATGGGATGGGACGGGCCTGCACGGCCGGGCCGACGGAGAAGCCAT -299
Zpz_sc01838.1.g00080.1      ACGGGATGGGATGGGACGGGCCTGCACGGCCGGGCCGACGGAGAAGCCAT -299
                            **************************************************

Zjn_sc00056.1.g01120.1      ACCGGCGCGTGGAGCCGTGGACCCCACCGGCGTCAGCCCATACCTCATCA -251
Zmw_sc05442.1.g00010.1      ACCGGCGCGTGGAGCCGTGGACCCCACCGGCGTCAGCCCATACCTCATCA -251
Zmw_sc03211.1.g00190.1      ACCGGCGCGTGGAGCCGTGGACCCCACCGGCGTCAGCCCATACCTCATCA -249
Zpz_sc01838.1.g00080.1      ACCGGCGCGTGGAGCCGTGGACCCCACCGGCGTCAGCCCATACCTCATCA -249
                            **************************************************

Zjn_sc00056.1.g01120.1      GCAGATCACCACAAATAAAAAAACTCGGCTCGCGCCGCGGCGCCCCAGAT -201
Zmw_sc05442.1.g00010.1      GCAGATCACCACAAATCAAAAAACTCGGCTCGCGCCGCGGCGCCCCAGAT -201
Zmw_sc03211.1.g00190.1      GCAGATCACC--AAATCAAAAAACTCGGCTCGCGCCGCGGCGCCCCAGAT -201
Zpz_sc01838.1.g00080.1      GCAGATCACC--AAATCAAAAAACTCGGCTCGCGCCGCGGCGCCCCAGAT -201
                            **********  **** *********************************

Zjn_sc00056.1.g01120.1      ACTCCCGGAGCGCGCGCGCCAGCTCGTCCACACAACCCATCCTTCGCCCG -151
Zmw_sc05442.1.g00010.1      ACTCCCGGAGCGCGCGCGCCATCTCGTCCACACAACCCATCCTTCGCCCG -151
Zmw_sc03211.1.g00190.1      ACTCCCGGAGCGCGCGCGCCATCTCGTCCACACAACCCATCCTTCGCCCG -151
Zpz_sc01838.1.g00080.1      ACTCCCGGAGCGCGCGCGCCATCTCGTCCACACAACCCATCCTTCGCCCG -151
                            ******************** ****************************

Zjn_sc00056.1.g01120.1      TTCGACCGCACCGACCGCGCGAGCGAGAGCAAGCGCGGGGCCGCCCGCCA -101
Zmw_sc05442.1.g00010.1      TTCGACCGCACCGACCGCGCGAGCGAGAGCAAGCGCGGGGCCGCCCGCCA -101
Zmw_sc03211.1.g00190.1      TTCGACCGCACCGACCGCGCGAGCGAGAGCAAGCGCGGGGCCGCCCGCCA -101
Zpz_sc01838.1.g00080.1      TTCGACCGCACCGACCGCGCGAGCGAGAGCAAGCGCGGGGCCGCCCGCCA -101
                            **************************************************

Zjn_sc00056.1.g01120.1      AGGCGTGGGTGGCGCCACGCGGGTCGCGCGATTTATACGCGCCCGCCACG  -51
Zmw_sc05442.1.g00010.1      AGGCGTGGGTGGCGCCACGCGGGTCGCGCGATTTATACGCGCCCGCCACG  -51
Zmw_sc03211.1.g00190.1      AGGCGTGGGTGGCGCCACGCGGGTCGCGCGATTTATACGGGCCCGCCACG  -51
Zpz_sc01838.1.g00080.1      AGGCGTGGGTGGCGCCACGCGGGTCGCGCGATTTATACGGGCCCGCCACG  -51
                            ************************************** **********

Zjn_sc00056.1.g01120.1      AGACTCACCGTCCGCTGCTGCTGCTCAGCAATCTCCCCACCCTACCAAAG   -1
Zmw_sc05442.1.g00010.1      AGACTCACCGTCCGCTGCTGCTGCTCAGCAATCTCCCCACCCTACCAAAG   -1
Zmw_sc03211.1.g00190.1      AGGCTCACCGTCCGCTGCTGCTGCTCAGCAATCTCCCCACCCTACCAAAG   -1
Zpz_sc01838.1.g00080.1      AGGCTCACCGTCCGCTGCTGCTGCTCAGCAATCTCCCCACCCTACCAAAG   -1
                            ** *************************************************
```

Supplementary Figure S7. Sequence alignment of the upstream regions of the *STO/BBX24* genes in *Zoysia* species . Sequence names starting with Zjn, Zmw, and Zpz represent sequences from *Z. japonica* 'Nagirizaki' , *Z. matrella* 'Wakaba' , and *Z. pacifica* 'Zanpa' , respectively. Asterisk (*) indicates identical sequence. Mutations are enlosed within a box and the two colors (red or green) indicate two types of *STO/BBX24* genes in these three *Zoysia* species.

```
Zjn_sc00155.1.g00080.1      MSSSTVLQQPPAAARVEALSLSSLSAIPPEYVRPADERAGLGDAFDLLAE 50
Zmw_sc01462.1.g00080.1      MSSSTVLQQPPAAARVEALSLSSLSAIPPEYVRPADERAGLGDAFDLLAE 50
Zmw_sc02035.1.g00140.1      MSSSTVLQQPPAAARVEALSLSSLSAIPPEYVRPADERAGLGDAFDLLAE 50
Zpz_sc01172.1.g00170.1      MSSSTVLQQPPAAARVEALSLSSLSAIPPEYVRPADERAGLGDAFDLLAE 50
                            **************************************************

Zjn_sc00155.1.g00080.1      QLDDGPRIPVVDISPFLMTTGGAADKKDQPQCVDAVRAAAAEWGVMHIAG 100
Zmw_sc01462.1.g00080.1      QLDDGPRIPVVDISPFLMTTGGAADKKDQPQCVDAVRAAAAEWGVMHIAG 100
Zmw_sc02035.1.g00140.1      QLDDGPRIPVVDISPFLMTTGGAADKKDQQQCVDAVRAAAAEWGVMHIAG 100
Zpz_sc01172.1.g00170.1      QLDDGPRIPVVDISPFLMTTGGAADKKDQQQCVDAVRAAAAEWGVMHIAG 100
                            ***************************** ********************

Zjn_sc00155.1.g00080.1      HGIPDELVDCLQAAGTAFFALPIHAKEAYANDPAAGRLQGYGSRLATNAS 150
Zmw_sc01462.1.g00080.1      HGIPDELVDCLQAAGTAFFALPIHAKEAYANDPAAGRLQGYGSRLATNAS 150
Zmw_sc02035.1.g00140.1      HGIPDELVDCLQAAGTAFFALPIHAKEAYANDPAAGRLQGYGSRLATNAS 150
Zpz_sc01172.1.g00170.1      HGIPDELVDCLQAAGTAFFALPIHAKEAYANDPAAGRLQGYGSRLATNAS 150
                            **************************************************

Zjn_sc00155.1.g00080.1      GQREWEDYLFHLLHPDGLADHALWPAHPPDYVATTREFGRRVRELASRLL 200
Zmw_sc01462.1.g00080.1      GQREWEDYLFHLLHPDGLADHALWPAHPPDYVATTREFGRRVRELASRLL 200
Zmw_sc02035.1.g00140.1      GQREWEDYLFHLLHPDGLADHALWPAHPPDYVATTREFGRRVRELASRLL 200
Zpz_sc01172.1.g00170.1      GQREWEDYLFHLLHPDGLADHALWPAHPPDYVATTREFGRRVRELASRLL 200
                            **************************************************

Zjn_sc00155.1.g00080.1      AILSLGLGLRNEHKLEDELTNNRTKAGDGDQEDLLLQLKINYYPRCPQPE 250
Zmw_sc01462.1.g00080.1      AILSLGLGLRNEHKLEDELTNNRTKAGDGDQEDLLLQLKINYYPRCPQPE 250
Zmw_sc02035.1.g00140.1      AILSLGLGLRNEHKLEDELTNNRTKAGDGDQEDLLLQLKINYYPRCPQPE 250
Zpz_sc01172.1.g00170.1      AILSLGLGLRNEHKLEDELTNNRTKAGDGDQEDLLLQLKINYYPRCPQPE 250
                            **************************************************

Zjn_sc00155.1.g00080.1      LAVGVEAHTDVSALSFILHNGVPGLQVLHGGRWVTARSEPGTMIVHVGDA 300
Zmw_sc01462.1.g00080.1      LAVGVEAHTDVSALSFILHNGVPGLQVLHGGRWVTARSEPGTMIVHVGDA 300
Zmw_sc02035.1.g00140.1      LAVGVEAHTDVSALSFIVHNGVPGLQVLHGGRWVTARSEPGTMIVHVGDA 300
Zpz_sc01172.1.g00170.1      LAVGVEAHTDVSALSFIVHNGVPGLQVLHGGRWVTARSEPGTMIVHVGDA 300
                            *****************:********************************

Zjn_sc00155.1.g00080.1      LEILSNGRYTSVLHRGLVNREAVRVSWVVFCEPPPDAVLLRPLPELVTEE 350
Zmw_sc01462.1.g00080.1      LEILSNGRYTSVLHRGLVNREAVRVSWVVFCEPPPDAVLLRPLPELVTEE 350
Zmw_sc02035.1.g00140.1      LEILSNGRYTSVLHRGLVNREAVRVSWVVFCEPPPDAVLLRPLPELVTEE 350
Zpz_sc01172.1.g00170.1      LEILSNGRYTSVLHRGLVNREAVRVSWVVFCEPPPDAVLLRPLPELVTEE 350
                            **************************************************

Zjn_sc00155.1.g00080.1      EPARFTPRTFKEHLDRKLFKKHERDGYKPDHQVIRDSSPKTN-------- 392
Zmw_sc01462.1.g00080.1      EPSRFTPRTFKEHLDRKLFKKHERDGYKPDHQVIRDSSPKTN-------- 392
Zmw_sc02035.1.g00140.1      EPARFTPRTFKEHLDRKLFKKHERDGYKPDHQVIRDSSPKTNSIVKIIPK 400
Zpz_sc01172.1.g00170.1      EPARFTPRTFKEHLDRKLFKKHERDGYKPDHQVIRDSSSKTNSIVKIIPK 400
                            **:***********************************.***

Zjn_sc00155.1.g00080.1      -
Zmw_sc01462.1.g00080.1      -
Zmw_sc02035.1.g00140.1      D 401
Zpz_sc01172.1.g00170.1      D 401
```

Supplementary Figure S8. Sequence alignment of predicted ANS1 proteins *Zoysia* species.

Sequence names starting with Zjn, Zmw, and Zpz represent sequences from *Z. japonica* 'Nagirizaki' , *Z. matrella* 'Wakaba' , and *Z. pacifica* 'Zanpa' , respectively. Asterisk (*) indicates identical sequence, colon (:) indicates fully conserved "strong groups" , and period (.) indicates fully conserved "weak groups" . Mutations are enlosed within a box and the two colors (red or green) indicate two types of ANS1 proteins in these three *Zoysia* species.

```
Zjn_sc00155.1.g00080.1     ATTGAATTACGTTATAATTACCTGAACCAGACATCTCATAAGATCGACCT -940
Zmw_sc01462.1.g00080.1     ATTGAATTACGTTATAATTACCTGAACCAGACATCTCATAAGATCGACCT -942
Zmw_sc02035.1.g00140.1     ATTGAATTATGTTATAATTACCCGAACCAGACATCTCATAAGATCGACCT -949
Zpz_sc01172.1.g00170.1     ATTGAATTATGTTATAATTACCCGAACCAGACATCTCATAAGATCGACCT -949
                           ********* ************ ***************************

Zjn_sc00155.1.g00080.1     CCTTTGGAACATGCGAAATTTTCTATTTCTTCTAATTTTTTTTCTATAAA -890
Zmw_sc01462.1.g00080.1     CCTTTGGAACATGCGAAATTTTCTATTTCTTCTAATTTTTTTTCTATAAA -892
Zmw_sc02035.1.g00140.1     CCTTTGGAACATGTGAAATTTTCTATTTCTTCTAATTTTTTT-CTATAAA -900
Zpz_sc01172.1.g00170.1     CCTTTGGAACATGTGAAATTTTCTATTTCTTCTAATTTTTTT-CTATAAA -900
                           ************* **************************** *******

Zjn_sc00155.1.g00080.1     TTATACTAATTTTTATGAAATTTCTACATTCCAAATGCAGCTTAAGACCT -840
Zmw_sc01462.1.g00080.1     TTGTACTAATTTTTATGAAATTTCTACATTCCAAATGCAGCTTAAGACCT -842
Zmw_sc02035.1.g00140.1     TTGTACTAATTTTTATGAAATTTCTACATTCCAAATGCGGCTTAAGATCC -850
Zpz_sc01172.1.g00170.1     TTGTACTAATTTTTATGAAATTTCTACATTCCAAATGCGGCTTAAGATCC -850
                           ** ************************************ ******** *

Zjn_sc00155.1.g00080.1     CCTTTGGAATATCTTAGTTCAATTTCATATGAATTATTTCAATTGTATAG -790
Zmw_sc01462.1.g00080.1     CCTTTGGAATATCTTAGTTCAATTTCATATGAATTATTTCAATTTTATAG -792
Zmw_sc02035.1.g00140.1     CCTTTGAAATATCTTAGTTCAATTTCATATGAATTATTTCAATTTTATAG -800
Zpz_sc01172.1.g00170.1     CCTTTGAAATATCTTAGTTCAATTTCATATGAATTATTTCAATTTTATAG -800
                           ****** ************************************* *****

Zjn_sc00155.1.g00080.1     GAATTTGAAAAAAAA--CATCATTAATTGCAAAAGAAGTCCAAAATTTGC -742
Zmw_sc01462.1.g00080.1     GAATTTGAAAAAAAAAACATCATTAATTGCAAAAGGAGTCCAAAATTTGC -742
Zmw_sc02035.1.g00140.1     GAATTTGAAAAAAAAAACATTATTAATTGCAAAAAGAGTCCAAAATTTGC -750
Zpz_sc01172.1.g00170.1     GAATTTGAAAAAAAAAACATTATTAATTGCAAAAAGAGTCCAAAATTTGC -750
                           ***************  *** *************  **************

Zjn_sc00155.1.g00080.1     AT--------CTATCCAATAGGAATTTTAGAGTCCCAATCTGGTTTAAAT -700
Zmw_sc01462.1.g00080.1     AT--------CTATCCAATAGGAATTTTAGAGTCCCAATCTGGTTTAAAT -700
Zmw_sc02035.1.g00140.1     ATGGAAGATGCTATCCAATAGGAATTTTAGAGTCCCAATCTGGTTTAAAT -700
Zpz_sc01172.1.g00170.1     ATGGAAGATGCTATCCAATAGGAATTTTAGAGTCCCAATCTGGTTTAAAT -700
                           **        ****************************************

Zjn_sc00155.1.g00080.1     CCTACTCCTACGAAATTCATTTATTTTTCATTGTTCCAAAAGAGCACTTA -650
Zmw_sc01462.1.g00080.1     CCTACTCCTACGAAATTCATTTATTTTTCATTGTTCCAAAAGAGCACTTA -650
Zmw_sc02035.1.g00140.1     CCTACTCCTACGAAATTCATTTATTTTTCATTGTTCCAAAA-AGCACTTA -651
Zpz_sc01172.1.g00170.1     CCTACTCCTACGAAATTCATTTATTTTTCATTGTTCCAAAA-AGCACTTA -651
                           ****************************************** ********

Zjn_sc00155.1.g00080.1     TATAATGAGGTATAAATTAGAAATTGATATTCATGCAGCTGCATCATTTC -600
Zmw_sc01462.1.g00080.1     TATAATGAGGTATAAATTAGAAATTGATATTCATGCAGCTGCATCATTTC -600
Zmw_sc02035.1.g00140.1     TATAATGAGGTATAAATTAGAAATTGATATTCATGCAGCTGCATCATTTC -601
Zpz_sc01172.1.g00170.1     TATAATGAGGTATAAATTAGAAATTGATATTCATGCAGCTGCATCATTTC -601
                           ************************************************

Zjn_sc00155.1.g00080.1     AACGCGTGTAAGAGGGGAAATAAAAAAAATACCCAAAAAGACCTAGTTGA -550
Zmw_sc01462.1.g00080.1     AACGCGTGTAAGAGGGGAAATAAAAAAAATACCCAAAAAGACCTAGTTGA -550
Zmw_sc02035.1.g00140.1     AACGCGTGTAAGAGGGGAAATAAAAAAAGTACCCAAAAAGATCTAGTTGA -551
Zpz_sc01172.1.g00170.1     AACGCGTGTAAGAGGGGAAATAAAAAAAGTACCCAAAAAGATCTAGTTGA -551
                           **************************** ************ ********

Zjn_sc00155.1.g00080.1     ATAAGTTTCACCGAAAATTATGAAATTTAATTTGGTTTTGTAAATTATGC -500
Zmw_sc01462.1.g00080.1     ATAAGTTTCACCGAAAATTATGAAATTTAATTTGGTTTTGTAAATTATGC -500
Zmw_sc02035.1.g00140.1     ATAAGTTTCGAGGAAAATTATGAAAATTAATTTGGTTTTGTAAATTATGT -501
Zpz_sc01172.1.g00170.1     ATAAGTTTCGAGGAAAATTATGAAAATTAATTTGGTTTTGTAAATTATGT -501
                           *********   ************* ***********************

Zjn_sc00155.1.g00080.1     GGACGACATGTCTTTTTCACACGAGAGGAAGAAAAATAATCGATTTTAAA -450
Zmw_sc01462.1.g00080.1     GGACGACATGTCTTTTTCACACGAGAGGAAGAAAAATAATCGATTTTAAA -450
Zmw_sc02035.1.g00140.1     GGACGACATGTCTTTTTCACACGAGAGAAAGAAAAATAATTGATTTTAAA -451
Zpz_sc01172.1.g00170.1     GGACGACATGTCTTTTTCACACGAGAGGAAGAAAAATAATTGATTTTAAA -451
                           **************************** ************ *********
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Zjn_sc00155.1.g00080.1     ATTTTAAACGTGAATTAATTTCATAATATGATGCCAATATAAGTTTTAAA -400
Zmw_sc01462.1.g00080.1     ATTTTAAACGTGAATTAATTTTATAATATGATGCCAATATAAGTTTTAAA -400
Zmw_sc02035.1.g00140.1     ATTTTAAACGTGAATTAATTTCATAATATGATGGCAATATAAGTTTTAAA -401
Zpz_sc01172.1.g00170.1     ATTTTAAACGTGAATTAATTTCATAATATGATGGCAATATAAGTTTTAAA -401
                           ********************* *********** ****************

Zjn_sc00155.1.g00080.1     GAAATTAAATTAAAATTATGATTAATAAGTACGAGTACTATATTAATATA -350
Zmw_sc01462.1.g00080.1     GAAATTAAATTAAAATTATGATTAATAAGTACGAGTACTATATTAATATA -350
Zmw_sc02035.1.g00140.1     GAAATTAAATTAAAATTATGATTAATAAGTACGAGTACTATATTAATATA -351
Zpz_sc01172.1.g00170.1     GAAATTAAATTAAAATTATGATTAATAAGTACGAGTACTATATTAATATA -351
                           **************************************************

Zjn_sc00155.1.g00080.1     TTGTGCATCGATGCTTTATACTCCAGTATTCTTTTCTTTCCCCAAAGCTC -300
Zmw_sc01462.1.g00080.1     TTGTGCATCGATGCTTTATACTCCAGTATTCTTTTCTTTCCCCAAAGCTC -300
Zmw_sc02035.1.g00140.1     TTGTGCATCGATGCTTTATACTCCAGTATTCTTTTCTTTCCCCAAAGCTC -301
Zpz_sc01172.1.g00170.1     TTGTGCATCGATGCTTTATACTCCAGTATTCTTTTCTTTCCCCAAAGCTC -301
                           **************************************************

Zjn_sc00155.1.g00080.1     TGAGCGGCGCTAAGGTATCTTGAGGGTGATGCACTAGCACTCGCAGGGG- -251
Zmw_sc01462.1.g00080.1     TGAGCGGCGCTAAGGTATCTTGAGGGTGATGCACTAGCACTCGCAGGGG- -251
Zmw_sc02035.1.g00140.1     TGAGCGGTGCTAAGGTATCTTGACCGTGAAGCACGAGCACTCGCAGGGGG -251
Zpz_sc01172.1.g00170.1     TGAGCGGTGCTAAGGTATCTTGAGGGTGAAGCACGAGCACTCGCAGGGGG -251
                           ******* ***************  **** **** **************

Zjn_sc00155.1.g00080.1     CTGGCACGTGGAAGGTCCGAGCCGCCACACGTGGAAGGGGCGCGTGGTGG -201
Zmw_sc01462.1.g00080.1     CTGGCACGTGGAAGGTCCGAGCCGCCACACGTGGAAGGGGCGCGTGGTGG -201
Zmw_sc02035.1.g00140.1     CTGGCACGTGGAAGGTCCAAACTGCGACACGTGGAAGGGGCGCGTGGTGG -201
Zpz_sc01172.1.g00170.1     CTGGCACGTGGAAGGTCCAAACTGCGACACGTGGAAGGGGCACGTGGTGG -201
                           ****************** * * ** *************** ********

Zjn_sc00155.1.g00080.1     TGTGGTGCAACGACCAGTCAAACACACCCAACGGTGCCACACGAGCTTGT -151
Zmw_sc01462.1.g00080.1     TGTGGTGCAACGACCAGTCAAACACAACCAACTGTGCCACACGAGCTTGT -151
Zmw_sc02035.1.g00140.1     TGTGGTGCAACGACCAGTCAAACACACCCAACGGTGCAACACGAGCTTGT -151
Zpz_sc01172.1.g00170.1     TGTGGTGCAACGACCAGTCAAACACACCCAACGGTGCAACACGAGCTTGT -151
                           ************************** ***** **** ************

Zjn_sc00155.1.g00080.1     TAGCTGCAGCAGCCTTTCTTCGTTCTGGCAAAGTCATGACGTGCGTTTAT -101
Zmw_sc01462.1.g00080.1     TAGCTGCAGCAGCCTTTCTTCGTTCTGGCAAAGTCATGACGTGCGTTTAT -101
Zmw_sc02035.1.g00140.1     TAGCTGCAGCAGCCTTTCTTCGTTCTGGCAAAGTCATGACGTGCGTTTAT -101
Zpz_sc01172.1.g00170.1     TAGCTGCAGCAGCCTTTCTTCGTTCTGGCAAAGTCATGACGTGCGTTTAT -101
                           **************************************************

Zjn_sc00155.1.g00080.1     ATAGTATAAAAATGCAGTAGCAGTCTTCTTCGATCCATCACCACACCTCC  -51
Zmw_sc01462.1.g00080.1     ATAGTATAAAAATGCAGTAGCAGTCTTCTTCGATCCATCACCACACCTCC  -51
Zmw_sc02035.1.g00140.1     ATAGTATAAAAATGCAGTAGCAGTCTTCTTCGATCCATCACCACACCTCC  -51
Zpz_sc01172.1.g00170.1     ATAGTATAAAAATGCAGTAGCAGTCTTCTTCGATCCATCACCACACCTCC  -51
                           **************************************************

Zjn_sc00155.1.g00080.1     AATCCATATTAACAGTGTTACTTGGAGGAGATTCATTATATCTGATCGAG   -1
Zmw_sc01462.1.g00080.1     AATCCATATTAACAGTGTTACTTGGAGGAGATTCATTATATCTGATCGAG   -1
Zmw_sc02035.1.g00140.1     AATCCATATTAACAGTGTTACTTGGAGGAGATTCATTACATCTGATCGAG   -1
Zpz_sc01172.1.g00170.1     AATCCATATTAACAGTGTTACTTGGAGGAGATTCATTACATCTGATCGAG   -1
                           ************************************* ***********
```
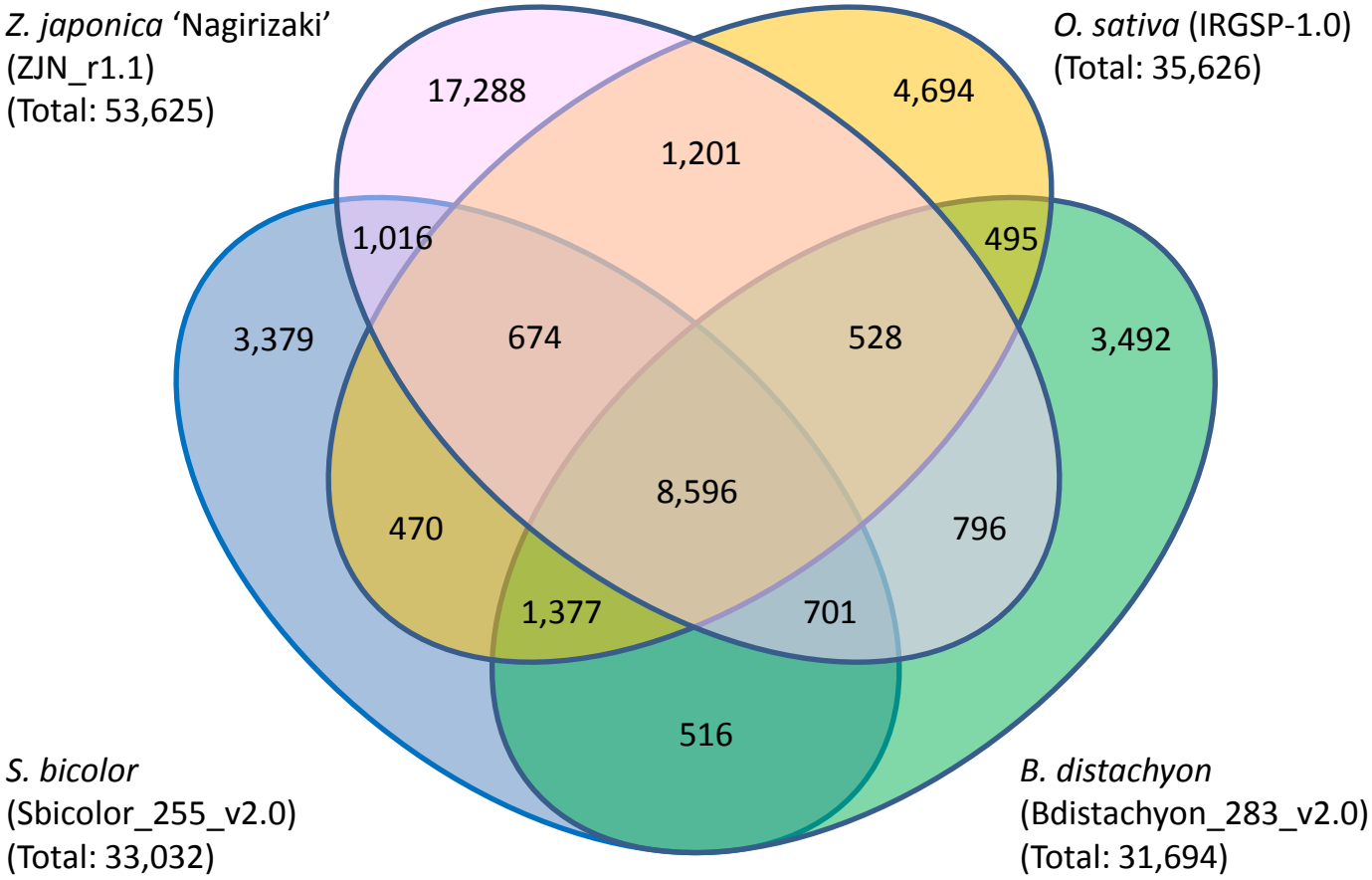
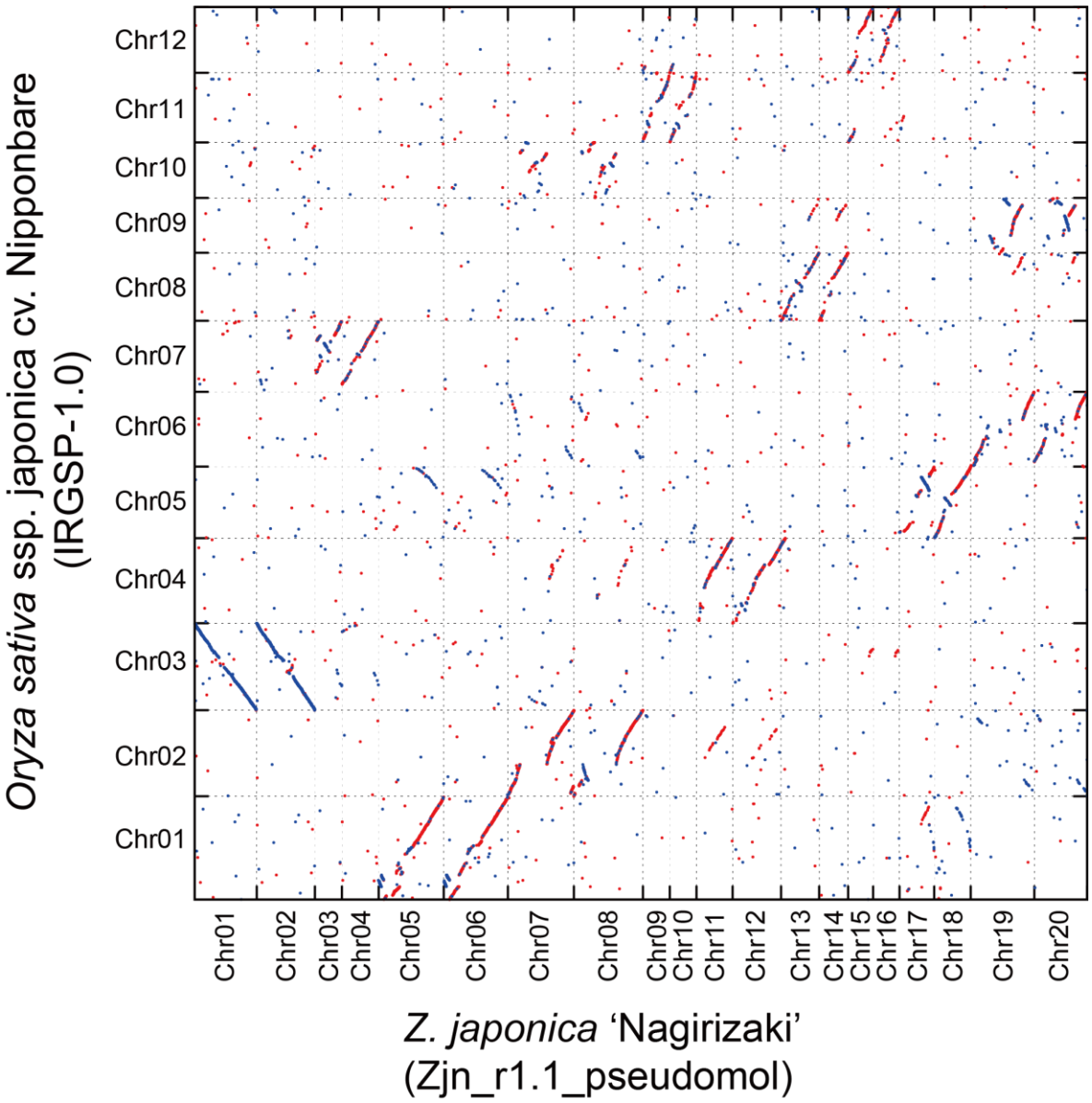
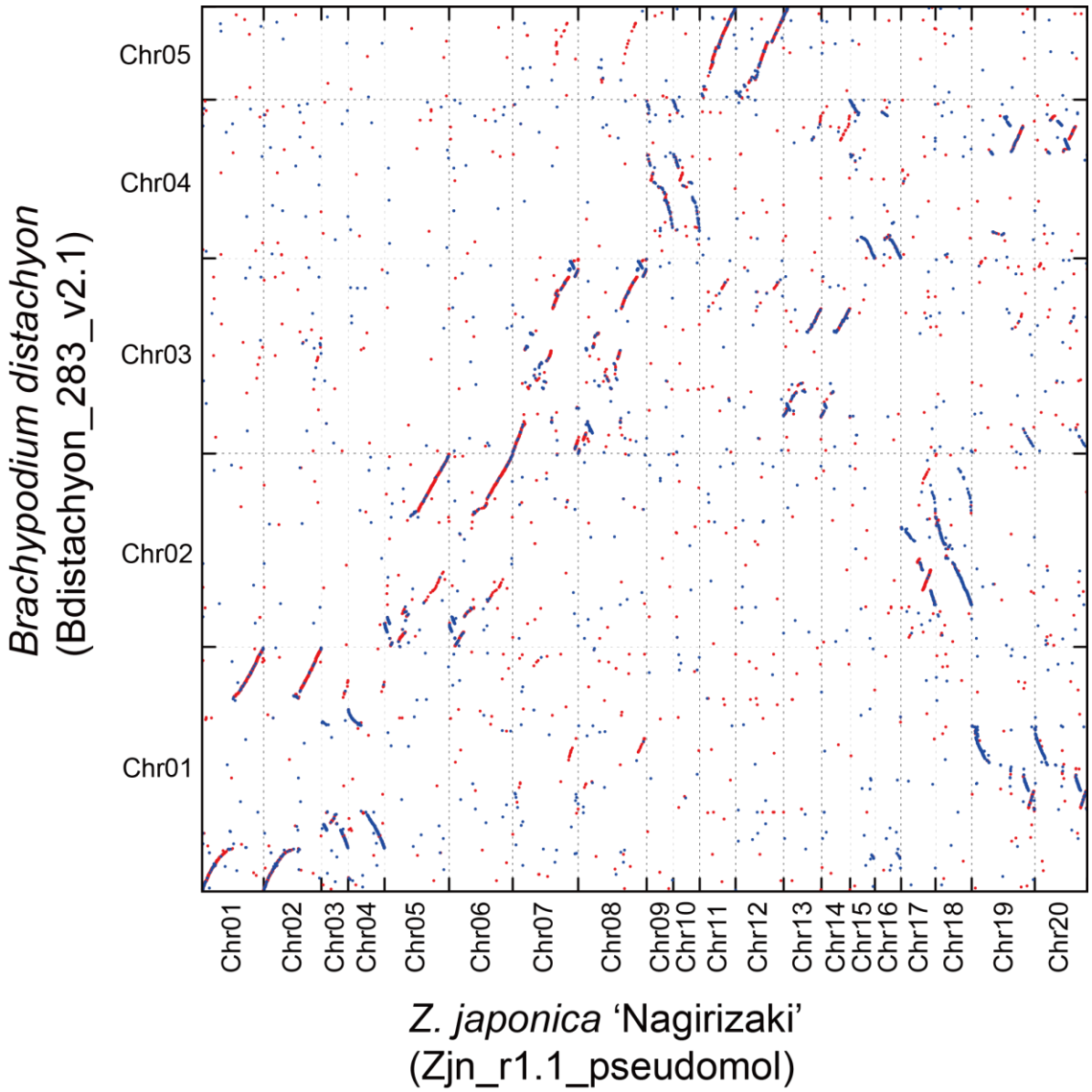

Supplementary Figure S9. Sequence alignment of the upstream regions of the *ANS1* genes in *Zoysia* species. Sequence names starting with Zjn, Zmw, and Zpz represent sequences from *Z. japonica* 'Nagirizaki' , *Z. matrella* 'Wakaba' , and *Z. pacifica* 'Zanpa' , respectively. Asterisk (*) indicates identical sequence. Mutations are enlosed within a box and the two colors (red or green) indicate two types of *ANS1* genes in these three *Zoysia* species.



Supplementary Figure S10. Classification of the genes of *Z. japonica* 'Nagirizaki', *O. sativa*, *S. bicolor*, and *B. distachyon*.
The genes were classified using CD-hit with parameters -c=0.4, -G=0, and -aS=0.5. In *Z. japonica* 'Nagirizaki', the genes classified as transposable elements were excluded.



Supplementary Figure S11. Comparison between the *Z. japonica* 'Nagirizaki' and *O. sativa* genomes. The translated protein sequences on the pseudomolecules of *Z. japonica* 'Nagirizaki' were compared with those of *O. sativa* (IRGSP-1.0) using BLAST searches with an E-value cut-off of 1E-100. The hits with same strand were colored by red, while the hits with reverse strand were colored by blue.



Supplementary Figure S12. Comparison between the *Z. japonica* 'Nagirizaki' and *B. distachyion* genomes. The translated protein sequences on the pseudomolecules of *Z. japonica* 'Nagirizaki' were compared with those of *B. distachyon* (Bdistachyon_283_v2.0) using BLAST searches with an E-value cut-off of 1E-100. The hits with same strand were colored by red, while the hits with reverse strand were colored by blue.