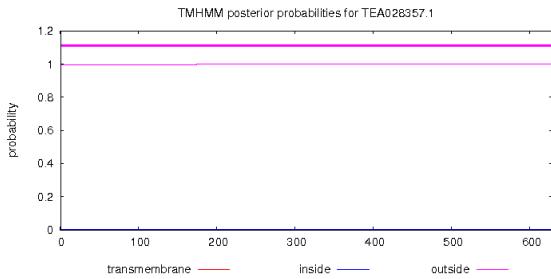# TEA028357.1 Length: 628
```
# TEA028357.1 Number of predicted TMHs:  0
# TEA028357.1 Exp number of AAs in TMHs: 0.02198
# TEA028357.1 Exp number, first 60 AAs:  0.00018
# TEA028357.1 Total prob of N-in:        0.00262
TEA028357.1    TMHMM2.0        outside      1    628
```


TMHMM posterior probabilities for TEA028357.1

TEA025870.1 Length: 776
```
# TEA025870.1 Number of predicted TMHs:  0
# TEA025870.1 Exp number of AAs in TMHs: 0.19882
# TEA025870.1 Exp number, first 60 AAs:  0.00141
# TEA025870.1 Total prob of N-in:        0.00426
TEA025870.1    TMHMM2.0        outside      1    776
```


TMHMM posterior probabilities for TEA025870.1
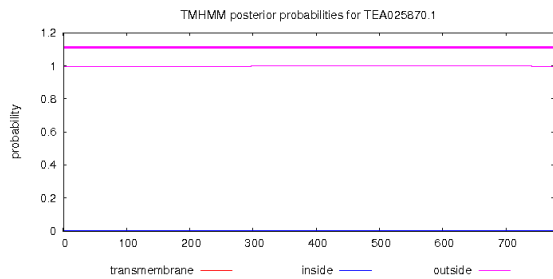
TEA016319.1 Length: 627
```
# TEA016319.1 Number of predicted TMHs:  0
# TEA016319.1 Exp number of AAs in TMHs: 0.11408
# TEA016319.1 Exp number, first 60 AAs:  3e-05
# TEA016319.1 Total prob of N-in:        0.00653
TEA016319.1    TMHMM2.0        outside      1    627
```


TMHMM posterior probabilities for TEA016319.1
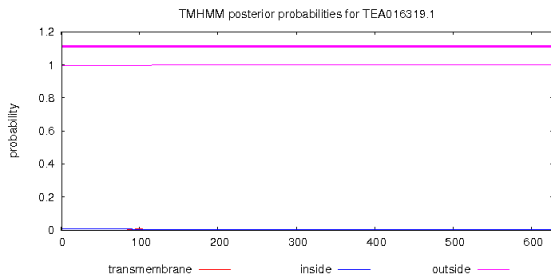
TEA029598.1 Length: 423
```
# TEA029598.1 Number of predicted TMHs:  0
# TEA029598.1 Exp number of AAs in TMHs: 0.02545
# TEA029598.1 Exp number, first 60 AAs:  0.00568
# TEA029598.1 Total prob of N-in:        0.01343
TEA029598.1    TMHMM2.0        outside      1    423
```


TMHMM posterior probabilities for TEA029598.1
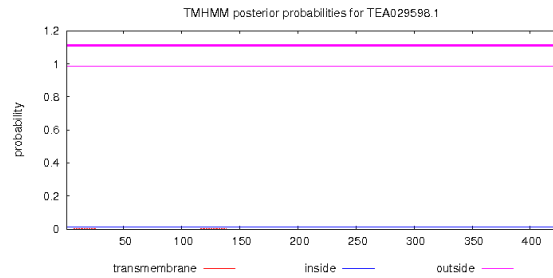
TEA008165.1 Length: 1032
```
# TEA008165.1 Number of predicted TMHs:  0
# TEA008165.1 Exp number of AAs in TMHs: 6.76661
# TEA008165.1 Exp number, first 60 AAs:  3.17779
# TEA008165.1 Total prob of N-in:        0.04338
TEA008165.1    TMHMM2.0        outside      1    1032
```


TMHMM posterior probabilities for TEA008165.1
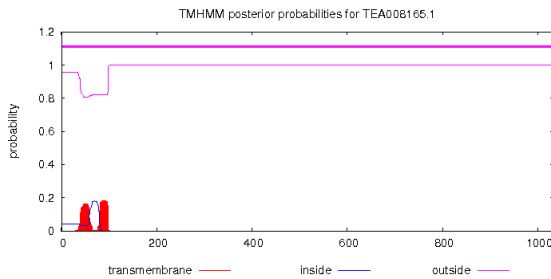
TEA027265.1 Length: 939
```
# TEA027265.1 Number of predicted TMHs:  0
# TEA027265.1 Exp number of AAs in TMHs: 0
# TEA027265.1 Exp number, first 60 AAs:  0
# TEA027265.1 Total prob of N-in:        0.00001
TEA027265.1    TMHMM2.0        outside      1    939
```


TMHMM posterior probabilities for TEA027265.1
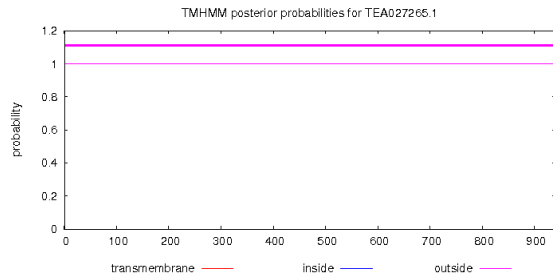
TEA006319.1 Length: 683
```
# TEA006319.1 Number of predicted TMHs:  0
# TEA006319.1 Exp number of AAs in TMHs: 0.00042
# TEA006319.1 Exp number, first 60 AAs:  0
# TEA006319.1 Total prob of N-in:        0.00017
TEA006319.1    TMHMM2.0        outside      1    683
```


TMHMM posterior probabilities for TEA006319.1
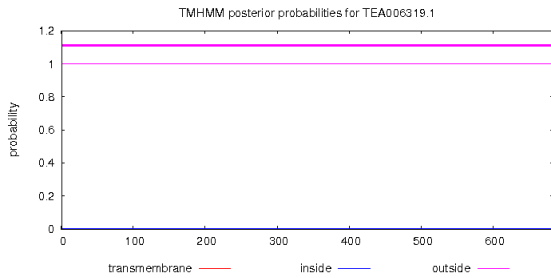
TEA006473.1 Length: 710
```
# TEA006473.1 Number of predicted TMHs:  0
# TEA006473.1 Exp number of AAs in TMHs: 0.00515
# TEA006473.1 Exp number, first 60 AAs:  0
# TEA006473.1 Total prob of N-in:        0.00031
TEA006473.1    TMHMM2.0        outside      1    710
```


TMHMM posterior probabilities for TEA006473.1
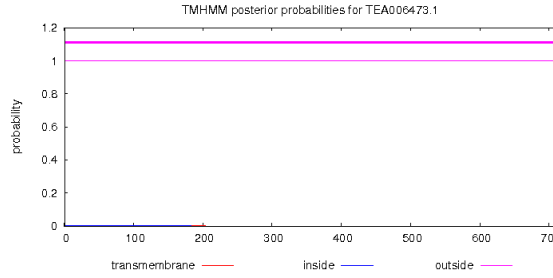
‡ **TEA014429.1** Length: 1191
# TEA014429.1 Number of predicted TMHs: 0
# TEA014429.1 Exp number of AAs in TMHs: 0.02164
# TEA014429.1 Exp number, first 60 AAs: 0.00074
# TEA014429.1 Total prob of N-in: 0.00023
TEA014429.1   TMHMM2.0   outside   1 1191

TMHMM posterior probabilities for TEA014429.1
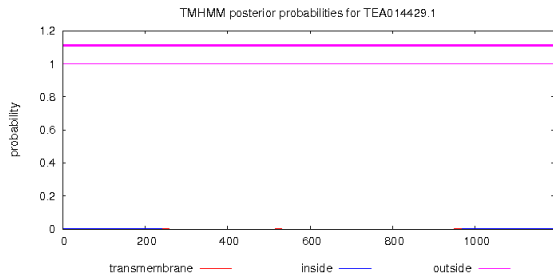
‡ **TEA031711.1** Length: 562
# TEA031711.1 Number of predicted TMHs: 0
# TEA031711.1 Exp number of AAs in TMHs: 0.0069899
# TEA031711.1 Exp number, first 60 AAs: 0.00016
# TEA031711.1 Total prob of N-in: 0.00833
TEA031711.1   TMHMM2.0   outside   1   562


TMHMM posterior probabilities for TEA031711.1
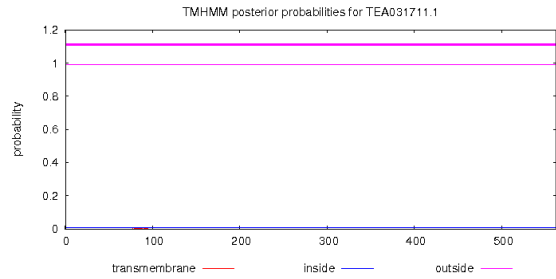
† **TEA001470.1** Length: 789
# TEA001470.1 Number of predicted TMHs: 0
# TEA001470.1 Exp number of AAs in TMHs: 3.06197
# TEA001470.1 Exp number, first 60 AAs: 0.21965
# TEA001470.1 Total prob of N-in: 0.01032
TEA001470.1   TMHMM2.0   outside   1   789

TMHMM posterior probabilities for TEA001470.1
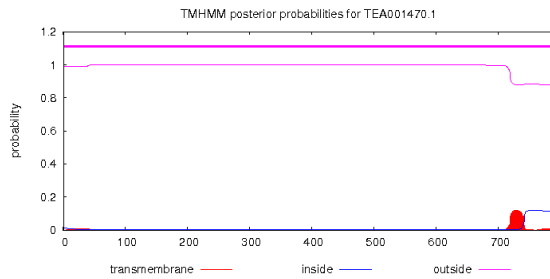
† **TEA017119.1** Length: 506
# TEA017119.1 Number of predicted TMHs: 0
# TEA017119.1 Exp number of AAs in TMHs: 0.04644
# TEA017119.1 Exp number, first 60 AAs: 0.00226
# TEA017119.1 Total prob of N-in: 0.01372
TEA017119.1   TMHMM2.0   outside   1   506


TMHMM posterior probabilities for TEA017119.1
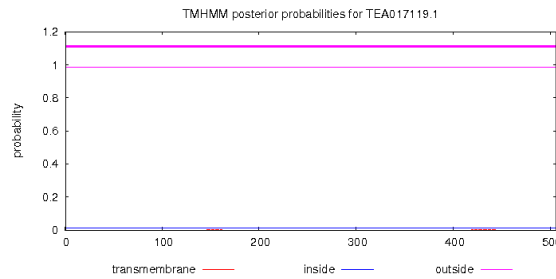
† **TEA005306.1** Length: 1097
# TEA005306.1 Number of predicted TMHs: 0
# TEA005306.1 Exp number of AAs in TMHs: 0.03434
# TEA005306.1 Exp number, first 60 AAs: 0
# TEA005306.1 Total prob of N-in: 0.00020
TEA005306.1   TMHMM2.0   outside   1 1097

TMHMM posterior probabilities for TEA005306.1
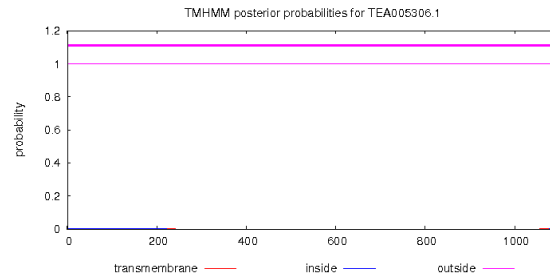
† **TEA009902.1** Length: 450
# TEA009902.1 Number of predicted TMHs: 0
# TEA009902.1 Exp number of AAs in TMHs: 0.71758
# TEA009902.1 Exp number, first 60 AAs: 0.10658
# TEA009902.1 Total prob of N-in: 0.00748
TEA009902.1   TMHMM2.0   outside   1   450


TMHMM posterior probabilities for TEA009902.1
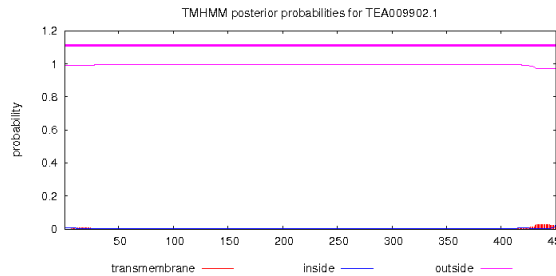
† **TEA005122.1** Length: 334
# TEA005122.1 Number of predicted TMHs: 0
# TEA005122.1 Exp number of AAs in TMHs: 0.01241
# TEA005122.1 Exp number, first 60 AAs: 0.00929
# TEA005122.1 Total prob of N-in: 0.04268
TEA005122.1   TMHMM2.0   outside   1   334

TMHMM posterior probabilities for TEA005122.1
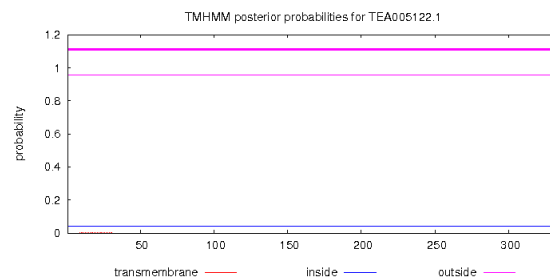
† **TEA028214.1** Length: 344
# TEA028214.1 Number of predicted TMHs: 0
# TEA028214.1 Exp number of AAs in TMHs: 0.00766
# TEA028214.1 Exp number, first 60 AAs: 0.00225
# TEA028214.1 Total prob of N-in: 0.02030
TEA028214.1   TMHMM2.0   outside   1   344

TMHMM posterior probabilities for TEA028214.1
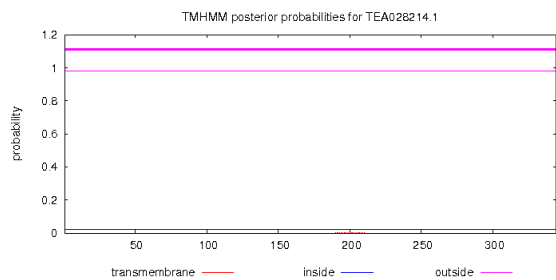
```
# TEA031689.1 Length: 311
# TEA031689.1 Number of predicted TMHs:  0
# TEA031689.1 Exp number of AAs in TMHs: 0.28379
# TEA031689.1 Exp number, first 60 AAs:  0.25957
# TEA031689.1 Total prob of N-in:        0.04973
TEA031689.1     TMHMM2.0     outside     1    311
```
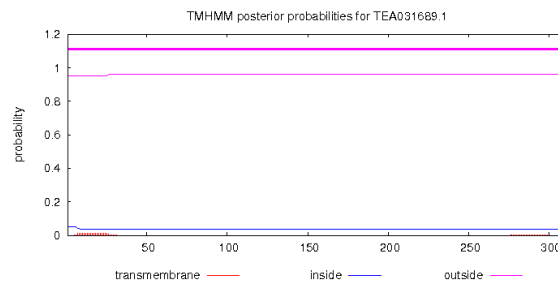

Supplementary Figure S1: Transmembrane helices of MAPKKKs of MEKK subfamily in *C. sinensis*. TMHMM Server, v.2.0 (http://www.cbs.dtu.dk/services/TMHMM/), ~~was used to generate the transmembrane helices.~~

‡ **TEA001765.1** Length: 842
# TEA001765.1 Number of predicted TMHs: 0
# TEA001765.1 Exp number of AAs in TMHs: 1.26294
# TEA001765.1 Exp number, first 60 AAs: 0
# TEA001765.1 Total prob of N-in: 0.00418
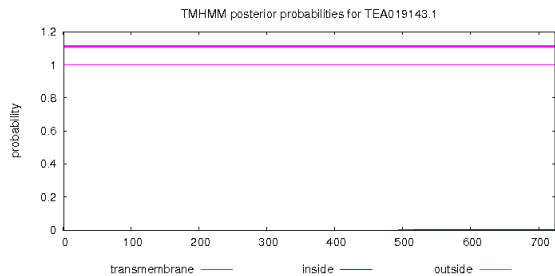TEA001765.1   TMHMM2.0   outside   1   842

TMHMM posterior probabilities for TEA001765.1
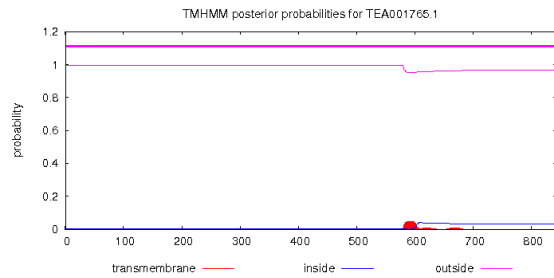
‡ **TEA002020.1** Length: 896
# TEA002020.1 Number of predicted TMHs: 0
# TEA002020.1 Exp number of AAs in TMHs: 0.01584
# TEA002020.1 Exp number, first 60 AAs: 0
# TEA002020.1 Total prob of N-in: 0.00015
TEA002020.1   TMHMM2.0   outside   1   896

TMHMM posterior probabilities for TEA002020.1
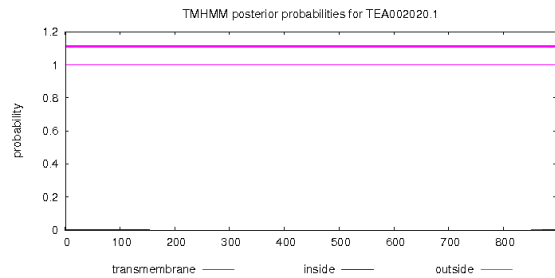
‡ **TEA000256.1** Length: 1086
# TEA000256.1 Number of predicted TMHs: 0
# TEA000256.1 Exp number of AAs in TMHs: 0.00826
# TEA000256.1 Exp number, first 60 AAs: 0
# TEA000256.1 Total prob of N-in: 0.00004
TEA000256.1   TMHMM2.0   outside   1   1086

TMHMM posterior probabilities for TEA000256.1
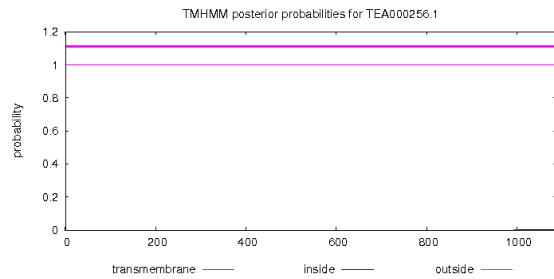
‡ **TEA029086.1** Length: 919
# TEA029086.1 Number of predicted TMHs: 0
# TEA029086.1 Exp number of AAs in TMHs: 0.27701
# TEA029086.1 Exp number, first 60 AAs: 0
# TEA029086.1 Total prob of N-in: 0.00050
TEA029086.1   TMHMM2.0   outside   1   919

TMHMM posterior probabilities for TEA029086.1
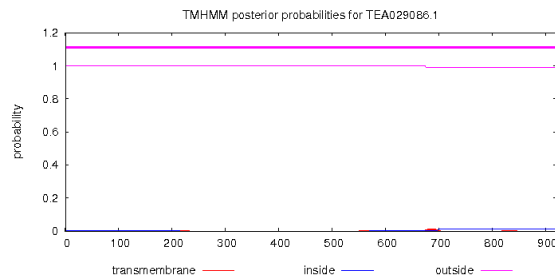
‡ **TEA022129.1** Length: 940
# TEA022129.1 Number of predicted TMHs: 0
# TEA022129.1 Exp number of AAs in TMHs: 37.32592
# TEA022129.1 Exp number, first 60 AAs: 0
# TEA022129.1 Total prob of N-in: 0.17108
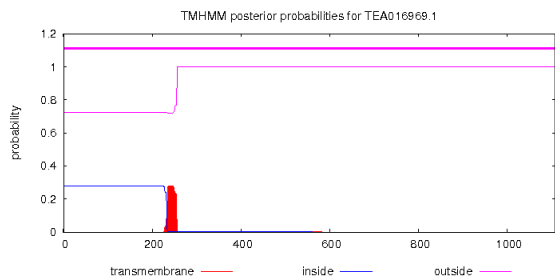TEA022129.1   TMHMM2.0   outside   1   940

TMHMM posterior probabilities for TEA022129.1
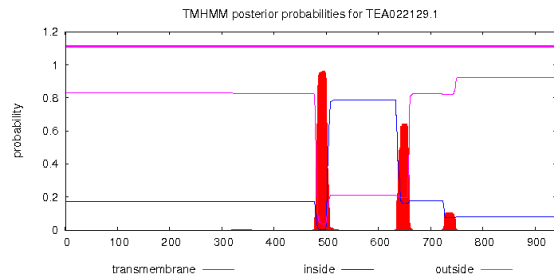
‡ **TEA019143.1** Length: 724
# TEA019143.1 Number of predicted TMHs: 0
# TEA019143.1 Exp number of AAs in TMHs: 0.01226
# TEA019143.1 Exp number, first 60 AAs: 0
# TEA019143.1 Total prob of N-in: 0.00005
TEA019143.1   TMHMM2.0   outside   1   724


TMHMM posterior probabilities for TEA019143.1

† **TEA028452.1** Length: 846
# TEA028452.1 Number of predicted TMHs: 0
# TEA028452.1 Exp number of AAs in TMHs: 0.05099
# TEA028452.1 Exp number, first 60 AAs: 0
# TEA028452.1 Total prob of N-in: 0.00001
TEA028452.1   TMHMM2.0   outside   1   846

TMHMM posterior probabilities for TEA028452.1
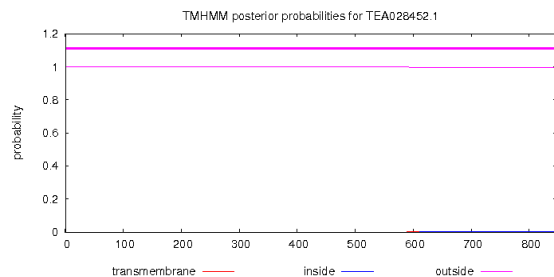
† **TEA016969.1** Length: 1107
# TEA016969.1 Number of predicted TMHs: 0
# TEA016969.1 Exp number of AAs in TMHs: 6.33735
# TEA016969.1 Exp number, first 60 AAs: 0
# TEA016969.1 Total prob of N-in: 0.27806
TEA016969.1   TMHMM2.0   outside   1   1107

TMHMM posterior probabilities for TEA016969.1

⊬ **TEA013270.1** Length: 755
TEA013270.1 Number of predicted TMHs: 0
TEA013270.1 Exp number of AAs in TMHs: 0.10844
TEA013270.1 Exp number, first 60 AAs: 0
TEA013270.1 Total prob of N-in: 0.00501
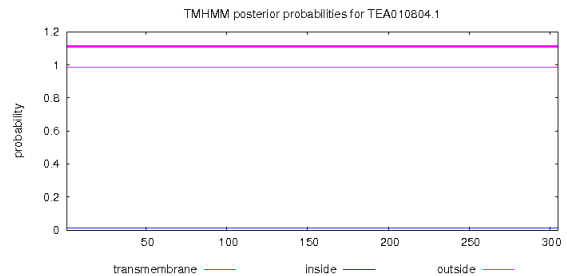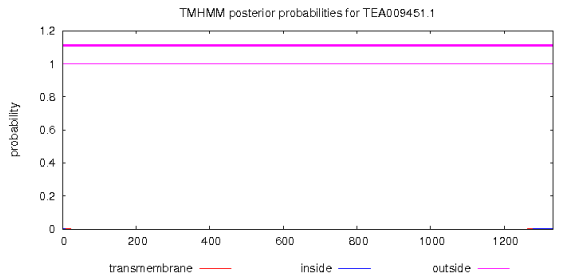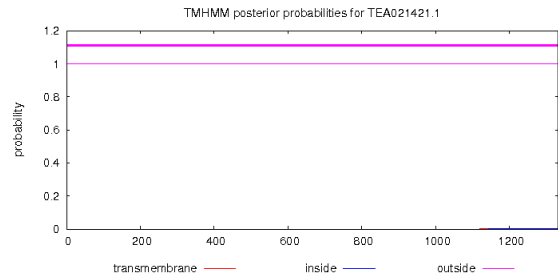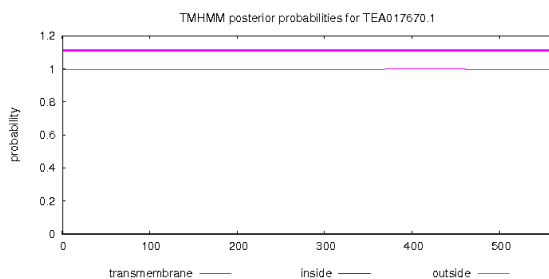TEA013270.1   TMHMM2.0   outside   1   755

TMHMM posterior probabilities for TEA013270.1
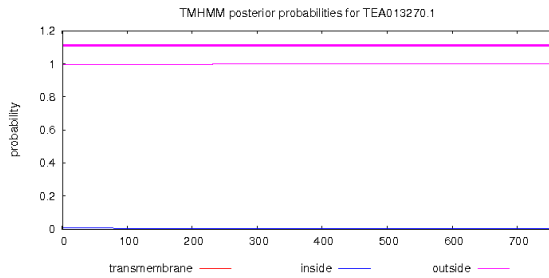
⊬ **TEA026716.1** Length: 368
TEA026716.1 Number of predicted TMHs: 0
TEA026716.1 Exp number of AAs in TMHs: 0.00933
TEA026716.1 Exp number, first 60 AAs: 0.00015
TEA026716.1 Total prob of N-in: 0.02057
TEA026716.1   TMHMM2.0   outside   1   368

TMHMM posterior probabilities for TEA026716.1
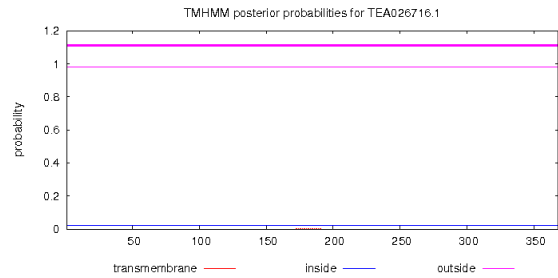
⊬ **TEA028758.1** Length: 1213
TEA028758.1 Number of predicted TMHs: 0
TEA028758.1 Exp number of AAs in TMHs: 0.0185
TEA028758.1 Exp number, first 60 AAs: 0.00018
TEA028758.1 Total prob of N-in: 0.00001
TEA028758.1   TMHMM2.0   outside   1   1213

TMHMM posterior probabilities for TEA028758.1
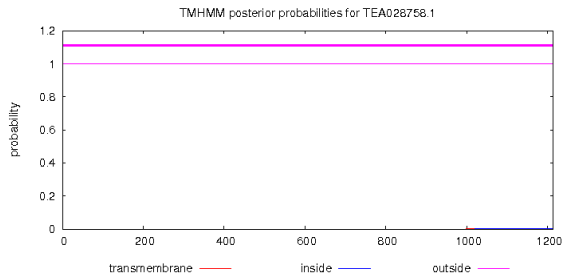
⊬ **TEA010804.1** Length: 305
TEA010804.1 Number of predicted TMHs: 0
TEA010804.1 Exp number of AAs in TMHs: 0.00132
TEA010804.1 Exp number, first 60 AAs: 0
TEA010804.1 Total prob of N-in: 0.01241
TEA010804.1   TMHMM2.0   outside   1   305

TMHMM posterior probabilities for TEA010804.1

† **TEA009451.1** Length: 1333
TEA009451.1 Number of predicted TMHs: 0
TEA009451.1 Exp number of AAs in TMHs: 0.02716
TEA009451.1 Exp number, first 60 AAs: 0.02022
TEA009451.1 Total prob of N-in: 0.00132
TEA009451.1   TMHMM2.0   outside   1   1333

TMHMM posterior probabilities for TEA009451.1

† **TEA021421.1** Length: 1331
TEA021421.1 Number of predicted TMHs: 0
TEA021421.1 Exp number of AAs in TMHs: 0.01119
TEA021421.1 Exp number, first 60 AAs: 0
TEA021421.1 Total prob of N-in: 0.00001
TEA021421.1   TMHMM2.0   outside   1   1331

TMHMM posterior probabilities for TEA021421.1

⊬ **TEA017670.1** Length: 561
TEA017670.1 Number of predicted TMHs: 0
TEA017670.1 Exp number of AAs in TMHs: 0.03517
TEA017670.1 Exp number, first 60 AAs: 0
TEA017670.1 Total prob of N-in: 0.00270
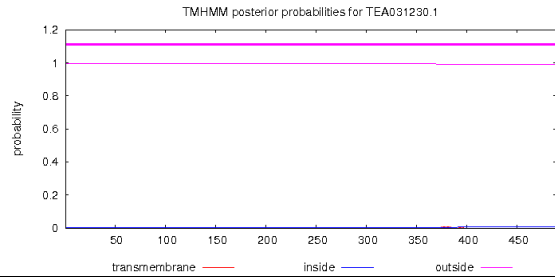TEA017670.1   TMHMM2.0   outside   1   561

TMHMM posterior probabilities for TEA017670.1

⊬ **TEA019184.1** Length: 601
TEA019184.1 Number of predicted TMHs: 0
TEA019184.1 Exp number of AAs in TMHs: 0.01866
TEA019184.1 Exp number, first 60 AAs: 0
TEA019184.1 Total prob of N-in: 0.00147
TEA019184.1   TMHMM2.0   outside   1   601

TMHMM posterior probabilities for TEA019184.1
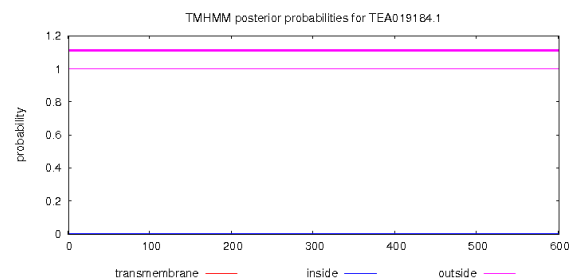
‡ **TEA000933.1** Length: 407
# TEA000933.1 Number of predicted TMHs: 0
# TEA000933.1 Exp number of AAs in TMHs: 0.46154
# TEA000933.1 Exp number, first 60 AAs: 0
# TEA000933.1 Total prob of N-in: 0.00794
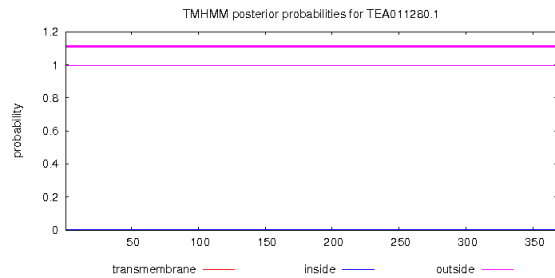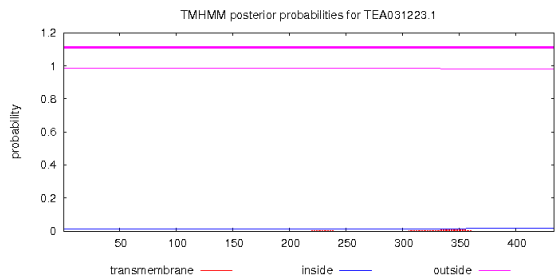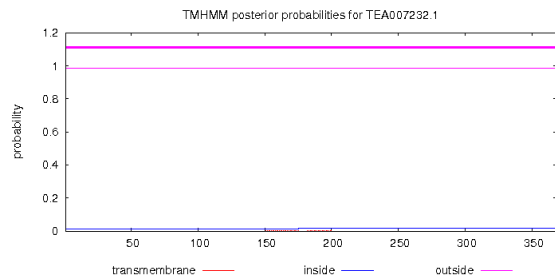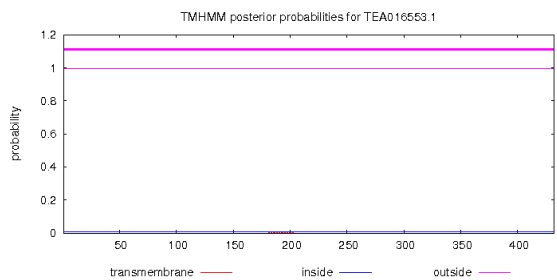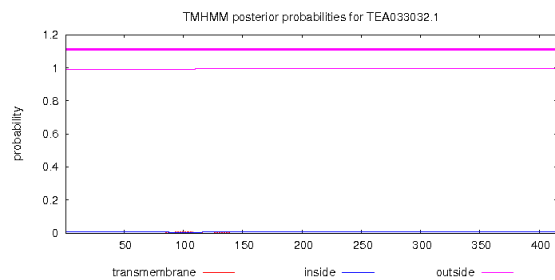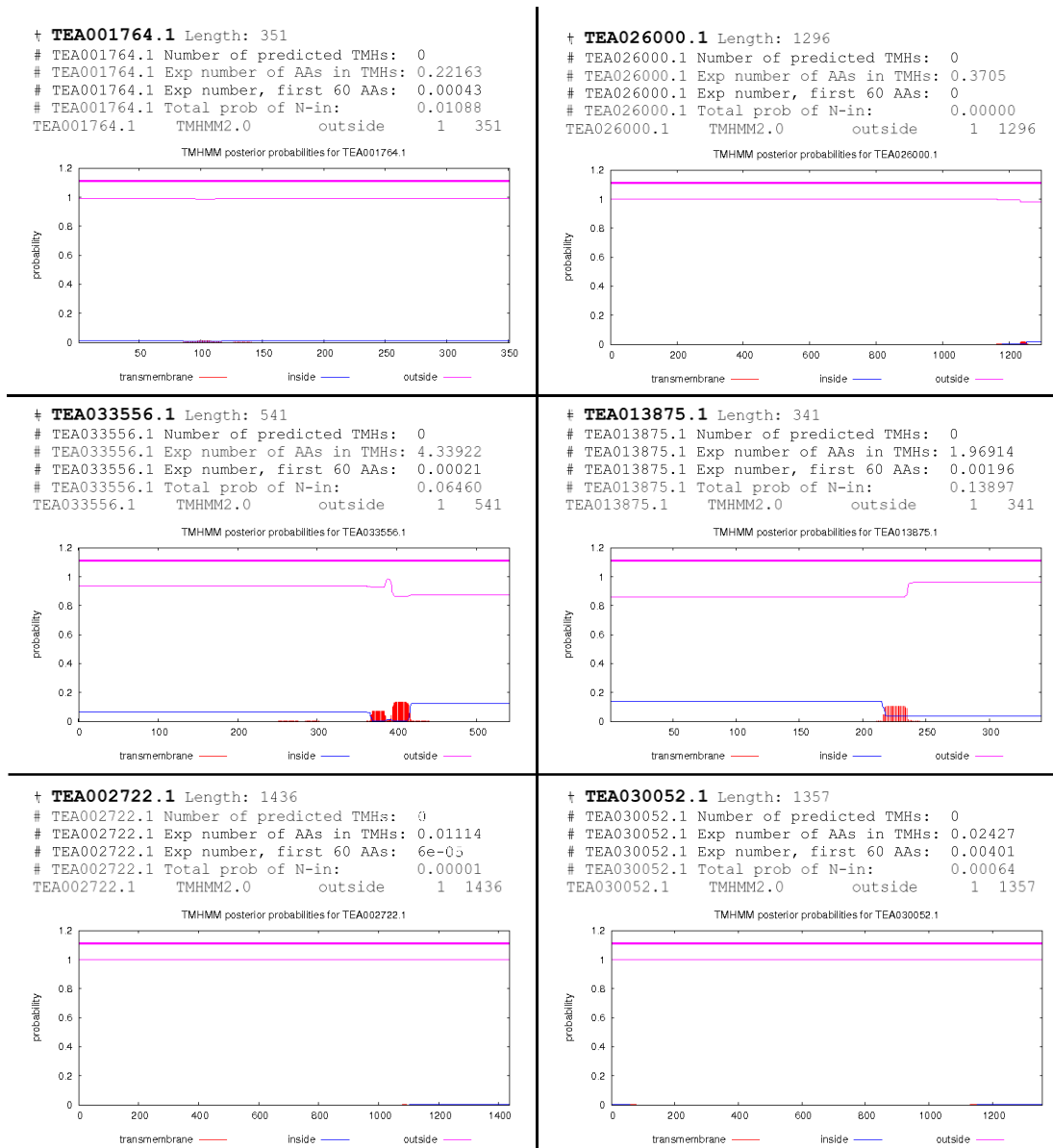TEA000933.1   TMHMM2.0   outside   1   407

TMHMM posterior probabilities for TEA000933.1
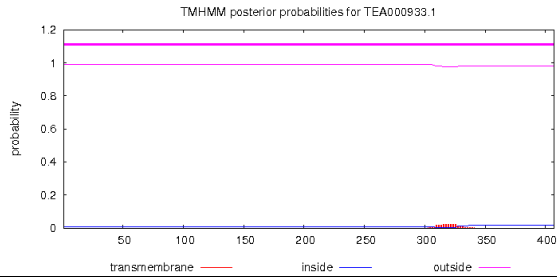
‡ **TEA031230.1** Length: 489
# TEA031230.1 Number of predicted TMHs: 0
# TEA031230.1 Exp number of AAs in TMHs: 0.13166
# TEA031230.1 Exp number, first 60 AAs: 0.00013
# TEA031230.1 Total prob of N-in: 0.00470
TEA031230.1   TMHMM2.0   outside   1   489

TMHMM posterior probabilities for TEA031230.1

† **TEA022171.1** Length: 404
# TEA022171.1 Number of predicted TMHs: 0
# TEA022171.1 Exp number of AAs in TMHs: 0.01418
# TEA022171.1 Exp number, first 60 AAs: 0
# TEA022171.1 Total prob of N-in: 0.01930
TEA022171.1   TMHMM2.0   outside   1   404

TMHMM posterior probabilities for TEA022171.1
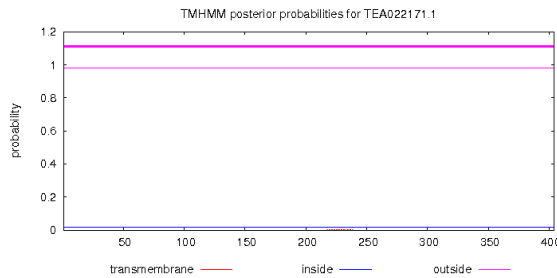
† **TEA011280.1** Length: 368
# TEA011280.1 Number of predicted TMHs: 0
# TEA011280.1 Exp number of AAs in TMHs: 0.0076
# TEA011280.1 Exp number, first 60 AAs: 0
# TEA011280.1 Total prob of N-in: 0.00291
TEA011280.1   TMHMM2.0   outside   1   368

TMHMM posterior probabilities for TEA011280.1

‡ **TEA031223.1** Length: 434
# TEA031223.1 Number of predicted TMHs: 0
# TEA031223.1 Exp number of AAs in TMHs: 0.27035
# TEA031223.1 Exp number, first 60 AAs: 0
# TEA031223.1 Total prob of N-in: 0.01318
TEA031223.1   TMHMM2.0   outside   1   434

TMHMM posterior probabilities for TEA031223.1

‡ **TEA007232.1** Length: 368
# TEA007232.1 Number of predicted TMHs: 0
# TEA007232.1 Exp number of AAs in TMHs: 0.04776
# TEA007232.1 Exp number, first 60 AAs: 0
# TEA007232.1 Total prob of N-in: 0.01435
TEA007232.1   TMHMM2.0   outside   1   368

TMHMM posterior probabilities for TEA007232.1

† **TEA016553.1** Length: 432
# TEA016553.1 Number of predicted TMHs: 0
# TEA016553.1 Exp number of AAs in TMHs: 0.01056
# TEA016553.1 Exp number, first 60 AAs: 0
# TEA016553.1 Total prob of N-in: 0.00632
TEA016553.1   TMHMM2.0   outside   1   432

TMHMM posterior probabilities for TEA016553.1

† **TEA033032.1** Length: 415
# TEA033032.1 Number of predicted TMHs: 0
# TEA033032.1 Exp number of AAs in TMHs: 0.16877
# TEA033032.1 Exp number, first 60 AAs: 8e-05
# TEA033032.1 Total prob of N-in: 0.00767
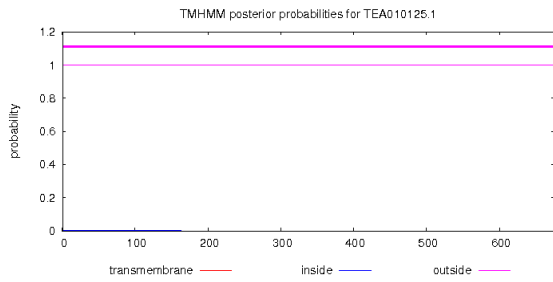TEA033032.1   TMHMM2.0   outside   1   415

TMHMM posterior probabilities for TEA033032.1
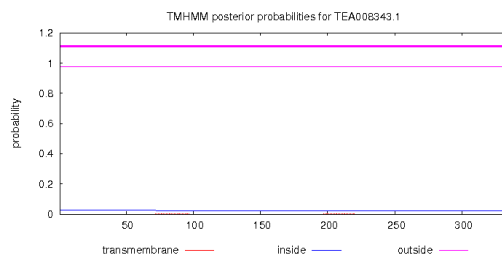
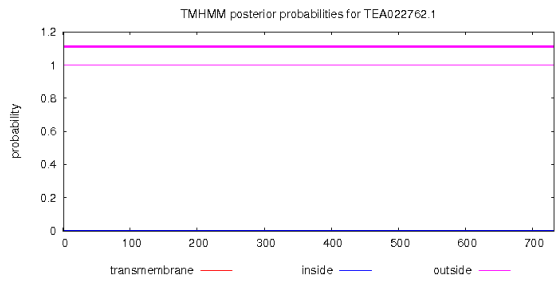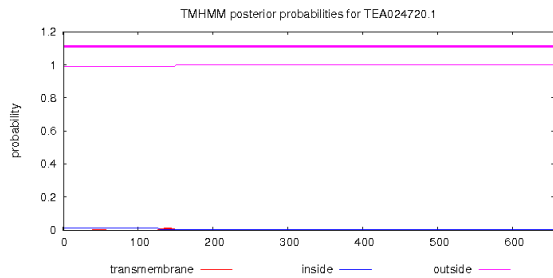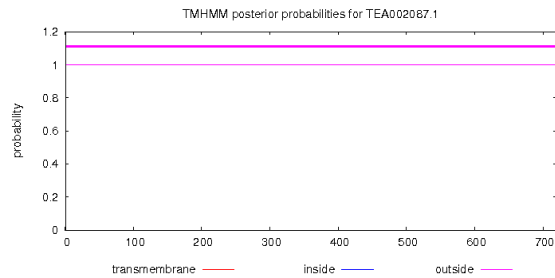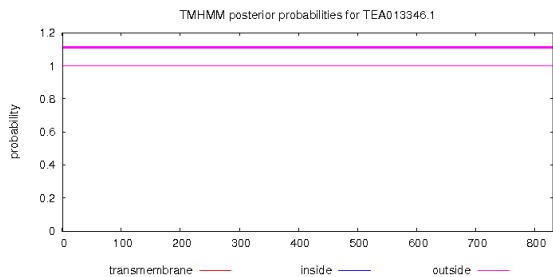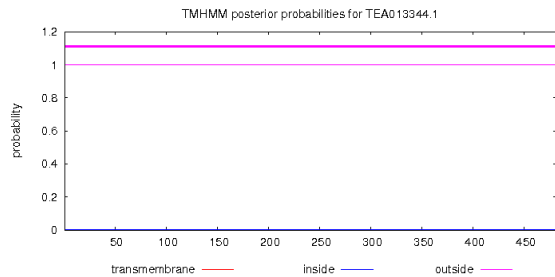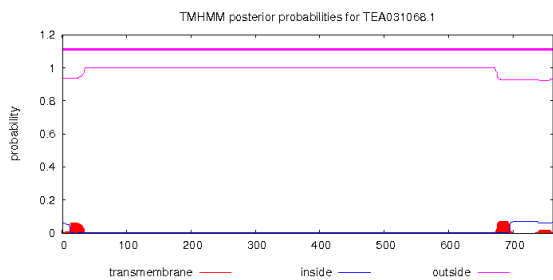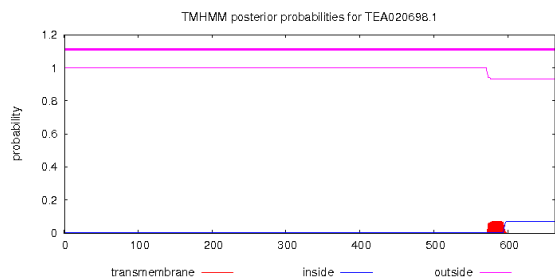**Supplementary Figure S2:** Transmembrane helices of MAPKKKs of Raf subfamily in *C. sinensis*. TMHMM Server, v.2.0 (http://www.cbs.dtu.dk/services/TMHMM/), ~~was used to generate the transmembrane helices.~~

TMHMM posterior probabilities for TEA010125.1

TMHMM posterior probabilities for TEA022762.1

TMHMM posterior probabilities for TEA024720.1

TMHMM posterior probabilities for TEA002087.1

TMHMM posterior probabilities for TEA013346.1

TMHMM posterior probabilities for TEA013344.1

TMHMM posterior probabilities for TEA031068.1

TMHMM posterior probabilities for TEA020698.1

Supplementary Figure S3: Transmembrane helices of MAPKKKs of ZIK subfamily in *C. sinensis*. TMHMM Server, v.2.0 (http://www.cbs.dtu.dk/services/TMHMM/), ~~was used to generate the transmembrane helices.~~
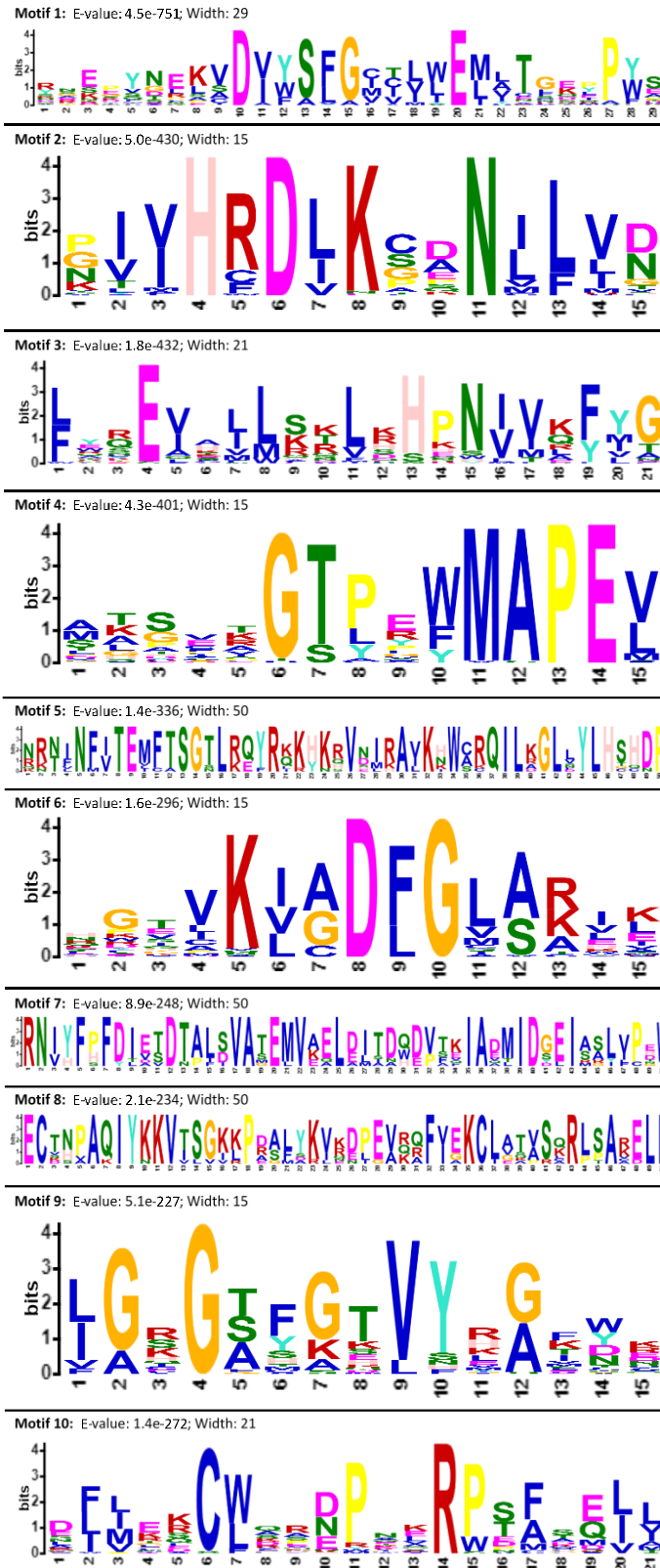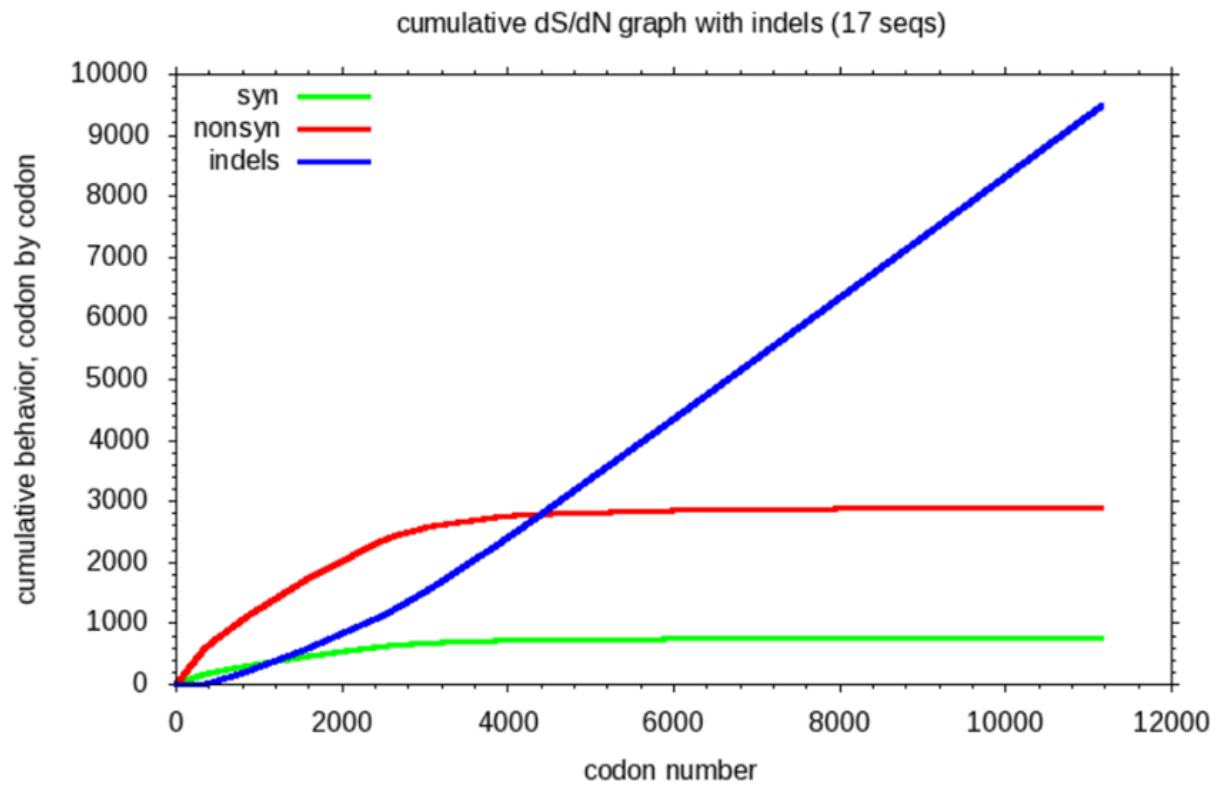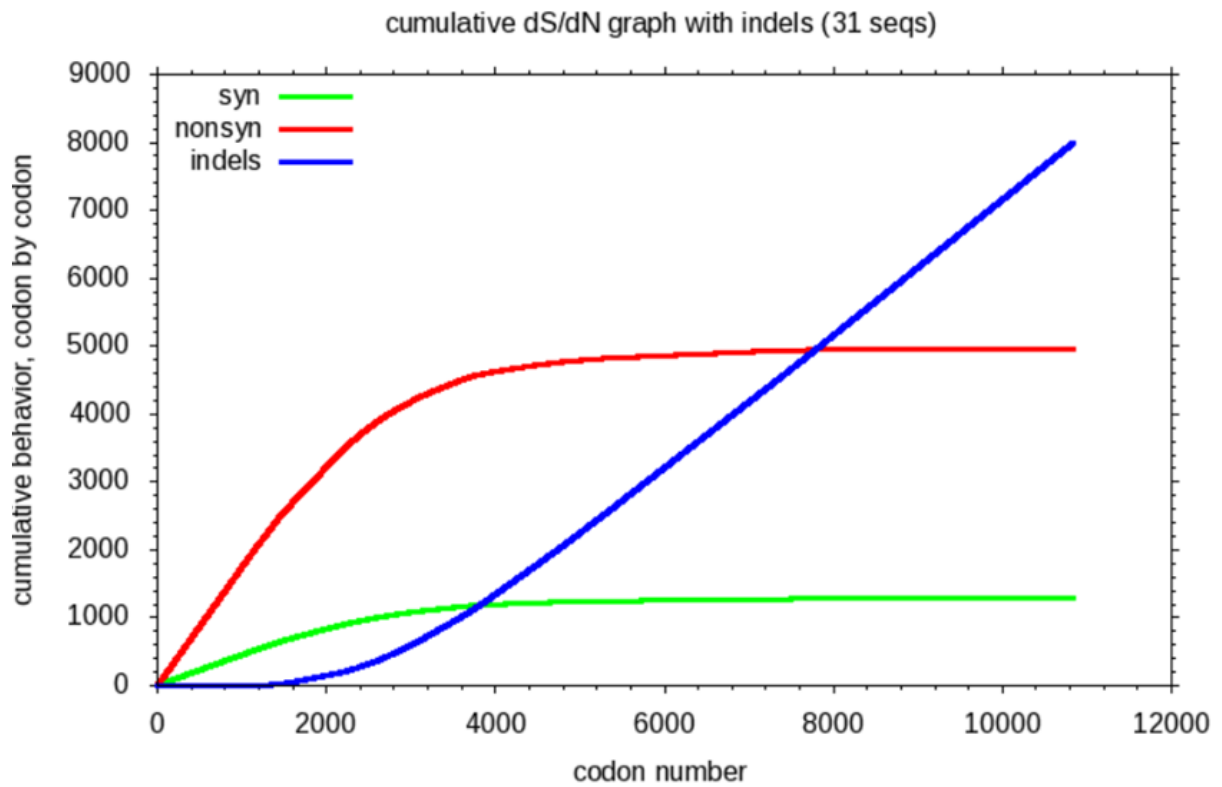
Supplementary Figure S4: Motif logos of the 10 identified motifs in 59 MAPKKKs in *C. sinensis*. The motif logos were generated by MEME suite.

Supplementary Figure S5: The ds/dn cumulative graph of MAPKKKs of MEKK subfamily in *C. sinensis*. SNAP server (https://www.hiv.lanl.gov/content/sequence/SNAP/SNAP.html) has been used to generate the graph.

Supplementary Figure S6: The ds/dn cumulative graph of MAPKKKs of Raf subfamily in *C. sinensis*. SNAP server (https://www.hiv.lanl.gov/content/sequence/SNAP/SNAP.html) has been used to generate the graph.
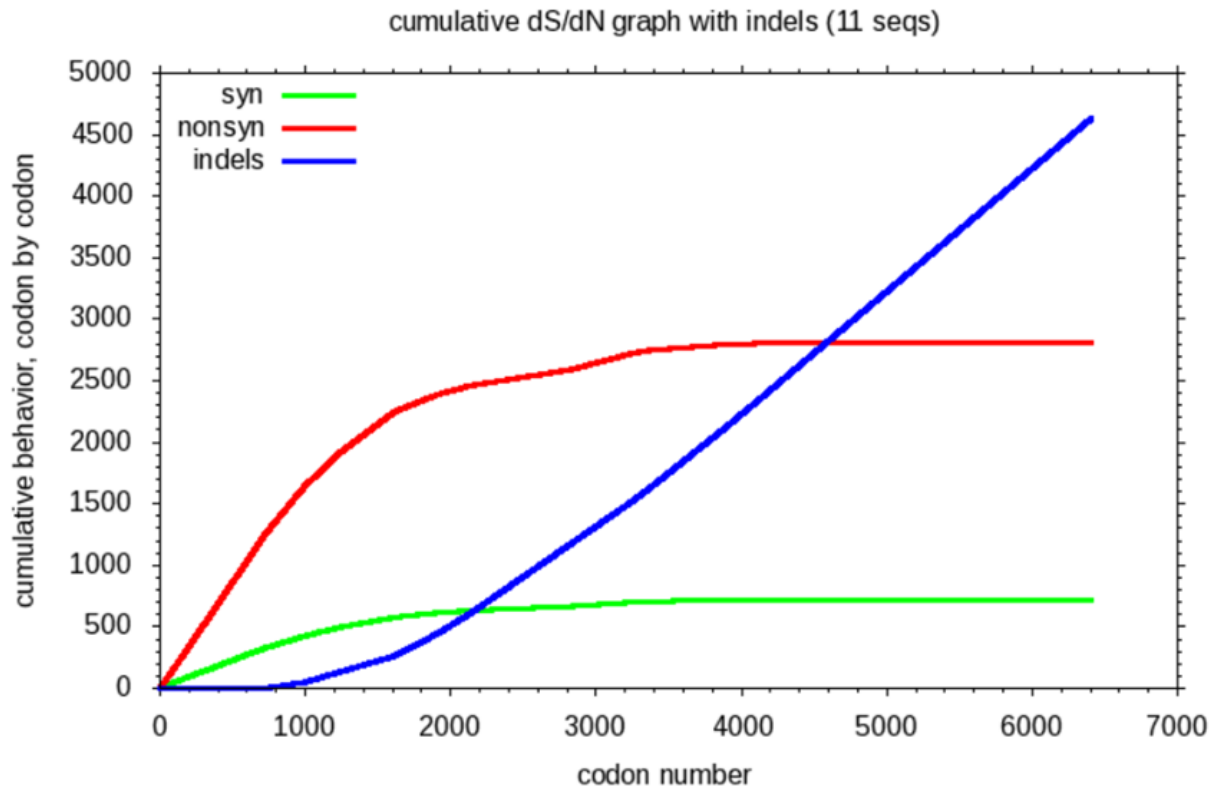
Supplementary Figure S7: The ds/dn cumulative graph of MAPKKKs of ZIK subfamily in *C. sinensis*. SNAP server (https://www.hiv.lanl.gov/content/sequence/SNAP/SNAP.html) has been used to generate the graph.
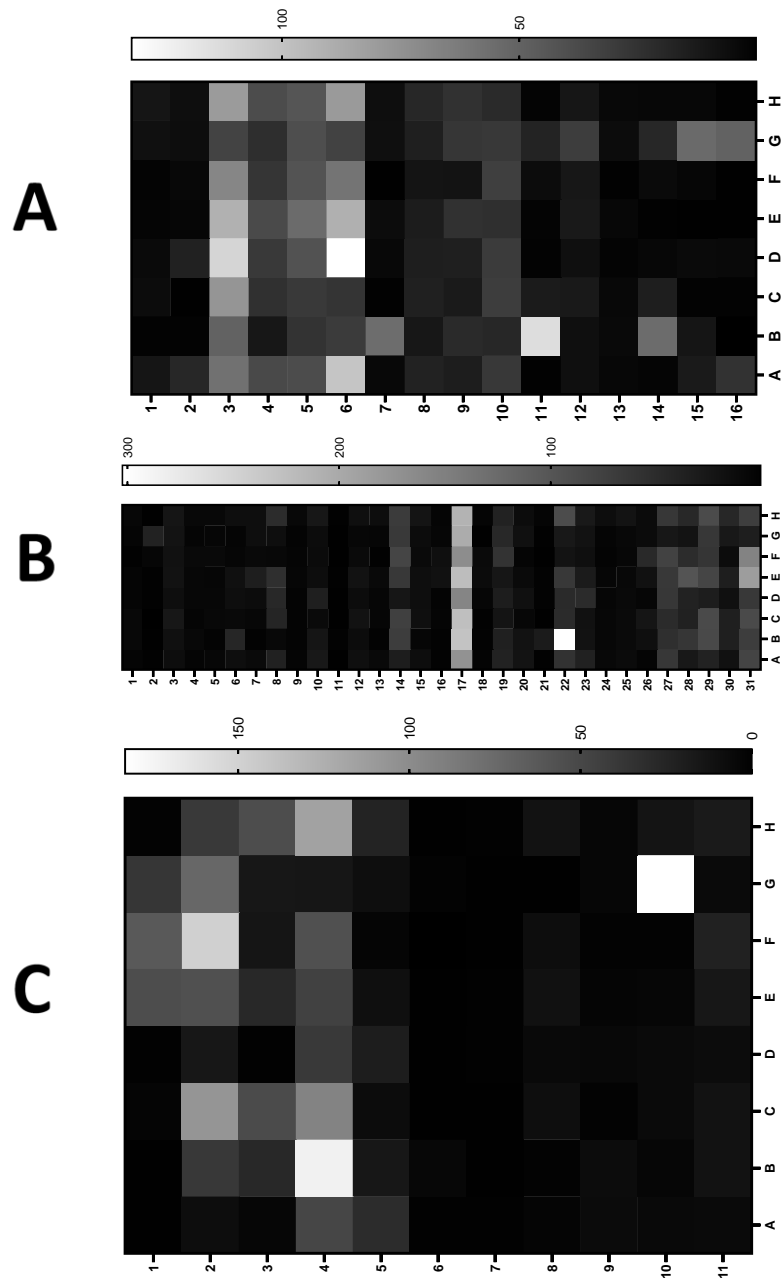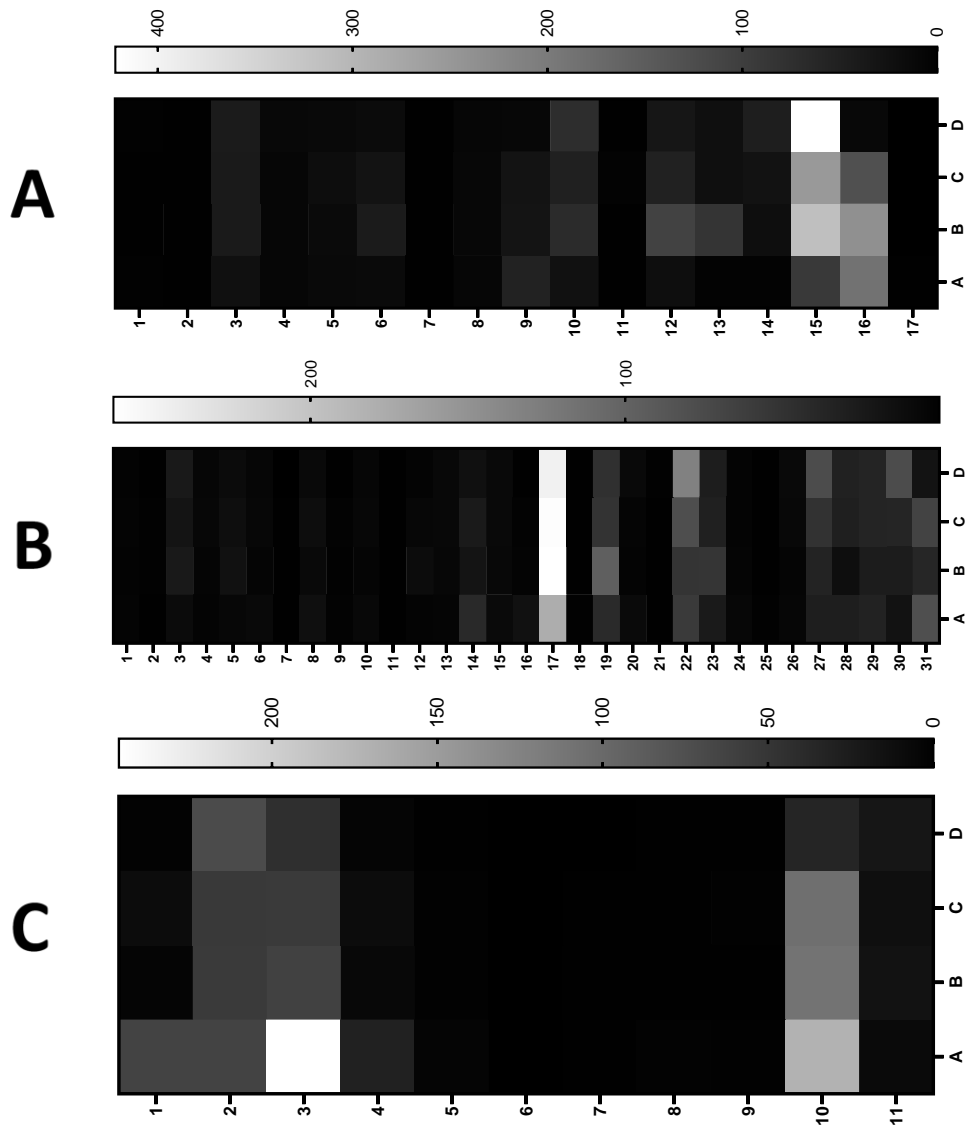
Supplementary Figure S8: Heat maps for tissue-specific expression patterns of A) MEKK; B) Raf and; C) ZIK genes in *C. sinensis*. The relative expression of these genes was analysed in different developmental stages, by using GraphPad Prism 8 software. The level of expression was in transcript per million (TPM). The numbers below represent the tea MAPKKK genes and the alphabets on the right represent the 8 different tissues.
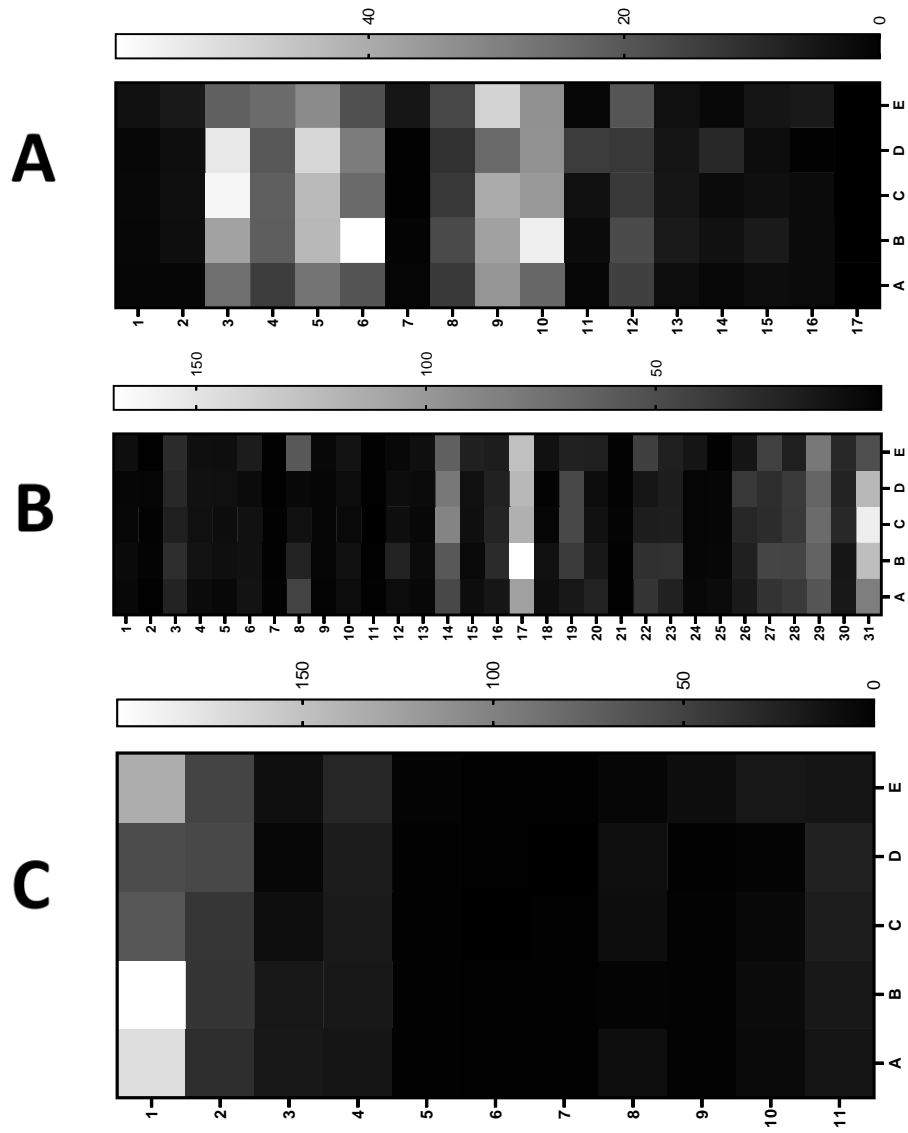
Supplementary Figure S9: Heat maps for cold stress expression patterns of A) MEKK; B) Raf and; C) ZIK genes in *C. sinensis*. The relative expression of these genes was analysed in different ~~developmental~~ stages, by using GraphPad Prism 8 software. The level of expression was in transcript per million (TPM). The numbers below represent the tea MAPKKK genes and the alphabets on the right represent the parameters of study.
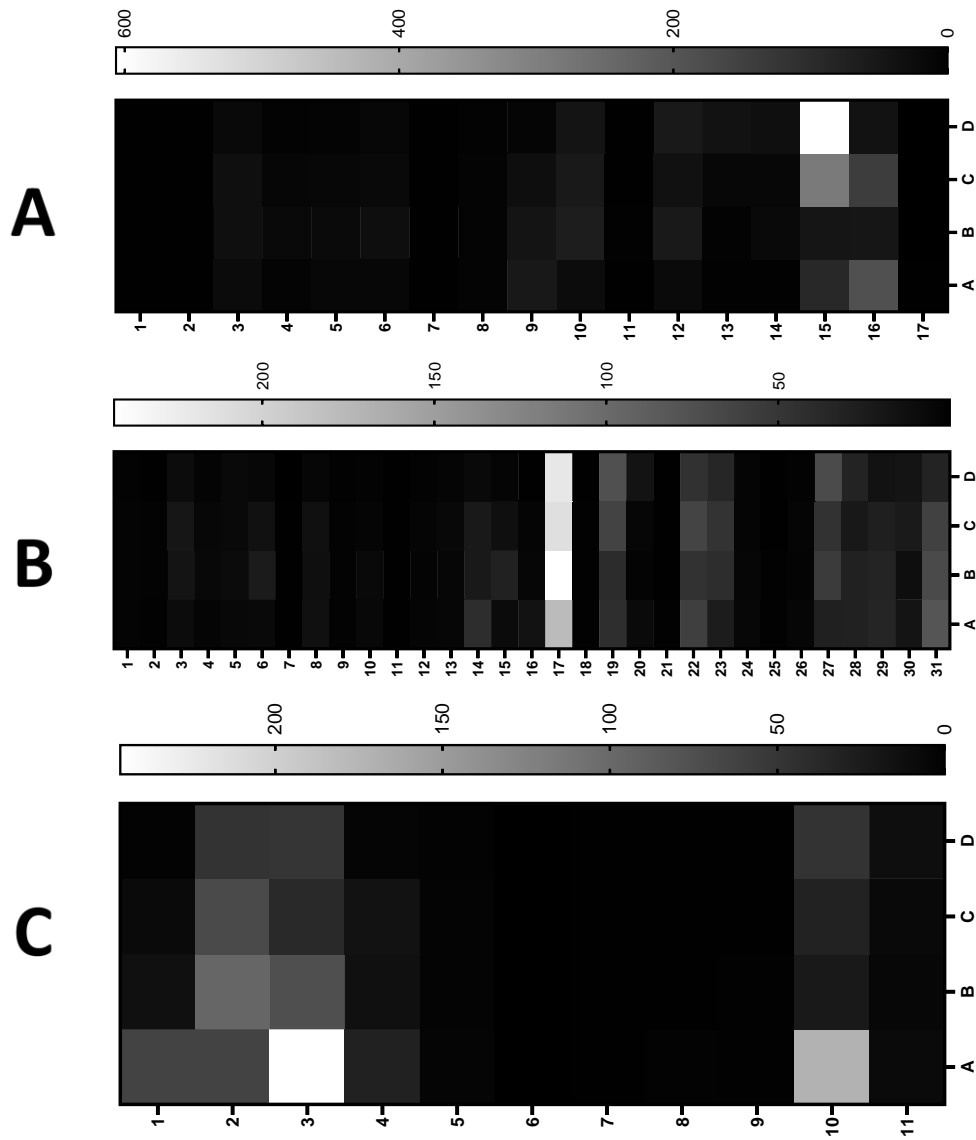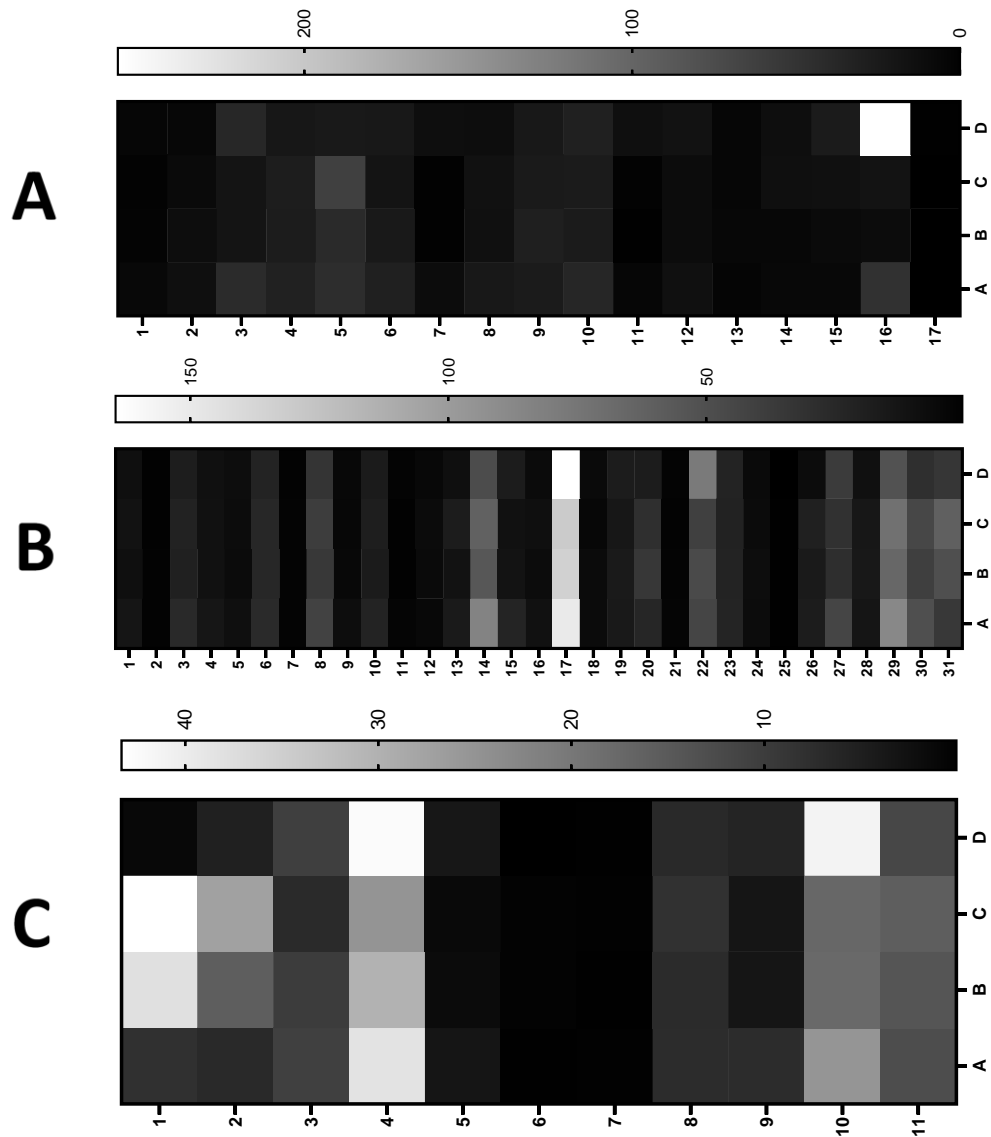
Supplementary Figure S10: Heat maps for drought stress expression patterns of A) MEKK; B) Raf and; C) ZIK genes in *C. sinensis*. The relative expression of these genes was analysed in different developmental stages, by using GraphPad Prism 8 software. The level of expression was in transcript per million (TPM). The numbers below represent the tea MAPKKK genes and the alphabets on the right represent the parameters of study.

Supplementary Figure S11: Heat maps for salt stress expression patterns of (A) MEKK (B) Raf and (C) ZIK genes in *C. sinensis*. The relative expression of these genes was analysed in different developmental stages, by using GraphPad Prism 8 software. The level of expression was in transcript per million (TPM). The numbers below represent the tea MAPKKK genes and the alphabets on the right represent the parameters of study.

Supplementary Figure S12: Heat maps for MeJA treatment expression patterns of (A) MEKK (B) Raf and (C) ZIK genes in *C. sinensis*. The relative expression of these genes was analysed in different developmental stages, by using GraphPad Prism 8 software. The level of expression was in transcript per million (TPM). The numbers below represent the tea MAPKKK genes and the alphabets on the right represent the parameters of study.