**Genome-wide identification of PP2A gene family in *Camellia sinensis* reveals the**

**potential role of *CsPP2A-TON2/FASS1* in abiotic stress**

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**Supplementary File 1**

**Table S1. BLAST positives table for PP2A gene family in *C. sinensis*.** The table shows both the A and B subfamilies. The PP2A protein sequences of *Arabidopsis thaliana* were used as query sequences to search for their homologs in tea database.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Arabidopsis PP2A gene IDs** | **Tea PP2A gene IDs** | **Identity percentage** | **Positive percentage** | **Gap percentage** |
| **A subfamily** |
| AtPP2A-A1 (AT1G25490) | TEA002042.1 | 66% | 75% | 14% |
| AtPP2A-A2 (AT3G25800) | TEA002042.1 | 71% | 76% | 14% |
| TEA011483.1 | 67% | 74% | 15% |
| AtPP2A-A3 (AT1G13320) | TEA002042.1 | 70% | 76% | 14% |
| TEA011483.1 | 66% | 74% | 14% |
| **B subfamily** |
| AtPP2ABBα (AT1G51690) | TEA015525.1 | 77% | 84% | 6% |
| AtPP2ABBβ (AT1G17720) | TEA015525.1 | 77% | 84% | 8% |
| AtPP2AB'α (AT5G03470) | TEA021355.1 | 69% | 84% | 2% |
| TEA019300.1 | 65% | 80% | 1% |
| AtPP2AB'β (AT3G09880) | TEA021355.1 | 71% | 83% | 2% |
| TEA019300.1 | 69% | 83% | 0% |
| AtPP2AB′γ (AT4G15415) | TEA015045.1 | 70% | 78% | 9% |
| TEA019300.1 | 69% | 79% | 6% |
| AtPP2AB′δ (AT3G26030) | TEA019300.1 | 69% | 83% | 1% |
| TEA015045.1 | 55% | 70% | 14% |
| At PP2AB′ε (AT3G54930) | TEA021355.1 | 61% | 78% | 3% |
| TEA019300.1 | 62% | 79% | 0% |
| AtPP2AB′ζ (AT3G54930) | TEA015045.1 | 70% | 80% | 6% |
| AtPP2AB′η (AT3G26020) | TEA019300.1 | 79% | 88% | 0% |
| TEA015045.1 | 66% | 75% | 8% |
| AtPP2AB′θ (AT1G13460) | TEA019300.1 | 75% | 86% | 2% |
| TEA015045.1 | 64% | 74% | 10% |
| AtPP2AB′κ (AT5G25510) | TEA009324.1 | 71% | 85% | 1% |
| TEA000454.1 | 60% | 74% | 9% |
| At PP2AB′′α (AT5G44090) | TEA000364.1 | 74% | 84% | 1% |
| TEA021728.1 | 69% | 81% | 3% |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AtPP2AB′′β (AT5G28850) | TEA000364.1 | 78% | 87% | 1% |
| TEA021728.1 | 74% | 84% | 4% |
| AtPP2AB′′γ (AT5G28900) | TEA000364.1 | 72% | 85% | 2% |
| TEA021728.1 | 75% | 84% | 3% |
| AtPP2AB′′δ (AT1G54450) | TEA000364.1 | 75% | 85% | 1% |
| TEA021728.1 | 76% | 84% | 4% |
| AtPP2AB′′ε (AT1G03960) | TEA000364.1 | 75% | 85% | 1% |
| TEA021728.1 | 76% | 84% | 4% |
| At PP2A-TON2/FASS1 (AT5G18580) | TEA018948.1 | 79% | 82% | 13% |

Table S2. Table showing the list of all the cis-acting elements (CAREs) identified from 2 kbp upstream region of all the identified PP2A (A and B subfamily) genes of *C. sinensis.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl.****no.** | **Cis-regulatory element identified** | **Sequence** | **Sequence length** | **Tea genes** | **Specific function of the cis-regulatory element** |
| 1. | AACA-motif | TAACAAACTCCA | 12 | TEA002042.1 | Endosperm-specific negative expression |
| 2. | ABRE | ACGTG/ CACGTG/ GCAACGTGTC | 5/ 6/ 10 | TEA002042.1/ TEA011483.1/ TEA015525.1/ TEA019300.1/ TEA015045.1/ TEA000454.1/TEA000364.1/ TEA018948.1 | Abscisic acid responsiveness |
| 3. | Box 4 | ATTAAT | 6 | TEA002042.1/ TEA011483.1/ TEA015525.1/ TEA021355.1/ TEA019300.1/ TEA015045.1/ TEA009324.1/ TEA000454.1/ TEA000364.1/ TEA018948.1 | Conserved DNA module involved in light responsiveness |
| 4. | CAT-box | GCCACT | 6 | TEA002042.1/TEA000364.1/ TEA018948.1 | Meristem expression |
| 5. | G-box | CACGTC/ CACGTGAAA/ TAAACGTG/ TCCACATGGCA | 6/ 8/ 9/ 10 | TEA011483.1/ TEA015525.1/ TEA019300.1/ TEA015045.1/ TEA000454.1/TEA000364.1/ TEA018948.1 | Light responsiveness |
| 6. | GCN4-motif | TGAGTCA | 7 | TEA002042.1/ TEA019300.1 | Endosperm expression |
| 7. | GT1-motif | GGTTAAT/ GGTTAA | 6/ 7 | TEA002042.1/ TEA011483.1/ TEA021355.1/ TEA019300.1/TEA015045.1/ | Light responsiveness |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  | TEA009324.1/ TEA018948.1 |  |
| 8. | LAMP-element | CTTTATCA | 8 | TEA002042.1 | Light responsiveness |
| 9. | LTR | CCGAAA | 6 | TEA002042.1/ TEA011483.1/ TEA015045.1/TEA021728.1/ TEA018948.1 | Low-temperature responsiveness |
| 10. | TCCC-motif | TCTCCCT | 7 | TEA002042.1/ TEA015525.1/ TEA015045.1/TEA000364.1/ TEA018948.1 | Light responsiveness |
| 11. | 3-AF1 binding site | TAAGAGAGGAA | 11 | TEA011483.1 | Light responsiveness |
| 12. | AE-box | AGAAACAA | 8 | TEA011483.1/ TEA021355.1/ TEA019300.1 | Light responsiveness |
| 13. | ARE | AAACCA | 6 | TEA011483.1/ TEA015525.1/ TEA021355.1/ TEA019300.1/ TEA015045.1/ TEA009324.1/ TEA021728.1/TEA018948.1 | Regulatory element essential for the anaerobic induction |
| 14. | AT-rich sequence | TAAAATACT | 9 | TEA011483.1 | Maximal elicitor-mediated activation |
| 15. | AT1-motif | AATTATTTTTTATT | 14 | TEA011483.1 | Light responsiveness |
| 16. | CGTCA-motif | CGTCA | 5 | TEA011483.1/ TEA015525.1/ TEA021355.1/ TEA019300.1/ TEA015045.1/ TEA009324.1/ TEA000454.1/ TEA000364.1/ TEA021728.1/ TEA018948.1 | MeJA-responsiveness |
| 17. | MBS | CAACTG | 6 | TEA011483.1/TEA019300.1/ TEA015045.1 | Drought-inducibility |
| 18. | O2-site | GTTGACGTGA/ GATGATGTGG | 10 | TEA011483.1/ TEA015525.1/ TEA021355.1/TEA015045.1/ TEA018948.1 | Regulatory element involved in zein metabolism regulation |
| 19. | P-box | CCTTTTG | 7 | TEA011483.1/ TEA019300.1/ TEA009324.1 | Gibberellin-responsive element |
| 20. | TCA-element | CCATCTTTTT/ TCAGAAGAGG | 10 | TEA011483.1/ TEA019300.1/ TEA009324.1/ TEA000454.1/TEA000364.1 | Salicylic acid responsiveness |
| 21. | TCT-motif | TCTTCA | 6 | TEA011483.1/ TEA009324.1/TEA000454.1/ TEA000364.1 | Light responsive element |
| 22. | TGACG-motif | TGACG | 5 | TEA011483.1/ TEA015525.1/ TEA021355.1/ TEA019300.1/ TEA015045.1/TEA009324.1/ TEA000454.1/ | MeJA-responsiveness |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  | TEA000364.1/ TEA021728.1/TEA018948.1 |  |
| 23. | AT-rich element | ATAGAAATCAA | 11 | TEA015525.1/ TEA000454.1/ TEA021728.1 | binding site of AT-rich DNA binding protein |
| 24. | Box II | ACACGTAGA | 9 | TEA015525.1 | Light responsive element |
| 25. | HD-Zip 3 | GTAAT(G/C)ATTAC | 11 | TEA015525.1 | Protein binding site |
| 26. | MBSI | AAAAAAC(G/C)GTTA | 12 | TEA015525.1/ TEA019300.1/ TEA018948.1 | Involved in flavonoid biosynthetic genes regulation |
| 27. | TC-rich repeats | ATTCTCTAAC | 10 | TEA015525.1/ TEA021355.1/ TEA018948.1 | Involved in defense and stress responsiveness |
| 28. | GATA-motif | AAGGATAAGG/ AAGATAAGATT/ GATAGGA | 7/ 10/ 11 | TEA021355.1/ TEA019300.1/ TEA009324.1/TEA000364.1 | Light responsive element |
| 29. | Gap-box | CAAATGAA(A/G)A | 10 | TEA021355.1 | Light responsive element |
| 30. | RY-element | CATGCATG | 8 | TEA021355.1/ TEA019300.1 | Regulatory element involved in seed-specific regulation |
| 31. | TGA-element | AACGAC | 6 | TEA021355.1/ TEA019300.1 | Auxin responsive element |
| 32. | CCAAT-box | CAACGG | 6 | TEA019300.1/ TEA015045.1/ TEA018948.1 | MYBHv1 binding site |
| 33. | I-box | CGATAAGGCG | 10 | TEA019300.1 | Light responsive element |
| 34. | ACE | GACACGTATG | 10 | TEA015045.1 | Light responsive element |
| 35. | ATCT-motif | AATCTAATCC | 10 | TEA015045.1/TEA009324.1/ TEA000364.1 | Light responsive element |
| 36. | GA-motif | ATAGATAA | 8 | TEA015045.1 | Light responsive element |
| 37. | MSA-like element | TCCAACGGT | 9 | TEA015045.1 | Cell cycle regulation |
| 38. | GARE-motif | TCTGTTG | 7 | TEA009324.1 | Gibberellin responsive element |
| 39. | HD-Zip 1 | CAAT(A/T)ATTG | 9 | TEA009324.1 | Differentiation of the palisade mesophyll cells |
| 40. | MRE | AACCTAA | 7 | TEA009324.1/TEA000364.1/ TEA018948.1 | Light responsive element |
| 41. | Sp1 | GGGCGG | 6 | TEA009324.1/ TEA000364.1 | Light responsive element |
| 42. | chs-CMA1a | TTACTTAA | 8 | TEA009324.1/ TEA018948.1 | Light responsive element |
| 43. | Chs-CMA2a | TCACTTGA | 8 | TEA000454.1 | Light responsive element |
| 44. | GC-motif | CCCCCG | 6 | TEA000364.1 | Anoxic specific inducibility |
| 45. | Box III | ATCATTTTCACT | 12 | TEA018948.1 | Protein binding site |

**Table S3: GO enrichment analysis of the PP2A genes (A and B subfamilies) of *C. sinensis*.** The potential functions of the PP2A genes have been classified in 3 major categories based on their biological function, cellular component and molecular function.

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| --- |
| **B I O L O G I C A L P R O C E S S** |
| **GO Ids** | **Description** | **Frequency of genes** | **Genes** | **References** |
| GO:0051225 | Spindle assembly | 1 | TEA019300.1 | Matsuoka et al., 2007; Binns et al., 2009 |
| GO:0007165 | Signal transduction | 2 | TEA015045.1/ TEA009324.1 | Ruiz-Gómez et al., 1997; Binns et al., 2009 |
| GO:0023052 | Signaling | 2 | TEA015045.1/ TEA009324.1 | Kido et al., 2002; Zhang et al., 2013; Binns et al., 2009 |
| GO:0000913 | Preprophase band assembly | 1 | TEA018948.1 | Binns et al., 2009 |
| GO:0000226 | Microtubule cytoskeleton organisation | 1 | TEA018948.1 | Subramanian et al., 2010; Binns et al., 2009 |
| GO:0030865 | Cortical cytoskeleton organisation | 1 | TEA018948.1 | Binns et al., 2009 |
| **C E L L U L A R C O M P O N E N T** |
| **GO Ids** | **Description** | **Number of****genes** | **Genes** | **References** |
| GO:0000159 | Protein phosphatase type 2A complex | 3 | TEA015525.1/ TEA015045.1/ TEA009324.1 | Rossio et al., 2013; McCright and Virshup, 1995; Binns et al., 2009 |
| GO:0070652 | HAUS complex | 1 | TEA019300.1 | Lawo et al., 2009; Binns et al., 2009 |
| GO:0008287 | Protein serine/threonine phosphatase complex | 2 | TEA015045.1/ TEA009324.1 | Binns et al., 2009 |
| GO:0005634 | Nucleus | 1 | TEA018948.1 | Baskaran and Rao, 1991; Binns et al., 2009 |
| GO:0009524 | Phragmoplast | 1 | TEA018948.1 | Binns et al., 2009 |
| GO:0005813 | Centrosome | 1 | TEA018948.1 | Jakobsen et al., 2011; Binns et al., 2009 |
| GO:0005819 | Spindle | 1 | TEA018948.1 | Özlü et al., 2010; Binns et al., 2009 |
| **M O L E C U L A R F U N C T I O N** |
| **GO Ids** | **Description** | **Number of genes** | **Genes** | **References** |
| GO:0008601 | Protein phosphatase type 2A regulator activity | 2 | TEA015525.1/ TEA009324.1 | Rossio et al., 2013; McCright and Virshup, 1995; Binns et al., 2009 |
| GO:0019888 | Protein phosphatase regulator activity | 2 | TEA015045.1/ TEA009324.1 | Rossio et al., 2013; McCright and Virshup, 1995; Binns et al., 2009 |
| GO:0046872 | Metal ion binding | 2 | TEA000364.1/ TEA018948.1 | Gugnoni et al., 2017; Brown, 2005; Binns et al., 2009 |
| GO:0005509 | Calcium ion binding | 1 | TEA018948.11 | Bumba et al., 2016; Binns et al., 2009 |

**Table S4: RMSD (root mean square deviation) score values of superimposed arabidopsis and tea plant PP2A proteins.** The superimposed protein pairs with lowest RMSD scores are colour coded (blue depicting arabidopsis proteins and green depicting tea proteins).

|  |  |  |
| --- | --- | --- |
| **Arabidopsis PP2A gene IDs** | **Tea PP2A gene IDs** | **RMSD scores** |
| **A subfamily** |
| AtPP2A-A1 (AT1G25490) | TEA002042.1 (CsPP2A-A1) | 2.784 |
| TEA011483.1 (CsPP2A-A2) | 2.090 |
| AtPP2A-A2 (AT3G25800) | TEA002042.1 (CsPP2A-A1) | **0.009** |
| TEA011483.1 (CsPP2A-A2) | 0.624 |
| AtPP2A-A3 (AT1G13320) | TEA002042.1 (CsPP2A-A1) | 0.035 |
| TEA011483.1 (CsPP2A-A2) | **0.616** |
| **B subfamily** |
| AtPP2ABBα (AT1G51690) | TEA015525.1 (CsPP2A-B1) | 0.452 |
| AtPP2ABBβ (AT1G17720) | TEA015525.1 (CsPP2A-B1) | **0.303** |
| AtPP2AB'α (AT5G03470) | TEA021355.1 (CsPP2A-B2) | 0.337 |
| TEA019300.1 (CsPP2A-B3) | 0.619 |
| AtPP2AB'β (AT3G09880) | TEA021355.1 (CsPP2A-B2) | **0.300** |
| TEA019300.1 (CsPP2A-B3) | **0.492** |
| AtPP2AB′γ (AT4G15415) | TEA015045.1 (CsPP2A-B4) | 0.372 |
| TEA019300.1 (CsPP2A-B3) | 0.588 |
| AtPP2AB′δ (AT3G26030) | TEA019300.1 (CsPP2A-B3) | 0.609 |
| TEA015045.1 (CsPP2A-B4) | 0.533 |

|  |  |  |
| --- | --- | --- |
| AtPP2AB′ε (AT3G54930) | TEA021355.1 (CsPP2A-B2) | 0.509 |
| TEA019300.1 (CsPP2A-B3) | 0.597 |
| AtPP2AB′ζ (AT3G54930) | TEA015045.1 (CsPP2A-B4) | 0.383 |
| AtPP2AB′η (AT3G26020) | TEA019300.1 (CsPP2A-B3) | 0.474 |
| TEA015045.1 (CsPP2A-B4) | 0.390 |
| AtPP2AB′θ (AT1G13460) | TEA019300.1 (CsPP2A-B3) | 0.510 |
| TEA015045.1 (CsPP2A-B4) | **0.367** |
| AtPP2AB′κ (AT5G25510) | TEA009324.1 (CsPP2A-B5) | **0.214** |
| TEA000454.1 (CsPP2A-B6) | **0.558** |
| AtPP2AB′′α (AT5G44090) | TEA000364.1 (CsPP2A-B7) | 18.511 |
| TEA021728.1 (CsPP2A-B8) | 0.373 |
| AtPP2AB′′β (AT5G28850) | TEA000364.1 (CsPP2A-B7) | 18.486 |
| TEA021728.1 (CsPP2A-B8) | **0.327** |
| AtPP2AB′′γ (AT5G28900) | TEA000364.1 (CsPP2A-B7) | 18.521 |
| TEA021728.1 (CsPP2A-B8) | 0.497 |
| AtPP2AB′′δ (AT1G54450) | TEA000364.1 (CsPP2A-B7) | 18.401 |
| TEA021728.1 (CsPP2A-B8) | 0.529 |
| AtPP2AB′′ε (AT1G03960) | TEA000364.1 (CsPP2A-B7) | 18.401 |
| TEA021728.1 (CsPP2A-B8) | 0.529 |
| AtPP2A-TON2/FASS1 (AT5G18580) | TEA018948.1 (CsPP2A-B9) | **0.428** |
| **CsPP2A-B7 superimposed with all AtPP2A proteins** |
| TEA000364.1 (CsPP2A-B7) | AtPP2A-A1 (AT1G25490) | 11.707 |
| AtPP2A-A2 (AT3G25800) | 17.0 |
| AtPP2A-A3 (AT1G13320) | 12.052 |
| AtPP2ABBα (AT1G51690) | 17.109 |
| AtPP2ABBβ (AT1G17720) | 17.304 |
| AtPP2AB'α (AT5G03470) | 20.492 |
| AtPP2AB'β (AT3G09880) | 20.676 |
| AtPP2AB′γ (AT4G15415) | 17.492 |
| AtPP2AB′δ (AT3G26030) | 22.138 |
| AtPP2AB′ε (AT3G54930) | 16.561 |
| AtPP2AB′ζ (AT3G54930) | 16.818 |
| AtPP2AB′η (AT3G26020) | 20.207 |
| AtPP2AB′θ (AT1G13460) | 21.040 |
| AtPP2AB′κ (AT5G25510) | 20.979 |
| AtPP2A-TON2/FASS1 (AT5G18580) | 17.333 |

Table S5: Z-scores of the predicted PP2A protein structures of arabidopsis and tea plant.

|  |  |  |
| --- | --- | --- |
| **Sl.No.** | **Arabidopsis** | **Z-score** |
| Sub-unit A |
| 1 | AtPP2AA1 | -14.65 |
| 2 | AtPP2AA2 | -14.51 |
| 3 | AtPP2AA3 | -14.26 |
| Sub-unit B |
| 1 | AtPP2ABBα | -7.42 |
| 2 | AtPP2ABBβ | -6.93 |
| 3 | AtPP2AB'α | -10.12 |
| 4 | AtPP2AB'β | -10.36 |
| 5 | AtPP2AB′γ | -9.51 |
| 6 | AtPP2AB′δ | -9.98 |
| 7 | AtPP2AB′ε | -9.42 |
| 8 | AtPP2AB′ζ | -9.25 |
| 9 | AtPP2AB′η | -9.41 |
| 10 | AtPP2AB′θ | -10.04 |
| 11 | AtPP2AB′κ | -10.09 |
| 12 | AtPP2AB′′α | -10.6 |
| 13 | AtPP2AB′′β | -9.04 |
| 14 | AtPP2AB′′γ | -9.93 |
| 15 | AtPP2AB′′δ | -9.68 |

|  |  |  |
| --- | --- | --- |
| 16 | AtPP2AB′′ε | -9.74 |
| 17 | AtPP2A-TON2-FASS1 | -9.35 |
| **Sl.No.** | **Tea** | **Z-score** |
| Sub-unit A |
| 1 | CsPP2AA1 | -12.33 |
| 2 | CsPP2AA2 | -12.49 |
| Sub-unit B |
| 1 | CsPP2AB1 | -5.62 |
| 2 | CsPP2AB2 | -9.8 |
| 3 | CsPP2AB3 | -9.77 |
| 4 | CsPP2AB4 | -9.06 |
| 5 | CsPP2AB5 | -10.2 |
| 6 | CsPP2AB6 | -9.47 |
| 7 | CsPP2AB7 | -3.35 |
| 8 | CsPP2AB8 | -8.48 |
| 9 | CsPP2AB9 | -7.54 |

Table S6. Tissue specific expression levels of all the tea PP2A (A and B subfamilies) genes. The expressionvalues have been given in transcripts per million (TPM).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Gene** | **Apical bud** | **Flower** | **Fruit** | **Young leaf** | **Mature leaf** | **Old leaf** | **Root** | **Stem** |
| **TEA002042.1** (*CsPP2A-A1*) | 47.21572779 | 40.80571594 | 31.76685047 | 41.69425108 | 35.81367386 | 27.40336594 | 37.71095723 | 42.74203902 |
| **TEA011483.1** (*CsPP2A-A2*) | 24.62665564 | 22.19557771 | 17.60154028 | 26.43921163 | 28.91821916 | 25.25322891 | 23.80559258 | 28.26086708 |
| **TEA015525.1** (*CsPP2A-B1/ CsPP2AB55α*) | 37.04537571 | 47.20326481 | 33.85966082 | 31.24712013 | 34.92274028 | 33.11385135 | 30.15113927 | 44.75998601 |
| **TEA021355.1** (*CsPP2A-B2/**CsPP2AB'α*) | 9.529215895 | 18.42935977 | 19.34707205 | 7.627519724 | 16.05536558 | 18.28051731 | 25.69554707 | 13.72203951 |
| **TEA019300.1** (*CsPP2A-B3/**CsPP2AB'β*) | 16.14257955 | 18.78087345 | 12.88586282 | 16.79768389 | 17.86507442 | 15.03354923 | 13.13175634 | 27.08853597 |
| **TEA015045.1** (*CsPP2A-B4/**CsPP2AB′γ*) | 15.52779143 | 11.1078321 | 13.68094797 | 15.5378576 | 13.12270921 | 13.16197246 | 8.362803812 | 14.47156267 |
| **TEA009324.1** (*CsPP2A-B5/**CsPP2AB′δ*) | 60.67958767 | 33.52436126 | 28.33062039 | 47.45345698 | 25.79995163 | 23.96488769 | 22.10169579 | 42.31923108 |
| **TEA000454.1** (*CsPP2A-B6/**CsPP2AB′ε*) | 34.05047929 | 8.817971597 | 28.09300873 | 27.63047595 | 25.37304596 | 10.93349035 | 14.56146284 | 53.76387328 |
| **TEA000364.1** (*CsPP2A-B7/**CsPP2AB′′α*) | 10.61826914 | 10.46506424 | 16.20328708 | 9.855783914 | 25.59577935 | 19.15972314 | 10.26255081 | 18.09425798 |
| **TEA021728.1** (*CsPP2A-B8/**CsPP2AB′′β*) | 9.265735271 | 14.12080645 | 6.269292124 | 7.901767625 | 7.860632745 | 8.896518422 | 6.658907016 | 11.02183425 |
| **TEA018948.1** (*CsPP2A-B9/**CsPP2A-TON2/FASS1*) | 68.58400638 | 37.60191988 | 50.24572609 | 56.64933189 | 58.38399126 | 28.53501701 | 38.60207567 | 77.48916427 |

Table S7. Expression levels of all the tea PP2A (A and B subfamilies) genes under cold stress. The expression values have been given in transcripts per million (TPM).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Gene** | **CK** | **CA1-6h** | **CA1-7d** | **CA2-7d** | **DA-7d** |
| **TEA002042.1** (*CsPP2A-A1*) | 14.94166702 | 14.98687437 | 24.65551908 | 20.48601978 | 22.50249662 |
| **TEA011483.1** (*CsPP2A-A2*) | 12.0135845 | 16.95642297 | 34.57665424 | 32.35170119 | 31.64737073 |
| **TEA015525.1** (*CsPP2A-B1/ CsPP2AB55α*) | 25.91937849 | 36.74039526 | 33.38519604 | 31.34630639 | 40.98103367 |
| **TEA021355.1** (*CsPP2A-B2/**CsPP2AB'α*) | 6.716083372 | 9.135039656 | 8.736038605 | 10.16537437 | 8.474511159 |
| **TEA019300.1** (*CsPP2A-B3/**CsPP2AB'β*) | 11.83924386 | 11.61672681 | 11.82388573 | 12.59277818 | 20.26149549 |
| **TEA015045.1** (*CsPP2A-B4/**CsPP2AB′γ*) | 8.169191029 | 10.14048911 | 10.89530963 | 9.231106787 | 10.62905125 |
| **TEA009324.1** (*CsPP2A-B5/**CsPP2AB′δ*) | 15.08151541 | 16.70445591 | 19.71885706 | 14.91196819 | 22.78843744 |
| **TEA000454.1** (*CsPP2A-B6/**CsPP2AB′ε*) | 17.39514944 | 12.95545831 | 18.55729727 | 14.24543308 | 30.27790932 |
| **TEA000364.1** (*CsPP2A-B7/**CsPP2AB′′α*) | 16.14767971 | 22.25696882 | 29.90380946 | 27.53449178 | 20.09900982 |
| **TEA021728.1** (*CsPP2A-B8/**CsPP2AB′′β*) | 3.8381915 | 5.872838043 | 7.513193665 | 8.553197029 | 7.955886338 |
| **TEA018948.1** (*CsPP2A-B9/**CsPP2A-TON2/FASS1*) | 37.05429502 | 34.15958648 | 48.10258924 | 38.75172329 | 37.91671528 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gene** | **N-0h** | **PEG-N-24h** | **PEG-N-48h** | **PEG-N-72h** |
| **TEA002042.1** (*CsPP2A-A1*) | 15.65475514 | 15.3922017 | 17.31353401 | 10.6092825 |
| **TEA011483.1** (*CsPP2A-A2*) | 20.44895222 | 29.38649816 | 28.19320673 | 29.54603352 |
| **TEA015525.1** (*CsPP2A-B1/ CsPP2AB55α*) | 21.70161935 | 22.17854927 | 27.21974434 | 29.76187135 |
| **TEA021355.1** (*CsPP2A-B2/**CsPP2AB'α*) | 23.48729362 | 16.47441788 | 14.74138142 | 10.44243976 |
| **TEA019300.1** (*CsPP2A-B3/**CsPP2AB'β*) | 9.430656737 | 7.864161184 | 9.22253428 | 8.00933972 |
| **TEA015045.1** (*CsPP2A-B4/**CsPP2AB′γ*) | 7.94179204 | 5.628877946 | 8.384088712 | 6.938951726 |
| **TEA009324.1** (*CsPP2A-B5/**CsPP2AB′δ*) | 15.49992789 | 9.076555023 | 11.39668463 | 6.259356932 |
| **TEA000454.1** (*CsPP2A-B6/**CsPP2AB′ε*) | 11.67024722 | 3.327453586 | 4.487936175 | 2.953864933 |
| **TEA000364.1** (*CsPP2A-B7/**CsPP2AB′′α*) | 8.085322634 | 7.261598955 | 9.326169493 | 5.434333542 |
| **TEA021728.1** (*CsPP2A-B8/**CsPP2AB′′β*) | 2.16848464 | 1.252870294 | 1.845972174 | 0.922720193 |
| **TEA018948.1** (*CsPP2A-B9/**CsPP2A-TON2/FASS1*) | 44.07960441 | 34.0285492 | 33.33523421 | 24.44984591 |

Table S8. Expression levels of all the tea PP2A (A and B subfamilies) genes under drought stress. The expression values have been given in transcripts per million (TPM).

Table S9. Expression levels of all the tea PP2A (A and B subfamilies) genes under salt stress. The expression values have been given in transcripts per million (TPM).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gene** | N-0h | NaCl-N-24h | NaCl-N-48h | NaCl-N-72h |
| **TEA002042.1** (*CsPP2A-A1*) | 15.6548114 | 12.53771727 | 22.22134624 | 13.3017552 |
| **TEA011483.1** (*CsPP2A-A2*) | 20.44888353 | 20.05054861 | 29.93686394 | 20.75280972 |
| **TEA015525.1** (*CsPP2A-B1/ CsPP2AB55α*) | 21.70167614 | 22.61683709 | 21.6520741 | 21.55674018 |
| **TEA021355.1** (*CsPP2A-B2/**CsPP2AB'α*) | 23.4872405 | 13.29511559 | 14.99865167 | 10.34026131 |
| **TEA019300.1** (*CsPP2A-B3/**CsPP2AB'β*) | 9.430656994 | 5.721107879 | 6.768927465 | 7.832598855 |
| **TEA015045.1** (*CsPP2A-B4/**CsPP2AB′γ*) | 7.941793644 | 7.702377388 | 7.004938982 | 9.571082648 |
| **TEA009324.1** (*CsPP2A-B5/**CsPP2AB′δ*) | 15.5000324 | 8.064401012 | 9.957025196 | 9.683604233 |
| **TEA000454.1** (*CsPP2A-B6/**CsPP2AB′ε*) | 11.67024947 | 3.891342593 | 4.473769137 | 4.840359748 |
| **TEA000364.1** (*CsPP2A-B7/**CsPP2AB′′α*) | 8.085331877 | 9.403392329 | 7.439085003 | 5.55347162 |
| **TEA021728.1** (*CsPP2A-B8/**CsPP2AB′′β*) | 2.168478586 | 1.219126403 | 1.265975855 | 0.376279266 |
| **TEA018948.1** (*CsPP2A-B9/**CsPP2A-TON2/FASS1*) | 44.07954578 | 42.21157141 | 36.80374791 | 32.64214068 |

Table S10. Expression levels of all the tea PP2A (A and B subfamilies) genes under MeJA hormonal treatment. The expression values have been given in transcripts per million (TPM).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gene** | CK | 12h\_MeJA | 24h\_MeJA | 48h\_MeJA |
| **TEA002042.1** (*CsPP2A-A1*) | 47.02620531 | 34.32444171 | 36.15884391 | 36.88570569 |
| **TEA011483.1** (*CsPP2A-A2*) | 49.36381488 | 35.04229683 | 34.88926124 | 35.5003364 |
| **TEA015525.1** (*CsPP2A-B1/ CsPP2AB55α*) | 33.32017551 | 24.93300914 | 23.4555809 | 25.51736133 |
| **TEA021355.1** (*CsPP2A-B2/**CsPP2AB'α*) | 7.177103943 | 4.718190447 | 5.369504128 | 9.189417609 |
| **TEA019300.1** (*CsPP2A-B3/**CsPP2AB'β*) | 22.16350853 | 18.36343527 | 17.42011619 | 18.19315429 |
| **TEA015045.1** (*CsPP2A-B4/**CsPP2AB′γ*) | 17.24607163 | 10.48931855 | 10.04656705 | 11.90360326 |
| **TEA009324.1** (*CsPP2A-B5/**CsPP2AB′δ*) | 25.45051186 | 20.84969736 | 18.1574396 | 20.12688119 |
| **TEA000454.1** (*CsPP2A-B6/**CsPP2AB′ε*) | 35.19282684 | 31.01342393 | 26.41231077 | 35.27980128 |
| **TEA000364.1** (*CsPP2A-B7/**CsPP2AB′′α*) | 17.98121505 | 12.67507272 | 12.45995889 | 16.76208854 |
| **TEA021728.1** (*CsPP2A-B8/**CsPP2AB′′β*) | 9.409586 | 7.492451367 | 6.948283688 | 6.267398179 |
| **TEA018948.1** (*CsPP2A-B9/**CsPP2A-TON2/FASS1*) | 58.14941128 | 47.0949077 | 43.38020194 | 62.60472752 |

 **Table S11: Primers of PP2A genes of tea plant.**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Gene ID** | **Forward primer** | **Reverse primer** |
| 1 | TEA021355.1 *(CsPP2A-B2)* | TTCCAGGTAGCAGAACGAGC | ATTGGCAGTCAGCCCATGAA |
| 2 | TEA021728.1 *(CsPP2A-B8)* | CGACCACCCCATTGACTACA | CGGTGTGGAACGAAAAGACG |
| 3 | TEA018948.1 *(CsPP2A-B9)* | AGAAGGTTCCATCAGTCACAGG | AGTGAAACCTTTTCAGCACCAG |

 **Table S12: Relative expression levels of tea PP2A genes obtained through qRT-PCR.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stress induced** | **Highly Upregulated** | **Relatively expression level** | **Downregulated** | **Relatively expression level** |
| **Cold Stress****(4 degrees for 2-7 days)** | 0 | TEA018948.1*(CsPP2A-B9)* | 1 | TEA021728.1*(CsPP2A-B8)* | 1 |
| 2d | 8.6748.4217.592 | 0.5610.4760.488 |
| 7d | 10.5678.9919.214 | 0.3410.3460.299 |
| **Salt stress****(200mM NaCl for 0-72 hours)** | 0 | TEA018948.1*(CsPP2A-B9)* | 1 | TEA021728.1*(CsPP2A-B8)* | 1 |
| 24h | 3.8714.4413.992 | 0.6540.5420.588 |
| 48h | 5.8044.8515.866 | 0.5010.4350.425 |
| 72h | 6.0274.9846.551 | 0.4860.4190.467 |
| **Drought stress****(25%PEG for 48 and 72 hours)** | 0 | TEA018948.1*(CsPP2A-B9)* | 1 | TEA021728.1*(CsPP2A-B8)* | 1 |
| 48h | 6.5915.3756.513 | 0.4450.4010.394 |
| 72h | 4.4543.9923.800 | 0.56140.4640.500 |
| **Methyl Jasmonate** **(MeJA for 12, 24, and 48 hours)** | 0 | TEA018948.1*(CsPP2A-B9)* | 1 | TEA021355.1*(CsPP2A-B2)* | 1 |
| 12h | 0.5670.6020.649 | 0.4120.4520.476 |
| 24h | 0.7870.4810.523 | 0.5450.4890.458 |
| 48h | 4.6744.6523.925 | 0.5860.6520.621 |

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