## Figure S1

Figure S1 Two-year-old seedlings of *G. biloba*

## Figure S2

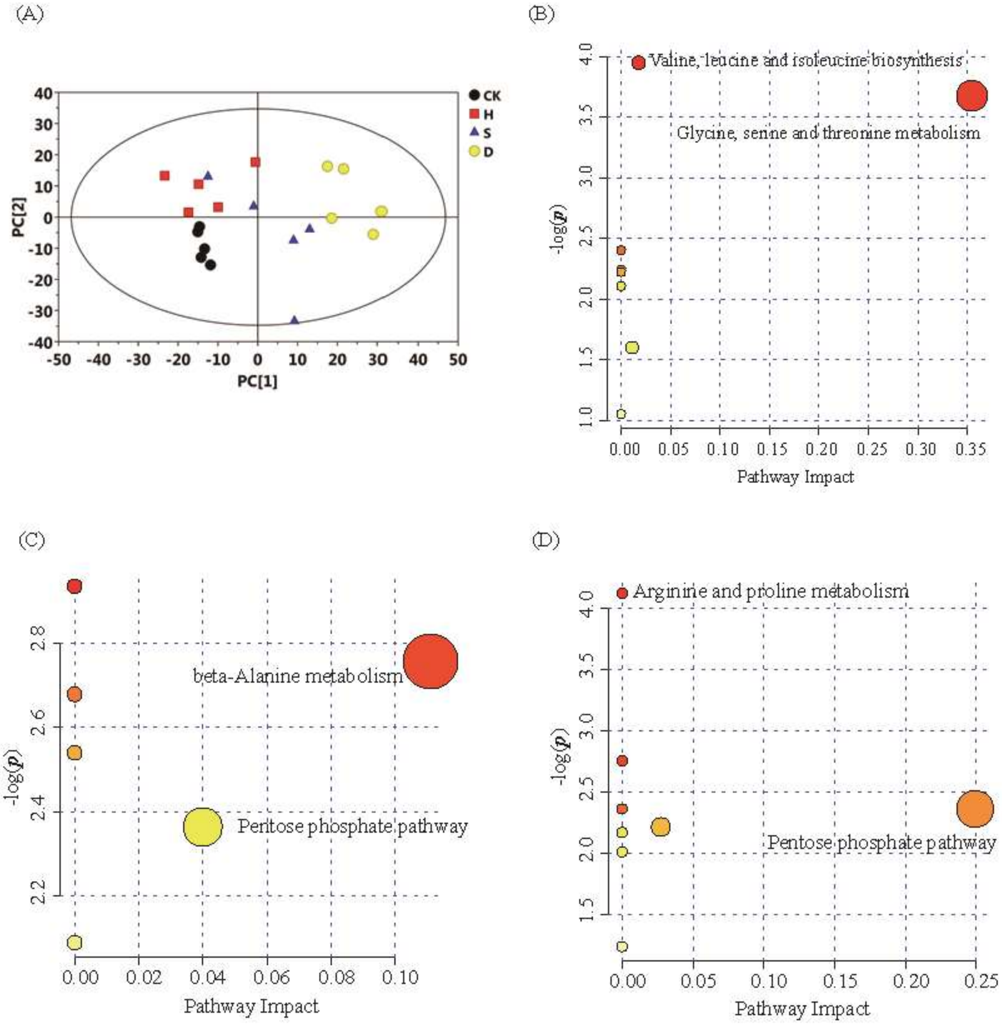

Figure S2. Metabolomic analyses and changes in metabolite levels in the leaves of *G. biloba* under the stress treatments. (A) Principal component analysis plot. Black circle = CK, red square = H, blue triangle = S, yellow circle = D. (B)–(D) Pathway enrichment of different metabolites (B) D vs. CK, (C) S vs. CK. and (D) H vs. CK. Each treatment was represented by five biological replicates. Circle color represents the p-value, whereas circle size is in proportion to the number of metabolites involved.

# Figure S3

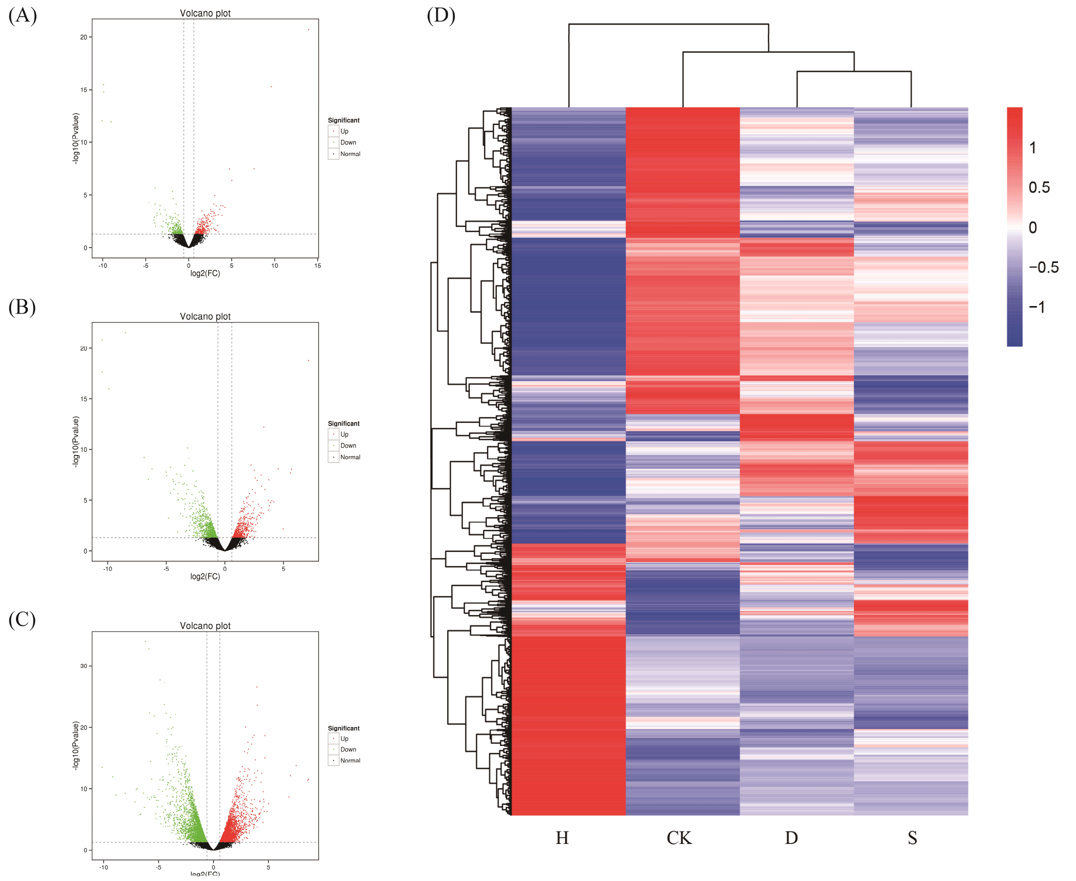

Figure S3 Analysis of DEGs under stress treatments. (A)–(C) Volcano plots of DEGs under (A) drought, (B) salt stress, and (C) heat stress. (D) Heatmap of DEGs under stress treatments. Red and blue indicate upregulation and downregulation, respectively.

Table S1 Major metabolites accumulated under stress treatments

| Metabolites | mean CK | Log$_2$(D/CK) | Log$_2$(S/CK) | Log$_2$(H/CK) |
|---|---|---|---|---|
| **Carbohydrate** | | | | |
| 2-deoxy-D-glucose 1 | 0.110 | 0.213 | -0.230 | -0.469 |
| 2-Deoxyerythritol | 0.000 | 18.535 | 16.845 | -0.078 |
| 3,6-Anhydro-D-galactose 4 | 0.014 | 0.367 | 0.197 | -0.299 |
| 6-deoxy-D-glucose 1 | 0.003 | -18.245 | -0.568 | 1.131 |
| arbutin | 0.005 | 0.108 | 0.653 | -0.125 |
| cellobiose 1 | 0.000 | -13.953 | 2.103 | 0.092 |
| Cellobiotol | 0.001 | 1.056 | 0.853 | 0.864 |
| D-Altrose 2 | 0.003 | -0.836 | 0.144 | -1.553 |
| d-Glucoheptose 1 | 0.003 | -0.197 | 0.188 | 0.651 |
| Digitoxose 1 | 0.016 | 0.678 | 0.538 | 0.454 |
| D-Talose 2 | 0.007 | -0.939 | -0.121 | 0.805 |
| Erythrose 2 | 0.020 | 0.339 | 0.664 | -0.145 |
| fructose 2 | 0.047 | -0.715 | -0.080 | 0.005 |
| fructose-6-phosphate | 0.000 | 0.265 | 0.199 | -1.383 |
| fucose 1 | 0.001 | -5.763 | -17.031 | 0.470 |
| Galactinol 3 | 0.008 | -0.268 | 0.153 | -1.038 |
| galactose 2 | 0.432 | -0.067 | -0.105 | -0.036 |
| Gentiobiose 1 | 0.018 | -0.468 | 0.076 | -0.730 |
| Glucose-1-phosphate | 0.049 | 0.318 | 0.436 | 0.419 |
| glucose-6-phosphate 1 | 0.015 | -0.008 | 0.215 | 0.367 |
| Isomaltose 1 | 0.000 | 17.463 | 17.130 | -0.078 |
| Isopropyl-beta-D-thiogalactopyranoside | 0.003 | 0.008 | 0.334 | 0.557 |
| lactose 2 | 0.000 | 16.091 | 14.886 | -0.078 |
| lactulose 2 | 0.004 | 0.090 | -0.180 | -0.061 |
| Levoglucosan | 0.004 | 0.374 | 0.084 | -1.603 |
| L-Threose 1 | 0.000 | 2.285 | 1.941 | 0.840 |
| Lyxose 1 | 0.001 | -0.009 | -0.464 | -0.601 |
| maltose | 0.009 | 0.290 | 1.138 | -0.152 |
| maltotriose 1 | 0.006 | -1.158 | -0.332 | -18.817 |
| mannose 2 | 0.560 | 0.130 | 0.126 | 0.575 |
| melibiose 2 | 0.006 | -0.039 | -0.310 | -0.020 |
| Palatinose | 0.019 | -0.517 | -0.196 | -0.533 |
| ribose | 0.004 | 0.418 | 1.076 | -0.749 |
| ribulose-5-phosphate 2 | 0.000 | -0.085 | -0.410 | -0.478 |
| salicin | 0.002 | 0.037 | -0.372 | 0.648 |
| Sophorose 2 | 0.010 | -0.888 | -0.468 | -0.662 |
| sorbose 1 | 1.516 | -1.333 | -0.096 | -0.120 |
| sucrose | 0.013 | -0.751 | -0.667 | -1.027 |
| Tagatose 1 | 0.102 | -0.170 | -0.562 | -0.004 |
| trehalose-6-phosphate | 0.014 | 0.389 | -0.010 | 1.149 |
| Sucrose-6-Phosphate | 0.230 | -0.424 | 0.569 | 0.780 |
| Turanose 1 | 0.000 | 0.215 | -1.339 | 0.006 |
| uridine 1 | 0.047 | -1.206 | -0.101 | -0.273 |
| xylose 1 | 0.016 | -0.019 | -0.524 | -1.183 |
| **Amino acids** | | | | |

| | | | | |
|---|---|---|---|---|
| 3-Hydroxynorvaline 2 | 0.001 | 0.941 | 0.433 | 0.587 |
| alanine 1 | 0.007 | -0.162 | 0.739 | -0.110 |
| beta-Alanine 2 | 0.002 | 0.376 | 0.409 | -0.169 |
| canavanine 1 | 0.000 | -0.065 | -0.147 | -0.753 |
| N-Methyl-DL-alanine | 0.001 | 0.287 | -0.351 | -0.868 |
| serine 2 | 0.003 | 1.702 | 0.764 | 0.705 |
| threonine 2 | 0.000 | 4.429 | 2.717 | 1.809 |
| valine | 0.005 | -0.585 | 0.519 | 0.032 |
| **Lipid** | | | | |
| 11-beta-prostaglandin-F-2-alpha 2 | 0.000 | 0.999 | 1.099 | 0.233 |
| D-erythronolactone 2 | 0.001 | 0.133 | -0.194 | 0.194 |
| Gluconic lactone 1 | 0.006 | -0.318 | 0.463 | -0.285 |
| Linoleic acid methyl ester | 0.006 | 1.001 | 1.362 | 0.430 |
| Methyl Palmitoleate | 0.001 | -16.144 | -0.184 | -1.325 |
| Ribonic acid, gamma-lactone | 0.006 | 0.809 | 0.131 | -0.030 |
| **Organic acid** | | | | |
| (2R,3S)-2-hydroxy-3- | 0.000 | 0.488 | 1.126 | 0.660 |
| 2,3-Dimethylsuccinic acid | 0.001 | 0.174 | 0.212 | -0.270 |
| 2-hydroxy-3-isopropylbutanedioic acid | 0.001 | 1.283 | 0.736 | 1.296 |
| 2-hydroxybutanoic acid | 0.000 | -14.273 | -0.562 | 0.452 |
| 2-Methylglutaric Acid | 0.002 | 0.786 | 0.884 | 0.740 |
| 3-Aminoisobutyric acid 1 | 0.002 | 0.185 | 0.525 | -0.227 |
| 3-Hexenedioic acid | 0.001 | 0.336 | 0.268 | 0.070 |
| 3-hydroxybenzoic acid | 0.002 | -0.290 | -0.945 | 0.139 |
| 1-Aminocyclopropanecarboxylic acid | 0.005 | 0.061 | -0.764 | -0.687 |
| 3-Hydroxypropionic acid 1 | 0.000 | 1.785 | 1.077 | -13.666 |
| 4-aminobutyric acid 1 | 0.000 | -0.722 | -0.449 | 4.761 |
| 4-Hydroxybenzoic acid | 0.004 | 0.007 | -0.296 | -0.058 |
| 4-hydroxybutyrate | 0.001 | 1.313 | 1.507 | 0.114 |
| 4-hydroxycinnamic acid | 0.017 | 0.608 | 0.284 | -0.327 |
| 6-hydroxy caproic acid | 0.001 | 0.617 | 0.870 | 0.725 |
| 6-phosphogluconic acid | 0.000 | 1.100 | 1.210 | 0.599 |
| Aminomalonic acid | 0.001 | 1.261 | 1.313 | 0.233 |
| arachidonic acid | 0.010 | -0.405 | -0.350 | -0.467 |
| beta-Mannosylglycerate 1 | 0.005 | 0.073 | 0.812 | 0.294 |
| Capric Acid | 0.001 | 1.390 | 0.962 | 1.456 |
| Chlorogenic Acid 2 | 0.000 | -0.410 | -0.133 | -0.128 |
| Citraconic acid 2 | 0.003 | 0.410 | 0.694 | 0.577 |
| Citramalic acid | 0.000 | -0.077 | 0.787 | 0.704 |
| citric acid | 0.000 | 1.323 | -2.913 | -14.077 |
| D-galacturonic acid 1 | 0.001 | -0.027 | -1.347 | -0.498 |
| D-Glyceric acid | 0.026 | 2.537 | 1.730 | 1.450 |
| Galactonic acid | 0.000 | 0.146 | 0.486 | 0.940 |
| Gallic acid | 0.004 | -0.601 | -0.467 | -0.993 |
| Glucoheptonic acid 2 | 0.004 | 0.109 | -1.206 | -1.513 |
| gluconic acid 2 | 0.000 | 15.911 | -0.214 | -0.078 |
| Glucosaminic acid | 0.000 | 2.384 | 1.282 | 2.855 |
| glucuronic acid 2 | 0.001 | 1.164 | 1.369 | 0.959 |
| Glutaric Acid | 0.001 | 0.047 | 0.648 | 0.218 |

|  |  |  |  |  |
|---|---|---|---|---|
| glycine 2 | 0.003 | 3.369 | 2.741 | 2.571 |
| glycolic acid | 0.020 | -0.236 | -0.171 | 0.158 |
| histidine 1 | 0.000 | -0.483 | 23.562 | -0.078 |
| isocitric acid 2 | 0.090 | -0.813 | -0.651 | -0.311 |
| Isoleucine | 0.001 | -0.493 | 0.906 | -0.407 |
| Itaconic acid | 0.001 | 1.415 | 0.977 | 2.010 |
| lactic acid | 0.014 | -0.691 | -0.790 | 0.278 |
| Lactobionic Acid 1 | 0.003 | 0.233 | 1.074 | 0.848 |
| L-Allothreonine 1 | 0.003 | -0.368 | -0.862 | -1.245 |
| linoleic acid | 0.001 | -0.586 | -0.444 | -1.547 |
| L-Malic acid | 0.307 | -0.076 | -0.069 | -0.021 |
| maleic acid | 0.002 | 1.109 | 0.542 | 0.120 |
| malonic acid 1 | 0.000 | 14.279 | 13.781 | 14.280 |
| mucic acid | 0.001 | -0.201 | -0.382 | -0.504 |
| oxalacetic acid | 0.000 | 0.262 | 1.228 | 1.867 |
| palmitic acid | 0.002 | 0.349 | 0.555 | 0.334 |
| prostaglandin A2 3 | 0.000 | -0.304 | -1.151 | -1.892 |
| Pyrrole-2-Carboxylic Acid | 0.004 | -18.862 | -18.593 | -18.457 |
| Pyruvic acid | 0.004 | -0.606 | 1.244 | 0.669 |
| quinic acid | 0.037 | -0.359 | 0.226 | -0.041 |
| Saccharic acid | 0.001 | -0.492 | -0.552 | -0.455 |
| shikimic acid | 0.003 | 0.110 | -1.676 | -18.140 |
| stearic acid | 0.002 | -0.254 | 0.131 | -0.537 |
| succinic acid | 0.027 | 1.119 | 0.917 | 0.541 |
| sulfuric acid | 0.015 | -0.036 | 0.736 | 0.777 |
| tartaric acid | 0.003 | -0.099 | 0.017 | 0.069 |
| Threonic acid | 0.005 | 0.578 | 0.224 | 0.273 |
| trans-3-hydroxycinnamic acid | 0.001 | -1.179 | -0.316 | -15.976 |
| urocanic acid 2 | 0.000 | 18.873 | 17.582 | -0.078 |
| **Phenols** |  |  |  |  |
| (+)-catechin | 0.000 | 16.984 | 18.104 | 15.392 |
| 1,2,4-Benzenetriol | 0.002 | 0.100 | 0.181 | 0.133 |
| catechol | 0.000 | 1.124 | 1.509 | 1.217 |
| phloroglucinol | 0.000 | -0.204 | -1.418 | -0.185 |
| pyrogallol | 0.001 | 0.307 | 0.444 | 0.270 |
| Thymol | 0.000 | 1.309 | 1.106 | 0.357 |
| resorcinol | 0.003 | 0.361 | 0.300 | -0.720 |
| **Flavonoid** |  |  |  |  |
| chrysin | 0.000 | -0.099 | 0.449 | -0.733 |
| Epicatechin | 0.009 | -1.207 | -0.950 | -0.715 |
| Epigallocatechin | 0.005 | 0.365 | -0.036 | -0.282 |
| Neohesperidin | 0.074 | 0.346 | 1.123 | -0.574 |
| Tricetin | 0.001 | -0.007 | 0.307 | 0.297 |
| **Others** |  |  |  |  |
| 1,3-diaminopropane | 0.000 | 2.341 | 3.463 | 3.392 |
| 2,3-Dihydroxypyridine | 0.001 | 0.303 | 0.448 | -0.088 |
| 2-hydroxypyridine | 0.653 | -0.695 | -0.395 | -0.418 |
| 3-Hydroxypyridine | 0.026 | -0.736 | -0.707 | -0.728 |
| 4-Androsten-11beta-ol-3,17-dione 1 | 0.000 | -0.252 | -0.356 | -0.474 |

| | | | | |
|---|---|---|---|---|
| 4-HYDROXYPYRIDINE | 0.006 | -0.075 | 0.382 | -0.467 |
| 7,8-Dimethylalloxazine | 0.000 | -0.318 | 0.482 | 0.054 |
| Aldosterone 2 | 0.000 | 0.247 | -0.773 | 0.074 |
| ascorbate | 0.023 | 0.015 | -0.549 | -0.283 |
| Biuret 3 | 0.000 | -13.158 | 1.370 | 0.617 |
| conduritol b epoxide 2 | 0.009 | 0.102 | 1.408 | 1.461 |
| creatine degr | 0.022 | 0.269 | 0.038 | 0.106 |
| D-Arabitol | 0.013 | -0.839 | 0.002 | 0.083 |
| D-erythro-sphingosine 1 | 0.007 | -0.389 | 0.048 | -0.235 |
| DL-Anabasine 1 | 0.003 | 0.876 | 0.935 | 0.340 |
| Ethanolamine | 0.014 | 1.430 | 0.377 | 0.760 |
| flavin adenine degrad product | 0.013 | -1.821 | 0.290 | 0.709 |
| fumaric acid | 0.004 | 1.013 | 0.969 | 1.015 |
| glutaraldehyde 3 | 0.000 | 16.366 | 15.936 | -0.078 |
| glycerol | 0.053 | 1.154 | 0.433 | 0.832 |
| inosine | 0.000 | -0.327 | 0.914 | 1.806 |
| Lactamide 2 | 0.257 | -1.531 | -1.196 | -0.449 |
| Maleamate 4 | 0.000 | -1.840 | -0.218 | -0.536 |
| myo-inositol | 8.083 | -0.313 | -0.117 | -0.327 |
| N-Acetyl-beta-D-mannosamine 4 | 0.013 | -1.099 | 0.419 | 0.169 |
| naringenin 2 | 0.147 | -1.119 | 0.127 | -0.599 |
| N-cyclohexylformamide 2 | 0.009 | 0.367 | 0.613 | -0.505 |
| oxamide | 0.000 | 16.526 | 16.422 | -0.078 |
| oxoproline | 0.045 | 0.566 | 0.350 | -1.342 |
| palatinitol 2 | 0.002 | -0.851 | 0.044 | 0.185 |
| Phenyl beta-D-glucopyranoside | 0.015 | 0.626 | 0.543 | -0.478 |
| phosphate | 0.692 | -0.397 | -0.725 | -1.105 |
| phytosphingosine 2 | 0.003 | 0.105 | 0.791 | -0.116 |
| piceatannol 2 | 0.001 | 0.122 | 1.276 | 0.467 |
| putrescine 2 | 0.043 | -0.317 | -0.346 | -1.096 |
| Threitol | 0.005 | 1.063 | 0.847 | 0.804 |

Table S2 Accumulation interpretation rate of principal component analysis model

| **Model** | **Type** | **A** | **N** | **$R^2X$(cum)** | **$Q^2$ (cum)** | **Title** |
|---|---|---|---|---|---|---|
| **M1** | **PCA-X** | **3** | **20** | **0.278** | **-0.1** | **TOTAL** |
| **M2** | **PCA-X** | **2** | **10** | **0.297** | **-0.21** | **CK-H** |
| **M3** | **PCA-X** | **2** | **10** | **0.313** | **-0.2** | **CK-S** |
| **M4** | **PCA-X** | **2** | **10** | **0.372** | **-0.0482** | **CK-D** |
| **M5** | **PCA-X** | **2** | **10** | **0.304** | **-0.172** | **H-S** |
| **M6** | **PCA-X** | **2** | **10** | **0.349** | **-0.0831** | **H-D** |
| **M7** | **PCA-X** | **2** | **10** | **0.3** | **-0.189** | **S-D** |

Table S3 Accumulation interpretation rate of the orthogonal projection to latent structure with discriminant analysis model

| Model | Type | A | N | $R^2X$(cum) | $R^2Y$(cum) | $Q^2$ (cum) | Title |
|---|---|---|---|---|---|---|---|
| M1 | OPLS-DA | 1+1+0 | 10 | 0.296 | 0.988 | 0.336 | CK-H |
| M2 | OPLS-DA | 1+1+0 | 10 | 0.311 | 0.997 | 0.478 | CK-S |
| M3 | OPLS-DA | 1+1+0 | 10 | 0.349 | 0.999 | 0.735 | CK-D |
| M4 | OPLS-DA | 1+1+0 | 10 | 0.281 | 0.992 | 0.344 | H-S |
| M5 | OPLS-DA | 1+1+0 | 10 | 0.306 | 0.998 | 0.671 | H-D |
| M6 | OPLS-DA | 1+1+0 | 10 | 0.274 | 0.996 | 0.388 | S-D |

Table S4 Summary statistics of sequencing data quality and mapping to the reference genome

| Samples | Base Number | Clean Reads | Mapped Reads | GC Content | %≥Q30 | Mapped Ratio |
|---|---|---|---|---|---|---|
| CK1 | 10,558,488,736 | 35,650,767 | 25,676,290 | 46.24% | 92.35% | 72.02% |
| CK2 | 9,025,040,374 | 30,708,446 | 22,039,370 | 47.38% | 91.93% | 71.77% |
| CK3 | 6,169,879,150 | 20,865,173 | 15,487,506 | 45.71% | 92.22% | 74.23% |
| D1 | 7,086,998,684 | 23,992,059 | 18,039,332 | 45.52% | 92.06% | 75.19% |
| D2 | 7,083,227,548 | 24,037,590 | 17,987,805 | 46.74% | 91.79% | 74.83% |
| D3 | 8,000,180,018 | 27,090,867 | 20,407,482 | 45.62% | 92.13% | 75.33% |
| S1 | 8,108,064,596 | 27,489,140 | 21,141,110 | 46.47% | 92.46% | 76.91% |
| S2 | 10,093,181,990 | 35,036,589 | 25,738,279 | 46.24% | 92.66% | 73.46% |
| S3 | 6,759,302,830 | 22,775,604 | 17,951,378 | 45.92% | 91.56% | 78.82% |
| H1 | 8,028,032,574 | 27,145,571 | 20,249,403 | 45.95% | 92.23% | 74.60% |
| H2 | 8,941,508,044 | 30,429,320 | 19,704,904 | 45.54% | 92.55% | 64.76% |
| H3 | 6,739,217,658 | 22,916,027 | 16,242,648 | 45.98% | 92.41% | 70.88% |

Table S5 Primer sequences used in qRT-PCR

| Gene ID | primer(5’-3’) |
|---|---|
| *GAPDH* | F: CTGCCAAGGCTGTAGGTAAGG<br>R: TCAGATTCCTCCTTGATGGCG |
| *Gb_19030* | F: TTGTCTACCAAATATCCCTCACCTT<br>R: TGACAAACCCAGAGCTACACG |
| *Gb_19037* | F: AGTCTGCATGGCGTAGAGTTGTG<br>R: GTGTGGAAGGAGCCAGGCATATC |
| *Gb_17714* | F: TTCTCCAAGTCGCACTGGTTCAAG<br>R: TGTCTGCTACTTCGCCTACTCCTC |
| *Gb_01536* | F: TGGCGGTGGTGGTGCTAGAC<br>R: GGTTGGAGTGTTGGCGACGTG |
| *Gb_01539* | F: CTCCTGGATCGCTTATGCTTGGTC<br>R: GAACCGACACCGGAAGAAGAAGAG |
| *Gb_35734* | F: AAGGAACACCAGCAGGAAGTCAAC<br>R: GGCAAGTCCGACAGGTCCAATG |
| *Gb_03208* | F: CATGCCAGGTCTCGTGTTCCATC<br>R: TCAGAAGGTGTCGGCGAATTGTG |
| *Gb_13947* | F: CCGACGCATTGAGCAACAGTTC<br>R: GTGCCTCGTGACGCCAATAGG |
| *Gb_16297* | F: GGCTATTCTGGTTCCAAGGTGGTG<br>R: CGTGCCTCGTGACGCCAATAG |
| *Gb_25507* | F: ACGCAGAGTGACGCCAACAATG<br>R: CTGAACTTCCACACCTCGCCATG |
| *Gb_33988* | F: AGCTTCGTCAAGTCAGGCAATCG<br>R: GCTTGCTGCTACCAGGCTGTG |
| *Gb_30123* | F: ACCTCAGCCTACTTCCTTCTCAGG<br>R: GCGATACTGCGAACTCCTGGAAC |
| *Gb_40485* | F: TTGGAACGGTGCCAGTGGAATTG<br>R: AAGTGGTATTGCTGCCGCTAACG |
| *Gb_23094* | F: TGTGGATTGAGCTTGAGTGAACGG<br>R: ATGTGCAGTCGTATTGTCGTCCAG |
| *Gb_26599* | F: TCAGCAGTGCAGCAGATTCCATG<br>R: TCTTCCGACGGCGTTCATTGTG |
| *Gb_02083* | F: CGGCTGGAACTCGAACATCTGG<br>R: TGCGACAACACTACGGACATACTG |
| miR160a | F: TGCCTGGCTCCCTGTATGC |

| | |
|---|---|
| miR172a-3p | F: CCGCAGAATCTTGATGATGCTGCAT |
| miR156 | F: CGCTGACAGAAGAGAGTGAGCAC |
| miR156a | F: GCTGACAGAAGAGAGTGAGCACA |
| miR156a-5p | F: GCGTGACAGAAGAGAGTGAGCAC |
| miR156e | F: CGCTTGACAGAAGATAGAGGGCAC |
| miR529 | F: CCGAGAAGAGAGAGAGCACAGCTT |
| miR529e | F: GCAGAAGAGAGAGAGTACAGCCC |
| miR160d | F: TCGGACCAGGCTTCATTCCC |
| novel_20 | F: TCGGACCAGGCTTCATTCCC |
| novel_29 | F: ACGCTCTTCTCTCTCGGCTTG |
| novel_35 | F: TGCCTGGCTCCCTGTATGC |
| novel_66/67 | F: CCGCTCCTTTTGTGGAAACTCTTCC |