# **Supplementary Information**

# Functional characterization of a UDP-xylose-preferring *C*glycosyltransferase from *Lemna aequinoctialis*

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#### 1. NMR data of compounds 1a, 5a, and 6a.



Phloretin 3'-C- $\beta$ -D-xyloside (1a):

<sup>1</sup>H NMR (400 MHz, methanol-*d*<sub>4</sub>): Aglycone:  $\delta$  = 7.06 (2H, d, *J* = 8.4 Hz, H-2, 6), 6.70 (2H, d, *J* = 8.4 Hz, H-3, 5), 5.95 (1H, s, H-5'), 3.36 (2H, m, 2H-α), 2.86 (1H, m, 2H-β). Xylosyl:  $\delta$  = 4.74 (1H, d, *J* = 9.9 Hz, H-1"), 4.09 (1H, t, *J* = 9.3 Hz, H-2"), 3.97 (1H, m, H-5"a), 3.68 (1H, m, H-4"), 3.38 (1H, m, H-3") 3.28 (1H, m, H-5"b); <sup>13</sup>C NMR (100 MHz, methanol-*d*<sub>4</sub>): Aglycone:  $\delta$  = 206.4 (C=O), 166.3 (C-4'), 165.1 (C-2'), 162.9 (C-6'), 156.5 (C-4), 133.9 (C-9), 130.3 (C-2, 6), 116.1 (C-3, 5), 104.1 (C-3'), 103.8 (C-1'), 95.6 (C-5'), 47.4 (C-α), 31.4 (C-β). Xylosyl:  $\delta$  = 80.3 (C-3"), 76.7 (C-1"), 72.7 (C-2"), 71.5 (C-4"), 64.4 (C-5").



2-Phenyl-3'-(*C*-β-D-xylosyl)-2',4',6'-trihydroxyacetophenone (**5a**):

<sup>1</sup>H NMR (400 MHz, methanol-*d*<sub>4</sub>): Aglycone:  $\delta$  = 7.20 (1H, m, H-4"), 7.18 (2H, m, H-2", H-4"), 7.09 (2H, m, H-3", H-5"), 5.85 (1H, s, H-5'), 4.31 (2H, m, H-2). Xylosyl:  $\delta$  = 4.65 (1H, d, *J* = 9.9 Hz, H-1"), 4.00 (1H, t, *J* = 9.2 Hz, H-2"), 3.88 (1H, t, *J* = 5.5 Hz, H-5"a), 3.55 (1H, m, H-4"), 3.34 (1H, m, H-3"), 3.19 (1H, m, H-5"b); <sup>13</sup>C NMR (100 MHz, methanol-*d*<sub>4</sub>): Aglycone:  $\delta$  = 204.7 (C=O), 166.5 (C-4'), 165.4 (C-2'), 163.8 (C-6'), 137.4 (C-1"),130.7 (C-2", 6"), 129.1 (C-3", 5"), 127.4 (C-4"), 105.3 (C-3'), 104.2 (C-1'), 95.7 (C-5'). Xylosyl:  $\delta$  = 80.3 (C-3"), 76.7 (C-1"), 72.7 (C-2""), 71.5 (C-5"), 71.5 (C-4"). [1]



Flopropione 3'-C- $\beta$ -D-xyloside (**6a**):

<sup>1</sup>H NMR (400 MHz, methanol-*d*<sub>4</sub>): Aglycone:  $\delta = 3.08$  (2H, dd, J = 7.3 Hz, H- $\alpha$ ), 1.13 (3H, t, J = 7.3 Hz, H- $\beta$ ), 5.92 (1H, s, H-5). Xylosyl:  $\delta = 4.72$  (1H, d, J = 9.9 Hz, H-1'), 4.05 (1H, t, J = 9.1 Hz, H-2'), 3.96 (1H, m, H-5'a), 3.63 (1H, m, H-4'), 3.37 (1H, m, H-3'), 3.25 (1H, m, H-5'b).<sup>[2]</sup>

### 2. Supplementary Tables

| Primers  | Sequences (5' to 3')                                  |  |  |  |  |
|----------|-------------------------------------------------------|--|--|--|--|
| LaCGT1-F | acagcccagatctgggtaccATGGCGTCAGTGATGTCGGCGGGA          |  |  |  |  |
| LaCGT1-R | agtggtggtggtggtggtggtgctcgagGAGACGTCTAATCTTGAACTTTTCC |  |  |  |  |
| R271A-F  | GCGACGGCGCTACCGCCGGAGCAGATAAGG                        |  |  |  |  |
| R271A-R  | CGGTAGCGCCGTCGCGCTACCGAAGCTCAC                        |  |  |  |  |
| W357A-F  | GCGAACTCCGTTACGGAGGCGGCGGTAAGC                        |  |  |  |  |
| W357A-R  | CGTAACGGAGTTCGCGCCGCAATGGCACAG                        |  |  |  |  |
| D378A-F  | GCGCAGAGGATCAACGCCATGGTGGTAGAG                        |  |  |  |  |
| D378A-R  | GTTGATCCTCTGCGCACCGTGCCGCGGCCA                        |  |  |  |  |
| Q379A-F  | <b>GC</b> GAGGATCAACGCCATGGTGGTAGAGAAG                |  |  |  |  |
| Q379A-R  | GGCGTTGATCCTC <mark>GC</mark> GTCACCGTGCCGCGG         |  |  |  |  |

Table S1. PCR primers and nucleotide sequence used in this study.

#### PCR primers

Note: The vector sequences are shown in lower case, and the mutation sites are labeled in red.

#### Nucleotide sequence of LaCGT1

#### Table S2. The transcriptome data of Lemna aequinoctialis from NCBI

| No. | Run               | Bases  | Size  | Experiment        | Assay<br>Type | LibrarySource  | Release<br>Date |
|-----|-------------------|--------|-------|-------------------|---------------|----------------|-----------------|
| 1   | <u>SRR5688502</u> | 4.2Gbp | 2.8Gb | <u>SRX2922957</u> | RNA-Seq       | TRANSCRIPTOMIC | 2017/6/15       |
| 2   | <u>SRR5688503</u> | 3.4Gbp | 2.3Gb | <u>SRX2922959</u> | RNA-Seq       | TRANSCRIPTOMIC | 2017/6/15       |

## 3. Supplementary Figures



Figure S1. Phylogenetic analysis of LaCGT1 with 65 previously reported functional plant CGT genes.



**Figure S2.** Fresh plant material of *Lemna aequinoctialis* (A) RNA electrophoresis of *Lemna aequinoctialis*. (B) Primers used in DNA barcoding and electrophoresis of *Lemna aequinoctialis* (C and D).

#### DPF conserved motif

| LaCGT1.txt        | MASUNSAGE, ADHEATTESAGMENTTETETAAMTAS, GGATTETCETEVUSAAFAUHUTDIVS, FSE, SERTIFETEPETUST, AASKTEERICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 93   |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Accomp            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 05   |
| Accord            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 00   |
| AecGTb            | MSRECCSSSSNGGTVPHVAVIESAEMCHISISVRIAATIASHGCIVIETEREVVSLAESRIIADIHS.SYEQIRSIIIRIIPELAEDVLEEIRCE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 96   |
| FeCGTa.txt        | MMGEITTSFFATTITTNEOPHVVVCSGACMCHITFFINIASAISSAFYNCKVTILIVIFIITLAESHHISSFFS.SHETIHRILFHVNLFAFKENVFFFLFY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 102  |
| GgCGT.txt         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 95   |
| GtUF6CGT.txt      | MGSITNNENLHIFIVCFI <mark>COVNEMIRIGKAFASKGLIVTISAFEI</mark> VGTEIRKANNINEECFIKVGSGMIRFEFFDECWESVNGSKFFEVWVYI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 95   |
| GUCGTa            | MGENNMSSIAFHFVVHVALLFSP <mark>GMCHLSFFIRLA</mark> SILHCHCHVTLITFCITVSKAEECLISRFLS.AFFQVNCLHFHLFPSISTISTEFFLCF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 95   |
| GuCGTb            | MISCINSEEVIVHVAFIESACMCHINECIPIAECFIF. HCCKVILITEKETVSLAESNLINECS, SFESSOINCVIINIIDVEFTCVN. TNEEFWIHF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 96   |
| LOCGTA            | MRECSSERNHEAFRETTTI SCENAEAA., VOHVATTESSENGHITEFTRI AAATAS., HCCVITETTEVVSAAFARHVEAFTS. SSE., LERRIEFETTEFTI VSS., VUST FEFTCE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 111  |
| Trocomb           | NORTH ATTRICES ADDINANTANON CUMPTED ACETAC DECOMPENNED TRADUCTION OF CURTER TRADUCTION FOR THE CONTRACT PARTY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.0  |
| Lipcorp tout      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50   |
| MICGT. txt        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 95   |
| OsCGTa            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 95   |
| OSCGTb            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 103  |
| PSCGTa            | MVCETSFFVCNFRETVSTISFAPHIAILSSACFCHIVSVRIAVAIASHGCIITIVTFIFTVSEAESPYISDFHS.CFFHIRIIEFHIIPIIACADTIFFFSCF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 103  |
| PsCGTb            | MAREFSCIVREGELIFTFTPHIVILESACMCHITVSTRLAAAIVSHGCIVILITELEMVSEAESNCISNICS.SFFHIRLIEHHIPFEAFDVEFFIRGF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 99   |
| SbCGTa            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 94   |
| ShCGTh            | MSKSENAGC REHVAUECOMMENTERTRAMTHS RECAUSUISAHETISTAFSRSISSEES IVE OTRSIFTCTIDIKENE RETNITEFFICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 94   |
| Teccr1 tyt        | MERSNENSTSKOHUSTTASTEMENTISETETSKRIVT INTLOUTETUSNEATKARSHINESSNN EHE DIETUTTEANTSEITS TRATVERT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 94   |
| ZmC/CIII D        | NAMECOURSE DUNTIFICAN CULTERADIANATORC UCONCULATION COROLITATENAAT AUDITED TATESETCA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 07   |
| ZincGra           | MARGELTISAR PROVIDE AND THE                                                                                                                                                                                                                                            | 100  |
| ZmcGTb            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 102  |
| Consensus         | a a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |
| LaCGT1.txt        | ESIRRA.ASI CIIISSVS.P.FFSALIIIVTITSAFVEIARAISIFVYIMFTSSAWMISLFISFF.PTASRGGAIEVECLAET.LFASALECAIRCENNIFTICFF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 195  |
| AeCGTa            | FAIRRS.AHI <mark>LCHIIASAC.P.AISAVVIIVSIISAVAEVVAAVGIENYVIFISSAAMIALCVAFE</mark> SASASLGGAAEIFEV <mark>E</mark> GLAALFINWLECFIRCEGNIFIICEV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 200  |
| AeCGTb            | EVIRES.ASIMCELITSVI.P.ELSAVIVEISIISTEVEVTKAIRIETYVTEISCAMMIALIAVEESVEKAAGEGEIAAVEIEGVGTS.LEGSWIEFEIHEEKHLEAICEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 203  |
| FeCGTa.txt        | RSTSTS. ARE EVELSATS. P. FTSAVESTET FTGGINTTLE. HI ENVTETTSAREFTINSVEHIARS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 203  |
| Caccm tyt         | ACTOC CULTUTE COLT D ELECTIVEMENTECTITETATCC/ULTUTETCCATECCCULTUTA VECCULTUTE VEUCCTPECTICUT UNIVERSITE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 204  |
| CHURGCOM ++++     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200  |
| GUOFOCGI.CAU      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200  |
| GucGra            | ASING SING IFILISITIP FILSTILLATIONICAL FILMENCE AND                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 204  |
| GUCGTB            | KTIRCSLCYH FTITSSISSP.BISAFIYIVSIISFIVETTERICFFSYIYFIAFARMESFFAHISVISERNFGVRESSFIGGVVETEGIAFIFRSVEFITIFENSIFESIFM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 209  |
| LpCGTa            | FRISRS.ARHICEVISSUS.P.FISALIILUVIITSSILFIAAEISLEAVILFISSAGMISLCISYE.EIAASGGVTIKIEGVAEL.LAFSSLECFIRFERNIFIGCEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 214  |
| LpCGTb            | EAVERS.AFLITEITSEVS.D.FIATVCIIAICSTFITVAAEISILAVVFFSISACMISINIAFTVAECVYGAGEGEEIRECLEES.IFFSWLFFFILFFAHIFAVHFV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 206  |
| MiCGT.txt         | EAIRES.AHIMEIISSIS.E.FISAIVIISSIVESEVEVAANILIESYVIFESIRECSIEETFIAEVASKINFISIQIIIVIEIEGESEVEVESVEEVEININHIFTIMII                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 203  |
| OSCGTa            | EANRES.AFTECFITTCAGASAIATIAITSVVIEVAKECCIECHILFTASAAMISICAYFTYILANAGEGGGVGEVITEGVYRIFKASIFCAIHCENHIFTRCFV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 201  |
| OsCGTb            | FAIRES. HIT GEVIAGVI. P. RVTATVITVIIVSHVNETARDIGVCCHVLYVSSAAMNSTCSYFFIYICNKCAGAEVGEVETEGVREIKRSWLECETIDINKIFTKCFI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 210  |
| PsCGTa            | ETIRES. AAIMCHIIASAT. P. FISAILATISVISSYIEVTKAICIETYVTETSCAAMIALSCVEERVRKEVGTGEVUSTIMEGLCTVECSWIEFTH. NENHTEARNES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 209  |
| PsCGTb            | ESTERS AND FUTURES TO EVENTITE TO THE SUPERTED TO THE TOTAL OF THE SUCH THE | 205  |
| PSCGID<br>ob.ocm. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 100  |
| SDCGTa            | FITATS.VHIDEFITSSIS.P. FISATSSFTTTSCVTTTVSDFTSTYTEMTSSAAFFCTRAATERTICTLVANRLATETETETGE. ISPSSTFFAMILESDFFSAFIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 199  |
| SECGTE            | ESIGNS.IHLEFEIASIS.P.EISAIEVEFFVITEFSEIAADESIETYTLIVISAFESIMAHIERIIECEEEISKKSEVCVEHDEF.ICVSSIEFCMIERRHEEVETIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 201  |
| TcCGT1.txt        | FLITCAAIKD <mark>I</mark> ESRISSMS.T.FFAALIVEVESMEAFF.VAERFGIKKYVEVIINAWFLALITYVPTIEREIEGEYVDIFEFIAL <mark>I</mark> GCKF <mark>I</mark> RFEEVFEPMISRSSEGYRFYL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 203  |
| ZmCGTa            | EATRRS.AFILCHILCAAEASAIVTLIVIASVAIEVARERGVECYVLFTSSAAMISLCAYFFAYILCAHAAAGSVGVGVGNVCIEGVFRIEKSSVECAIHCEDHIFTCCEV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 206  |
| ZmCGTb            | FALRRS.AHINGFIIAGAA.P.RVSAVITEVTITSHVIFIAKEIGVCCHVLFFSSATMISLIAYTEVHIEKKAECGSEIGEVETECVCF.IFCSCLFCVIIHIDKLFTKCFI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 210  |
| Consensus         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |
|                   | R271                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |
| LaCCT1 tyt        | FREEADLAND FART TO THE ATTACT AT A THE AUGUST ON THE FREE AS TO THE ACT SEATING THE ACT OF A THE ACT OF ACT OF A THE ACT OF ACT OF ACT OF ACT OF ACT OF A THE ACT OF A | 301  |
| ACCENT.           | ENCOURTE AND                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 205  |
| ABCGI a           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 210  |
| Aecgrb            | ENGLALICADEVITNISALEASILAAINAGNVVEGLEPPIAIGECEVNEGASKAAAAGRLEWAAWILAGEEGAVLIVARENNALEROINELGIGEESSGCRAIWVVSSL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 310  |
| FeCGTa.txt        | SNARYESISKGIIVNTEESFEETISAINSGL.TISTIFPVIFIGEINELEHNKCEEIIPVIICCEEKGVIYVSEGEPTAMSSIGIIEIGMGIERSICHEIWVVKISK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 310  |
| GgCGT.txt         | ELSEKIKKIHGVIVNIFECIEKISIFAINGGKVVKGIFPVYCVGFEVECEFEKVVKRGETISEWIIECESCSVVYVSFG REAMGRECIREVGICIVKSCWFFIFVVKIKI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 315  |
| GtUF6CGT.txt      | CCFKNISKNFCIIMETFYEIEHEIIENNCKLCPIKEICFIFKIFKESSNGITGNFMKVEECKEWISSFISTVVYVSVCKVYIKCFCVTEMAYGIINSEVSBIKVIFFS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 320  |
| GuCGTa            | ELSEKIKKIHGVIVNTEGIEKISIEAINGGKVVKGIEPVYGVGEEVECEFEKVVKRGETISEWIECESGAVVYVSEGEETAMGREGIEVKSGWREITVVKCKI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 315  |
| GuCGTb            | ELSEKIKKISCIFINSFEELEFEALAAINNGRVVEGIFPVYEICEIVECEFEKVRSSEKINSSIIKWICCEACSVVYVCICKERTCIRECIKEMACGIISCGYKEIWVKIKI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 324  |
| LocgTa            | FIGRAMARADGET INTERATE PATE AND COSE AVSCET UTEVELT ASSET HTAAFET V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 324  |
| Locomb            | FNCKANERAL TUPSWEATE FATALERCE WINGTEDUILTE IVCKEKSNA U EI DWITACHTEN FUR DE THENAACTERSCERMENT KTKU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 312  |
| MiCCT tyt         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 312  |
| OCCETT:           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 211  |
| OSCGIA            | ANGESTISAATI VNILALEEEAVAALCCG NVASGEEVVAAGELLESNCALEC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 205  |
| OSCGTD            | ENGREMVNIDGVI INTELALEEVALAAIRUGKVVRGEEPVEAVEHSSLASEAIRGAAALAEGSEMANIRCCEARSVVYVARGEREAVSHEIREIAAGLEASGSHAIITILKIIV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 325  |
| PsCGTa            | ENGAAVICADEVIVNTEEALEGIIISAINAGIVIFGIEPVIAIGICEELKIGASAREAGE.ELGWATWILACEEKSVIYVAHEKRAISIVOIREIGKGIEKSGCHAIVVKSKI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 323  |
| PSCGTb            | EIGEAMICADGIISNIFEAIDGEILAAINAGAVVFGFEPVIAVGECEFIKIRAAARFAVE.REEWMANHIACFEKSVLYVAFGARTACSREGIKEIGIGIEKSGCPAINVVKSKI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 319  |
| SbCGTa            | SNVSSIHKVKGVIINTENSFESEATEAVRRNGVEHILFIGEIESYEAKKAHELFWIEGEFESVIFVSFEERAISKEGIREIGAALEKSGCREITVIKGGK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 301  |
| SbCGTb            | SNVASISYIKCVIINTETWIEFEAVEAIKRNCVCHIIFICEIEAIKAEESCMCIPWIEFCAFKSVIFISFCERCAHTKECIRFFAAALEKSCWRAIWVIKSCK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 304  |
| TcCGT1.txt        | CMSERITRADGIIINTWEALEFVSIKAIRENEKINCIMTERIYEVGEVARTTVCEVVGNECIDWISKCETESVIYVAIGSGETISYKOMTELAWGIEMSRCEEIWVVRIFT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 314  |
| ZmCGTa            | ANGROLVACOCITYNTECAFE FLAVTALROGSITVSCGF FPVFTVCFML FVRFCAFET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 317  |
| 7mCCPPh           | ANC DET TNAME ET UNTER A DE RUN LE CEDU VATE TNECCUSURE CONCUSURE DE CONCUSURATE UNA VELLE DE TANCE A DE TANCE | 325  |
| Conconcilo        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 525  |
| consensus         | <sup>gp</sup> W357 <sup>wi</sup> D378 Q379 <sup>q</sup> <sup>i</sup> <sup>w</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |
| Tecorm1 text      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 100  |
| DaCGII.CAU        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 400  |
| Aecgra            | VIRELEGVIEELIGLEGERKKME.GRGIVVKIVULAVIAHAAVGERIGEGVIEVIDAALHGVKVIAVERHELERI.NAWVVERGEEWPIENSWEGAEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 400  |
| AecGTb            | VIRELLAGVITELLIG.EGTRERVGERGYVVKSVUGEEVTAHFSVGGFISFAWISVABAALCEICIEVEAGELCKV.AALVVERCGAGAWVREWGNSGSGGIEETFT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 427  |
| FeCGTa.txt        | IEKEEKSEERKEFG.EEEYIKES.EKGKEVK.WVNOTEEIGHTAVGGEISECENISVMAAARPCVEILAWEQHEECKE.NAWVVEKAGICVWEREWASGIC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 407  |
| GgCGT.txt         | VERAEEEGLEGVIG.FEIVERMVKERKGIVVKENVUGSEDIGHKAVGGEVSECENNEVVERAWFGVKILGWELHEICKI.NAEVVAKGGWEVERGKIKEGERL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 417  |
| GtUF6CGT.txt      | KRIGTEFHVIF.EEFWEKAGERCKVVO.RSECECVIAHEATVCFITECEWISTCEAISSCVEVITEFOFFICVTNAKFIVEEFKVCVRIGRGEIENRI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 416  |
| GuCGTa            | VERAEEEGIIGVIG.FEIVERMVKEKKGIVVKEVVGSEIGHKAVGGFVSEGEWNSVEAAWFGVKIIGWFLHEIGKI.NAEVVAKGWCWKEGWINEGERL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 417  |
| GuCGTb            | VEREECEFEILEVIG.NEVEKCVNEKGMAVKIEVECHEIGHESVGGEVNEGEN SIVECVNEGENIETESWAHDEIGKI.ASSEVVKMGVGIN SCVNGNGAAA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 426  |
| LpCGTa            | VEREECEGERAVEELIG.EGFICEVEWKGKVVSGWUGRAVEDHESVGGEVSECEWESVERAALCONEVIAWERHEICHI.NAMVVEKSGICKWESIWIWEGEEEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 428  |
| LpCGTb            | VERLELEGACKEIIG.ECYLERVKERGVVINGRVIGHTIBSHRAVGGEFSESESSVADAAICGCEITIWEMGETCH.SALVAERRCMCVWERGWCWSAFFK.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 414  |
| MiCGT.txt         | VICEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 412  |
| OSCGTA            | VERELA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 412  |
| Occomb            | UPPER ACTIVITY CONTRACTOR AND CAMPAGE AND  | 126  |
| Decicitio         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 120  |
| FSCGIA            | VERES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 42.5 |
| PSCGI'D           | VERLELL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 421  |
| SDCGTa            | VERELKEEVELMIG.ASEVERTKKKGLIVKGVKGECIMAHEAIGGEVSECKNEVIDAARIGVEVIAWEQHEIGEV.NAGVVEKAGIGIWVEKGKGCTKL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 401  |
| SbCGTb            | VLKELKEFTEDIIG.SSFLERTKNRCVIKGTALGERIHAHSAIGGFVSHGKNSVDAAKLCVEVLAMEPHEIGRV.NAEVVEKVEIGINVFCMCKAGEFL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 404  |
| TcCGT1.txt        | MEKICACREFSIVNVKGEIEYIE.ECFILERNKEIGMULPNTCHCIAIDAHESIGGFIS <mark>HCENK</mark> SIESIVNCVEVIAWELYAECKM.NATIIT.EELEVAVREEVIFTKAV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 422  |
| ZmCGTa            | VERCETADIGELIG.DEFLERVCCRAFVINGEVECEELIGESVELFISECEN SITEAAAFEVEVLAWFRELCRV.NAAIVARSCIEAWEEGVINGEEGL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 418  |
| ZmCGTb            | VEREESAVITELIG. EEFIERVCCRCIVTKARVICEAILKHFANGIFISES WISAAAASVFITAMERGETHEV.NAMVTVSCOVENMMEHMSWFCFFWT.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 426  |
| Consensus         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 100  |
|                   | PSPG box                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |
| LaCGT1.tv+        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 462  |
| ACCER-            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 102  |
| ACCER             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 412  |
| MECGID            | VCEPERGRAUNELIGEASIKESIANAKANININS VGVERATEANKSI AGLEGVEIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 485  |
| FeCGTa.txt        | AALVEKVKMIMGNNDIRKSAMKVGEEAKRACIVGESSATAIMNIIGSIKF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 457  |
| GgCGT.txt         | VKGEEIGEAIREVMNESIVKKAICVKKLARKAISVGGGEVAICKIMEVWKKNV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 472  |
| GtUF6CGT.txt      | ITRIEVERALREITSGEKAEEVKENAIKWKKKAEETVAKCEYSERNIVGFIEEVARKTGIK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 477  |
| GuCGTa            | VKGEEIGEAIREVMNESIVMKAICVKKLARKAISVGEGCEVAICKIMEVWKKNV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 472  |
| GuCGTb            | VKGEEIARAINEM <mark>K</mark> SNESIRNK <mark>A</mark> REMKEAARKAAGV <mark>GE</mark> SCEVIIKKCIEEWKKRIVCGI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 485  |
| LpCGTa            | VRRETAGEVAELMASEAAAAAAAKVKELMVRAATAGESECRCTEELVSRETCSGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 484  |
| LOCGTD            | TEGET TARE THE FNOR A TRAVARKNEKET ASANA FOR SKICKFEFT ARTNEY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 468  |
| MICGT tyt         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 470  |
| OCCETA            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 471  |
| Occomb            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1/1  |
| DECOTO            | VOREARCH VERTIARA UVPERMANUEL VANUE TERTUGILLEVANIAMAI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 401  |
| PSCGTa            | VSSETTRFFVRETRELLAVGEARKRIHEERVMGLRFMESSYEGIRKEVALVEAKRRSSFECVSE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 493  |
| PSCGTb            | VSSLIVAKRVREGENAVGESVREMCEEAVRGIGEGESSYEGIRKFIAGVVE.RGSSFFEI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 483  |
| SbCGTa            | IGREEIAEKMIEVMCEEKIRVSAGEVRAKAKETFEVICESEAIICRIIHSENNITCNS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 459  |
| SbCGTb            | IGREEIAEKLIEIRNEERIRERVKEVREKAREERES <mark>GE</mark> ISETIIRELIHSIKIK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 458  |
| TcCGT1.txt        | VSRLEIEKMVRRVIESKEGKMKRNRARSVCSLAIKAIEKCESSYNTIIEVAKEFEKNHKVL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 483  |
| ZmCGTa            | TTRKEVAKKIKCNYCYCAVAEKAAKVCDAAAAIAKCCTSYCSIEEFVCRCREAERK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 475  |
| ZmCCTb            | VTGVETAKKVKEVNSTF AVRANTTPTAFFAKAVATGETSVRSNFFFTSSVKATVAS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 483  |
| Caller Call       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 103  |
| Conceneure        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |

Figure S3. Sequence alignment of LaCGT1 with homologues.



Figure S4. SDS-PAGE of His-tagged LaCGT1 purified by Ni-NTA affinity chromatography.

M, Protein marker; C, crude protein extract; P, purified LaCGT1.



**Figure S5. Sugar donor promiscuity of LaCGT1.** (A) Relative conversion rates of *C*-glycosylated products using different sugar donors. LaCGT1 could glycosylate phloretin into nothofagin (red) and di-*C*-glycosylated product (yellow). (B) HPLC chromatograms of enzyme reactions of LaCGT1 with different sugar donors at high enzyme concentrations (50 µg/mL, 2 h). (C) LC/MS/MS analysis of glycosylated products in the negative ion mode.



Figure S6. Effects of reaction temperature (A), time (B), reaction buffer (C), and divalent metal ions (D) on the activities of LaCGT1. Phloretin (1) was used as the acceptor and UDP-Xyl was used as the sugar donor. An optimized reaction time of 60 min was used. LaCGT1 exhibited its maximum activity at pH 8.0 (50 mM Na<sub>2</sub>HPO<sub>4</sub>-NaH<sub>2</sub>PO<sub>4</sub>, and 25°C.



**Figure S7**. Determination of kinetic parameters for purified LaCGT1. The apparent  $K_m$  value was determined using phloretin (1) as the acceptor and UDP-Xyl as the sugar donor at 25°C and pH 8.0 for 10 min.



Figure S8. Substrates 8-24 that cannot be glycosylated by LaCGT1 using UDP-Xyl as the sugar donor.



Figure S9. HPLC and LC/MS analysis of LaCGT1 catalytic reaction mixtures for compound 1 with UDP-Xyl. The experiments were performed in triplicate. (A) HPLC chromatogram of 1 and enzymatic product 1a (3'-C-Xyl). (B) The structure of substrate and enzymatic product. (C) MS/MS spectra for 1 and 1a. The analysis conditions are described in experimental procedures. (D) UV spectrum of 1a.



Figure S10. HPLC and LC/MS analysis of LaCGT1 catalytic reaction mixtures for compound 2 with UDP-Xyl. The experiments were performed in triplicate. (A) HPLC chromatogram of 2 and enzymatic product 2a (3'-C-Xyl). (B) The structure of substrate and enzymatic product. (C) MS/MS spectra for 2 and 2a. The analysis conditions are described in experimental procedures. (D) UV spectrum of 2a.



Figure S11. HPLC and LC/MS analysis of LaCGT1 catalytic reaction mixtures for compound 3 with UDP-Xyl. The experiments were performed in triplicate. (A) HPLC chromatogram of 3 and enzymatic product 3a (3'-C-Xyl). (B) The structure of substrate and enzymatic product. (C) MS/MS spectra for 3 and 3a. The analysis conditions are described in experimental procedures. (D) UV spectrum of 3a.



**Figure S12. HPLC and LC/MS analysis of LaCGT1 catalytic reaction mixtures for compound 4 with UDP-Xyl.** The experiments were performed in triplicate. (A) HPLC chromatogram of 4 and enzymatic product 4a (3'-*C*-Xyl). (B) The structure of substrate and enzymatic product. (C) MS/MS spectra for 4 and 4a. The analysis conditions are described in experimental procedures. (D) UV spectrum of 4a.



Figure S13. HPLC and LC/MS analysis of LaCGT1 catalytic reaction mixtures for compound 5 with UDP-Xyl. The experiments were performed in triplicate. (A) HPLC chromatogram of 5 and enzymatic product 5a (3-*C*-Xyl). (B) The structure of substrate and enzymatic product. (C) MS/MS spectra for 5 and 5a. The analysis conditions are described in experimental procedures. (D) UV spectrum of 5a.



**Figure S14. HPLC and LC/MS analysis of LaCGT1 catalytic reaction mixtures for compound 6 with UDP-Xyl.** The experiments were performed in triplicate. (A) HPLC chromatogram of 6 and enzymatic product 6a (3-*C*-Xyl). (B) The structure of substrate and enzymatic product. (C) MS/MS spectra for 6 and 6a. The analysis conditions are described in experimental procedures. (D) UV spectrum of 6a.



Figure S15. HPLC and LC/MS analysis of LaCGT1 catalytic reaction mixtures for compound 7 with UDP-Xyl. The experiments were performed in triplicate. (A) HPLC chromatogram of 7 and enzymatic product 7a (3'-C-Xyl). (B) The structure of substrate and enzymatic product. (C) MS/MS spectra for 7 and 7a. The analysis conditions are described in experimental procedures. (D) UV spectrum of 7a.



Figure S16. <sup>1</sup>H NMR spectrum of 1a in Methanol-d<sub>4</sub>, 400 MHz.



Figure S17. <sup>13</sup>C NMR spectrum of 1a in Methanol-d<sub>4</sub>, 100 MHz.



Figure S19. HMBC spectrum of 1a in Methanol-d4, 400 MHz.



Figure S20. <sup>1</sup>H-<sup>1</sup>H COSY spectrum of 1a in Methanol-*d*<sub>4</sub>, 400 MHz.



Figure S21. <sup>1</sup>H NMR spectrum of 5a in Methanol-*d*<sub>4</sub>, 400 MHz.



Figure S22. <sup>13</sup>C NMR spectrum of 5a in Methanol-*d*<sub>4</sub>, 100 MHz.



Figure S23. <sup>1</sup>H NMR spectrum of 6a in Methanol-d<sub>4</sub>, 400 MHz.

## References

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