

Description of Additional Supplementary Files

File Name: Supplementary Data 1

Description: Soil characteristics of the eleven sampled soils

File Name: Supplementary Data 2

Description: Genome descriptions

File Name: Supplementary Data 3

Description: Pairwise comparison of average amino acid identity of Lutacidiplasmatales genomes

File Name: Supplementary Data 4

Description: Pairwise comparison of 16S rRNA gene similarity of Lutacidiplasmatales genomes

File Name: Supplementary Data 5

Description: Lutacidiplasmatales genomes as type material for reclassification

File Name: Supplementary Data 6

Description: BLASTn comparison of AcS3-62 16S rRNA gene against the nonredundant database (June 2020)

File Name: Supplementary Data 7

Description: Presence of Lutacidiplasmataceae and Lutacidiplasma in >150,000 16S rRNA libraries

File Name: Supplementary Data 8

Description: Key pathways in Thermoplasmatota genomes and ancestral reconstructions

File Name: Supplementary Data 9

Description: Comparison of Lutacidiplasmatales oxidative phosphorylation loci to other Thermoplasmatota

File Name: Supplementary Data 10

Description: Carbohydrate active enzymes (CAZymes) of the Thermoplasmatota

File Name: Supplementary Data 11

Description: . Secreted peptidases of the Thermoplasmatota

File Name: Supplementary Data 12

Description: Comparing different species tree estimations using constrained trees

File Name: Supplementary Data 13

Description: Quantified mechanisms of gene content change

File Name: Supplementary Data 14

Description: arCOG annotations of gene family origination hot spots in LCA of Lutacidiplasmatales and Poseidoniales

File Name: Supplementary Data 15

Description: GenBank accessions of phylogenetically diverse reference genomes

File Name: Supplementary Data 16

Description: Comparing different gene tree estimations using constrained trees

File Name: Supplementary Data 17

Description: Reconciliation statistics of *cydA* gene family

File Name: Supplementary Data 18

Description: Reconciliation statistics of *arcA* gene family

File Name: Supplementary Data 19

Description: Metagenome sample sequence information

File Name: Supplementary Data 20

Description: Marker gene information for expanded taxa sampling ML trees

File Name: Supplementary Data 21

Description: Probable origination branches of 4,255 gene families

File Name: Supplementary Data 22

Description: Reconciliation statistics of *ctaB* gene family

File Name: Supplementary Data 23

Description: Progressive K number gains and losses in the evolution from Thermoplasmatota LCA to Lutacidiplasmatales LCA

File Name: Supplementary Data 24

Description: Best hit taxonomy of originating gene families.

File Name: Supplementary Data 25

Description: Duplication and loss of gene families originating in Lutacidiplasmatales in comparison to ancestral gene families

File Name: Supplementary Data 26

Description: Phylogenomic tree data