**Figure 3-source data 1.** List of source organisms, locus tags and accessions for the LbpA and GcvH proteins considered in phylogenetic trees shown in Figure 3 and Figure 3-figure supplement 1.

|  |  |  |
| --- | --- | --- |
| ***Organism*** | ***locus tag*** | ***accession*** |
| *Acidianus hospitalis* W1 | Ahos\_1686 | AEE94563 |
| *Acidihalobacter prosperus* V6 (DSM 14174) | BJI67\_RS04090 | WP\_070071950 |
| *Acidihalobacter prosperus* V6 (DSM 14174) | BJI67\_RS04100 | WP\_070071952 |
| *Acidimicrobium ferrooxidans* DSM 10331T | Afer\_0973 | ACU53912 |
| *Acidimicrobium ferrooxidans* DSM 10331T | Afer\_0974 | ACU53913 |
| *Acidithiobacillus caldus* SM-1 (CGMCC 1.7296) | Atc\_2344 | AEK58992 |
| *Acidithiobacillus caldus* SM-1 (CGMCC 1.7296) | Atc\_2346 | AEK58994 |
| *Acidithiobacillus ferrivoran*s SS3 (DSM 17398) | Acife\_2468 | AEM48562 |
| *Acidithiobacillus ferrivoran*s SS3 (DSM 17398) | Acife\_2470 | AEM48564 |
| *Acidithiobacillus ferrooxidans* ATCC 23270T | AFE\_2547 | ACK79688 |
| *Acidithiobacillus ferrooxidans* ATCC 23270T | AFE\_2549 | ACK78498 |
| *Acidithiobacillus ferrooxidans* ATCC 53993 | Lferr\_2175 | ACH84379 |
| *Acidithiobacillus ferrooxidans* ATCC 53993 | Lferr\_2177 | ACH84381 |
| *Acidithiobacillus thiooxidans* ATCC 19377T | ATHIO\_RS0101750 | WP\_010637288 |
| *Acidithiobacillus thiooxidans* ATCC 19377T | ATHIO\_RS0101760 | WP\_010637291 |
| *Atererythrobacter* *epoxidivorans* CGMCC 1.7731T | AMC99\_00773 | WP\_061922963 |
| *Aquifex aeolicus* VF5 | aq\_402 | O66720 |
| *Chloroherpeton thalassium* ATCC 35110T | Ctha\_0140 | ACF12611 |
| *Defluviimonas* *indica* DSM 24802T | SAMN05444006\_102168 | SDW24616 |
| *Defluviimonas* sp. 20V17 | U879\_RS07770 | WP\_035841171 |
| *Escherichia coli* K12 | SF31\_19040 | AKD93032 |
| *Ectothiorhodospira haloalkaliphila* ATCC 51935T | ECTHA\_RS0104455 | WP\_025282108 |
| *Ectothiorhodospira haloalkaliphila* ATCC 51935T | ECTHA\_RS0104445 | WP\_025282106 |
| *Ectothiorhodosinus mongolicus* M9T (DSM 15479T) | B0B04\_RS03030 | [WP\_076754807](https://www.ncbi.nlm.nih.gov/protein/1140905876) |
| *Ectothiorhodosinus mongolicus* M9T (DSM 15479T) | B0B04\_RS03040 | WP\_076754809 |
| *Ectothiorhodospira marina* DSM 241T | SAMN05444515\_102239 | WP\_090251068 |
| *Ectothiorhodospira marina* DSM 241T | SAMN05444515\_102241 | WP\_090251072 |
| *Ectothiorhodospira mobilis* DSM 4180 | SAMN05421721\_10350 | WP\_090483756 |
| *Ectothiorhodospira mobilis* DSM 4180 | SAMN05421721\_10352 | WP\_090483758 |
| *Ectothiorhodospira* sp. PHS-1 | ECTPHS\_RS10605 | WP\_008932750 |
| *Ectothiorhodospira* sp. PHS-1 | ECTPHS\_RS10615 | WP\_008932752 |
| *Ferrithrix thermotolerans* DSM 19514T | BUA24\_RS08735 | WP\_072791444 |
| *Ferrithrix thermotolerans* DSM 19514T | BUA24\_RS08740 | WP\_072791447 |
| *Gordonia rhizosphera* NBRC 16068T | GORHZ\_RS13480 | NZ\_BAHC01000000 |
| *Halorhodospira halochloris* str. A (DSM 1059T) | M911\_11200 | AHK79630 |
| *Halorhodospira halochloris* str. A (DSM 1059T) | M911\_11210 | AHK79632 |
| *Hoeflea* sp. BRH\_c9 | VR78\_06480 | KJS17053 |
| *Hydrogenivirga* sp. 128-5-R1-1 | HG1285\_RS14255 | WP\_008286388 |
| *Hydrogenobacter thermophilus* TK-6T (DSM 6534T) | HTH\_RS09400 | WP\_012964498 |
| *Hydrogenobacter thermophilus* TK-6T (DSM 6534T) | HTH\_RS09415 | WP\_012964501 |
| *Hydrogenobaculum* sp. HO | HydHO\_1068 | AGG15383 |
| *Hydrogenobaculum* sp. HO | HydHO\_1071 | AGG15386 |
| *Hydrogenobaculum* sp. Y04AAS1 | HY04AAS1\_RS05425 | WP\_012514115 |
| *Hydrogenobaculum* sp. Y04AAS1 | HY04AAS1\_RS05440 | WP\_012514118 |
| *Hyphomicrobium denitrificans* ATCC 51888T | Hden\_0696 | ADJ22516 |
| *Hyphomicrobium denitrificans* ATCC 51888T | Hden\_2793 | ADJ24589 |
| *Hyphomicrobium* sp. GJ21 | HYPGJ\_RS10105 | WP\_046847083 |
| *Kyrpidia tusciae* DSM 2912T | Btus\_2489 | ADG07149 |
| *Kyrpidia tusciae* DSM 2912T | Btus\_2490 | ADG07150 |
| *Metallosphaera cuprina* Ar-4T (JCM 15769T) | Mcup\_0662 | AEB94767 |
| *Metallosphaera sedula* DSM 5348T | Msed\_1570 | ABP95725 |
| *Rhodobacter aestuarii* JA296T (JCM 144887T) | BW967\_RS14430 | WP\_076485799 |
| *Rhodobacter* sp. SW2 | RSW2DRAFT\_RS16455 | WP\_008033037 |
| *Saccharomonospora marina* XMU15 (DSM 45390T) | SACMADRAFT\_RS09400 | WP\_009153571 |
| *Saccharomonospora marina* XMU15 (DSM 45390T) | SACMADRAFT\_RS09445 | WP\_009153580 |
| *Saccharomonospora marina* XMU15 (DSM 45390T) | SACMADRAFT\_RS09450 | WP\_009153581 |
| *Sulfobacillus acidophilus* DSM 10332T | Sulac\_1389 | AEW04886 |
| *Sulfobacillus acidophilus* DSM 10332T | Sulac\_1390 | AEW04887 |
| *Sulfobacillus acidophilus* TPY | TPY\_3525 | AEJ41677 |
| *Sulfobacillus acidophilus* TPY | TPY\_3526 | AEJ41678 |
| *Sulfobacillus thermosulfidooxidans* DX | BFX05\_RS00170 | WP\_0760055821 |
| *Sulfobacillus thermosulfidooxidans* DX | BFX05\_RS00175 | WP\_020373190 |
| *Sulfolobus acidocaldarius* DSM 639T | Saci\_0349 | AAY79765 |
| *Sulfolobus acidocaldarius* DSM 639T | Saci\_0350 | AAY79766 |
| *Sulfolobus “islandicus”* M.14.25 | M1425\_1122 | ACP37884 |
| *Sulfolobus solfataricus* P2 (DSM 1617) | SSO1105 | AAK41362 |
| *Sulfolobus tokodaii* str. 7 (DSM 16993T) | STK\_18940 | BAB66988 |
| *Sulfolobus tokodaii* str. 7 (DSM 16993T) | STK\_18950 | BAB66989 |
| *Sulfuricella denitrificans* skB26T (DSM 22764T) | SCD\_RS03980 | WP\_021035773 |
| *Thermithiobacillus tepidarius* DSM 3134T | G579\_RS0105280 | WP\_028989345 |
| *Thermithiobacillus tepidarius* DSM 3134T | G579\_RS0105270 | WP\_038018313 |
| *Thermocrinis albus* DSM 14484T | THAL\_RS06810 | WP\_012992376 |
| *Thermocrinis albus* DSM 14484T | THAL\_RS06825 | WP\_012992379 |
| *Thermocrinis minervae* DSM 19557T | SAMN05444391\_1184 | SHK48708 |
| *Thermocrinis minervae* DSM 19557T | SAMN05444391\_1187 | SHK48788 |
| *Thermocrinis jamiesonii* GBST (DSM 27162T) | K217\_RS0105850 | WP\_029552192 |
| *Thermocrinis jamiesonii* GBST (DSM 27162T) | K217\_RS0105865 | WP\_029552195 |
| *Thermomicrobium roseum* DSM 5159T | trd\_0143 | ACM05628 |
| *Thermomicrobium roseum* DSM 5159T | trd\_0144 | ACM04497 |
| *Thermomicrobium roseum* DSM 5159T | trd\_0157 | ACM04821 |
| *Thioalkalivibrio nitratireducens* DSM 14787T | TVNIR\_3241 | AGA34878 |
| *Thioalkalivibrio nitratireducens* DSM 14787T | TVNIR\_3243 | AGA34880 |
| *Thioalkalivibrio* sp. AKL11 | D574\_RS0111990 | WP\_083916433 |
| *Thioalkalivibrio* sp. AKL11 | D574\_RS0112000 | WP\_018941302 |
| *Thioalkalivibrio* sp. ALJ3 | C935\_RS0110705 | WP\_081616601 |
| *Thioalkalivibrio* sp. ALJ3 | C935\_RS0110715 | WP\_018862495 |
| *Thioalkalivibrio* sp. ALMg13-2 | F618\_RS0106170 | WP\_077276997 |
| *Thioalkalivibrio* sp. ALMg13-2 | F618\_RS0106180 | WP\_018168416 |
| *Thioalkalivibrio* sp. K90mix | TK90\_0638 | ADC71153 |
| *Thioalkalivibrio* sp. K90mix | TK90\_0640 | ADC71155 |
| *Thioalkalivibrio sulfidiphilus* HL-EbGr7 | Tgr7\_2208 | ACL73288 |
| *Thioalkalivibrio sulfidiphilus* HL-EbGr7 | Tgr7\_2210 | ACL73290 |
| *Thioalkalivibrio versutus* | TVD\_10610 | AKJ95782 |
| *Thioalkalivibrio versutus* | TVD\_10620 | AKJ95783 |
| *Thiohalorhabdus denitrificans* HL 19 (DSM 15699T) | BLP36\_RS08615 | WP\_054965387 |
| *Thiohalorhabdus denitrificans* HL 19 (DSM 15699T) | BLP36\_RS08625 | WP\_054965385 |
| *Thiohalospira halophila* DSM 15071T | SAMN05660831\_02558 | SFD89889 |
| *Thiohalospira halophila* DSM 15071T | SAMN05660831\_02560 | SFD89950 |
| *Thiorhodospira sibirica* ATCC 700588T | ThisiDRAFT\_2440 | EGZ43482 |
| *Thiorhodospira sibirica* ATCC 700588T | ThisiDRAFT\_1533 | EGZ46119 |