**S3 Table. List of bacterial strains and plasmids used**

|  |  |  |
| --- | --- | --- |
| Strain or plasmid | Genotypes or characteristics | Source or reference |
| Strains |  |  |
| KP7600 | W3110 type-A, F-, lacIq, lacZ∆M15, λ-, galK2, galT22, IN(rrnD-rrnE)1 | NBRP |
| HV1 | A high virulent mutant from KP7600 carrying LptD G580S | This study |
| HV10 | A high virulent mutant from KP7600 carrying LptE T95I | This study |
| HV11 | A high virulent mutant from KP7600 carrying LptE T95I | This study |
| HV3 | A high virulent mutant from KP7600 carrying LptD G348D | This study |
| HVK9a | A high virulent mutant from KP7600 carrying LptD S350N | This study |
| HVK9b | A high virulent mutant from KP7600 carrying LptE E139K | This study |
| JD20181 | KP7600 yabP::miniTn10; Kanr, LptD WT | NBRP |
| PHVDG580S | KP7600 yabP::miniTn10; Kanr, LptD G580S | This study |
| PHVDG348D | KP7600 yabP::miniTn10; Kanr, LptD G348D | This study |
| PHVDS350N | KP7600 yabP::miniTn10; Kanr, LptD S350N | This study |
| JD26070 | KP7600 cobC::miniTn10; Kanr, LptE WT | NBRP |
| PHVET95I | KP7600 cobC::miniTn10; Kanr, LptE T95I | This study |
| PHVE139K | KP7600 cobC::miniTn10; Kanr, LptE E139K | This study |
| JD20181R | KP7600 intergenic(insH1-Int)::cat; Cmr, yabP::miniTn10; Kanr, LptD WT | This study |
| PHVDG580SR | KP7600 intergenic(insH1-Int):cat; Cmr, yabP::miniTn10; Kanr, LptD G580S | This study |
| JD26070R | KP7600 intergenic(caiE-F)::cat; Cmr, cobC::miniTn10; Kanr, LptE WT | This study |
| PHVET95IR | KP7600 intergenic(caiE-F)::cat; Cmr, cobC::miniTn10; Kanr, LptE T95I | This study |
| AM1 | KP7600 yabP::miniTn10; Kanr, LptE T86am | This study |
| AM2 | KP7600 yabP::miniTn10; Kanr, LptE T86am, LptD G580S | This study |
| AM3 | KP7600 cobC::miniTn10; Kanr, LptE T86am | This study |
| AM4 | KP7600 cobC::miniTn10; Kanr, LptE T86am T95I | This study |
| AM5 | KP7600 yabP::miniTn10; Kanr, LptE F90am, | This study |
| AM6 | KP7600 yabP::miniTn10; Kanr, LptE F90am, LptD G580S | This study |
| AM7 | KP7600 cobC::miniTn10; Kanr, LptE F90am | This study |
| AM8 | KP7600 cobC::miniTn10; Kanr, LptE F90am T95I | This study |
| AM9 | KP7600 yabP::miniTn10; Kanr, LptE R124am | This study |
| AM10 | KP7600 yabP::miniTn10; Kanr, LptE R124am, LptD G580S | This study |
| AM11 | KP7600 cobC::miniTn10; Kanr, LptE R124am | This study |
| AM12 | KP7600 cobC::miniTn10; Kanr, LptE R124am T95I | This study |
| AM13 | KP7600 yabP::miniTn10; Kanr, LptE R150am | This study |
| AM14 | KP7600 yabP::miniTn10; Kanr, LptE R150am, LptD G580S | This study |
| AM15 | KP7600 cobC::miniTn10; Kanr, LptE R150am | This study |
| AM16 | KP7600 cobC::miniTn10; Kanr LptE R150am T95I | This study |
| SP1 | KP7600 yabP::miniTn10; Kanr, LptD G580S, R429H | This study |
| SP2 | KP7600 yabP::miniTn10; Kanr, LptD G580S, G445D | This study |
| SP3 | KP7600 yabP::miniTn10; Kanr, LptD G580S, G489D | This study |
| SP4 | KP7600 yabP::miniTn10; Kanr, LptD G580S, E509K | This study |
| SP5 | KP7600 yabP::miniTn10; Kanr, LptD G580S, lptE -6G>A | This study |
| SP6 | KP7600 intergenic(insH1-Int):cat; Cmr, yabP::miniTn10; Kanr, LptD G580S, LptE W21R | This study |
| SP7 | KP7600 cobC::miniTn10; Kanr, LptE T95I, -9G>A | This study |
| SP8 | KP7600 intergenic(caiE-F)::cat; Cmr, cobC::miniTn10; Kanr, LptE T95I, LptD G412D | This study |
| SP9 | KP7600 intergenic(caiE-F)::cat; Cmr, cobC::miniTn10; Kanr, LptE T95I, LptD R429H | This study |
| SP10 | KP7600 intergenic(caiE-F)::cat; Cmr, cobC::miniTn10; Kanr, LptE T95I, LptD E509K | This study |
| BW25113 | rrnB, DElacZ4787, HsdR514, DE(araBAD)567, DE(rhaBAD)568, rph-1 | NBRP |
| CL1 | BW25113 O7-type (LptE K79A, A83S, K84Q, I101V, N105S, T107S, D141E, V144I) | This study |
| CL2 | BW25113 O44-type (LptD N316Q) | This study |
| CL3 | BW25113 LY180-type (LptD E137K, D524K) | This study |
| CL4 | BW25113 O157-type (LptD D57N, P209S, LptE K79A, A83S, K84Q, I101V, N105S, T107S, A120T, D141E, V144I) | This study |
| CL5 | BW25113 O111-type (LptD W249R, LptE E171K) | This study |
| CL6 | BW25113 O55-type (LptD K92Del, E93Del, LptE K79A, A83S, K84Q, I101V, N105S, T107S, A120T, D141E, V144I) | This study |
| CL7 | BW25113 O18-type (LptD E299K, D475A, V478A, K490R, D524K, E618D) | This study |
| CL8 | BW25113 O81-type (LptD E299K, D475A, V478A, K490R, D524K, E618D, LptE P181L) | This study |
| CL9 | BW25113 O6-type (LptD E299K, K473R, D475A, V478A, K490R, D524K, E618D) | This study |
| CL10 | BW25113 O127-type (LptD E299K, N316K, K473R, D475A, V478A, K490R, D524K, E618D) | This study |
| BL21Star(DE3) | F-, ompT, hsdSB (rB-, mB-), gal, dcm, rne131, (DE3) | Thermo Fisher |
|  |  |  |
| Plasmids |  |  |
| pAC-ZEAXipi | A vector to produce zeaxanthin, Cmr | Addgene [[1](#_ENREF_1)] |
| pAC-BETAipi | A vector to produce beta-carotene, Cmr | Addgene [[2](#_ENREF_2)] |
| pET28b | *E. coli* vector for protein overproduction, Kanr | Novagen |
| pET28b-LptD | pET28b with partial LptD (319-775 aa) | This study |
| pET28b-LptE | pET28b with partial LptE (20-193 aa) | This study |
| pEVOL-pBpF | tRNA synthetase/tRNA pair for the *in vivo* incorporation of a photocrosslinker, p-benzoyl-l-phenylalanine, Cmr | Addgene [[3](#_ENREF_3)] |
| pKD46 | λRed recombinase expression, temperature-sensitive, Ampr | [[4](#_ENREF_4)] |
| pKD4 | flp-kan-flp; Kanr, Ampr | [[4](#_ENREF_4)] |
| pKD3 | flp-cat-flp; Cmr, Ampr | [[4](#_ENREF_4)] |

Kan: kanamycin, Cm: chloramphenicol, Amp: ampicillin.

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