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| **Table S2.** Primers used in this study |
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| **Gene name** | **Forward primer (5' - 3')** | **Reverse primer (5' - 3')** | **Location /Target** |
| Complete *nif* cluster with *nif* promoter | S5.*ni f* cluster-up (GCTCTAGAGCGGAGACTATTTCCCAAAAT) | S6.*nif* cluster-down(TGCGGATCCGCGTGTAATGGTTATATGAAT) | For cloning *nif* cluster to pHY300PLK |
| Complete *nif* cluster without *nif* promoter | pET28-*nif*-up(CGGGATCCAATGGACTCTTTAGCTGATCT) | pET28*-nif*-down (CCCAAGCTTTAATGGTTATATGAATCAAGA) | For cloning *nif* cluster to pET-28b |
| *nifBHDKENXhesA* | S5*.nif* cluster-up (GCTCTAGAGCGGAGACTATTTCCCAAAAT) | pS-V-down (CGCGGATCCGGTCATTAGCTTCATCTG) | For construction of Δ*nifV* |
| *nifBHDKENX* | S5*.nif* cluster-up (GCTCTAGAGCGGAGACTATTTCCCAAAAT) | pS-O-down (GCGGATCCAACCATAACCGTAGCCTGCTTTA) | For construction of Δ*hesAnifV* |
| *nifBHDKEN* | S5*.nif* cluster-up (GCTCTAGAGCGGAGACTATTTCCCAAAAT) | pS-X-down (GCGGATCCAACCATAACCGTAGCCTGCTTTA) | For construction of Δ*nifXVhesA* |
| *nifBHDKE* | S5*.nif* cluster-up (GCTCTAGAGCGGAGACTATTTCCCAAAAT) | pS-N-down (CGCGGATCCGGTCATTAGCTTCATCTG) | For construction of Δ*nifNXVhesA* |
| *nifBHDKEN* | S5.*nif* cluster-up (GCTCTAGAGCGGAGACTATTTCCCAAAAT) | *nifN*-XhoI (AACTCGAGCTTCATCCTCCCCTCCCCCTCTCG)  | For construction of Δ*nifX* or Δ*nifXhesA* |
| *nifV* | *nifV*-UP-XS(AACTCGAGAAGAGCTCGGAGGGGATACAGATGAGTCGG) | S6.*nif* cluster-down(TGCGGATCCGCGTGTAATGGTTATATGAAT)  | For construction of Δ*nifXhesA* or Δ*hesA* |
| *nifBHDKENXhesA* | Orf1-up (AACTCGAGGGAGGGGATACAGATGCTGAGGAGGGCAGCGGC) | S6.*nif* cluster-down(TGCGGATCCGCGTGTAATGGTTATATGAAT) | For construction of Δ*nifX* |
| *nifBHDKENX* | S5.*nif* cluster-up (GCTCTAGAGCGGAGACTATTTCCCAAAAT) | *nifX*-XhoI (AACTCGAGCTCATGATTCGGCTTTGCCGCTG)  | For construction of Δ*hesA* |
| *nifX* | *nifX*-up-Hind (GCGAAGCTTATGAAGG TTGCATTTGCGACG) | c-*nifX*-down (TGGTCTAGACATGATTCGGCTTTGCCGCTG) | For complement of Δ*nifX* |
| *hesA* | *hesA*-up-Hind(ATTAAGCTTATGCTGAGGAGGGCAGCGGC) | *hesA*-down-XbaI (GCGTCTAGACCGTCACGAAGTGTCGTATCAC) | For complement of Δ*hesA* |
| *nifXhesA* | *nifX*-up-Hind (GCGAAGCTTATGAAGGTTGCATTTGCGACG) | *hesA*-down-XbaI (GCGTCTAGACCGTCACGAAGTGTCGTATCAC) | For complement of Δ*nifXhesA* |
| *nif* promoter | P*nifB-*100-up (CGGGGTACCCGT AAAATTTGACACATATG) | P*nif*-down-Hind (GCCAAGCTTATATAATTAC ATCTTAGAGACAG) | For construction of P*nif::lacZ* fusion |
| *nif* promoter | pfoot-up (AGGAGAGCCGTATTTACGGAC) | pfoot-down (GCTACTGGAAGATGAATGCGCG). | For footprinting assay |
| *rpoD* | Sigma A-F (CCGGAATTCGATGGCGAATGATCAGCATACT) | Sigma A-R (ACGCGTCGACGTCCGCAATGTAACGCTTC-) | σ70 |
| *nifH* | pS-*nifH*-up (CGGGATCCTATGAGACAAATTGCGTTTTAC) | *nifH*-R (ACCTGCCAGCTCTTCATACTC) | RT-PCR |
| *nifK* | *nifK*-up (ATGAGCGAGCGTCCGAATAT) | *nifK*-down (TCAATGCCTCGGGAATTTC) | RT-PCR |
| 16S rDNA | *E. coli*-16S-F (GGTGATAGCGGTGAAATGCG) | *E.coli*-16S-R (CTGGCAACAAAGGATAAGGGTT) | RT-PCR (control) |
| 16S rDNA | *Paeni*-16S-F (ATGGGCGAAGGAGGAAAGAC) | *Paeni*-16S-R (CCAGGCGGAATGCTTARTGTG) | RT-PCR (control) |
| *nifB* | Random primer mix | s6-GSP2 (ATCTCCAGGTCCCGCAATGCCG) | 5’-RACE |
| *nifB* | Random primer mix | s6-GSP3 (TCATTGACGCAATCGAATTTG) | 5’-RACE |