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Protocol

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Precise genome engineering in *Pseudomonas* using phage-encoded homologous recombination and the Cascade–Cas3 system

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Supplementary Table 1 Antibiotic concentrations used in four *Pseudomonas* strains.

Strain \ Antibiotic (μg mL^{-1})	Kanamycin [*km*]	Gentamycin [*genta*]	Apramycin [*apra*]	Tetracycline [*tet*]	Ampicillin [*amp*]	Chloramphenicol [*cm*]
P. aeruginosa PAO1	300	15	60	50	ND[b]	90
P. protegens pf5	10	15	20	35	ND	ND
P. putida KT2440	15	10	40	--[a]	300	ND
P. syringae pv. tomato str. DC3000	15	3	20	3	200	ND

--[a] Did not test this antibiotic

ND[b] Can not use this antibiotic

Supplementary Table 2 Recombineering systems used in this protocol.

Recombineering systems	Recombinases	Vector	Antibiotic resistance gene	Promoter for guide RNA and Cascade-Cas3 system	Promoter for recombinases
pHERD30T-BAD-redγβα-kan	Redα, Redβ and Redγ	pHERD30T	kanamycin resistance gene	*araC* P_{BAD} promoter	*rhaR-rhaS* P_{Rha} promoter
pHERD30T-BAD-pluγβα-kan	Pluα, Pluβ and Pluγ				
pHERD30T-BAD-TE_{Psy}-kan	$RecT_{Psy}$ and $RecE_{Psy}$				
pHERD30T-BAD-pluγTE_{Psy}-kan	$RecT_{Psy}$, $RecE_{Psy}$ and Pluγ				
pHERD30T-BAD-redγTE_{Psy}-kan	$RecT_{Psy}$, $RecE_{Psy}$, and Redγ				
pHERD30T-BAD-BAS-kan	Alpha, Beta and SSB from phage_AB31				
pHERD30T-BAD-pluγBAS-kan	Alpha, Beta, SSB from phage_AB31 and Pluγ				
pHERD30T-BAD-redγBAS-kan	Alpha, Beta, SSB from phage_AB31 and Redγ				

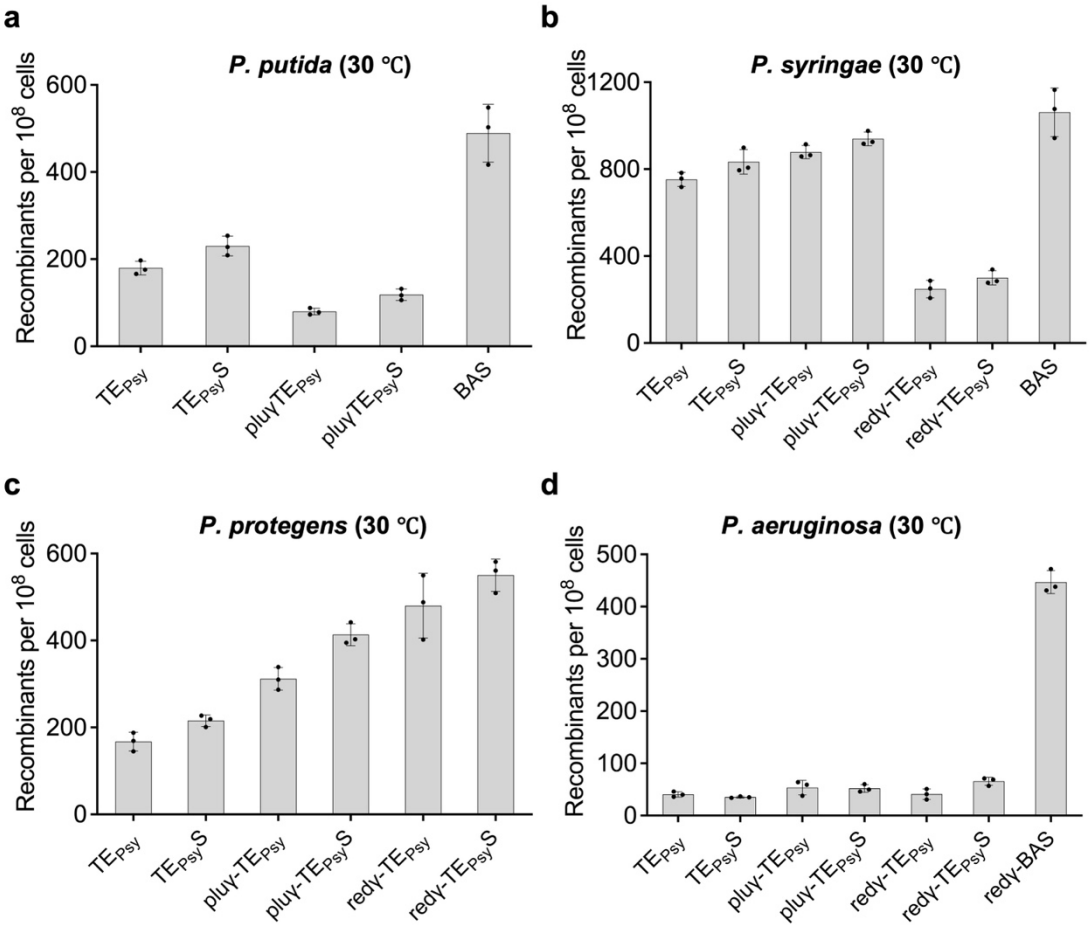
Supplementary Table 3 *Pseudomonas* strains used in this protocol.

Strains	Description	Optimum growth temperature (℃)	Source
P. putida KT2440	A metabolically versatile saprophytic soil bacterium that has been certified as a biosafety host for the cloning of foreign genes	30	[1]
P. syringae DC3000	An agriculturally important plant pathogen could cause bacterial speck of tomato	30	[2]
P. protegens pf5	A plant commensal bacterium that inhabits the rhizosphere and produces secondary metabolites that suppress soilborne plant pathogens	30	[3]
P. aeruginosa PAO1	A ubiquitous environmental bacterium that is one of the top three causes of opportunistic human infections. A major factor in its prominence as a pathogen is its intrinsic resistance to antibiotics and disinfectants.	37	[4]

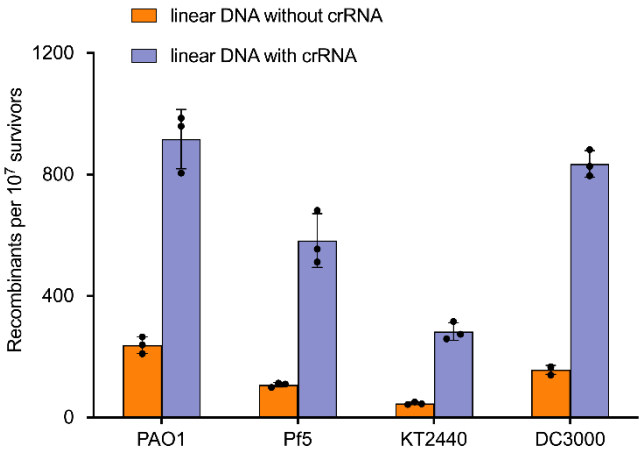
Supplementary Table 4 Plasmids used in this protocol.

Plasmids	Addgene number	Characteristics	Step number	Sequence	references
pHERD30T-BAD-GFP-Rha-Cas-kan	201836	*gfp* under BAD promoter, *cas* under Rha promoter	Step 39	Supplementary note 1	[5]
pHERD30T-BAD-redγβα-Rha-Cas-kan (Redγβα-Cas3)	194866	*redγβα* under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 2	[5]
pHERD30T-BAD-pluγβα-Rha-Cas-kan (Pluγβα-Cas3)	194867	*pluγβα* under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 3	[5]
pBBR1-Rha-TE$_{Psy}$-kan	201841	*rec*TE$_{Psy}$ under Rha promoter		Supplementary note 4	[5]
pBBR1-Rha-TE$_{Psy}$S-kan	201842	*rec*TE$_{Psy}$SSB under Rha promoter		Supplementary note 5	This study
pBBR1-Rha-pluγTE$_{Psy}$-kan	201837	*rec*TE$_{Psy}$ and *pluγ* under Rha promoter		Supplementary note 6	[5]
pBBR1-Rha-pluγTE$_{Psy}$S-kan	201838	*rec*TE$_{Psy}$SSB and *pluγ* under Rha promoter		Supplementary note 7	This study
pBBR1-Rha-redγTE$_{Psy}$-kan	201839	*rec*TE$_{Psy}$ and *redγ* under Rha promoter		Supplementary note 8	[5]
pBBR1-Rha-redγTE$_{Psy}$S-kan	201840	*rec*TE$_{Psy}$SSB and *redγ* under Rha promoter		Supplementary note 9	This study
pHERD30T-BAD-TE$_{Psy}$-Rha-Cas-kan (TE$_{Psy}$-Cas3)	194868	*rec*TE$_{Psy}$ under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 10	[5]
pHERD30T-BAD-pluγTE$_{Psy}$-Rha-Cas-kan (PluγTE$_{Psy}$-Cas3)	194869	*rec*TE$_{Psy}$ and *pluγ* under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 11	[5]
pHERD30T-BAD-redγTE$_{Psy}$-Rha-Cas-kan (RedγTE$_{Psy}$-Cas3)	194870	*rec*TE$_{Psy}$ and *redγ* under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 12	[5]
pHERD30T-BAD-BAS-Rha-Cas-kan (BAS-Cas3)	194871	BAS gene under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 13	[5]
pHERD30T-BAD-pluγBAS-Rha-Cas-kan (PluγBAS-Cas3)	194872	BAS gene and *pluγ* under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 14	[5]
pHERD30T-BAD-redγBAS-Rha-Cas-kan (RedγBAS-Cas3)	194873	BAS gene and *redγ* under BAD promoter, *cas* under Rha promoter	Steps 10, 14	Supplementary note 15	[5]
pR6K-Tps-genta-tet-T7RP	201843	PCR template to amplify lox71-genta^{R}-lox66 or *genta^{R}* gene	Steps 27B(i), 41	Supplementary note 16	[5]

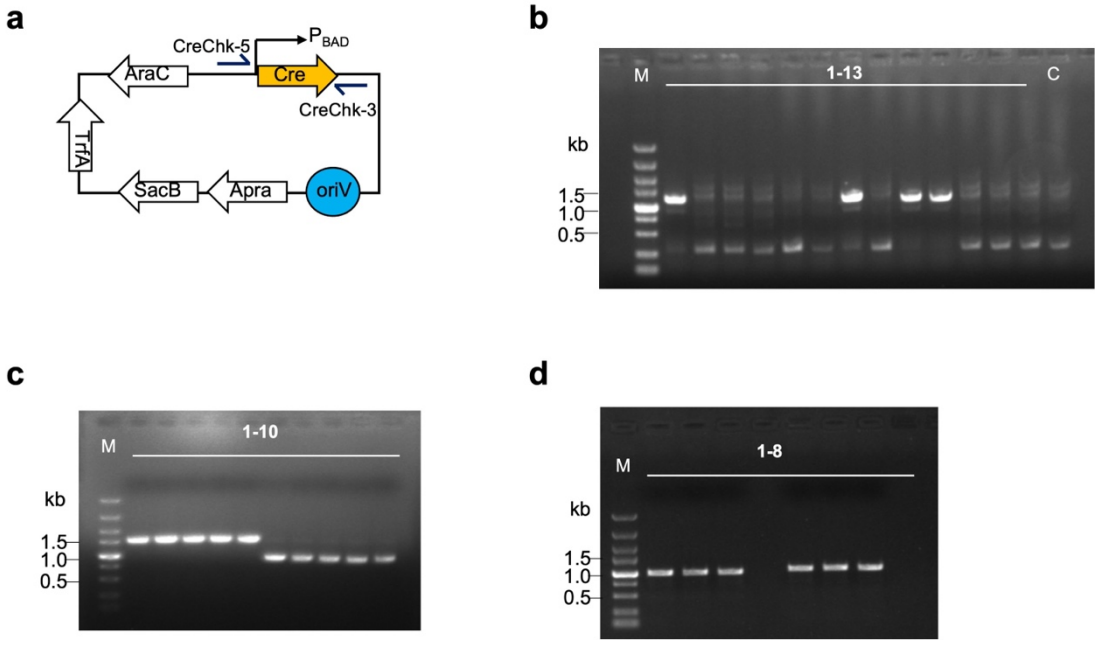
pR6K-SacB-genta	201844	PCR template to amplify the SacB-genta^{R} cassette	Step 27A(i)	Supplementary note 17	This study
pRK2-BAD-Cre-SacB-apra	201845	Express the site-specific recombinase (Cre) and add sucrose to quench the plasmid under the SacB counter selection pressure	Step 27B(iv)	Supplementary note 18	[5]
pHERD30T-SacB-genta	201846	the counter-selection marker (*sacB*) to counterselect the plasmid after adding sucrose	Step 27A(xii)	Supplementary note 19	This study
pHERD30T-BAD-redγβα-kan-amp-ccdB	201847	*redγβα* under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 20	This study
pHERD30T-BAD-pluγβα-kan-amp-ccdB	201848	*pluγβα* under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 21	This study
pHERD30T-BAD-TE$_{Psy}$-kan-amp-ccdB	201849	*rec*TE$_{Psy}$ under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 22	This study
pHERD30T-BAD-pluγTE$_{Psy}$-kan-amp-ccdB	201850	*rec*TE$_{Psy}$ and *pluγ* under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 23	This study
pHERD30T-BAD-redγTE$_{Psy}$-kan-amp-ccdB	201851	*rec*TE$_{Psy}$ and *redγ* under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 24	This study
pHERD30T-BAD-BAS-kan-amp-ccdB	201852	BAS gene under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 25	This study
pHERD30T-BAD-pluγBAS-kan-amp-ccdB	201853	BAS gene and *pluγ* under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 26	This study
pHERD30T-BAD-redγBAS-kan-amp-ccdB	201854	BAS gene and *redγ* under BAD promoter, *cas* under Rha promoter and amp-ccdB cassette	Step 1	Supplementary note 27	This study



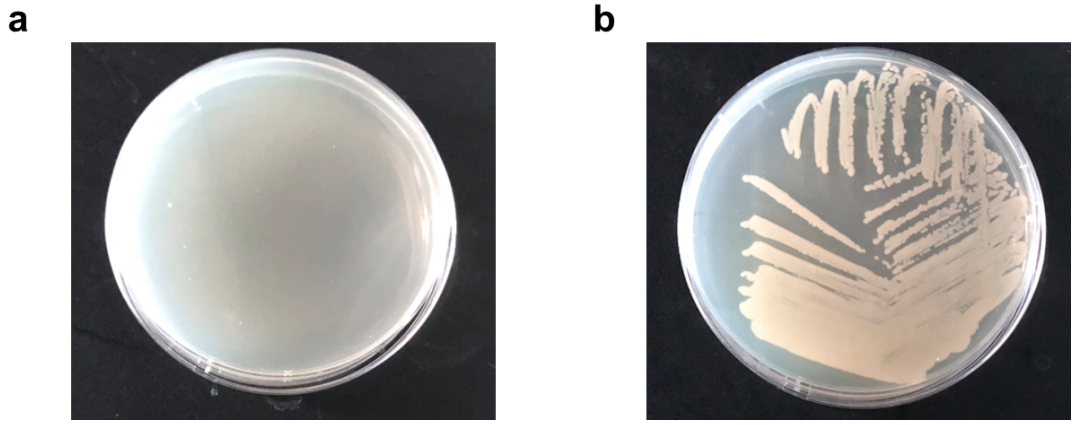
Supplementary Figure 1. The effect of SSB protein on recombination efficiency in Pseudomonas. (**a**) Results from the recombineering assay in *P. putida* KT2440 upon the expression of TE_{Psy}, $TE_{Psy}SSB$, $Plu\gamma TE_{Psy}$, $Plu\gamma TE_{Psy}SSB$ and BAS at 30 °C. (**b**) Results from the recombineering assay in *P. Syringae* DC3000 upon the expression of TE_{Psy}, $TE_{Psy}SSB$, $Plu\gamma TE_{Psy}$, $Plu\gamma TE_{Psy}SSB$, $Red\gamma TE_{Psy}$, $Red\gamma TE_{Psy}SSB$ and BAS at 30 °C. (**c**) Results from the recombineering assay in *P. protegens* pf5 upon the expression of TE_{Psy}, $TE_{Psy}SSB$, $Plu\gamma TE_{Psy}$, $Plu\gamma TE_{Psy}SSB$, $Red\gamma TE_{Psy}$ and $Red\gamma TE_{Psy}SSB$ at 30 °C. (**d**) Results from the recombineering assay in *P. aeruginosa* PAO1 upon the expression TE_{Psy}, $TE_{Psy}SSB$, $Plu\gamma TE_{Psy}$, $Plu\gamma TE_{Psy}SSB$, $Red\gamma TE_{Psy}$, $Red\gamma TE_{Psy}SSB$ and RedγBAS at 30 °C. Data represent the mean ± SD from three independent experiments in each case. Statistical source data are provided in Supplementary Data 1.



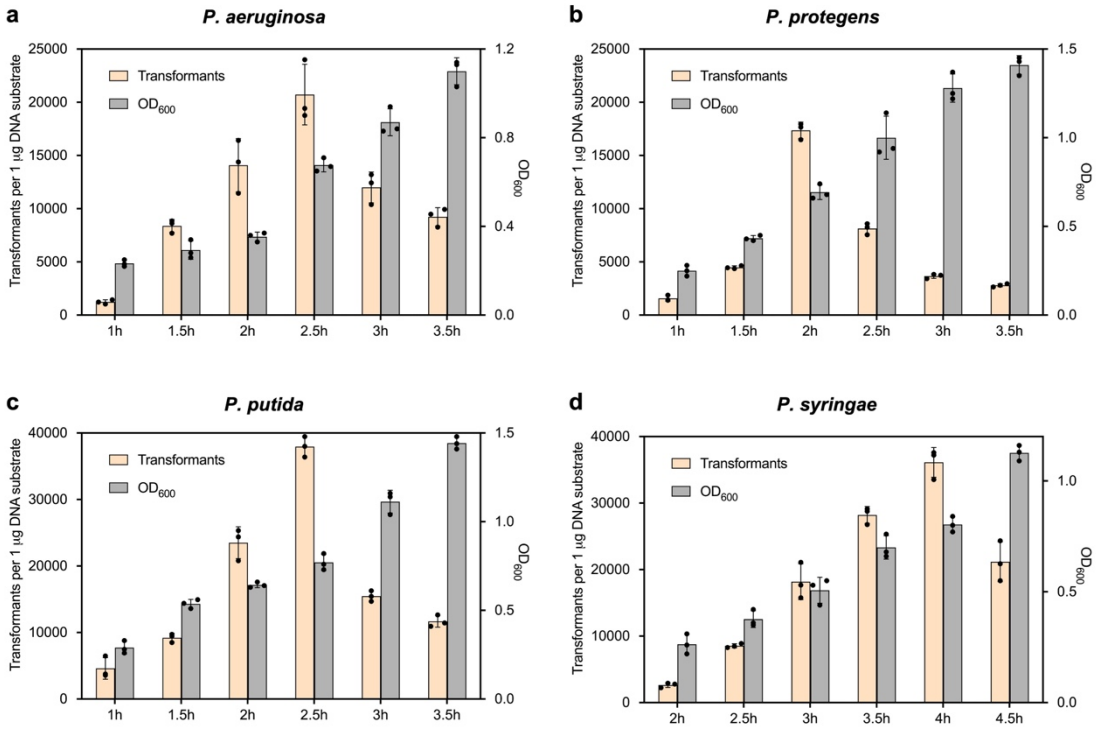
Supplementary Figure 2. Recombineering efficiency test in *Pseudomonas* using RedγBAS-Cas3 for *P. aeruginosa* PAO1, RedγTE$_{Psy}$-Cas3 for *P. protegens* Pf5, BAS-Cas3 for *P. putida* KT2440, and BAS-Cas3 for *P. syringae* DC3000. Data represent the mean ± SD from three independent experiments in each case. Statistical source data are provided in Supplementary Data 1.



Supplementary Figure 3. PCR verification of genome engineering via site-specific recombinase (Cre) in *P. putida* KT2440. (**a**) Diagram of the expression plasmid pRK2-BAD-Cre-SacB-apra. (**b**) Insertion of the lox72-Genta-lox66 cassette into the *lysR* target using primer pairs KTlysChk-5/GenChk-5 gives a PCR product of 1082 bp. Lane M is the Takara DL5000 marker. Lane C is the wild-type strain, used as a negative control. Lanes 1–13 are recombinants. Clones 1, 7 and 10 are correct. (**c**) Colony PCR verification using primer pairs KTlysChk-5/KTlysChk-3 before Cre induction (lanes 1−5) gives a PCR product of 1590 bp, and after Cre induction (lane 6–10) gives PCR product of 784 bp. All clones are correct. (**d**) Colony PCR verification using primer pairs CreChk-5/CreChk-3 after Cre expression plasmid counter-selection. Clones 4 and 8 are correct.



Supplementary Figure 4. SacB function test on LB plate containing 10 % sucrose. *P. putida* mutant colony harbouring the Cre expression plasmid, pRK2-BAD-Cre-SacB-Apra (**a**) and plasmid quenching (**b**).



Supplementary Figure 5. Optimization of transformation in *Pseudomonas*. The optical density (OD) at 600 nm (OD_{600}) and number of transformants after electroporation of pHERD30T-BAD-GFP-Rha-Cas-kan in *P. aeruginosa* PAO1 (**a**), *P. protegens* Pf5 (**b**), *P. putida* KT2440 (**c**), and *P. syringae* DC3000 (**d**). Data represent the mean ± SD from three independent experiments in each case. Statistical source data are provided in Supplementary Data 1.

Reference

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Supplementary note

Supplementary note 1: Complete sequence of the pHERD30T-BAD-GFP-Rha-Cas-kan plasmid in Genbank format.

LOCUS pHERD30T-BAD-GFP-kan 13796 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-GFP-kan
ACCESSION pHERD30T-BAD-GFP-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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/label=" pHERD30T ori"
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Supplementary note 2: Complete sequence of the pHERD30T-BAD-redγβα-Rha-Cas-kan plasmid in Genbank format.

LOCUS pHERD30T-BAD-redγβα-kan 14928 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-redγβα-kan
ACCESSION pHERD30T-BAD-redγβα-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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rep_origin 1093..2291
/label=" pHERD30T ori"
/note="replication origin"
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ORIGIN
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Supplementary note 3: Complete sequence of the pHERD30T-BAD-pluγβα-Rha-Cas-kan plasmid in Genbank format.

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DEFINITION  pHERD30T-BAD-pluγβα-kan
ACCESSION   pHERD30T-BAD-pluγβα-kan
KEYWORDS
SOURCE
  ORGANISM

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Supplementary note 4: Complete sequence of the pBBR1-Rha-TE$_{Psy}$-kan plasmid in Genbank format.

LOCUS pBBR1-Rha-TE$_{Psy}$-kan 8921 bp DNA circular SYN 21-MAR-2019
DEFINITION pBBR1-Rha-TE$_{Psy}$-kan
ACCESSION pBBR1-Rha-TE$_{Psy}$-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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/note="kanamycin resistance gene"
rep_origin 1093..2291
/label=" pHERD30T ori"
/note="replication origin"
CDS 2292..3140
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CDS 3214..4050
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CDS 6943..8604
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ORIGIN

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Supplementary note 5: Complete sequence of the pBBR1-Rha-TE$_{Psy}$S-kan plasmid in Genbank format.

LOCUS pBBR1-Rha-TE$_{Psy}$S-kan 9387 bp DNA circular SYN 21-MAR-2019
DEFINITION pBBR1-Rha-TE$_{Psy}$S-kan
ACCESSION pBBR1-Rha-TE$_{Psy}$S-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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Supplementary note 6: Complete sequence of the pBBR1-Rha-pluγTE$_{Psy}$-kan plasmid in Genbank format.

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DEFINITION pBBR1-Rha-pluγTE$_{Psy}$-kan
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KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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//

Supplementary note 7: Complete sequence of the pBBR1-Rha-pluγTE$_{Psy}$S-kan plasmid in Genbank format.

LOCUS pBBR1-Rha-pluγTE$_{Psy}$S-kan 9658 bp DNA circular SYN 21-MAR-2019
DEFINITION pBBR1-Rha-pluγTE$_{Psy}$S-kan
ACCESSION pBBR1-Rha-pluγTE$_{Psy}$S-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
rep_origin 1..675
/label="pBBR1 ori"
/note="replication origin"
CDS 1657..2655
/label="mob"
/note="replication protein"
CDS 2913..3707
/label="kanR"
/note="kanamycin resistance gene"
CDS 4006..4944
/label="rhaR"
/note="regulator gene of L-rhamnose operon"
CDS 4928..5764
/label="rhaS"
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/label="Rha promoter"
CDS 6059..6313
/label="pluγ"
/note="gam protein from Photorhabdus, recBCD inhibitor
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Supplementary note 8: Complete sequence of the pBBR1-Rha-redγTE$_{Psy}$-kan plasmid in Genbank format.

LOCUS pBBR1-Rha-redγTE$_{Psy}$-kan 9351 bp DNA circular SYN 21-MAR-2019
DEFINITION pBBR1-Rha-redγTE$_{Psy}$-kan
ACCESSION pBBR1-Rha-redγTE$_{Psy}$-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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/label="pBBR1 ori"
/note="replication origin"
CDS 1657..2655
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CDS 2913..3707
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//

Supplementary note 9: Complete sequence of the pBBR1-Rha-redγTE$_{Psy}$S-kan plasmid in Genbank format.

LOCUS pBBR1-Rha-redγTE$_{Psy}$S-kan 9820 bp DNA circular SYN 21-MAR-2019
DEFINITION pBBR1-Rha-redγTE$_{Psy}$S-kan
ACCESSION pBBR1-Rha-redγTE$_{Psy}$S-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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Supplementary note 10: Complete sequence of the pHERD30T-BAD-TE_{Psy}-Rha-Cas-kan plasmid in Genbank format.

LOCUS pHERD30T-BAD-TE_{Psy}-kan 15589 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-TE_{Psy}-kan
ACCESSION pHERD30T-BAD-TE_{Psy}-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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ORIGIN

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Supplementary note 11: Complete sequence of the pHERD30T-BAD-pluγTE$_{Psy}$-Rha-Cas-kan plasmid in Genbank format.

LOCUS pHERD30T-BAD -pluγTE$_{Psy}$-kan 15960 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-pluγTE$_{Psy}$-kan
ACCESSION pHERD30T-BAD-pluγTE$_{Psy}$-kan
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SOURCE
ORGANISM

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Supplementary note 12: Complete sequence of the pHERD30T-BAD-redγTE$_{Psy}$-Rha-Cas-kan plasmid in Genbank format.

LOCUS pHERD30T-BAD-redγTE$_{Psy}$-kan 16019 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-redγTE$_{Psy}$-kan
ACCESSION pHERD30T-BAD-redγTE$_{Psy}$-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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rep_origin 1093..2291
/label=" pHERD30T ori"
/note="replication origin"
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/label="rhaR"
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Supplementary note 13: Complete sequence of the pHERD30T-BAD-BAS-Rha-Cas-kan plasmid in Genbank format.

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ACCESSION   pHERD30T-BAD-BAS-kan
KEYWORDS
SOURCE
  ORGANISM

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Supplementary note 14: Complete sequence of the pHERD30T-BAD-pluγBAS-Rha-Cas-kan plasmid in Genbank format.

LOCUS pHERD30T-BAD-pluγBAS-kan 15143 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-pluγBAS-kan
ACCESSION pHERD30T-BAD-pluγBAS-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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rep_origin 1093..2291
/label=" pHERD30T ori"
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Supplementary note 15: Complete sequence of the pHERD30T-BAD-redγBAS-Rha-Cas-kan plasmid in Genbank format.

LOCUS pHERD30T-BAD-redγBAS-kan 15293 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-redγBAS-kan
ACCESSION pHERD30T-BAD-redγBAS-kan
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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Supplementary note 16: Complete sequence of the pR6K-Tps-genta-tet-T7RP plasmid in Genbank format.

LOCUS pR6K-Tps-genta-tet-T7RP 6103 bp DNA circular SYN 21-MAR-2019
DEFINITION pR6K-Tps-genta-tet-T7RP
ACCESSION pR6K-Tps-genta-tet-T7RP
KEYWORDS
SOURCE
ORGANISM

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misc_feature 1494..1527
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misc_feature 2312..2345
/label="lox66"
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CDS 2346..2969
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/note="regulator gene of tetO promoter"
CDS 3054..5705
/label="T7P"
/note="T7 RNA polymerase"
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Supplementary note 17: Complete sequence of the pR6K-SacB-genta plasmid in Genbank format.

LOCUS pR6K-SacB-genta 4216 bp DNA circular SYN 21-MAR-2019
DEFINITION pR6K-SacB-genta
ACCESSION pR6K-SacB-genta
KEYWORDS
SOURCE
ORGANISM

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Supplementary note 18: Complete sequence of the pRK2-BAD-Cre-SacB-apra plasmid in Genbank format.

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LOCUS       pRK2-BAD-Cre-SacB-apra    7524 bp    DNA    circular SYN 21-MAR-2019
DEFINITION  pRK2-BAD-Cre-SacB-apra
ACCESSION   pRK2-BAD-Cre-SacB-apra
KEYWORDS
SOURCE
  ORGANISM

FEATURES             Location/Qualifiers
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     CDS             3768..4916
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//

Supplementary note 19: Complete sequence of the pHERD30T-SacB-genta plasmid in Genbank format.

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LOCUS       pHERD30T-SacB-genta        5756 bp    DNA     circular SYN 21-MAR-2019
DEFINITION  pHERD30T-SacB-genta
ACCESSION   pHERD30T-SacB-genta
KEYWORDS
SOURCE
  ORGANISM

FEATURES             Location/Qualifiers
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     rep_origin      1392..2162
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Supplementary note 20: Complete sequence of the pHERD30T-BAD-redγβα-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-redγβα-kan-amp-ccdB 16255 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-redγβα-kan-amp-ccdB
ACCESSION pHERD30T-BAD-redγβα-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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rep_origin 1093..2291
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/note="replication origin"
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Supplementary note 21: Complete sequence of the pHERD30T-BAD-pluγβα-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-pluγβα-kan-amp-ccdB 16226 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-pluγβα-kan-amp-ccdB
ACCESSION pHERD30T-BAD-pluγβα-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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ORIGIN

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Supplementary note 22: Complete sequence of the pHERD30T-BAD-TE_{Psy}-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-TE_{Psy}-kan-amp-ccdB 16916 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-TE_{Psy}-kan-amp-ccdB
ACCESSION pHERD30T-BAD-TE_{Psy}-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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Supplementary note 23: Complete sequence of the pHERD30T-BAD-pluγTE$_{Psy}$-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-pluγTE$_{Psy}$-kan-amp-ccdB 17187 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-pluγTE$_{Psy}$-kan-amp-ccdB
ACCESSION pHERD30T-BAD-pluγTE$_{Psy}$-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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ORIGIN

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Supplementary note 24: Complete sequence of the pHERD30T-BAD-redγTE$_{Psy}$-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-redγTE$_{Psy}$-kan-amp-ccdB 17346 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-redγTE$_{Psy}$-kan-amp-ccdB
ACCESSION pHERD30T-BAD-redγTE$_{Psy}$-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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ORIGIN

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Supplementary note 25: Complete sequence of the pHERD30T-BAD-BAS-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-BAS-kan-amp-ccdB 16190 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-BAS-kan-amp-ccdB
ACCESSION pHERD30T-BAD-BAS-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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rep_origin 1093..2291
/label=" pHERD30T ori"
/note="replication origin"
CDS 2292..3140
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ORIGIN

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Supplementary note 26: Complete sequence of the pHERD30T-BAD-pluγBAS-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-pluγBAS-kan-amp-ccdB 16461 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-pluγBAS-kan-amp-ccdB
ACCESSION pHERD30T-BAD-pluγBAS-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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rep_origin 1093..2291
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Supplementary note 27: Complete sequence of the pHERD30T-BAD-redγBAS-Rha-Cas-kan-amp-ccdB plasmid in Genbank format.

LOCUS pHERD30T-BAD-redγBAS-kan-amp-ccdB 16620 bp DNA circular SYN 21-MAR-2019
DEFINITION pHERD30T-BAD-redγBAS-kan-amp-ccdB
ACCESSION pHERD30T-BAD-redγBAS-kan-amp-ccdB
KEYWORDS
SOURCE
ORGANISM

FEATURES Location/Qualifiers
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rep_origin 1093..2291
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ORIGIN

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