

Cytochromes P450 associated with the biosyntheses of ribosomally-synthesized and post-translationally modified peptides

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Streptomyces sp. CLI2509 (TrpA)MRLLFSLKKNKMSQ.....QKSLKAHAWYIWI..	26
Streptomyces laurentii ATCC 31255VFDVSALEGGAVMKLLFAIRNKVSA.....QKSLKASAWYIWI..	38
Streptomyces rimosus ATCC 10970.txt	.....VAEQCFVSRSAGVGRFVSFACPGGAVMKLLINSLKMKKA.....EKSLKAYAWYIWI..	54
Streptomyces sp. SAT1	.....VPAPNRKE...SAMKLLFAVRNKVSA.....RKSLKASAWYIWI..	36
Streptomyces sp. YIM 121038	.....MAKIIKALKAAT.....KKNEPSLKQSAWYIWI..	28
Streptomyces spectabilis strain ATCC 27741	.....LPRAENAWKEGFY.MAKIIQALKAAT.....KKSEPSLKQSAWYIWI..	41
Streptomyces tsukubensis AT3	.....MKLLSSLKKKIAP.....EKSLKAYAWYIWI..	26
Xanthomonas sacchari R1	.....VQARLADAIAPRALASAKPRSPPERAIVTPAEMSLMKLLFSIKHLLSS.....KKPLKSYAWYIWI..	62
Streptomyces sp. 3214.6	.....LLWRYSMKMFALKRKIVG.....EKSLKAYAWYLWI..	32
Streptomyces roseochromogenus subsp. oscitans DS 12.976	.....MKLLFAIRNKVAA.....AKSLKANAWYLWI..	26
Streptomyces olivoreticuli subsp. olivoreticuli ATCC 31159	.....VAIKFRARNANRRVENE.RGGVWPMSKFLSAVRNAGNPICRDFPFFKSEPSLKQSAWYVWY..	61
Streptomyces katrae strain S3 isolate 4	.....MKMLFAIRNAVSG.....QKSLKKSAWYFWY..	26
Streptomyces sp. W1SF4	.....MKMLFAIRNAVSG.....QKSLKKSAWYFWY..	26
Streptomyces hungungensis BH38	.....VSELACPVRQFIPYIRE..RKGLT.MAKIIAALRTRG.....SKSEPSLKQAAWYFWY..	50
Streptomyces griseochromogenes ATCC 14511	.....VRDISALEGGVVMKLLFALRNKVSA.....QKSLKKSAWYFWY..	38
Streptomyces alboniger strain ATCC 12461	.....LIASPDASLVQVRREPTELTGGMYMKMIRSLKKKITG.....EKSLKAYAWYHWY..	50
Streptomyces kanamyceticus ATCC 12853	.....MPVIACHLPVYQLLIGYQAPRVQVSHVPMELTGGMCMKIVRSLKKRITG.....EKSLKAYAWYHWY..	63
Xanthomonas translucens pv. translucens DSM 18974	.....MPRMNVLFISKQLSS.....KSLKSYAWLHWY..	29
Amycolatopsis sp. AA4	.....MKLVRLVRKALPS.....KSLKSYAWYGWI..	25
Kitasatospora sp. MMS16-BH015	..VNFSWASLFEAVESGSGGNYPSRNHHSQRRRRNHRVTPNGGTAVKLVHFVKKVMPE.....KSLKAYAWYGWI..	68
Nocardia terpenica strain NC YFY NT001	.....MRPRSGRERGN..TLEPGGVVVALVRIVKRMKQG.....KSLKQYAWYGWI..	44
Streptomyces albulus NK660	.....MEVRMKFVRLVKRMRSD.....KSLKAYAWYGWI..	29
Streptomyces noursei ATCC 11455	.....MGHLTPQPPRHSLLRRSKTLSAACHGAQSAPAKEVRMKFVRLVKRMRTE.....KSLKAYAWYGWI..	61
Streptomyces platensis ATCC 23948	.....MPGILPGIDIFCHRISIS..FATQMEVLMKLVRLVKFRPE.....KSLKAYAWYGWI..	51
Streptomyces sp. 769	.....MSHLTPQPPRHSLLRRSKTLSAACHGAQSAPAKEVRMKFVRLVKRMRTE.....KSLKAYAWYGWI..	61
Streptomyces sp. TLI 053	.....MKLVHFVKKVMPE.....KSLKAYAWYGWI..	25
Streptomyces sp. CB01881	.....MKLVHFVKKVMPE.....KSLKAYAWYGWI..	25
Xanthomonas cucurbitae ATCC 23378	.....VIDCAHRPSGQ..TTPQNRMSLMKMLFSLKNLLAS.....NKSLSYAWYIWI..	46
Xanthomonas vasicola pv. vasculorum Xv1601	MVGQPCVAFVLAQPLSLARKYPLIVYLIKSPERAI PPY IRI SLMKILFSIKHMLAS.....RKSLKASAWTEYF..	70
Xanthomonas vasicola pv. vasculorum SAM119	MVGQPCVAFVLAQPLSLARKYPLIVYLIKSPERAI PPY IRI SLMKILFSIKHMLAS.....RKSLKASAWTEYF..	70
Xanthomonas vasicola NCPPB 902	MVGQPCVAFVLAQPLSLARKYPLIVYLIKSPERAI PPY IRI SLMKILFSIKHMLAS.....RKSLKSSSWPVYF..	70
Xanthomonas vasicola NCPPB 1060	MVGQPYVAFVLAQPLSLARKYPLIVYLIKSPERAI PPY IRI SLMKILFSIKHMLAS.....RKSLKSSSWGLYM..	70
Xanthomonas albilineans GPE PC73	.....VMMPFMKMLMTIKELLSSN.....KSLKSSAWALYISY	34
Xanthomonas albilineans Xa-FJ1	.....VMMPFMKMLMTIKELLSSN.....KSLKSSAWALYISY	34
Consensus	.....l k w	

Figure S1. Multiple sequence alignment of the putative atropitide precursor peptides.

Table S1. Partial genome neighborhood network (GNN) result of P450s adjacent to RiPP PTM enzymes.

Shared name	name	Pfam	Pfam description	# of sequences in SSN cluster	# of sequences in SSN cluster with neighbors	# of queries with Pfam neighbors	# of Pfam neighbors
PqqD	PqqD	PF05402	Coenzyme PQQ synthesis protein D (PqqD)	3	3	3	3
DUF4135	DUF4135	PF13575	Domain of unknown function (DUF4135)	17	16	9	9
DUF4135-DUF6624	DUF4135-DUF6624	PF13575-PF20329	Domain of unknown function (DUF4135)- Family of unknown function (DUF6624)	2	2	2	2
LANC_like	LANC_like	PF05147	Lanthionine synthetase C-like protein	41	35	11	13
LANC_like-DUF4135	LANC_like-DUF4135	PF05147-PF13575	Lanthionine synthetase C-like protein- Domain of unknown function (DUF4135)	19	18	7	7
RamS	RamS	PF19402	Lanthionine-containing peptide SapB precursor RamS	14	14	3	3
Lant_dehydr_C	Lant_dehydr_C	PF14028	Lantibiotic biosynthesis dehydratase C-term	43	43	23	28
Lant_dehydr_N	Lant_dehydr_N	PF04738	Lantibiotic dehydratase, N terminus	41	41	17	17
Lant_dehydr_N-Lant_dehydr_C	Lant_dehydr_N-Lant_dehydr_C	PF04738-PF14028	Lantibiotic dehydratase, N terminus- Lantibiotic biosynthesis dehydratase C-term	19	19	4	4
DUF692	DUF692	PF05114	Protein of unknown function (DUF692)	35	34	33	33
Strep_pep	Strep_pep	PF14404	Ribosomally synthesized peptide in <i>Streptomyces</i> species	121	116	28	28
Thiopep_pre	Thiopep_pre	PF19409	Thiopeptide-type bacteriocin precursor	5	5	4	4
YcaO	YcaO	PF02624	YcaO cyclodehydratase, ATP-and Mg ²⁺ -binding	53	52	38	38