

Table S2 Summary of Nonsynonymous mutations of isolate 1982-M6152 (1982) and 19-043682 (2019)

S2-1 Potential AMR mutation sites:

Strain	1982 (Y/N)	2019 (Y/N)	Ref Pos	Gene Name	PG45 Gene size (nt)	#Mutations	Mutations /100 nt	Disrupted (Y/N)	Gene Description	Functional Role:	Notes:
2019	N	Y	375	dnaA	1401	1	0.07	N	chromosomal replication initiator protein DnaA	Replication	Rifamycin inhibitor
2019	N	Y	1717	MBOVPG45_RS00010	1110	1	0.09	N	DNA polymerase III subunit beta	Replication	
2019	N	Y	15908	MBOVPG45_RS00090	1605	1	0.06	N	ABC transporter ATP-binding protein	ABC transporter system	ABC transporter system involved in efflux pump resistance
Both	Y	Y	22594	MBOVPG45_RS00115	1872	2	0.11	Both	peptidase S41	Protein Synthesis	
2019	N	Y	36577	MBOVPG45_RS00180	1086	2	0.18	N	ABC transporter permease	ABC transporter system	
2019	N	Y	53148	MBOVPG45_RS00205	1242	9	0.72	N	class I tRNA ligase family protein	Protein Synthesis	
2019	N	Y	54319	rlmB	702	5	0.71	N	23S rRNA (guanosine(2251)-2'-O)-methyltransferase RlmB	Protein Synthesis	rlmA confers resistance to mycinamicin, tylosin and lincosamides
2019	N	Y	54964	MBOVPG45_RS00215	585	5	0.85	2019	sigma-70 family RNA polymerase sigma factor	Transcription	Rifamycin inhibitor
2019	N	Y	55733	secE	237	1	0.42	N	preprotein translocase subunit SecE	Protein transport	
2019	N	Y	61321	MBOVPG45_RS00245	552	3	0.54	N	ribosome recycling factor (frr)	Protein Synthesis	
2019	N	Y	67139	rsmA	789	6	0.76	N	16S rRNA (adenine(1518)-N(6)/adenine(1519)-N(6))-dimethyltransferase RsmA	Protein Synthesis	16S methyltransferases mutations confer aminoglycoside resistance
2019	N	Y	68835	mnmE	1338	4	0.30	N	tRNA uridine-5-carboxymethylaminomethyl(34) synthesis GTPase MnmE	Protein Synthesis	
2019	N	Y	72682	serS	1269	1	0.08	N	serine--tRNA ligase	Protein Synthesis	
Both	Y	Y	75564	yidC	2166	10	0.46	1982	membrane protein insertase YidC	Protein transport	
Both	Y	Y	81331	MBOVPG45_RS00350	4377	15	0.34	N	PolC-type DNA polymerase III	Replication	
2019	N	Y	86893	MBOVPG45_RS00365	1224	3	0.25	N	replication-associated recombination protein A	Replication, DNA recombination	
2019	N	Y	87536	pheS	966	2	0.21	N	phenylalanine--tRNA ligase subunit alpha	Protein Synthesis	
2019	N	Y	89028	MBOVPG45_RS00380	2187	18	0.82	N	phenylalanine--tRNA ligase subunit beta	Protein Synthesis	
2019	N	Y	93312	MBOVPG45_RS00395	1161	10	0.86	N	aminotransferase class V-fold PLP-dependent enzyme	Protein Synthesis	
2019	N	Y	94484	MBOVPG45_RS00400	429	7	1.63	N	iron-sulfur cluster assembly scaffold protein	Protein assembly	
2019	N	Y	94954	MBOVPG45_RS00405	1248	6	0.48	N	DNA polymerase IV	Replication	
Both	Y	Y	97237	MBOVPG45_RS00415	768	2	0.26	N	rRNA pseudouridine synthase	Protein Synthesis	
2019	N	Y	102115	MBOVPG45_RS00445	696	1	0.14	N	50S ribosomal protein L1	Protein Synthesis	
2019	N	Y	105222	MBOVPG45_RS00465	534	2	0.37	N	tRNA (cytidine(34)-2'-O)-methyltransferase	Protein Synthesis	
2019	N	Y	105633	MBOVPG45_RS00470	732	7	0.96	N	RNA methyltransferase	Protein Synthesis	
2019	N	Y	106703	ylqF	861	3	0.35	N	ribosome biogenesis GTPase YlqF	Protein Synthesis	
2019	N	Y	122978	MBOVPG45_RS00555	1122	2	0.18	N	ABC transporter permease	ABC transporter system	
2019	N	Y	126802	MBOVPG45_RS00570	2403	4	0.17	N	ATP-binding cassette domain-containing protein	ABC transporter system	
2019	N	Y	133930	MBOVPG45_RS00600	2058	1	0.05	N	ATP-binding cassette domain-containing protein	ABC transporter system	
2019	N	Y	155399	thiI	1137	4	0.35	N	tRNA 4-thiouridine(8) synthase ThiI	Protein Synthesis	
2019	N	Y	170114	MBOVPG45_RS00740	2490	7	0.28	2019	valine--tRNA ligase	Protein Synthesis	
2019	N	Y	180543	dnaK	1779	2	0.11	N	molecular chaperone DnaK	Protein Synthesis	
2019	N	Y	181437	MBOVPG45_RS00790	1284	7	0.55	N	methylenetetrahydrofolate--tRNA-(uracil(54)-C(5))-methyltransferase (FADH(2)-oxidizing) TrmFO	DNA methylation	
2019	N	Y	187768	MBOVPG45_RS00815	2424	9	0.37	N	DEAD/DEAH box helicase family protein	Transcription, Protein synthesis	
2019	N	Y	195409	tig	1506	3	0.20	N	trigger factor	Protein Synthesis	

Both	Y	Y	248926	MBOVPG45_RS01075	1266	33	2.61	Both	endonuclease/exonuclease/phosphatase family protein	Cell signalling, DNA repair	
2019	N	Y	264264	MBOVPG45_RS01150	1392	6	0.43	2019	glutamate--tRNA ligase	Protein Synthesis	
2019	N	Y	265487	MBOVPG45_RS01155	2040	29	1.42	2019	peptidase S41	Protein Synthesis	
2019	N	Y	267529	MBOVPG45_RS01160	1932	25	1.29	N	peptidase S41	Protein Synthesis	
2019	N	Y	289078	gyrA	2760	8	0.29	N	DNA gyrase subunit A	Topoisomerase	fluoroquinolone resistance
2019	N	Y	293726	rpsD	597	2	0.34	N	30S ribosomal protein S4	Protein Synthesis	
2019	N	Y	294448	rpmE	213	1	0.47	N	50S ribosomal protein L31	Protein Synthesis	
2019	N	Y	294901	hrcA	1008	1	0.10	N	heat-inducible transcriptional repressor HrcA	Transcription	
2019	N	Y	295867	grpE	1026	4	0.39	N	nucleotide exchange factor GrpE	Protein Synthesis	
2019	N	Y	298696	MBOVPG45_RS01270	711	2	0.28	N	rRNA pseudouridine synthase	Protein Synthesis	
1982	Y	N	304123	rpsJ	324	1	0.31	N	30S ribosomal protein S10	Protein Synthesis	rpsJ confers tetracycline resistance
Both	Y	Y	305116	rplC	831	1	0.12	N	50S ribosomal protein L3	Protein Synthesis	
2019	N	Y	305204	rplD	951	10	1.05	N	50S ribosomal protein L4	Protein Synthesis	rplD confers macrolide resistance
2019	N	Y	306754	rplB	846	1	0.12	N	50S ribosomal protein L2	Protein Synthesis	
2019	N	Y	307518	rpsS	279	1	0.36	N	30S ribosomal protein S19	Protein Synthesis	
2019	N	Y	308038	rplV	345	1	0.29	N	50S ribosomal protein L22	Protein Synthesis	
2019	N	Y	308343	rpsC	651	3	0.46	N	30S ribosomal protein S3	Protein Synthesis	
2019	N	Y	310225	MBOVPG45_RS01360	327	1	0.31	N	50S ribosomal protein L24	Protein Synthesis	
2019	N	Y	311251	rpsH	396	1	0.25	N	30S ribosomal protein S8	Protein Synthesis	
Both	Y	Y	312554	rpsE	696	3	0.43	N	30S ribosomal protein S5	Protein Synthesis	
2019	N	Y	333960	MBOVPG45_RS01485	906	2	0.22	N	energy-coupling factor transporter transmembrane protein EcjT	ABC transporter system	
2019	N	Y	341084	obgE	1269	2	0.16	N	GTPase ObgE	Protein Synthesis	
2019	N	Y	345146	MBOVPG45_RS01540	1068	1	0.09	N	sugar ABC transporter permease	ABC transporter system	
2019	N	Y	345580	MBOVPG45_RS01545	2103	4	0.19	N	ATP-binding cassette domain-containing protein	ABC transporter system	
2019	N	Y	371209	MBOVPG45_RS01640	1620	5	0.31	N	arginine--tRNA ligase	Protein Synthesis	
2019	N	Y	380382	lepA	1794	4	0.22	N	elongation factor 4	Protein Synthesis	
2019	N	Y	392689	MBOVPG45_RS01720	1119	1	0.09	N	ABC transporter permease subunit	ABC transporter system	
2019	N	Y	401183	MBOVPG45_RS01770	705	1	0.14	N	ABC transporter ATP-binding protein	ABC transporter system	
Both	Y	Y	401939	MBOVPG45_RS01775	1863	8	0.43	N	ABC transporter permease	ABC transporter system	
2019	N	Y	411488	MBOVPG45_RS01820	963	7	0.73	N	DNA polymerase III subunit delta	Replication	
2019	N	Y	416161	whiA	882	3	0.34	N	DNA-binding protein WhiA	Replication	
2019	N	Y	419734	ligA	1965	2	0.10	N	DNA ligase (NAD(+)) LigA	Replication, DNA repair	
2019	N	Y	454173	asnS	1359	1	0.07	N	asparagine--tRNA ligase	Protein Synthesis	
2019	N	Y	462062	MBOVPG45_RS02005	1797	5	0.28	N	ABC transporter ATP-binding protein	ABC transporter system	
2019	N	Y	477575	tsaE	405	2	0.49	N	tRNA (adenosine(37)-N6)-threonylcarbamoyltransferase complex ATPase subunit type 1 TsaE	Protein Synthesis	
2019	N	Y	477995	MBOVPG45_RS02070	558	4	0.72	N	tRNA (adenosine(37)-N6)-threonylcarbamoyltransferase complex dimerization subunit type 1 TsaB	Protein Synthesis	
2019	N	Y	478888	tsaD	930	3	0.32	N	tRNA (adenosine(37)-N6)-threonylcarbamoyltransferase complex transferase subunit TsaD	Protein Synthesis	
2019	N	Y	487031	MBOVPG45_RS02105	1959	1	0.05	N	peptidase S41	Protein Synthesis	
2019	N	Y	504209	trpS	996	1	0.10	N	tryptophan--tRNA ligase	Protein Synthesis	
Both	Y	Y	505264	MBOVPG45_RS02170	1749	9	0.51	2019	threonine--tRNA ligase	Protein Synthesis	
2019	N	Y	523679	MBOVPG45_RS02255	2340	16	0.68	N	leucine--tRNA ligase	Protein Synthesis	
Both	Y	Y	527473	ssb	561	5	0.89	N	single-stranded DNA-binding protein	Replication, DNA recombination, DNA repair	

2019	N	Y	529969	MBOVPG45_RS02280	684	4	0.58	N	16S rRNA (uracil(1498)-N(3))-methyltransferase	Protein Synthesis	
2019	N	Y	531421	MBOVPG45_RS02290	1143	2	0.17	N	cell division protein FtsZ	Replication	
2019	N	Y	534120	rsmH	903	5	0.55	N	16S rRNA (cytosine(1402)-N(4))-methyltransferase RsmH	Protein Synthesis	
2019	N	Y	538752	dcm	948	7	0.74	N	DNA cytosine methyltransferase	DNA methylation	
2019	N	Y	545064	MBOVPG45_RS02345	687	5	0.73	N	NERD domain-containing protein	Replication	
2019	N	Y	566912	MBOVPG45_RS02435	432	2	0.46	N	single-stranded DNA-binding protein	Replication, DNA recombination, DNA repair	
Both	Y	Y	582733	alaS	1136	9	0.79	2019	alanine--tRNA ligase	Protein Synthesis	novobiocin resistance
2019	N	Y	585222	mnmA	1125	5	0.44	N	tRNA 2-thiouridine(34) synthase MnmA	Protein Synthesis	
2019	N	Y	606351	MBOVPG45_RS02615	1002	1	0.10	N	bifunctional oligoribonuclease/PAP phosphatase NrnA	Protein Synthesis	
2019	N	Y	613725	MBOVPG45_RS02640	1317	1	0.08	N	histidine--tRNA ligase	Protein Synthesis	
2019	N	Y	624992	topA	1842	1	0.05	2019	type I DNA topoisomerase	Topoisomerase	
2019	N	Y	631133	MBOVPG45_RS02710	1752	1	0.06	N	ABC transporter permease subunit	ABC transporter system	
2019	N	Y	631191	MBOVPG45_RS02715	933	2	0.21	N	ATP-binding cassette domain-containing protein	ABC transporter system	
2019	N	Y	636688	MBOVPG45_RS02730	1377	2	0.15	N	glycine--tRNA ligase	Protein Synthesis	
2019	N	Y	637373	dnaG	1941	4	0.21	N	DNA primase	Replication	
2019	N	Y	639516	MBOVPG45_RS02740	1530	1	0.07	N	RNA polymerase sigma factor	Transcription	Rifamycin inhibitor
2019	N	Y	643759	MBOVPG45_RS02760	1875	18	0.96	2019	peptidase S41	Protein Synthesis	
2019	N	Y	645973	MBOVPG45_RS02765	897	5	0.56	N	elongation factor Ts	Protein Synthesis	
2019	N	Y	646646	rpsB	954	3	0.31	N	30S ribosomal protein S2	Protein Synthesis	
2019	N	Y	656135	MBOVPG45_RS02805	2088	14	0.67	N	peptidase S41	Protein Synthesis	
2019	N	Y	674943	dnaB	1476	1	0.07	N	replicative DNA helicase	Replication	
Both	Y	Y	682961	MBOVPG45_RS02905	825	2	0.24	N	ABC transporter permease subunit	ABC transporter system	
Both	Y	Y	697741	ileS	2679	6	0.22	2019	isoleucine--tRNA ligase	Protein Synthesis	pseudomonic acid target
2019	N	Y	700827	MBOVPG45_RS03000	1620	2	0.12	N	CTP synthase	Nucleotide synthesis	
2019	N	Y	730969	MBOVPG45_RS03145	807	1	0.12	N	isoleucine--tRNA ligase	Protein Synthesis	
2019	N	Y	731350	MBOVPG45_RS03150	1551	10	0.64	2019	methionine--tRNA ligase	Protein Synthesis	
Both	Y	Y	757435	parC	2586	19	0.73	N	DNA topoisomerase IV subunit A	Topoisomerase	fluoroquinolone resistance
2019	N	Y	760101	parE	1917	4	0.21	N	DNA topoisomerase IV subunit B	Topoisomerase	fluoroquinolone resistance
2019	N	Y	764252	rsmD	549	1	0.18	N	16S rRNA (guanine(966)-N(2))-methyltransferase RsmD	Protein Synthesis	
2019	N	Y	767941	MBOVPG45_RS03325	453	1	0.22	N	23S rRNA (pseudouridine(1915)-N(3))-methyltransferase RlmH	Protein Synthesis	
2019	N	Y	768041	mnmG	1842	6	0.33	N	tRNA uridine-5-carboxymethylaminomethyl(34) synthesis enzyme MnmG	Protein Synthesis	
Both	Y	Y	785098	dnaE	2934	16	0.55	N	DNA polymerase III subunit alpha	Replication	
2019	N	Y	798146	MBOVPG45_RS03425	1614	1	0.06	N	ATP-binding cassette domain-containing protein	ABC transporter system	tylosin resistance (GenBank), macrolide resistance (CARD)
2019	N	Y	805063	MBOVPG45_RS03465	1833	4	0.22	N	ABC transporter ATP-binding protein	ABC transporter system	
2019	N	Y	806434	MBOVPG45_RS03470	1785	6	0.34	N	ABC transporter ATP-binding protein	ABC transporter system	
2019	N	Y	826479	rpoC	4437	1	0.02	N	DNA-directed RNA polymerase subunit beta'	Transcription	Rifamycin inhibitor
2019	N	Y	830647	MBOVPG45_RS03510	3636	1	0.03	N	DNA-directed RNA polymerase subunit beta	Transcription	
2019	N	Y	832675	MBOVPG45_RS03525	522	2	0.38	N	50S ribosomal protein L10	Protein Synthesis	
2019	N	Y	834722	lysS	1470	3	0.20	N	lysine--tRNA ligase	Protein Synthesis	
2019	N	Y	836887	MBOVPG45_RS03545	2160	8	0.37	2019	S1 RNA-binding domain-containing protein	Protein Synthesis	
2019	N	Y	846198	rpsP	291	2	0.69	N	30S ribosomal protein S16	Protein Synthesis	
2019	N	Y	847407	fnt	840	4	0.48	N	methionyl-tRNA formyltransferase	Protein Synthesis	
Both	Y	Y	853121	MBOVPG45_RS03600	867	3	0.35	1982	MurR/RpiR family transcriptional regulator	Transcription	
2019	N	Y	873133	MBOVPG45_RS03705	813	6	0.74	2019	carbohydrate ABC transporter permease	ABC transporter system	
2019	N	Y	873886	MBOVPG45_RS03710	996	1	0.10	N	sugar ABC transporter permease	ABC transporter system	
2019	N	Y	880184	MBOVPG45_RS03730	738	2	0.27	N	YebC/PmpR family DNA-binding transcriptional regulator	Transcription	

2019	N	Y	883839	rlmD	1323	11	0.83	N	23S rRNA (uracil(1939)-C(5))-methyltransferase RlmD	Protein Synthesis	
Both	Y	Y	898026	MBOVPG45_RS03825	918	1	0.11	N	RluA family pseudouridine synthase	Protein Synthesis	
2019	N	Y	900146	trmB	618	4	0.65	2019	tRNA (guanosine(46)-N7)-methyltransferase TrmB	Protein Synthesis	
2019	N	Y	904514	rsmI	726	5	0.69	N	16S rRNA (cytidine(1402)-2'-O)-methyltransferase	Protein Synthesis	
2019	N	Y	905196	MBOVPG45_RS03870	903	6	0.66	N	DNA polymerase III subunit delta	Replication	
Both	Y	Y	906098	MBOVPG45_RS03875	648	3	0.46	N	dTMP kinase	Nucleotide synthesis	
2019	N	Y	907714	dnaX	1851	6	0.32	N	DNA polymerase III subunit gamma/tau	Replication	
2019	N	Y	918571	MBOVPG45_RS03945	723	1	0.14	N	adenine phosphoribosyltransferase	Nucleotide synthesis	
2019	N	Y	920868	MBOVPG45_RS03950	1806	1	0.06	N	translation initiation factor IF-2	Protein Synthesis	
2019	N	Y	921262	nusA	1635	6	0.37	N	transcription termination/antitermination protein NusA	Transcription	
2019	N	Y	956001	gatB	1422	8	0.56	N	Asp-tRNA(Asn)/Glu-tRNA(Gln) amidotransferase subunit GatB	Protein Synthesis	
2019	N	Y	957458	gatA	1314	8	0.61	N	Asp-tRNA(Asn)/Glu-tRNA(Gln) amidotransferase subunit GatA	Protein Synthesis	
2019	N	Y	958689	MBOVPG45_RS04140	306	4	1.31	N	glutamyl-tRNA(Gln) amidotransferase	Protein Synthesis	
2019	N	Y	965875	MBOVPG45_RS04185	1134	4	0.35	N	DnaJ domain-containing protein	Protein Synthesis	
2019	N	Y	966639	rbfA	342	1	0.29	N	30S ribosome-binding factor RbfA	Protein Synthesis	
2019	N	Y	969173	MBOVPG45_RS04210	1236	9	0.73	2019	tyrosine--tRNA ligase	Protein Synthesis	
2019	N	Y	970301	MBOVPG45_RS04215	603	2	0.33	N	tRNA-binding protein	Protein Synthesis	
2019	N	Y	972501	prnC	723	3	0.41	N	peptide chain release factor N(5)-glutamine methyltransferase	DNA methylation	
2019	N	Y	974517	MBOVPG45_RS04245	573	7	1.22	N	cell division protein Fic	Replication	
2019	N	Y	976501	MBOVPG45_RS04255	1968	6	0.30	N	type IIA DNA topoisomerase subunit B (gyrB)	Topoisomerase	fluoroquinolone resistance
2019	N	Y	978986	smpB	447	2	0.45	N	SsrA-binding protein	Protein Synthesis	
2019	N	Y	982458	MBOVPG45_RS04285	960	1	0.10	N	LacI family transcriptional regulator	Transcription	
2019	N	Y	988794	MBOVPG45_RS04310	1089	5	0.46	N	ABC transporter ATP-binding protein	ABC transporter system	
Both	Y	Y	989187	MBOVPG45_RS04315	8127	90	1.11	N	ABC transporter permease	ABC transporter system	
2019	N	Y	999725	tilS	861	8	0.93	N	tRNA lysidine(34) synthetase TilS	Protein Synthesis	
2019	N	Y	1000569	MBOVPG45_RS04330	567	1	0.18	N	aminoacyl-tRNA hydrolase	Protein Synthesis	

S2-2. Unlikely AMR Candidates:

Strain	1982 (Y/N)	2019 (Y/N)	Ref Pos	Gene Name	PG45 Gene size (nt)	#Mutations	Mutations /100 nt	Disrupted (Y/N)	Gene Description		
1982	Y	N	3257	MBOVPG45_RS00030	786	1	0.13	N	alpha/beta hydrolase	Multi-role family	
2019	N	Y	4439	MBOVPG45_RS00035	792	1	0.13	N	alpha/beta hydrolase	Multi-role family	
2019	N	Y	5197	MBOVPG45_RS00040	1182	3	0.25	N	NADH-dependent flavin oxidoreductase	Metabolism	
2019	N	Y	6185	MBOVPG45_RS00045	1047	3	0.29	N	lipoate--protein ligase A	Metabolism	
2019	N	Y	7253	MBOVPG45_RS00050	1038	1	0.10	N	lipoate--protein ligase	Metabolism	
2019	N	Y	11281	MBOVPG45_RS00070	1413	1	0.07	N	IS1634-like element ISMbov2 family transposase	Transposable elements	
2019	N	Y	36735	MBOVPG45_RS00185	2952	9	0.30	N	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	61188	MBOVPG45_RS00240	723	1	0.14	N	UMP kinase	Metabolism	
2019	N	Y	66075	MBOVPG45_RS00275	999	7	0.70	N	NAD(P)-binding domain-containing protein	Metabolism	
2019	N	Y	67846	MBOVPG45_RS00285	762	5	0.66	N	TatD family hydrolase	DNA repair	
2019	N	Y	73768	MBOVPG45_RS00310	1032	3	0.29	N	glycosyltransferase family 2 protein	Metabolism	
2019	N	Y	74822	rnpA	324	3	0.93	N	ribonuclease P protein component	Rnase	
2019	N	Y	78149	MBOVPG45_RS00330	981	1	0.10	N	lipoate--protein ligase	Metabolism	
Both	Y	Y	78548	MBOVPG45_RS00335	822	6	0.73	N	alpha/beta hydrolase	Multi-role family	
2019	N	Y	80472	MBOVPG45_RS00345	981	3	0.31	N	aspartate--ammonia ligase	Metabolism	
2019	N	Y	88161	MBOVPG45_RS00375	660	4	0.61	N	uracil-DNA glycosylase	DNA repair	
2019	N	Y	91227	MBOVPG45_RS00385	1266	5	0.39	N	serine hydroxymethyltransferase	Methylation	

2019	N	Y	92255	pip	972	7	0.72	2019	prolyl aminopeptidase	Metabolism	
2019	N	Y	96345	MBOVPG45_RS00410	1095	2	0.18	N	nicotinate-nucleotide adenyltransferase	Metabolism	
2019	N	Y	99358	fba	876	3	0.34	N	class II fructose-1,6-bisphosphate aldolase	Metabolism	
2019	N	Y	100528	MBOVPG45_RS00435	573	3	0.52	N	nuclease	DNA repair	
2019	N	Y	107976	MBOVPG45_RS00490	963	4	0.42	N	HPr kinase/phosphorylase	Metabolism	
2019	N	Y	108881	MBOVPG45_RS00495	984	4	0.41	N	prolipoprotein diacylglycerol transferase	Posttranslational modification	
2019	N	Y	110067	MBOVPG45_RS00500	924	1	0.11	N	FAD-dependent oxidoreductase	Metabolism	
Both	Y	Y	115075	lpdA	1614	2	0.12	N	dihydrolipoyl dehydrogenase	Metabolism	
2019	N	Y	129778	MBOVPG45_RS00585	1218	1	0.08	N	YitT family protein	Stress protein	
2019	N	Y	132891	MBOVPG45_RS00595	447	1	0.22	N	RpiB/LacA/LacB family sugar-phosphate isomerase	Metabolism	
Both	Y	Y	144605	MBOVPG45_RS00650	2388	9	0.38	N	phosphoketolase family protein	Metabolism	
2019	N	Y	146413	pepF	1842	4	0.22	N	oligoendopeptidase F	Metabolism	
2019	N	Y	157477	MBOVPG45_RS00705	1434	4	0.28	N	transposase	Transposable elements	
									bifunctional 5,10-methylenetetrahydrofolate dehydrogenase/5,10-methenyltetrahydrofolate cyclohydrolase	Metabolism	
2019	N	Y	170942	MBOVPG45_RS00745	861	2	0.23	N	phosphate acetyltransferase	Metabolism	
2019	N	Y	172051	MBOVPG45_RS00750	957	4	0.42	N	phosphate acetyltransferase	Metabolism	
2019	N	Y	173363	MBOVPG45_RS00755	1194	2	0.17	2019	acetate/propionate family kinase	Metabolism	
2019	N	Y	174264	MBOVPG45_RS00760	423	1	0.24	N	panetheine-phosphate adenyltransferase	Metabolism	
2019	N	Y	174840	MBOVPG45_RS00765	582	4	0.69	N	YihA family ribosome biogenesis GTP-binding protein	Metabolism	
2019	N	Y	178094	pyk	1437	1	0.07	N	pyruvate kinase	Metabolism	
Both	Y	Y	183309	MBOVPG45_RS00800	990	7	0.71	N	lactate dehydrogenase	Metabolism	
2019	N	Y	184839	MBOVPG45_RS00805	801	6	0.75	N	alpha/beta hydrolase	Multi-role family	
2019	N	Y	186667	MBOVPG45_RS00810	1029	1	0.10	N	IS30 family transposase	Transposable elements	
2019	N	Y	201195	MBOVPG45_RS00870	2307	13	0.56	2019	S8 family serine peptidase	Peptidase	
2019	N	Y	218020	MBOVPG45_RS00935	453	3	0.66	2019	SocA family protein	Transport protein	
2019	N	Y	222893	MBOVPG45_RS00955	1029	1	0.10	N	IS30-like element ISMbov1 family transposase	Transposable elements	
2019	N	Y	224139	MBOVPG45_RS00960	1413	1	0.07	N	IS1634-like element ISMbov2 family transposase	Transposable elements	
2019	N	Y	230209	MBOVPG45_RS00975	1434	2	0.14	N	transposase	Transposable elements	
2019	N	Y	252748	MBOVPG45_RS01085	1017	1	0.10	N	IS30 family transposase	Transposable elements	
2019	N	Y	256515	pgk	1185	2	0.17	N	phosphoglycerate kinase	Metabolism	
2019	N	Y	257653	MBOVPG45_RS01110	1002	2	0.20	N	nicotinate phosphoribosyltransferase	Metabolism	
2019	N	Y	269648	MBOVPG45_RS01165	555	4	0.72	N	5-formyltetrahydrofolate cyclo-ligase	Metabolism	
2019	N	Y	273077	MBOVPG45_RS01185	2679	33	1.23	2019	type I restriction-modification system subunit M	Restriction enzyme	
Both	Y	Y	275617	MBOVPG45_RS04625	1158	6	0.52	N	restriction endonuclease subunit S	Restriction enzyme	
2019	N	Y	276761	MBOVPG45_RS01195	3198	12	0.38	2019	type I restriction endonuclease subunit R	Restriction enzyme	
2019	N	Y	280080	MBOVPG45_RS01200	921	1	0.11	N	site-specific integrase	Recombination	
2019	N	Y	281463	MBOVPG45_RS01205	1194	7	0.59	N	restriction endonuclease subunit S	Restriction enzyme	
2019	N	Y	282460	MBOVPG45_RS01210	1245	2	0.16	N	IS3 family transposase	Transposable elements	
2019	N	Y	299555	MBOVPG45_RS01275	1086	6	0.55	N	M42 family metalloproteinase	Metabolism	
2019	N	Y	302153	recA	993	2	0.20	N	recombinase RecA	Recombination	
2019	N	Y	303010	recU	492	1	0.20	N	Holliday junction resolvase RecU	Recombination	
2019	N	Y	314969	MBOVPG45_RS01405	993	7	0.70	N	histidine acid phosphatase	Multi-role family	
2019	N	Y	335706	tpiA	783	2	0.26	N	triose-phosphate isomerase	Metabolism	
2019	N	Y	336442	deoC	669	4	0.60	N	deoxyribose-phosphate aldolase	Metabolism	
2019	N	Y	337141	MBOVPG45_RS01505	1296	2	0.15	N	pyrimidine-nucleoside phosphorylase	Metabolism	
2019	N	Y	338666	deoD	702	3	0.43	N	purine-nucleoside phosphorylase	Metabolism	
Both	Y	Y	349035	MBOVPG45_RS01555	2187	31	1.42	N	P80 family lipoprotein	Metabolism	
2019	N	Y	351154	MBOVPG45_RS01560	1434	5	0.35	N	transposase	Transposable elements	
2019	N	Y	353654	MBOVPG45_RS01570	1716	6	0.35	N	GIY-YIG nuclease family protein	Multi-role family	
2019	N	Y	357311	MBOVPG45_RS01585	837	2	0.24	N	deoxyribonuclease IV	DNA repair	
Both	Y	Y	358227	MBOVPG45_RS01590	837	5	0.60	N	HAD hydrolase family protein	Metabolism	

2019	N	Y	359126	MBOVPG45_RS01595	1467	1	0.07	N	MFS transporter	Transport protein	
2019	N	Y	364058	MBOVPG45_RS01610	1203	6	0.50	N	acetate/propionate family kinase	Metabolism	
2019	N	Y	365312	MBOVPG45_RS01615	975	8	0.82	N	phosphate acetyltransferase	Metabolism	
2019	N	Y	369370	MBOVPG45_RS01630	972	3	0.31	N	lactate dehydrogenase	Metabolism	
2019	N	Y	370053	MBOVPG45_RS01635	1245	4	0.32	N	malate transporter	Metabolism	
2019	N	Y	373493	MBOVPG45_RS01645	1572	7	0.45	N	glycosyltransferase family 2 protein	Metabolism	
2019	N	Y	374344	MBOVPG45_RS01650	1434	6	0.42	N	transposase	Transposable elements	
2019	N	Y	376115	MBOVPG45_RS01655	795	5	0.63	2019	alpha/beta hydrolase	Multi-role family	
2019	N	Y	377305	MBOVPG45_RS01660	732	1	0.14	N	nitroreductase	Metabolism	
2019	N	Y	377784	MBOVPG45_RS01665	1452	18	1.24	N	phosphotransferase	Metabolism	
2019	N	Y	381462	MBOVPG45_RS01675	759	2	0.26	2019	phosphotransferase	Metabolism	
2019	N	Y	397770	MBOVPG45_RS01750	1572	6	0.38	N	phospho-sugar mutase	Metabolism	
2019	N	Y	404108	MBOVPG45_RS01780	2733	15	0.55	N	cation-transporting P-type ATPase	Transport protein	
2019	N	Y	410113	MBOVPG45_RS01815	1029	1	0.10	N	IS30-like element ISMbov1 family transposase	Transposable elements	
2019	N	Y	417290	MBOVPG45_RS01845	1188	4	0.34	N	phosphopentomutase	Metabolism	
Both	Y	Y	426836	MBOVPG45_RS01870	2232	7	0.31	N	putative immunoglobulin-blocking virulence protein	Virulence	
2019	N	Y	430161	MBOVPG45_RS01875	2250	1	0.04	N	putative immunoglobulin-blocking virulence protein	Virulence	
Both	Y	Y	449716	MBOVPG45_RS01940	2205	4	0.18	2019	UvrD-helicase domain-containing protein	DNA repair	Mutation increases error rate, increases chance for AMR mutation
2019	N	Y	466370	msrB	930	2	0.22	N	peptide-methionine (R)-S-oxide reductase MsrB	Metabolism	
Both	Y	Y	466982	MBOVPG45_RS02020	276	4	1.45	1982	Smr/MutS family protein	DNA repair, DNA recombination	Mutation increases error rate, increases chance for AMR mutation
2019	N	Y	467471	mutM	840	4	0.48	N	bifunctional DNA-formamidopyrimidine glycosylase/DNA-(apurinic or apyrimidinic site) lyase	DNA repair	Mutation increases error rate, increases chance for AMR mutation
2019	N	Y	468171	MBOVPG45_RS02030	1293	4	0.31	N	glucose-6-phosphate isomerase	Metabolism	
2019	N	Y	469380	MBOVPG45_RS02035	1251	11	0.88	N	glucose-6-phosphate isomerase	Metabolism	
2019	N	Y	471148	MBOVPG45_RS02045	1365	4	0.29	N	phosphopyruvate hydratase (eno)	Metabolism	
2019	N	Y	473268	MBOVPG45_RS02050	1434	5	0.35	N	transposase	Transposable elements	
2019	N	Y	476136	MBOVPG45_RS02060	1017	1	0.10	N	IS30 family transposase	Transposable elements	
2019	N	Y	488484	MBOVPG45_RS02110	1302	1	0.08	N	ATP-binding protein	Multi-role family	
2019	N	Y	496543	MBOVPG45_RS02130	945	8	0.85	2019	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	497823	MBOVPG45_RS02135	552	5	0.91	N	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	498724	MBOVPG45_RS02140	1017	1	0.10	N	IS30 family transposase	Transposable elements	
2019	N	Y	501954	MBOVPG45_RS02155	1434	3	0.21	N	transposase	Transposable elements	
2019	N	Y	507923	MBOVPG45_RS02180	702	14	1.99	N	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	512844	atpH	561	4	0.71	N	ATP synthase F1 subunit delta	ATP synthesis	
2019	N	Y	513447	MBOVPG45_RS02215	1587	1	0.06	N	FOF1 ATP synthase subunit alpha	ATP synthesis	
1982	Y	N	515730	MBOVPG45_RS02220	864	1	0.12	N	FOF1 ATP synthase subunit gamma	ATP synthesis	
2019	N	Y	517631	MBOVPG45_RS02230	414	1	0.24	N	ATP synthase F1 subunit epsilon	ATP synthesis	
2019	N	Y	519897	MBOVPG45_RS02245	717	1	0.14	N	glycerol-3-phosphate acyltransferase	Metabolism	
Both	Y	Y	521292	lon	3132	5	0.16	N	endopeptidase La	Metabolism	
2019	N	Y	528299	MBOVPG45_RS02275	1947	9	0.46	N	M13 family metalloproteinase	Metabolism	
2019	N	Y	530918	MBOVPG45_RS02285	378	5	1.32	N	glycine cleavage system protein H	Metabolism	
2019	N	Y	535888	MBOVPG45_RS02310	669	1	0.15	N	TrkA family potassium uptake protein	Metabolism	
2019	N	Y	536751	MBOVPG45_RS02315	1560	2	0.13	N	TrkH family potassium uptake protein	Metabolism	
2019	N	Y	540693	uvrB	2010	9	0.45	N	excinuclease ABC subunit UvrB	DNA repair	Mutation increases error rate, increases chance for AMR mutation

2019	N	Y	542155	uvrA	2832	10	0.35	N	excinuclease ABC subunit UvrA	DNA repair	Mutation increases error rate, increases chance for AMR mutation
Both	Y	Y	557979	MBOVPG45_RS02400	2826	3	0.11	N	conjugal transfer protein TraE	Transformation	
2019	N	Y	569339	MBOVPG45_RS02455	1773	5	0.28	N	type IV secretory system conjugative DNA transfer family protein	Transformation	
Both	Y	Y	575129	MBOVPG45_RS02480	1602	4	0.25	1982	IS1634-like element ISMbov3 family transposase	Transposable elements	
2019	N	Y	577264	MBOVPG45_RS02490	453	4	0.88	2019	SocA family protein	Transport protein	
2019	N	Y	578011	MBOVPG45_RS02495	723	1	0.14	N	SDR family oxidoreductase	Metabolism	
2019	N	Y	582294	ruvX	441	1	0.23	N	Holliday junction resolvase RuvX	Recombination	
2019	N	Y	586464	MBOVPG45_RS02525	729	3	0.41	N	purine-nucleoside phosphorylase	Metabolism	
2019	N	Y	591273	MBOVPG45_RS02550	1050	6	0.57	N	zinc-dependent alcohol dehydrogenase	Metabolism	
2019	N	Y	592432	MBOVPG45_RS02555	585	10	1.71	2019	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	593925	MBOVPG45_RS02560	1041	1	0.10	N	zinc-dependent alcohol dehydrogenase	Metabolism	
2019	N	Y	594709	MBOVPG45_RS02565	732	3	0.41	N	DNA processing protein DprA	Transformation	
2019	N	Y	595603	MBOVPG45_RS02570	837	4	0.48	N	HAD family phosphatase	Metabolism	
2019	N	Y	596888	MBOVPG45_RS02575	1353	3	0.22	N	YitT family protein	Stress protein	
2019	N	Y	597675	MBOVPG45_RS02580	2979	5	0.17	N	AAA family ATPase	Multi-role family	
2019	N	Y	609179	glpK	1509	3	0.20	N	glycerol kinase GlpK	Metabolism	
2019	N	Y	615303	MBOVPG45_RS02645	1671	2	0.12	N	APC family permease	Transport protein	
2019	N	Y	620753	MBOVPG45_RS02665	1245	2	0.16	N	IS3 family transposase	Transposable elements	
2019	N	Y	633285	MBOVPG45_RS02720	1356	1	0.07	N	lipoprotein ABC transporter substrate-binding protein	Metabolism	
2019	N	Y	641833	MBOVPG45_RS02750	1365	3	0.22	N	FAD-dependent oxidoreductase	Metabolism	
2019	N	Y	647839	MBOVPG45_RS02775	927	1	0.11	N	type II restriction endonuclease	Restriction enzyme	
2019	N	Y	648784	MBOVPG45_RS02780	849	13	1.53	N	DNA adenine methylase	DNA repair	
Both	Y	Y	650147	MBOVPG45_RS02785	1374	24	1.75	N	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	659437	rnuC	1440	1	0.07	N	DNA recombination protein RnuC	Recombination	
2019	N	Y	659637	MBOVPG45_RS02815	1611	2	0.12	N	dicarboxylate/amino acid:cation symporter	Metabolism	
1982	Y	N	662114	MBOVPG45_RS02820	1350	1	0.07	N	FAD-dependent oxidoreductase	Metabolism	
2019	N	Y	663026	MBOVPG45_RS02825	1245	2	0.16	N	IS3 family transposase	Transposable elements	
Both	Y	Y	666001	MBOVPG45_RS02835	900	4	0.44	Both	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	670440	MBOVPG45_RS02860	1434	5	0.35	N	transposase	Transposable elements	
2019	N	Y	677174	MBOVPG45_RS02885	2001	4	0.20	N	DHH family phosphoesterase	DNA repair, DNA recombination	
2019	N	Y	677990	MBOVPG45_RS02890	1068	14	1.31	N	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	679145	MBOVPG45_RS02895	1602	3	0.19	N	IS1634 family transposase	Transposable elements	
2019	N	Y	693602	ruvA	597	2	0.34	N	Holliday junction branch migration protein RuvA	Recombination	
2019	N	Y	697337	MBOVPG45_RS02990	711	4	0.56	N	signal peptidase II	Cell signalling	
2019	N	Y	704332	MBOVPG45_RS03050	1245	2	0.16	N	IS3 family transposase	Transposable elements	
2019	N	Y	713717	MBOVPG45_RS03080	2271	10	0.44	N	S8 family peptidase	Peptidase	
2019	N	Y	716234	MBOVPG45_RS03085	1044	1	0.10	N	AAA family ATPase	Multi-role family	
2019	N	Y	717489	MBOVPG45_RS03090	1434	1	0.07	N	transposase	Transposable elements	
2019	N	Y	719249	MBOVPG45_RS03095	2226	7	0.31	N	AAA family ATPase	Multi-role family	
Both	Y	Y	733123	ftsY	1059	2	0.19	N	signal recognition particle-docking protein FtsY	Cell signalling	
2019	N	Y	736512	MBOVPG45_RS03185	336	2	0.60	N	HIT family protein	Multi-role family	
2019	N	Y	741395	MBOVPG45_RS03210	555	1	0.18	N	inorganic diphosphatase	Metabolism	
2019	N	Y	743052	MBOVPG45_RS03215	1947	4	0.21	N	transketolase	Metabolism	
2019	N	Y	749051	prs	996	1	0.10	N	ribose-phosphate pyrophosphokinase	Metabolism	
2019	N	Y	749061	rsmG (pseudogene), prs	695	1	0.14	N	pseudogene	None	
2019	N	Y	751100	MBOVPG45_RS03260	1029	4	0.39	N	IS30-like element ISMbov1 family transposase	Transposable elements	
Both	Y	Y	753684	MBOVPG45_RS03275	717	5	0.70	N	ribonuclease HIII	Rnase	
2019	N	Y	756247	MBOVPG45_RS03285	1602	4	0.25	N	IS1634-like element ISMbov3 family transposase	Transposable elements	
2019	N	Y	762108	MBOVPG45_RS03300	1398	3	0.21	N	CvpA family protein	Toxin biosynthesis	

Both	Y	Y	772736	MBOVPG45_RS03345	2316	25	1.08	1982	S8 family serine peptidase	Peptidase	
2019	N	Y	778219	MBOVPG45_RS03365	1812	25	1.38	2019	LppA family lipoprotein	Metabolism	
2019	N	Y	780828	MBOVPG45_RS03375	2310	9	0.39	2019	S8 family serine peptidase	Peptidase	
2019	N	Y	788183	MBOVPG45_RS03390	918	4	0.44	N	5'-3' exonuclease	DNA repair	
2019	N	Y	789498	MBOVPG45_RS03395	1602	2	0.12	N	IS1634 family transposase	Transposable elements	
2019	N	Y	791109	MBOVPG45_RS03400	2043	11	0.54	N	bifunctional metallophosphatase/5'-nucleotidase	DNA repair	
2019	N	Y	802899	MBOVPG45_RS03450	1389	3	0.22	N	transposase	Transposable elements	
2019	N	Y	810822	MBOVPG45_RS03485	1089	10	0.92	N	M42 family peptidase	Metabolism	
2019	N	Y	812080	MBOVPG45_RS03490	1017	1	0.10	N	IS30 family transposase	Transposable elements	
2019	N	Y	839138	MBOVPG45_RS03550	2169	5	0.23	N	AAA domain-containing protein	Multi-role family	
1982	Y	N	843830	MBOVPG45_RS03560	1098	1	0.09	N	DNA adenine methylase	DNA repair	
2019	N	Y	848393	MBOVPG45_RS03590	2973	28	0.94	N	phosphoglucomutase	Metabolism	
2019	N	Y	851558	ptsP	1713	7	0.41	N	phosphoenolpyruvate--protein phosphotransferase	Metabolism	
2019	N	Y	854531	araD	732	1	0.14	N	L-ribulose-5-phosphate 4-epimerase	Metabolism	
2019	N	Y	855274	MBOVPG45_RS03615	885	4	0.45	N	L-ribulose-5-phosphate 3-epimerase	Metabolism	
2019	N	Y	856260	MBOVPG45_RS03620	654	3	0.46	N	3-keto-L-gulonate-6-phosphate decarboxylase UlaD	Metabolism	
2019	N	Y	856957	MBOVPG45_RS03625	489	1	0.20	N	PTS transporter subunit EIIA	Transport protein	
2019	N	Y	858957	MBOVPG45_RS03635	1809	1	0.06	N	PTS ascorbate transporter subunit IIC	Transport protein	
2019	N	Y	860078	MBOVPG45_RS03640	1062	1	0.09	N	phosphotriesterase	Metabolism	
2019	N	Y	862854	MBOVPG45_RS04565	168	5	2.98	2019	variable surface lipoprotein	variable surface lipoprotein	
Both	Y	Y	864315	MBOVPG45_RS03660	207	3	1.45	1982	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	864948	MBOVPG45_RS03665	900	6	0.67	N	Fic family protein	Posttranslational modification	
2019	N	Y	866317	MBOVPG45_RS04570	903	1	0.11	N	site-specific DNA-methyltransferase	Methylation	
2019	N	Y	867221	MBOVPG45_RS04575	522	5	0.96	2019	site-specific DNA-methyltransferase	Methylation	
2019	N	Y	870763	MBOVPG45_RS03695	1017	1	0.10	N	IS30 family transposase	Transposable elements	
2019	N	Y	876432	MBOVPG45_RS03720	2757	25	0.91	N	C1 family peptidase	Metabolism	
2019	N	Y	879655	MBOVPG45_RS03725	1008	2	0.20	N	ZIP family metal transporter	Metabolism	
2019	N	Y	880921	nadE	813	3	0.37	N	NAD(+) synthase	Metabolism	
2019	N	Y	882769	MBOVPG45_RS03745	924	4	0.43	N	alpha/beta hydrolase	Multi-role family	
1982	Y	N	885156	MBOVPG45_RS03755	900	1	0.11	N	ATP-binding protein	Multi-role family	
2019	N	Y	886043	MBOVPG45_RS03760	1008	4	0.40	N	DNA damage-inducible protein DnaD	DNA repair	
Both	Y	Y	887092	MBOVPG45_RS03765	573	4	0.70	N	dephospho-CoA kinase	Metabolism	
2019	N	Y	890617	MBOVPG45_RS03795	1125	11	0.98	2019	site-specific DNA-methyltransferase	Methylation	
2019	N	Y	891887	MBOVPG45_RS03800	1284	8	0.62	N	MFS transporter	Transport protein	
2019	N	Y	899288	MBOVPG45_RS03835	654	1	0.15	N	chromate transporter	Metabolism	
2019	N	Y	906851	recR	588	3	0.51	N	recombination protein RecR	Recombination	
Both	Y	Y	912118	MBOVPG45_RS03905	1497	10	0.67	N	2,3-bisphosphoglycerate-independent phosphoglycerate mutase	Metabolism	
2019	N	Y	916526	pgsA	609	2	0.33	2019	CDP-diacylglycerol--glycerol-3-phosphate 3-phosphatidyltransferase	Metabolism	
2019	N	Y	917577	MBOVPG45_RS03935	906	2	0.22	N	phosphatidate cytidyltransferase	Metabolism	
2019	N	Y	928069	MBOVPG45_RS03990	1029	1	0.10	N	IS30 family transposase	Transposable elements	
Both	Y	Y	930394	MBOVPG45_RS04005	1092	2	0.18	N	variable surface lipoprotein	variable surface lipoprotein	
Both	Y	Y	931489	MBOVPG45_RS04010	765	17	2.22	1982	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	939874	MBOVPG45_RS04050	615	2	0.33	N	abortive infection protein	Immune response	
2019	N	Y	940364	MBOVPG45_RS04055	861	4	0.46	N	nucleotidyl transferase AbiEii/AbiGii toxin family protein	Toxin biosynthesis	
2019	N	Y	942397	MBOVPG45_RS04065	1017	1	0.10	N	IS30 family transposase	Transposable elements	
Both	Y	Y	945959	MBOVPG45_RS04085	759	4	0.53	1982	variable surface lipoprotein	variable surface lipoprotein	
Both	Y	Y	946967	MBOVPG45_RS04090	609	7	1.15	N	variable surface lipoprotein	variable surface lipoprotein	
2019	N	Y	949632	MBOVPG45_RS04110	1845	1	0.05	N	ribonuclease J	Rnase	

2019	N	Y	959225	MBOVPG45_RS04145	855	8	0.94	N	RluA family pseudouridine synthase	Posttranslational modification	
Both	Y	Y	967387	MBOVPG45_RS04200	1602	6	0.37	1982	IS1634-like element ISMbov3 family transposase	Transposable elements	
2019	N	Y	972044	MBOVPG45_RS04230	234	1	0.43	N	acyl carrier protein	Metabolism	
2019	N	Y	976131	MBOVPG45_RS04250	1422	5	0.35	N	YitT family protein	Stress protein	
2019	N	Y	978606	MBOVPG45_RS04260	315	2	0.63	N	thioredoxin family protein	Metabolism	
2019	N	Y	981821	MBOVPG45_RS04280	207	1	0.48	2019	variable surface lipoprotein	variable surface lipoprotein	
Both	Y	Y	984371	MBOVPG45_RS04300	1245	2	0.16	N	IS3 family transposase	Transposable elements	
Both	Y	Y	985381	mgfA	2709	9	0.33	N	magnesium-translocating P-type ATPase	Metabolism	
Both	Y	Y	997722	hflB	2031	3	0.15	N	ATP-dependent zinc metalloprotease FtsH	Membrane maintenance	
2019	N	Y	1001054	MBOVPG45_RS04335	2271	9	0.40	N	AAA family ATPase	Multi-role family	

S2-3. Uncharacterized Proteins:

Strain	1982 (Y/N)	2019 (Y/N)	Ref Pos	Gene Name	PG45 Gene size (nt)	#Mutations	Mutations /100 nt	Disrupted (Y/N)	Gene Description		
Both	Y	Y	41706	MBOVPG45_RS00190	9981	5	0.05	2019	PDxFFG protein	Uncharacterized protein	
2019	N	Y	60006	MBOVPG45_RS00235	1035	1	0.10	N	membrane protein	Uncharacterized protein	
2019	N	Y	117143	MBOVPG45_RS00540	546	3	0.55	N	DJ-1/PfpI family protein	Uncharacterized protein	
Both	Y	Y	141369	MBOVPG45_RS00640	1818	2	0.11	N	membrane protein	Uncharacterized protein	
2019	N	Y	154022	MBOVPG45_RS00690	1629	12	0.74	2019	membrane protein	Uncharacterized protein	
Both	Y	Y	158505	MBOVPG45_RS00710	741	24	3.24	N	DUF285 domain-containing protein	Uncharacterized protein	
Both	Y	Y	162561	MBOVPG45_RS00725	1521	17	1.12	Both	DUF285 domain-containing protein	Uncharacterized protein	
Both	Y	Y	164311	MBOVPG45_RS00730	1521	16	1.05	2019	DUF285 domain-containing protein	Uncharacterized protein	
2019	N	Y	182781	MBOVPG45_RS00795	384	3	0.78	N	membrane protein	Uncharacterized protein	
2019	N	Y	283862	MBOVPG45_RS01215	4713	26	0.55	N	DUF4011 domain-containing protein	Uncharacterized protein	
2019	N	Y	313704	MBOVPG45_RS01400	1056	13	1.23	2019	Cof-type HAD-IIB family hydrolase	Uncharacterized protein	
2019	N	Y	339998	MBOVPG45_RS01515	825	2	0.24	N	Cof-type HAD-IIB family hydrolase	Uncharacterized protein	
2019	N	Y	356763	MBOVPG45_RS01580	1707	1	0.06	N	membrane protein	Uncharacterized protein	
2019	N	Y	414758	MBOVPG45_RS01835	1185	24	2.03	N	DUF285 domain-containing protein	Uncharacterized protein	
2019	N	Y	455097	MBOVPG45_RS01960	762	1	0.13	N	membrane protein	Uncharacterized protein	
Both	Y	Y	493605	MBOVPG45_RS02125	1989	11	0.55	1982	BspA family leucine-rich repeat surface protein	Uncharacterized protein	
2019	N	Y	545712	MBOVPG45_RS02350	810	5	0.62	N	DUF45 domain-containing protein	Uncharacterized protein	
2019	N	Y	561474	MBOVPG45_RS02405	2238	5	0.22	N	membrane protein	Uncharacterized protein	
2019	N	Y	573609	MBOVPG45_RS02470	1119	10	0.89	N	BspA family leucine-rich repeat surface protein	Uncharacterized protein	
2019	N	Y	587200	MBOVPG45_RS02530	1524	10	0.66	N	DUF285 domain-containing protein	Uncharacterized protein	
2019	N	Y	641166	MBOVPG45_RS02745	786	4	0.51	N	Nif3-like dinuclear metal center hexameric protein	Uncharacterized protein	
2019	N	Y	651781	MBOVPG45_RS02795	2310	9	0.39	2019	leucine-rich repeat domain-containing protein	Uncharacterized protein	
2019	N	Y	654099	MBOVPG45_RS02800	1839	4	0.22	2019	leucine-rich repeat domain-containing protein	Uncharacterized protein	
1982	Y	N	667694	MBOVPG45_RS02845	909	1	0.11	1982	BspA family leucine-rich repeat surface protein	Uncharacterized protein	
1982	Y	N	690881	MBOVPG45_RS02945	2367	1	0.04	N	membrane protein	Uncharacterized protein	
2019	N	Y	754547	MBOVPG45_RS03280	930	2	0.22	N	Cof-type HAD-IIB family hydrolase	Uncharacterized protein	
Both	Y	Y	814940	MBOVPG45_RS03500	8013	58	0.72	2019	SGNH/GDSL hydrolase family protein	Uncharacterized protein	
2019	N	Y	833816	MBOVPG45_RS03530	726	5	0.69	N	leucine-rich repeat domain-containing protein	Uncharacterized protein	
2019	N	Y	860963	MBOVPG45_RS03645	858	6	0.70	N	Cof-type HAD-IIB family hydrolase	Uncharacterized protein	
2019	N	Y	863158	MBOVPG45_RS03655	999	35	3.50	N	DUF285 domain-containing protein	Uncharacterized protein	
2019	N	Y	887599	MBOVPG45_RS03770	381	5	1.31	N	YigZ family protein	Uncharacterized protein	
2019	N	Y	896766	MBOVPG45_RS03820	1059	1	0.09	N	membrane protein	Uncharacterized protein	
2019	N	Y	901081	MBOVPG45_RS03850	612	2	0.33	N	DUF402 domain-containing protein	Uncharacterized protein	
2019	N	Y	913679	MBOVPG45_RS03910	900	12	1.33	N	Cof-type HAD-IIB family hydrolase	Uncharacterized protein	
2019	N	Y	920884	MBOVPG45_RS03955	303	3	0.99	N	YlxR family protein	Uncharacterized protein	

2019	N	Y	929129	MBOVPG45_RS03995	1008	2	0.20	N	membrane protein	Uncharacterized protein	
2019	N	Y	954349	MBOVPG45_RS04120	2418	10	0.41	N	DUF2779 domain-containing protein	Uncharacterized protein	
Both	Y	Y	980663	MBOVPG45_RS04275	999	48	4.80	2019	DUF285 domain-containing protein	Uncharacterized protein	

S2-4. Hypothetical Proteins

Strain	1982 (Y/N)	2019 (Y/N)	Ref Pos	Gene Name	PG45 Gene size (nt)	#Mutations	Mutations /100 nt	Disrupted (Y/N)	Gene Description		
2019	N	Y	14976	MBOVPG45_RS00085	453	1	0.22	N	hypothetical protein	hypothetical protein	
2019	N	Y	30658	MBOVPG45_RS00155	1422	1	0.07	N	hypothetical protein	hypothetical protein	
2019	N	Y	65553	MBOVPG45_RS00270	513	2	0.39	N	hypothetical protein	hypothetical protein	
2019	N	Y	79432	MBOVPG45_RS00340	765	1	0.13	N	hypothetical protein	hypothetical protein	
2019	N	Y	97890	MBOVPG45_RS00420	1194	13	1.09	N	hypothetical protein	hypothetical protein	
2019	N	Y	99221	MBOVPG45_RS00425	261	2	0.77	N	hypothetical protein	hypothetical protein	
2019	N	Y	102344	MBOVPG45_RS00450	459	3	0.65	N	hypothetical protein	hypothetical protein	
2019	N	Y	104072	MBOVPG45_RS00460	762	16	2.10	N	hypothetical protein	hypothetical protein	
2019	N	Y	106274	MBOVPG45_RS00475	234	3	1.28	N	hypothetical protein	hypothetical protein	
Both	Y	Y	107419	MBOVPG45_RS00485	390	5	1.28	N	hypothetical protein	hypothetical protein	
2019	N	Y	110917	MBOVPG45_RS00505	690	10	1.45	N	hypothetical protein	hypothetical protein	
2019	N	Y	118227	MBOVPG45_RS00545	909	1	0.11	N	hypothetical protein	hypothetical protein	
Both	Y	Y	119112	MBOVPG45_RS00550	2886	48	1.66	N	hypothetical protein	hypothetical protein	
Both	Y	Y	128082	MBOVPG45_RS00575	984	2	0.20	N	hypothetical protein	hypothetical protein	
2019	N	Y	132243	MBOVPG45_RS00590	1941	2	0.10	N	hypothetical protein	hypothetical protein	
1982	Y	N	156567	MBOVPG45_RS00700	279	1	0.36	N	hypothetical protein	hypothetical protein	
2019	N	Y	165866	MBOVPG45_RS00735	2436	6	0.25	N	hypothetical protein	hypothetical protein	
2019	N	Y	175241	MBOVPG45_RS00770	1503	22	1.46	N	hypothetical protein	hypothetical protein	
2019	N	Y	178282	MBOVPG45_RS00780	981	19	1.94	N	hypothetical protein	hypothetical protein	
2019	N	Y	185839	MBOVPG45_RS04405	234	5	2.14	N	hypothetical protein	hypothetical protein	
2019	N	Y	200561	MBOVPG45_RS00865	1410	2	0.14	N	hypothetical protein	hypothetical protein	
1982	Y	N	235507	MBOVPG45_RS01005	990	2	0.20	1982	hypothetical protein	hypothetical protein	
2019	N	Y	239758	MBOVPG45_RS01020	306	1	0.33	N	hypothetical protein	hypothetical protein	
2019	N	Y	241469	MBOVPG45_RS01030	1521	2	0.13	2019	hypothetical protein	hypothetical protein	
2019	N	Y	242137	MBOVPG45_RS01035	660	9	1.36	N	hypothetical protein	hypothetical protein	
Both	Y	Y	242831	MBOVPG45_RS01040	636	7	1.10	1982	hypothetical protein	hypothetical protein	
2019	N	Y	253208	MBOVPG45_RS01090	897	1	0.11	N	hypothetical protein	hypothetical protein	
2019	N	Y	271059	MBOVPG45_RS01175	480	21	4.38	2019	hypothetical protein	hypothetical protein	
2019	N	Y	291937	MBOVPG45_RS01225	1503	7	0.47	N	hypothetical protein	hypothetical protein	
2019	N	Y	334428	MBOVPG45_RS01490	1053	18	1.71	N	hypothetical protein	hypothetical protein	
2019	N	Y	341776	MBOVPG45_RS01525	1539	9	0.58	N	hypothetical protein	hypothetical protein	
2019	N	Y	347859	MBOVPG45_RS01550	1170	6	0.51	N	hypothetical protein	hypothetical protein	
2019	N	Y	352974	MBOVPG45_RS01565	405	2	0.49	N	hypothetical protein	hypothetical protein	
2019	N	Y	361083	MBOVPG45_RS01600	2238	28	1.25	N	hypothetical protein	hypothetical protein	
2019	N	Y	363231	MBOVPG45_RS01605	906	5	0.55	N	hypothetical protein	hypothetical protein	
2019	N	Y	398393	MBOVPG45_RS01755	888	27	3.04	N	hypothetical protein	hypothetical protein	
2019	N	Y	399190	MBOVPG45_RS01760	891	22	2.47	N	hypothetical protein	hypothetical protein	
Both	Y	Y	400121	MBOVPG45_RS01765	1149	35	3.05	2019	hypothetical protein	hypothetical protein	
2019	N	Y	418892	MBOVPG45_RS01850	1248	3	0.24	N	hypothetical protein	hypothetical protein	
2019	N	Y	424904	MBOVPG45_RS01865	1171	34	2.90	N	hypothetical protein	hypothetical protein	
2019	N	Y	433117	MBOVPG45_RS01880	2571	1	0.04	N	hypothetical protein	hypothetical protein	
2019	N	Y	434748	MBOVPG45_RS01885	1512	1	0.07	N	hypothetical protein	hypothetical protein	
2019	N	Y	437928	MBOVPG45_RS01905	2244	3	0.13	N	hypothetical protein	hypothetical protein	

2019	N	Y	443328	MBOVPG45_RS01920	1071	2	0.19	2019	hypothetical protein	hypothetical protein	
2019	N	Y	444935	MBOVPG45_RS01925	2385	1	0.04	N	hypothetical protein	hypothetical protein	
1982	Y	N	447801	MBOVPG45_RS01935	1647	1	0.06	N	hypothetical protein	hypothetical protein	
2019	N	Y	451398	MBOVPG45_RS01945	669	2	0.30	N	hypothetical protein	hypothetical protein	
2019	N	Y	456260	MBOVPG45_RS01970	579	1	0.17	N	hypothetical protein	hypothetical protein	
Both	Y	Y	463976	MBOVPG45_RS02010	1944	38	1.95	2019	hypothetical protein	hypothetical protein	
2019	N	Y	479290	MBOVPG45_RS02080	1872	21	1.12	N	hypothetical protein	hypothetical protein	
2019	N	Y	491269	MBOVPG45_RS02120	1725	17	0.99	N	hypothetical protein	hypothetical protein	
Both	Y	Y	500449	MBOVPG45_RS02150	687	18	2.62	N	hypothetical protein	hypothetical protein	
2019	N	Y	503162	MBOVPG45_RS02160	765	2	0.26	N	hypothetical protein	hypothetical protein	
2019	N	Y	506905	MBOVPG45_RS04420	441	4	0.91	N	hypothetical protein	hypothetical protein	
2019	N	Y	508825	MBOVPG45_RS02185	1674	21	1.25	N	hypothetical protein	hypothetical protein	
2019	N	Y	510784	MBOVPG45_RS02190	471	4	0.85	2019	hypothetical protein	hypothetical protein	
2019	N	Y	526035	MBOVPG45_RS02260	729	9	1.23	N	hypothetical protein	hypothetical protein	
Both	Y	Y	532709	MBOVPG45_RS02295	1218	5	0.41	N	hypothetical protein	hypothetical protein	
2019	N	Y	538024	MBOVPG45_RS02320	453	1	0.22	N	hypothetical protein	hypothetical protein	
2019	N	Y	551171	MBOVPG45_RS02380	1233	1	0.08	N	hypothetical protein	hypothetical protein	
2019	N	Y	552200	MBOVPG45_RS02385	645	1	0.16	N	hypothetical protein	hypothetical protein	
2019	N	Y	553973	MBOVPG45_RS02390	4548	27	0.59	N	hypothetical protein	hypothetical protein	
2019	N	Y	557345	MBOVPG45_RS02395	588	4	0.68	N	hypothetical protein	hypothetical protein	
2019	N	Y	563125	MBOVPG45_RS02410	306	1	0.33	N	hypothetical protein	hypothetical protein	
2019	N	Y	564824	MBOVPG45_RS02420	1509	2	0.13	2019	hypothetical protein	hypothetical protein	
2019	N	Y	565492	MBOVPG45_RS02425	660	8	1.21	N	hypothetical protein	hypothetical protein	
2019	N	Y	566186	MBOVPG45_RS02430	663	5	0.75	N	hypothetical protein	hypothetical protein	
2019	N	Y	567250	MBOVPG45_RS02440	267	6	2.25	2019	hypothetical protein	hypothetical protein	
2019	N	Y	567514	MBOVPG45_RS02445	852	3	0.35	N	hypothetical protein	hypothetical protein	
2019	N	Y	570980	MBOVPG45_RS02460	1362	10	0.73	N	hypothetical protein	hypothetical protein	
2019	N	Y	572379	MBOVPG45_RS04635	153	6	3.92	2019	hypothetical protein	hypothetical protein	
2019	N	Y	576731	MBOVPG45_RS02485	390	3	0.77	2019	hypothetical protein	hypothetical protein	
Both	Y	Y	578792	MBOVPG45_RS02500	2172	37	1.70	N	hypothetical protein	hypothetical protein	
2019	N	Y	581268	MBOVPG45_RS02505	729	7	0.96	N	hypothetical protein	hypothetical protein	
2019	N	Y	634259	MBOVPG45_RS02725	1791	19	1.06	N	hypothetical protein	hypothetical protein	
2019	N	Y	643726	MBOVPG45_RS02755	504	1	0.20	N	hypothetical protein	hypothetical protein	
2019	N	Y	651430	MBOVPG45_RS02790	253	6	2.37	2019	hypothetical protein	hypothetical protein	
2019	N	Y	669998	MBOVPG45_RS02855	990	1	0.10	N	hypothetical protein	hypothetical protein	
2019	N	Y	681045	MBOVPG45_RS02900	1170	34	2.91	2019	hypothetical protein	hypothetical protein	
2019	N	Y	732728	MBOVPG45_RS03155	285	1	0.35	N	hypothetical protein	hypothetical protein	
2019	N	Y	735556	MBOVPG45_RS03180	699	11	1.57	N	hypothetical protein	hypothetical protein	
2019	N	Y	736781	MBOVPG45_RS03190	1386	22	1.59	N	hypothetical protein	hypothetical protein	
2019	N	Y	738079	MBOVPG45_RS03195	2175	26	1.20	2019	hypothetical protein	hypothetical protein	
2019	N	Y	740336	MBOVPG45_RS03200	588	4	0.68	N	hypothetical protein	hypothetical protein	
2019	N	Y	744092	MBOVPG45_RS03220	945	7	0.74	N	hypothetical protein	hypothetical protein	
2019	N	Y	745757	MBOVPG45_RS03225	717	27	3.77	N	hypothetical protein	hypothetical protein	
2019	N	Y	747240	MBOVPG45_RS03230	717	23	3.21	N	hypothetical protein	hypothetical protein	
2019	N	Y	764720	MBOVPG45_RS03315	1020	10	0.98	2019	hypothetical protein	hypothetical protein	
Both	Y	Y	765831	MBOVPG45_RS03320	1716	5	0.29	N	hypothetical protein	hypothetical protein	
2019	N	Y	774671	MBOVPG45_RS03350	1332	11	0.83	N	hypothetical protein	hypothetical protein	
2019	N	Y	776724	MBOVPG45_RS03360	1434	13	0.91	N	hypothetical protein	hypothetical protein	
2019	N	Y	783151	MBOVPG45_RS03380	1425	13	0.91	N	hypothetical protein	hypothetical protein	
2019	N	Y	796785	MBOVPG45_RS03420	1218	6	0.49	N	hypothetical protein	hypothetical protein	
2019	N	Y	808377	MBOVPG45_RS03475	1470	26	1.77	2019	hypothetical protein	hypothetical protein	
2019	N	Y	831335	MBOVPG45_RS03515	645	3	0.47	N	hypothetical protein	hypothetical protein	
2019	N	Y	835897	MBOVPG45_RS03540	891	6	0.67	2019	hypothetical protein	hypothetical protein	

2019	N	Y	854021	MBOVPG45_RS03605	471	4	0.85	N	hypothetical protein	hypothetical protein	
2019	N	Y	861982	MBOVPG45_RS03650	696	12	1.72	2019	hypothetical protein	hypothetical protein	
Both	Y	Y	865893	MBOVPG45_RS04450	372	3	0.81	Both	hypothetical protein	hypothetical protein	
2019	N	Y	871183	MBOVPG45_RS03700	1854	30	1.62	N	hypothetical protein	hypothetical protein	
2019	N	Y	881806	MBOVPG45_RS03740	906	5	0.55	N	hypothetical protein	hypothetical protein	
2019	N	Y	911465	MBOVPG45_RS03900	666	4	0.60	N	hypothetical protein	hypothetical protein	
2019	N	Y	914797	MBOVPG45_RS03915	753	10	1.33	N	hypothetical protein	hypothetical protein	
2019	N	Y	915811	MBOVPG45_RS03925	534	3	0.56	N	hypothetical protein	hypothetical protein	
Both	Y	Y	918202	MBOVPG45_RS03940	657	3	0.46	Both	hypothetical protein	hypothetical protein	
Both	Y	Y	934781	MBOVPG45_RS04465	468	8	1.71	2019	hypothetical protein	hypothetical protein	
Both	Y	Y	937718	MBOVPG45_RS04470	1113	14	1.26	1982	hypothetical protein	hypothetical protein	
2019	N	Y	943606	MBOVPG45_RS04070	225	5	2.22	2019	hypothetical protein	hypothetical protein	
2019	N	Y	955374	MBOVPG45_RS04125	309	8	2.59	N	hypothetical protein	hypothetical protein	