Supplementary Information

Bacteriocin Gene-Trait matching across the complete *Lactobacillus* Pan-genome.

Fergus W. J. Collins[1,2,3], Paula M. O'Connor[1,2], Orla O'Sullivan[1,2], Beatriz Gomez-Sala[1], Mary C. Rea[1,2], Colin Hill[2,3] and R. Paul Ross[1,2,3*]

[1]Teagasc Food Research Centre, Teagasc Moorepark, Fermoy, Cork, Ireland, [2]APC Microbiome Institute, University College Cork, Ireland, [3]Department of Microbiology, University College Cork, Ireland

* Correspondence: p.ross@ucc.ie

Address: College of Science, Engineering and Food Science (SEFS), University College Cork, Ireland

Phone: 00353214903760

Supplementary Table 1. Source of Strains

Species Name	StrainID	Source	Antimicrobial Encoded
Lactobacillus agilis	DSM-20509	Environment	
Lactobacillus aquaticus	DSM-21051	Environment	
Lactobacillus concavus	DSM-17758	Environment	
Lactobacillus coryniformis torquens	DSM-20004	Environment	
Lactobacillus paracollinoides	DSM-15502	Environment	
Lactobacillus sharpeae	DSM-20505	Environment	
Weissella kandleri	DSM-20593	Environment	
Carnobacterium divergens	DSM-20623	Food	
Carnobacterium maltaromaticum	DSM-20342	Food	
Carnobacterium maltaromaticum	DSM-20722	Food	Yes
Lactobacillus acetotolerans	DSM-20749	Food	
Lactobacillus acidifarinae	DSM-19394	Food	
Lactobacillus acidipiscis	DSM-15836	Food	Yes
Lactobacillus acidipiscis	DSM-15353	Food	
Lactobacillus algidus	DSM-15638	Food	
Lactobacillus alimentarius	DSM-20249	Food	
Lactobacillus bifermentans	DSM-20003	Food	
Lactobacillus capillatus	DSM-19910	Food	
Lactobacillus casei	DSM-20011	Food	
Lactobacillus collinoides	DSM-20515	Food	
Lactobacillus crustorum	LMG-23699	Food	
Lactobacillus crustorum	JCM-15951	Food	
Lactobacillus curvatus	DSM-20019	Food	
Lactobacillus delbrueckii bulgaricus	DSM-20081	Food	
Lactobacillus delbrueckii delbrueckii	DSM-20074	Food	
Lactobacillus delbrueckii indicus	DSM-15996	Food	
Lactobacillus delbrueckii lactis	DSM-20072	Food	
Lactobacillus farciminis	DSM-20184	Food	
Lactobacillus frumenti	DSM-13145	Food	
Lactobacillus fuchuensis	DSM-14340	Food	
Lactobacillus futsaii	JCM-17355	Food	Yes
Lactobacillus hammesii	DSM-16381	Food	
Lactobacillus harbinensis	DSM-16991	Food	
Lactobacillus helveticus	CGMCC-1.1877	Food	Yes
Lactobacillus kefiranofaciens kefiranofaciens	DSM-5016	Food	
Lactobacillus kefiranofaciens kefirgranum	DSM-10550	Food	Yes
Lactobacillus kefiri	DSM-20587	Food	
Lactobacillus kimchicus	JCM-15530	Food	
Lactobacillus kimchiensis	DSM-24716	Food	
Lactobacillus kisonensis	DSM-19906	Food	
Lactobacillus koreensis	JCM-16448	Food	
Lactobacillus mindensis	DSM-14500	Food	

Supplementary Table 1. Continued

Lactobacillus namurensis	DSM-19117	Food	
Lactobacillus nantensis	DSM-16982	Food	Yes
Lactobacillus nodensis	DSM-19682	Food	Yes
Lactobacillus odoratitofui	DSM-19909	Food	
Lactobacillus otakiensis	DSM-19908	Food	
Lactobacillus panis	DSM-6035	Food	
Lactobacillus parabrevis	LMG-11984	Food	
Lactobacillus parabrevis	ATCC-53295	Food	
Lactobacillus paracasei tolerans	DSM-20258	Food	
Lactobacillus parakefiri	DSM-10551	Food	
Lactobacillus paralimentarius	DSM-13238	Food	
Lactobacillus paralimentarius	DSM-13961	Food	Yes
Lactobacillus perolens	DSM-12744	Food	
Lactobacillus plantarum plantarum	CGMCC-1.2437	Food	Yes
Lactobacillus pontis	DSM-8475	Food	
Lactobacillus rapi	DSM-19907	Food	
Lactobacillus rossiae	DSM-15814	Food	
Lactobacillus sakei carnosus	DSM-15831	Food	
Lactobacillus sanfranciscensis	DSM-20451	Food	
Lactobacillus secaliphilus	DSM-17896	Food	
Lactobacillus selangorensis	DSM-13344	Food	
Lactobacillus selangorensis	ATCC-BAA-66	Food	
Lactobacillus senmaizukei	DSM-21775	Food	
Lactobacillus siliginis	DSM-22696	Food	
Lactobacillus spicheri	DSM-15429	Food	
Lactobacillus suebicus	DSM-5007	Food	
Lactobacillus sunkii	DSM-19904	Food	
Lactobacillus tucceti	DSM-20183	Food	
Lactobacillus versmoldensis	DSM-14857	Food	
Lactobacillus xiangfangensis	LMG-26013	Food	
Lactobacillus zymae	DSM-19395	Food	
Lactococcus lactis	LMG-7760	Food	
Leuconostoc argentinum	KCTC-3773	Food	Yes
Leuconostoc carnosum	JB16	Food	
Leuconostoc citreum	KM20	Food	
Leuconostoc fallax	KCTC-3537	Food	Yes
Leuconostoc gasicomitatum	LMG-18811	Food	
Leuconostoc gelidum	KCTC-3527	Food	Yes
Leuconostoc kimchii	IMSNU-11154	Food	
Leuconostoc mesenteroides	ATCC-8293	Food	
Leuconostoc pseudomesenteroides	4882	Food	
Pediococcus argentinicus	DSM-23026	Food	
Weissella halotolerans	DSM-20190	Food	
Weissella minor	DSM-20014	Food	
Weissella viridescens	DSM-20410	Food	

Supplementary Table 1. Continued

Atopobium minutum	DSM-20586	Human/Animal	
Atopobium rimae	DSM-7090	Human/Animal	
Carnobacterium maltaromaticum	DSM-20730	Human/Animal	Yes
Kandleria vitulina	DSM-20405	Human/Animal	Yes
Lactobacillus acidophilus	DSM-20079	Human/Animal	Yes
Lactobacillus amylophilus	DSM-20533	Human/Animal	Yes
Lactobacillus amylotrophicus	DSM-20534	Human/Animal	
Lactobacillus amylovorus	DSM-20531	Human/Animal	Yes
Lactobacillus amylovorus	DSM-16698	Human/Animal	Yes
Lactobacillus animalis	DSM-20602	Human/Animal	
Lactobacillus antri	DSM-16041	Human/Animal	
Lactobacillus apodemi	DSM-16634	Human/Animal	Yes
Lactobacillus aviarius araffinosus	DSM-20653	Human/Animal	
Lactobacillus aviarius aviarius	DSM-20655	Human/Animal	
Lactobacillus brantae	DSM-23927	Human/Animal	
Lactobacillus brevis	DSM-20054	Human/Animal	
Lactobacillus ceti	DSM-22408	Human/Animal	
Lactobacillus coleohominis	DSM-14060	Human/Animal	
Lactobacillus crispatus	DSM-20584	Human/Animal	Yes
Lactobacillus equi	DSM-15833	Human/Animal	
Lactobacillus equicursoris	DSM-19284	Human/Animal	Yes
Lactobacillus equigenerosi	DSM-18793	Human/Animal	
Lactobacillus fermentum	DSM-20055	Human/Animal	
Lactobacillus gallinarum	DSM-10532	Human/Animal	Yes
Lactobacillus gasseri	ATCC-33323	Human/Animal	
Lactobacillus gastricus	DSM-16045	Human/Animal	Yes
Lactobacillus gigeriorum	DSM-23908	Human/Animal	Yes
Lactobacillus hamsteri	DSM-5661	Human/Animal	Yes
Lactobacillus hayakitensis	DSM-18933	Human/Animal	
Lactobacillus hominis	DSM-23910	Human/Animal	Yes
Lactobacillus iners	DSM-13335	Human/Animal	
Lactobacillus ingluviei	DSM-15946	Human/Animal	
Lactobacillus ingluviei	DSM-14792	Human/Animal	
Lactobacillus intestinalis	DSM-6629	Human/Animal	Yes
Lactobacillus jensenii	DSM-20557	Human/Animal	
Lactobacillus johnsonii	ATCC-33200	Human/Animal	Yes
Lactobacillus kalixensis	DSM-16043	Human/Animal	Yes
Lactobacillus kitasatonis	DSM-16761	Human/Animal	Yes
Lactobacillus mucosae	DSM-13345	Human/Animal	
Lactobacillus murinus	DSM-20452	Human/Animal	Yes
Lactobacillus oligofermentans	DSM-15707	Human/Animal	
Lactobacillus oris	DSM-4864	Human/Animal	
Lactobacillus pantheris	DSM-15945	Human/Animal	
Lactobacillus parabuchneri	DSM-5707	Human/Animal	Yes
Lactobacillus psittaci	DSM-15354	Human/Animal	
Lactobacillus rennini	DSM-20253	Human/Animal	

Supplementary Table 1. Continued

Lactobacillus reuteri	DSM-20016	Human/Animal	
Lactobacillus ruminis	DSM-20403	Human/Animal	
Lactobacillus saerimneri	DSM-16049	Human/Animal	
Lactobacillus salivarius	DSM-20555	Human/Animal	
Lactobacillus saniviri	DSM-24301	Human/Animal	
Lactobacillus senioris	DSM-24302	Human/Animal	
Lactobacillus ultunensis	DSM-16047	Human/Animal	Yes
Lactobacillus vaccinostercus	DSM-20634	Human/Animal	
Lactobacillus vaginalis	DSM-5837	Human/Animal	
Olsenella uli	DSM-7084	Human/Animal	
Fructobacillus fructosus	DSM-20349	Plant	
Lactobacillus buchneri	DSM-20057	Plant	
Lactobacillus cacaonum	DSM-21116	Plant	
Lactobacillus camelliae	DSM-22697	Plant	
Lactobacillus coryniformis coryniformis	DSM-20001	Plant	
Lactobacillus dextrinicus	DSM-20335	Plant	
Lactobacillus diolivorans	DSM-14421	Plant	
Lactobacillus fabifermentans	DSM-21115	Plant	
Lactobacillus floricola	DSM-23037	Plant	
Lactobacillus florum	DSM-22689	Plant	
Lactobacillus ghanensis	DSM-18630	Plant	
Lactobacillus graminis	DSM-20719	Plant	Yes
Lactobacillus hokkaidonensis	DSM-26202	Plant	Yes
Lactobacillus hordei	DSM-19519	Plant	Yes
Lactobacillus manihotivorans	DSM-13343	Plant	
Lactobacillus nasuensis	JCM-17158	Plant	
Lactobacillus ozensis	DSM-23829	Plant	
Lactobacillus plantarum	DSM-13273	Plant	Yes
Lactobacillus plantarum argentoratensis	DSM-16365	Plant	
Lactobacillus pobuzihii	NBRC-103219	Plant	
Lactobacillus pobuzihii.Chen	KCTC-13174	Plant	
Lactobacillus sucicola	DSM-21376	Plant	
Lactobacillus taiwanensis	DSM-21401	Plant	Yes
Lactobacillus thailandensis	DSM-22698	Plant	
Lactobacillus uvarum	DSM-19971	Plant	
Lactobacillus vini	DSM-20605	Plant	
Pediococcus lolii	DSM-19927	Plant	
Pediococcus parvulus	DSM-20332	Plant	
Pediococcus stilesii	DSM-18001	Plant	
Weissella confusa	DSM-20196	Plant	
Lactobacillus fructivorans	DSM-20203	Unknown	
Lactobacillus paracasei paracasei	DSM-5622	Unknown	Yes
Lactobacillus pasteurii	DSM-23907	Unknown	Yes
Lactobacillus pentosus	DSM-20314	Unknown	Yes
Lactobacillus rhamnosus	DSM-20021	Unknown	Yes
Leuconostoc mesenteroides cremoris	ATCC-19254	Unknown	

Supplementary Table 1. Continued

Pediococcus acidilactici	AS1-2696	Unknown	
Lactobacillus amylolyticus	DSM-11664	Wine/Alcohol Products	Yes
Lactobacillus composti	DSM-18527	Wine/Alcohol Products	
Lactobacillus delbrueckii jakobsenii	DSM-26046	Wine/Alcohol Products	
Lactobacillus farraginis	DSM-18382	Wine/Alcohol Products	Yes
Lactobacillus fructivorans	ATCC-27394	Wine/Alcohol Products	
Lactobacillus fructivorans	DSM-20350	Wine/Alcohol Products	
Lactobacillus helveticus	LMG-22464	Wine/Alcohol Products	Yes
Lactobacillus hilgardii	DSM-20176	Wine/Alcohol Products	
Lactobacillus homohiochii	DSM-20571	Wine/Alcohol Products	
Lactobacillus kunkeei	DSM-12361	Wine/Alcohol Products	
Lactobacillus lindneri	DSM-20690	Wine/Alcohol Products	
Lactobacillus malefermentans	DSM-5705	Wine/Alcohol Products	
Lactobacillus mali	DSM-20444	Wine/Alcohol Products	
Lactobacillus mali	ATCC-27304	Wine/Alcohol Products	
Lactobacillus nagelii	DSM-13675	Wine/Alcohol Products	
Lactobacillus oeni	DSM-19972	Wine/Alcohol Products	
Lactobacillus parabuchneri	DSM-15352	Wine/Alcohol Products	
Lactobacillus parafarraginis	DSM-18390	Wine/Alcohol Products	Yes
Lactobacillus paralimentarius	DSM-19674	Wine/Alcohol Products	
Lactobacillus paraplantarum	DSM-10667	Wine/Alcohol Products	Yes
Lactobacillus paucivorans	DSM-22467	Wine/Alcohol Products	
Lactobacillus sakei sakei	DSM-20017	Wine/Alcohol Products	
Lactobacillus satsumensis	DSM-16230	Wine/Alcohol Products	
Lactobacillus similis	DSM-23365	Wine/Alcohol Products	
Lactobacillus zeae	DSM-20178	Wine/Alcohol Products	Yes
Oenococcus kitaharae	DSM-17330	Wine/Alcohol Products	
Oenococcus oeni	ATCC-BAA-1163	Wine/Alcohol Products	Yes
Pediococcus cellicola	DSM-17757	Wine/Alcohol Products	
Pediococcus claussenii	DSM-14800	Wine/Alcohol Products	Yes
Pediococcus damnosus	DSM-20331	Wine/Alcohol Products	Yes
Pediococcus ethanolidurans	DSM-22301	Wine/Alcohol Products	
Pediococcus inopinatus	DSM-20285	Wine/Alcohol Products	
Pediococcus pentosaceus	DSM-20336	Wine/Alcohol Products	

Supplementary Table 2 Bacteriocin Genes Including Leader Sequences

Species	Strain	Potential Unmodified Lantibiotic Peptide
Lantibipeptides		
L. taiwanensis	DSM 21401	MKELNLDVEKFDLADNLEVILEANGV-TSTGCCNGPSKLQG
L. amylovorus	DSM 20531	MTESALLDLKIDESAVNAFDAEGY-AKSYSAYSSCSCVNPPCPIATMD
L. gastricus	DSM 16045	MSKEELNSIVGRAFEEMDIQQMTSIQGS-GTETAQSTPAISRVTLSIARKSSAKCISWISFSAGGLNSYKSKC
P. damnosus (Pediocin PD-1)	DSM 20331	MKKNLMKSAEESSGNVLEELNNAQLGMISGG-KKIKKSSSGDICTLTSECDHLATWVCC
Class IIa Bacteriocins		
L. hordei	DSM 19519	MKKIEKLTEKEMANIIGG-KYYGNGVTCGKHSCSVDWGKATTCIINNGAMAWATGGHQGTHKC
		MKKEIELSEKELVRIIGG-KYYGNGVSCTKKHGCKVNWGQAFTCSVNRFANFGHGNC
L. acidipiscis	DSM 15836	LSLEESSSVIGG-KYYGNGLHIPKHGKPYINWGQAIQSIGKISYHGWVNGITSGAAGVGRH
L. futsaii	JCM 17355	MKGRYVNMKKVIDENSLSLISGG-KYYGNGVSCGKHTCKVNWGQAWNESVNRWGNSWVNGLTGLRQH
C. maltaromaticum	DSM 20722	MKSVKELNKKEMQQIN-AISYGNGVYCNKEKCWVNKAENKQAITGIVIGGWASSLAGMGH
		MNSVKELNVKEMKQLHGG-VYYGNGVSCSKTKCSVNWGQAFQERYTAGINSFVSGVASGAGSIGRRP
L. agilis	DSM 20509	MSDKMENKKKLTTADLAKVTGG-SRYYGNGITCGKHKCTVNWGQAWTCGVNRLANFGHGNC
L. aquaticus	DSM 21051	MNGG-KNYGNGVYCTKKHGYKVDWGQAWSIIGNNSAANSTTRGAAGWKSK
L. rennini	DSM 20253	MLSKEELTQVNGG-KYYGNGVSCSKHSCSVDWGKALTCTINNGAMAWTTGGHQGNHKC
L. ruminis	DSM 20403	MRQLSEKELKKIMGG-KYYGNGVYCGKHKCRVDWGQAWGCSVNRWGAAVGTGGKATIGHC
P. pentosaceus	DSM 20336	MKKIEKLTEKEMANIIGG-KYYGNGLYCGKHSCSVDWGKATTCIINNGAMAWATGGHQGTHKC
C. maltaromaticum	DSM 20342	MKSVKELNKKEMQQINGG-AISYGNGVYCNKEKCWVNKAENKQAITGIVIGGWASSLAGMGH
Class IIb Bacteriocins		
L. murinus	DSM 20452	MENLQMFDVMTEEELTEINGG-YNRLAGQIGHYTGKAVIVGATVLGIASLF
		MNNAELNLFEELSTSDLQNIVGG-KRGLGYHIVDAVVSFGKGFLDAF
		MNKFQVITDLSQIKGG-YDIEKALWGGYGYQLGWRNKWNLSHRYFKI
		MEKLEDFKPLDTKATSSIVGG-GVPGWYYGMLWKIGVSGYKHRKDIMNGFDRGFNNYPK
L. acidophilus	DSM 20079	MNKFKDLNELELSNIAGG-SNNIFWTRVGVGWAAEARCMIKPSLGNWTTKAVSCGAKGLYAAVRG
		MKKKILESDLKNIKGG-VAPIVYPIAGYVMKQMFEHSDQIIKGFKRGWKKYK
L. taiwanensis	DSM 21401	MKLNDKELSKIVGG-NRWGDTVLSAASGAGTGIKACKSFGPWGMAICGSNRRLFWLYS
		MKQFNYLSHKDLAVVVGG-RNNWQTNVGGAVGSAMIGATVGGTICGPACAVAGAHYLPILWTGVTAATGGFGKIRK
L. crispatus	DSM 20584	MKQLNSEQLQNIIGG-NRWTNAYSAALGCAVPGVKYGKKLGGVWGAVIGGVGGAAVCGLAGYVRKG
		MSKVEVLNEEELTTVVGG-SKGKGRNNWAGNTIGIVSSAATGAALGSAICGPGCGFVGAHWGAVGWTAVASFSGAFGKIRK
L. nantensis	DSM 16982	MKSLNKFSTISEKNLDNCNGG-SFKGFVQGFINGLTGKKH
		MKKYKKIDNNTLKNISGG-KGPWNYKTGYNLGKWISKRF
L. apodemi	DSM 16634	MNKFQVITDLNQIKGG-YDIEKALWKGYGYQLGWRSKWNLSHRYFKI
		MDKLESFKLLDTKATSSIVGG-GVPGWYYSMLWKIGVSGYKHRKDIMSGFDKGFNNYPK
L. plantarum	DSM 13273	MKIKLTVLNEFEELTADAEKNISGG-RRSRKNGIGYAIGYAFGAVERAVLGGSRDYNK
		MTVNKMIKDLDVVDAFAPISNNKLNGVVGG-GAWKNFWSSLRKGFYDGEAGRAIRR
		MLQFEKLQYSRLPQKKLAKISGG-FNRGGYNFGKSVRHVVDAIGSVAGIRGILKSIR
		MKKFLVLRDRELNAISGG-VFHAYSARGVRNNYKSAVGPADWVISAVRGFIHG
L. plantarum subsp. *plantarum*	CGMCC 1.2437	MKIKLTVLNEFEELTADAEKNISGG-RRSRKNGIGYAIGYAFGAVERAVLGGSRDYNK
		MTVNKMIKDLDVVDAFAPISNNKLNGVVGG-GAWKNFWSSLRKGFYDGEAGRAIRR
		MLQFEKLQYSRLPQKKLAKISGG-FNRGGYNFGKSVRHVVDAIGSVAGIRGILKSIR
		MKKFLVLRDRELNAISGG-VFHAYSARGVRNNYKSAVGPADWVISAVRGFIHG
L. paraplantarum	DSM 10667	LPQKKLAKISGG-FNRGGYNFGKSVRHVVDAIGSVAGIRGILKSIR
		MKKFLVLRGRELNAISGG-VFHAYSARGVRNNYKSAVGPADWVISAVRGFIHG
L. intestinalis	DSM 6629	MVTKFKTMNLKELENTIGG-RHSVPYSYGYQSGRGFKGAAAAYNIIKTVASFFE
		MKDTVKFEKLDCNQLSKIVGG-KRKKHHPWYWSIQEFGRGFLAGLASKYNL
L. rhamnosus	DSM 20021	MTKLNEAELSKISGG-IGPLAIPVAAILGFLATDAWSHADELVAGVKQGWERS
		MDHLKTLNTADLASISGG-DNGNLWTFIGKAIGSTARSWAEGAMFAPAIGPAKEIVDKLNGN
L. zeae	DSM 20178	MNTVSNRFNTVTEDELSVVSGG-NAWGNAVNGALNGAATGARFGKNLGPWGMIGGMALGAGIGGYFGYNG
		MDSELTDVVGG-RNTWQQNVSGVAGAAAGGAALGAVVGGPAGAFLGAHYGPILWTAVTGFTGGF
Leuc. fallax	KCTC 3537	MEKLSEQELAKASGG-CPLLPIVVTVAASGAHFVAKDGWNHLDQIRSGWRKSGNSKW
		MDFKTQPNVLSLEKLMMISGG-STDGSWEDFGAGLHKTVNTVIYAGTTVARAHTRSHQRCFTGNKW

Supplementary Table 2. Continued

Species	Strain	Potential Unmodified Lantibiotic Peptide
Class IId Bacteriocins		
L. paralimentarius	DSM 13961	MSKFKELSITELYKTSGG-NFFGGSNGYSWRDKKGHWHYTVTSGVSSTVAQIIGNGWGSAGAPGVGQR
L. pentosus	DSM 20314	MQKIAGG-KSNTYSLQMGSVVRTATKIFKKMEW
L. hokkaidonensis	DSM 26202	MKFKKLSEKELQKINGG-VTLSVATHSKNGLKKFFKWVRKL
L. xiangfangensis	LMG 26013	MNSQKVLISSELSNVIGG-KLVKLYTAEPYTFYRDTRTKKIVMRQTTGYSAHLQHVIADGWVRSAHL
L. paracasei	DSM 5622	MKQFDEQKMVNMSDEELLGFIGG-DSIRDVSPTFNKIRRWFDGLFK
L. murinus	DSM 20452	MNKFQVITDLSQIKGG-YDIEKALWGGYGYQLGWRNKWNLSHRYFKI
Leuc. kimchii	IMSNU 11154	MQDVKYRELSEAELSVIAGG-KSFWSWASDASSWLSGPQQPNSPLLKKKR
Leuc. geldium	KCTC 3527	MKSLQDFQTMNHTQLAQVNGG-KRVYIPNGNGAWLDSNTGKGGVDWNVAVPALGSIMVNGWAQNGPLAHLHP
C. maltaromaticum (cbnX)	DSM 20722	MKSVKELNVKEMQQTIGG-WGWKEVVQNGQTIFSAGQKLGNMVGKIVPLPFG
Lactococcin 972 like Bacteriocins		
L. equicursoris	DSM 19284	MNKIKSFAVAVFATTAIAFSAVPVLASSYVIDAQ-GGTWNYGVGSKYVWSYYSHNSKTHKASVEGKYYVTSGWIKEKTQARASAAKAAAGNQSYYDVK
L. amylophilus	DSM 20533	MKSAKKLMTAFAVTAGLLGTGVGSAVMAASVG-GGTWNYGVGLTGTFGYSDYLHNSKTHSASVGRTKSDCNKVTKTKGVWAQSKYTKIPPTGLNYWWSVS
L. graminis	DSM 20719	MASAQAASADIPIASGQMELTQGQTPIMSCISKG-GGTWYSGFSGTKVYSQYYHGSKKHSATAKNGWGAGVRNTQKAGIWAYSSVNSTLTGNKTYWAVY
L. hamsteri	DSM 5661	MKKSKKLIASLTATCAAVMLSTSPVLAATVYEH-GGVWNYGVGKKYVWSYYSHHRLTHKSSVEGKYYSSSGWVSPGTEARASAEKAQHGNKSYFDVE
Leuc. argentinum	KCTC 3773	MNKFKKVVLTGVIASGIFSGISFAHADQVG-GGDWRHGVGSYYVWSYYFHNYRNHSSSVSGQYFASSGRTSPGYDAQASAPKSLFGNKAYYDFW

Supplementary Table 3. Bacterial strains screened for bacteriocin production

Species	Strain	Growth Medium	Condition	Temp (˚C)
Carnobacterium maltaromaticum	DSM 20342	TSA	Aerobic	30
Carnobacterium maltaromaticum	DSM 20722	TSA	Aerobic	30
Carnobacterium maltaromaticum	DSM 20730	TSA	Aerobic	30
Lactobacillus acidipiscis	DSM 15836	MRS + Vitamin soln.	Anaerobic	30
Lactobacillus acidophilus	DSM 20079	mMRS	Anaerobic	37
Lactobacillus agilis	DSM 20509	mMRS	Anaerobic	38
Lactobacillus amylophilus	DSM 20533	MRS	Aerobic	30
Lactobacillus amylovorus	DSM 16698	MRS	Anaerobic	37
Lactobacillus amylovorus	DSM 20531	MRS	Anaerobic	37
Lactobacillus apodemi	DSM 16634	MRS	Anaerobic	37
Lactobacillus aquaticus	DSM 21051	MRS	Anaerobic	37
Lactobacillus buchneri	DSM 20057	MRS	Aerobic	37
Lactobacillus casei	DSM 20011	MRS	Aerobic	30
Lactobacillus composti	DSM 18527	MRS	Anaerobic	30
Lactobacillus coryniformis subsp. *coryniformis*	DSM 20001	MRS	Aerobic	30
Lactobacillus coryniformis subsp. *torquens*	DSM 20004	MRS	Aerobic	30
Lactobacillus crispatus	DSM 20584	mMRS	Anaerobic	37
Lactobacillus equicursoris	DSM 19284	MRS	Anaerobic	37
Lactobacillus fabifermentans	DSM 21115	MRS	Anaerobic	30
Lactobacillus fuchuensis	DSM 14340	MRS	Aerobic	20
Lactobacillus futsaii	JCM 17355	MRS	Aerobic	30
Lactobacillus gastricus	DSM 16045	MRS	Anaerobic	37
Lactobacillus graminis	DSM 16045	MRS	Aerobic	30
Lactobacillus hamsteri	DSM 5661	MRS	Anaerobic	37
Lactobacillus harbinensis	DSM 16991	MRS	Anaerobic	37
Lactobacillus helveticus	CGMCC 1.1877	MRS	Anaerobic	37
Lactobacillus helveticus	LMG 22464	MRS	Anaerobic	37
Lactobacillus hokkaidonensis	DSM 26202	MRS	Anaerobic	25
Lactobacillus hordei	DSM 19519	MRS	Anaerobic	30
Lactobacillus intestinalis	DSM 6629	MRS	Aerobic	37
Lactobacillus johnsoni	DSM 10533	MRS	Anaerobic	37
Lactobacillus kalixensis	DSM 16043	MRS	Aerobic	37
Lactobacillus kimchicus	JCM 15530	MRS	Aerobic	37
Lactobacillus kimchiensis	DSM 24716	MRS	Anaerobic	25
Lactobacillus kitasatonis	DSM 16761	MRS	Anaerobic	37
Lactobacillus mali	DSM 20444	MRS	Aerobic	30
Lactobacillus mindensis	DSM 14500	MRS	Anaerobic	30
Lactobacillus murinus	DSM 20452	MRS	Aerobic	37
Lactobacillus nantensis	DSM 16982	mMRS + 1% maltose + 0.5% YE	Aerobic	30
Lactobacillus nodensis	DSM 19682	MRS	Anaerobic	30
Lactobacillus otakiensis	DSM 19908	MRS	Anaerobic	30

Supplementary Table 3. Continued

Species	Strain	Growth Medium	Condition	Temp (˚C)
Lactobacillus parabuchneri	DSM 5707	MRS	Aerobic	30
Lactobacillus paracasei subsp. *paracasei*	DSM 5622	MRS	Aerobic	30
Lactobacillus paracasei subsp. *tolerans*	DSM 20258	MRS	Aerobic	30
Lactobacillus parafarraginis	DSM 18390	MRS	Anaerobic	30
Lactobacillus paralimentarius	DSM 13961	MRS	Aerobic	30
Lactobacillus paralimentarius	DSM 13238	MRS	Aerobic	30
Lactobacillus paraplantarum	DSM 10667	MRS	Aerobic	30
Lactobacillus pasteurii	DSM 23907	MRS	Anaerobic	37
Lactobacillus pentosus	DSM 20314	MRS	Aerobic	30
Lactobacillus plantarum	DSM 13273	MRS	Aerobic	37
Lactobacillus plantarum subsp. *argentoratensis*	DSM 16365	MRS	Anaerobic	30
Lactobacillus plantarum subsp. *plantarum*	DSM 20174	MRS	Aerobic	30
Lactobacillus rennini	DSM 20253	MRS + CAA	Aerobic	30
Lactobacillus reuteri	DSM 20016	MRS	Aerobic	37
Lactobacillus rhamnosus	DSM 20021	MRS	Aerobic	37
Lactobacillus rossiae	DSM 15814	MRS + 1% maltose + 1% YE	Anaerobic	30
Lactobacillus ruminis	DSM 20403	MRS	Anaerobic	37
Lactobacillus similis	DSM 23365	MRS	Anaerobic	37
Lactobacillus taiwanensis	DSM 21401	MRS	Anaerobic	37
Lactobacillus xiangfangensis	LMG 26013	MRS	Aerobic	30
Lactobacillus zeae	DSM 20178	MRS	Aerobic	37
Leuconostoc fallax	DSM 20189	MRS	Aerobic	30
Leuconostoc gasicomitatum	LMG 18811	MRS	Anaerobic	22
Leuconostoc gelidum subsp. *gelidum*	DSM 5578	MRS	Anaerobic	25
Leuconostoc lactis	DSM 8581	MRS	Aerobic	30
Oenococcus kitaharae	DSM 17330	mMRS + 10% tomato juice	Anaerobic	30
Oenococcus oeni	ATCC-BAA 1163	MRS	Anaerobic	37
Pediococcus cellicola	DSM 17757	MRS	Anaerobic	30
Pediococcus claussenii	DSM 14800	MRS pH 5.7	Aerobic	30
Pediococcus damnosus	DSM 20331	mMRS pH 5.7	Anaerobic	26
Pediococcus ethanolidurans	DSM 22301	MRS	Anaerobic	37
Pediococcus pentosaceus	DSM 20336	MRS	Aerobic	30
Pediococcus stilesii	DSM 18001	MRS	Anaerobic	30

Supplementary Table 4. Indicator Strains

Species	Strain	Growth Medium	Conditions	Temp (˚C)
Enterococcus faecium	LMG 11423	MRS	Anaerobic	37
E. mundtii	LMG 10748	MRS	Anaerobic	37
E. saccharolyticus	LMG 11427	MRS	Anaerobic	37
Lactobacillus acidophilus	LMG 9433	MRS	Anaerobic	37
L. agilis	LMG 9186	MRS	Anaerobic	37
L. amylovorus	LMG 9496	MRS	Anaerobic	37
L. casei	LMG 6904	mMRS	Anaerobic	37
L. crispatus	LMG 9479	MRS	Anaerobic	37
L. delbrueckii subsp. *bulgaricus*	LMG 6901	MRS	Anaerobic	37
L. delbrueckii subsp. *lactis*	LMG 7942	MRS	Anaerobic	37
L. fermentum	LMG 6902	MRS	Anaerobic	37
L. johnsonii	DSM 10533	MRS	Anaerobic	37
L. plantarum	LMG 6907	MRS	Anaerobic	37
L. rhamnosus	GG	MRS	Anaerobic	37
Listeria innocua	DPC 3572	BHI	Aerobic	37
Micrococcus luteus	DPC 6275	BHI	Aerobic	30
Staphylococcus aureus	DPC 5246	BHI	Aerobic	37
Salmonlella typhimurium	LT2	BHI	Aerobic	37

Supplementary Figure 1. Divergence and percentage identity of helveticin homologs encoded by *Lactobacillus* species (Clustal ω)

Supplementary Figure 2. Colony MALDI TOF MS and SDS PAGE profiles of the peptides produced by the cells indicate the mass and identity of each bacteriocin produced

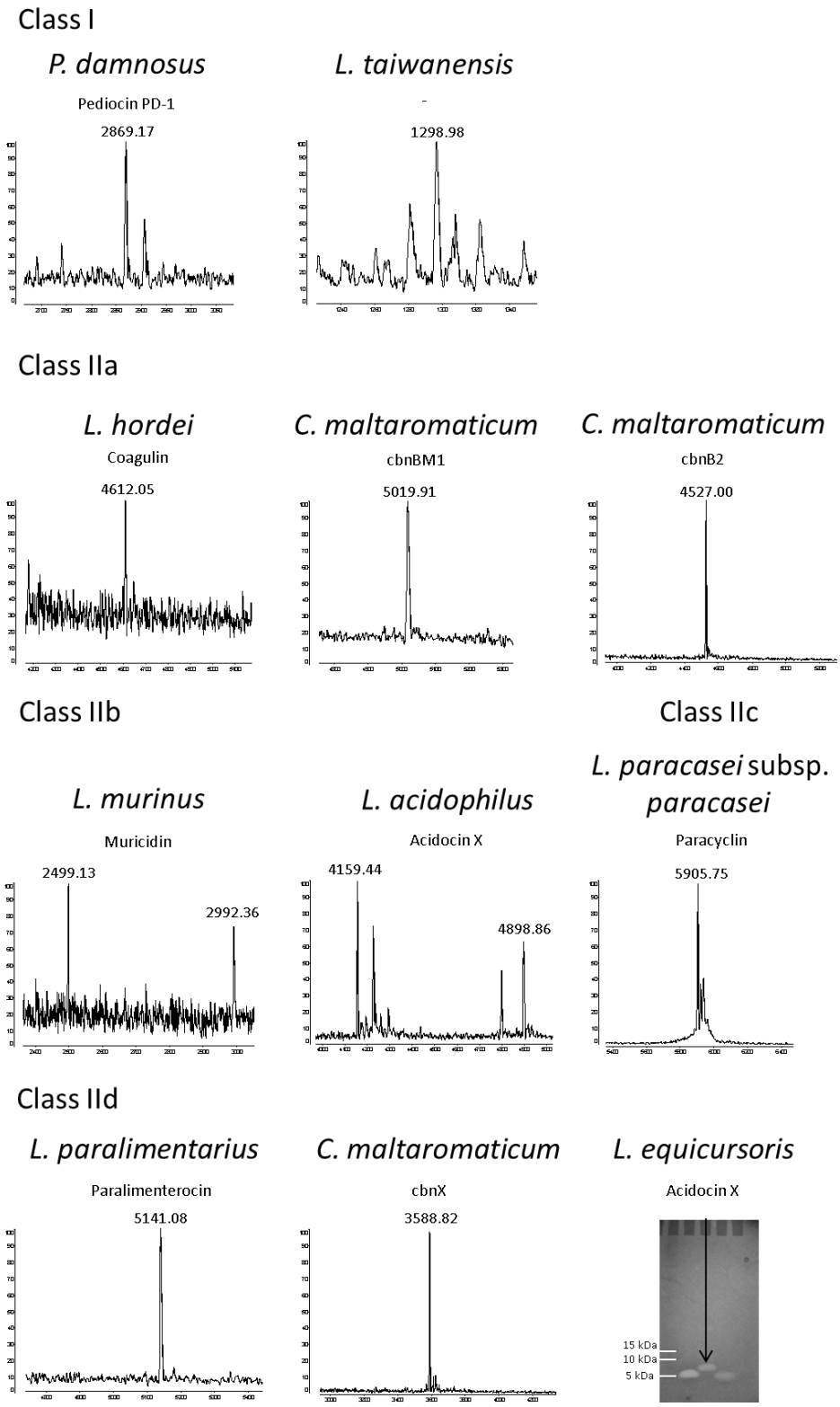
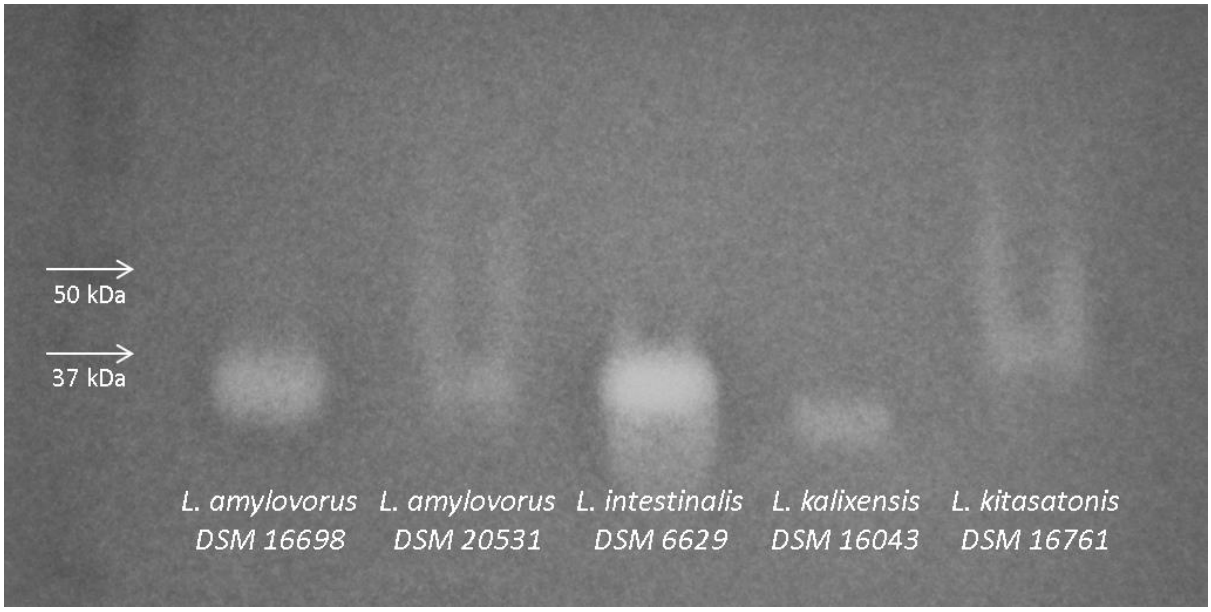
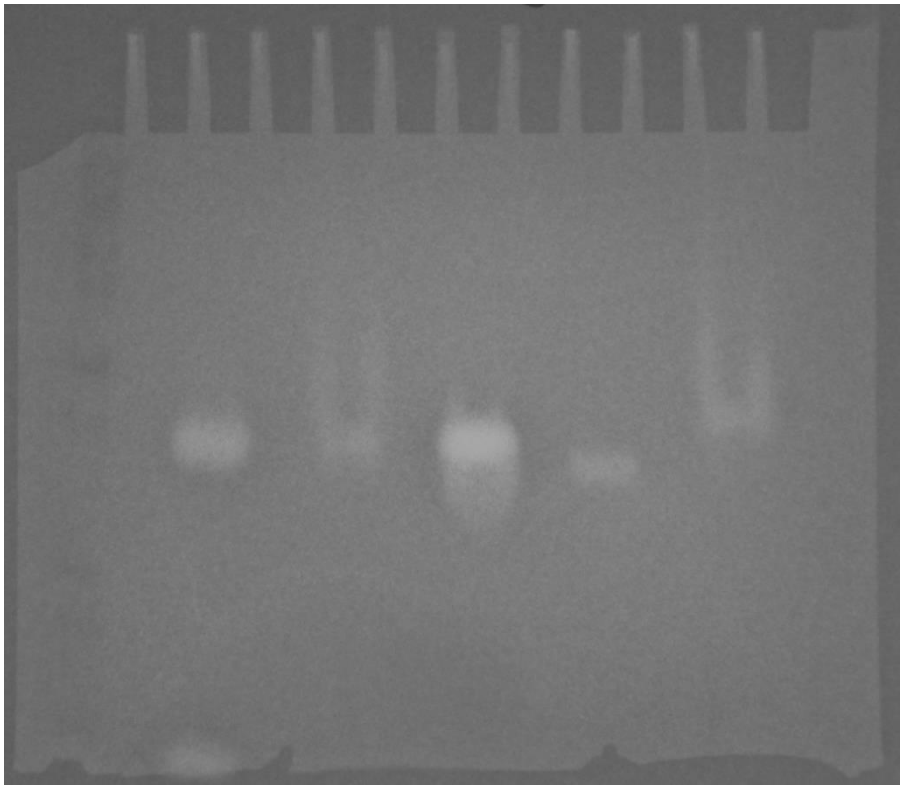


Figure 3. An SDS PAGE gel overlayed with the indicator *L. delbrueckii* subsp. *bulgaricus* shows the mass of the antimicrobial helveticin-like peptides produced by these lactobacilli (Unedited gel image can be seen in Supplementary Figure 4).



Supplementary Figure 4. Unedited SDS Gel overlay displaying zones of inhibition for helveticin like proteins produced by *L. amylovorus* DSM 16698, *L. amylovorus* DSM 20531, *L. intestinal* DSM 6629, *L. kalixensis* 16043 and *L. kitasatonis* DSM 16761



Supplementary Figure 5. Unedited SDS Gel overlay displaying zones of inhibition for the production of the bacteriocin 'equicursorin' by *L. equicursoris* DSM 19284 (central lane of gel)