

## 223Antimicrobial *Bacillus*: metabolites and their mode of action

charlie tran, Ian E. Cock, Xiaojing Chen and Yunjinag Feng

**Table S1.** 47 antimicrobial metabolites from *Bacillus*.

Metabolite	Source strain	Molecular target	Indicator strain	Bioactivity (MIC or otherwise indicated)	Source location	Reference
Bacitracin A	N/A	Cell wall/Biofilm	Staphylococcus mutans MTCC 497	78.12 µg/ml	N/A	[16]
	B. GU057	Cell wall/Biofilm	Staphylococcus aureus Micrococcus luteus	ZoI = 18mm ZoI = 13mm	Saline soil in the roots of Terminalia Arjuna roots in District D.I.Khan at pH 8.2.	[137]
	B. licheniformis DW2	Cell wall/Biofilm	N/A	N/A	N/A	[138]
	B. licheniformis 10716	Cell wall/Biofilm	N/A	N/A	N/A	[139]
	B. licheniformis strain AL	Cell wall/Biofilm	N/A	N/A	N/A	[139]
	B. licheniformis 16	Cell wall/Biofilm	N/A	N/A	N/A	[140]
	B. licheniformis 28 KA	Cell wall/Biofilm	Bacillus licheniformis	N/A	N/A	[141]
	B. subtilis C 126	Cell wall/Biofilm	Micrococcus flavus N/A	N/A	Sugar Cane	[142]
	B. licheniformis A-5	Cell wall/Biofilm	N/A	N/A	Chinese liquor-making process	[142]
	B. subtilis MH-4	Cell wall/Biofilm	N/A	N/A	N/A	[143]
	B. spp. GU215	Cell wall/Biofilm	Staphylococcus aureus	ZoI = 18mm	N/A	[144]
	B. paralicheniformis UBBLi30	Cell wall/Biofilm	Micrococcus luteus MRSA Streptococcus aureus Streptococcus Pyrogenes Propionibacterium Acnes Micrococcus luteus MTCC 106 MRSA	ZoI = 30.6mm ZoI = 9.6mm ZoI = 10.6mm ZoI = 10.3mm ZoI = 11.0mm 0.015625 mg/l 8 mg/l	Traditional fermented food and preserved in culture collection of Unique Biotech Limited, India	[32]
Bacilysin			E. coli	0.001 µg/ml		[21]
	B. amyloliquefaciens X030/ (KM191359.1)	Cell wall	N/A	N/A	Peanut soil in Henan province	[145]
	B. subtilis A14	Cell wall	N/A	N/A	N/A	[146]
	B. subtilis 168	Cell wall	N/A	N/A	N/A	[147]
	B. subtilis ME488	Cell wall	N/A	N/A	Korean greenhouse soils	[148]
	B. sp. strain CS93	Cell wall	N/A	N/A	Pozol, Villahermosa, Tabasco, Mexico	[149]
	B. amyloliquefaciens ZJU-2011	Cell wall	N/A	N/A	East China Sea	[20]
	B. amyloliquefaciens MTCC 10456	Cell wall	Malassezia furfur ATCC 44344, Malassezia furfur ATCC 12078, Malassezia globose ATCC MYA 4612	50-100 µg/mL 50-110 µg/mL 30-100 µg/mL	Seaweed	[150]
	B. luciferensis K2	Cell wall	N/A	N/A	Organic soils of Sikkim, India	[151]
	B. amyloliquefaciens K12	Cell wall	N/A	N/A	Organic soils of Sikkim, India	[151]
	B. subtilis BioCWB	Cell wall	N/A	N/A	Organic soils of Sikkim, India	[151]

[illegible]

	B. clausii UBBC07 (MTC 5472)	Cell wall	Micrococcus luteus Listeria monocytogenes Enterococcus faecium Enterococcus faecalis Clostridioides difficile Staphylococcus aureus MRSA	20.5 mg/L 16.9 mg/L 11.9 mg/L 10.8 mg/L 12.7 mg/L 15.3 mg/L 13.7 mg/L	N/A	[153]
		Cell wall	Micrococcus luteus MRSA	16 mg/L 128 mg/L		[153]
Mersacidin	N/A	Cell wall	Staphylococcus aureus SG511 Staphylococcus aureus SA137/93A Staphylococcus aureus SA137/93G	1 µg/ml 35 µg/ml 30 µg/ml		[34]
	B. HIL Y-85,54728	Cell wall	Micrococcus luteus ATCC 4698 Staphylococcus simulans 22	0.1 µg/ml 11 µg/ml	Mulund (salt pan), Maharashtra, India	[154]
	N/A	Cell wall	Staphylococcus aureus SH1000 Staphylococcus aureus R33 MRSA Staphylococcus epidermidis NCTC11047 Streptococcus pneumoniae BAA-255 Micrococcus luteus ATCC 4698 Enterococcus faecium ATCC 19579 Enterococcus faecalis ATCC 29212 Enterococcus faecium 7131121 VRE	32 µg/ml 32 µg/ml 16, 32 µg/ml 2 µg/ml 1, 2 µg/ml 32 µg/ml 64 µg/ml 64 µg/ml		[155]
	Bacillus amyloliquefaciens subsp. plantarum B9601-Y2	Cell wall	N/A	N/A	wheat rhizosphere	[156]
Amylolysin A	B. amyloliquefaciens GA1	Cell wall/ Cell membrane	Micrococcus luteus ATCC 9341 Staphylococcus epidermis ATCC 1228 Staphylococcus aureus ATCC 25923 Staphylococcus aureus ATCC 43300 Staphylococcus aureus RFB127 Enterococcus faecalis ATCC 29212 Enterococcus faecalis RFB129 Enterococcus faecium RFB128 Listeria monocytogenes LMG 23905 Listeria monocytogenes LMG 21263 Listeria monocytogenes LM2234 Listeria innocua ATCC33090 Listeria innocua RFB159 Listeria ivanovii RFB160 Bacillus cereus RFB125 Bacillus subtilis ATCC 6633 Bacillus megaterium RFB124 Streptococcus agalactiae RFB141 Weissella sp RFB139 Lactobacillus plantarum RFB138 Escherichia coli RFB149 Pseudomonas aeruginosa RFB148 Cryptococcus neoformans IHEM3969 Saccharomyces cerevisiae RFY100	0.7 µM 2.8 µM 2.8 µM 0.4 µM 1.4 µM 1.4 µM 0.7 µM 0.1 µM 0.4 µM 0.5 µM 0.4 µM 0.7 µM 0.7 µM 0.8 µM 0.2 µM 1.4 µM 0.4 µM 2.8 µM 2.8 µM > 2.8 µM > 2.8 µM > 2.8 µM > 2.8 µM > 2.8 µM	Strawberry	[37]
	B. subtilis S499	Cell wall/ Cell membrane	N/A	N/A	Cultivated soil in the Iturie region (Democratic Republic of Congo; Delcambe, 1965)	[157]

Haloduracin	B. halodurans C-125	Cell wall/ Cell membrane	Lactococcus lactis HP Lactococcus lactis 481 Lactococcus lactis 11454 Vancomycin resistant Enterococcus faecium Bacillus anthracis Sterne 7702 Bacillus subtilis Methicillin-resistant Staphylococcus aureus Staphylococcus aureus Staphylococcus epidermidis 15X Micrococcus luteus Streptococcus mutans	73.4 nM 195 nM 625 nM 781 nM  677 nM 469 nM 4690 nM  1560 nM 313 nM 1250 nM 2500 nM	N/A	[38]
$\epsilon$ -poly-L-Lysine	B. subtilis SDNS	Cell membrane	Escherichia coli Staphylococcus aureus Enterococcus faecalis Pseudomonas aeruginosa Vibrio sp. N2, Vibrio fluvialis Vibrio bulifucus	Active Active Active Active Active Active Active	Sea water in Alexandria	[43]
	N/A	N/A	Gardnerella vaginalis	33 $\mu\text{g/mL}$		[97]
Plantazolicin	B. velezensis FZB42	Cell membrane	Bacillus brevis ATCC 8246 Bacillus subtilis 168 Bacillus cereus ATCC 14579 Bacillus licheniformis ATCC 9789 Micrococcus luteus Bacillus subtilis CU1065 Bacillus subtilis HB0042 Bacillus sphaericus Paenibacillus granivorans Bacillus megaterium 7A1	Active Active Active Active Active Active Active Active Active Active	N/A	[158]
		Cell membrane	Bacillus anthracis Sterne 7702 Bacillus anthracis Sterne 34F2 A0517.1 Bacillus cereus 2002013145 Bacillus cereus 2002013146 Bacillus cereus 2002013100 Bacillus cereus 2002013102 Bacillus cereus ATCC 4342 Bacillus cereus ATCC 7064 Bacillus cereus CDC 32805 Bacillus cereus G9241 Bacillus megaterium 899 Bacillus mycoides 96/3308	1 2 >64 >64 >64 >64 >64 >64 >64 8 32 >64	N/A	[45]
	B. velezensis LM2303	Cell membrane	N/A	N/A	N/A	[159]
Octapeptin B (EM-49)	B. circulans ATCC 21,656	Cell membrane	Escherichia coli SC 9251 Escherichia coli SC 9252 Escherichia coli SC 9253 Bacillus subtilis GSY 201	1.6 $\mu\text{g/mL}$ 0.8 $\mu\text{g/mL}$ 0.3 $\mu\text{g/mL}$ 0.2 $\mu\text{g/mL}$	N/A	[160]
Aurantinin B	B. subtilis fmb60	Cell membrane	Staphylococcus aureus ATCC 25923 Micrococcus luteus CMCC 28001	1.56 $\mu\text{g/mL}$ 3.12 $\mu\text{g/mL}$	Compost	[48]

			Bacillus pumilus CMCC 63202 Bacillus cereus ATCC 14579 Bacillus subtilis ATCC 168 Listeria monocytogenes CICC 21662 Enterococcus faecalis ATCC 29212 Pseudomonas fluorescens ATCC 49642 Clostridium sporogenes CICC 10385 Staphylococcus aureus MRSA Escherichia coli ATCC 25922	0.78 µg/mL 0.78 µg/mL 1.56 µg/mL 1.56 µg/mL 1.56 µg/mL 1.56 µg/mL 0.78 µg/mL 6.25 µg/mL >100 µg/mL		
Aurantinin C	B. subtilis fmb60	Cell membrane	Staphylococcus aureus ATCC 25923 Micrococcus luteus CMCC 28001 Bacillus pumilus CMCC 63202 Bacillus cereus ATCC 14579 Bacillus subtilis ATCC 168 Listeria monocytogenes CICC 21662 Enterococcus faecalis ATCC 29212 Pseudomonas fluorescens ATCC 49642 Clostridium sporogenes CICC 10385 Staphylococcus aureus MRSA Escherichia coli ATCC 25922	1.56 µg/mL 3.12 µg/mL 0.78 µg/mL 0.78 µg/mL 1.56 µg/mL 1.56 µg/mL 1.56 µg/mL 1.56 µg/mL 0.78 µg/mL 6.25 µg/mL >100 µg/mL	Compost	[48]
Aurantinin D	B. subtilis fmb60	Cell membrane	Staphylococcus aureus ATCC 25923 Micrococcus luteus CMCC 28001 Bacillus pumilus CMCC 63202 Bacillus cereus ATCC 14579 Bacillus subtilis ATCC 168 Listeria monocytogenes CICC 21662 Enterococcus faecalis ATCC 29212 Pseudomonas fluorescens ATCC 49642 Clostridium sporogenes CICC 10385 Staphylococcus aureus MRSA Escherichia coli ATCC 25922	1.56 µg/mL 3.12 µg/mL 0.78 µg/mL 0.78 µg/mL 1.56 µg/mL 1.56 µg/mL 1.56 µg/mL 1.56 µg/mL 0.78 µg/mL 6.25 µg/mL >100 µg/mL	Compost	[48]
Myriocin			C. albicans (ATCC 10231D-5) C. glabrata (ATCC 10231D-5) C. glabrata (109) C. albicans (1114) C. albicans (12-99)	2.0 µg/mL 1.0 µg/mL 0.5 µg/mL 1.0 µg/mL 0.25 µg/mL		[49]
	B. amyloliquefaciens LZN01	Cell membrane /Intra-cellular	N/A	N/A		[161]
Gramicidin A	B. brevis ATCC 8185	Cell membrane, DNA	Streptococcus pyogenes Enterococcus faecalis Streptococcus pneumoniae Streptococcus agalactiae Listeria monocytogenes	33 nM 270 nM 8.3 nM 1100 nM 4300 nM		[52]
Gramicidin S	N/A	Cell membrane	Enterococcus faecium 3.9µM Streptococcus aureus 3.9-7.8 µM Klebsiella pneumoniae 31.3 – 62.5 µM Acinetobacter baumannii 15.6-62.5µM Pseudomonas aeruginosa 31.3-62.5µM Enterobacter cloacae 1.95 0 62.5µM	3.9 µM 3.9 – 7.8 µM 31.3 – 62.5 µM 15.6 – 62.5 µM 31.3 – 62.5 µM 1.98 – 62.5 µM		[55]
	B. brevis ATCC 9999	Cell membrane	N/A	N/A		[162]

	<i>B. brevis</i> var. G.B.	Cell membrane	N/A	N/A		[163]
Surfactin A	<i>B. velezensis</i> LM2303	Cell membrane	N/A	N/A	dung of wild yak inhabited Qinghai-Tibet plateau, China	[159]
	<i>Bacillus subtilis</i> PB2-L1	Cell membrane	<i>Bacillus cereus</i> AS1.1846 <i>Staphylococcus aureus</i> AS1.2465 <i>Micrococcus luteus</i> CMCC28000 <i>Pseudomonas fluorescens</i> AS1.1802 <i>Salmonella enteritidis</i> CICC21527 <i>Bacillus subtilis</i> ATCC9943	100 µg/mL 50 µg/mL 200 µg/mL 400 µg/mL 200 µg/mL 100 µg/mL		[164]
	<i>B. subtilis</i> CMB32	Cell membrane	<i>Colletotrichum gloeosporioides</i>		Soil	[165]
	<i>B. amyloliquefaciens</i> strain FJAT-2349	Cell membrane	N/A	N/A	Soil sample from JiuHuaMountain, Anhui Province, China	[166]
	<i>B. sp</i> P5	Cell membrane	N/A	N/A	Puba, a regional fermentation product from cassava	[167]
	<i>B. velezensis</i> LHSB1	Cell membrane	N/A	N/A	Peanut seeds	[168]
	<i>B. velezensis</i> BvL03	Cell membrane	N/A	N/A		[169]
	<i>B. pumilus</i> ICVB403	Cell membrane	N/A	N/A	Copepod eggs	[170]
	<i>Bacillus</i> NH-100	Cell membrane	<i>Fusarium moiliforme</i> <i>Fusarium oxysporum</i> <i>Fusarium solani</i> P302 <i>Fusarium solani</i> ofio601 As5 <i>Fusarium Solani</i> SAN1077 <i>Trichoderma atroviride</i> P150907	Active Active Active Active Active Active	Applied Microbiology and Biotechnology (AMB) Lab, CIIT, Islamabad	[171]
	<i>Bacillus</i> NH-217	Cell membrane	<i>Fusarium moiliforme</i> <i>Fusarium oxysporum</i> <i>Fusarium solani</i> P302 <i>Fusarium solani</i> ofio601 As5 <i>Fusarium Solani</i> SAN1077 <i>Trichoderma atroviride</i> P150907	Active Active Active Active Active Active		[171]
	<i>B. subtilis</i> S1702	Cell membrane	N/A	N/A		[172]
Surfactin B	<i>B. amyloliquefaciens</i> HR62	Cell membrane	N/A	N/A		[173]
	<i>B. subtilis</i> S1702	Cell membrane	N/A	N/A		[172]
Surfactin C	<i>Bacillus atrophaeus</i> 176s	Cell membrane	N/A	N/A	<i>Tortella tortuosa</i> (Pottiaceae, Bryophyta) grown in an Austrian pine forest on limestone.	[174]
Lichenysin	<i>B. megaterium</i> pL6 (Project Report SC 3488)	Cell membrane	N/A	N/A	Soil, Universidade de São Paulo, São Paulo, SP, Brazil	[175]
Fengycin A	<i>Bacillus amyloliquefaciens</i> Q-426	Cell membrane /Cell wall, Intracellular, QS	<i>Fusarium oxysporum</i> f. sp. spinaciae O-27	31.25 µg/ml	Isolated from compost samples collected in the Dalianregion of China	[176]
	<i>B. velezensis</i> LHSB1	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A		[168]
	<i>B. subtilis</i> HC8	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A		[177]
	<i>B. subtilis</i> strain F-29-3	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A	Isolated from potato farm	[178]
	<i>B. megaterium</i> pL6 (Project Report SC 3488)	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A	Soil, Universidade de São Paulo, São Paulo, SP, Brazil	[175]
	<i>B. amyloliquefaciens</i> strain 32a	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A		[179]



Fengycin C	B. subtilis XF-1 (CGMCC No. 2357)	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A	rhizosphere soil of Chinese cabbage (Brassica pekinensis)	[181]
	B. subtilis EA-CB0015	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A	phyllosphere of a banana plant	[187]
	B. subtilis S1702	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A		[172]
Fengycin D	B. subtilis XF-1 (CGMCC No. 2357)	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A	rhizosphere soil of Chinese cabbage (Brassica pekinensis)	[181]
	B. subtilis S1702	Cell membrane /Cell wall, Intracellular, QS	N/A	N/A		[172]
Iturin A	B. velezensis LM2303	Cell membrane, Intracellular cellular processes	N/A	N/A	dung of wild yak inhabited Qinghai-Tibet plateau, China	[159]
	B. megaterium pL6 (Project Report SC 3488	Cell membrane, Intracellular cellular processes	N/A	N/A	Soil, Universidade de São Paulo, São Paulo, SP, Brazil	[175]
	B. subtilis B-3	Cell membrane, Intracellular cellular processes	Aspergillus clavatus SRRC 17 Aspergillus flavus SRRC 295 (nonaflatoxigenic) Aspergillus flavus SRCC 2089 (aflatoxigenic) Aspergillus orchaceus SRRC 335 Aspergillus parasiticus SRRC 1008 Aspergillus versicolor SRRC 108B Fusarium moniliforme SRRC 1086 Fusarium nivale (Ferlacia) SRRC 131 Penicillium citrinum SRRC 1013 Penicillium expansum SRRC 1134 Penicillium italicum SRRC 1169 Penicillium virdicatum SRRC 217	Active Active  Active Active Active Active Active Active Active Active	N/A	[188]
	B. velezensis BvL03	Cell membrane, Intracellular cellular processes	N/A	N/A		[169]
	B. amyloliquefaciens ANT1	Cell membrane, Intracellular cellular processes	N/A	N/A	Isolated from a surgical room at the St. Mary of Lourdes Clinic (Naples district, Italy	[184]
	B. licheniformis W10	Cell membrane, Intracellular cellular processes	N/A	N/A	Isolated from a tomato rhizosphere	[189]
	B. subtilis strain KS03	Cell membrane, Intracellular cellular processes	Gloeosporium gloeosporioides	N/A	rice straw	[190]
	B. subtilis RB14-CS	Cell membrane, Intracellular cellular processes	Rhizoctonia solani,	N/A	N/A	[191]
	B. subtilis JA	Cell membrane, Intracellular cellular processes	Fusarium graminearum	N/A	Key Laboratory of Ion Beam Engineering, Chinese Academy of Sciences, Hefei 230031, Anhui province, China	[192]

	B. subtilis HC8	Cell membrane, Intra-cellular cellular processes	N/A	N/A	Giant hogweed, Heracleum sosnowskyi Manden	[177]
	B. sp. strain CS93	Cell membrane, Intra-cellular cellular processes	N/A	N/A	Pozol, Villahermosa, Tabasco, Mexico	[152]
	B. subtilis SSE4	Cell membrane, Intra-cellular cellular processes	N/A	N/A	Shrimp shells	[193]
	B. megaterium pL6 (Project Report SC 3488	Cell membrane, Intra-cellular cellular processes	N/A	N/A	Soil, Universidade de São Paulo, São Paulo, SP, Brazil	[175]
	B. amyloliquefaciens PPCB004	Cell membrane, Intra-cellular cellular processes	Alternaria citri (Penz.) Mussat PPCF001 Botryosphaeria sp. PPAF001 Colletotrichum gloeosporioides (Penz.) Penz. & Sacc Fusicoccum aromaticum (Sacc.) Petr. & Syd Lasiodiploa theobromae (Pat.) Griffon & Maubi Penicillium crustosum Thom Phomopsis persea Zerova Bacillus subtilis UMAF6614 Bacillus subtilis UMAF 6639 Bacillus subtilis PPCB001	Active Active Active  Active  Active Active Active Active Active	Citrus fruit	[194]
	B. strain UMAF6639	Cell membrane, Intra-cellular cellular processes	Alternaria citri (Penz.) Mussat PPCF001 Botryosphaeria sp. PPAF001 Colletotrichum gloeosporioides (Penz.) Penz. & Sacc Fusicoccum aromaticum (Sacc.) Petr. & Syd Lasiodiploa theobromae (Pat.) Griffon & Maubi Penicillium crustosum Thom Phomopsis persea Zerova Bacillus subtilis UMAF6614 Bacillus subtilis UMAF 6639 Bacillus subtilis PPCB001	Active Active Active  Active  Active Active Active Active Active	N/A	[194]
	B. subtilis CMB32	Cell membrane, Intra-cellular cellular processes	N/A	N/A	Soil	[165]
	B. subtilis 3-10	Cell membrane, Intra-cellular cellular processes	N/A	N/A	Soil, Wuhan	[195]
	B. amyloliquefaciens S13-3	Cell membrane, Intra-cellular cellular processes	N/A	N/A	N/A	[196]
	B. amyloliquefaciens S20	Cell membrane, Intra-cellular cellular processes	Fusarium oxysporum Ralstonia solanacearum	Active Active	rhizosphere soil from a healthy eggplant	[197]

	<i>B. amyloliquefaciens</i> strain 32a	Cell membrane, Intracellular cellular processes	N/A	N/A	Tunisian soil sample	[179]
	<i>B. amyloliquefaciens</i> BAS23	Cell membrane, Intracellular cellular processes	<i>Cochliobolus lunata</i> <i>Fusarium semitectum</i> <i>Heterodera oryzae</i>	Active Active Active	Soil bacteria were isolated from rice paddy fields in Nakhon Pathom province, Thailand	[198]
	<i>B. amyloliquefaciens</i> L-H15	Cell membrane, Intracellular cellular processes	<i>Fusarium oxysporum</i> <i>Phytophthora capsici</i> <i>Rhizoctonia solani</i>	Active Active Active	Cucumber seedling substrate	[199]
	<i>B. amyloliquefaciens</i> BUZ-14	Cell membrane, Intracellular cellular processes	<i>Botrytis cinerea</i> <i>Monilinia fructicola</i> <i>Mandevilla laxa</i> <i>Penicillium digitatum</i> <i>Penicillium italicum</i> <i>Penicillium expansum</i>	16.9 µg/ml 8.5 µg/ml 4.1 µg/ml 16.9 µg/ml 8.5 µg/ml 8.5 µg/ml	surface of peach fruit from an orchard in Zaragoza	[200]
	<i>B. amyloliquefaciens</i> S76-3	Cell membrane, Intracellular cellular processes	<i>Fusarium Graminearum</i>	50 ug/ml	spikes of wheat grown in our own experiment fields in our university, Wuhan, China	[79]
	<i>B. subtilis</i> ZK0	Cell membrane, Intracellular cellular processes	N/A	N/A	Cotton	[201]
	<i>B. subtilis</i> 3057	Cell membrane, Intracellular cellular processes	N/A	N/A	N/A	[202]
	<i>B. amyloliquefaciens</i> LZ-5	Cell membrane, Intracellular cellular processes	<i>Saccharomyces cerevisiae</i>	0.76 mg/ml	Chinese honey	[203]
	<i>B. subtilis</i> S1702	Cell membrane, Intracellular cellular processes	N/A	N/A	healthy table grapes	[172]
	<i>B. pumilus</i> strain YSPMK11	Cell membrane, Intracellular cellular processes	N/A	N/A	cauliflower plants were collected from four different naturally growing agro climatic zones of Himachal Pradesh.	[204]
	<i>B. subtilis</i> l'1a strain	Cell membrane, Intracellular cellular processes	N/A	N/A	sludge of a 100-year-old oil refinery in Czechowice-Dziedzice (Po- land)	[205]
	<i>B. subtilis</i> NBRC 109107	Cell membrane, Intracellular cellular processes	N/A	N/A	National Institute of Technology and Evaluation (NITE) of Japan	[206]
	<i>B. siamensis</i> JFL15	Cell membrane, Intracellular cellular processes	N/A	N/A	isolated from the gastrointestinal tract of hair-tail	[207]
	<i>B. subtilis</i> strain ET-1	Cell membrane, Intracellular cellular processes	N/A	N/A	soil and both phenotypically and genetically identified at the microbiology laboratory of ENEA Research Centre Trisaia	[208]
	<i>B. amyloliquefaciens</i> DA12	Cell membrane, Intracellular cellular processes	<i>Fusarium graminearum</i> macroconidia	Active	soil in which tomatoes grew in a greenhouse in Buyeo-gun, Chungcheong	[209]

	B. amyloliquefaciens CX-20	Cell membrane, Intracellular cellular processes	N/A	N/A	Professor Shouwen Chen (College of Life Sciences, Hubei University, Wuhan, China).	[210]
	B. amyloliquefaciens Pc3	Cell membrane, Intracellular cellular processes	N/A	N/A	Antarctic seawater	[183]
	B. subtilis CCTCCM207209	Cell membrane, Intracellular cellular processes	N/A	N/A	Strain previously isolated from soil and stored at the China Center for Type Culture Collection (Wuhan, China)	[183]
	B. amyloliquefaciens Ba01	Cell membrane, Intracellular cellular processes	N/A	N/A	isolated from healthy potato tuber	[211]
	B. amyloliquefaciens strain FJAT-2349	Cell membrane, Intracellular cellular processes	N/A	N/A		[166]
	B. amyloliquefaciens LL3	Cell membrane, Intracellular cellular processes	N/A	N/A		[189]
	B. subtilis ABS-S14	Cell membrane, Intracellular cellular processes	N/A	N/A	isolated from soil collected from citrus groves around the south of Thailand	[212]
Bacillomycin D	Bacillus amyloliquefaciens Q-426	Cell membrane, Intracellular processes, siderophore	N/A	N/A	Isolated from compost samples collected in the Dalianregion of China	[176]
	B. subtilis 3057	Cell membrane, Intracellular cellular processes, siderophore	N/A	N/A	N/A	[202]
	B. amyloliquefaciens SQR9	Cell membrane, Intracellular processes, siderophore	N/A	N/A	Cucumber rhizosphere	[213]
	B. vallismortis ZZ185	Cell membrane, Intracellular processes, siderophore	Fusarium graminearum Alternaria alternata Rhizoctonia solani Cryphonectria parasitica Phytophthora capsici.	Active Active Active Active	Healthy stems of the plant Broadleaf Holly (Ilex latifolia Thunb) collected in Nanjing, China	[214]
	B. amyloliquefaciens strain SD-32	Cell membrane, Intracellular processes, siderophore	Podosphaera fusca	Active	Soil sample obtained in Japan	[109]
	B. amyloliquefaciens BS6	Cell membrane, Intracellular processes, siderophore	N/A	N/A	N/A	[202]
	B. mycoides 4079	Cell membrane, Intracellular processes, siderophore	N/A	N/A	N/A	[202]
	B. velezensis HN-2	Cell membrane, Intracellular processes, siderophore	Colletotrichum gloeosporioides	EC50 = 3.462 ug/ml	Soil	[82]
	B. velezensis FZB42	Cell membrane, Intracellular processes, siderophore	Fusarium oxysporum	Active		[215]

	B. sp. strain BCLRB2	Cell membrane, Intracellular processes, siderophore	N/A	N/A	healthy leaves of olive tree	[216]
	B. velezensis NST6	Cell membrane, Intracellular processes, siderophore	Staphylococcus aureus Staphylococcus epidermidis MRSA 3090	2 µg/ml 2 µg/ml 2 µg/ml	soil sample	[217]
	B. amyloliquefaciens C5	Cell membrane, Intracellular processes, siderophore	N/A	N/A	roots of olive tree	[218]
	B. velezensis BvL03	Cell membrane, Intracellular processes, siderophore	N/A	N/A		[169]
	B. amyloliquefaciens MTCC 10456	Cell membrane, Intracellular processes, siderophore	N/A	N/A	Seaweed	[150]
	B. sp. PPM3	Cell membrane, Intracellular processes, siderophore	N/A	N/A	Bacillus sp. PPM3 isolated from marine sediment from the Red Sea in Hurghada, Egypt	[219]
Mycosubtilin	B. subtilis 370	Cell membrane	Mycoderma valida Saccharomyces carlsbergensis, 9080 Rhodotorula rubra Sporobolomyces roseus Torula cremoris Dipodascus uninucleolus Hansenula anomala, 4104 Torulopsis delbruckii Microsporum lanosum Trichophyton mentagrophytes Fusarium moniliforme Nematospora coryli Penicillium notatum Chaetomium bostrychodes Microsporum audouinii Achorium schoenleinii Cryptococcus neoformans Epidermophyton inguinale Sclerotinia fructicola Ustilago zeae Trichophyton sp.	Active Active		[220]
	B. sp. PPM3		N/A	N/A		[219]
	Bacillus subtilis ATCC 6633		Saccharomyces cerevisiae Yarrowia lipolytica CBS6303 Pichia pastoris Candida albicans ATCC 10231 Candida albicans IHEM3742 Candida parapsilosis IHEM9557 Candida tropicalis IHEM6246 Candida guilliermondii IHEM 1067 Candida glabrata IHEM 6161 Candida glabrata L999	4 ug/ml 8 ug/ml 32 ug/ml 32 ug/ml 64 ug/ml 128 ug/ml 16 ug/ml 128 ug/ml 16 ug/ml 2 ug/ml		[221]

			Candida glabrata S53452 Candida glabrata H34736 Candida glabrata W16119 Cryptococcus neoformans IHEM 3969 Aspergillus parasiticus IHEM4384 Aspergillus terreus IHEM2499 Aspergillus fumigatus IHEM3562	150 ug/ml 150 ug/ml 150 ug/ml 8 ug/ml >300 ug/ml >300 ug/ml >300 ug/ml		
Bacillomycin L	B. amyloliquefaciens K103	Cell membrane	Rhizoctonia solani Kühn	N/A	lemon	[87]
	B. subtilis NCIB 8872	Cell membrane	N/A	N/A		[222]
	B. amyloliquefaciens SYBC H47	Cell membrane	Botryosphaeria dothidea	N/A	Peach Gummosis	[223]
Mycobacillin	B. subtilis B3	Cell membrane	Aspergillus niger strain G3Br	20 mg/ml		[94,224]
Subtilisin A	B. subtilis ATCC 19659	Cell membrane//Bio-film	N/A	N/A		[225]
	B. subtilis EMD4	Cell membrane//Bio-film	Bacillus cereus ATCC14579 Bacillus subtilis ATCC14593 Bacillus licheniformis ATCC21415 Bacillus thuringiensis ATCC33679 Enterococcus faecalis ATCC29212 Enterococcus faecium ATCC19953 Lactobacillus delbrueckii ssp. lactis ATCC4797 Lactobacillus casei ssp. casei ATCC4646 Lactobacillus pentosus ATCC8041 Leuconostoc mesenteroides ATCC9135 Listeria monocytogenes ATCC19111 Pediococcus pentosaceus NRRL B-14009 Streptococcus thermophilus KFRI 193	Active Active Active Active Active Active Active Active Active Active Active Active Active	Soy Sauce	[226]
	B. amyloliquefaciens (EU105395)	Cell membrane//Bio-film	Micrococcus luteus ATCC 10420 Listeria monocytogenes Scott A Gardnerella vaginalis ATCC 14018 Gardnerella vaginalis (clinical isolate) Streptococcus agalactiae (clinical isolate)	Active Active Active Active Active		[227]
	B. amyloliquefaciens BAhja NK10	Cell membrane//Bio-film	Micrococcus luteus A1 NCIMB 8166 Listeria monocytogenes WSLC 1018	2.8mm 2.4mm	Soil	[228]
	B. tequilensis FR9	Cell membrane//Bio-film	Listeria monocytogenes MTCC 657	Active	free-range chickens GUT	[229]
	B. subtilis KATMIRA1933	Cell membrane//Bio-film	Gardnerella vaginalis Listeria monocytogenes Escherichia coli	6.25 µg/ml 125 µg/ml 250 µg/ml		[99]
	B. subtilis BSD-2	Cell membrane//Bio-film	N/A	N/A		[230]
	N/A	Cell membrane//Bio-film	G. vaginalis	7.2 µg/mL		[97]
	B. subtilis strain SEM-2	Cell membrane//Bio-film	N/A	N/A	silkworm excrement composting	[231]
Zwittermicin A	B. thuringiensis HD-1	Intracellular processes	Erwinia herbicola L S005 Escherichia coli K37	60 µg/ml 100 µg/ml		[100]

			Bacillus subtilis 168 Staphylococcus aureus 3001	120 µg/ml 200 µg/ml		
	B. cereus UW85	Intracellular processes	N/A	N/A	Root of a field-grown alfalfa plant from Arlington, WI	[23]
	B. amyloliquefaciens BS6	Intracellular processes	N/A	N/A		[202]
	B. mycoides S	Intracellular processes	N/A	N/A		[202]
	B. thuringiensis BS8	Intracellular processes	N/A	N/A		[202]
Difficidin	B. subtilis ATCC 39320	Intracellular processes	Escherichia coli MB 4827	35 µg/ml		[103]
	B. velezensis LM2303	Intracellular processes	N/A	N/A	dung of wild yak inhabited Qinghai-Tibet plateau, China	[159]
	B. velezensis LDO2	Intracellular processes	N/A	N/A	peanut	[232]
	B. velezensis FZB42	Intracellular processes	N/A	N/A		[158]
	B. velezensis V4	Intracellular processes	N/A	N/A		[233]
	B. amyloliquefaciens subsp. plantarum B9601-Y2	Intracellular processes	N/A	N/A		[156]
	B. subtilis S499	Intracellular processes	N/A	N/A		[157]
Sublancin (Lantibiotic)	B. subtilis 168	Intracellular processes	MRSA	15 µM		[105]
	Bacillus subtilis A52	Intracellular processes	Staphylococcus aureus MTCC 1433 Bacillus subtilis MTCC 121 Bacillus cereus MTCC 430 Bacillus coagulans MTCC 492 Staphylococcus pyogenes MTCC 1928 Streptococcus anginosus MTCC 1929 Streptococcus oralis MTCC 2696 Streptococcus mutans MTCC 497 Micrococcus luteus MTCC 106	10 ug/ml 5 ug/ml 5 ug/ml 8 ug/ml 2 ug/ml 6 ug/ml 8 ug/ml 10 ug/ml 2 ug/ml		[234]
Amicoumacin A	B. subtilis B1779	Intracellular processes	Bacillus subtilis Staphylococcus Aureus Loktanella Hongkongensis	18.87 µM 18.87 µM 1.18 µM	Marine sediment at depth of 1000 m in the Red Sea	[235]
			Bacillus subtilis 1779 Staphylococcus aureus UST950701-005 Methicillin-resistant Staphylococcus aureus ATCC43300	20 µM 5.0 µM 4.0 µM		[236]
	B. pumilus BN-103	Intracellular processes	N/A	N/A		[237]
	B. subtilis BSXE-1601	Intracellular processes	Vibrio vulnificus S01P2 Vibrio harveyi SRTT9 Vibrio alginolyticus AR-1 Vibrio parahaemolyticus 20130629002S01 Pseudoalteromonas sp. LPE40 Shewanella marisflavi AP629 Streptococcus iniae iniae NUF849 Aeromonas hydrophila AP40301 Edwardsiella tarda HC01090721 Vibrio splendidus BSD11	1.25 ug/ml 1.25 ug/ml 1.25 ug/ml 1.25 ug/ml 1.25 ug/ml 1.25 ug/ml 10 ug/ml >10 ug/ml >10 ug/ml >10 ug/ml		[238]
Prumycin	B. amyloliquefaciens SD-32	Intracellular processes	N/A	N/A		[109]
			Staphylococcus aureus FDA 209P Bacillus subtilis PCI 219	>100 >100		[111]

			Sarcina lutea PCI 1001 Salmonella typhimurium Escherichia coli NIHJ Pseudomonas aeruginosa P-3 Klebsiella pneumoniae Shigella sonnei Vibrio comma 904 Proteus vulgaris OX-19 Mycobacterium ATCC 607 Xanthomonas oryzae Xanthomonas citri Alternaria mali Alternaria kikuchiana Alternaria japonica Sclerotinia cinerea Sclerotinia sclerotiorum Botrytis fabae Botrytis cinerea Botrytis cytoneriac Cochliobolus miyabeanus Collectotrichum lagenarium Candida albicans Saccharomyces cerevisiae Cryptococcus neoformans Hormodendrum pedrosoi Fusarium moniliforme USDA 1004-1 Penicillium notatum Trichophyton rubrum Trichophyton mentagrophytes Trichosporon beigellii Glasosporium laeticolor Glomerella cingulate Ophiobolus miyabeanus Aspergillus niger	3.12 >100 100 >100 >100 100 12.5 >100 >100 50 >100 >100 >100 50 12.5 1.56 6.25 6.25 >100 50 50 >100 >100 >100 25 >100 >100 100 100 >100 50 100 25 >100		
Thiocillin	B. cereus (strain ATCC 14579)	Intracellular processes	N/A	N/A		[239]
		Intracellular processes	Staphylococcus aureus ATCC 29213 Staphylococcus aureus 1974149 Staphylococcus aureus 1974148 Enterococcus faecalis 1674621 Enterococcus faecalis 1674614 Bacillus subtilis ATCC 6633 Streptococcus pyogenes 1744264	2 ug/ml 2 ug/ml 2 ug/ml 0.5 ug/ml 0.5 ug/ml 4 ug/ml 0.5 ug/ml		[240]
Hetiamacin E	B. subtilis PJS	Intracellular processes	Staphylococcus epidermidis ATCC 12228 (MSSE) Staphylococcus epidermidis 16-4 (MSSE) Staphylococcus epidermidis 16-5 (MRSE) Staphylococcus aureus ATCC 29213 (MSSA) Staphylococcus aureus ATCC 33591 (MRSA)	2 µg/mL 4 µg/mL 4 µg/mL 8 µg/mL 16 µg/mL		[114]

			Enterococcus faecium ATCC 700221 (VRE) Escherichia coli ATCC 25922 Pseudomonas aeruginosa PAO1 Acinetobacter baumannii ATCC 19606 Shigella flexneri ATCC 12022	64 µg/mL 64 µg/mL 64 µg/mL 64 µg/mL 64 µg/mL		
Hetiamacin F	B. subtilis PJS	Intracellular processes	Staphylococcus epidermidis ATCC 12228 (MSSE) Staphylococcus epidermidis 16-4 (MSSE) Staphylococcus epidermidis 16-5 (MRSE) Staphylococcus aureus ATCC 29213 (MSSA) Staphylococcus aureus ATCC 33591 (MRSA) Enterococcus faecium ATCC 700221 (VRE) Escherichia coli ATCC 25922 Pseudomonas aeruginosa PAO1 Acinetobacter baumannii ATCC 19606 Shigella flexneri ATCC 12022	32 µg/mL 32 µg/mL 32 µg/mL >32 µg/mL >32 µg/mL >32 µg/mL >32 µg/mL 32 µg/mL 32 µg/mL >32 µg/mL		[114]
Rhizoctin A	B. cabrialesii TE3	Intracellular processes	N/A	N/A		[241]
	B. subtilis NBRC3134	Intracellular processes	N/A	N/A		[242]
	B. subtilis ATCC 6633	Intracellular processes	Budding and filamentous fungi (Not available) Caenorhabditis elegans	N/A		[116]
Macrolactin N	B. subtilis AT29	Intracellular processes	Staphylococcus aureus PDF  Escherichia coli  Staphylococcus aureus  Bacillus subtilis	IC50 = 7.5 µg/mL MIC = 100 µg/mL MIC50 = 100 µg/mL MIC50 = 100 µg/mL		[117]
Azoxybacillin	B. cereus NR2991	Intracellular processes	Aspergillus fumigatus  Trichophyton mentagrophytes  Candida albicans	IC80 = 0.71 ~ 1.3 µg/mL IC80 = 0.03~ 0.04 µg/mL Ic80: 4.2~ 5.8 µg/mL		[119]
Stigmatellin Y	B. subtilis BR4	Quorum sensing	Pseudomonas aeruginosa (ATCC 27853)	N/A		[124]
Bacillaene	N/A	Quorum sensing	Escherichia coli K10 Escherichia coli SC10909 Escherichia coli SC10857 Escherichia coli SC10896 Escherichia coli BAS2006 Escherichia coli BAS847	37.0 µg/mL 0.09 µg/mL 5.0 µg/mL 0.6 µg/mL 0.6 µg/mL 0.5 µg/mL		[243]
	B. velezensis LM2303	Quorum sensing	N/A	N/A	dung of wild yak inhabited Qinghai-Tibet plateau, China	[159]
	B. subtilis XF-1 (CGMCC No. 2357)	Quorum sensing	N/A	N/A	rhizosphere soil of Chinese cabbage (Brassica pekinensis)	[43]

	<i>B. amyloliquefaciens</i> C-1	Quorum sensing	N/A	N/A		[244]
	<i>B. amyloliquefaciens</i> DH-4	Quorum sensing	N/A	N/A		[245]
	<i>B. subtilis</i> 3610	Quorum sensing	N/A	N/A		[246]
	<i>B. velezensis</i> FZB42	Quorum sensing	N/A	N/A		[158]
	<i>B. amyloliquefaciens</i> ssp. <i>plantarum</i> F11	Quorum sensing	N/A	N/A		[247]
	<i>B. subtilis</i> strain SEM-2	Quorum sensing	N/A	N/A		[232]
	<i>B. subtilis</i> ATCC 55422	Quorum sensing	N/A	N/A		[248]
	<i>Bacillus amyloliquefaciens</i> subsp. <i>plantarum</i> B9601-Y2	Quorum sensing	N/A	N/A	wheat rhizosphere	[156]
	<i>B. amyloliquefaciens</i> LL3	Quorum sensing	N/A	N/A		[189]
Bacillibactin	<i>B. amyloliquefaciens</i> MBI600		<i>Pseudomonas syringae</i> pv. <i>Tomato</i> <i>V. dahliae</i> 70wt-r1 <i>R. solani</i> AG2-1 <i>A. flavus</i> CBS128202 <i>Fusarium oxysporum</i> f. sp. <i>radices</i> – <i>lycopersici</i> – FRL1	N/A		[249]
	<i>B. velezensis</i> LM2303	Quorum sensing	N/A	N/A	dung of wild yak inhabited Qinghai-Tibet plateau, China	[159]
	<i>B. subtilis</i> S499		N/A	N/A		[157]
	<i>B. subtilis</i> BSD-2	Quorum sensing	N/A	N/A		[231]
	<i>B. siamensis</i> JFL15	Quorum sensing	N/A	N/A	isolated from the gastrointestinal tract of hair-tail	[207]
	<i>B. subtilis</i> strain SEM-2	Quorum sensing	N/A	N/A	silkworm excrement composting	[231]
Itoic Acid	<i>B. subtilis</i> B-1471	Quorum sensing	N/A	N/A		[250]
		Quorum sensing	<i>Saccharomyces cerevisiae</i>	N/A		[251]
Schizokinen	<i>B. megaterium</i> ATCC 19213	Quorum sensing	N/A	N/A		[128]
		Quorum sensing	<i>Saccharomyces cerevisiae</i>	N/A		[251]

ZoI = Zone of inhibition.