Supplementary Material

Genera specific distribution of DEAD-box RNA helicases in cyanobacteria

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This file contains one supplementary table: **Table S1**, four supplementary figures: **Fig. S1**, **Fig. S2**, **Fig. S3** and **Fig. S4** and supplementary references.

Table S1. DEAD-box RNA helicase proteins encoded in cyanobacterial genomes. The list of sequence identifiers was obtained by searching the NCBI non-redundant sequences database using the helicase core domain (F9-R338) of the DEAD-box protein CrhR (*slr0083*) from *Synechocystis* sp. PCC 6803. The order, species, strain and accession number for each protein is indicated, as well as the corresponding clade (CrhR, CsdA or RhlE) within the DEAD-box protein family.

Order	Species	Strain	Accession Number	Group
Chroococcales				
	Aphanothece halophytica	PCC 7418	WP_015227798.1	CrhR
	Candidatus Atelocyanobacterium thalassa isolate	ALOHA	WP_012954034.1	CrhR
	Candidatus Atelocyanobacterium thalassa isolate	SIO64986	KFF41262.1	CrhR
	Chroogloeocystis siderophila	5.2 s.c.1	WP_073551513.1	CrhR
	Crocosphaera watsonii	WH 8501	WP_007303466.1	CrhR
	Cyanobacterium aponinum	PCC 10605	WP_015219980.1	CrhR
	Cyanobacterium sp.	IPPAS B-1200	WP_069789285.1	CrhR
	Cyanobacterium stanieri	PCC 7202	AFZ47545.1	CrhR
	Geminocystis herdmanii	PCC 6308	WP_017294180.1	CrhR
	Geminocystis sp.	NIES-3708	WP_066348995.1	CrhR
	Geminocystis sp.	NIES-3709	WP_066117391.1	CrhR
	Gloeocapsa sp.	PCC 7428	WP_015190184.1	CrhR
	Gloeocapsa sp.	PCC 73106	WP_006530822.1	CrhR
	Microcystis aeruginosa	KW	WP_079208639.1	CrhR
	Microcystis aeruginosa	NIES-44	WP_045361726.1	CrhR
	Microcystis aeruginosa	NIES-88	WP_061432786.1	CrhR
	Microcystis aeruginosa	NIES-98	WP_069474107.1	CrhR
	Microcystis aeruginosa	NIES-843	WP_012265913.1	CrhR
	Microcystis aeruginosa	NIES-2481	WP_066030023.1	CrhR
	Microcystis aeruginosa	NIES-2549	WP_046662813.1	CrhR
	Microcystis aeruginosa	PCC 7005	WP_024970412.1	CrhR
	Microcystis aeruginosa	PCC 7806	WP_002741230.1	CrhR
	Microcystis aeruginosa	PCC 9432	WP_002733094.1	CrhR
	Microcystis aeruginosa	PCC 9443	WP_002769059.1	CrhR
	Microcystis aeruginosa	PCC 9701	WP_004268339.1	CrhR
	Microcystis aeruginosa	PCC 9717	WP_002763242.1	CrhR
	Microcystis aeruginosa	PCC 9806	WP_002781592.1	CrhR
	Microcystis aeruginosa	SPC777	WP_016516037.1	CrhR
	Microcystis panniformis	FACHB-1757	WP_052277776.1	CrhR
	Microcystis sp.	T1-4	WP_008198520.1	CrhR
	Rubidibacter lacunae	KORDI 51-2	WP_022606644.1	CrhR

Order	Species	Strain	Accession Number	Group
Chroococcidiopsidales				
	Chroococcidiopsis thermalis	PCC 7203	WP_015155494.1	CrhR
Gloeobacterales				
	Gloeobacter kilaueensis	JS1	WP_023172363.1	No group
	Gloeobacter violaceus	PCC 7421 (a)	WP_011142503.1	No group
	Gloeobacter violaceus	PCC 7421 (b)	WP_011142321.1	No group
Nostocales				
	Anabaena cylindrica	PCC 7122	WP_015216841.1	CrhR
	Anabaena cylindrica	PCC 7122	WP_015217396.1	RhlE
	Anabaena sp.	90	WP_015081159.1	CrhR
	Anabaena sp.	90	WP_015079554.1	RhlE
	Anabaena sp.	AL09	OBQ05623.1	CrhR
	Anabaena sp.	AL09	OBQ03207.1	RhlE
	Anabaena sp.	ATCC 33047	WP_066377041.1	CrhR
	Anabaena sp.	CRKS33	OBQ40729.1	CrhR
	Anabaena sp.	CRKS33	OBQ32742.1	RhlE
	Anabaena sp.	LE011-02	OBQ04690.1	CrhR
	Anabaena sp.	LE011-02	OBQ05997.1	RhlE
	Anabaena sp.	PCC 7108	WP_016953324.1	CrhR
	Anabaena sp.	PCC 7108	WP_016951584.1	RhlE
	Anabaena sp.	WA102	WP_053540454.1	CrhR
	Anabaena sp.	WA102	WP_053539369.1	RhlE
	Anabaena sp.	WA113	OBQ22342.1	CrhR
	Anabaena sp.	WA113	OBQ18746.1	RhlE
	Anabaena variabilis	ATCC 29413	ABA20266.1	CrhR
	Anabaena variabilis	ATCC 29413	ABA21574.1	RhlE
	Aphanizomenon flos-aquae	2012/KM1/D3	WP_039204634.1	CrhR
	Aphanizomenon flos-aquae	2012/KM1/D3	WP_039200299.1	RhlE
	Aphanizomenon flos-aquae	LD13	OBQ18590.1	CrhR
	Aphanizomenon flos-aquae	LD13	OBQ22990.1	RhlE
	Aphanizomenon flos-aquae	NIES-81	WP_027404570.1	CrhR
	Aphanizomenon flos-aquae	NIES-81	WP_027401622.1	RhlE
	Calothrix sp.	336/3	WP_035153586.1	CrhR
	Calothrix sp.	HK-06	WP_073618868.1	CrhR
	Calothrix sp.	HK-06	WP_073622274.1	RhlE
	Calothrix sp.	PCC 6303	WP_015200162.1	CrhR
	Calothrix sp.	PCC 6303	WP_015195959.1	RhlE
	Calothrix sp.	PCC 7103	WP_019489262.1	CrhR
	Calothrix sp.	PCC 7103	WP_035173265.1	RhlE
	Calothrix sp.	PCC 7507	WP_015131393.1	CrhR
	Calothrix sp.	PCC 7507	WP_015132072.1	RhlE
	Chlorogloeopsis fritschii	PCC 6912	WP_016873588.1	CrhR
	Chlorogloeopsis sp.	PCC 7702	WP_017322836.1	CrhR

Order	Species	Strain	Accession Number	Group
Nostocales				
	Chrysosporum ovalisporum	UAM-MAO	CEJ43554.1	CrhR
	Cylindrospermopsis raciborskii	CS-505	WP_006276327.1	CrhR
	Cylindrospermopsis raciborskii	MVCC14	WP_071250936.1	CrhR
	Cylindrospermopsis sp.	CR12	WP_057176886.1	CrhR
	Cylindrospermum stagnale	PCC 7417	WP_015206929.1	CrhR
	Cylindrospermum stagnale	PCC 7417	WP_015209745.1	RhlE
	Dolichospermum circinale	AWQC131C	WP_028090653.1	CrhR
	Dolichospermum circinale	AWQC131C	WP_028091112.1	RhlE
	Dolichospermum circinale	AWQC310F	WP_028084471.1	CrhR
	Dolichospermum circinale	AWQC310F	WP_028084089.1	RhlE
	Fischerella major	NIES-592	WP_073555827.1	CrhR
	Fischerella muscicola	PCC 73103	WP_016860456.1	CrhR
	Fischerella muscicola	PCC 7414	WP_026085820.1	CrhR
	Fischerella sp.	JSC-11	WP_009453863.1	CrhR
	Fischerella sp.	NIES-3754	WP_062246540.1	CrhR
	Fischerella sp.	PCC 9339	WP_017311292.1	CrhR
	Fischerella sp.	PCC 9605	WP_026731393.1	CrhR
	Fortiea contorta	PCC 7126	WP_017654089.1	CrhR
	Hapalosiphon sp.	MRB220	WP_026721223.1	CrhR
	Hassallia byssoidea	VB512170	KIF28888.1	CrhR
	Hassallia byssoidea	VB512170 (a)	KIF30245.1	No group
	Hassallia byssoidea	VB512170 (b)	KIF31317.1	No group
	Mastigocladopsis repens	PCC 10914	WP_017315850.1	CrhR
	Mastigocoleus testarum	BC008	WP_027842873.1	CrhR
	Nodularia spumigena	CCY9414	WP_006195458.1	CrhR
	Nodularia spumigena	CCY9414	WP_006195497.1	RhlE
	Nodularia spumigena	CENA596	WP_063873820.1	CrhR
	Nostoc azollae	0708	WP_013190002.1	CrhR
	Nostoc azollae	0708	ADI63752.1	RhlE
	Nostoc calcicola	FACHB-389	WP_073642635.1	CrhR
	Nostoc piscinale	CENA21	WP_062295266.1	CrhR
	Nostoc punctiforme	PCC 73102	WP_012410842.1	CrhR
	Nostoc punctiforme	PCC 73102	WP_012409963.1	RhlE
	Nostoc sp.	KVJ20	WP_069069063.1	CrhR
	Nostoc sp.	KVJ20	WP_069072171.1	RhlE
	Nostoc sp.	MBR 210	OCQ99908.1	CrhR
	Nostoc sp.	NIES-3756	WP_067773294.1	CrhR
	Nostoc sp.	NIES-3756	WP_067768693.1	RhlE
	Nostoc sp.	PCC 7107	WP_015111687.1	CrhR
	Nostoc sp.	PCC 7107	AFY45650.1	RhlE
	Nostoc sp.	PCC 7120 (CrhB)	WP_010995395.1	CrhR
	Nostoc sp.	PCC 7120 (CrhC)	WP_010998849.1	RhlE
	Nostoc sp.	PCC 7524	WP_015138780.1	CrhR
	Raphidiopsis brookii	D9	WP_009343384.1	CrhR

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Nostocales				
	Richelia intracellularis	HH01	WP_008231885.1	CrhR
	Richelia intracellularis	RC01	CDN14942.1	CrhR
	Rivularia sp.	PCC 7116	WP_015121796.1	CrhR
	Scytonema hofmanni	UTEX B 1581	WP_029631515.1	RhlE
	Scytonema hofmanni	UTEX B 1581	WP_029633835.1	CrhR
	Scytonema hofmannii	PCC 7110	WP_017746800.1	CrhR
	Scytonema sp.	HK-05	WP_073628368.1	CrhR
	Scytonema tolypothrichoides	VB-61278	WP_048871842.1	CrhR
	Tolypothrix bouteillei	VB521301	WP_038078122.1	CrhR
	Tolypothrix campylonemoides	VB511288	WP_071838559.1	No group
	Tolypothrix campylonemoides	VB511288	WP_041035416.1	CrhR
	Tolypothrix sp.	PCC 7601	WP_045867700.1	CrhR
	Trichormus sp.	NMC-1	WP_071190055.1	CrhR
	Trichormus sp.	NMC-1	WP_071190771.1	RhlE
Oscillatoriales				
	Arthrospira maxima	CS-328	WP_006670629.1	CrhR
	Arthrospira platensis	C1	WP_035760177.1	CrhR
	Arthrospira platensis	NIES-39	WP_043468916.1	CrhR
	Arthrospira platensis	Paraca	WP_006617243.1	CrhR
	Coleofasciculus chthonoplastes	PCC 7420	WP_006102098.1	CrhR
	Crinalium epipsammum	PCC 9333	WP_015205239.1	CrhR
	Cyanothece sp.	ATCC 51142	WP_009543508.1	CrhR
	Cyanothece sp.	CCY0110	WP_008276945.1	CrhR
	Cyanothece sp.	PCC 7425	WP_012629831.1	CrhR
	Cyanothece sp.	PCC 7822	WP_013323350.1	CrhR
	Cyanothece sp.	PCC 8801	WP_015785253.1	CrhR
	Desertifilum sp.	IPPAS B-1220	WP_069967535.1	CrhR
	filamentous cyanobacterium	ESFC-1	WP_018396245.1	CrhR
	Geitlerinema sp.	PCC 7105	WP_017661231.1	No group
	Geitlerinema sp.	PCC 7407	WP_015173091.1	CrhR
	Geitlerinema sp.	PCC 9228	WP_071517408.1	CrhR
	Limnoraphis robusta	CS-951	WP_046278382.1	CrhR
	Lyngbya aestuarii	BL J	WP_023065801.1	CrhR
	Lyngbya confervoides	BDU141951	WP_044150923.1	RhlE
	Lyngbya confervoides	BDU141951	WP_063776105.1	No group
	Lyngbya sp.	PCC 8106	WP_039896992.1	CrhR
	Microcoleus sp.	PCC 7113	WP_015182542.1	RhlE
	Microcoleus sp.	PCC 7113	WP_015184396.1	CrhR
	Microcoleus vaginatus	FGP-2	WP_006633595.1	CrhR
	Moorea bouillonii	PNG5-198	WP_075900005.1	CrhR
	Moorea producens	3L	WP_008177600.1	CrhR
	Moorea producens	JHB	WP_071104591.1	CrhR
	Moorea producens	PAL-8-15-08-1	WP_070393209.1	CrhR

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Oscillatoriales				
	Oscillatoria acuminata	PCC 6304	WP_015146953.1	CrhR
	Oscillatoria nigro-viridis	PCC 7112	WP_015177386.1	CrhR
	Oscillatoria sp.	PCC 10802	WP_017715337.1	CrhR
	Oscillatoria sp.	PCC 6506	WP_007354567.1	CrhR
	Oscillatoriales cyanobacterium	CG2_30_40_61	OIP73250.1	CrhR
	Oscillatoriales cyanobacterium	CG2_30_44_21	OIP71395.1	CrhR
	Oscillatoriales cyanobacterium	CG2_30_44_21	OIP71446.1	RhlE
	Oscillatoriales cyanobacterium	JSC-12	WP_009557052.1	CrhR
	Oscillatoriales cyanobacterium	MTP1	WP_058883613.1	CrhR
	Oscillatoriales cyanobacterium	USR001	OCR00684.1	CrhR
	Phormidium ambiguum	IAM M-71	WP_073595642.1	RhlE
	Phormidium ambiguum	IAM M-71	WP_073595739.1	CrhR
	Phormidium sp.	OSCR	KPQ34456.1	No group
	Phormidium tenue	NIES-30	WP_073610295.1	RhlE
	Phormidium tenue	NIES-30	WP_073607089.1	CrhR
	Planktothricoides sp.	SR001	WP_054466936.1	CrhR
	Planktothrix agardhii	NIVA-CYA 126/8	WP_042151026.1	CrhR
	Planktothrix agardhii	PCC 7805	CUM60384.1	CrhR
	Planktothrix paucivesiculata	PCC 9631	CUR15004.1	CrhR
	Planktothrix rubescens	7821	WP_026787128.1	CrhR
	Planktothrix serta	PCC 8927	CUR16751.1	CrhR
	Planktothrix sp.	PCC 11201	WP_079680322.1	CrhR
	Planktothrix tepida	PCC 9214	WP_072718935.1	CrhR
	Roseofilum reptotaenium	AO1-A	OJJ22692.1	CrhR
	Trichodesmium erythraeum	IMS101	ABG52788.1	CrhR
Pleurocapsales				
	Hydrococcus rivularis	NIES-593	WP_073598826.1	CrhR
	Myxosarcina sp.	GI1	WP_036485380.1	CrhR
	Pleurocapsa sp.	PCC 7319	WP_019508420.1	CrhR
	Pleurocapsa sp.	PCC 7327	WP_015145756.1	CrhR
	Stanieria cyanosphaera	PCC 7437	WP_015194510.1	CrhR
	Stanieria sp.	NIES-3757	BAU65148.1	CrhR
	Xenococcus sp.	PCC 7305	WP_006508547.1	CrhR
Spirulinales				
	Spirulina major	PCC 6313	WP_072621974.1	CrhR
	Spirulina subsalsa	PCC 9445	WP_017305715.1	CrhR
Synechococcales				
	Acaryochloris marina	MBIC11017	WP_012162240.1	CrhR
	Acaryochloris marina	MBIC11017	WP_012160835.1	CsdA
	Acaryochloris sp.	CCMEE 5410	WP_010476696.1	CrhR
	Acaryochloris sp.	CCMEE 5410	WP_010469002.1	CsdA

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Synechococcales				
	Aphanocapsa montana	BDHKU210001 (a)	KIF26984.1	No group
	Aphanocapsa montana	BDHKU210001 (b)	KIF27867.1	No group
	Candidatus Synechococcus spongiarum		WP_074457638.1	CsdA
	Candidatus Synechococcus spongiarum	142	KKZ10452.1	CsdA
	Candidatus Synechococcus spongiarum	LMB bulk15M	OOV28380.1	CsdA
	Candidatus Synechococcus spongiarum	SH4	WP_025782217.1	CsdA
	Candidatus Synechococcus spongiarum	SP3	KKZ12789.1	CsdA
	Chamaesiphon minutus	PCC 6605	AFY93922.1	CrhR
	Cyanobium gracile	PCC 6307	AFY27888.1	RhlE
	Cyanobium gracile	PCC 6307	WP_015108547.1	CsdA
	Cyanobium sp.	CACIAM 14	KEF42712.1	RhlE
	Cyanobium sp.	CACIAM 14	KEF42202.1	CsdA
	Cyanobium sp.	NIES-981	SBO41936.1	RhlE
	Cyanobium sp.	NIES-981	SBO42872.1	CsdA
	Cyanobium sp.	PCC 7001	WP_006910544.1	RhlE
	Cyanobium sp.	PCC 7001	EDY39500.1	CsdA
	Dactylococcopsis salina	PCC 8305	WP_015230714.1	CrhR
	Leptolyngbya boryana	IAM M-101	WP_036045359.1	CrhR
	Leptolyngbya sp.	'hensonii'	WP_075596736.1	CrhR
	Leptolyngbya sp.	'hensonii'	WP_075601042.1	RhlE
	Leptolyngbya sp.	Heron Island J	WP_023075084.1	RhlE
	Leptolyngbya sp.	Heron Island J	WP_023073685.1	CrhR
	Leptolyngbya sp.	Heron Island J	WP_036052321.1	CsdA
	Leptolyngbya sp.	JSC-1	WP_036003541.1	CrhR
	Leptolyngbya sp.	KIOST-1	WP_035986653.1	RhlE
	Leptolyngbya sp.	KIOST-1	WP_035986580.1	CrhR
	Leptolyngbya sp.	NIES-2104	WP_058994620.1	CrhR
	Leptolyngbya sp.	NIES-3755	WP_068384456.1	CrhR
	Leptolyngbya sp.	O-77	BAU42382.1	CrhR
	Leptolyngbya sp.	O-77	BAU44142.1	RhlE
	Leptolyngbya sp.	PCC 6406	WP_008312463.1	RhlE
	Leptolyngbya sp.	PCC 7375	WP_006514332.1	RhlE
	Leptolyngbya sp.	PCC 7375	WP_006515861.1	CrhR
	Leptolyngbya sp.	PCC 7375	WP_006517045.1	CsdA
	Leptolyngbya sp.	PCC 7376	WP_015132458.1	RhlE
	Leptolyngbya sp.	PCC 7376	WP_015135334.1	CrhR
	Leptolyngbya valderiana	BDU 20041 (a)	OAB57648.1	No group
	Leptolyngbya valderiana	BDU 20041 (b)	WP_063718621.1	No group
	Limnothrix rosea	IAM M-220	WP_075890464.1	RhlE
	Limnothrix rosea	IAM M-220	WP_075892628.1	CrhR
	Limnothrix sp.	CACIAM 69d	OKY70165.1	CrhR
	Limnothrix sp.	P13C2	OCQ91779.1	CrhR
	Neosynechococcus sphagnicola	sy1	WP_052128427.1	RhlE
	Neosynechococcus sphagnicola	sy1	WP_052128892.1	CrhR

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Synechococcales				
	Nodosilinea nodulosa	PCC 7104	WP_017300039.1	RhlE
	Nodosilinea nodulosa	PCC 7104	WP_017300013.1	CrhR
	Phormidesmis priestleyi	Ana	KPQ31693.1	CsdA
	Phormidesmis priestleyi	Ana	KPQ37420.1	RhlE
	Phormidesmis priestleyi	Ana	KPQ34081.1	CrhR
	Phormidesmis priestleyi	BC1401	WP_068814569.1	CrhR
	Phormidesmis priestleyi	ULC007	WP_073069542.1	CrhR
	Phormidesmis priestleyi	ULC007	WP_073074629.1	RhlE
	Prochlorococcus marinus	AS9601	WP_011818638.1	CsdA
	Prochlorococcus marinus	GP2	WP_032524576.1	CsdA
	Prochlorococcus marinus	MIT 1312	KZR62459.1	CsdA
	Prochlorococcus marinus	MIT 1313	KZR69712.1	CsdA
	Prochlorococcus marinus	MIT 1320	KZR74671.1	CsdA
	Prochlorococcus marinus	MIT 1323	KZR76670.1	CsdA
	Prochlorococcus marinus	MIT 1342	KZR84025.1	CsdA
	Prochlorococcus marinus	MIT 9107	WP_032514218.1	CsdA
	Prochlorococcus marinus	MIT 9201	WP_032522590.1	CsdA
	Prochlorococcus marinus	MIT 9202	WP_002807683.1	CsdA
	Prochlorococcus marinus	MIT 9211	WP_012195637.1	CsdA
	Prochlorococcus marinus	MIT 9215	WP_012007924.1	CsdA
	Prochlorococcus marinus	MIT 9301	WP_011863159.1	CsdA
	Prochlorococcus marinus	MIT 9302	WP_032527473.1	CsdA
	Prochlorococcus marinus	MIT 9303	ABM77716.1	CsdA
	Prochlorococcus marinus	MIT 9312	WP_011376662.1	CsdA
	Prochlorococcus marinus	MIT 9313	CAE21258.1	CsdA
	Prochlorococcus marinus	MIT 9314	WP_032515082.1	CsdA
	Prochlorococcus marinus	MIT 9321	WP_032516671.1	CsdA
	Prochlorococcus marinus	MIT 9322	WP_032518542.1	CsdA
	Prochlorococcus marinus	MIT 9515	WP_011820499.1	CsdA
	Prochlorococcus marinus	NATL1A	WP_011824061.1	CsdA
	Prochlorococcus marinus	NATL2A	WP_011294736.1	CsdA
	Prochlorococcus marinus	PAC1	WP_036906556.1	CsdA
	Prochlorococcus marinus	SB	WP_032519145.1	CsdA
	Prochlorococcus marinus	SCGC AAA795-F05	WP_075508085.1	CsdA
	Prochlorococcus marinus	SCGC AAA795-I15	WP_075448480.1	CsdA
	Prochlorococcus marinus	SCGC AAA795-J16	WP_075487375.1	CsdA
	Prochlorococcus marinus	SCGC AAA795-M23	WP_075438860.1	CsdA
	Prochlorococcus marinus subsp. marinus	CCMP1375	WP_011125246.1	CsdA
	Prochlorococcus marinus subsp. pastoris	CCMP1986	WP_011132734.1	CsdA
	Prochlorococcus sp.	HOT208_60m_805A16	WP_079293733.1	CsdA
	Prochlorococcus sp.	HOT208_60m_808G21	WP_079292895.1	CsdA
	Prochlorococcus sp.	HOT208_60m_808M21	WP_079339458.1	CsdA
	Prochlorococcus sp.	HOT208_60m_810B23	WP_079300013.1	CsdA
	Prochlorococcus sp.	HOT208_60m_813B04	WP_079331862.1	CsdA

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Synechococcales				
	Prochlorococcus sp.	HOT208_60m_813E23	WP_079334503.1	CsdA
	Prochlorococcus sp.	HOT208_60m_813G15	WP_079322771.1	CsdA
	Prochlorococcus sp.	HOT208_60m_813I02	WP_079330881.1	CsdA
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Unclassified				
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	cyanobacterium endosymbiont of *Epithemia turgida*		WP_044107193.1	CrhR
Enterobacterales				
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	Escherichia coli	K-12	WP_000123737.1	DbpA
	Escherichia coli	K-12	WP_000047499.1	RhlB
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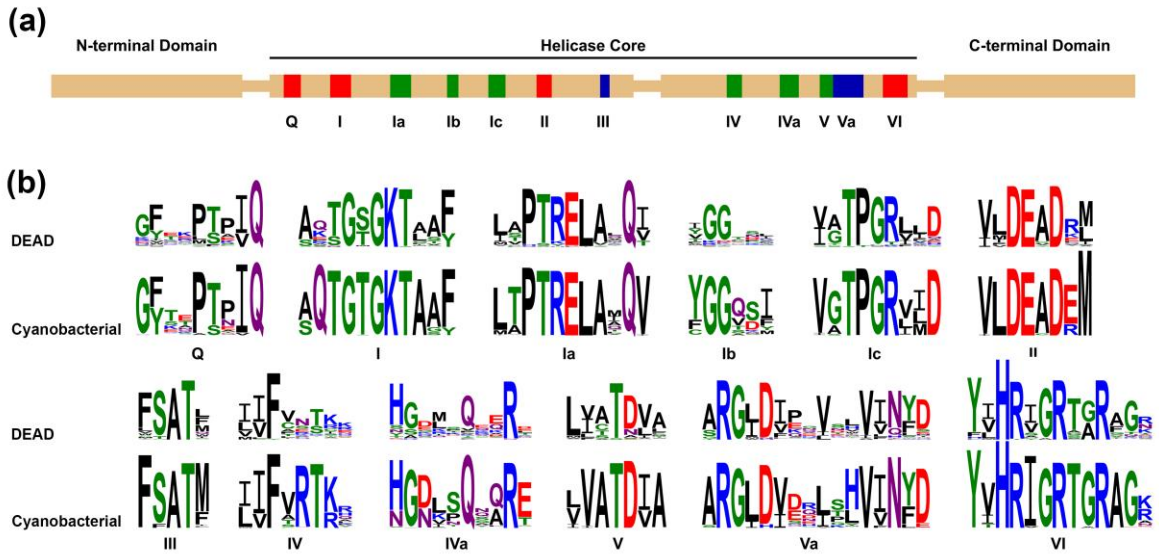
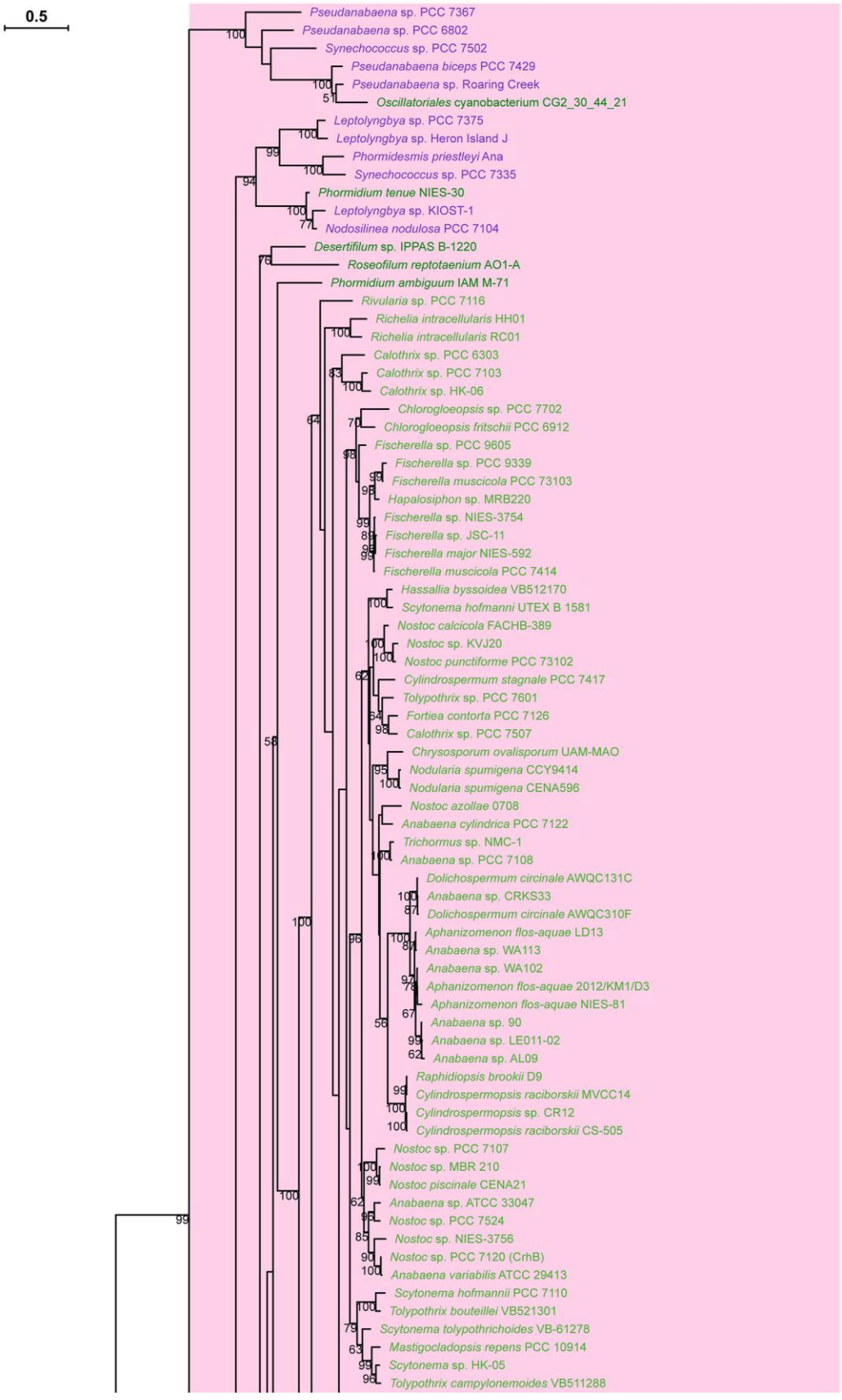


Fig. S1. Characteristic sequence motifs of DEAD-box RNA helicases. (a) Conserved domains characterizing the DEAD-box RNA helicase subfamily within SF2. The helicase core region consists of twelve conserved sequence motifs distributed within two recombinase A (RecA)-like domains. Accessory domains at the N- or C-terminus of the helicase core confer additional functionality or sequence specificity. Colours indicate the primary function of each motif: red for ATP binding and hydrolysis, green for RNA binding, and blue for coordination between ATP and RNA binding. (b) Sequence logos show conservation of the twelve motifs that characterize the DEAD-box protein family [1] with the 362 cyanobacterial DEAD-box helicases analyzed in this study. Sequence logos for the DEAD-box protein family were generated from alignments of the DEAD-box helicase complements of *Escherichia coli* (5) [2], *Bacillus subtilis* (4) [3], *Saccharomyces cerevisiae* (25) [4] and *Homo sapiens* (42) [5].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Phormidesmis priestleyi Ana
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Phormidium ambiguum IAM M-71
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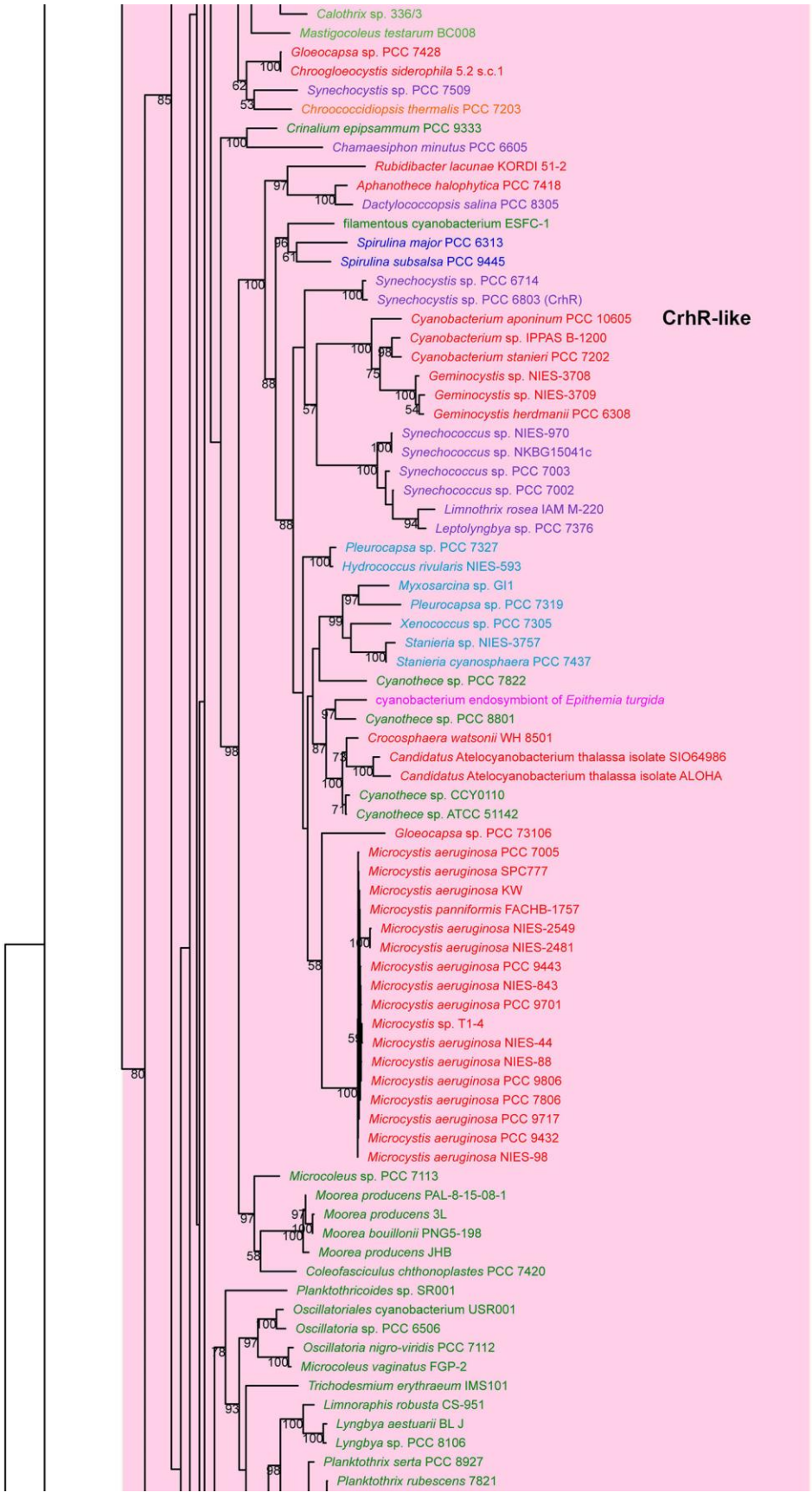
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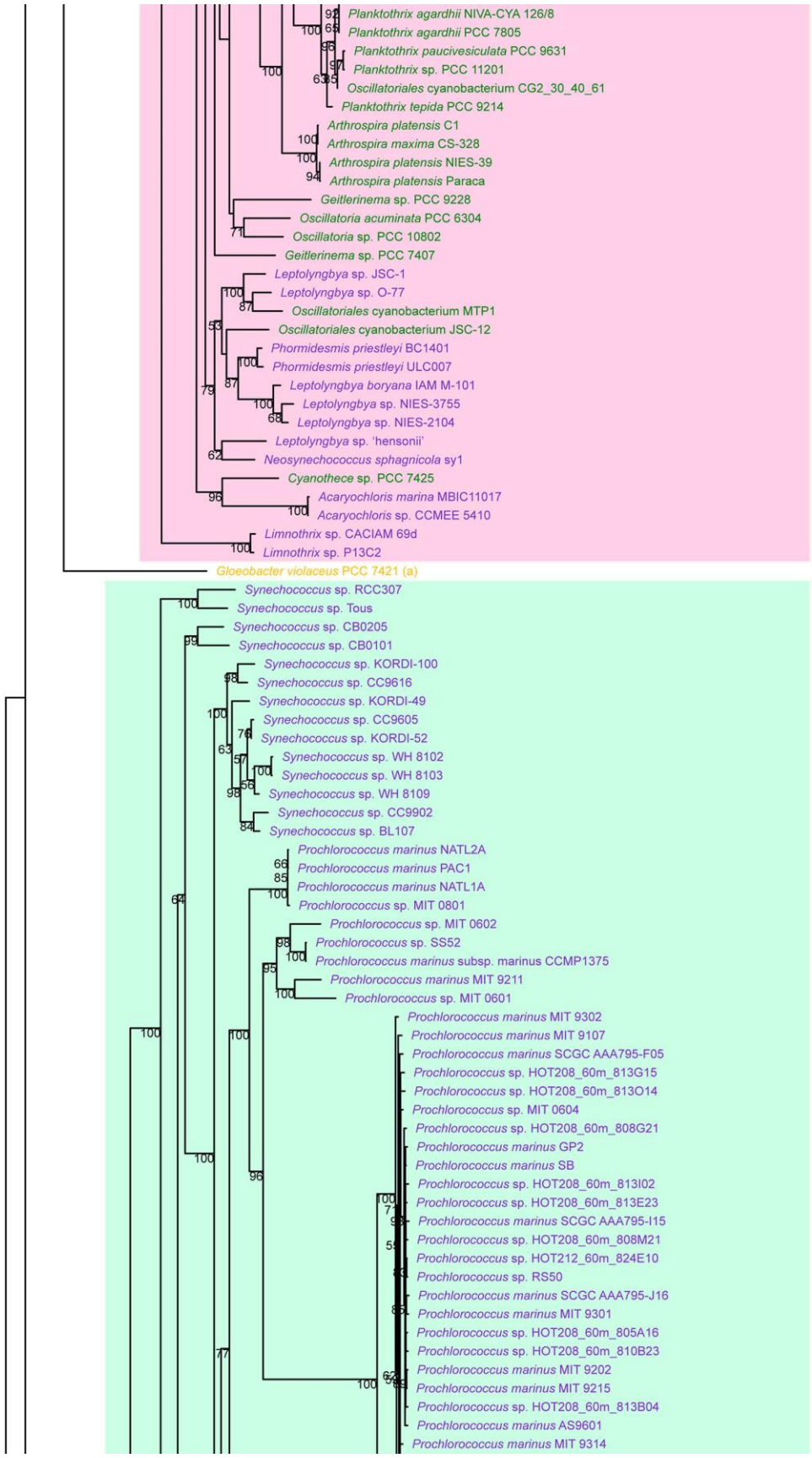
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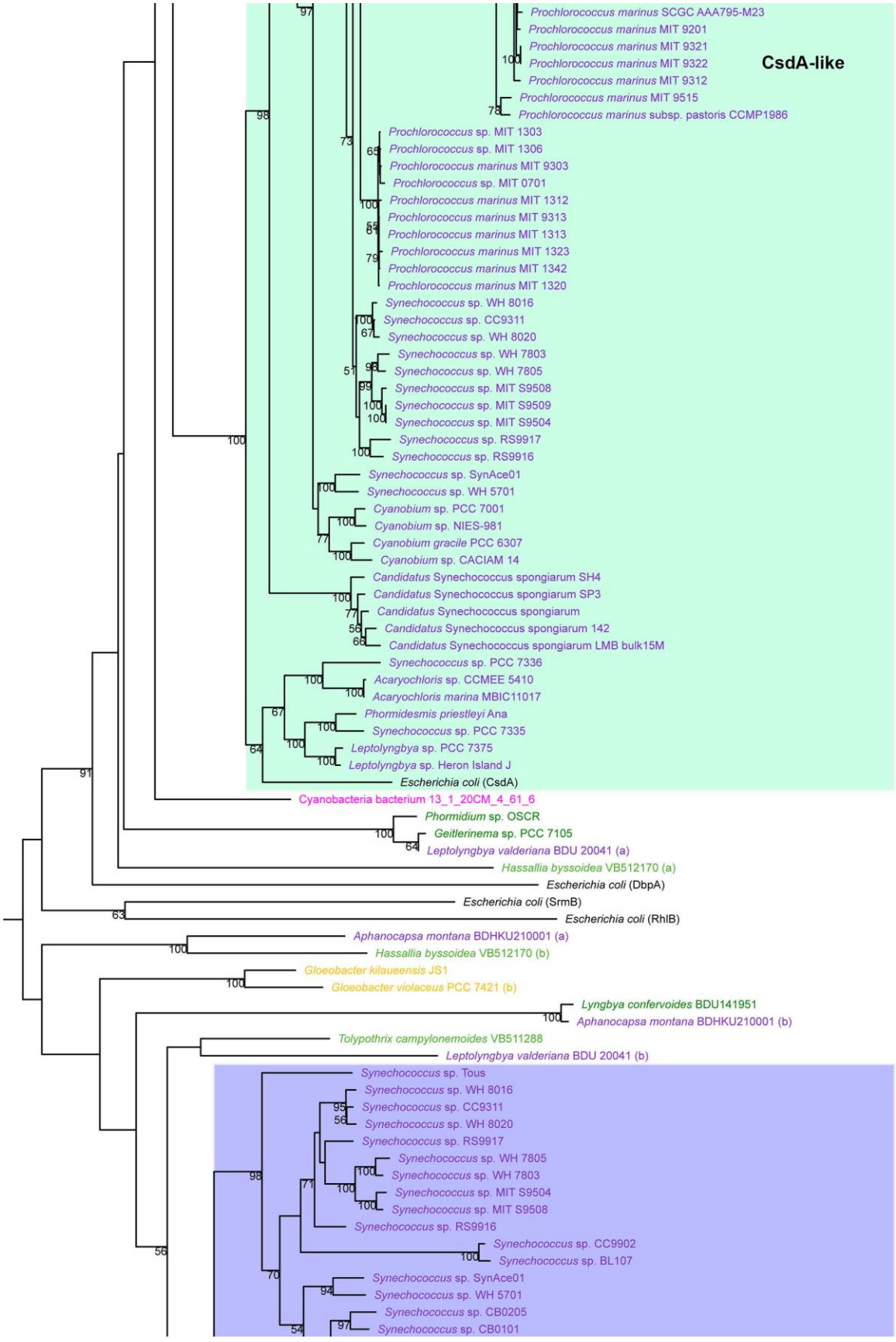
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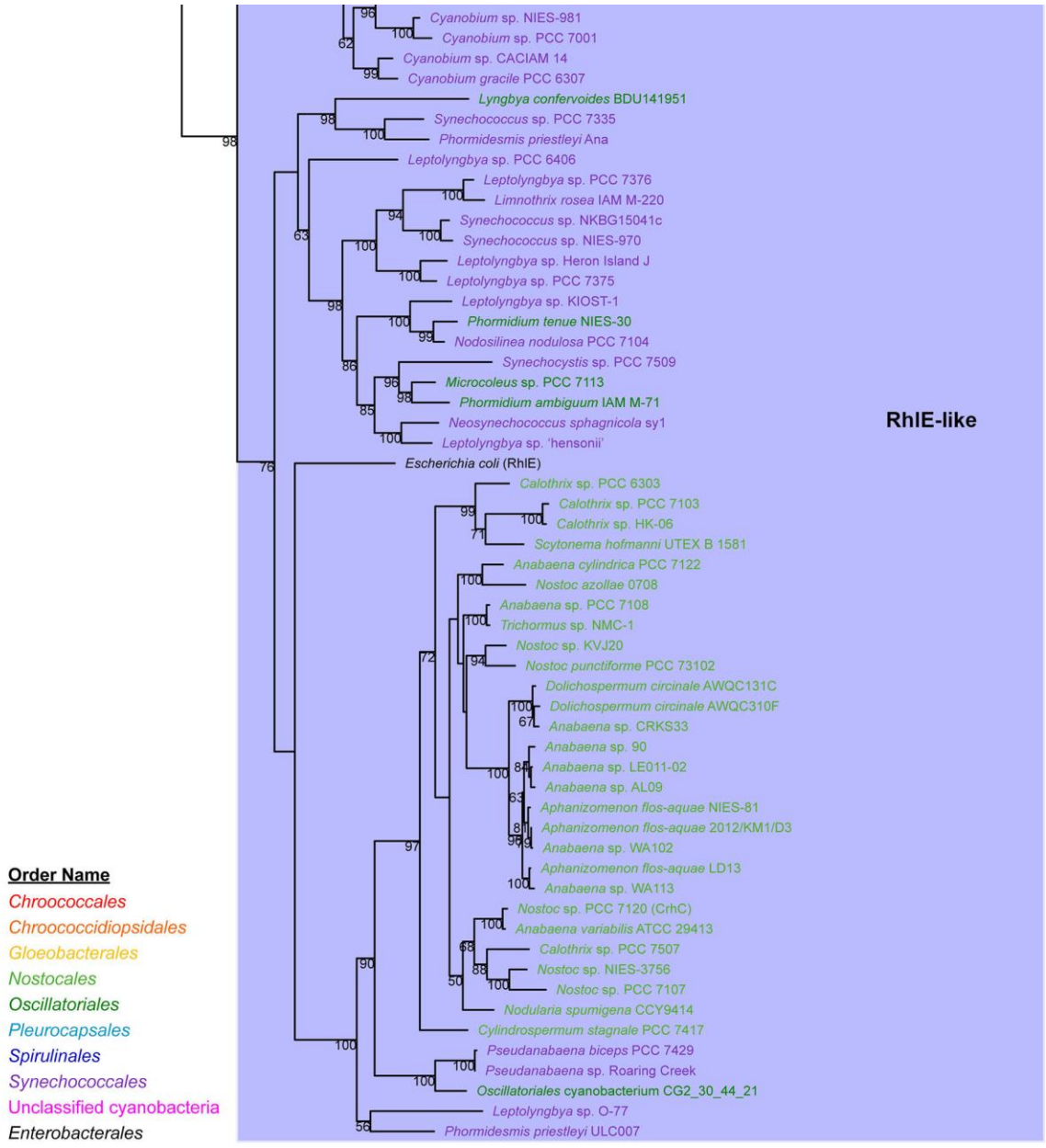

Fig. S2. Maximum likelihood tree of cyanobacterial DEAD-box RNA helicase proteins. The mid-point rooted maximum likelihood tree shows three major clades, corresponding to CrhR-like, CsdA-like and RhlE-like proteins. Highly related strains have been included in this analysis because of the extensive taxonomic issues that exist within cyanobacteria, such as the polyphyletic genus *Synechococcus* [6]. The DEAD-box proteins of *E. coli* (CsdA, DbpA, RhlB, RhlE and SrmB) are included to verify classification of the cyanobacterial proteins. Bootstrap values ≥ 50% shown are at the nodes. Branch lengths are proportional to the mean number of

substitutions per amino acid site as indicated by the scale bar. The strain names are coloured to denote the common taxonomic orders.

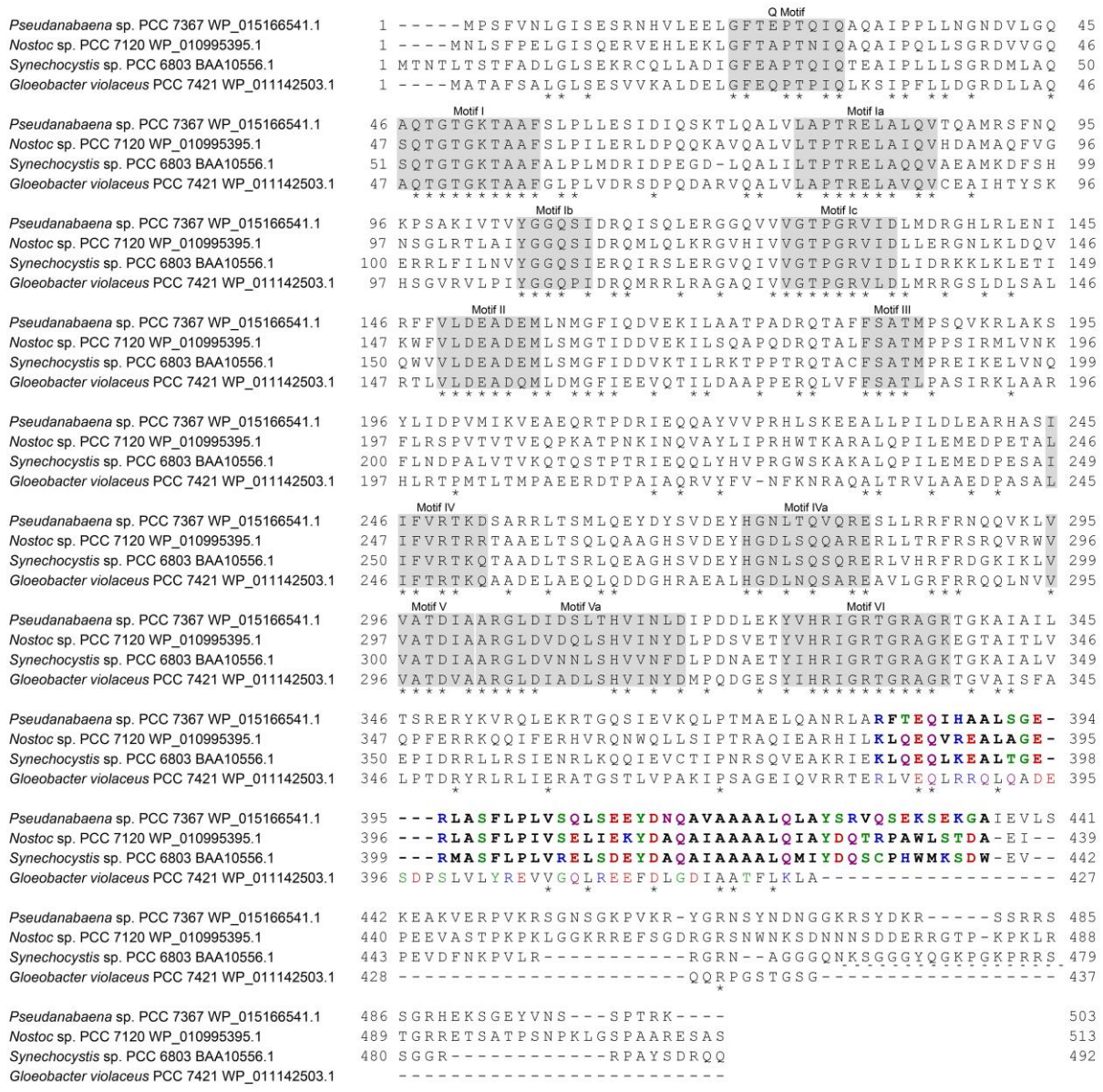

Fig. S3. The *Gloeobacter violaceus* PCC 7421 DEAD-box helicase lacks the CrhR-specific C-terminal extension domain. MUSCLE alignment was performed using selected representatives of the CrhR-like helicase clade against the CrhR-related protein from *G. violaceus*. The twelve conserved DEAD-box RNA helicase motifs are indicated in grey. The conserved sequence motif that defines the cyanobacterial CrhR clade is shown in bold and coloured based on amino acid chemistry.

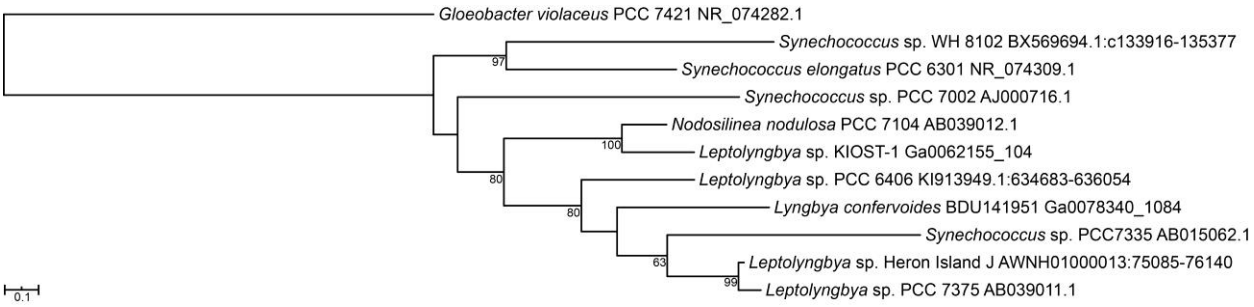

Fig. S4. 16S rDNA maximum-likelihood tree showing the cyanobacterial strains that encode DEAD-box proteins from all three clades of cyanobacterial DEAD-box proteins are closely related. 16S rDNA nucleotide sequences were aligned by MUSCLE and used to construct a maximum-likelihood tree with *Gloeobacter violaceus* PCC 7421 as an outgroup. Several *Leptolyngbya* species and closely related cyanobacteria, as well as several *Synechococcus* species were included to confirm the clustering of the strains that encode all three DEAD-box proteins. Bootstrap values ≥50% are shown at the nodes. Branch lengths are proportional to the mean number of substitutions per nucleotide site as indicated by the scale bar.

References

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