

SUPPLEMENTARY INFORMATION

EXPERIMENTAL ARTICLES

MOLECULAR DIVERSITY OF CYANOBACTERIA FROM LAKES KHOVSGOL AND WATERBODIES OF KHANGAI-KHENTII MOUNTAINOUS REGION OF MONGOLIA

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1 Table S1. Genetic similarity matrix (%) between strains CBMCmnp285, CBMCmnp504 and other representatives of the genus *Leptodesmis*.

No	Strain	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	<i>Leptodesmis paradoxa</i> CBMCmnp285																			
2	<i>Leptodesmis paradoxa</i> CBMCmnp504	98,97																		
3	<i>Leptodesmis paradoxa</i> LK021 KU219719	99,15	98,68																	
4	<i>Leptodesmis alaskaensis</i> V20 region MK861877	96,67	96,87	96,39																
5	<i>Leptodesmis lacustris</i> BACA0203 MT176753.2	97,12	97,03	96,69	97,71															
6	<i>Leptodesmis alaskaensis</i> strain V20 NR172587	96,67	96,87	96,39	100,00	97,71														
7	<i>Leptodesmis sichuanensis</i> strain PKUACSCSTA121 NR176517	95,50	95,81	95,82	95,95	95,82	95,95													
8	<i>Leptodesmis paradoxa</i> NR177860	99,15	98,68	100,00	96,39	96,69	96,39	95,82												
9	<i>Leptodesmis lacustris</i> strain BACA0203 NR189177	97,12	97,03	96,69	97,71	100,00	97,71	95,82	96,69											
10	<i>Leptodesmis lacustris</i> BACA0202 OM732227	97,12	97,03	96,70	97,71	99,72	97,71	95,82	96,70	99,72										
11	<i>Leptodesmis lacustris</i> BACA0204 OM732228	97,27	97,18	96,84	97,86	99,86	97,86	95,97	96,84	99,86	99,86									
12	<i>Leptodesmis alaskaensis</i> BACA0748 OP508344	96,53	96,73	96,26	99,86	97,57	99,86	95,81	96,26	97,57	97,57	97,72								
13	<i>Leptodesmis atroviridis</i> strain CCNU0258 PP811616	97,42	96,57	97,28	95,34	96,55	95,34	95,80	97,28	96,55	96,55	96,70	95,20							
14	<i>Leptodesmis atroviridis</i> strain CCNU0004 PP811617	97,56	96,73	97,43	95,49	96,70	95,49	95,95	97,43	96,70	96,70	96,84	95,36	99,86						
15	<i>Leptodesmis fuscus</i> CCNU0015 PP812197	97,56	97,63	98,15	95,96	95,82	95,96	95,65	98,15	95,82	95,82	95,97	95,82	97,86	98,01					
16	<i>Leptodesmis olivacea</i> CCNU0011 PP812200	97,27	96,58	96,85	97,27	96,84	97,27	95,37	96,85	96,84	96,84	96,99	97,13	97,28	97,43	97,14				
17	<i>Leptodesmis undulata</i> CCNU0617 PP812202	98,14	97,48	97,57	96,24	97,28	96,24	96,70	97,57	97,28	97,28	97,43	96,10	97,42	97,57	96,39	97,14			
18	<i>Leptodesmis xinxiangensis</i> HNU2023 PQ047518	97,56	96,73	97,43	95,49	96,70	95,49	95,95	97,43	96,70	96,70	96,84	95,36	99,86	100,00	98,01	97,43	97,57		
19	<i>Leptodesmis xinxiangensis</i> HNU2023 PQ047519	97,56	96,73	97,43	95,49	96,70	95,49	95,95	97,43	96,70	96,70	96,84	95,36	99,86	100,00	98,01	97,43	97,57	100,00	
20	<i>Phormidesmis nigrescens</i> AB KU219714	93,20	93,45	93,08	94,45	94,62	94,45	92,47	93,08	94,62	94,62	94,77	94,31	92,77	92,92	92,63	93,22	93,69	92,92	92,92

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7 Table S2. Genetic similarity matrix (%) between the strain *Stenomitos* sp. CBMCmnp617 and other representatives of the genus *Stenomitos*.

No	Strain	1	2	3	4	5	6	7	8	9	10	11
1	<i>Stenomitos</i> sp CBMCmnp617											
2	<i>Stenomitos hiloensis</i> HA6792KK3 region MN152980	98,57										
3	<i>Stenomitos tremulus</i> CPCC AF218371	98,28	99,43									
4	<i>Stenomitos pantisii</i> TAU-MAC 4318 NR_176603	97,70	98,57	98,28								
5	<i>Stenomitos kolaensis</i> Pasv RS28 Ile KU175690	97,85	99,01	99,01	99,00							
6	<i>Stenomitos rutilans</i> NR_177919	97,27	97,85	98,28	97,84	98,43						
7	<i>Stenomitos frigidus</i> ANT.L53B. AY493608	96,97	98,43	98,57	98,14	97,85	97,41					
8	<i>Stenomitos frigidus</i> ANT.L52. AY493609	96,97	98,43	98,57	98,14	97,85	97,41	100,00				
9	<i>Stenomitos frigidus</i> ANT.REIDJ. AY493611	96,96	98,28	98,42	97,69	97,70	97,56	98,86	98,86			
10	<i>Stenomitos nagguensis</i> CSML-F035 NR_186900	97,56	98,72	99,15	98,43	98,43	98,00	99,15	99,15	98,86		
11	<i>Stenomitos frigidus</i> ANT.L64B.1 AY493577	96,97	98,43	98,57	97,84	97,85	97,56	99,00	99,00	99,86	99,00	
12	<i>Stenomitos terricola</i> FBCCA190 ON787614	97,56	97,70	97,99	97,11	96,97	97,12	97,70	97,70	97,40	97,85	97,41

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9 Table S3. Genetic similarity matrix (%) between the strain CBMCmnp294, CBMCmnp615 and other representatives of the genus *Pseudanabaena*.

No	Strain	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	<i>Pseudanabaena catenata</i> CBMCmnp294														
2	<i>Pseudanabaena catenata</i> CBMCmnp615	98,58													
3	<i>Pseudanabaena catenata</i> SAG 254.80 KM020004	99,15	99,44												
4	<i>Pseudanabaena catenata</i> SAG 1464-1 KM020005	99,15	99,44	100,00											
5	<i>Pseudanabaena galeata</i> strain: SAG13. LC016778	97,57	99,01	98,44	98,44										
6	<i>Pseudanabaena galeata</i> SAG 13.83 LC571769	97,57	99,01	98,44	98,44	100,00									
7	<i>Pseudanabaena galeata</i> SAG 13.83 KM020003	97,57	99,01	98,44	98,44	100,00	100,00								
8	<i>Pseudanabaena limnetica</i> CHAB786 KM386855	93,36	94,43	93,97	93,97	95,49	95,49	95,49							
9	<i>Pseudanabaena limnetica</i> CHAB792 KM386856	93,51	94,58	94,12	94,12	95,64	95,64	95,64	99,86						
10	<i>Pseudanabaena cinerea</i> NIES4065 LC314118	97,28	98,58	98,15	98,15	98,44	98,44	98,44	94,89	95,04					
11	<i>Pseudanabaena cinerea</i> NIES4063 TNS:TNSAL58673 LC314122	97,28	98,58	98,15	98,15	98,44	98,44	98,44	94,89	95,04	100,00				
12	<i>Pseudanabaena cinerea</i> NR_177726	97,28	98,58	98,15	98,15	98,44	98,44	98,44	94,89	95,04	100,00	100,00			
13	<i>Pseudanabaena yagii</i> NIES4237 TNS:TNSAL61729 LC314143	97,43	98,15	97,72	97,72	99,15	99,15	99,15	95,49	95,64	97,72	97,72	97,72		
14	<i>Pseudanabaena yagii</i> NIES4238 LC314145	97,43	98,15	97,72	97,72	99,15	99,15	99,15	95,49	95,64	97,72	97,72	97,72	100,00	
15	<i>Chroakolemma pellucida</i> NR_177773	88,05	88,23	88,39	88,39	89,05	89,05	89,05	87,74	87,91	87,39	87,39	87,39	89,54	89,54

10 Table S4. Genetic similarity matrix (%) between the strain CBMCmnp363 and other representatives of the genus *Limnothrix*.

No	Strain	1	2	3	4	5	6	7
1	<i>Limnothrix</i> sp. CBMCmnp363							
2	MT176705 <i>Limnothrix</i> sp. BACA0027	99,82						
3	MT176713 <i>Limnothrix</i> sp. BACA0045	99,82	100,00					
4	MT176715 <i>Limnothrix</i> sp. BACA0048	99,82	100,00	100,00				
5	PP795345 <i>Limnothrix</i> sp. BACA0785e	99,82	100,00	100,00	100,00			
6	FM177493 <i>Limnothrix redekei</i> 2LT25S01 FM177493	99,73	99,56	99,56	99,56	99,56		
7	AJ505943 <i>Limnothrix redekei</i> 165c	99,73	99,56	99,56	99,56	99,56	100,00	
8	AJ505942 <i>Limnothrix redekei</i> 165a	99,73	99,56	99,56	99,56	99,56	100,00	100,00

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12 Table S5. Genetic similarity matrix (%) between the strain CBMCmnp292 and other representatives of the genera *Persinema*, *Lagosinema* и

13 *Trichocoleus*.

No	Strain	1	2	3	4	5	6
1	<i>Persinema komarekii</i> CBMCmnp292						
2	<i>Persinema komarekii</i> TM S1 cl2 MF348313	99,86					
3	<i>Persinema</i> sp. FFKUACRSB PQ733573	99,86	99,72				
4	<i>Persinema</i> sp. FFKUACRSB PQ733574	99,86	99,72	100,00			
5	<i>Lagosinema tenuis</i> NGPC151 MH295768	96,84	96,99	96,84	96,84		
6	<i>Trichocoleus desertorum</i> ATA48CV2 consensus ACE Ile p KF307604	90,19	90,35	90,19	90,19	90,55	
7	<i>Trichocoleus desertorum</i> WJT16NPBG1 P17C KF307620	90,34	90,51	90,34	90,34	90,70	99,30

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Table S6. Genetic similarity matrix (%) between the strain CBMCmnp506 and other representatives of the genus *Phormidium*.

No	Strain	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	<i>Phormidium</i> sp. CBMCmnp506																
2	<i>Phormidium</i> sp. 00511 00001 KC854783	99,29															
3	<i>Phormidium nigroviride</i> strain PCC 7112 NR_112168	94,45	94,45														
4	<i>Phormidium corium</i> PMC299.07 GQ859649	94,02	93,85	97,58													
5	<i>Phormidium autumnale</i> BB-1 KT343916	93,86	93,70	98,01	99,01												
6	<i>Phormidium autumnale</i> CYN127 JX847023	93,85	93,85	98,59	98,15	98,58											
7	<i>Phormidium uncinatum</i> VR6 OQ543112	93,82	93,82	98,54	98,10	98,54	100										
8	<i>Phormidium irriguum</i> f. Minor NR_177721	92,44	92,27	93,23	92,93	93,41	92,77	93,02									
9	<i>Phormidium papyraceum</i> ULC441 OK586776	91,38	90,73	93,23	92,48	93,56	92,93	92,70	91,81								
10	<i>Phormidium ambiguum</i> IAM M-71 AB003167	91,32	91,30	92,59	92,27	92,74	91,48	91,52	95,66	91,77							
11	<i>Phormidium aerugineo-caeruleum</i> 9N-01 FR798943	91,22	91,20	93,54	92,79	93,25	92,93	92,71	91,96	98,30	91,62						
12	<i>Phormidium terebriforme</i> UAM 409 JN382221	91,15	91,30	93,39	92,75	93,07	92,76	93,00	90,82	90,91	90,93	91,05					
13	<i>Phormidium pseudopriestleyi</i> ANT.LACV5.3 AY493600	90,84	90,99	93,53	93,07	93,22	93,07	93,32	90,34	91,36	90,60	91,68	99,15				
14	<i>Phormidium chlorinum</i> FO-SIORAS-13 KU855377	90,25	90,06	91,35	92,00	91,21	90,57	90,27	90,22	89,31	89,05	89,79	89,71	89,40			
15	<i>Phormidium tenue</i> JS241FWAG13511 PP601361	89,22	89,52	90,86	90,08	89,90	89,59	89,59	90,20	89,07	90,14	89,73	91,35	91,36	91,45		
16	<i>Phormidium lucidum</i> CY-012 KC217548	88,55	88,17	88,80	88,00	87,99	87,64	87,90	90,52	87,64	88,73	87,82	90,39	89,75	89,87	92,62	
17	<i>Phormidium mucicola</i> IAM M-221 AB003165	87,52	87,46	88,64	88,99	89,65	88,31	88,25	88,02	88,35	90,95	88,67	87,62	87,62	87,14	87,98	85,99

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Table S7. Genetic similarity matrix (%) between the strain CBMCmnp501 and other representatives of the species *Koinonema pervagatum*.

No	Strain	1	2	3	4
1	<i>Koinonema pervagatum</i>. CBMCmnp501				
2	<i>Koinonema pervagatum</i> PMC_1263.20 MW405064	98,15			
3	<i>Koinonema pervagatum</i> isolate D NR_177853	98,15	99,72		
4	<i>Koinonema pervagatum</i> 62PC MF362672	97,28	98,87	99,15	
5	<i>Koinonema pervagatum</i> 61PC MF362671	97,72	99,15	99,44	98,87

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23 Table S8. Genetic similarity matrix (%) between the strain CBMCmnp502 and other representatives of the species *Planktothricoides raciborskii*.

No	Strain	1	2
1	<i>Planktothricoides raciborskii</i> CBMCmnp502		
2	<i>Planktothricoides raciborskii</i> NIES207 AB045960	99,71	
3	<i>Planktothricoides raciborskii</i> NSLA3 AB045962	99,56	99,56

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25 Table S9. Genetic similarity matrix (%) between the strain CBMCmnp356 and other representatives of the genus *Trichormus*.

No	Strain	1	2	3	4	5	6	7
1	<i>Trichormus variabilis</i> CBMCmnp356							
2	<i>Trichormus variabilis</i> strain KCTC AG10008 DQ234829	100,00						
3	<i>Trichormus variabilis</i> GREIFSWALD strain GREIFSWALD AJ630457	100,00	100,00					
4	<i>Trichormus</i> sp. MGCY298 KY052183	100,00	100,00	100,00				
5	<i>Trichormus variabilis</i> HINDAK 2001/4 strain HINDAK 2001/4 AJ630456	99,56	99,56	99,56	99,56			
6	<i>Trichormus naviculoides</i> BACA0682 PP847293	99,56	99,56	99,56	99,56	100,00		
7	<i>Trichormus</i> sp. UIC 10339 KF444210	99,01	99,01	99,01	99,01	98,90	98,89	
8	<i>Trichormus azollae</i> Kom BAI/1983 strain Kom BAI/1983 AJ630454	95,99	95,99	95,99	95,99	95,64	95,62	95,64

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27 Table S10. Genetic similarity matrix (%) between the strain CBMCmnp507 and other representatives of the genera *Constrictifilum*, *Calothrix* и

28 *Goleter*.

No	Strain	1	2	3	4	5
1	<i>Constrictifilum</i> sp CBMCmnp507					
2	<i>Constrictifilum</i> sp. Assy 17 OP502076	98,40				
3	<i>Calothrix</i> sp. CCAP 1410/13 HF678491	98,24	99,37			
4	<i>Goleter apudmare</i> HA4340-LM2 KF417425	97,42	97,93	98,25		
5	<i>Constrictifilum karadense</i> MKW3 NR_172623	96,77	97,45	97,29	95,47	
6	<i>Goleter apudmare</i> HA4356-MV2 JN385289	96,26	96,80	97,29	98,89	94,47

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Table S11. Genetic similarity matrix (%) between the strain CBMCmnp303 and other representatives of the genus *Scytonematopsis*

No	Strain	1	2	3	4	5	6
1	<i>Scytonematopsis contorta</i> CBMCmnp303						
2	<i>Scytonematopsis</i> sp. 2 PNG7-MK64 KY411156	99,32					
3	<i>Scytonematopsis contorta</i> HA4267-MV1 clone B3-5 + p2 HQ847557	99,14	98,97				
4	<i>Scytonematopsis contorta</i> HA4267-MV1 clone B3-5 + p3 HQ847558	98,80	98,63	99,66			
5	<i>Scytonematopsis</i> sp. M07 16S KY411152	98,28	98,28	98,81	99,15		
6	<i>Scytonematopsis crustacea</i> NIES-266 LC455661	92,19	92,02	92,61	92,23	92,05	
7	<i>Scytonematopsis maxima</i> LCR-FBC NR_186894	91,28	91,11	91,09	90,71	89,94	91,85

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