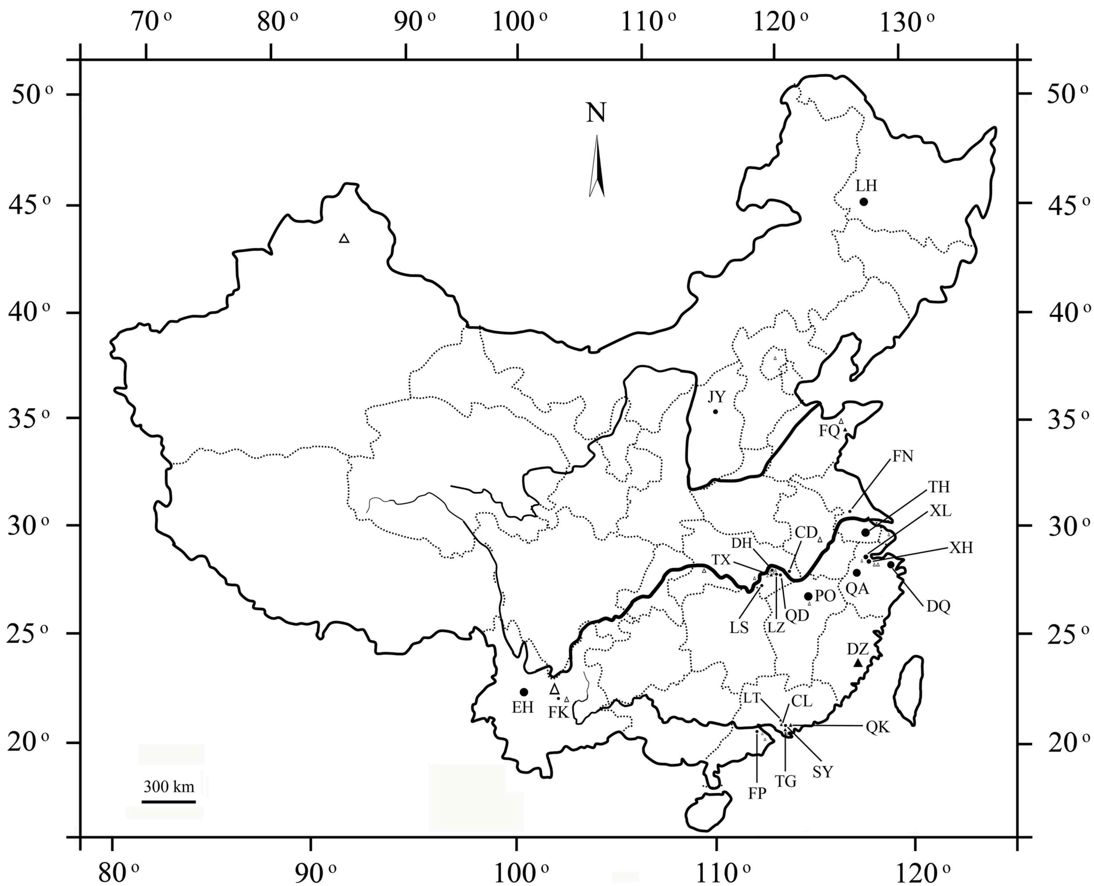

Figure S1 Location of freshwater bodies where cyanobacterial strains and water samples were obtained. Empty triangle, cyanobacterial strains were isolated; solid triangle, water samples were collected; solid circle, both cyanobacterial strains and water samples were obtained. Only geographic origin of water samples were labeled using abbreviations of freshwater bodies listed in Table 1.

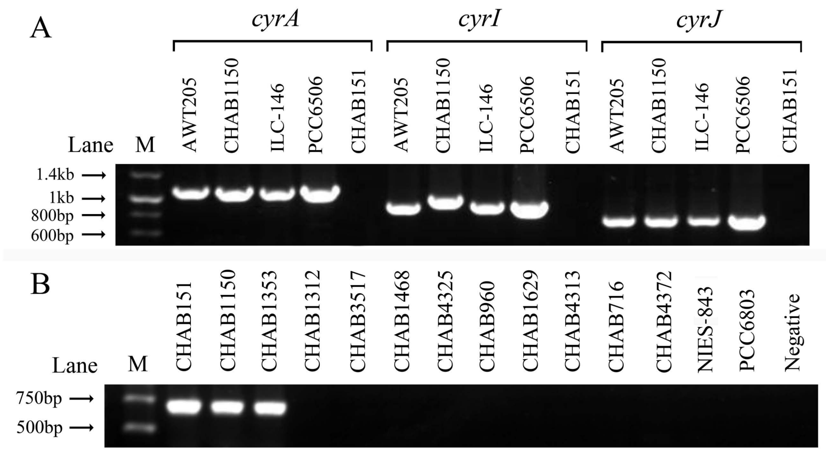

Figure S2 Specificity examination of *cyr* (A) and *rpoC1* (B) primers.

The strain numbers are as follows, *C. raciborskii* CHAB151 (non-CYNs-producing), *R. curvata* CHAB1150 (CYNs-producing), *R. mediterranea* CHAB1353, *Aph. issatschenkoi* CHAB1312, *Aph. flos-aquae* CHAB3517, *Aph. gracile* CHAB1468, *A. bergii* CHAB4325, *A. affinis* CHAB960, *A. flos-aquae* CHAB1629, *P. agardhii* CHAB4313, *Pseudanabaena mucicola* CHAB716, *M. wesenbergii* CHAB4372, *M. aeruginosa* NIES-843, *Synechocystis* sp. PCC6803, *C. raciborskii* AWT205 (CYNs-producing), *Aph. ovalisporum* ILC-164 (CYNs-producing), and *Oscillatoria* sp. PCC6506 (CYNs-producing).

C. raciborskii AWT205 *cyrI*	241	TATGAATGCGAAAGTGAGCTTGAATTAGCAAAGTATCAAGAAGACGCACCCACATTGATTAAAGAAATGCGGAGGCTGGT
		Y E C E S E L E L A K Y Q E D A P T L I K E M R R L V
TG *cyrI* 5 (SY *cyrI* 5)	241	TATGAATGCGAAAGTGAGCTTGAATTAGCAAAGTATCAAGAAGACGCACCCACATTGATTAAATAAATGCGGAGGCTGGT
		Y E C E S E L E L A K Y Q E D A P T L I K * M R R L V
C. raciborskii CHAB358 *cyrI* (TG *cyrI* 2, TG *cyrI* 7, TG *cyrI* 8, TG *cyrI* 10, SY *cyrI* 4, SY *cyrI* 6)	241	TATGAATGCGAAAGTGAGCTTGAATTAGCAAAGTATCAAGAAGACGCACCCACATTGATTAAAGAAATGCGGAGGCTGGT
		Y E C E S E L E L A K Y Q E D A P T L I K E M R R L V
C. raciborskii AWT205 *cyrI*	496	GAATATTATAAAGATAAACCAAATATCATAAATCAAATCGCAGCAAATGTATATTTAAAAACGTCTGCATCAGGAGGAGA
		E Y Y K D K P N I I N Q I A A N V Y L K T S A S G G E
TG *cyrI* 5 (SY *cyrI* 5)	496	GAATATTATAAAGATAAACCAAATATCATAAATCAAATCGCAGCAAATGTATATTTAAAAACGTCTGCATCAGGAGGAGA
		E Y Y K D K P N I I N Q I A A N V Y L K T S A S G G E
C. raciborskii CHAB358 *cyrI* (TG *cyrI* 2, TG *cyrI* 7, TG *cyrI* 8, TG *cyrI* 10, SY *cyrI* 4, SY *cyrI* 6)	496	GAATATTATAAAGATAAACCAAATATCATAAATTAAATCGCAGCAAATGTATATTTAAAAACGTCTGCATCAGGAGGAGA
		E Y Y K D K P N I I N * I A A N V Y L K T S A S G G E

Figure S3 Partial alignment of mutant *cyrI* gene sequences and deduced protein sequences. Rectangle, nucleotide mutation; asterisk, stop codon.

```
Itype1    TG cyrI 1                 1    ATGACCATATATGAAAATAAGTTGAGTAGTTATCAAAAAAATCAAGATGCCATAATATCTGCAAAAGAACTCGAAGAATG
                                          M  T  I  Y  E  N  K  L  S  S  Y  Q  K  N  Q  D  A  I  I  S  A  K  E  L  E  E  W
Itype2    LZ cyrI 1                 1    ATGACCATATATGAAAATAAGTTGAGTAGTTATCAAAAAAATCAAGATGCCATAATATCTGCAAAAGAACTCGAAGAATG
                                          M  T  I  Y  E  N  K  L  S  S  Y  Q  K  N  Q  D  A  I  I  S  A  K  E  L  E  E  W
Itype3    DZ cyrI 1                 1    ATGACCATATATGAAAATAAGTTGAGTAGTTATCAAAAAAATCAAGATGCCATAATATCTGCAAAAGAACTCGAAGAATG
                                          M  T  I  Y  E  N  K  L  S  S  Y  Q  K  N  Q  D  A  I  I  S  A  K  E  L  E  E  W
Itype4af  CD cyrI 1                 1    ATGACCATATATGAAAATAAGTTGAGTAGTTATCAAAAAAATCAAGATGCCATAATATCTGCAAAAGAACTCGAAGAATG
                                          M  T  I  Y  E  N  K  L  S  S  Y  Q  K  N  Q  D  A  I  I  S  A  K  E  L  E  E  W
Itype4ar  CD cyrI 10                1    ATGACCATATATGAAAATAAGTTGAGTAGTTATCAAAAAAATCAAGATGCCATAATATCTGCAAAAGAACTCGAAGAATG
                                          M  T  I  Y  E  N  K  L  S  S  Y  Q  K  N  Q  D  A  I  I  S  A  K  E  L  E  E  W
C. raciborskii AWT205 cyrI          1    ATGACCATATATGAAAATAAGTTGAGTAGTTATCAAAAAAATCAAGATGCCATAATATCTGCAAAAGAACTCGAAGAATG
                                          M  T  I  Y  E  N  K  L  S  S  Y  Q  K  N  Q  D  A  I  I  S  A  K  E  L  E  E  W

Itype1    TG cyrI 1                81    GCATT---------------------------------------------------------------------------
                                           H  L
Itype2    LZ cyrI 1                81    GCATT---------------------------------------------------------------------------
                                           H  L
Itype3    DZ cyrI 1                81    GCATT---------------------------------------------------------------------------
                                           H  L
Itype4af  CD cyrI 1                81    GCATTTACAGCAGTTTTCATCTATTTAAACCAGATTTTGATTACCTTCTCCCTTTGTGCGAAACAAAAACCGTGGTTCAT
                                           H  L  Q  Q  F  S  S  I  *  T  R  F  *  L  P  S  P  F  V  R  N  K  N  R  G  S  F
Itype4ar  CD cyrI 10               81    GCATTTACAGCGAATTTCAGGTAAATGAACCACGGTTTTTGTTTCGCGCAAAGGGAGAAGGTAATCAAAATCTGGTTTAA
                                           H  L  Q  R  I  S  G  K  *  T  T  V  F  V  S  R  K  G  R  R  *  S  K  S  G  L  N
C. raciborskii AWT205 cyrI         81    GCATT---------------------------------------------------------------------------
                                           H  L

Itype1    TG cyrI 1                86    -----------------TAATTGGACTTCTAGACCATTCAATAGATGCGGTAATAGTACCGAATTATTTTCTTGAGCAAG
                                                             I  G  L  L  D  H  S  I  D  A  V  I  V  P  N  Y  F  L  E  Q  E
Itype2    LZ cyrI 1                86    -----------------TAATTGGACTTCTAGACCATTCAATAGATGCGGTAATAGTACCGAATTATTTTCTTGAGCAAG
                                                             I  G  L  L  D  H  S  I  D  A  V  I  V  P  N  Y  F  L  E  Q  E
Itype3    DZ cyrI 1                86    -----------------TAATTGGACTTCTAGACCATTCAATAGATGCGGTAATAGTACCGAATTATTTTCTTGAGCAAG
                                                             I  G  L  L  D  H  S  I  D  A  V  I  V  P  N  Y  F  L  E  Q  E
Itype4af  CD cyrI 1               161    TTACCTGAAATTCGCTGTAATTGGACTTCTAGACCATTCAATAGATGCGGTAATAGTACCGAATTATTTTCTTGAGCAAG
                                          T  *  N  S  L  *  L  D  F  *  T  I  Q  *  M  R  *  *  Y  R  I  I  F  L  S  K
Itype4ar  CD cyrI 10              161    ATAGATGAAAACTGCTGTAATTGGACTTCTAGACCATTCAATAGATGCGGTAATAGTACCGAATTATTTTCTTGAGCAAG
                                          R  *  K  L  L  *  L  D  F  *  T  I  Q  *  M  R  *  *  Y  R  I  I  F  L  S  K
C. raciborskii AWT205 cyrI         86    -----------------TAATTGGACTTCTAGACCATTCAATAGATGCGGTAATAGTACCGAATTATTTTCTTGAGCAAG
                                                             I  G  L  L  D  H  S  I  D  A  V  I  V  P  N  Y  F  L  E  Q

Itype1    TG cyrI 1               389    ATTTAGCAAAACTTGGTGATAAAAAAACTGTTTGCGGGTATAGTTAGAGAGTTTAAAGAAGATAACCCTGGCGCACCACAT
                                           L  A  K  L  G  D  K  K  L  F  A  G  I  V  R  E  F  K  E  D  N  P  G  A  P  H
Itype2    LZ cyrI 1               389    ATTTAGCAAAACTTGGTGATAAAAAAACTGTTTGCGGGTATCGTTAGAGAGTTTAAAGAAGATAACCCTGGCGCACCACAT
                                           L  A  K  L  G  D  K  K  L  F  A  G  I  V  R  E  F  K  E  D  N  P  G  A  P  H
Itype3    DZ cyrI 1               389    ATTTAGCAAAACTTGGTGATAAAAAAACTGTTTGCGGGTATCGTTAGAGAGTTTAAAGAAGATAACCCTGGCGCACCACAT
                                           L  A  K  L  G  D  K  K  L  F  A  G  I  V  R  E  F  K  E  D  N  P  G  A  P  H
Itype4af  CD cyrI 1               481    ATTTAGCAAAACTTGGTGATAAAAAAACTGTTTGCGGGTATAGTTAGAGAGTTTAAAGAAGATAACCCTGGCGCACCACAT
                                         I  *  Q  N  L  V  I  K  N  C  L  R  V  *  L  E  S  L  K  K  I  T  L  A  H  H  I
Itype4ar  CD cyrI 10              481    ATTTAGCAAAACTTGGTGATAAAAAAACTGTTTGCGGGTATAGTTAGAGAGTTTAAAGAAGATAACCCTGGCGCACCACAT
                                         I  *  Q  N  L  V  I  K  N  C  L  R  V  *  L  E  S  L  K  K  I  T  L  A  H  H  I
C. raciborskii AWT205 cyrI        389    ATTTAGCAAAACTTGGTGATAAAAAAACTGTTTGCGGGTATCGTTAGAGAGTTTAAAGAAGATAACCCTGGCGCACCACAT
                                           L  A  K  L  G  D  K  K  L  F  A  G  I  V  R  E  F  K  E  D  N  P  G  A  P  H

Itype1    TG cyrI 1               469    TGTGACGTAATGGCATGGGGTTTTCT------------------------------CGAATATTGTAAAGATAAACCAAA
                                         C  D  V  M  A  W  G  F  L                                 E  Y  C  K  D  K  P  N
Itype2    LZ cyrI 1               469    TGTGACGTAATGGCATGGGGTTTTCT------------------------------CGAATATTATAAAGATAAACCAAA
                                         C  D  V  M  A  W  G  F  L                                 E  Y  Y  K  D  K  P  N
Itype3    DZ cyrI 1               469    TGTGACGTAATGGCATGGGGTTTTCTACATTGTGACGTAATGGCATGGGGTTTTCTCGAATATTATAAAGATAAACCAAA
                                         C  D  V  M  A  W  G  F  L  H  C  D  V  M  A  W  G  F  L  E  Y  Y  K  D  K  P  N
Itype4af  CD cyrI 1               561    TGTGACGTAATGGCATGGGGTTTTCT------------------------------CGAATATTATAAAGATAAACCAAA
                                         V  T  *  W  H  G  V  F  S                                  N  I  I  K  I  N  Q  I
Itype4ar  CD cyrI 10              561    TGTGACGTAATGGCATGGGGTTTTCT------------------------------CGAATATTATAAAGATAAACCAAA
                                         V  T  *  W  H  G  V  F  S                                  N  I  I  K  I  N  Q  I
C. raciborskii AWT205 cyrI        469    TGTGACGTAATGGCATGGGGTTTTCT------------------------------CGAATATTATAAAGATAAACCAAA
                                         C  D  V  M  A  W  G  F  L                                 E  Y  Y  K  D  K  P  N

Itype1    TG cyrI 1               599    CAACTCAAAGCGAATATATAGCAT------ACAAAACAGATGATCCAGCTAGTTTCGGTCTTGATAGCAAAAAGATCGCA
                                           T  Q  S  E  Y  I  A  Y        K  T  D  D  P  A  S  F  G  L  D  S  K  K  I  A
Itype2    LZ cyrI 1               599    CAACTCAAAGCGAATATATAGCATTAGCATACAAAACAGATGATCCAGCTAGTTTCGGTCTTGATAGCAAAAAGATCGCA
                                           T  Q  S  E  Y  I  A  L  A  Y  K  T  D  D  P  A  S  F  G  L  D  S  K  K  I  A
Itype3    DZ cyrI 1               629    CAACTCAAAGCGAATATATAGCATTAGCATACAAAACAGATGATCCAGCTAGTTTCGGTCTTGATAGCAAAAAGATCGCA
                                           T  Q  S  E  Y  I  A  L  A  Y  K  T  D  D  P  A  S  F  G  L  D  S  K  K  I  A
Itype4af  CD cyrI 1               691    CAACTCAAAGCGAATATATAGCAT------ACAAAACAGATGATCCAGCTAGTTTCGGTCTTGATAGCAAAAAGATCGCA
                                         Q  L  K  A  N  I  *  H        T  K  Q  M  I  Q  L  V  S  V  L  I  A  K  R  S  H
Itype4ar  CD cyrI 10              691    CAACTCAAAGCGAATATATAGCAT------ACAAAACAGATGATCCAGCTAGTTTCGGTCTTGATAGCAAAAAGATCGCA
                                         Q  L  K  A  N  I  *  H        T  K  Q  M  I  Q  L  V  S  V  L  I  A  K  R  S  H
C. raciborskii AWT205 cyrI        599    CAACTCAAAGCGAATATATAGCAT------ACAAAACAGATGATCCAGCTAGTTTCGGTCTTGATAGCAAAAAGATCGCA
                                           T  Q  S  E  Y  I  A  Y        K  T  D  D  P  A  S  F  G  L  D  S  K  K  I  A
```

Figure S4 Partial alignment of representative *cyrI* gene sequences and deduced protein sequences. Repeat sequences and insertion sequences were italicized. Dash line, gaps introduced into the alignment; bold line, ITRs; arrow, beginning of repeat sequences; asterisk, stop codon.

C. raciborskii AWT205 *cyrJ* repeat1	TTGGCGATCCGTCATCGATCTGTTAAAGGCTCCCCTGCCTGAAGGGAA
C. raciborskii AWT205 *cyrJ* repeat2	------...AA.....................................
C. raciborskii CS-505 *cyrJ* repeat1	....
C. raciborskii CS-505 *cyrJ* repeat2	------...AA.....................................
C. raciborskii cyDB-1 *cyrJ* repeat1	....
C. raciborskii cyDB-1 *cyrJ* repeat2	------...AA.....................................
C. raciborskii CHAB358 *cyrJ* repeat1	....
C. raciborskii CHAB358 *cyrJ* repeat2	..T...
C. raciborskii CHAB3438 *cyrJ* repeat1	....
C. raciborskii CHAB3438 *cyrJ* repeat2	..T...
R. curvata CHAB1150 *cyrJ* repeat1	....
R. curvata CHAB1150 *cyrJ* repeat2	..T...
R. curvata CHAB3416 *cyrJ* repeat1	....
R. curvata CHAB3416 *cyrJ* repeat2	..T...
R. curvata HB1 *cyrJ* repeat1	....
R. curvata HB1 *cyrJ* repeat2	..T...
R. mediterranea FSS-150 *cyrJ* repeat1	....
R. mediterranea FSS-150 *cyrJ* repeat2	------...AA.....................................
Aphanizomenon sp. 10E6 *cyrJ* repeat1	....
Aphanizomenon sp. 10E6 *cyrJ* repeat2	..T...
Aph. ovalisporum ILC-164 *cyrJ* repeat1	........A....G....G...............A..TGC..T.A...
Aph. ovalisporum ILC-164 *cyrJ* repeat2	...................A............................
A. lapponica 966 *cyrJ* repeat1	........A...G.....G............T...C.T.C..T.A...
A. lapponica 966 *cyrJ* repeat2	........A...G.....GA.......A.....T.....C.....A..
Oscillatoria sp. PCC6506 *cyrJ* repeat1	.....A..A...T..T..G.G.............G.A..C....A...
Oscillatoria sp. PCC6506 *cyrJ* repeat2	..T..A..A.A.......G....................C........
L. wollei Yabba Creek *cyrJ* repeat1	........A...T.....A....................C...AA...
L. wollei Yabba Creek *cyrJ* repeat2	..T..C..AT........A....................C........

Figure S5 Alignment of repeated 48-nucleotide fragments within *cyrJ* gene sequences from CYNs-producing strains. Dash line, gaps introduced into the alignment; dots, nucleotides identical to repeat1 of *C. raciborskii* AWT205.

Itype1 TG *cyrI* 1	1	MTIYENKLSSYQKNQDAIISAKELEEWHLIGLLDHSIDAVIVPNYFLEQE
Itype2 LZ *cyrI* 1	1	MTIYENKLSSYQKNQDAIISAKELEEWHLIGLLDHSIDAVIVPNYFLEQE
Itype3 DZ *cyrI* 1	1	MTIYENKLSSYQKNQDAIISAKELEEWHLIGLLDHSIDAVIVPNYFLEQE
C. raciborskii AWT205 *cyrI*	1	MTIYENKLSSYQKNQDAIISAKELEEWHLIGLLDHSIDAVIVPNYFLEQE
Itype1 TG *cyrI* 1	51	CMTISERIKKSKYFSAYPGHPSVSRLGQELYECESELELAKYQEDAPTLI
Itype2 LZ *cyrI* 1	51	CMTISERIKKSKYFSAYPGHPSVSRLGQELYECESELELAKYQEDAPTLI
Itype3 DZ *cyrI* 1	51	CMTISERIKKSKYFSAYPGHPSVSRLGQELYECESELELAKYQEDAPTLI
C. raciborskii AWT205 *cyrI*	51	CMTISERIKKSKYFSAYPGHPSVSSLGQELYECESELELAKYQEDAPTLI
Itype1 TG *cyrI* 1	101	KEMRRLVHPYISPIDRLRVEVDDIWSYGCNLAKLGDKKLFAGIVREFKED
Itype2 LZ *cyrI* 1	101	KEMRRLVHPYISPIDRLRVEVDDIWSYGCNLAKLGDKKLFAGIVREFKED
Itype3 DZ *cyrI* 1	101	KEMRRLVHPYISPIDRLRVEVDDIWSYGCNLAKLGDKKLFAGIVREFKED
C. raciborskii AWT205 *cyrI*	101	KEMRRLVHPYISPIDRLRVEVDDIWSYGCNLAKLGDKKLFAGIVREFKED
Itype1 TG *cyrI* 1	151	NPGAPHCDVMAWGFL----------EYCKDKPNIINQIAANVYLKTSASG
Itype2 LZ *cyrI* 1	151	NPGAPHCDVMAWGFL----------EYYKDKPNIINQIAANVYLKTSASG
Itype3 DZ *cyrI* 1	151	NPGAPHCDVMAWGFLHCDVMAWGFLEYYKDKPNIINQIAANVYLKTSASG
C. raciborskii AWT205 *cyrI*	151	NPGAPHCDVMAWGFL----------EYYKDKPNIINQIAANVYLKTSASG
Itype1 TG *cyrI* 1	191	GEIVLWDEWPTQSEYIA--YKTDDPASFGLDSKKIAQPKLEIQPNQGDLI
Itype2 LZ *cyrI* 1	191	GEIVLWDEWPTQSEYIALAYKTDDPASFGLDSKKIAQPKLEIQPNQGDLI
Itype3 DZ *cyrI* 1	201	GEIVLWDEWPTQSEYIALAYKTDDPASFGLDSKKIAQPKLEIQPNQGDLI
C. raciborskii AWT205 *cyrI*	191	GEIVLWDEWPTQSEYIA--YKTDDPASFGLDSKKIAQPKLEIQPNQGDLI
Itype1 TG *cyrI* 1	239	LFNSMRIHAVKKIETGVRMTWGCL
Itype2 LZ *cyrI* 1	241	LFNSMRIHAVKKIETGVRMTWGCL
Itype3 DZ *cyrI* 1	251	LFNSMRIHAVKKIETGVRMTRGCL
C. raciborskii AWT205 *cyrI*	239	LFNSMRIHAVKKIETGVRMTWGCL

Figure S6 Predicted secondary structures of CyrI proteins. Bold line, α-helix and β-sheet; dash line, gaps introduced into the alignment; rectangle, amino acids involved in Fe^{2+} binding.

```
                                     α          β         α
Jtype1  TG cyrJ 2               1  RSLGTVLLQAWSSRPDTVVFDELLSFPYLFIKGKDMGFTWTDLDSSQMPH
Jtype2a TG cyrJ 1               1  RSLGTVLLQAWSSRPDTVVFDELLSFPYLFIKGKDMGFTWTDLDSSQMPH
Jtype2b SY cyrJ 1               1  RSLGTVLLQAWSSRPDTVVFDELLSFPYLFIKGKDMGFTWTDLDSSQMPH
Jtype3  TG cyrJ 7               1  RSLGTVLLQAWSSRPDTVVFDELLSFPYLFIKGKDMGFTWTDLDSSQMPH
C. raciborskii AWT205 cyrJ      1  RSLGTVLLQAWSSRPDTVVFDELLSFPYLFIKGKDMGFTWTDLDSSQMPH
                                     α              α               α
Jtype1  TG cyrJ 2              51  ADWRSVIDLLKAPLPEG---------------------------------K
Jtype2a TG cyrJ 1              51  ADWRSVIDLLKAPLPEGNLRSVIDLLKAPLPEG----------------K
Jtype2b SY cyrJ 1              51  ADWRSVIDLLKAPLPDW--RSVIDLLKAPLPEG----------------K
Jtype3  TG cyrJ 7              51  ADWRSVIDLLKAPLPEGNLRSVIDLLKAPLPEGNLRSVIDLLKAPLPEGK
C. raciborskii AWT205 cyrJ     51  ADWRSVIDLLKAPLPEG--KSIIDLLKAPLPEG----------------K
                                    β               α      β      α     α
Jtype1  TG cyrJ 2              69  SICYQKHQAYHLIEETMGIEWISPFSNCFLIRQPKEMLLSFRKIVPHFTF
Jtype2a TG cyrJ 1              85  SICYQKHQAYHLIEETMGIEWILPFSNCFLIRQPKEMLLSFRKIVPHFTF
Jtype2b SY cyrJ 1              83  SICYQKHQAYHLIEETMGIEWILPFSNCFLIRQPKEMLLSFRKIVPHFTF
Jtype3  TG cyrJ 7             101  SICYQKHQAYHLIEETMGIEWILPFSNCFLIRQPKEMLLSFRKIVPHFTF
C. raciborskii AWT205 cyrJ     83  SICYQKHQAYHLIEETMGIEWILPFSNCFLIRQPKEMLLSFRKIVPHFTF
                                         α               β    α         α
Jtype1  TG cyrJ 2             119  EETGWIELKRLFDYVHQTSGVIPPVIDAHDLLNDPRRMLSKLCQVVGVEF
Jtype2a TG cyrJ 1             135  EETGWIELKRLFDYVHQTSGVIPPVIDAHDLLNDPQRMLSKLCQVVGVEF
Jtype2b SY cyrJ 1             133  EETGWIELKRLFDYVHQTSGVIPPVIDAHDLLNGPRRMLSKLCQVVGVEF
Jtype3  TG cyrJ 7             151  EETGWIELKRLFDYVHQTSGVIPPVIDARDLLNDPWRMLSKLCQVVGVEF
C. raciborskii AWT205 cyrJ    133  EETGWIELKRLFDYVHQTSGVIPPVIDAHDLLNDPRRMLSKLCQVVGVEF
                                                α
Jtype1  TG cyrJ 2             169  TETMLSWPPMEVELNEKLAPWYSTVASSTHFRSYQNK
Jtype2a TG cyrJ 1             185  TETMLSWPPMEVELNEKLAPWYSTVASSTRFRSYQNK
Jtype2b SY cyrJ 1             183  TETMLSWPPMEVELNEKLAPWYSTVASSTHFRSYQNK
Jtype3  TG cyrJ 7             201  TETMLSWPPMEVELNEKLAPWYSTVASSTHFRSYQNK
C. raciborskii AWT205 cyrJ    183  TETMLSWPPMEVELNEKLAPWYSTVASSTHFHSYQNK
```

Figure S7 Predicted secondary structures of CyrJ proteins. Bold line, α-helix and β-sheet; dash line, gaps introduced into the alignment.

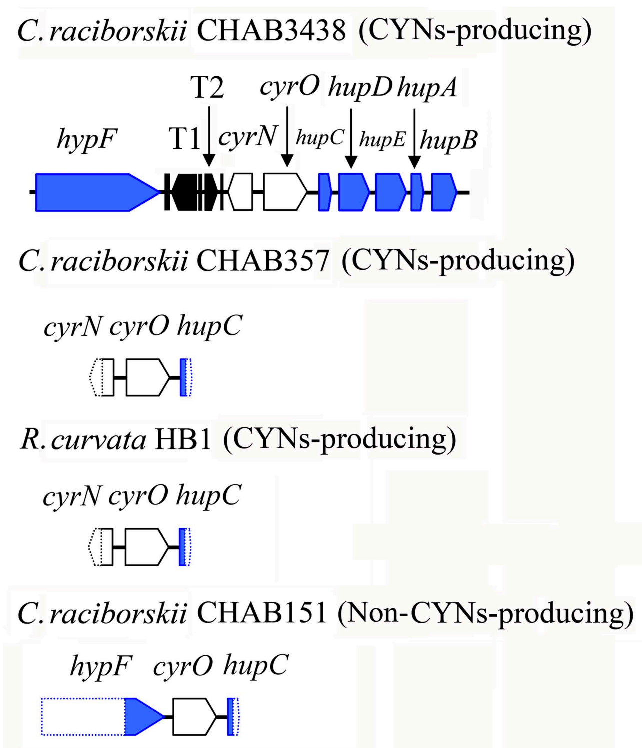

Figure S8 *hyp* genes and intergenic sequences in CYNs-producing and non-CYNs-producing cyanobacterial strains. Blue bar, *hyp* genes; white bar, *cyrN* and *cyrO* genes; black bar, transposase or vestiges thereof; dash line, gene regions which were not sequenced.

Table S1 Details of cyanobacterial strains used in this study.

Cyanobacteria	**Geographic origin**	**Year of isolation**
Microcystis		
Microcystis sp.		
CHAB3377	Nuoshan reservoir, Qingdao, Shandong	2007
CHAB3393	Fish pond, Nanjing, Jiangsu	2007
CHAB4373	Three gorges reservoir, Yichang, Hubei	2008
CHAB4368	Erhai lake, Dali, Yunnan	2007
M. aeruginosa		
CHAB3390	Chaohu lake, Anhui	2007
CHAB453	Fish pond, Wuhan, Hubei	2006
M. flos-aquae		
Two strains	Guazhu lake, Shaoxing, Zhejiang	2006
M. botrys		
CHAB331	Xihu lake, Hangzhou, Zhejiang	2006
CHAB342	Hang-Yong canal, Shaoxing, Zhejiang	2006
CHAB3382	Erhai lake, Dali, Yunnan	2007
M. viridis		
CHAB3379	Xingyun lake, Yuxi, Yunnan	2007
M. smithii		
CHAB3301	Fish pond, Kunming, Yunnan	2006
M. wesenbergii		
CHAB328	Guanqiao pond, Wuhan, Hubei	2006
CHAB1418	Dianchi lake, Kunming, Yunnan	2006
CHAB4372	Erhai lake, Dali, Yunnan	2007
Cylindrospermopsis		
C. raciborskii		
Twelve strains	Fish pond, Kunming, Yunnan	2006
Eight strains	Wenshan lake, Shenzhen, Guangdong	2006
Two strains	Shiyan reservoir, Shenzhen, Guangdong	2006
Four strains	Fish pond, Panyu, Guangdong	2012
Nine strains	Nanhu lake, Wuhan, Hubei	2006
Eight strains	Donghu lake, Wuhan, Hubei	2012
Six strains	Chidong lake, Qichun, Hubei	2006
Twenty strains	Liangzi lake, Ezhou, Hubei	2006, 2011
CHAB3412	Qiaodun lake, Daye, Hubei	2011
Three strains	Lushui reservoir, Chibi, Hubei	2012
Eight strains	Xianghu lake, Hangzhou, Zhejiang	2012
CHAB3447	Xihu lake, Hangzhou, Zhejiang	2012
Seventeen strains	Qiandao lake, Hangzhou, Zhejiang	2012

Two strains	Dongqian lake, Ningbo, Zhejiang	2012
Raphidiopsis		
R. curvata		
CHAB341	Fusha reservoir, Zhongshan, Guangdong	2006
CHAB3360	Donghu lake, Wuhan, Hubei	2006
HB1	Guanqiao pond, Wuhan, Hubei	1995
Two strains	Chidong lake, Qichun, Hubei	2006
Four strains	Qiaodun lake, Daye, Hubei	2011
Three strains	Jinyang lake, Taiyuan, Shanxi	2010
CHAB3411	Xianghu lake, Hangzhou, Zhejiang	2011
Four strains	Xihu lake, Hangzhou, Zhejiang	2012
Two strains	Qiandao lake, Hangzhou, Zhejiang	2012
R. mediterranea		
Three strains	Donghu lake, Wuhan, Hubei	2006, 2012
HB2	Guanqiao pond, Wuhan, Hubei	2006
Two strains	Chidong lake, Qichun, Hubei	2006
CHAB3326	Liangzi lake, Ezhou, Hubei	2006
CHAB3422	Lushui reservoir, Chibi, Hubei	2012
CHAB3468	Qiandao lake, Hangzhou, Zhejiang	2012
Anabaena		
Anabaena sp.		
Two strains	Dianchi lake, Kunming, Yunnan	2007
CHAB4327	Fish pond, Kunming, Yunnan	2006
Two strains	Donghu lake, Wuhan, Hubei	2006
CHAB336	Guanqiao pond, Wuhan, Hubei	2006
CHAB4325	Xinghu lake, Wuhan, Hubei	2006
CHAB4304	Fish pond, Nanjing, Jiangsu	2007
CHAB4307	Guazhu lake, Shaoxing, Zhejiang	2007
Four strains	Poyang lake, Jiangxi	2012
A. eucompacta		
Four strains	Nanhu lake, Wuhan, Hubei	2006
Two strains	Guanqiao pond, Wuhan, Hubei	2006
CHAB1040	Chidong lake, Qichun, Hubei	2006
A. spirioides		
CHAB511	Guanqiao pond, Wuhan, Hubei	2006
CHAB5152	Poyang lake, Jiangxi	2012
A. ucrainica		
Seven strains	Dianchi lake, Kunming, Yunnan	2006, 2007
Nine strains	Erhai lake, Dali, Yunnan	2006
A. flos-aquae		
Three strains	Three gorges reservoir, Yichang, Hubei	2008
HAB634	Chidong lake, Qichun, Hubei	2006

Two strains	Nanhu lake, Wuhan, Hubei	2006
Three strains	Taihu lake, Wuxi, Jiangsu	2009
Two strains	Poyang lake, Jiangxi	2012
A. oumiana		
Three strains	Guanqiao pond, Wuhan, Hubei	2006
CHAB5110	Poyang lake, Jiangxi	2012
A. aphanizomenioides		
Two strains	Wenshan lake, Shenzhen, Guangdong	2006
Two strains	Chidong lake, Qichun, Hubei	2006
CHAB2313	Honghu lake, Honghu, Hubei	2006
Two strains	Yuyuantan park, Beijing	2006
A. affinis		
Two strains	Dianchi lake, Kunming, Yunnan	2007
Two strains	Three gorges reservoir, Yichang, Hubei	2008
CHAB960	Chidong lake, Qichun, Hubei	2006
Three strains	Poyang lake, Jiangxi	2012
A. kisseleviana		
CHAB2398	Wenshan lake, Shenzhen, Guangdong	2006
Four strains	Longhu lake, Daqing, Heilongjiang	2012
A. crassum		
Three strains	Poyang lake, Jiangxi	2012
A. planktonic		
Two strains	Poyang lake, Jiangxi	2012
A. circinalis		
CHAB5160	Poyang lake, Jiangxi	2012
Aphanizomenon		
Aph. issatschenkoi		
CHAB628	Dianchi lake, Kunming, Yunnan	2007
Seven strains	Chidong lake, Qichun, Hubei	2006
Two strains	Honghu lake, Honghu, Hubei	2006
Four strains	Donghu lake, Wuhan, Hubei	2006
CHAB D3	Xinghu lake, Wuhan, Hubei	2007
Aph. flos-aquae		
Three strains	Dianchi lake, Kunming, Yunnan	2006, 2007
Three strains	Erhai lake, Dali, Yunnan	2006
Four strains	Three gorges reservoir, Yichang, Hubei	2008
Aph. gracile		
FACHB-1039	Dianchi lake, Kunming, Yunnan	2004
CHAB1468	Yuehu lake, Wuhan, Hubei	2007
Planktothrix		
P. agardhii		
Three strains	Dianchi lake, Kunming, Yunnan	2007

Three strains	Fish pond, Kunming, Yunnan	2006
CHAB683	Erhai lake, Dali, Yunnan	2007
Two strains	Fusha reservoir, Zhongshan, Guangdong	2006
Three strains	Nanhu lake, Wuhan, Hubei	2006
Two strains	Chidong lake, Qichun, Hubei	2006
CHAB643	Guanqiao pond, Wuhan, Hubei	2007
CHAB679	Yuehu lake, Wuhan, Hubei	2007
Three strains	Majianggong river, Jinxian, Jiangxi	2006
CHAB662	Taihu lake, Wuxi, Jiangsu	2007
Three strains	Hang-Yong canal, Shaoxing, Zhejiang	2006
Two strains	Fuchunjiang waterworks, Hangzhou, Zhejiang	2006
CHAB619	Dishui lake, Shanghai	2006
Six strains	Yuyuantan park, Beijing	2006, 2007
Three strains	Ulungur lake, Fuhai, Xinjiang	2007
P. raciborskii		
CHAB626	Fish pond, Kunming, Yunnan	2006
P. mougeotii		
Two strains	Erhai lake, Dali, Yunnan	2008
Three strains	Manmade wetland, Guangzhou, Guangdong	2007
P. spiroides		
CHAB4340	Guazhu lake, Shaoxing, Zhejiang	2007
Planktothrix sp.		
Two strains	Erhai lake, Dali, Yunnan	2008
Four strains	Poyang lake, Jiangxi	2012
Four strains	Longhu lake, Daqing, Heilongjiang	2012
Lyngbya		
Lyngbya sp.		
Three strains	Fish pond, Kunming, Yunnan	2007
Six strains	Erhai lake, Dali, Yunnan	2007
Two strains	Tianmu hotspring, Lushan, Jiangxi	2007
Six strains	Poyang lake, Jiangxi	2012
Three strains	Sward, Nanjing, Jiangsu	2009
Oscillatoria		
Oscillatoria sp.		
Two strains	Shiyan reservoir, Shenzhen, Guangdong	2007
Two strains	Fuchunjiang waterworks, Hangzhou, Zhejiang	2006
Pseudanabaena		
Pseudanabaena sp.		
CHAB2916	Erhai lake, Dali, Yunnan	2008

CHAB685	Donghu lake, Guangzhou, Guangdong	2008
Ten strains	Donghu lake, Wuhan, Hubei	2009
Twelve strains	Xinghu lake, Wuhan, Hubei	2009
Two strains	Guanqiao pond, Wuhan, Hubei	2006
CHAB2969	Taihu lake, Wuxi, Jiangsu	2008
CHAB3113	Jinyang lake, Taiyuan, Shanxi	2009
CHAB1496	Ulungur lake, Fuhai, Xinjiang	2007
Limnothrix		
Limnothrix sp.		
Five strains	Donghu lake, Wuhan, Hubei	2009
Three strains	Poyang lake, Jiangxi	2012
Other strains		
C. raciborskii AWT205	Australia	—
C. raciborskii cyDB-1	Brazil	2003
Aph. ovalisporum ILC-164	Israel	—

Table S2 Localization of water bodies investigated in this study.

Water bodies	Latitude and Longitude
Longhu lake, Daqing, Heilongjiang	46°42′N, 124°22′E
Jinyang lake, Taiyuan, Shanxi	37°46′N, 112°30′E
Fish pond, Qingdao, Shandong	37°46′N, 112°30′E
Taihu lake, Wuxi, Jiangsu	30°55′–31°33′N, 119°53′–120°36′E
Fish pond, Nanjing, Jiangsu	32°01′N, 118°49′E
Qiandao lake, Hangzhou, Zhejiang	29°26′–29°42′N, 118°43′–119°11′E
Xianghu lake, Hangzhou, Zhejiang	30°09′N, 120°13′E
Xihu lake, Hangzhou, Zhejiang	30°14′N, 120°08′E
Dongqian lake, Ningbo, Zhejiang	29°45′N, 121°39′E
Donghu lake, Wuhan, Hubei	30°33′N, 114°23′E
Tangxun lake, Wuhan, Hubei	30°25′N, 114°20′E
Guanqiao Pond, Wuhan, Hubei	30°31′N, 114°23′E
Liangzi lake, Ezhou, Hubei	30°15′N, 114°30′E
Qiaodun lake, Daye, Hubei	30°06′N, 114°56′E
Chidong lake, Qichun, Hubei	29°47′N, 115°41′E
Lushui reservoir, Chibi, Hubei	29°41′N, 113°55′E
Poyang lake, Nanchang, Jiangxi	28°22′–29°45′N, 115°47′–116°45′E
Erhai lake, Dali, Yunnan	25°35′–25°58′N, 100°5′–100°17′E
Fish pond, Kunming, Yunnan	24°56′N, 102°42′E
Dongzhen reservoir, Putian, Fujian	25°28′N, 118°56′E
Fish pond, Panyu, Guangdong	22°56′N, 113°18′E
Shiyan reservoir, Shenzhen	22°41′N, 113°54′E
Qiankeng reservoir, Shenzhen	22°41′N, 114°0′E
Tiegang reservoir, Shenzhen	22°37′N, 113°52′E
Luotian reservoir, Shenzhen	22°51′N, 113°52′E
Changliupi reservoir, Shenzhen	22°43′N, 113°51′E
Wenshan lake, Shenzhen	22°32′N, 113°55′E

Table S3 GenBank accession numbers of reference gene sequences used in the phylogenetic analysis.

Organism	Gene region			
	rpoC1	*cyrA*	*cyrI*	*cyrJ*
C. raciborskii AWT205	KJ139708	EU140798	EU140798	EU140798
C. raciborskii CS-505	ACYA01000039	ACYA01000027	ACYA01000027	ACYA01000027
C. raciborskii cyDB-1	KJ139709	KJ139707	KJ139696	KJ139693
C. raciborskii CHAB151	KJ139719	—	—	—
C. raciborskii CHAB358	KJ139714	KJ139742	KJ139742	KJ139742
C. raciborskii CHAB1351	KJ139720	—	—	—
C. raciborskii CHAB3409	KJ139725	—	—	—
C. raciborskii CHAB3412	KJ139726	—	—	—
C. raciborskii CHAB3424	KJ139727	—	—	—
C. raciborskii CHAB3438	KJ139716	KJ139743	KJ139743	KJ139743
C. raciborskii CHAB5182	KJ139729	—	—	—
R. mediterranea CHAB1355	KJ139721	—	—	—
R. mediterranea CHAB3326	KJ139722	—	—	—
R. mediterranea CHAB3428	KJ139730	—	—	—
R. mediterranea CHAB3433	KJ139715	—	—	—
R. mediterranea CHAB3468	KJ139731	—	—	—
R. mediterranea HB2	KJ139724	—	—	—
R. mediterranea FSS-150	—	—	—	KC342468
R. curvata CHAB341	KJ139712	—	—	—
R. curvata CHAB1150	KJ139711	JN873921	JN873921	JN873921
R. curvata CHAB3405	KJ139732	—	—	—
R. curvata CHAB3413	KJ139735	—	—	—
R. curvata CHAB3416	KJ139723	KJ139706	KJ139687	KJ139692
R. curvata CHAB3448	KJ139737	—	—	—
R. curvata HB1	KJ139718	KJ139745	KJ139745	KJ139745
R. brookii D9	ACYB01000007	—	—	—
Aphanizomenon sp. 10E6	—	GQ385961	GQ385961	GQ385961
Aphanizomenon sp. 22D11	—	GQ385960	—	—
Aph. ovalisporum ILC-164	—	AF395828	KJ139697	KJ139694
Aph. gracile ANA196-A	JQ811806.1	—	—	—
A. lapponica 966	—	—	—	KC342460
A. variabilis ATCC29413	CP000117	—	—	—
U. natans TAC101	—	AY897605	—	—
L. wollei Yabba Creek	—	—	—	KC342466
Oscillatoria sp. PCC6506	—	FJ418586	FJ418586	FJ418586
Oscillatoria sp. PCC7926	—	—	HQ690088	—

Table S4 Extracellular and intracellular CYNs in the cultures of four CYNs-producing cyanobacterial strains at the 3rd day and the 7th day.

Strain [a]		**AWT205**	**CHAB358**	**CHAB3438**	**CHAB1150**
0 day	OD_{680}	0.13	0.13	0.13	0.13
3rd day	OD_{680}	0.29 ± 0.01 [b]	0.24 ± 0.00	0.34 ± 0.00	0.34 ± 0.01
	CYN (μg)	1.58 ± 0.36 [c] (4.23 ± 0.43)	–	2.84 ± 0.22 (9.12 ± 1.18)	–
	7-deoxy-CYN (μg)	0.06 ± 0.01 (0.20 ± 0.00)	2.19 ± 0.07 (8.03 ± 0.08)	0.23 ± 0.02 (0.27 ± 0.05)	2.31 ± 0.16 (13.04 ± 0.42)
7th day	OD_{680}	0.56 ± 0.02	0.34 ± 0.00	0.61 ± 0.02	0.58 ± 0.01
	CYN (μg)	6.71 ± 0.22 (10.32 ± 0.82)	–	8.78 ± 1.89 (20.42 ± 3.52)	–
	7-deoxy-CYN (μg)	0.31 ± 0.02 (0.39 ± 0.03)	5.50 ± 0.33 (17.14 ± 0.36)	0.56 ± 0.12 (0.54 ± 0.17)	9.78 ± 1.32 (28.32 ± 1.91)

[a], The strain numbers were described in the main text.

[b], Mean ± SD.

[c], Extracellular and intracellular (in parentheses) toxins in 100 ml culture.