

Title: Novel groups and unique distribution of phage *phoH* genes in paddy waters in northeast China

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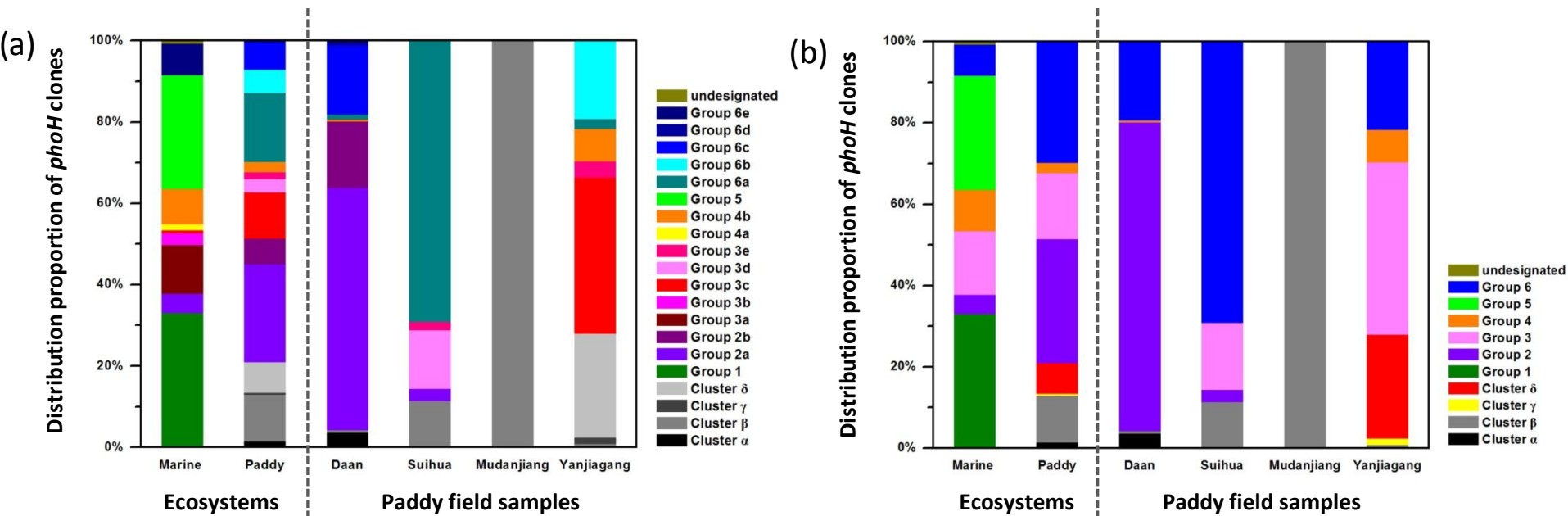


Fig. S1. Comparison of distribution proportions of the phage *phoH* clones in different groups. (a) The group/subgroup composition of each sample; (b) The overall group composition of each sample by collapsing the subgroups. The phage *phoH* clones were obtained from paddy samples from Daan, Suihua, Mudanjiang and Yanjiagang in this study and from marine samples from the Sargasso Sea and worldwide oceans²³.

Table S1. Properties of soil samples collected from open paddy fields.

Sample	Location	Soil type	Latitude and longitude	Total P (g kg ⁻¹)	Total C (g kg ⁻¹)	Total N (g kg ⁻¹)	C/N	pH
DA	Daan, Jilin	Saline-alkaline soil	45 °36 N,123 °50 E	0.45	12.52	0.47	26.64	7.46
SH	Suihua, Heilongjiang	Black soil	46 °43 N,126 °59 E	1.00	34.69	2.56	13.55	5.76
MDJ	Mudanjiang, Heilongjiang	Dark brown soil	44 °26 N,129 °29 E	0.63	15.21	0.99	15.36	6.10
YJG	Yanjiagang, Heilongjiang	Black soil	45 °35 N,126 °20 E	0.50	14.06	0.91	15.45	5.67

C, carbon; N, nitrogen; P, phosphorus.

Table S2. Source of phage *phoH* sequences used for the NMDS analysis.

Source	Sample site	NCBI accession number	Number of clones	Reference
Paddy	Daan		166	
	Suihua	KX189635-KX190058	97	This study
	Mudanjiang		36	
	Yanjiagang		125	
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Marine	Raunefjorden		18	
	British Columbia		18	
	Gulf of Mexico		19	
	Kongsfjorden		19	
	Mediterranean Sea	JF963974-JF964153	18	Goldsmith <i>et al.</i> 2011
	Sargasso Sea	JF964160-JF964251	69	
	Sargasso Sea 0m		38	
	Sargasso Sea 200m		21	
	Sargasso Sea 500m		24	
	Sargasso Sea 1000m		28	

Table S3. The closest relative and the distribution of phylogenetic groups of sequenced *phoH* clones from the four paddy water samples at the amino acid level in this study.

Clone name	Length ^a	Closest relative			Alignment	Identity (%)	Phylogenetic group
		Clone/isolate	Source	Accession number ^b			
SH-phoH-1	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-2	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-3	129	SAR_0m_phoH_30	Sargasso Sea	AEQ27325	74/128	58	Group 3e
SH-phoH-4	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-5	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-6	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-7	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-8	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-9	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-10	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-11	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-12	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	75/134	56	Group 3d
SH-phoH-13	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-14	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-15	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-16	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-17	132	SAR_1000m_phoH_11	Sargasso Sea	AEQ27389	74/134	55	Group 3d
SH-phoH-18	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-19	128	SAR_phoH_Mar_2011_0m_04	Sargasso Sea	AKV56976	69/127	54	Group β
SH-phoH-20	129	MED_phoH_13	Mediterranean surface water	AEQ27550	74/128	58	Group 6a
SH-phoH-21	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	75/134	56	Group 3d
SH-phoH-22	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	75/134	56	Group 3d
SH-phoH-23	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-24	135	SAR_phoH_Sept_2010_0m_09	Sargasso Sea	AKV56959	114/134	85	Group 2a
SH-phoH-25	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-26	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	75/134	56	Group 3d
SH-phoH-27	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-28	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-29	132	SAR_phoH_Sept_2011_100m_02	Sargasso Sea	AKV57024	75/134	56	Group 3d
SH-phoH-30	135	SAR_phoH_Sept_2010_0m_09	Sargasso Sea	AKV56959	113/134	84	Group 2a
SH-phoH-31	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-32	129	MED_phoH_13	Mediterranean surface water	AEQ27550	77/128	60	Group 6a
SH-phoH-33	129	MED_phoH_13	Mediterranean surface water	AEQ27550	74/128	58	Group 6a
SH-phoH-34	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-35	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-36	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-37	132	SAR_1000m_phoH_11	Sargasso Sea	AEQ27389	74/134	55	Group 3d
SH-phoH-38	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-39	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-40	132	SAR_phoH_Sept_2011_100m_02	Sargasso Sea	AKV57024	74/134	55	Group 3d
SH-phoH-41	129	MED_phoH_13	Mediterranean surface water	AEQ27550	73/128	57	Group 6a
SH-phoH-42	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	75/134	56	Group 3d
SH-phoH-43	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-44	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-45	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-46	132	SAR_1000m_phoH_11	Sargasso Sea	AEQ27389	74/134	55	Group 3d
SH-phoH-47	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-48	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-49	129	MED_phoH_13	Mediterranean surface water	AEQ27550	77/128	60	Group 6a
SH-phoH-50	132	SAR_1000m_phoH_11	Sargasso Sea	AEQ27389	72/134	54	Group 3d
SH-phoH-51	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-52	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-53	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-54	129	MED_phoH_13	Mediterranean surface water	AEQ27550	77/128	60	Group 6a
SH-phoH-55	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-56	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-57	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-58	129	SAR_0m_phoH_30	Sargasso Sea	AEQ27325	73/128	57	Group 3e
SH-phoH-59	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-60	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-61	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	75/134	56	Group 3d
SH-phoH-62	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-63	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-64	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-65	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-66	129	MED_phoH_13	Mediterranean surface water	AEQ27550	77/128	60	Group 6a
SH-phoH-67	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-68	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-69	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	74/134	55	Group 3d
SH-phoH-70	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-71	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-72	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-73	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-74	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-75	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-76	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a

SH-phoH-77	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-78	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-79	132	SAR_0m_phoH_29	Sargasso Sea	AEQ27324	75/134	56	Group 3d
SH-phoH-80	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-81	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-82	135	SAR_phoH_Sept_2010_0m_09	Sargasso Sea	AKV56959	113/134	84	Group 2a
SH-phoH-83	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-84	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-85	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
SH-phoH-86	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-87	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-88	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-89	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-90	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-91	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-92	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-93	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-94	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-95	129	MED_phoH_13	Mediterranean surface water	AEQ27550	76/128	59	Group 6a
SH-phoH-96	129	MED_phoH_13	Mediterranean surface water	AEQ27550	75/128	59	Group 6a
SH-phoH-97	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-1	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-2	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-3	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-4	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-5	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-6	128	SAR_0m_phoH_30	Sargasso Sea	AEQ27325	75/128	59	Group β
MDJ-phoH-7	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-8	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-9	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-10	128	SAR_0m_phoH_30	Sargasso Sea	AEQ27325	73/128	57	Group β
MDJ-phoH-11	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-12	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-13	128	SAR_phoH_Mar_2011_0m_04	Sargasso Sea	AKV56976	69/127	54	Group β
MDJ-phoH-14	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-15	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-16	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-17	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	69/127	54	Group β
MDJ-phoH-18	128	SAR_0m_phoH_37	Sargasso Sea	AEQ27332	70/127	55	Group β
MDJ-phoH-19	128	SAR_phoH_Mar_2011_0m_04	Sargasso Sea	AKV56976	69/127	54	Group β
MDJ-phoH-20	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	71/127	56	Group β
MDJ-phoH-21	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-22	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-23	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-24	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-25	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	69/127	54	Group β
MDJ-phoH-26	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-27	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-28	128	SAR_phoH_Mar_2011_0m_04	Sargasso Sea	AKV56976	69/127	54	Group β
MDJ-phoH-29	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-30	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	69/127	54	Group β
MDJ-phoH-31	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	69/127	54	Group β
MDJ-phoH-32	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-33	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-34	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	68/127	54	Group β
MDJ-phoH-35	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
MDJ-phoH-36	128	GOM_phoH_09	Gulf of Mexico	AEQ27527	70/127	55	Group β
DA-phoH-1	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-2	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	105/134	78	Group 2b
DA-phoH-3	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	114/134	85	Group 2a
DA-phoH-4	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-5	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-6	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	113/134	84	Group 2a
DA-phoH-7	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	106/134	79	Group 2b
DA-phoH-8	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-9	129	MED_phoH_02	Mediterranean Sea	AEQ27539	79/128	62	Group 6c
DA-phoH-10	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	107/134	80	Group 2b
DA-phoH-11	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	106/134	79	Group 2b
DA-phoH-12	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	105/134	78	Group 2b
DA-phoH-13	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-14	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-15	135	<i>Synechococcus</i> phage S-RSM4	Red Sea	YP_003097238	114/134	85	Group 2a
DA-phoH-16	129	SAR_0m_phoH_30	Sargasso Sea	AEQ27325	66/128	52	Group α
DA-phoH-17	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-18	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	122/134	91	Group 2a
DA-phoH-19	129	MED_phoH_02	Mediterranean Sea	AEQ27539	77/128	60	Group 6c
DA-phoH-20	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-21	129	MED_phoH_02	Mediterranean Sea	AEQ27539	77/128	60	Group 6c
DA-phoH-22	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	115/134	86	Group 2a
DA-phoH-23	135	<i>Synechococcus</i> phage S-RSM4	Red Sea	YP_003097238	114/134	85	Group 2a
DA-phoH-24	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	107/134	80	Group 2b
DA-phoH-25	129	MED_phoH_08	Mediterranean Sea	AEQ27545	77/128	60	Group 6c
DA-phoH-26	135	<i>Synechococcus</i> phage S-SSM7	Sargasso Sea	YP_004324370	121/134	90	Group 2a
DA-phoH-27	135	uncultured Mediterranean phage uvMED	Mediterranean Sea	BAR30472	106/134	79	Group 2b

YJG-phoH-30	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-31	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	57/124	46	Group 4b
YJG-phoH-32	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-33	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 6b
YJG-phoH-34	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 6b
YJG-phoH-35	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-36	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-37	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-38	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-39	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 4b
YJG-phoH-40	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 4b
YJG-phoH-41	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-42	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 2a
YJG-phoH-43	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	58/124	47	Group 6b
YJG-phoH-44	127	<i>Acinetobacter</i> phage YMC13/03/R2096	South Korea	YP_009146825	56/124	45	Group γ
YJG-phoH-45	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 4b
YJG-phoH-46	128	SAR_phoH_27	Sargasso Sea	AEQ27433	83/128	65	Group 6b
YJG-phoH-47	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 2a
YJG-phoH-48	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 2a
YJG-phoH-49	129	MED_phoH_02	Mediterranean Sea	AEQ27539	80/128	63	Group 2a
YJG-phoH-50	129	SAR_phoH_67	Sargasso Sea	AEQ27473	81/128	63	Group 4b
YJG-phoH-51	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6b
YJG-phoH-52	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6b
YJG-phoH-53	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 2a
YJG-phoH-54	129	MED_phoH_08	Mediterranean Sea	AEQ27545	80/128	63	Group 6b
YJG-phoH-55	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6a
YJG-phoH-56	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 3e
YJG-phoH-57	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	80/130	62	Group 2a
YJG-phoH-58	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 2a
YJG-phoH-59	128	SAR_phoH_27	Sargasso Sea	AEQ27433	83/128	65	Group 6b
YJG-phoH-60	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group 2a
YJG-phoH-61	129	MED_phoH_02	Mediterranean Sea	AEQ27539	80/128	63	Group 6b
YJG-phoH-62	198	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group 4b
YJG-phoH-63	129	SAR_phoH_27	Sargasso Sea	AEQ27433	77/128	60	Group 2a
YJG-phoH-64	129	SAR_phoH_67	Sargasso Sea	AEQ27473	81/128	63	Group 3e
YJG-phoH-65	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 2a
YJG-phoH-66	129	MED_phoH_08	Mediterranean Sea	AEQ27545	79/128	62	Group 2a
YJG-phoH-67	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group 2a
YJG-phoH-68	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6b
YJG-phoH-69	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6b
YJG-phoH-70	129	SAR_0m_phoH_30	Sargasso Sea	AEQ27325	73/128	57	Group 2a
YJG-phoH-71	128	SAR_phoH_27	Sargasso Sea	AEQ27433	83/128	65	Group 4b
YJG-phoH-72	128	SAR_phoH_27	Sargasso Sea	AEQ27433	83/128	65	Group 2a
YJG-phoH-73	129	MED_phoH_02	Mediterranean Sea	AEQ27539	79/128	62	Group δ
YJG-phoH-74	129	SAR_phoH_67	Sargasso Sea	AEQ27473	80/128	63	Group δ
YJG-phoH-75	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	80/130	62	Group δ
YJG-phoH-76	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	80/130	62	Group δ
YJG-phoH-77	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	80/130	62	Group δ
YJG-phoH-78	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group δ
YJG-phoH-79	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group δ
YJG-phoH-80	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group δ
YJG-phoH-81	129	SAR_phoH_67	Sargasso Sea	AEQ27473	81/128	63	Group δ
YJG-phoH-82	129	SAR_phoH_67	Sargasso Sea	AEQ27473	81/128	63	Group δ
YJG-phoH-83	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group δ
YJG-phoH-84	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group δ
YJG-phoH-85	129	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group δ
YJG-phoH-86	129	SAR_phoH_67	Sargasso Sea	AEQ27473	80/128	63	Group δ
YJG-phoH-87	129	MED_phoH_08	Mediterranean Sea	AEQ27545	80/128	63	Group δ
YJG-phoH-88	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	80/130	62	Group δ
YJG-phoH-89	129	MED_phoH_02	Mediterranean Sea	AEQ27539	80/128	63	Group δ
YJG-phoH-90	129	MED_phoH_08	Mediterranean Sea	AEQ27545	77/128	60	Group δ
YJG-phoH-91	129	BBC_phoH_01	British Columbia	AEQ27556	74/128	58	Group δ
YJG-phoH-92	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	81/130	62	Group δ
YJG-phoH-93	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group δ
YJG-phoH-94	129	MED_phoH_08	Mediterranean Sea;	AEQ27545	80/128	63	Group δ
YJG-phoH-95	128	SAR_0m_phoH_37	Sargasso Sea	AEQ27332	80/127	63	Group δ
YJG-phoH-96	129	MED_phoH_08	Mediterranean Sea;	AEQ27545	80/128	63	Group δ
YJG-phoH-97	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group δ
YJG-phoH-98	129	BBC_phoH_01	British Columbia	AEQ27556	75/128	59	Group δ
YJG-phoH-99	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group δ
YJG-phoH-100	128	SAR_phoH_27	Sargasso Sea	AEQ27433	82/128	64	Group δ
YJG-phoH-101	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	80/130	62	Group δ
YJG-phoH-102	129	MED_phoH_02	Mediterranean Sea	AEQ27539	78/128	61	Group δ
YJG-phoH-103	129	SAR_phoH_67	Sargasso Sea	AEQ27473	78/128	61	Group δ
YJG-phoH-104	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group δ
YJG-phoH-105	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 2a
YJG-phoH-106	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6b
YJG-phoH-107	129	MED_phoH_08	Mediterranean Sea	AEQ27545	80/128	63	Group 2a
YJG-phoH-108	128	SAR_phoH_27	Sargasso Sea	AEQ27433	83/128	65	Group 2a
YJG-phoH-109	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6b
YJG-phoH-110	129	MED_phoH_02	Mediterranean Sea	AEQ27539	80/128	63	Group 3e
YJG-phoH-111	129	BBC_phoH_01	British Columbia	AEQ27556	74/128	58	Group 6b
YJG-phoH-112	129	MED_phoH_08	Mediterranean Sea	AEQ27545	77/128	60	Group 3e
YJG-phoH-113	129	BBC_phoH_01	British Columbia	AEQ27556	74/128	58	Group 6b

YJG-phoH-114	129	MED_phoH_08	Mediterranean Sea	AEQ27545	80/128	63	Group 6a
YJG-phoH-115	129	MED_phoH_08	Mediterranean Sea	AEQ27545	77/128	60	Group 2a
YJG-phoH-116	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	81/130	62	Group 6b
YJG-phoH-117	129	MED_phoH_02	Mediterranean Sea	AEQ27539	78/128	61	Group 2a
YJG-phoH-118	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 2a
YJG-phoH-119	128	SAR_100m_phoH_05	Sargasso Sea	AEQ27480	80/130	62	Group 2a
YJG-phoH-120	128	SAR_phoH_27	Sargasso Sea	AEQ27433	83/128	65	Group 2a
YJG-phoH-121	128	SAR_phoH_27	Sargasso Sea	AEQ27433	85/128	66	Group 6b
YJG-phoH-122	129	SAR_phoH_67	Sargasso Sea	AEQ27473	81/128	63	Group γ
YJG-phoH-123	129	SAR_phoH_67	Sargasso Sea	AEQ27473	81/128	63	Group 6b
YJG-phoH-124	128	SAR_phoH_27	Sargasso Sea	AEQ27433	84/128	66	Group 2a
YJG-phoH-125	129	MED_phoH_08	Mediterranean Sea	AEQ27545	80/128	63	Group 6b

^aThe length of amino acid residues.

^bAccession number of amino acid sequences.

Table S4. The statistical overview of the closest relative of the *phoH* clones from the four paddy water samples in this study.

Source	Accession number	Clone/isolate	Daan (166) ^a		Suihua (97) ^a		Mudanjiang (36) ^a		Yanjiagang (125) ^a	
			Number of clones	Identity (%)	Number of clones	Identity (%)	Number of clones	Identity (%)	Number of clones	Identity (%)
Sargasso Sea	YP_004324370	<i>Synechococcus</i> phage S-SSM7	75	84-90						
	AEQ27325	SAR_0m_phoH_30	10	51-63	2	57, 58	2	57, 59	1	57
	AEQ27392	SAR_1000m_phoH_14	1	61					6	48-68
	AEQ27324	SAR_0m_phoH_29			8	55, 56				
	AEQ27389	SAR_1000m_phoH_11			4	54, 55				
	AKV56976	SAR_phoH_Mar_2011_0m_04			1	54	3	54		
	AKV56959	SAR_phoH_Sept_2010_0m_09			3	84, 85				
	AKV57024	SAR_phoH_Sept_2011_100m_02			2	55, 56				
	AEQ27332	SAR_0m_phoH_37					1	55	1	63
	AEQ27433	SAR_phoH_27							39	60-66
	AEQ27473	SAR_phoH_67							9	61, 63
	AEQ27480	SAR_100m_phoH_05							9	62
	AEQ27394	SAR_1000m_phoH_16							6	68-70
Mediterranean Sea	BAR30472	uncultured phage uvMED	31	77-92						
	AEQ27539	MED_phoH_02	24	60-62					7	61-63
	AEQ27545	MED_phoH_08	2	60					11	60-63
	AEQ27550	MED_phoH_13	3	59, 60	67	57-60				
Gulf of Mexico	AEQ27527	GOM_phoH_09			10	55	30	54-56		
British Columbia	AEQ27556	BBC_phoH_01							4	58, 59
Red Sea	YP_003097238	<i>Synechococcus</i> phage S-RSM4	20	84-86						
South Korea	YP_009146825	<i>Acinetobacter</i> phage YMC13/03/R2096							32	45-47

^aNumber in parenthesis is the total number of clones obtained from each sample.