Key to vegetative cells of snow-inhabiting species of *Chloromonas* sensu Ettl (1970, 1983).

The key is mainly based on the previous key (Matsuzaki *et al.* 2018). Species examined using cultured material are marked with asterisks (on the basis of the supplemental references and the present study).

1. Cell inverted teardrop-shaped with a prominent posterior end ……………… *C. nivalis**

1. Cell not inverted teardrop-shaped with a prominent posterior end
…………………………………………………………………………………… 2

2. Cell not elongate or ellipsoidal ………………………………………………….3

2. Cell elongate or ellipsoidal ………………………………………………………… 6

3. Cell with prominent anterior papilla ………………………………………… 4

3. Cell without prominent anterior papilla ………………………………………… 5

4. Two contractile vacuoles positioned near the base of flagella; anterior papilla without concave top face; maximum cell length less than 15 µm ………………..*C. andreii*

4. Four contractile vacuoles positioned near the base of flagella; anterior papilla with concave top face; maximum cell length more than 15 µm……………………*C. rubroleosa*

5. Cell ovoid or pyriform …………………………………………………… *C. brevispina*

5. Cell almost spherical ……………………………………………… *C. miwae**

6. Chloroplast asteroid-shaped; maximum cell length more than 40 µm

…………………………………………………………………. *C. bolyaiana*

6. Chloroplast not asteroid-shaped; maximum cell length less than 40 µm

…………………………………………………………………………… 7

7. Cell elongate kidney to elongate bean shaped ………………………………………… 8

7. Cell elongate cylindrical, elongate ellipsoidal, elongate ovoid or ellipsoidal
…………………………………………………………………………...12

8. Chloroplast cup-shaped ……………………………………………..…. *C. rostafinskii*

8. Chloroplast parietal on the dorsal side of the cell ………………………………… 9

9. Chloroplast with a longitudinal slit in the anterior half of the chloroplast; cell aggregates (more than 16 cells) formed in old cultures ……………...……..*C. polyptera**

9. Chloroplast without a longitudinal slit in the anterior half of the chloroplast; cell aggregates not formed in old cultures ……………………………………………… 10

10. Chloroplast filling in the posterior end of the protoplast …………… *C. krienitzii**

10. Chloroplast not filling in the posterior end of the protoplast ……………………… 11

11. Maximum cell width less than 10 µm; zoospores formed within the parental cell up to eight
…………………… ………………………………………… *C. fukushimae**

11. Maximum cell width more than 10 µm; zoospores formed within the parental cell generally up to four
…………………………………………… *C. hindakii**

12. Chloroplast seemingly composed of elongate ovoid or elongate cylindrical platelets ………………………………………………………………………… 13

12. Chloroplast seemingly composed of angular discs ……………………… 15

13. Cell aggregates formed in old cultures; zoospores formed within the parental cell up to 16 …………………………………………………………… *C. tughillensis**

13. Cell aggregates not formed in old cultures; zoospores formed within the parental cell up to four or eight …………………………………………………………………… 14

14. Cell elongate ellipsoidal; zoospores formed within the parental cell up to eight

………………..…………………………………………………… *C. hohamii**

14. Cell elongate cylindrical; zoospores formed within the parental cell up to four

……………………………………………………….……………… *C. tenuis**

15. Eyespot absent ……………………………………………….……………… 16

15. Eyespot present …………………………………………….………………… 18

16. Cell aggregates formed in old cultures ……………………………..…… *C. pichinchae**

16. Cell aggregates not formed in old cultures ……………………………………… 17

17. Maximum cell length more than 20 µm; maximum cell width more than 13 µm ……………………………………………………..… *C. chenangoensis**

17. Maximum cell length less than 20 µm; maximum cell width less than 13 µm …………………………………………………………….…… *C. hoshawii**

18. Maximum cell length less than 15 µm ……………………..……..… *C. alpina*

18. Maximum cell length more than 15 µm …………………………………………….…… 19

19. Maximum cell length more than 25 µm; cell aggregates formed in old cultures

……………………………………………………………..…… *C. remiasii**

19. Maximum cell length less than 25 µm; cell aggregates not formed in old cultures

………………………………………………………………………………… 20

20. Zoospores formed within the parental cell up to eight; eyespot positioned in the anterior half to one third of the cell ………………………………… *C. muramotoi**

20. Zoospores formed within the parental cell up to four; eyespot positioned irregularly in the posterior third to anterior third of the cell ………………… *C. kaweckae* sp. nov.*

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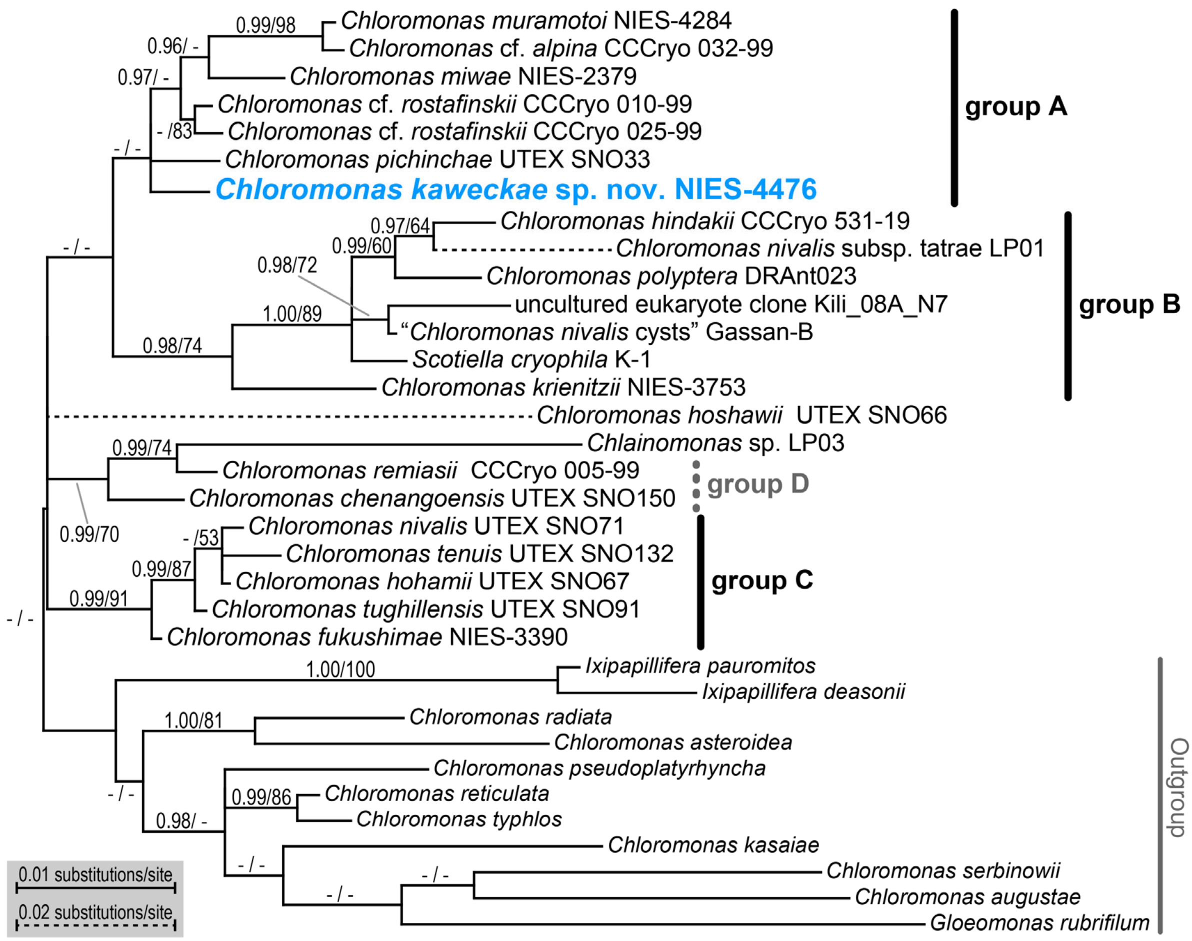

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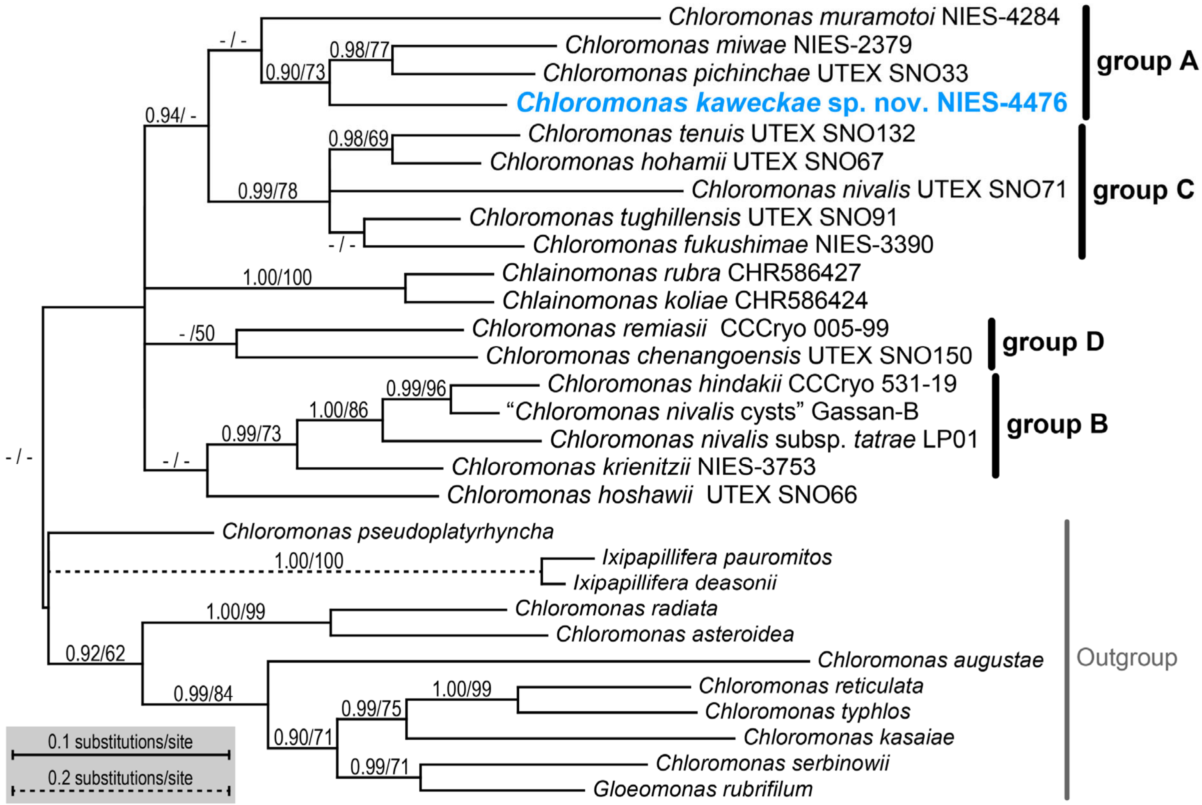
0.96/ -
Chloromonas cf. alpina CCCryo 032-99
0.97/ -
Chloromonas miwae NIES-2379
Chloromonas cf. rostafinskii CCCryo 010-99
- /83
Chloromonas cf. rostafinskii CCCryo 025-99
- / -
Chloromonas pichinchae UTEX SNO33
Chloromonas kaweckae sp. nov. NIES-4476
group A
0.97/64
Chloromonas hindakii CCCryo 531-19
0.99/60
Chloromonas nivalis subsp. tatrae LP01
- / -
0.98/72
Chloromonas polyptera DRAnt023
uncultured eukaryote clone Kili_08A_N7
1.00/89
"Chloromonas nivalis cysts" Gassan-B
0.98/74
Scotiella cryophila K-1
Chloromonas krienitzii NIES-3753
group B
Chloromonas hoshawii UTEX SNO66
0.99/74
Chlainomonas sp. LP03
Chloromonas remiasii CCCryo 005-99
group D
Chloromonas chenangoensis UTEX SNO150
0.99/70
Chloromonas nivalis UTEX SNO71
- /53
Chloromonas tenuis UTEX SNO132
0.99/87
Chloromonas hohamii UTEX SNO67
group C
0.99/91
Chloromonas tughillensis UTEX SNO91
- / -
Chloromonas fukushimae NIES-3390
1.00/100
Ixipapillifera pauromitos
Ixipapillifera deasonii
1.00/81
Chloromonas radiata
Chloromonas asteroidea
Chloromonas pseudoplatyrhyncha
- / -
0.99/86
Chloromonas reticulata
0.98/ -
Chloromonas typhlos
Outgroup
Chloromonas kasaiae
- / -
- / -
Chloromonas serbinowii
- / -
Chloromonas augustae
Gloeomonas rubrifilum
0.01 substitutions/site
0.02 substitutions/site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Chloromonas hohamii UTEX SNO67
Chloromonas nivalis UTEX SNO71
Chloromonas tughillensis UTEX SNO91
Chloromonas fukushimae NIES-3390
Chlainomonas rubra CHR586427
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Chloromonas chenangoensis UTEX SNO150
Chloromonas hindakii CCCryo 531-19
"Chloromonas nivalis cysts" Gassan-B
Chloromonas nivalis subsp. tatrae LP01
Chloromonas krienitzii NIES-3753
Chloromonas hoshawii UTEX SNO66
Chloromonas pseudoplatyrhyncha
Ixipapillifera pauromitos
Ixipapillifera deasonii
Chloromonas radiata
Chloromonas asteroidea
Chloromonas augustae
Chloromonas reticulata
Chloromonas typhlos
Chloromonas kasaiae
Chloromonas serbinowii
Gloeomonas rubrifilum
group A
group C
group D
group B
Outgroup
- / -
0.98/77
0.90/73
0.94/ -
0.98/69
0.99/78
- / -
1.00/100
- /50
0.99/96
1.00/86
0.99/73
- / -
- / -
1.00/100
1.00/99
0.92/62
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1.00/99
0.99/75
0.90/71
0.99/71
0.1 substitutions/site
0.2 substitutions/site

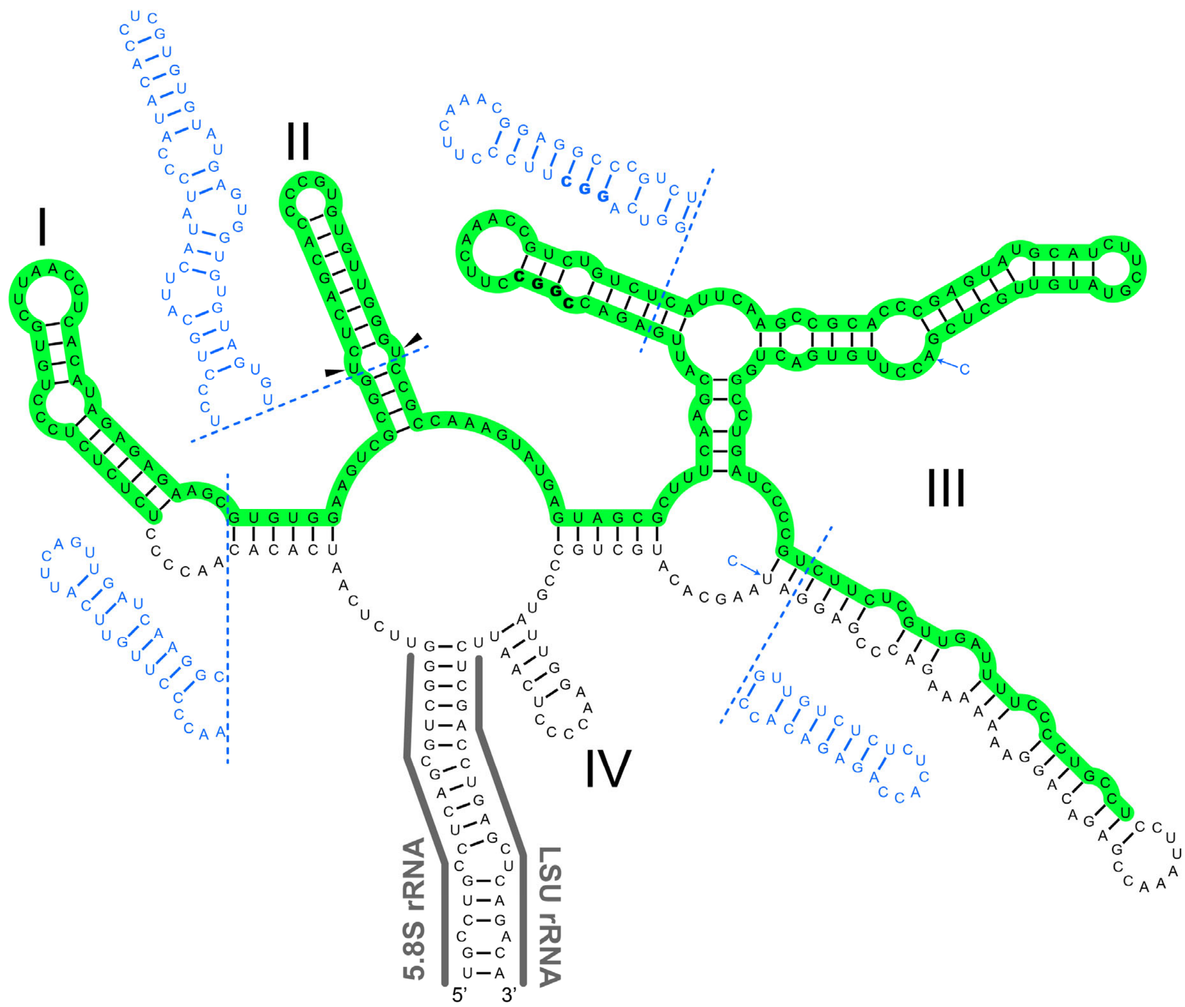
I
II
III
IV
5.8S rRNA
LSU rRNA
5'
3'

Table S1. Primers used for amplifications and sequencing of nuclear-encoded small and large subunits of ribosomal DNA (SSU and LSU rDNA, respectively), internal transcribed spacer region 2 of nuclear rDNA (ITS2), RuBisCO large subunit gene (*rbc*L), ATP synthase beta subunit gene (*atp*B), and P700 chlorophyll *a* apoprotein A2 gene (*psa*B). This table is mainly based on the table S3 in Matsuzaki et al. (2015).

Designation	Position[1]	Sequence (5'–3')
SSU rDNA		
FA[2]	1–21	AACCTGGTTGATCCTGCCAGT
FC[3]	458–478	GGGAGGTAGTGACAAIAAATA
RD[2]	570–550[4]	GCTGGCACCAGACTTGCCCTC
FE[2]	1112–1132	GGGAGTATGGTCGCAAGGCTG
RF[2]	1202–1182[4]	CCCGTGTTGAGTCAAATTAAG
RB[2]	1799–1774[4]	TGATCCTTCTGCAGGTTCACCTAC
LSU rDNA		
F1[5]	77–101	ATTCCCCTAGTAACGGCGAGCGAAC
F2[5]	804–826	CGAAAGATGGTGAACTATGCCTG
R1[5]	882–860[4]	TGCACGTCAGCACATCTACGAGC
F3[5]	1501–1521	CAGCAATTGGACATGGGTTAG
R2[5]	1726–1702[4]	CTATCGCCGGATGATCCGATTCCAG
R3[5]	2159–2139[4]	CCTTTAGGACCATCACAATGC
ITS2		
Fa[6]	1761–1787[7]	GGGATCCGTTTCCGTAGGTGAACCTGC
Fc[6]	30–49[8]	GCATCGATGAAGAACGCAGC
Rb[6]	50–23[4, 9]	GGGATCCATATGCTTAAGTTCAGCGGGT
***rbc*L**		
F1[10]	1–20	ATGGTTCCACAAACAGAAAC
Snow-F1[11]	178–200	GAATCTTCWACWGGTACTTGGAC
Snow-F4[12]	472–494	GAACGTGACAAATTAAACAAATA

Snow-R3[11]	656–634[4]	ATRAAACGGTCTCTCCAACGCAT
Snow-R12[12]	1030–1006[4]	CTAAAGTAACTTCACGTTCTCCTTC
R42AE[13]	1403–1384[4]	TCRAAYTTRATYTCYTTCCA
R3[10]	1421–1402[4]	TTGTCAATAGTATCAAATTC
***atp*B**		
F1[14]	180–200	TGTTACTTGTGAAGTTCAACA
F30[15]	208–227	GGTGATAAYTGTGTAMGWGC
F2[14]	721–741	GAACCACCAGGTGCTCGTATG
R3[14]	895–875[4]	GGTAACCTACAGCTGATGGCA
R4[14]	1433–1412[4]	CCTACTAAGTAGAATGCTTGTT
***psa*B**		
F1[16]	205–224	GCITGGCARGGIAAYTTYGA
F5[16]	989–1010	TACAYTTCCAATTAGGYTTAGC
R2[16]	1133–1114[4]	ATRTAYTGRTGRTGIGTRTA
R6[16]	1760–1741[4]	ATIGTRTTIARCATCCARAA

[1]Coordinate numbers from SSU rDNA of *Chlorella vulgaris* (Huss and Sogin 1990), LSU rDNA of *Oryza sativa* (Takaiwa et al. 1985), the nuclear-encoded 5.8S or LSU rDNA of *Didymogenes soliella* (Hoshina and Fujiwara 2013), *rbcL* of *Chlorella ellipsoidea* (Yoshinaga et al. 1988), or *atp*B or *psa*B of *Chlorella vulgaris* (Wakasugi et al. 1997), respectively.

[2]Primer sourced from Nakazawa and Nozaki (2004).

[3]Primer sourced from Nakada et al. (2007).

[4]Reverse primer.

[5]Primer sourced from Matsuzaki et al. (2014)

[6]Primer sourced from Coleman (1994).

[7]Position in SSU rDNA.

[8]Position in 5.8S rDNA.

[9]Position in LSU rDNA.

[10]Primer sourced from Nozaki et al. (1995).

[11]Primer sourced from Muramoto et al. (2008).

[12]Primer sourced from Matsuzaki et al. (2015).

[13]Primer sourced from Shimada et al. (1995).

[14]Primer sourced from Nozaki et al. (1999).

[15]Primer sourced from Nozaki et al. (2002).

[16]Primer sourced from Nozaki et al. (2000).

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Table S2. Taxa and specimens/strains used for the molecular analyses (Figs 3–5, Figs S1–S3 in the Supporting information) and DDBJ/ENA/GenBank accession numbers of their five genes. Asterisk indicates the authentic strain.

Taxon	Specimen/strain designation	Accession number				
		SSU rDNA	LSU rDNA	*rbc*L	*atp*B	*psa*B
Ingroup						
Cr. chenangoensis	UTEX[1] SNO150*	AB906341	LC360468	LC012736	AB906360	AB906371
Cr. fukushimae	NIES[2]-3390	AB906343	AB906353	LC012739	AB906362	AB906373
Cr. hindakii	CCCryo[3] 531-19*	MN251865		MN251877.2		
Cr. hohamii	UTEX SNO67	AB906344	AB906354	AB434265, LC012742	AB906363	AB906374
Cr. hoshawii	UTEX SNO66*	AB906345	LC360469	AB434272	AB906364	AB906375
Cr. kaweckae sp. nov.	NIES-4476	LC683781[4]	LC683782[4]	LC683784[4]	LC683785[4]	LC683786[4]
Cr. krienitzii	NIES-3753*	LC012712	LC060474	LC012740	LC012720	LC012728
Cr. miwae	NIES-2379	AB906350	LC060476	AB434271	AB906369	AB906380
Cr. muramotoi	NIEX-4284*	LC438435	LC438439	LC438451	LC438443	LC438447
Cr. nivalis	UTEX SNO71	LC360465	LC360470	LC360492	LC360484	LC360488
	Gassan-B[5]	LC012714	LC060478	LC012743	LC012722	LC012730
Cr. nivalis subsp. *tatrae*	LP01[6]	KY499614		KY499615.2		
Cr. pichinchae	UTEX SNO33	AB906346	LC060481	AB434266, LC012746	AB906365	AB906376
Cr. polyptera	DRAnt023[7]	JQ790556				
Cr. remiasii	CCCryo 005-99*	LC360466	LC360471	LC360493	LC360485	LC360489
Cr. tenuis	UTEX SNO132*	AB906347	AB906355	AB434263	AB906366	AB906377
Cr. tughillensis	UTEX SNO91*	AB906348	AB906356	LC012747	AB906367	AB906378
Cr. cf. *alpina*	CCCryo 032-99	AF514403				
Cr. cf. *rostafinskii*	CCCryo 010-99	AF514400				
	CCCryo 025-99	AF514402				
Ci. koliae	CHR586424[8]			DQ885962		
Ci. rubra	CHR586427[9]			DQ885969		
Ci. sp.	LP03[10]	MF803745				
Sc. cryophila	K-1[11]	MG253843				
uncultured clone	Kili_08A_N7[12]	KX771778				
Outgroup						
Cr. asteroidea	SAG[13] 11-47[14]	U70783	LC360473	AB022225	AB084808	AB084342
Cr. augustae	SAG 5.73[14]	AJ410452	LC360474	AB504764	AB504757	AB504769
Cr. chlorococcoides	SAG 15.82*	AJ410449, AB624555	AB906359	LC361432	AB624580	AB624595
Cr. kasaiae	NIES-2862*	AB734109	LC360475	LC012751	AB734110	AB734111
Cr. pseudoplatyrhyncha	NIES-2563	AB548689	LC360476	LC012752	AB548690	AB548691
Cr. radiata	UTEX 966[14]	U57697	LC360477	AJ001878	AB084311	AB084345
Cr. reticulata	SAG 29.83 (= UTEX 1970[14])	U70791, AB624560	AF395508	AB022534	AB084312	AB084346, AB084347
Cr. serbinowii	UTEX 492[14] (= SAG 11.84)	U70795, AB624568, AB624569	LC360478	AJ001879	AB084317	AB084354
Cr. typhlos	SAG 26.86 (= UTEX 1969)	AB624566	LC360479	AB022228	AB084307	AB084341
Gl. rubrifilum	SAG 3.85[15]	AJ410455	LC360481	AB504765	AB504758	AB504770
Ix. deasonii	SAG 46.72*	AJ410446	LC360482	AB101508	AB101503	AB101514
Ix. pauromitos	NIES-3707*	LC057290	LC360483	LC360495	LC360487	LC360491

Abbreviations: *atp*B, ATP synthase beta subunit gene; *Ci.*, *Chlainomonas*; *Cr.*, *Chloromonas*; *Gl.*, *Gloeomonas*; *Ix.*, *Ixipapillifera*; LSU rDNA, large subunit ribosomal DNA; *psa*B, P700 chlorophyll *a* apoprotein A2 gene; *rbc*L, RuBisCO large subunit gene; *Sc.*, *Scotiella*; SSU rDNA, small subunit ribosomal DNA.

[1]Culture Collection of Algae at the University of Texas at Austin, USA (https://utex.org/).

[2]Microbial Culture Collection at the National Institute for Environmental Studies, Japan (https://mcc.nies.go.jp/index_en.html).

[3]Culture Collection of Cryophilic Algae at the Fraunhofer Institute for Cell Therapy and Immunology, Germany (http://cccryo.fraunhofer.de/web/infos/welcome/).

[4]Sequenced in the present study.

[5]Specimen of cysts collected from snowpack on Mt. Gassan, Japan (Matsuzaki *et al.* 2015).

[6]Specimen of cysts collected from snowpack on the High Tatras, Slovakia (Procházková *et al.* 2018a).

[7]Specimen of cysts collected from snowpack on Antarctic Peninsula (Remias *et al.* 2013).

[8]Specimen of vegetative cells collected from snowpack on Ahuriri Valley, New Zealand (Novis *et al.* 2008).

[9]Specimen of vegetative cells collected from snowpack on Cle Elum Valley, USA (Novis *et al.* 2008).

[10]Specimen of vegetative cells collected from snowpack on the High Tatras, Slovakia (Procházková *et al.* 2018b).

[11]Specimen of cysts collected from snowpack on Austrian Alps (Remias *et al.* 2018).

[12]Environmental sequence originating from a soil sample from Mt. Kilimanjaro, Tanzania (Vimercati *et al.* 2019).

[13]Sammlung von Algenkulturen at the University of Göttingen (http://sagdb.uni-goettingen.de/).

[14]Epitype proposed by Pröschold *et al.* (2001).

[15]Epitype of *Chloromonas rubrifilum* designated by Pröschold *et al.* (2001).

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Table S3. List of meta-amplicon sequencing datasets examined in this study, screened for distribution hits of *Chloromonas kaweckae*.

			Collection site			number of reads					
Reference	**BioProject**	**Run Accession**	**Region**	**Country**	**Details**	**deposited**	**treated**	**Molecular marker**	**# of reads assignable to *C. kaweckae***	**% of identical matches**	**% of reads assignable to *C. kaweckae*/ deposited**
Brown et al. 2015	PRJNA231162	SRR1104197	North America	USA	Colorado & Washington	11346703	10384303	ITS-2	0	0	0,00000%
Lutz et al. 2015a	PRJEB8832	ERR792548	Northern Europe	Iceland	several places_18S	41437	-	18S rRNA	0	-	0,00000%
Lutz et al. 2015b	PRJEB11474	ERR1121456	Arctic region	Norway	green snow on Feiringbreen, Svalbard_18S	7552	-	18S rRNA	0	-	0,00000%
	PRJEB11474	ERR1121457	Arctic region	Norway	red snow on Feiringbreen, Svalbard_18S	8292	-	18S rRNA	0	-	0,00000%
Lutz et al. 2016	PRJEB10548	ERR3721900	Northern Europe	Iceland	ICE12-3_18S	5461	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721902	Northern Europe	Iceland	ICE12-4_18S	1908	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721904	Northern Europe	Greenland	MIT12-19_18S	5995	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721906	Northern Europe	Greenland	MIT12-7_18S	5371	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721908	Arctic region	Norway	SVA13-10_18S	13427	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721909	Arctic region	Norway	SVA13-2_18S	6178	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721911	Arctic region	Norway	SVA13-20_18S	7123	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721913	Arctic region	Norway	SVA13-23_18S	5416	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721915	Arctic region	Norway	SVA13-31_18S	12844	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721917	Arctic region	Norway	SVA13-33_18S	7678	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721919	Arctic region	Norway	SVA13-36_18S	23461	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721921	Arctic region	Norway	SVA13-4_18S	6975	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721923	Arctic region	Norway	SVA13-43_18S	16445	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721925	Arctic region	Norway	SVA13-48_18S	6338	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721927	Arctic region	Norway	SVA13-54_18S	5062	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721929	Arctic region	Norway	SVA13-65_18S	7423	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721931	Arctic region	Sweden	TAR13-1_18S	9621	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721933	Arctic region	Sweden	TAR13-17_18S	8761	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721935	Arctic region	Sweden	TAR13-21_18S	9321	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721937	Arctic region	Sweden	TAR13-28_18S	9394	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721940	Arctic region	Sweden	TAR13-30_18S	6485	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721942	Arctic region	Sweden	TAR13-35_18S	7329	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721943	Arctic region	Sweden	TAR13-39_18S	11659	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721945	Arctic region	Sweden	TAR13-41_18S	7584	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721947	Arctic region	Sweden	TAR13-8_18S	77659	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721949	Arctic region	Sweden	TAR14-1_18S	12518	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721951	Arctic region	Sweden	TAR14-10_18S	6077	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721953	Arctic region	Sweden	TAR14-11_18S	4937	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721955	Arctic region	Sweden	TAR14-12_18S	7447	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721957	Arctic region	Sweden	TAR14-4_18S	10470	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721959	Arctic region	Sweden	TAR14-5_18S	4288	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721961	Arctic region	Sweden	TAR14-6_18S	7611	-	18S rRNA	0	-	0,00000%
	PRJEB10548	ERR3721963	Arctic region	Sweden	TAR14-7_18S	2053	-	18S rRNA	0	-	0,00000%
Lutz et al. 2017	PRJEB14001	ERR1422205	Arctic region	Norway & Sweden	Svalbard & Talfala_18S	684638	-	18S rRNA	0	-	0,00000%
Lutz et al. 2019	PRJEB24479	ERR2260020	Europe	Austria	Austrian Alps_WP79_18S	187527	-	18S rRNA	**963**	**9.41-99.70**	**0,51353%**
	PRJEB24479	ERR2260021	Europe	Austria	Austrian Alps_WP79_ITS-2	127126	-	ITS-2	0	-	0,00000%
	PRJEB24479	ERR2260022	Europe	Austria	Austrian Alps_WP99_18S	248583	-	18S rRNA	**48**	**9.41-99.70**	**0,01931%**
	PRJEB24479	ERR2260023	Europe	Austria	Austrian Alps_WP99_ITS	163340	-	ITS-2	0	-	0,00000%
Nakashima et al. 2021	PRJNA726817	SRR14385502	Snow in Mt. Tateya	Japan	SAMN18962876 (6TA76)	80185	78283	18S rRNA	**1**	**100**	**0,00125%**
	PRJNA726817	SRR14385503	Snow in Mt. Tateya	Japan	SAMN18962875 (6TA75)	105764	31500	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385504	Snow in Mt. Tateya	Japan	SAMN18962874 (6TA73)	46583	10109	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385505	Snow in Mt. Tateya	Japan	SAMN18962873 (6TA72)	44169	11702	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385506	Snow in Mt. Tateya	Japan	SAMN18962872 (16TAs7F-3)	120565	105291	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385507	Snow in Mt. Tateya	Japan	SAMN18962908 (7TAs6-1)	59834	15664	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385508	Snow in Mt. Tateya	Japan	SAMN18962907 (7TAs3-3)	68990	13074	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385509	Snow in Mt. Tateya	Japan	SAMN18962871 (16TAs7E-5)	61341	54029	18S rRNA	**298**	**99.5-100**	**0,48581%**
	PRJNA726817	SRR14385510	Snow in Mt. Tateya	Japan	SAMN18962906 (7TAs3-1)	40238	10350	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385511	Snow in Mt. Tateya	Japan	SAMN18962905 (7TAs2-3)	95598	27060	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385512	Snow in Mt. Tateya	Japan	SAMN18962904 (7TAs2-2)	49191	11881	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385513	Snow in Mt. Tateya	Japan	SAMN18962903 (7TAs2-1)	71880	16654	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385514	Snow in Mt. Tateya	Japan	SAMN18962902 (7TAs1W-3)	102904	24584	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385515	Snow in Mt. Tateya	Japan	SAMN18962901 (7TAs1W-2)	37545	9891	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385516	Snow in Mt. Tateya	Japan	SAMN18962900 (7TAs1W-1)	83697	23881	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385517	Snow in Mt. Tateya	Japan	SAMN18962899 (7TAs1E-6)	46776	15520	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385518	Snow in Mt. Tateya	Japan	SAMN18962898 (7TAs1E-5)	82126	28724	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385519	Snow in Mt. Tateya	Japan	SAMN18962897 (7TAs1E-4)	71747	21441	18S rRNA	**1**	**99.5**	**0,00139%**
	PRJNA726817	SRR14385520	Snow in Mt. Tateya	Japan	SAMN18962870 (16TAs7E-1)	115612	100195	18S rRNA	**73**	**99.5**	**0,06314%**
	PRJNA726817	SRR14385521	Snow in Mt. Tateya	Japan	SAMN18962896 (7TAs1E-3)	61843	16293	18S rRNA	**2**	**99.5**	**0,00323%**

	PRJNA726817	SRR14385522	Snow in Mt. Tateya	Japan	SAMN18962895 (7TAs1E-1)	58455	12163	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385523	Snow in Mt. Tateya	Japan	SAMN18962894 (7TAs1C-3)	73342	18619	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385524	Snow in Mt. Tateya	Japan	SAMN18962893 (7TAs1C-2)	59637	14162	18S rRNA	**15**	**99.5**	**0,02515%**
	PRJNA726817	SRR14385525	Snow in Mt. Tateya	Japan	SAMN18962892 (7TAs1C-1)	70181	19364	18S rRNA	**2**	**99.5**	**0,00285%**
	PRJNA726817	SRR14385526	Snow in Mt. Tateya	Japan	SAMN18962891 (6TAs5-2r)	55191	18901	18S rRNA	**5**	**99.5**	**0,00906%**
	PRJNA726817	SRR14385527	Snow in Mt. Tateya	Japan	SAMN18962890 (6TAs4-3)	81638	20118	18S rRNA	**25**	**99.5**	**0,03062%**
	PRJNA726817	SRR14385528	Snow in Mt. Tateya	Japan	SAMN18962889 (6TAs4-2)	67836	18965	18S rRNA	**1**	**99.5**	**0,00147%**
	PRJNA726817	SRR14385529	Snow in Mt. Tateya	Japan	SAMN18962888 (6TAs4-1)	52091	16643	18S rRNA	**4**	**99.5**	**0,00768%**
	PRJNA726817	SRR14385530	Snow in Mt. Tateya	Japan	SAMN18962887 (6TAs3-3)	95668	27384	18S rRNA	**80**	**99.5-100**	**0,08362%**
	PRJNA726817	SRR14385531	Snow in Mt. Tateya	Japan	SAMN18962869 (16TAs4-2)	104039	91327	18S rRNA	**105**	**99.5**	**0,10092%**
	PRJNA726817	SRR14385532	Snow in Mt. Tateya	Japan	SAMN18962886 (6TAs2-3)	77728	24752	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385533	Snow in Mt. Tateya	Japan	SAMN18962885 (6TAs1W-4)	89714	25762	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385534	Snow in Mt. Tateya	Japan	SAMN18962884 (6TAs1W-2)	73762	20482	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385535	Snow in Mt. Tateya	Japan	SAMN18962883 (6TAs1E-4)	62923	16423	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385536	Snow in Mt. Tateya	Japan	SAMN18962882 (6TAs1E-3)	83764	25698	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385537	Snow in Mt. Tateya	Japan	SAMN18962881 (6TAs1E-2)	86077	29945	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385538	Snow in Mt. Tateya	Japan	SAMN18962880 (6TAs1E-1)	64794	21417	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385539	Snow in Mt. Tateya	Japan	SAMN18962879 (6TAs1C-3)	74082	24161	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385540	Snow in Mt. Tateya	Japan	SAMN18962878 (6TAs1C-2)	90553	23748	18S rRNA	**3**	**99.5**	**0,00331%**
	PRJNA726817	SRR14385541	Snow in Mt. Tateya	Japan	SAMN18962877 (6TAs1C-1)	109262	32217	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385542	Snow in Mt. Tateya	Japan	SAMN18962868 (16TAs2-4)	89501	79913	18S rRNA	0	0	0,00000%
	PRJNA726817	SRR14385543	Snow in Mt. Tateya	Japan	SAMN18962867 (16TAs2-3)	235868	206002	18S rRNA	**479**	**99.5**	**0,20308%**
Yakimovich et al. 2020	PRJEB34539	ERR3545915	North America	Canada	BRE18-01	303027	257898	18S rRNA	**0**	0	0,00000%
	PRJEB34539	ERR3545916	North America	Canada	BRE18-02x	458257	387217	18S rRNA	**0**	0	0,00000%
	PRJEB34539	ERR3545917	North America	Canada	BRE18-10	316395	265704	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545918	North America	Canada	BRE18-19	415755	360192	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545919	North America	Canada	BRE18-Ro	1062	932	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545920	North America	Canada	FRO18-09	139084	134518	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545921	North America	Canada	GAR18-01	383540	321029	18S rRNA	**2**	**99.6**	**0,00060%**
	PRJEB34539	ERR3545922	North America	Canada	GAR18-02	421942	370602	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545923	North America	Canada	GAR18-01.2	142514	134815	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545924	North America	Canada	GAR18-04	58896	56416	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545925	North America	Canada	HOL18-13	151396	145125	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545926	North America	Canada	HOL18-18	134402	126223	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545927	North America	Canada	Hol18-21	406263	326633	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545928	North America	Canada	Hol18-25a	133688	126870	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545929	North America	Canada	Hol18-25b	141720	131937	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545930	North America	Canada	Hol18-39d	351098	306694	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545931	North America	Canada	Hol18-40	156340	149211	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545932	North America	Canada	Hol18-42	380527	322957	18S rRNA	**1**	**99.6**	**0,00026%**
	PRJEB34539	ERR3545933	North America	Canada	Hol18-42b	370836	315878	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545934	North America	Canada	Hol18-47	367594	315387	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545935	North America	Canada	Hol18-49	131107	119249	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545936	North America	Canada	Hol18-52	98330	94108	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545937	North America	Canada	Hol18-59	180264	169928	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545938	North America	Canada	LIB18-01	1251	898	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545939	North America	Canada	NES18-01	328910	286453	18S rRNA	0	0	0,00000%
	PRJEB34539	ERR3545940	North America	Canada	Nes18-02	169903	162507	18S rRNA	0	0	0,00000%
Terashima et al. 2017	PRJNA384269	SRR5482949	Asia	Japan	Green snow B2, Asahidake, Hokkaido	107590	-	18S rRNA	0	0	0,00000%
	PRJNA384269	SRR5482950	Asia	Japan	Red snow B2, Asahidake, Hokkaido	108765	-	18S rRNA	**31**	**99.41**	**0.03%**
	PRJNA384269	SRR5482951	Asia	Japan	Red snow A2, Asahidake, Hokkaido	110702	-	18S rRNA	**26**	**99.41-99.70**	**0.02%**
	PRJNA384269	SRR5482952	Asia	Japan	Red snow A1, Asahidake, Hokkaido	111509	-	18S rRNA	**14**	**99.41-99.70**	**0.01%**

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Table S4. Comparison of vegetative cell and asexual reproduction characteristics of 12 snow-inhabiting species of *Chloromonas* which have ovoid to ellipsoidal cell shapes without a prominent anterior papilla. This table is mainly based on Matsuzaki *et al.* (2018, 2019).

	C. kaweckae sp. nov.	*C. alpina*	*C. bolyaiana*	*C. brevispina*	*C. chenangoensis*
Strain(s) examined	NIES-4476, CCCryo 557-22	–	–	–	UTEX SNO150, UTEX SNO143
Cell shape	ovoid, elongate-ovoid to ellipsoidal	ellipsoidal to ovoid	ellipsoidal	ellipsoidal to ovoid or pyriform	ellipsoidal
Cell width × cell length (µm)	9.2–15.5 × 16.0–22.5	4–7 × 9–12	46 – 52 × 52 – 72	5–13 × 10–19	7.5–17.5 × 14–25
Chloroplast shape	cup-shaped with irregular incisions; seemingly composed of angular discs	parietal, seemingly composed of numerous discoid lobes obviously separated from each other	asteroid-shaped	cup-shaped	cup-shaped, seemingly composed of angular discs
Eyespot	generally ellipsoidal but variable, positioned in the posterior third to anterior third of the cell	ellipsoidal, positioned anterior third of the cell	absent	absent	absent
Cell aggregates in old culture	not observed	–	–	–	not observed
Number of zoospores formed within the parental cell wall	2 or 4	2 or 4	2, 4 or 8	up to 8	2 or 4
References	present study	Wille (1903)	Kol (1947)	Hoham et al. (1979)	Hoham et al. (2006); Matsuzaki et al. (2014)

Table S4. Extended

C. hohamii	*C. hoshawii*	*C. miwae*	*C. muramotoi*	*C. pichinchae*	*C. remiasii*	*C. tughillensis*
UTEX SNO67	UTEX SNO66	NIES-2379, NIES-2380	NIES-4284	UTEX SNO33	CCCryo 005-99, CCCryo 047-99	UTEX SNO91, UTEX SNO88, UTEX SNO92
elongate-ellipsoidal	ellipsoidal to elongate-ovoid	spherical or ovoid	ovoid or spindle-shaped with a rounded posterior end	elongate-ovoid to ellipsoidal	ellipsoidal to spindle-shaped	elongate-ellipsoidal
5–10 × 12–25	4.9–9.3 × 13.8–18.6	10–13 × 9–15	8.5–13.3 × 12.3–19.5	8–15 × 18–26	10.2–15.6 × 18.2–30.8	6–12 × 16–23
cup-shaped, apparently composed of elongate-ovoid or elongate-cylindrical platelets	cup-shaped, seemingly composed of angular discs	cup-shaped, seemingly composed of angular discs	cup-shaped, seemingly composed of angular discs	cup-shaped, seemingly composed of angular discs	Cup-shaped, seemingly composed of angular discs	Cup-shaped, apparently composed of elongate-ovoid or elongate-cylindrical platelets
absent or generally present	absent	absent	D-shaped to rod-shaped, positioned in the anterior half to one third of the cell	absent	ellipsoidal to elongate D-shaped, positioned in the anterior third of the cell	not observed
not observed	not observed	–	not observed	observed	observed	observed
2, 4 or 8	2 or 4 (rarely 8)	generally 2 or 4	up to 8	generally 2 or 4	2 or 4 (rarely 8)	2, 4, 8 or 16
Hoham et al. (1983); Matsuzaki et al. (2014)	Matsuzaki et al. (2018)	Muramoto et al. (2010)	Matsuzaki et al. (2019)	Wille (1903); Hoham (1975); Matsuzaki et al. (2014)	Matsuzaki et al. (2018)	Hoham et al. (2006); Matsuzaki et al. (2014)

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