

Supplementary Materials

Table S1. Comparison of morphological characteristics of algae strains with similar species (Bold represents new species).

Strains	Thallus	Filaments	False branching	Filament width (µm)	Sheaths	trichomes
<i>Albertania yunnanense</i> SXACC0114	bright blue-green filaments penetrating the agar	filaments tightly inter-twined and typically clustered, straight or curved	exist	1.5-3.8	each sheath has a single trichomes, thin, solid, colorless, more pronounced, tightly attached to the trichomes, occasionally widening, usually open at the end	occasionally tapering slightly towards their ends, isopolar or irregular, straight or curved, yellow-green to bright blue-green
<i>Albertania alaskensis</i>	typically clustered, colonies penetrate the agar, are difficult to remove, bright green to yellow-brown	solitary or bundled, narrow or coiled, wavy, uneven filament width, with short cells, distinctly narrow at the end	none in young culture, often in the old culture	1.8-3	lamella, thin, strong, closed at the ends of the algae silk, sometimes broadened and colorless	bright yellow-green to olive green
<i>Albertania skiophila</i>	compact subaerophytic bio-films on solid substrata, green-brown and black	each sheath with a single trichome, occasionally tapers slightly towards its end, and the trichomes are broken up by the random presence of necrotic cells	occasionally	not available	firm, thin, usually open colorless at the end	colourless

<i>Tildeniella yunnanense</i> SXACC0117	clumpy, forming a compact mat, blue-green	straight, sometimes curved, loose or densely wound, cylindrical, with long filament	not observed		0.9-2.4	thin, strong and colorless, 1.2-2.2 µm wide, tightly attached to trichomes	bright blue-green or yellow-green, erect or curved
<i>Tildeniella alaskaensis</i>	compact mat, blue-green to dark green	filaments solitary, curved, irregularly curved and coiled, unaltered, cylindrical, isopolar, solitary, one per sheath	none		1.0-2.2	Strong, thin, colorless	bright green
<i>Tildeniella nuda</i>	colonies grow in clusters, do not penetrate the agar, forming a compact mat	filaments relatively short	none		not available	usually absent, thin, strong and colorless, 1.0-1.4 µm wide	bright blue-green, cell division occurs throughout the trichomes
<i>Tildeniella torsiva</i>	colonies clusters, unfolded, irregular clusters, filigree penetrating agar bright blue-green, olive green (old)	straight, curved or spirally coiled, usually wound	rare branching in older cultures	false in	1.7-2.5	Strong, thin, up to 0.7 µm wide, usually inconspicuous, colorless	trichomes are not tapered, straight, curved, or sometimes spirally coiled

Strains	Cell width (µm)	Cross-walls	Cell form	Apical cell	Cell length (µm)	Hormogonia	Other characteristics	Ecology
<i>Albertania yunnanense</i> SXACC0114	1.5-3.5	slightly constricted or not constricted	spherical or cylindrical, isopolar, shorter than wide or longer than wide, sometimes expanding	spherical or cylindrical	1.2-3.0	straight, consisting of 2-8 cells	Sometimes necrotic cells appear, homogeneous contents, usually without granules,	cascade

							occasionally granules, the cells are clearly separated, and trichomes fragment through randomly occurring necrotic cells within the filament	
<i>Albertania alaskensis</i>	2.1-3.2	slightly constricted	isodiametric or longer than wide before division parietal thylakoids end cells markedly narrowed, longer	conical, round, sometimes mushroom like calyptra	1.4-4	not observed	characteristic 90 degrees turned cell within the trichome	freshwater, periphytic on roots or in snow
<i>Albertania skiophila</i>	2.0-3.0	not constricted	variable shape, often isodiametric, sometimes slightly shorter or slightly longer than wide	round	2.0-4.0	straight, consisting of 2-8 cells	uniform cell contents, sometimes granular necrotic cells, and filaments are preferentially grown in dimly lit places	Subaerophytic biofilms attached to calcareous substrata
<i>Tildeniella yunnanense</i> SXACC0117	1.4-2.5	slightly constricted or not constricted	isodiametric or longer than wide	round or cylindrical	1.0-2.9	via trichome breakage and subsequent	usually homogeneous contents with	benthic of the waterfall

						disintegration, releasing hormogonia	occasional granules and significant cell separation	
<i>Tildeniella alaskaensis</i>	1.1-1.6	not constricted	isodiametric or slightly longer than wide	round, without calyptra	1.6-3.0	not observed	Most filaments are arched but never spirally coiled	meltwater, periphyton on roots
<i>Tildeniella nuda</i>	1.0-1.2	constricted	always longer than wide sometimes elongated	cylindrical round, sometimes with a swollen tip	2.0-4.3 (5.1)	none	mostly homogeneous contents and rarely swollen or have small particles in the polar areas of the cells	on a wet stone wall
<i>Tildeniella tor-siva</i>	1.4-1.9	slightly constricted	rarely isodiametric mostly longer than wide	round	1.5-2.7	none	Cell contents usually homogeneous and granularfree	limestone wall