

**Supplementary material for the article**

**Morphological and molecular evaluation of *Pseudanabaena epilithica* sp. nov. and *P. suomiensis* sp. nov. (Pseudanabaenaceae, Cyanobacteria) From Finland.**

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**Table S7.** Morphological comparison of the newly described species *P. epilithica* UHCC 1008<sup>†</sup> and *P. suomiensis* UHCC 1009<sup>†</sup> and all taxonomically accepted species of *Pseudanabaena* presented in Komárek and Anagnostidis [1], Skuja [2], Niiyama et al [3], Tuji and Niiyama [4], Kling et al [5] and Turicchia et al [6]. Names of all taxonomically accepted *Pseudanabaena* species have been obtained from AlgaeBase [7]. N/A; not available, –; no

Species name	Macroscopic appearance	Trichome morphology	Constrictions	Sheaths or envelopes	Vegetative cell color, shape & size (µm)	Cell content	Apical cell	Motility	Ecology
<i>P. epilithica</i> UHCC 1008 <sup>†</sup>	purple to deep brown-colored irregular clusters, loosely attached to the substrate	cylindrical, straight or bent (young trichomes), later long and flexuous, not attenuated towards the end	constricted	–	purple to purple-brown, cylindrical to barrel-shaped W: (1.5) 1.7–1.9 (2.1) L: up to 2.5–3.0 µm long	Differentiated into centro – and chromato- plasma with scarce but prominent granules and/or 1–2 refractive granules (aerotopes?)	Usually rounded, without calyptra, usually with ring-like or cupola-like large refractive granules	infrequent forward movement	epilithic, wet rock within a man-made/artificial cavity next to a waterfall
<i>P. suomiensis</i> UHCC 1009 <sup>†</sup>	trichomes are usually arranged in parallel or subparallel fascicles, later forming a thin brownish biofilm, which can be attached firmly to the substrate and/or grow at the liquid media/air interface	cylindrical, mostly straight or slightly bent, usually arranged in parallel or subparallel, not attenuated towards the end, few-celled or up to 200–300 µm long	constricted	–	brownish, cylindrical with rounded ends W: (1.5) 1.6–1.9 (2.1) L: up to 3.5	Differentiated into centro - and chromato- plasma with scarce but prominent granules and/or 1–2 refractive granules (aerotopes?)	rounded without calyptra or thickened cell wall but with 2 small (or 1 large) ring-like or cupola-like refractive granules	forward movement and clockwise-anticlockwise rotation	epilithic, dry rock
<i>P. catenata</i>	–	solitary or aggregated into olive-green or blue-green mats, ± straight, rarely variously bent, flexible, long, not attenuated towards the ends	constricted	–	blue-green, olive-green, pale greyish to greyish-blue, cylindrical, truncate-rounded at both ends W: 1.2–2.0 L: 1.5–3x longer than wide	Homogenous or ± clearly differentiated in centro- and chromato- plasma, without aerotopes	rounded or slightly conical	characteristically motile without oscillation and rotation	various freshwater and brackish habitats; benthic, epipelagic, sapropelagic, periphytic
<i>P. spelaea</i>	thin, membranaceous	± curved, entangled, sometimes parallel, not attenuated towards the ends	clearly constricted	very thin, mucilaginous, diffluent, occasionally present	cylindrical, with rounded ends or slightly barrel-shaped to isodiametric W: 0.8–1.2 L: 2x longer than wide	mostly with one polar granule on either side at cross walls	rounded	N/A	subaerophytic, cave environments
<i>P. skujae</i>	–	solitary, ± straight or slightly flexuous	deeply constricted	–	faint bluish-cylindrical, with two granules at both sides W: 2.3–2.5 L: up to 7.5	homogeneous, not visibly differentiated into centro- and chromato- plasma with two large ‘voluntine bodies’ at each side at the cross walls	elongated, conically-pointed with one ‘voluntine body’	slow gliding motion	subaerophytic, cave environments

Table S7-Cont

Species name	Macroscopic appearance	Trichome morphology	Constrictions	Sheaths or envelopes	Vegetative cell color, shape & size (µm)	Cell content	Apical cell	Motility	Ecology
<i>P. limnetica</i>	–	solitary, straight or slightly curved, not attenuated towards the ends	strongly constricted or almost unconstricted	occasionally with thin indistinct mucilaginous envelopes or sheaths	pale blue-green or olive-green, long cylindrical, truncated at both ends W: 1.2–1.5 L: 2–8x longer than wide	homogenous with ± distinctive chromatoplasma without aerotopes	rounded	yes	freshwater habitats
<i>P. minima</i>	–	solitary or crowded in clusters, ± straight, not attenuated towards the ends	intensely constricted	N/A	pale blue-green W: 1.3–2.5 L: 1.5–4.0	homogenous without aerotopes	widely rounded	N/A	moist soil, mud, benthic and epipelagic in ponds, springs, swamps and salty fields
<i>P. galeata</i>	fine, thin indefinite, expanded, and prostrated colonies, forming hemispherical, bubble-like formations or erected flaky clusters usually bright blue-green or emerald-green to olive-green	solitary or in clusters, short, straight or variously curved and entangled, sometimes arranged in parallel, less frequently screw- or ring-like, not attenuated towards the ends	deeply constricted	–	pale to bright blue-green to grey-blue, cylindrical, with rounded ends W: 0.8–2.4 (2.7) L: 2–4x longer than wide	scarce but prominent granules, clearly or indistinctly differentiated in centro- and chromato- plasma 1–2 small polar granules	flat-rounded, rarely slightly conical-rounded with ring- or cupola-like large aerotopes	forwards without waving and rotation	freshwater; benthic, epiphytic, endogloeic, rarely in plankton
<i>P. foetida</i> var. <i>foetida</i> PTG	–	solitary, straight or slightly curved, not attenuated towards the ends	conspicuous	–	bright blue-green, long cylindrical with rounded ends W: 1.0–1.7 (2.2) L: 3.4–11.0	differentiated in centro- and chromato- plasma, with polar aerotopes	without calyptra	infrequent	freshwater; planktic
<i>P. foetida</i> var. <i>subfoetida</i> PS1306	–	solitary, straight or slightly curved, not attenuated towards the ends	conspicuous	–	bright blue-green, isodiametric to longer than wide with rounded ends W: 2.1–2.9 L: 2.5–8.5	finely granulated clearly differentiated in centro- and chromato- plasma, with polar aerotopes	without calyptra	infrequent	freshwater; planktic
<i>P. foetida</i> var. <i>intermedia</i> NIES-512	–	solitary, straight, not attenuated towards the ends	conspicuous	–	bright blue-green, cylindrical with rounded ends W: 1.6–2.2 L: 3.0–8.3	differentiated in centro- and chromato- plasma, with aerotopes	without calyptra	infrequent	freshwater; planktic
<i>P. cinerea</i>	–	solitary, almost straight, not attenuated towards the ends	conspicuous	–	brownish green or greenish grey to grey, cylindrical W: 1.4–2.5 L: 2.3–9.9	granulated, differentiated in centro- and chromato- plasma	without calyptra	–	freshwater; planktic

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Species name	Macroscopic appearance	Trichome morphology	Constrictions	Sheaths or envelopes	Vegetative cell color, shape & size (µm)	Cell content	Apical cell	Motility	Ecology
<i>P. yagii</i>	thin membranaceous colonies	solitary or in clusters, straight or curved, not attenuated towards the ends	conspicuous	yes	bright blue-green, cylindrical with rounded ends W: 1.5–2.3 L: 1.9–6.8	differentiated in centro- and chromato- plasma, with aerotopes	without calyptra	trembling (only in short trichomes)	freshwater; planktic
<i>P. rutilus-viridis</i>	–	solitary, short or long, sometimes arranged in small flake-like colonies, not attenuated towards the ends	yes	–	reddish violet or blue-green, cylindrical, barrel-shaped to oval with rounded end W: (1.4) 1.6–2.5 (3.2) L: 2.0–4.4 (8.0)	with small granule (aerotope?)	N/A	trembling and creeping	freshwater; planktic
<i>P. biceps</i>	–	solitary or in small groups, straight or slightly curved, not attenuated towards the ends	intensely constricted	–	pale to bright blue-green, cylindrical to barrel-shaped, rounded at the ends W: 2.7–3.0 L: 3.0–7.5	distinctly differentiated in centro- and chromato- plasma with few granules	± narrowed, rounded-pointed at the ends bearing one large subterminal annular aerotope or a few small aerotopes	N/A	freshwater, benthic or epipellic
<i>P. apiculato-flexuosa</i>	–	solitary or in clusters, long, usually coiled, not attenuated towards the ends,	slightly constricted	facultative; very fine, thin, colourless (mainly in cultures)	blue-green, cylindrical W: 1.0–2.5 L: 4.8–6.2	not clearly differentiated into centro- and chromato- plasma	conical, rounded-pointed	slightly motile	alkaline marshes
<i>P. belizensis</i>	–	solitary or joined in irregular clusters, long, usually coiled, not attenuated towards the ends	distinctly constricted	facultative; thin, diffuse, colourless (only in cultures)	pale blue-green, cylindrical W: 1.0–2.0 (2.4) L: 6.0–15.0	± homogenous	cylindrical and rounded	slightly motile	alkaline marshes
<i>P. mucicola</i>	–	solitary or few together, short (up to 12-celled), straight or slightly bent, not attenuated towards the ends	±clearly constricted	fine, diffluent, colourless mucilaginous envelope, rarely fine sheaths	pale bluish to blue-green short, cylindrical with rounded ends to slightly barrel-shaped W: 1.3–2.0 L: 1–2x longer than wide	homogenous or finely granulated	cylindrical with conical-rounded or rounded end, without calyptra	–	freshwater, endogloeic, epiplanktic

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Species name	Macroscopic appearance	Trichome morphology	Constrictions	Sheaths or envelopes	Vegetative cell color, shape & size (µm)	Cell content	Apical cell	Motility	Ecology
<i>P. persicina</i>	red to pinkish in colour, very thin, finely membranaceous	intensely coiled and tangled, few- or multi- celled	clearly constricted	thin, amorphous, diffluent, mucilage	pale reddish, cylindrical W: 1.7–2.0 L: 2.0–7.0	± homogenous without aerotopes	acute conical without calyptra	trembling or slowly gliding	marine, epizoic or epiphytic
<i>P. curta</i>	–	irregularly aggregated in gelatinous mats, short (max; 12 µm long), straight or slightly arcuated to S-like curved, not attenuated towards the ends, irregularly arranged in mucilage	not or slightly constricted	thin, indistinct, diffluent	pale blue-green, long cylindrical, W: 0.5–0.8 L: 2–3x longer than wide	granulated	rounded or slightly conical-rounded	N/A	edaphic; surface layers of sandy soils
<i>P. thermalis</i>	thin, indefinite, expanded and prostrate colonies, forming spherical to subspherical, bubble-like or erect, flaky clusters, bright blue-green, or emerald-green to olive green	straight or variously curved and entangled, sometimes arranged in parallel, frequently screw- or ring-like coiled, short (up to 150-celled) or long, not attenuated towards the ends	not or slightly constricted	–	bright blue-green to grey-blue, joined with each other with a thick hyaline bridge W: 0.8–2.4 (2.7) L: 2–4x longer than wide	sometimes with scarcely prominent granules	flat-rounded, rarely slightly conical with ring- or cupola-like large aerotopes	N/A	thermal waters
<i>P. lonchoides</i>	thallus fine, thin indefinite, expanded, forming mats attached to the substrate or free-floating, usually bright blue-green, rarely bluish to greenish or yellow-green to emerald-green	straight or variously curved, sometimes slightly screw-like or spirally-coiled, usually densely arranged and entangled or parallel-arranged, usually 50–100-celled, not attenuated towards the ends	± clearly constricted	–	bright blue-green or emerald-green to grey-blue or greyish, cylindrical with rounded ends, joined with each other with a thick hyaline bridge W: 0.6–1.3 L: 2.0–8.0	homogeneous, without granules, differentiated in centro- and chromato- plasma	acute conical with a single ± lance-like lengthened aerotope, without calyptra	forwards without oscillation and rotation	thermal springs
<i>P. oblonga</i>	–	short	deeply constricted	N/A	spherical to subcylindrical W: 4.6 L: up to 7.0	N/A	conical	N/A	thermal springss

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Species name	Macroscopic appearance	Trichome morphology	Constrictions	Sheaths or envelopes	Vegetative cell color, shape & size (µm)	Cell content	Apical cell	Motility	Ecology
<i>P. articulata</i>	–	solitary or crowded in microscopic aggregates, moderately long (4–40-celled), ± straight or slightly irregularly curved, not attenuated towards the ends	exceedingly constricted	usually without mucilaginous envelopes	pale greyish to greyish blue-green, cylindrical truncate-rounded ends W: 0.8–1.3 L: 3.5–11	scattered coarse granules without aerotopes	rounded or conical rounded	rapid gliding without oscillation and rotation	facultatively benthic, later tychoplanktic and planktic
<i>P. acicularis</i>	–	solitary, usually short, straight, arcuated or slightly irregularly curved	–	N/A	pale blue-green W: 1.0–1.5 L: 8.0–12.0	more or less homogenous	straight, elongated and pointed	N/A	free-floating in lakes
<i>P. amphigranulata</i>	–	straight, short (up to 30-celled), not attenuated towards the ends	slightly or distinctly constricted	–	pale blue-green, with two aerotopes at both sides of the septa W: 1.0–1.4–2.2 L: 2.0–7.0	± distinctly differentiated in centro- and chromato- plasma	rounded without calyptra	slowly motile	various freshwater and brackish habitats; benthic, metaphytic, periphytic
<i>P. balatonica</i>	– –	straight, short	distinctly constricted	fine, indistinct sheath	short cylindrical, isodiametric to up to 2x longer than wide	N/A	N/A	N/A	–
<i>P. tenuis</i>	–	solitary or in clusters, straight or slightly coiled, not attenuated towards the ends	distinctly constricted	–	pale blue-green, long cylindrical to long ellipsoidal with rounded ends, somewhat zigzag joined with each other W: 1.0–1.5 L: 6.0–8.0	without aerotopes	rounded	N/A	freshwater, benthic, on putrified mud, in humus benthos, littoral of lakes
<i>P. raphidioides</i>	–	usually 4–8 celled, attenuated towards the ends, ± screw-like; may disintegrate into solitary cells	N/A	N/A	pale grey-green, cylindrical, W: 0.7–0.9 L: longer than wide	solitary granules at cross-walls	gradually pointed	N/A	freshwater, planktic
<i>P. papillaterminata</i>	–	solitary, usually short, straight, arcuated or slightly waved	distinctly constricted	–	pale blue-green, W: 2.5–3.3 L: 3.5–7.0	1–3 refractive granules	small conical protrusion, probably with a ring-shaped aerotope	N/A	freshwater and salty habitats; benthic

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Species name	Macroscopic appearance	Trichome morphology	Constrictions	Sheaths or envelopes	Vegetative cell color, shape & size (µm)	Cell content	Apical cell	Motility	Ecology
<i>P. dictyothalla</i>	blue-green, free-floating mucilaginous to irregularly clathrate thallus	straight when young, later long, arranged parallel or subparallel or irregularly flexuous, not attenuated towards the ends	constricted	instinct, initially gelatinous, later amorphous and confluent	blue-green, cylindrical with truncate-rounded ends W: 1.0–1.5–2.0 L: 1.0–7.0	homogenous without aerotopes	acute or rounded conical without calyptra	N/A	freshwater, planktic
<i>P. woronichinii</i>	–	solitary, short (max. 8-celled), straight or slightly curved, not or slightly attenuated towards the ends; arranged within mucilage of host organism	not or slightly constricted	–	pale blue-green or greyish, long cylindrical, W: 1.0–2.0 L: 2.5–8.0	sometimes with refractive granules	rounded or slightly conical-rounded	–	freshwater, endogloeic
<i>P. endophytica</i>	–	solitary or in groups, very short, straight or slightly irregularly curved, ± radially-oriented	–	thin, colourless	pale blue-green, isodiametric to longer than wide, W: 1.5–2.3 L: 2.3–6.9	homogenous	rounded	–	freshwater, endogloeic
<i>P. westiana</i>	–	short (max; 8-celled), ± radially-oriented or dispersed within mucilage of other spp.	slightly constricted	thick mucilaginous envelope	intense to pale blue-green, short cylindrical to rod-like or cylindrical-ellipsoidal with rounded ends W: 0.6–1.5 L: 1.0–3.0	homogenous or with tiny granules	N/A	–	freshwater, endogloeic
<i>P. rosea</i>	–	solitary, short (up to 6-celled), straight or slightly bent, not attenuated towards the ends	constricted	–	reddish-violet, cylindrical W: 1.0–2.5 L: ± isodiametric or slightly longer than wide	homogenous without aerotopes	cylindrical with flat conical apex without calyptra	–	freshwater, endogloeic
<i>P. arcuata</i>	–	solitary, short (max. 15-celled), ± straight or curved (arcuated), not attenuated towards the ends	clearly constricted	amorphous, diffluent	pale blue-green to pale olive-green, cylindrical, W: 0.9–1.3 L: 2.0–14.0	homogenous or finely granulated	acute, cylindrical and conical or slightly truncated without calyptra	–	freshwater, endogloeic

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Species name	Macroscopic appearance	Trichome morphology	Constrictions	Sheaths or envelopes	Vegetative cell color, shape & size (µm)	Cell content	Apical cell	Motility	Ecology
<i>P. edaphica</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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