International Journal of Systematic and Evolutionary Microbiology (2001), **51**, 1699–1701 Printed in Great Britain

NOTE

Transfer of *Pfennigia purpurea* Tindall 1999 (*Amoebobacter purpureus* Eichler and Pfennig 1988) to the genus *Lamprocystis* as *Lamprocystis purpurea* comb. nov.

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On the basis of its close phylogenetic relationship to *Lamprocystis roseopersicina*, the phototrophic purple sulfur bacterium originally described as *Amoebobacter purpureus* and recently transferred to *Pfennigia purpurea* is reclassified as *Lamprocystis purpurea* comb. nov. In addition, an emended description of the genus *Lamprocystis* is given.

Keywords: phototrophic purple bacteria, *Amoebobacter purpureus*, *Pfennigia purpurea*, *Lamprocystis purpurea*, new combination

The genus *Amoebobacter* comprised spherical, non-motile species containing gas vesicles (Winogradsky, 1888; Pfennig, 1989). Two species, *Amoebobacter roseus* (the type species) and *Amoebobacter pendens*, were transferred to the genus *Thiocapsa* and a third species, *Amoebobacter pedioformis*, was transferred to the new genus *Thiolamprovum* (Guyoneaud *et al.*, 1998). *Amoebobacter purpureus* was proposed as the new type species of the genus (Guyoneaud *et al.*, 1998). However, because the type species of *Amoebobacter* had been removed, other species of this genus had to change their names, according to Rule 37a of the International Code of Nomenclature of Bacteria (Lapage *et al.*, 1992), unless the name is conserved and the new type established by the Judicial Commission. It was therefore illegitimate to retain the name *Amoebobacter* and to define *Amoebobacter purpureus* as the new type species, as outlined by Tindall (1999). He proposed the transfer of this species to the new genus *Pfennigia*.

However, recent data demonstrate the close relationship of this species to *Lamprocystis roseopersicina* (Bosshard *et al.*, 2000). In fact, a number of new sequences of 16S rDNA have become available since the study of Guyoneaud *et al.* (1998) was completed. It was therefore already quite clear that *Amoebobacter purpureus* would fit into neither *Thiocapsa* nor *Thiolamprovum*, but its relationship to *Lamprocystis* remained unclear, because of the lack of 16S rDNA sequence information. The 16S rDNA sequence of the type strain of *Lamprocystis roseopersicina* is now available and places this species in the group of spherical-to-ovoid, freshwater *Chromatiaceae*, most of which are non-motile and contain gas vesicles (Bosshard *et al.*, 2000). Indeed, the sequence is highly similar (more than 98%) to that of *Amoebobacter purpureus* (Eichler & Pfennig, 1988) and the placement of both bacteria within one genus is strongly supported. Historically, differentiation of the genera *Lamprocystis* and *Amoebobacter* was based mainly on morphological properties, principally motility by flagella and the formation of slime capsules (Pfennig & Trüper, 1989). Because these properties will be of minor importance in a phylogenetically orientated taxonomy (Imhoff *et al.*, 1998), it is not justifiable to maintain two different genera on the basis of these properties alone, in particular if genetic information clearly points out the close relationship of the two bacteria. Both species have in common almost identical DNA G+C contents, high similarity of 16S rDNA sequences, spherical cell shape and the formation of gas vesicles, similar temperature and pH ranges for growth and the lack of salt requirement. They differ in regard to flagellar motility, colour and carotenoid content and the ability to grow chemolithotrophically. Therefore, the properties of the two species fit very well those of two species of a genus. Characteristic properties to differentiate the species of the genus *Lamprocystis* and to distinguish these species from those of *Thiocapsa* and *Thiolamprovum* are shown in Table 1. Considering the classical taxonomic system of phototrophic bacteria, it is only motility and the possession of flagella that may provoke contradiction. However, it is well known that the formation of flagella in some bacteria is an unstable property, that flagellar motility

Table 1. Differential characteristics of *Lamprocystis* species and comparison with species of *Thiocapsa* and *Thiolamprovum*

Taxa are identified as: 1, *Lamprocystis roseopersicina*; 2, *Lamprocystis purpurea*; 3, *Thiocapsa roseopersicina*; 4, *Thiocapsa pendens*; 5, *Thiocapsa rosea*; 6, *Thiolamprovum pedioforme*. Abbreviations: +, positive in most strains; −, negative in most strains; ND, not determined; OK, okenone; SP, spirilloxanthin; RA, rhodopinal. Cells of all species shown are spheres. None of the species requires NaCl for growth, although marine strains of *Thiocapsa roseopersicina* may tolerate low concentrations of NaCl.

Characteristic	1	2	3	4	5	6
Motility	+	−	−	−	−	−
Cell diameter (μm)	2·0–3·5	1·9–2·3	1·2–3·0	1·5–2·0	2·0–3·0	2·0
Gas vesicles	+	+	−	+	+	+
Aggregate formation	Irregular aggregates	Clumps of cells	Tetrads, irregular aggregates	Irregular aggregates	Irregular aggregates	Platelets
Colour of cell suspension	Pink to violet	Purple-red	Pink to rose-red	Pink to rose-red	Pink to rose-red	Pink to rose-red
Carotenoid group	RA	OK	SP	SP	SP	SP
DNA G+C content (mol%)	63·8	63·5–63·6	63·3–66·3	65·3	64·3	65·5
Vitamin B_{12} requirement	ND	ND	−	+	+	−
Sulfate assimilation	ND	−	+	−	−	−
Chemolithotrophic growth	−	+	+	−	+	+
pH optimum	7·0–7·3	7·0–7·3	7·3	6·7–7·5	6·7–7·5	7·4–7·6
Temperature optimum (°C)	20–30	23–25	20–35	20–35	20–35	37

may develop only under certain growth conditions (in particular in bacteria that form gas vesicles) and that formation of flagella may be lost completely during continued laboratory maintenance. For these reasons, putting too much emphasis on this property must be avoided; it cannot necessarily be regarded as a genus-specific property.

On the basis of the available data and in accordance with the rules of the International Code of Nomenclature of Bacteria (Lapage *et al.*, 1992), the transfer of this species to the genus *Lamprocystis* as the new combination *Lamprocystis purpurea* comb. nov. is proposed. Because of the priority of the genus and species name of *Lamprocystis roseopersicina* (Schroeter 1886), *Pfennigia purpurea* Tindall 1999 (*Amoebobacter purpureus* Eichler and Pfennig 1988) is transferred to *Lamprocystis purpurea* comb. nov.

Emended description of the genus *Lamprocystis*

Lamprocystis (Lam.pro.cys′tis. Gr. adj. *lampros* bright, brilliant; Gr. n. *cystis* the bladder, a bag; N.L. fem. n. *Lamprocystis* brilliant bag).

Cells spherical to ovoid, 1·9–3·5 μm in diameter, diplococcus-shaped before cell division, may occur in irregular aggregates or clumps of cells. Cells multiply by binary fission, are non-motile or motile by means of single flagella and form gas vesicles in the central part. Gram-negative and belong to the *γ-Proteobacteria*. Internal photosynthetic membranes are of the vesicular type and contain the photosynthetic pigments bacteriochlorophyll *a* and carotenoids. Photolithoautotrophic growth under anoxic conditions in the light with reduced sulfur compounds such as sulfide and elemental sulfur as electron donors. During oxidation of sulfide, elemental sulfur is stored transiently in the peripheral part of the cells that is free of gas vesicles. Final oxidation product is sulfate. In the presence of sulfide and bicarbonate, simple organic substrates are photoassimilated. Obligately phototrophic or facultatively chemotrophic under microoxic to oxic conditions in the dark. The G+C content of the DNA is 63·5–63·8 mol% (buoyant density).

Type species: *Lamprocystis roseopersicina* (Kützing 1849) Schroeter 1886, 151.

Description of *Lamprocystis purpurea* comb. nov. (*Amoebobacter purpureus* Eichler and Pfennig 1988, 205^{VP}; effective publication Eichler and Pfennig 1988, 399; *Pfennigia purpurea* Tindall 1999, 1308^{VP})

Lamprocystis purpurea (pur.pur′e.a. L. fem. adj. *purpurea* purple or purple-red).

Cells are nearly spherical to oval, 1·9–2·3 μm wide and 2·0–3·2 μm long, non-motile and contain gas vesicles in central parts of cells. Cells single or in irregular aggregates of up to 40 cells. Colour of dense cell suspensions is purple-red. Photosynthetic pigments are bacteriochlorophyll *a* and the carotenoid okenone as a major component. Photolithoautotrophic growth under anoxic conditions in the light with sulfide, thiosulfate and elemental sulfur as electron donors. In the presence of sulfide and bicarbonate, acetate, propionate, pyruvate, lactate, glucose and formate are photoassimilated. Chemolithoautotrophic growth possible with sulfide and thiosulfate as electron donors under microoxic conditions in the dark. Assimilatory sulfate reduction is absent. Mesophilic freshwater bacterium with optimum growth at 23–25 °C and pH 7·0–7·3. Habitat: anoxic, sulfide-containing water of stratified freshwater lakes, mud and stagnant water of ponds and lakes; may occur as a dominant bloom-forming bacterium together with *Thiocapsa roseopersicina* in wastewater lagoons containing degradable organic substances. The G+C content of the DNA is 63·5–63·6 (buoyant density).

Type strain: DSM 4197^T [= ThSch12^T (Eichler and Pfennig) = BN 4450^T (Imhoff)]. The EMBL access-

ion numbers of the 16S rDNA sequence of the type strain are Y12366 and AJ223235.

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