Description of \textit{Caldalkalibacillus uzonensis} sp. nov. and emended description of the genus \textit{Caldalkalibacillus}

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Strain JW/WZ-YB58ᵀ, a thermophilic (42–64 °C), aerobic, alkalitolerant (pH 25–6.4–9.7), heterotrophic, sporulating, retarded-peritrichously flagellated and slightly curved rod-shaped bacterium, was isolated from the hot spring Zarvarzin II in the East Thermal Field of the Uzon Caldera, Kamchatka (Far East Russia). The isolate tolerated high concentrations of CO₂. The major membrane phospholipid fatty acids of JW/WZ-YB58ᵀ included iso-C₁₅:₀ (24.5 %), anteiso-C₁₅:₀ (18.3 %) and iso-C₁₇:₀ (17.5 %). The G+C content of the genomic DNA is 45 mol% (HPLC method). Based on 16S rRNA gene sequence analysis and physiological properties, isolate JW/WZ-YB58ᵀ (=ATCC BAA-1258ᵀ =DSM 17740ᵀ) is proposed as the type strain of \textit{Caldalkalibacillus uzonensis} sp. nov. In contrast to the type species \textit{Caldalkalibacillus thermarum}, a catalase-reaction-positive aerobe, \textit{C. uzonensis} was catalase-reaction-negative; thus the description of the genus \textit{Caldalkalibacillus} is emended to include a catalase-reaction-negative species.

An aerobic heterotrophic, flagellated and slightly curved rod-shaped bacterium, strain JW/WZ-YB58ᵀ, which tolerated high concentrations of CO₂ (up to 90 %) in the head space, was isolated from a hot spring located in the Uzon Caldera (Kamchatka, Far East Russia) and was named ‘\textit{Thermalkalibacillus uzonensis}’ (Zhao et al., 2006). Analysis of 16S rRNA gene sequences suggested that JW/WZ-YB58ᵀ instead represents a novel species of the genus \textit{Caldalkalibacillus} (Xue et al., 2006), which previously contained only the type strain of the species \textit{Caldalkalibacillus thermarum} HA₁ᵀ, an aerobic, heterotrophic, thermophilic bacterium (Xue et al., 2006). The 16S rRNA gene sequence of \textit{C. thermarum} HA₁ᵀ was 96.5 % similar to that of strain JW/WZ-YB58ᵀ and 99 % similar to that of \textit{Bacillus} sp. TA2.A1 (Peddie et al., 2000), suggesting that strain JW/WZ-YB58ᵀ represents a separate species of the genus \textit{Caldalkalibacillus}. The next closest neighbour, \textit{Bacillus horti}, showed 92–93 % 16S rRNA gene sequence similarity to \textit{Caldalkalibacillus} strains (Fig. 1).

Physiological and biochemical properties of strain JW/WZ-YB58ᵀ were described in detail by Zhao et al. (2006). Major phospholipid fatty acids of strain JW/WZ-YB58ᵀ included iso-C₁₅:₀ (24.5 %), anteiso-C₁₅:₀ (18.3 %), iso-C₁₆:₀ (9.9 %), iso-C₁₇:₀ (17.5 %), anteiso-C₁₇:₀ (9.7 %) and C₁₆:₀ (7.6 %). Strain JW/WZ-YB58ᵀ and \textit{C. thermarum} HA₁ᵀ shared many properties. For example, both were strictly aerobic, thermophilic, alkalitolerant, Gram-stain-positive, sporulating rods that were able to grow on a variety of organic substrates including yeast extract, carbohydrates and organic acids. Both species contained iso-C₁₅:₀ (24.5–33.8 %) and iso-C₁₇:₀ (17.5–35.5 %) as major phospholipid fatty acids and the G+C contents of genomic DNA of both strains are about 45 mol% (although one was determined using the HPLC method and the other by \textit{Tm}).

However, the two species differed significantly in several properties (Table 1). For example, in contrast to the type species of the genus \textit{C. thermarum}, strain JW/WZ-YB58ᵀ was motile, contained two to five peritrichously inserted flagella, and was unable to utilize alcohols and sugar alcohols (e.g. D-sorbitol, D-mannitol, glycerol) as carbon and energy sources. Strain JW/WZ-YB58ᵀ also contained anteiso-C₁₅:₀ as the second most abundant fatty acid and was catalase-reaction-negative (Table 1). Strain JW/WZ-YB58ᵀ is therefore assigned to a novel species of the genus \textit{Caldalkalibacillus}, \textit{Caldalkalibacillus uzonensis} sp. nov., and

The GenBank/EMBL/DDBJ accession number for the 16S rRNA gene sequence of strain JW/WZ-YB58ᵀ is DQ221694.
the last difference described above necessitates the emendation of the genus description.

Emended description of the genus Caldalkalibacillus Xue et al. 2006

The description is based on that provided by Xue et al. (2006), with the following amendments. The genus contains catalase-reaction-positive and catalase-reaction-negative species. Predominant cellular phospholipid fatty acids include iso-C15:0, anteiso-C15:0 and iso-C17:0.

Description of Caldalkalibacillus uzonensis sp. nov.

Caldalkalibacillus uzonensis (u.zo.nen’sis. N.L. masc. adj. uzonensis pertaining to the isolation habitat of the type strain, the Uzon Caldera, east of Mt Uzon in Kamchatka, in Far East Russia).

The description is based on the previous detailed publication as ‘Thermalkalibacillus uzonensis’ (Zhao et al., 2006). Cells are Gram-type- (Wiegel, 1981) and Gram-staining-positive, straight to slightly curved rods, 0.7–0.8×5.5–12 μm. Terminally located spherical spores (1.2–1.6 μm in diameter) cause swelling of the mother cell. Cells are motile with two to five peritrichously inserted flagella. Growth is observed only under aerobic conditions. Colonies on nutrient broth agar are circular with entire edges and transparent. Swarming occurs when colonies age. Oxidase reaction, ONPG hydrolysis and gelatin hydrolysis are positive. Catalase reaction, Voges–Proskauer reaction, indole production, urea hydrolysis and starch hydrolysis are negative. At pH 25°C 8.0, the growth temperature range is 42–64°C with optimum growth at 50–52°C. The pH 25°C range is 6.4–9.7, with optimum growth at pH 25°C 8.2–8.4 when grown at 52°C. NaCl is tolerated at 0–6% (w/v). Cells grow on complex substrates (such as yeast extract), carbohydrates and acids but not on alcohols or sugar alcohols. Acid production occurs from trehalose, lactose, sucrose, arabinose and fructose. Major phospholipid fatty acids are iso-C15:0 (24.5%), anteiso-C15:0 (18.3%), iso-C16:0 (9.9%), iso-C17:0 (17.5%), anteiso-C17:0 (9.7%), and C16:0 (7.6%). The G+C content of genomic DNA of the type strain is 45 mol% (HPLC; Mesbah et al., 1989). Cells do not grow...
chemolithoautotrophically on 1–5 % v/v CO or 5 % CO₂ with or without H₂ and do not oxidize CO, even at low concentrations (100 p.p.m.). Cells growing under shaking tolerate up to 90 % (v/v) CO in the air-balanced headspace.

The type strain is JW/WZ-YB58ᵀ (=ATCC BAA-1258ᵀ =DSM 17740ᵀ), which was isolated from a microbial mat sample collected from the edges of the hot spring Zarvarzin II in the East Thermal Field of the Uzon Caldera, Kamchatka (Far East Russia).

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References


