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Streptomyces baliensis sp. nov., isolated from Balinese soil

Misa Otoguro, 1 Shanti Ratnakomala, 2 Yulin Lestari, 3 Ratih D. Hastuti, 4 Evi Triana, 5 Yantyati Widayastuti 2 and Katsuhiko Ando 1

1NITE Biological Resource Center (NBRC), Department of Biotechnology, National Institute of Technology and Evaluation (NITE), 2-5-8 Kazusakamatsuri, Kisarazu, Chiba 292-0818, Japan
2Research Center for Biotechnology, Indonesian Institute of Sciences, Jl. Raya Bogor Km. 46, Cibinong 16911, Indonesia
3Department of Biology, Faculty of Mathematics and Natural Sciences, Bogor Agricultural University, Jl. Raya pajajaran, Bogor 16144, Indonesia
4Soil Research Institute, Jl. Ir. H. Juanda 98, Bogor 16002, Indonesia
5Research Center for Biology, Indonesian Institute of Sciences, Jl. Raya Bogor Km. 46, Cibinong 16911, Indonesia

The taxonomic positions of actinomycete strains ID03-0915 T and ID03-0825, isolated from soil on the Indonesian island of Bali, were examined using a polyphasic taxonomic approach. The morphological and chemotaxonomic characteristics of these organisms are typical of the genus Streptomyces. Phylogenetic analyses performed using almost-complete 16S rRNA gene sequences demonstrated that the strains were closely related to Streptomyces glauciniger and Streptomyces flacvicolor. However, DNA–DNA hybridization and phenotypic characteristics revealed that the strains differed from known Streptomyces species. Therefore, we conclude that strains ID03-0915 T and ID03-0825 (= BTCC B-563) represent a novel species of the genus Streptomyces, for which we propose the name Streptomyces baliensis sp. nov. The type strain is strain ID03-0915 T (= BTCC B-568 = NBRC 104278 T).

The genus Streptomyces was proposed by Waksman & Henrici (1943) and includes aerobic, spore-forming soil bacteria with high DNA G+C contents (69-78 mol%); rod-shaped spores originate from the substrate mycelium, L-l-diaminopimelic acid (L-Apm) is found in the cell wall and galactose and mannose are found in whole-cell hydrolysates. Although the genus Streptomyces contains more than 500 species (Itain et al., 1997) with validly published names, the genus remains a target for screening for novel secondary metabolites.

In the course of an investigation of actinomycetes from Indonesia, strains ID03-0915 T and ID03-0825 were isolated from soil collected from the island of Bali. These isolates formed colonies typical of the genus Streptomyces. The aim of this study was to determine the taxonomic positions of strains ID03-0915 T and ID03-0825 by a polyphasic taxonomic approach that included phylogenetic analyses, chemotaxonomic characteristics, DNA–DNA hybridization and physiological properties.

The strains were isolated using the SDS/yeast extract method (Hayakawa & Nonomura, 1989) and humic acid/vitamin (HV) agar (Hayakawa & Nonomura, 1987) supplemented with cycloheximide (50 mg l−1) and sodium dextric acid (20 mg l−1). Morphological and chemotaxonomic studies were performed with the two isolates to confirm whether they exhibited properties similar to those of the genus Streptomyces. Morphology was observed under a light microscope and a scanning electron microscope (SEM model JSM-6060; JEOL) on yeast extract-starch (YS) medium or HV agar incubated for 14 days at 28 °C. Cultural and physiological characteristics were examined as described previously (Shirling & Gottlieb, 1966).

Apm isomers and whole-cell sugar patterns were analysed according to the procedures developed by Hasegawa et al. (1983) and Lechevalier & Lechevalier (1980). Fatty acid compositions were analysed by GC using the MIDI system (Sasser, 1990; Kämpfer & Kroppenstedt, 1996). Isoprenoid quinones and polar lipids were examined as described previously (Schaal, 1985; Minnikin et al., 1984; Tamura et
Streptomyces species be recognized as belonging to distinct species of the genus (Labeda, 1993, 1996, 1998). It is clear from the phenotypic and genotypic data that the two isolates should be classified within a novel species of the genus Streptomyces, for which we propose the name Streptomyces baliensis sp. nov.

**Description of Streptomyces baliensis sp. nov.**

*Streptomyces baliensis* (ba.li.en' sis. N.L. masc. adj. baliensis pertaining to the island of Bali, Indonesia, where the first strains were isolated).


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