**Candida andamanensis** sp. nov., **Candida laemsonensis** sp. nov. and **Candida ranongensis** sp. nov., anamorphic yeast species isolated from estuarine waters in a Thai mangrove forest

Somjit Am-In,1,2 Savitree Limtong,1 Wichien Yongmanitchai1 and Sasitorn Jindamorakot2

**Correspondence**
Savitree Limtong
fscistl@ku.ac.th

1Department of Microbiology, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand
2Central Research Unit, National Center for Genetic Engineering and Biotechnology, National Science and Technology Development Agency (NSTDA), Pathumthani 12120, Thailand

Five strains (RV5T, RV140, R31T, RS17 and RS28T) representing three novel anamorphic ascomycetous yeast species were isolated by membrane filtration from estuarine waters collected from a mangrove forest in Laem Son National Park, Ranong Province, Thailand, on different occasions. On the basis of morphological, biochemical, physiological and chemotaxonomic characteristics, sequence analysis of the D1/D2 domain of the large-subunit rRNA gene and the internal transcribed spacer region and phylogenetic analysis, three strains were found to represent two novel *Candida* species. Two strains (RV5T and RV140) represented a single novel species, for which the name *Candida laemsonensis* sp. nov. is proposed. The type strain is RV5T (=BCC 35154T =NBRC 105873T =CBS 11419T). Strain R31T was assigned to a novel species that was named *Candida andamanensis* sp. nov. (type strain R31T =BCC 25965T =NBRC 103862T =CBS 10859T). On the basis of morphological, biochemical, physiological and chemotaxonomic characteristics, sequence analysis of the D1/D2 domain of the large-subunit rRNA gene and phylogenetic analysis, strains RS17 and RS28T represented another novel species of *Candida*, for which the name *Candida ranongensis* sp. nov. is proposed. The type strain is RS28T (=BCC 25964T =NBRC 103861T =CBS 10861T).

**Yeasts in the genus Candida** are distributed widely in both terrestrial and aquatic habitats. In aquatic habitats, *Candida* strains have been found in fresh water, estuarine water and sea water (Cooke et al., 1960; Hagler & Ahearn, 1981, 1987; Spencer & Spencer, 1997; de Almeida, 2005; Butinar et al., 2005; Nagahama, 2006; de Garcia et al., 2007; Limtong et al., 2007, 2008; Boonmak et al., 2009; Limtong et al., 2010). Mangrove forests, or intertidal forests, are plant communities in saline coastal habitats distributed over a wide range of geographical zones (Aksornkoae, 1999). Yeasts and other fungi are prevalent in mangrove ecosystems, where they play an important role in the detrital food web and may be a food source for some marine invertebrates and zooplankton (Nagahama, 2006). Yeasts are generally abundant in water adjacent to and within mangrove swamps (Fell et al., 2004). Recently, we reported two novel yeast species from estuarine waters collected from mangrove forests in a coastal area of the Andaman Sea in Khao Lumpee-Haad Thaimueang National Park and Mu Ko Ra-Ko Prathong National Park, Phang-Nga Province, as *Candida thaimueangensis* (Limtong et al., 2007) and *Candida phangngensis* (Limtong et al., 2008). Two more novel species, *Candida siamensis*, obtained from sediment (Boonmak et al., 2009), and *Candida suwanaritii* (Limtong et al., 2010), obtained from water in a mangrove forest in Pred Nai village, Trat Province, in coastal areas of the Gulf of Thailand have also been reported.

In the course of investigations of yeasts in waters of a mangrove forest in Laem Son National Park, Ranong Province, Thailand (9° 13′–32′ N 98° 16′–27′ E), various yeast strains were isolated by the membrane filtration technique. *Kluyveromyces siamensis* (Am-In et al., 2008) and *Candida sanitii* (Limtong et al., 2010) were described for yeasts isolated from this mangrove forest, and five other strains which were found to represent three novel species of the genus *Candida* are described in this study.

**Abbreviation:** LSU, large subunit.

The GenBank/EMBL/DDBJ accession numbers for the 26S rRNA gene D1/D2 and ITS region sequences determined in this study are AB438205, AB438206, AB334210–AB334213, AB54173, AB54174 and AB525239.
Yeast isolation

Yeast strains were isolated from estuarine waters collected in 1998–1999, 2005 and 2006 by membrane filtration following the method of Limtong et al. (2007). Purified yeast strains were suspended in YM broth (0.3 % yeast extract, 0.3 % malt extract, 0.5 % peptone and 1 % glucose) supplemented with 10 % glycerol and maintained at −80 °C.

DNA sequencing and phylogenetic analysis

Methods for DNA isolation, amplification of the D1/D2 domain of the large subunit (LSU) rRNA gene by PCR and sequencing with the ABI BigDye Terminator cycle sequencing kit, version 3.1 (Applied Biosystems), using an ABI PRISM 3100 automated DNA sequencer (Applied Biosystems), were described previously (Am-In et al., 2008). The sequences were compared pairwise using the BLASTN sequence similarity search program (Altschul et al., 1997) and were aligned with sequences of related species retrieved from GenBank using the multiple alignment program CLUSTAL_X version 1.83 (Thompson et al., 1997). A phylogenetic tree was constructed from the evolutionary distance data with Kimura’s two-parameter correction (Kimura, 1980) using the neighbour-joining method (Saitou & Nei, 1987). Confidence levels of clades were estimated from bootstrap analysis (1000 replicates) (Felsenstein, 1985).

Yeast characterization

The strains were characterized morphologically, biochemically and physiologically according to the standard methods described by Yarrow (1998). Assimilation of nitrogen compounds was investigated on solid media with starved inocula following the method of Nakase & Suzuki (1986a). Vitamin requirements were determined according to the method of Komagata & Nakase (1967). Growth at various temperatures was determined by cultivation in YM broth. Ubiquinones were extracted from cells cultivated in 500 ml Erlenmeyer flasks containing 250 ml YPD broth (1 % yeast extract, 2 % peptone and 2 % glucose) on a rotary shaker at 28 °C for 24–48 h and harvested by centrifugation. The cells were washed three times with distilled water. The isolation, purification and identification of ubiquinones were carried out according to Nakase & Suzuki (1986b).

Novel species, delineation and ecology

The sequences of the D1/D2 domain of the LSU rRNA gene revealed that 94 of the strains were found to belong to 25 ascomycetous species (Candida berthetii, C. boidinii, C. butyri, C. glabrata, C. parapsilosis, C. phangngensis, C. picinguabensis, C. pseudolambica, C. rugosa, C. silvae, C. thaimueangensis, C. tropicalis, Debaryomyces nepalensis, Galactomyces geotrichum, Linera saturnus, Kodamaea ohmeri, Pichia burtonii, P. caribbica, P. galeiformis, P. kluveri, P. kudriavzevii, P. occidentalis, P. sporocuriosa, P. terricola and Torulaspora maleaeae) and four basidiomycetous species (Rhodotorula mucilaginosa, Trichosporon asahii, Trichosporon coremiiforme and Trichosporon japonicum). The remaining strains were found to represent undescribed and/or novel yeast species. Among the strains of novel species, strains RV5T and RV140, which were isolated from two water samples collected in 1998–1999, strain R31T, which was obtained from a water sample collected in 2005, and strains RS17 and RS28T, which were isolated from two water samples collected in 2006, were found to represent three novel species.

This investigation revealed a wide diversity of yeasts in the waters of this mangrove forest. Investigations of yeasts in water from other mangrove forests in Thailand have identified Candida conglobata, C. membranifaciens, C. parapsilosis, C. phangngensis, C. picinguabensis, C. thaimueangensis, C. tropicalis, Geotrichum siamensis, Lodderomyces elongisporus, P. caribbica, P. guilliermondii and R. mucilaginosa in water from Kho Lumpee-Haad Thaimueang National Park (Kaewwichian et al., 2010; Limtong et al., 2007, 2008) and C. parapsilosis, C. phangngensis, Candida cf. glabrata UWO (PS) 98-110.4, P. caribbica, P. fabianii, P. guilliermondii and R. mucilaginosa in water from Mu Ko Ra-Şo Prathong National Park (Limtong et al., 2007, 2008). Comparison of the yeasts found in waters of the three mangrove forests indicated that most species found in this study were not present in the other mangrove forests. Only C. parapsilosis, P. caribbica and R. mucilaginosa were found from all three mangrove forests, while C. thaimueangensis and P. fabianii found in this study were present in one of the other mangrove forests. This may result from different environmental factors.

Yeast isolation and identification

A total of 149 yeast strains were obtained from the estuarine water samples. Identification on the basis of comparison of sequences of the D1/D2 domain of the LSU rRNA gene revealed that 94 of the strains were found to belong to 25 ascomycetous species (Candida berthetii, C. boidinii, C. butyri, C. glabrata, C. parapsilosis, C. phangngensis, C. picinguabensis, C. pseudolambica, C. rugosa, C. silvae, C. thaimueangensis, C. tropicalis, Debaryomyces nepalensis, Galactomyces geotrichum, Linera saturnus, Kodamaea ohmeri, Pichia burtonii, P. caribbica, P. galeiformis, P. kluveri, P. kudriavzevii, P. occidentalis, P. sporocuriosa, P. terricola and Torulaspora maleaeae) and four basidiomycetous species (Rhodotorula mucilaginosa, Trichosporon asahii, Trichosporon coremiiforme and Trichosporon japonicum). The remaining strains were found to represent undescribed and/or novel yeast species. Among the strains of novel species, strains RV5T and RV140, which were isolated from two water samples collected in 1998–1999, strain R31T, which was obtained from a water sample collected in 2005, and strains RS17 and RS28T, which were isolated from two water samples collected in 2006, were found to represent three novel species.

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the ITS region. From these results, we concluded that strains RV5T and RV140 represent a single novel species.

Sequence similarity analysis of the D1/D2 domain of the LSU rRNA gene showed that strain R31T was closely related to *C. conglobata*, with 0.9% nucleotide substitutions (five nucleotide substitutions out of 530 nt), and to *Candida aaseri* and *C. butyri*, again with 0.9% nucleotide substitutions (five nucleotide substitutions and one gap out of 531 nt). The phylogenetic tree based on sequences of the D1/D2 domain of the LSU rRNA gene demonstrated that strain R31T was placed in a position distinct from *C. conglobata*, *C. aaseri* and *C. butyri* (Fig. 1). Therefore strain R31T was considered to represent a distinct species. As the sequence differences in the D1/D2 domain of the LSU rRNA gene were relatively small, the ITS region was sequenced to confirm the novelty of this strain. In this region, the sequence of strain R31T differed from those of its closest relatives as follows: from *C. butyri* by 5.1% nucleotide substitutions (31 substitutions and 11 gaps out of 607 nt), from *C. aaseri* by 5.5% nucleotide substitutions (33 substitutions and 17 gaps out of 604 nt) and from *C. conglobata* by 5.8% nucleotide substitutions (35 substitutions and 30 gaps out of 601 nt). These results supported the conclusion that strain R31T represents a novel species.

Strains RS17 and RS28T showed identical LSU rRNA gene D1/D2 domain sequences. The closest strains in terms of pairwise sequence similarity were *Candida sp. BG02-7-10-001A-1-1* (AY520387) and *Candida sp. BG02-7-21-004Q-1-2* (AY502097). The phylogenetic tree based on sequences of the LSU rRNA gene showed that strain RS17 and RS28T were closely related to each other, with 0.9% nucleotide substitutions (three substitutions and one gap out of 607 nt). These results supported the conclusion that strains RS17 and RS28T represent a single novel species.
gene D1/D2 domain demonstrated that the two strains clustered with Candida sp. BG02-7-17-001A-1-1 and Candida sp. BG02-7-21-004Q-1-2 and were placed in a position distant from C. scorzettiae and other related species (Fig. 1). Therefore, the two novel strains were considered to represent another single novel, phylogenetically distinct species.

Cells of strains RV5T and RV140 were subglobose, ellipsoidal to elongate, while cells of strains R31T, RS17 and RS28T were ovoidal to ellipsoidal (Fig. 2). The strains proliferated by multilateral budding. Pseudohyphae were formed, but true hyphae were not formed by the novel strains. No ascospores were produced from individual strains or strains paired on YM agar, 5 % malt extract agar, Fowell’s acetate agar, cornmeal agar or Gorodkowa agar after 6 weeks at 15 or 28 °C.

On the basis of morphological, biochemical, physiological and chemotaxonomic characteristics, sequence analysis of the LSU rRNA gene D1/D2 domain and the ITS region and phylogenetic analysis, we conclude that strains RV5T and RV140 represent a single novel species of Candida, for which the name Candida laemsonensis sp. nov. is proposed, and that strain R31T represents a novel species that we name Candida andamanensis sp. nov. On the basis of morphological, biochemical, physiological and chemotaxonomic characteristics, sequence analysis of the LSU rRNA gene D1/D2 domain and phylogenetic analysis, strains RS17 and RS28T were found to represent a third novel species, for which the name Candida ranongensis sp. nov. is proposed.

In practice, C. laemsonensis sp. nov. can be distinguished from C. berthetii, its closest phylogenetic relative, by only a few phenotypic characteristics, including its ability to assimilate sorbose and cellobiose, its ability to grow in 0.01 and 0.1 % cycloheximide and its ability to grow on 50 and 60 % glucose.

C. andamanensis sp. nov. can be distinguished from its closest relative C. conglobata by its inability to ferment D-glucose, D-galactose and trehalose, by its ability to assimilate sucrose, maltose, melezitose and methyl α-D-glucoside and

![Fig. 2. Budding cells on YM agar after 4 days at 28 °C (a, c, g) and pseudohyphae formed on cornmeal agar after 7 days at 28 °C (b, d, e, f) by Candida laemsonensis sp. nov. RV5T (a, b), Candida andamanensis sp. nov. R31T (c–e) and Candida ranongensis sp. nov. RS28T (f, g). Bars, 10 μm.](http://ijs.sgmjournals.org)
by its ability to grow in 0.01% cycloheximide, 50% glucose and at 37 °C. *C. andamanensis* sp. nov. can be distinguished from *C. aasri* by its inability to assimilate lactose and citric acid, its ability to assimilate D-arabinose, its ability to grow in vitamin-free medium, at 0.01% cycloheximide and at 40 and 42 °C (weak) and by its ability to grow on 50 and 60% glucose. *C. andamanensis* sp. nov. can be separated from *C. butyri* by its inability to ferment D-glucose and to assimilate citric acid and by its ability to grow in vitamin-free medium and at 0.01% cycloheximide and at 40 and 42 °C (weak).

*C. ranongensis* sp. nov. can be distinguished from *C. scorzettae*, the closest described species, on the basis of the LSU rRNA gene D1/D2 domain sequence and some phenotypic characteristics, including its inability to assimilate cellobiose, lactose, salicin and citric acid and its ability to assimilate L-sorbitose and to grow in 10% NaCl and at 37, 40 and 42 °C (weak).

Strains RV5T and RV140 of *C. laemsonensis* sp. nov. were isolated from different water samples collected in 1998–1999 which were characterized by pH of 7.7 and 7.4, temperatures of 25.3 and 25.2 °C and salinity of 0 p.p.t. Strains RS17 and RS28T of *C. ranongensis* sp. nov. were derived from water samples collected in 2005 which were characterized by lower pH (6.9 and 7.0), higher temperatures (27.4 and 27.3 °C) and higher salinity (14 and 13 p.p.t.). Strain R31T of *C. andamanensis* sp. nov. was obtained from a water sample collected in 2005 that was characterized by the highest pH (8.0), temperature (29.7 °C) and salinity (34 p.p.t.). This shows that the three novel species are not the dominant species in this mangrove forest and that each of them was present only in a specific natural environment that differed in pH, temperature and salinity. The three novel species were found in water only from a mangrove forest in Ranong Province, and not from the other mangrove forests in other areas of Thailand, indicating that they are not common species of these mangrove habitats.

**Latin diagnosis of Candida laemsonensis Am-In, Limtong, Yongmanitchai & Jindamorakot sp. nov.**

*In medio liquido YM, post dies 3 ad 28 °C cellulæ subglobosæ, ellipsoïdæ aut elongatæ (3–6 × 3–7 μm), singulae aut binae, per germinationem multiplorem reproducentes. In agar YM, post dies 4 ad 28 °C, cultura butyrosa, cremea, sublatum, glabra et margine labata minuta. Pseudo hyphae formantur nec hyphae non formantur. Ascosporae non formantur. D-Glucosum (infrime) fermentatur et non D-galactosum, sucrosum, maltosum, lactosum, trehalosum, raffinosum nec melibiosum. D-Glucosum, L-sorosum (lente), cellobiosum, ethanolum, glycerol, salcinum, D-glucono-δ-lactonum (infrime), acidum DL-lacticum, acidum succinicum, acidum citricum, nitrosum, nitricum, ethylaminum, L-lysinum et cadaverinum assimilantur at non D-galactosum, sucrosum, maltosum, trehalosum, lactosum, melibiosum, raffinosum, melitosum, inulimum, amyllum solubile, D-xylosum, L-arabinosum, D-arabinosum, D-ribosum, L-rhamnosum, N-acetyl-D-glucosaminum, methanolum, erythritolum, ribitolum, D-mannitolum, galactitolum, D-glucitolum, methyl-α-D-glucosinum, acidum D-glucuronium, acidum D-gluconicium, acidum D-galacturonum, acidum 2-keto-D-glucuronum, acidum 5-keto-D-glucuronum nec inositolum. Vitamina externa ad crescentiam necessaria non sunt. Crescit in 50% glucosum, 60% glucosum, 0.01% cycloheximido et 0.1% cycloheximido. Non crescit in 10% NaCl/5% glucosum, 15% NaCl/5% glucosum. Cresce postes in temperatura 20, 25, 37, 40 et 42 °C (infrime) et non crescit in temperatura 45 °C. Amyllum non formatur. Acidum fermentatur. Diazonium caeruleum B non respondens. Ureum non hydrolysatur. Ubiquinonum majus Q-7.

Holotypus: stirps RV5T isolatus aqua, Ranong Provincia, Thailandia. *Cultura et conservatur in collectionie culturae in BIOTEC Culture Collection (BCC), National Center for Genetic Engineering and Biotechnology (BIOTEC), Pathumthani, Thailandia ut BCC 35154T*; NITE Biological Resources Center (NBRC), Department of Biotechnology, National Institute of Technology and Evaluation, Chiba, *Japonia conservatur ut NBRC 105873T* et Centraalbureau voor Schimmelcultures (CBS), Utrecht, *Hollandia ut CBS 11419T*.

**Description of Candida laemsonensis Am-In, Limtong, Yongmanitchai & Jindamorakot sp. nov.**

*Candida laemsonensis* (laem.son.en-sis. N.L. fem. adj. laemsonensis referring to Laem Son National Park, Ranong Province, Thailand, where the first two strains were isolated).

After growth on YM agar for 3 days at 28 °C, cells are subglobose, ellipsoid to elongate (3–6 × 3–7 μm) and occur singly or in pairs (Fig. 2a). Budding is multilateral. The streak culture on YM agar after 4 days at 28 °C is butyrous, cream-coloured, raised, smooth-surfaced and has a finely lobed margin. In slide culture on cornmeal agar at 28 °C after 7 days, rudimentary pseudo hyphae are formed but septate hyphae are not formed (Fig. 2b). No ascospores are produced from individual strains or strains paired on YM agar, 5% malt extract agar, cornmeal agar or Gorodkowa agar after 6 weeks at 15 or 28 °C. Glucose is fermented weakly and D-galactose, sucrose, maltose, lactose, trehalose, raffinose and melibiose are not fermented. D-Glucose, L-sorbitose (latent), cellobiose, ethanol, glycerol, salicin, D-glucono-1,5-lactone (weak), DL-lactic acid, succinic acid, citric acid, nitrate, nitrite, ethylamine, L-lysine and cadaverine are assimilated; D-galactose, sucrose, maltose, trehalose, lactose, melibiose, raffinose, melezitose, inulin, soluble starch, D-xylose, L- and D-arabinose, D-ribose, L-rhamnose, N-acetyl-D-glucosamine, methanol, erythritol, ribitol, D-mannitol, galactitol, D-gluconol, methyl α-D-glucoside, D-gluconic acid, D-gluconic acid, D-galacturonic acid, 2-keto-D-glucuronic acid, 5-keto-D-glucuronic acid and inositol are not assimilated. Grows in vitamin-free medium and in the presence of 50 and 60% glucose and 0.01 and 0.1% cycloheximide. No growth in the presence of 10% NaCl/5% glucose or 15% NaCl/5% glucose. Growth is observed at 20, 25, 37, 40 and 42 °C (weak); no growth at 45 °C. Starch-like...
three novel Candida species isolated in Thailand

Latin diagnosis of Candida andamanensis Am-In, Limtong, Yongmanitchai et Jindamorakot sp. nov.

In medio liquido YM, post dies 3 ad 28 °C cellulae ovoideae aut ellipsoidae (3–5 × 3–7 μm), singulae aut binae, per germinationem multipolarem reproducuntur. In agaro YM, post dies 3 ad 28 °C, cultura butyrosa, creema, sublatum, glabra et margine glabra vel undulato. Pseudohyphae formantur nec hyphae non formantur. Ascosporeae non formantur. Fermentatio nulla. D-Glucosum, D-galactosum, L-sorbosum, sucrosum, maltosum, cellobiosum, trehalosum, melezitosum, D-xylolium, L-arabinosum, D-arabinosum, D-ribosum, N-acetyl-D-glucosaminum, ethanolum, glycerolum, erythritolium, ribitolium, D-mannitolum, D-glucitolum, methyl-D-glucosidum, salicinum, acidum D-glucicum, D-glucosamino-D-lactonum, acidum sucinnicum assimilantur at non lactosum, melibiosum, raffinosum, inulinum, amyllum soluble, L-rhamnosum, methanolum, galactitolum, D-gluconicum, acidum D-galacturonici num, acidum 2-keto-D-gluconicum, acidum 5-keto-D-gluconicum, acidum DL-lacticum, acidum citricum nec inositolum. Ethylaminum, L-lysinum et cadaverinum assimilantur at non nitrosum nec nitricum. Vitamina externa ad crescentiam necessaria non sunt. Crescit in 10% NaCl/5% glucosum, 15% NaCl/5% glucosum, 0.01% cycloheximido, 50% glucosum et 60% glucosum. Non crescit in 0.1% cycloheximido. Crescere potest in temperatura 20, 25, 37, 40 et 42 °C (infirmo) et non crescit in temperatura 45 °C. Diazonium caeruleum B non responsens. Urea non hydrolysatur. Acidum nec amyllum non formatur. Ubiquinonum majus Q-9.

Holotypus: strīps R31T isolatus aqua, Ranong Provincia, Thailandia. Cultura et conservatur in collectione culturearum in BCC, BIOTEC, Pathumthani, Thailandia ut BCC 25965T; NBRC, Department of Biotechnology, National Institute of Technology and Evaluation, Chiba, Japania conservatur ut NBRC 103862T et CBS, Utrecht, Hollandia ut CBS 10859T.

Description of Candida andamanensis Am-In, Limtong, Yongmanitchai et Jindamorakot sp. nov.

Candida andamanensis (an.da.man.en’sis. N.L. fem. adj. andamanensis referring to the Andaman Sea, on the coast of which the mangrove forest from which the type strain was isolated is located).

After 3 days of growth in YM broth at 28 °C, cells are ovoidal to ellipsoidal (3–5 × 3–7 μm) and occur singly or in pairs (Fig. 2c). Budding is multilateral. After 3 days of growth on YM agar at 28 °C, the streak culture is butyrous, cream-coloured and raised, with a smooth surface, and has an entire to undulating margin. Pseudohyphae are formed but true hyphae are not formed in slide culture on cornmeal agar after 7 days at 28 °C (Fig. 2d, e). Ascospores are not produced on YM agar, 5% malt extract agar, Fowell’s acetate agar, cornmeal agar or Gorodkowa agar after 6 weeks at 15 or 28 °C. Fermentation is negative. D-Glucose, D-galactose, L-sorbose, sucrose, maltose, cellobiose, trehalose, melezitose, D-xyllose, L- and D-arabinose, D-ribose, N-acetyl-D-glucosamine, ethanol, glycerol, erythritol, ribitol, D-mannitol, D-glucitol, methyl-D-glucoside, salicin, D-gluconic acid, D-glucono-1,5-lactone and succinic acid are assimilated; lactose, melibiose, raffinose, inulin, soluble starch, L-rhamnose, methanol, galactitol, D-glucuronic acid, D-galacturonic acid, 2-keto-D-gluconate, 5-keto-D-glucurate DL-lactic acid, citric acid and inositol are not assimilated. Ethylamine, L-lysine and cadaverine are assimilated, but nitrate and nitrite are not. Grow in vitamin-free medium and in the presence of 10% NaCl/5% glucosum, 15% NaCl/5% glucosum, 0.01% cycloheximide and 50 and 60% glucosum. No growth in the presence of 0.1% cycloheximide. Growth is observed at 20, 25, 37, 40 and 42 °C (weak); no growth at 45 °C. Diazonium blue B reaction is negative. Urea is not hydrolysed. No acid formation from glucose. Starch-like compounds are not produced. Ubiquinone is Q-9.

Holotypus: R31T is the holotype. The strain was isolated from estuarine water collected from a mangrove forest in Laem Son National Park, Ranong Province, Thailand. Living cultures from the type have been deposited as BCC 25965T, NBRC 103862T and CBS 10859T.
D-glucuronic acid, d-galacturonic acid, d-galactonic acid, 5-keto-d-glucuronic acid, l-citruline nectarum nec inositolum. Ethylamminum, l-lysine et cadaverinum assimilantur at non nitrosum nec nitricum. Vitamina externa ad crescentiam necessaria non sunt. Crescit in 10% NaCl/5% glucosum, 0.01% cycloheximido, 50% glucosum et 60% glucosum. Non crescit in 15% NaCl/5% glucosum et 0.1% cycloheximido. Crescere potest in temperatura 20, 25, 37, 40 et 42 °C (infrime) et non crescit in temperatura 45 °C. Diazonium caeruleum B non respondens. Ureum non hydrolysatur. Acidum nec amyllum non formatur. Ubiquinonum majus Q-9.

Holotypus stirps RS28T isolatus aqua, Ranong Provincia, Thailandia. Cultura et conservatus in collectione culturarium in BCC, BIOTEC, Pathumthani, Thailandia ut BCC 25964T; NBRC, Department of Biotechnology, National Institute of Technology and Evaluation, Chiba, Japonia conservatus ut NBRC 103861T et CBS, Utrecht, Hollandia ut CBS 10861T.

Description of Candida ranongensis Am-In, Limtong, Yongmanitchai & Jindamorakot sp. nov.

Candida ranongensis (ra.nong.en’sis. N.L. fem. adj. ranongensis referring to Ranong Province, where the mangrove forest that yielded the first strains is located).

After 3 days of growth in YM broth at 28 °C, cells are ovoidal to ellipsoidal (3–4 x 4–7 μm) and occur singly or in pairs (Fig. 2g). Budding is multilateral. After 3 days of growth on YM agar at 28 °C, the streak culture is butyrous, cream-coloured and raised, with a smooth surface, and has an entire margin. Pseudohiphyae are formed but true hyphae are not formed in slide culture on cornmeal agar after 7 days at 28 °C (Fig. 2f). No ascospores are produced from individual strains or strains paired on YM agar, 5% malt extract agar, Fowell’s acetate agar, cornmeal agar or Gorodkowa agar after 6 weeks at 15 or 28 °C. Fermentation is negative. D-Glucose, D-galactose, D-sorbitose, maltose, trehalose, D-xylolose, N-acetyl-D-glucosamine, ethanol, glycerothibitol (latent), D-mannitol, D-glucitol, D-gluconic acid, D-glucono-1,5-lactone, 2-keto-D-gluconate (weak), DL-lactic acid and succinic acid are assimilated; sucrose, cellobiose, lactose, melibiose, raffinose, melizitose, inulin, soluble starch, L- and D-arabinose, D-ribose, L-rhamnose, methanol, erythritol, galactitol, methyl α-D-glucoside, salicin, D-glucuronic acid, D-galacturonic acid, 5-keto-D-glucuronic acid, citric acid and inositol are not assimilated. Ethylamine, l-lysine and cadaverine are assimilated, but nitrate and nitrite are not. Grows in vitamin-free medium and in the presence of 10% NaCl/5% glucose, 0.01% cycloheximide and 50 and 60% glucose. No growth in the presence of 15% NaCl/5% glucose or 0.1% cycloheximide. Growth is observed at 20, 25, 37, 40 and 42 °C (weak); no growth at 45 °C. Diazonium blue B reaction is negative. Urea is not hydrolysed. No acid formation from glucose. Starch-like substances are not produced. Ubiquinone is Q-9.

Holotype: RS28T is the holotype. The strain was isolated from estuarine water collected from a mangrove forest in Laem Son National Park, Ranong Province, Thailand. Living cultures from the type have been deposited as BCC 25964T, NBRC 103861T and CBS 10861T.

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References


