First Report of Ceriporiopsis resinascens (Phanerochaetaceae, Basidiomycota) in Korea

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An unrecorded Ceriporiopsis species was collected at Mt. Gariwang, Gangwon Province, in 2008. Based on morphological characteristics, such as a fully resupinate basidiocarp, a reddish white to pinkish poroid hymenophore and a monomitic hyphal system with clamp connections, the species was identified as Ceriporiopsis resinascens. This is the first report of Ceriporiopsis resinascens in Korea. We confirmed the identity of the species as Ceriporiopsis resinascens based on ITS sequence analysis.

KEYWORDS: Ceriporiopsis resinascens, ITS, Wood-rotting fungi

The genus Ceriporiopsis Domański was classified in the family Polyporaceae Fr. ex Corda along with other genera that possess poroid hymenophores (Ryvarden, 1991). This genus is characterized by resupinate basidiocarps, monomitic hyphal systems, non-amyloid hyaline basidiospores and white rot physiology. Most characteristics of Ceriporiopsis are similar to those of Oligoporus Bref. and Tyromyces P. Karst. (Gilbertson and Ryvarden, 1986). However, Ceriporiopsis differs from Oligoporus in its rotting type. Specifically, the latter causes brown rot in attacked wood. Tyromyces is distinguished by the presence of mostly plicate basidiocarps and scattered skeletal hyphae (Gilbertson and Ryvarden, 1986). Previous studies have suggested that Ceriporiopsis exhibits a stronger relationship with members of Corticiaceae Herter, such as Phlebia Fr. and Phanerochaete P. Karst., than with other polypores (Nakasone and Burdsall, 1984; Burdsall, 1998). Recent phylogenetic studies support the classification of the genus Ceriporiopsis in the modern family Phanerochaetaceae Jülich and its close relationship with the genera Irpex Fr. and Phlebia (Greslebin et al., 2004; Lee, 2006).

In Korea, three species of Ceriporiopsis have been reported: C. gilvescens (Bres.) Domański (the type species of the genus), C. mucida (Pers.) Gilb. & Ryvarden and C. subvermispora (Plát) Gilb. & Ryvarden (Jung, 1992, 1994, 1996; Lee and Jung, 2005). During an assessment of the national biological inventory in Korea, which was organized by the National Institute of Biological Resources (NIBR; www.nibr.go.kr), we encountered an unreported Ceriporiopsis species from Gangwon Province. Based on its morphological characteristics, we identified the species as Ceriporiopsis resinascens (Romell) Domański (Breienbach and Kränzlin, 1986; Burdsall, 1998). To confirm its affinity to Ceriporiopsis resinascens, we sequenced the internal transcribed spacer (ITS) region and conducted a phylogenetic analysis of the organism.

The macroscopic and microscopic characteristics were evaluated based on a voucher specimen (F20081106KCM38) deposited at the NIBR. Measurements and drawings were made from slide preparations mounted in 3% KOH (Largeent et al., 1977) using an Olympus BX51 light microscope. Size measurements were made using 20 randomly selected mature basidiospores and basidia from the voucher specimen. A key to the Ceriporiopsis species that have been found in Korea was constructed according to the description by Jung (1992, 1994, 1996).

For molecular identification, the total DNA was extracted from a dried specimen using an AcuPrep genomic DNA extraction kit (Bioneer, Korea). The ITS region was amplified using the primer sets ITS5 and ITS4 (White et al., 1990). PCR amplification was performed as described by Lee and Jung (2008). Amplified products were purified using a PCR purification kit (Bioneer). Sequencing was performed using the aforementioned primers on an ABI 3730XL automated sequencer (Applied Biosystems, USA). The ITS sequence was proofread and edited using the jPHYDIT program (Jeon et al., 2005) and then deposited in GenBank (accession number GU080235). Phylogenetic trees were inferred from sequence alignment using the neighbor-joining (NJ), maximum parsimony (MP) and maximum likelihood (ML) methods implemented using PAUP 4.0b10 (Swofford, 2002). The tree was rooted with the sequences of Ceriporia lacerata (FJ462746) and Irpex lacteus (AF163046), which showed the highest similarity with Ceriporiopsis species among the ITS region sequences in the GenBank database.

An unrecorded Ceriporiopsis species was identified to
the genus level by its fully resupinate basidiocarp and reddish white to pinkish poroid hymenophore and to the species level based on microscopic features such as the size of the basidiospores and basidia. Unfortunately, we could not examine specimens of the previously reported Korean Ceriporiopsis species, C. gilvescens, C. mucida and C. subvermispora. According to Jung (1992, 1996) and Gilbertson and Ryvarden (1986), the microscopic features of the four Ceriporiopsis species found in Korea vary somewhat. The allantoid basidiospores of C. subvermispora are clearly distinguished from those of C. resinascens. Additionally, the large basidiospores (5.1–6.6 × 3.4–4.3 µm) of C. resinascens are evidently distinguished from those of C. gilvescens (4–5 × 2 µm; Jung 1992) and C. mucida (2.5–3.5(4) × 2–2.5 µm; Gilbertson and Ryvarden, 1986).

A BLAST search of the GenBank database revealed that the ITS sequences of the unknown specimen (F20081106KCM38) were 99.0% homologous (5 of 622 positions showed nucleotide differences) with European Ceriporiopsis resinascens (EU340896). The aligned sequences of 14 Ceriporiopsis species and two outgroup species (Ceriporia lacerata and Irpex lacteus) formed a matrix of 440 nucleotide positions in length. Among these, 275 sites were constant, 36 sites were variable but parsimony-uninformative and 129 sites were parsimony-informative. NJ, MP and ML analyses yielded similar phylogenetic trees. The NJ tree is presented in Fig. 2. Branches supported by the three different analyses are represented as bold lines in the tree. The phylogenetic trees included Korean Ceriporiopsis resinascens in a monophyletic clade with the other eight Ceriporiopsis species.

Based on the results of these morphological and phylogenetic analyses, we confirmed the identity of Ceriporiopsis resinascens within the genus Ceriporiopsis. Due to the ecological importance of Ceriporiopsis species, such as their ability to degrade nonphenolic lignin structures (Srebrotnik et al., 1997), further studies exploring the ecological role of Korean C. resinascens are necessary.

**Taxonomy**


**Korean name.** Su-Ji-Mil-Gu-Meong-Beo-Seot, nom. nov.

Basidiocarp annual, resupinate, about 5 cm wide along the bark of deciduous trees, soft when young; pores angular, variable, 2–3(–4) mm, pore surface reddish white to pinkish; margin cream to pale yellowish white, 1–3 mm wide. Hyphal system monomitic; generative hyphae with clamp connections. Basidia clavate, 21.7–24.6 × 6.3–10.3 μm. Basidiospores ellipsoid, 5.1–6.6 × 3.4–4.3 μm.

**Specimens examined.** KOREA: Gangwon Province, Mt. Gariwang, collected from the branch of a dead deciduous tree, 6 November 2008, Jin Sung Lee and Changmu Kim (F20081106KCM38).

**Notes.** This species is easy to recognize, in part because of its white to pinkish pore surface when fresh. The basidiocarp frequently becomes hard and brittle. Larger basidiospores distinguish *Ceriporiopsis resinascens* from *C. gilvescens* and *C. mucida*.

**Key to Korean Ceriporiopsis species**

1. Basidiospores cylindrical to alantoid
   
   2. Basidiospores longer than 5 μm
      
      2. Basidiospores shorter than 5 μm
         
         3. Basidiocarp firm and pore surface white to pale pinkish
            
            3. Basidiocarp soft and pore surface cream-yellow
               
               4. Tyromyces resinascens (Romell) Domański

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**References**


