

## Morphological Characteristics of *Monascus ruber*

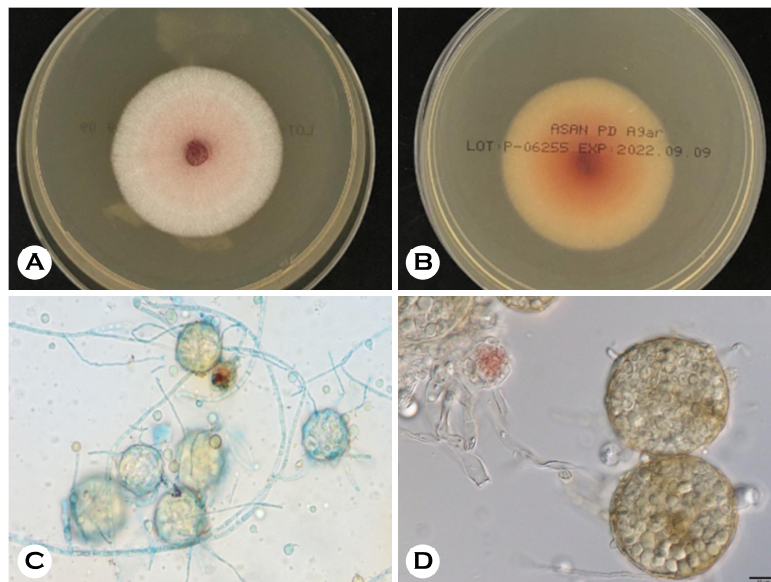
Jayoung Kim<sup>1</sup>, Gi-Ho Sung<sup>2,3</sup>, Junsang Oh<sup>2</sup> and Soo-Young Kim<sup>4\*</sup>

<sup>1</sup>Department of Laboratory Medicine, International St. Mary's Hospital, Catholic Kwandong University, Incheon, Korea

<sup>2</sup>Translational Research Division, Biomedical Institute of Mycological Resource, International St. Mary's Hospital, Catholic Kwandong University, Incheon, Korea

<sup>3</sup>Department of Microbiology, College of Medicine, Catholic Kwandong University, Gangneung, Korea

<sup>4</sup>Department of Laboratory Medicine, St. Vincent's Hospital, College of Medicine, The Catholic University of Korea, Suwon, Korea



**Fig. 1.** Morphological characteristics of *Monascus ruber* after 7 days of culture at 25°C in Sabouraud's dextrose agar: (A) a flat, spreading mold, with thinly floccose texture, and white to reddish color colony, (B) the reverse side of the culture with orange to red pigment, (C) numerous rounds, and thin-walled cleistothecia containing oval ascospores with smooth walls in lactophenol blue staining (×400), (D) in wet staining (×1,000)

*Monascus ruber* (anamorph: *Basipetospora rubra*) is a filamentous Ascomycetous fungus (family: Monascaceae; order:

Eurotiales) isolated from fermented foods and grain. In Asia, it is traditionally used to produce *Monascus*-fermented rice.

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\*Corresponding: Soo-Young Kim, Department of Laboratory Medicine, St. Vincent's Hospital, College of Medicine, The Catholic University of Korea, 93 Jungbu-daero, Paldal-gu, Suwon-si, Gyeonggi-do, 16247, Korea.

Phone: +82-31-249-7594, Fax: +82-31-249-7645, e-mail: vsykim@catholic.ac.kr

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It is commonly used as a natural food colorant (yellow-, orange-, and red-colored pigments), flavoring agent, and preservative for fish and meat<sup>1</sup>. Until recently, only a few cases of *M. ruber* infection have been reported in elderly patients. These cases included invasive gastric infection post-consumption of contaminated dried and salted fish, renal infection post-surgery, and onychomycosis in diabetic individuals from French Guiana, India, and Morocco. Onychomycosis was successfully treated orally with terbinafine, but treatment for gastric infection with liposomal amphotericin B resulted in nephrotoxicity despite normal renal function at admission<sup>2,3</sup>.

Recently, *M. ruber* was isolated from a patient with chronic otitis media from Korea<sup>3</sup>. The 69-year-old male patient presented to the Otolaryngology Department, suffering from right-sided otorrhea for 1 year and reduced hearing for 7 years. Tympanoscopy of the right ear showed a near-perforation of the tympanic membrane with purulent discharge and fungal hyphae. A swab specimen from the discharge was cultured using Sabouraud's dextrose agar supplemented with chloramphenicol. After 7 days of incubation at 25°C, a flat, spreading mold with a thinly floccose texture and white to reddish color was evident (Figs. 1A, 1B). Microscopic examination revealed numerous round and thin-walled cleistothecia containing oval ascospores with smooth walls in lactophenol blue staining (Fig. 1C) and wet staining (Fig. 1D). The result of MALDI-TOF MS using tube extraction method showed no identification. The fungus was identified as *M. ruber* (synonym *M. pilosus*) through a polyphasic approach combining morphological characters and sequencing of the internal transcribed spacer regions, large subunit ribosomal ribonucleic acid,  $\beta$ -tubulin, and calmodulin encoding-genes. Endoscopic trans-canal myringoplasty was successfully performed on the patient, followed by a 6-week oral treatment with fluconazole.

**Key Words:** Cleistothecia, *Monascus ruber*, Natural pigments

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## CONFLICT OF INTEREST

In relation to this article, we declare that there is no conflict of interest.

## ORCID

Jayoung Kim: 0000-0003-2977-1813  
Gi-Ho Sung: 0000-0002-1861-5543  
Junsang Oh: 0000-0002-0811-2491  
Soo-Young Kim: 0000-0002-8491-5130

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