

Article

A Comparative Transcriptome Analysis Reveals Physiological Maturation Properties of Mycelia in *Pleurotus tuoliensis*

Fang Du ¹, Nu Er zi ya·Ya Li mai mai ti ², Qingxiu Hu ^{1,*}, Yajie Zou ¹, Dou Ye ¹, and Haijun Zhang ¹

¹ Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing 100081, China

² Institute of Plant Protection, Xinjiang Academy of Agricultural Sciences/Key Laboratory of Integrated Pest Management on Crop in Northwestern Oasis, Urumqi 830091, China

* Correspondence: Huqingxiu@caas.cn

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Abstract: *Pleurotus tuoliensis* is a precious edible fungus with extremely high nutritive and medicinal value. The cultivation period of *P. tuoliensis* is longer than those of other *Pleurotus* species, which is mainly due to a longer mycelium physiological maturation period (30–60 days). Currently, the molecular processes underlying physiological maturation of the mycelium remain unclear. We performed a comparative transcriptomic analysis of immature and mature mycelia using RNA-seq. De novo transcriptome assembly resulted in identification of 17,030 unigenes. 451 differentially expressed genes—including those encoding nucleoside diphosphate kinase (NDPK), glycoside hydrolase family proteins, exopolysaccharidase, and versatile peroxidases—were identified. Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) analyses revealed that nucleotide synthesis and energy metabolism are highly active during the physiological maturation of mycelia, and genes related to these pathways were significantly upregulated in mature mycelia. NDPK is predicted to be essential for mycelia maturation. Our findings contribute to a comprehensive understanding of mycelia maturation in a commercially important fungal species. Future efforts will focus on the function of NDPK and the mechanism by which it regulates mycelia maturation.

Keywords: *Pleurotus tuoliensis*; mycelium physiological maturation; comparative transcriptomic analysis; nucleoside diphosphate kinase

1. Introduction

Pleurotus tuoliensis, also known as Bailinggu, is one of the most commercially important species of edible mushrooms [1]. *P. tuoliensis* was initially found in Xinjiang province [2] and is now widely commercially cultivated in China, Japan, and Korea, due to its desirable nutritional and medicinal value [3].

In recent years, *P. tuoliensis* yield decreased year by year. In 2017, only 70,000 tons were produced, which represents a 77% decrease from 2012 (<http://hz.cefa.org.cn/2019/03/18/10498.html>). This decrease may be due to this fungus' biological characteristics, such as long cultivation period, a high proportion of deformed fruiting bodies, poor uniformity of fruiting bodies, and strain degeneration [4]. Together, these factors present challenges for mushroom farmers and thus lead to a decline in cultivation enthusiasm. Physiological maturation of *P. tuoliensis* mycelia is essential for its fruiting. This maturation takes 30–60 days and is responsible for the above-mentioned long cultivation period. In this physiological maturation stage, mycelia accumulate and metabolize