Chiang Mai J. Sci. 2024; 51(2): e2024029
https://doi.org/10.12982/CMJS.2024.029
Journal homepage : http://epg.science.cmu.ac.th/ejournal/

Research Article

Transcriptomic Evidence of Base and Nucleotide Excision Repair Mechanisms in Response to UV-B Radiation in an Arctic Fungus *Pseudogymnoascus australis* Strain HNDR4

Teow Chong Teoh [a,b,c], Mohammed Rizman-Idid [a,c], Hao Jie Wong [d], Nuradilla Mohamad-Fauzi [a,b,c], Nurlizah Abu Bakar [c], Jerzy Smykla [e] and Siti Aisyah Alias [a,c]*

[a] Institute of Ocean and Earth Sciences, Advanced Studies Complex, Universiti Malaya, 50603, Lembah Pantai, Kuala Lumpur, Malaysia

[b] Institute of Biological Sciences, Faculty of Science, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

[c] National Antarctic Research Centre, Advanced Studies Complex, Universiti Malaya, 50603, Lembah Pantai, Kuala Lumpur, Malaysia

[d] Laboratory of Gene Regulation Research, Division of Biological Science, Nara Institute of Science and Technology, Ikoma, Nara, 630-0192, Japan

[e] Institute of Nature Conservation, Polish Academy of Sciences, al. Adama Mickiewicza 33, 31-120 Kraków, Poland

*Author for correspondence; e-mail: saa@um.edu.my

Received: 29 April 2023
Revised: 26 January 2024
Accepted: 29 January 2024

ABSTRACT

Polar micro-fungi are known to have developed protective mechanisms and responses against the harmful effects of UV radiation. In this study, physiological, cellular, and transcriptomic responses of an Arctic fungal strain of *Pseudogymnoascus australis* towards UV-B radiation were examined. Fungal isolate was cultured on 0.45µm nylon membranes overlayed on Czapex-Dox agar (CDA) at 15ºC for 10 d in dark condition to reach the mid-log phase. To assess DNA damage and recovery, the isolates were exposed to UV-B radiation (UV dosage of 6.1 kj m^{-2} d^{-1}) for 130 min, followed by 0, 2 and 6 hr incubation under light condition. Differential gene expression in DNA repair after UV-B treatment at these time points was analysed based on RNA-Seq data output of 40 million reads per sample from an Illumina NovaSeq 6000 system platform. The results revealed that radiation-repair (*RAD*) genes were upregulated and the photoreactivation (*PHR1*) gene was downregulated after UV-B exposure in light condition. Downregulation of oxidoreductase activity was observed from the GO enrichment analysis. The KEGG pathway enrichment analysis exhibited upregulation of base excision repair (BER) genes and nucleotide excision repair (NER) genes upon UV-B exposure. This is the first RNA-Seq transcriptomic study on the DNA repair mechanisms employed by a polar fungus to mitigate UV-induced DNA damage.

Keywords: base excision repair (*BER*), nucleotide excision repair (*NER*), polar micro-fungi, transcriptome, RNA-Seq

1. INTRODUCTION

Fungi in Arctic and Antarctica are constantly challenged by extreme polar conditions and environmental stressors such as ultra-low temperatures, acid–base imbalances, oligotrophic