Received: 15 February 2022 | Revised: 3 August 2022 | Accepted: 6 September 2022

DOI: 10.1002/tqem.21924

RESEARCH ARTICLE

WILEY

Depolymerization of polyaromatic hydrocarbons by *Penicillium* spp. inhabit the phyllosphere of urban ornamental plants

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Funding information
University of Sri Jayewardenepura, Sri Lanka under the research, Grant/Award Number: ASP/01/RE/TEC/2017/72.

Abstract

A variety of anthropogenic sources release hazardous polyaromatic hydrocarbons (PAHs) into the phyllosphere which is an excellent niche for diverse fungi, and some of them have PAHs degradation capabilities. Therefore, this research attempted to determine the PAHs (phenanthrene, anthracene, naphthalene, and pyrene) degradation capability of phyllosphere inhabited *Penicillium* species. The leaf samples were collected from highly polluted urban areas (Panchikawatta, Pettah, Orugodawatta, Maradana, Sapugaskanda, and Colombo Fort) in Sri Lanka to isolate fungal species inhabiting the phyllosphere. Furthermore, their distribution patterns among the leaf tissue layers were studied using bright-field microscopic observations. Moreover, the best PAH degraders were screened out using plate assays and confirmed through High Performance Liquid Chromatography (HPLC) analysis. Further, their enzymatic activities during the PAHs degradation were analyzed. As per the microscopic observations, the highest fungal distribution was in the upper epidermis of the leaves followed by the fungal distribution in the interspaces of palisade mesophyll layers. Out of isolated fungal species, two *Penicillium* spp. (*Penicillium citrinum* P_{23}B-91 and *Penicillium griseofulvum* P_9B - *30*) showed the highest PAHs (phenanthrene, anthracene, naphthalene, and pyrene) degradation capabilities. Manganese peroxidase (MnP) enzyme dominated phenanthrene degradation in *P. griseofulvum* P_9B - 30, which showed the highest phenanthrene degradation ability (61%). In addition, *P. citrinum* P23B-91 was good at degrading anthracene (88%) and also displayed a higher MnP activity during the anthracene degradation than laccase and lignin peroxidase activities. The discoveries from the toxicity assay during the PAHs degradation processes revealed that the produced byproducts had no toxic effects on the fungal growth cycle and the phyllosphere. Therefore this phyllosphere *Penicillium* spp. are ideal for the bioremediation of polluted air in urbanized areas.

KEYWORDS
bioremediation, HPLC, laccase, *Penicillium* spp, phyllosphere

