

LICHEN-ASSOCIATED FUNGAL ISOLATES AND THEIR CYTOTOXIC ACTIVITY AGAINST SW480ADH CANCER CELLS

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Endolichenic and other lichen-associated fungi live inside lichen thalli without causing disease. They are a promising but poorly studied source of new bioactive secondary metabolites, and in Kazakhstan they have not yet been characterised. The aim of this work was to identify fungal isolates obtained from lichens collected in the Karaganda region of Kazakhstan by molecular methods and to evaluate the cytotoxicity of their extracts against SW480ADH human colorectal adenocarcinoma cells.

Fungi were isolated from surface-sterilised lichen thalli and identified by Sanger sequencing of the ITS and TEF1 loci, followed by maximum-likelihood phylogenetic analysis. Four fungal extracts were tested against SW480ADH cells in a cell viability assay at 10–1000 µg/mL after 24 and 48 h of exposure.

The isolates selected for bioactivity testing were identified as *Trichoderma atroviride*, *Simplicillium lanosoniveum*, *Beauveria bassiana*, *Daldinia loculata*, *Irpex lacteus*, *Cladosporium* sp. and *Neurospora* sp. Their hosts were the lichens *Flavoparmelia caperata*, *Pseudevernia furfuracea*, *Vulpicida pinastri*, *Parmelia fertilis*, *Flavopunctelia* sp., *Asahinea chrysantha* and *Evernia divaricata*.

At 1000 µg/mL, the extracts of *S. lanosoniveum* (Extract 1) and *Neurospora* sp. (Extract 4) abolished cell viability at both time points ($p < 0.001$). The *B. bassiana* extract (Extract 2) reduced viability in a time-dependent manner, while the *Cladosporium* sp. extract (Extract 3) had only a weak effect. In the concentration series, Extract 4 was the most potent: at 500 µg/mL, viability fell to about 32% after 24 h and 18% after 48 h. No extract was cytotoxic at concentrations up to 100 µg/mL.

Thus, lichen-associated fungi from the Karaganda region of Kazakhstan are a promising source of cytotoxic secondary metabolites. Extracts of *Neurospora* sp. and *S. lanosoniveum* showed concentration- and time-dependent activity against SW480ADH cells and are priority candidates for bioassay-guided fractionation. Chromatographic separation (VLC, MPLC) and NMR analysis of the *Cladosporium* sp. extract yielded 2-(4-(ethoxycarbonyl)phenyl)acetic acid.

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