# DIVERSITY AND PHYTOTOXIC POTENTIAL OF EXTREMOPHILIC FUNGI PRESENT IN SOIL FROM THE LONGYEARBREEN GLACIER, SVALBARD ARCHIPELAGO, NORWAY

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Stressful conditions to which the fungal community in extreme ecosystems is subjected may be responsible for selecting fungi that produce secondary metabolites with phytotoxic activity. These compounds may be relevant for the development of natural herbicides, as weeds account for up to 90% of global crop losses. This study aimed to investigate the diversity and phytotoxic potential of the fungal community from the Longyearbreen Glacier soil, located in the Svalbard Archipelago, Norway. Soil samples were collected at five points along a glacial chronosequence, processed in quadruplicate, and the isolated fungi were subjected to an extract preparation protocol involving solid-state fermentation, lyophilization, metabolite extraction with dichloromethane, and drying. The extracts were screened at 1 mg/mL for herbicidal activity using *Lactuca sativa* (lettuce) and *Allium schoenoprasum* (chive) seeds as eudicot and monocot models, respectively. Seed germination assays were conducted in 24-well plates incubated at 26 °C under continuous light for 10 days (*L. sativa*) and 14 days (*A. schoenoprasum*). Extracts that inhibited germination were reproduced and retested to determine the Minimum Inhibitory Concentration (MIC). Extracts that maintained activity were further analyzed by Nuclear Magnetic Resonance (NMR) spectroscopy and scaled up for purification. A total of 233 filamentous fungi were isolated and grouped into 166 morphotypes, based on macromorphological features and confirmed by molecular biology. One representative of each morphotype was selected for extract production. To date, 143 extracts have been tested, of which 11 inhibited seed germination, and two retained phytotoxic potential in MIC assays. Sequencing of the ITS4 region identified these fungi as *Penicillium piltunense* UFMGCB 20823 and *P. samsonianum* UFMGCB 20935**.** Preliminary NMR analyses suggest that the metabolic profile from *P. samsonianum* UFMGCB 20935 has aromatic groups that may be interesting for future studies, indicating promise for large-scale purification and structural elucidation. These findings highlight the potential of extremophilic fungi as a source of novel metabolites with applications in sustainable weed management.

**Keywords:** *Extremophilic fungi, secondary metabolites, phytotoxic activity, natural herbicides, sustainable weed management*