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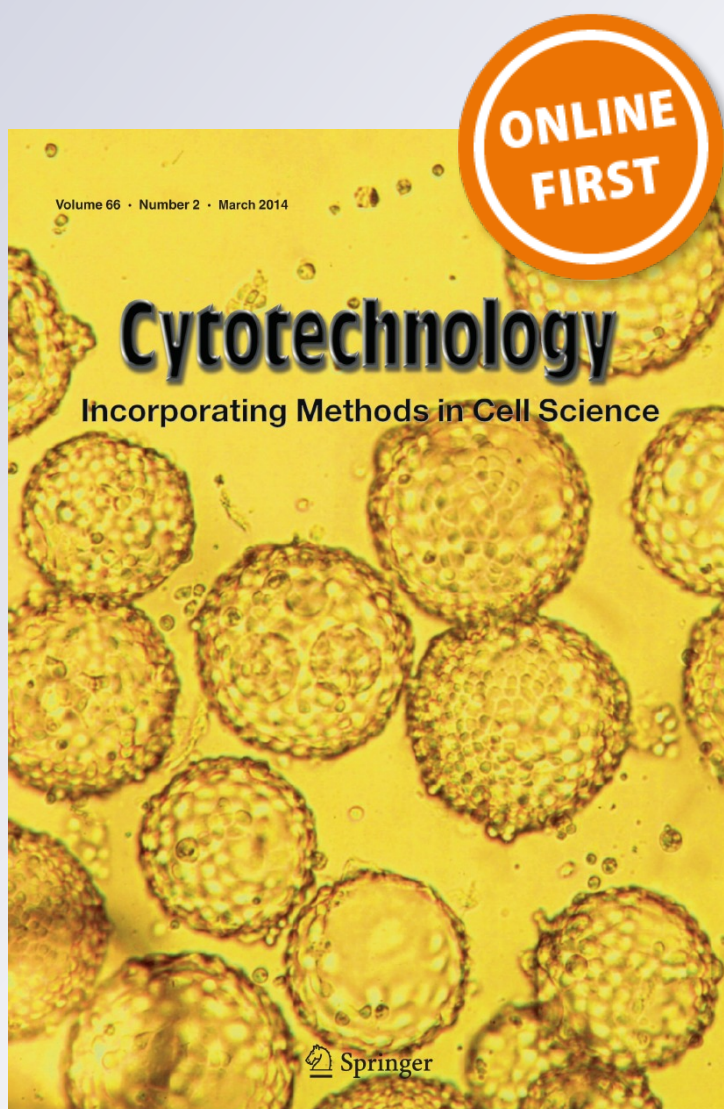
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Evaluation of in vitro antioxidant, antimicrobial, genotoxic and anticancer activities of lichen *Cetraria islandica*

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Abstract In this study, the antioxidant, antimicrobial, genotoxic and anticancer activities of *Cetraria islandica* methanol extract were determined by using free radical and superoxide anion scavenging activity, reducing power, determination of total phenolic compounds and flavonoid contents, broth microdilution minimal inhibitory concentration against five bacterial and five fungal species, cytokinesis block micronucleus (MN) assay on peripheral blood lymphocytes (PBLs) and the microculture tetrazolium test on FemX (human melanoma) and LS174 (human colon carcinoma) cell lines. As a result of the study, we found that *C. islandica* methanol extract exhibited moderate free-radical-scavenging activity with IC₅₀ values 678.38 µg/ml. Moreover, the tested extract had effective reducing power and superoxide anion radical scavenging. The minimal inhibitory concentration values against the tested microorganisms ranged from 0.312 to 5 mg/ml. The extract increased MN

frequency in a dose dependent manner, but it was significant in higher tested concentrations (50, 100 and 200 µg/ml). No significant differences were observed between NDI values in all treatments and untreated PBLs. In addition, the tested extract had strong anticancer activity towards both cell lines with IC₅₀ values of 22.68 and 33.74 µg/ml. It can be concluded that the tested extract exhibited a certain level of in vitro antioxidant, antimicrobial, genotoxic and anticancer activities.

Keywords *Cetraria islandica* · Methanol extract · Antioxidant, antimicrobial, genotoxic, anticancer activities

Introduction

Lichens are symbiotic organisms consisting of a fungus partner and a photosynthetic organism, either algae or Cyanobacteria (Bates et al. 2011). More than 20,000 known species of lichens have been identified and inhabit diverse ecosystems ranging from arctic tundra to desert climates (Obloh and Ademosun 2006). They are ubiquitous on barks, stems, leaves and in soil but often grow in habitats less favorable for higher plants (Vrablikova et al. 2006). These organisms have historically been used as food, dyes, in production of alcohol and perfume industry. Lichens have also, for hundreds of years, been used in folk medicine in many countries (Bown 2001). Chemical studies on the

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