EFFECTS OF UV RADIATION TO MICROORGANISMS ISOLATED FROM BORON MINES IN TURKEY.

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Introduction: Extremophiles, having many interesting biological secrets, provide a novel source of discoveries in applied and especially basic sciences. We studied a newly described extremophiles, i.e., microorganisms tolerating toxic levels of boron (BoroTolerants)[3]. Boron is a relatively rare element in the Earth's crust, representing only 0.001% of the crust mass, it can be highly concentrated by the action of water, in which many borates are soluble. Altough boron is commonly concentrated as borate (BO_3 or BO_4) in terrestrial clays and organic-rich sediments (**,**80–800 ppm), but it has never been found at concentrations above 20ppm in any extraterrestrial source. Boron is also significant for understanding panspermia theory and theory of life's origins. The sugar ribose is central to metabolism, most notably as the derivatized sugar component of RNA. Any theory of life's origins focused on RNA must therefore include a plausible prebiotic ribose production pathway [1]. Borate minerals have been shown to stabilize ribose synthesized via the formose reaction, making boron a potentially important chemical element connecting geoscience to organic chemistry. One of the main objections to this mode of ribose accumulation on the early Earth is that evaporitic borate deposits (e.g. colemanite, ulexite and kernite) may not have been present on the early Earth (**.**3.5 Ga) Economically important sources of boron are the minerals colemanite, rasorite (kernite), ulexite and tincal. Together these constitute 90% of mined boron-containing ore. The largest global borax deposits known, many still untapped, are in Central and Western Turkey, including the provinces of Eskişehir, Kütahya and Balıkesir. DNA repair processes may be critical in environments containing mixtures of organic and radioactive wastes since DNA damage results from radiation generated by decaying radionuclides [2]. Two obstacles limiting the testing of bacterial responses to ionizing radiation are cost and source access. A potential solution is the utilization of cheap, readily available DNA-damaging agents such as UV light to model the effects of ionizing radiation on microbial survival. UV light in the 200 300 nm range inflicts damage to bacterial DNA and RNA [2].

In this work, we isolated 40 bacteria cultures and 5 fungus from of Eskişehir, Kütahya and Balıkesir Boron Mines. And 10 of borotolerant bacteria cultures (>100mM BO3 cons.) and 2 highly boron resistant fungus isolate (up to 500mM) used UV radiation study. Result are very promising to study with borotolerant microorganisms for radiation application.

Material & Method: 40 bacteria cultures and 5 fungus isolated from 15 different (colemanite, ulexite and tincal) mines samples colleted from of Eskişehir, Kütahya and Balıkesir Boron Mines in Turkey.

Stationary phase bacterial isolates suspended in 0.02 M phosphate buffer (pH 7.0) were used in UV irradiation tests. Subsurface bacterial cultures and reference bacteria grown in TSB broth and fungal cultures grown in Malt Extract Broth. Aliquots (5 ml) of each suspension were transferred to 60 mm petri plates resulting in a depth of less than 3 mm of liquid. The open petri plates were exposed to UV fluence rates of 300-700 pW cm^{-2} (254nm and 365nm) with the total dose being a function of fluence rate and time of exposure.[4,5] Each bacterial and fungal suspension was irradiated individually. Cultures were manually agitated during UV exposure to prevent the settling of cells. Following irradiation, a 1.0 ml aliquot of each suspension was serially diluted in 0.02 M phosphate buffer and incubated in sterile TSB. After 12h incubating irradiated cultures in TBS, liquids mesuared OD at 540 nm. Percent rate of survival at each dose was determined by comparing OD of irradiated cells to a non-irradiated control.

Results:

We isolated 40 bacteria cultures and 5 fungus from of Eskişehir, Kütahya and Balıkesir Boron Mines. And 10 of borotolerant bacteria cultures (>100mM BO_3 cons.) and 2 highly boron resistant fungus isolate (up to 500mM) used for UV radiation study. 0, 50, 100 mM boron containing media were used and survival rate %78-%82 to UV-A and UV-C on 100mM boron containing media. 0 mM boron containing media has almost %30 survival rate. Result are very promising to study with borotolerant microorganisms for radiation application. Further polyphasic identification for isolates are still continued.

References:

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