**Hyperarid Regions:**

Deserts are included in arid regions which is one of the largest ecosystem on earth by surface area but there is very less information known about the microbial diversity living there. In these arid regions microbial community is affected by both biotic and abiotic factors such as variations in temperature, increase in UV radiations, low nutrient content and less soil moisture content biotic factors like plant abundance and species composition. In desert soil with low nutrients, plants give distinct and resourceful habitation. Plants employ specific influence on soil microbes, maintain associations with specific species and cultivate specific population of bacteria. The regions with limited water and nutrients have more bacterial diversity in rhizosphere as compared to other plants due to buildup of nutrients at the junction of root and soil. Both qualitatively and quantitatively this rhizosphere effect is highlighted in deserts.(Andrew et al., 2012) The profound abiotic stresses which harm living things (including plants and bacteria) in these regions, such as drought, salinity, very low or high temperatures, and other environmental extremes, makes life there extremely challenging. Desert is heat up by the sun at day time (40-50°C)due to less coverage of foliage, but at night time temperature decreases to 0°C.(Alsharif et al., 2020)The drylands, or regions with climatically characterized annual shortfalls in accessible moisture, make up more than 47.2% of the planet's land area (LA). The United Nations Convention to Combat Desertification (UNCCD) views three of the dryland regions as being of particular environmental concern due to their vulnerability to desertification or ecosystem degradation. These three regions are the arid (12.1% LA), semiarid (17.7% LA), and dry subhumid (9.9% LA). The naturally hyperarid deserts (7.5% LA) are part of the fourth dryland region; these are unproductive biologically speaking. The most vulnerable areas to global climate change are regarded to be dry regions, which sit at the nexus of biologically unproductive hyperarid deserts and generally well-vegetated semiarid zones.(Neilson et al., 2012)The microhabitat of plants living in dry(arid) region help their host to change in hard conditions. The microbiome, which functions as the second and expanded genome of the plant, provides the host species with a number of essential nutrients (phosphorus and nitrogen). This helps in promoting plant growth through nitrogen fixation, plant hormone production, mineral dissolution, siderophores, and HCN production, and by activating plant defence mechanisms against various bacterial and fungal pathogens. In substitution, the host plant supplies the microbiome a reliable habitat and photosynthetic products. (Sun et al., 2021). Considering the importance of these dry areas globally, little is known about their potential metabolic activity, a range of soil bacteria, or possible role in the global biogeochemical cycle. These areas lack vegetation, just as the hyperarid core, although they receive less annual precipitation than the hyperarid core, which can go for years without receiving any. The variety and community dynamics of fertility islands connected to cryptobiotic desert crusts have received the majority of attention in arid-land microbial ecology to date. To assess the potential contribution of soil bacteria from these areas to ecosystem biogeochemistry, a thorough survey of the bacterial diversity of arid lands is an essential first step. In soil samples taken from the Atacama Desert's hyperarid fringe, novel bacterial populations were discovered. The communities were characterized by surprisingly low numbers of the phyla that are typically dominating in soil communities: Acidobacteria, Alpha- and Betaproteobacteria, and unique Actinobacteria and Chloroflexi. The communities at the hyperarid boundary had a larger diversity and a distinctive community structure that suggested better functional potential when compared to earlier characterizations of hyperarid Atacama soils. Instead of the Nitriliruptoraceae and Rubrobacteraceae families that predominate at the hyperarid border, Actinobacteria most closely related to Frankia were discovered to be heavily dominating in hyperarid. Phylogenetic associations to chemolithoautotrophic taxa were found who have genetic potential of non-phototrophic primary production and geochemical cycling that fulfill their energy by oxidation of nitrite, CO, iron or sulfur in arid ecosystem.(Neilson et al., 2012).

Under extreme dry conditions, warm and elevated solar radiation stress, lithic-associated microhabitats living in cold and hot deserts are observed as environmental shelters for life. Phototrophic-based associations produce in the semi transparent rock element. The sensitivity of rocks to endolithic establishment depends primarily on the physical and chemical properties of the element. These characteristics are important to provide enough light for photosynthesis, moisture content during rain or fog episode, heat absorber and reflector for temperature regulation and protection against damaging UV radiations to the microbial diversity. (Robinson et al., 2015)**.** The macro-abiotic factors that influence the geographic pattern of desert plants are longitude, altitude and precipitation (bio15). Change in altitude affect the temperature, humidity, heat and light which in turn lead to influence the growth and distribution of plants. Winter precipitation affected the growth of plants in hyperarid areas. Desert plants can act as a suitable repository of potentially advantageous microorganisms that can support plant growth under abiotic stress conditions as a result of global warming and climate change. For desert agriculture, microbial tools are crucial for sustainingly raising agricultural yield in an environmentally benign way.(Sun et al., 2021)

The major abiotic stressor in desert ecosystem is water scarcity. Survival of life in desert region can be maintained by balancing between availability and loss of water. Rainfall (Precipitation), surface flow, fog, groundwater, vapors are the natural sources of water in deserts for the inhabitants living there. Due to a number of reasons, such as daily temperature changes, intense wind erosion, sedimentation, and especially a lack of water, the soil in desert regions is exceptionally dry. The soil in most desert areas is referred to as dry "Aridisols" with very little organic matter and nitrogen, a pH that is slightly alkaline, a high concentration of salt ions, and greater amounts of phosphate, calcium carbonate, and magnesium carbonate in all or some soil sections. Soil salinity is the other characteristics of desert soil which is the greatest problem that harm desert environments. Increase in evaporation and less rainfall can become the cause of buildup of salt ions. Soil with high salt concentration in hyperarid regions undergoes through osmotic stress, toxicity of ions and variations in plants accommodation. Reactive oxygen species (ROS), which harm DNA, proteins, and membrane lipids, are produced when temperatures and radiation are high, which can be damaging to plants. Diagonal and sharp leaf angles reduce the absorption of light and buildup of heat as part of the adaptation to these stress levels, which also results in a shift in leaf reflectance. The development of phenolic chemicals, such as flavonoids, that serve as "UV-absorbing sunscreen" or the presence of thick wax coatings on the leaf surfaces are two further defence mechanisms against excessive light and temperature. (Alsharif et al., 2020)

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