

Editorial

Climate change: threat to life forms on earth

Climate change is no longer a proposed threat- it is real, and if activities leading to the rapid acceleration of climate change are not curtailed, life forms on the earth, including human beings will be finding it very difficult to survive. We have been aware of climate changes leading to global warming, melting of ice at Arctic regions due to increasing temperature, erratic rainfalls affecting agriculture and many more such occurrences. The changing climate with its more extreme weather is already affecting many plant and animal species and disrupting ecosystem functioning. The Intergovernmental Panel on Climate Change estimates that 20 to 30 per cent of assessed plants and animals could be at risk of extinction if average global temperatures reach the projected levels by 2100. Evolution would have to occur 10,000 times faster than it typically does in order for most species to adapt and avoid extinction. A 2011 study found that in response to warming temperatures, species are moving to higher elevations at an average rate of 36 feet per decade and to higher latitudes approximately 10 miles per decade, though individual species vary in their rates. Over the years uncontrolled human activities such as rapid industrialization and urbanization, deforestation, several fold increase in the use of fossil fuels leading to emission of toxic fuels have led to an extremely grave pollution condition making it difficult even to breathe. India is one of the countries where pollution has reached an extremely alarming level.

While human beings have the option for moving from place to another and expressing the discomfort, plants, which are rooted to the soil can only adjust their metabolic systems to withstand the adverse conditions. Plants are affected to a great degree by abiotic stresses such as extremes of both high and low temperature, drought, salinity, heavy metals in soil and many others. Plant metabolic processes are affected under such stresses and those which have tolerant mechanisms survive the effects of such stresses while some may succumb to the stresses. The stresses affect the cell membrane causing its disintegration to some extent which in turn leads to several changes including photosynthesis, cell signaling and transport. Production of reactive oxygen species (ROS) such as superoxide, hydroxyl, and hydrogen peroxide cause damage to the cells and the presence or induction of antioxidant systems which can scavenge the toxic ROS provides tolerance to a great degree.

Besides plants, animals and human beings, microorganisms, either in the air or in the soil are also affected greatly with changing climatic conditions. Some of the microorganisms thrive better in higher temperatures and if these are pathogenic, the probability of diseases either of plants or humans increases. Not only the microorganisms directly, but their interaction with plants are also affected. Predicted climatic changes are expected to affect pathogen development and survival rates and modify host susceptibility, resulting in changes in the impact of diseases on crops. The effects of these climatic changes will differ by pathosystem and geographical region. These changes may affect not only the optimal conditions for infection but also host specificity and mechanisms of plant infection. Changing abiotic conditions will also affect the microclimate surrounding plants and the susceptibility of plants to infection. These changing conditions are expected to affect microbial communities in the soil and canopy pathosystems, possibly altering the currently observed beneficial effects of these communities. Because both pathogens and host plants will be affected by the changing climate, dramatic changes in the magnitude of disease expression in a given pathosystem, the geographical distribution of particular plant diseases, the economic importance of particular diseases in a given location, and the set of diseases that challenge each crop are expected.

While abiotic stresses may pre-dispose the plants to pathogen attack, it is quite probable that beneficial microorganisms in the soil, themselves tolerant to the stresses may aid the plants by providing enhanced tolerance to the abiotic stressor as well as negatively affect the pathogen. Since the response of a plant to any stress is the final outcome of interactions occurring underground, studies would need to focus on the interaction of host-rhizosphere microorganism and pathogen under various abiotic stresses to interpret the observed results.

It is thus clear that climate change will continue to affect us not only directly but also indirectly through its effects on plants in general and crops on which agriculture is fully dependent. If we have to combat the threat caused by climate changes we have to deal with nature more judiciously keeping in mind the long time effects of our actions.

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