

Change in environment a key factor for emergence of new pathogen races

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New Delhi: The Biotic stress refers to diseases, insect – pests and weeds which affects adversely the normal growth of living organisms (plant, animals, and human beings). It requires conducive interaction among the host, pest and environment. Such stresses can causes losses even up to 100 percent in the year of epidemic and the most infamous example was epidemic of brown spot of rice in 1943 (*Helminthosporium oryzae*), causing the Great Bengal Famine, in States of West Bengal, Bihar and Odisha. The historic devastation caused death due to starvation of about four million people.

Pests and pathogens evolve continuously and rate of evolution speeds up if environment becomes congenial. Thus, change in environment is key factor for emergence of new races of pathogen, minor diseases of insect-pests become major biotic stresses. Elevated Co₂, a greenhouse gas responsible for climate change, can increase levels of simple sugars in leaves and lower their nitrogen content. These can increase the damage caused by many insects, who will consume more leaves to meet their metabolic requirements of nitrogen. Thus, any attack will be more severe. Higher temperatures

from global warming, mainly due to elevated CO₂, will mean that more numbers of pests will survive the winter season.

The Agriculture Minister, Mr Radha Mohan Singh recently chaired the In- Session meeting of the Consultative Committee of the Ministry of Agriculture and Farmers Welfare on “Emerging biotic stresses as a challenge under changing climate” in New Delhi. Mr Singh said that while there is clear evidence that climate change is altering the distribution of animal and plant pests and disease, the full effects are difficult to predict. Changes in temperature, moisture and atmospheric gases can fuel growth and generation rates of plants, fungi and insects, altering the interactions between pests, their natural enemies and their hosts. “Changes in land covers, such as deforestation or desertification, can make remaining plants and animals increasingly vulnerable to pests and diseases. While new pests and diseases have regularly emerged throughout history, climate change has now resulted in emergence of large number of unknown biotic stress challenges in the environment,” he said.

Pests of Plant, continue to be one of the biggest constraints to food and agricultural production. They cause on an average an annual loss of more than 40 percent of the world’s food supply, thus posing a threat to our food security.

Climate change exercised impact resulted in either emergence of a new biotic stress, alteration of a minor stress as major challenge or domestication of an invasive pest into another country.

1. Climate change has posed a stiff challenge to sustainability of series of Sr genes in wheat governing resistance against Ug99 race of stem rust.
2. Elevated temperature and CO₂ have also posed serious threat to wheat against acclimatisation of blast, virulent isolates of late blight disease of potato and important diseases of rice, namely blast and sheath blight.
3. Country has recently witnessed emergences and or acclimatisation of destructive invasive pests and diseases like South American pin worm on tomato; Western flower thrips on flowers; Tropical race of fusarium wilt on banana, spiraling whitefly in coconut, etc.
4. With change in temperatures and humidity levels, the population of insects like mosquitoes, midges, ticks, fleas and the viruses they carry may expand their geographic range, and expose animals and humans to diseases to which they do not possess natural immunity.
5. Increased drought may result in reduced water bodies that in turn will facilitate increased interaction between domesticated livestock and wildlife resulting in outbreak of malignant catarrhal fever, a highly fatal disease for cattle, since all wild beasts carry the fever virus.
6. Fishes are vulnerable to emerging climate-related diseases, particularly since their ecosystems are so fragile and water is an effective disease carrier.
7. Plant protection sciences and biosecurity awareness in India has advance significantly over the years. Recently India has effectively managed many such exigencies which otherwise could have resulted in national calamities.
8. To thwart any possibilities of biosecurity threat to Indian wheat due to emergence of stem rust race UG99 in Africa, India acted proactively to screen varieties against the pathogen in Kenya. As a result number of UG99 resistant varieties deployed in the country and prevented occurrence of epidemic.
9. During 2015-16, immediately after an invasive wheat blast disease destroyed large acreage

of wheat in Bangladesh, India sent 40 wheat genotypes to CYMMIT for screening against blast in South American countries where the disease is prevalent.

10. Domestically DARE-ICAR, DAC, SAUs and State Agricultural Department are engaged in implementing protection technologies in complementarity to protect losses in crops, animals and fishes due to biotic stresses.
11. As a result of proactive efforts of NPPO, the imminent losses in cotton due to whitefly during 2016-17 was effectively managed, as a result production of cotton in North India is expected to surpass yields of last three years.
12. Very recently outbreak of invasive H5N8 strain of avian influenza in poultry birds was effectively managed in the country through adoption of proper biosafety and biocontainment measures.
13. Changing biotic stress scenario has highlighted the need for future studies on models which can predict the severity of important pathogens of major crops, animals and fishes in real-field conditions. Simultaneously, disease management strategies should be reoriented in changing conditions with amalgamation of new strategies for sustainable food production.

Few of the immediate strategies to strengthen agricultural biosecurity and to ensure efficient management of biotic stresses as suggested by the agriculture ministry are:

- (a) Development of Biotic stress resilient crops/ breeds of animals using indigenous as well as wild resources.
- (b) Enhanced use of cutting edge technologies and tools like MAS, transgenic and advanced molecular tools to accelerate the process of development of biotic stress resilient organisms.
- (c) Strengthening of domestic and International quarantines to prevent movement of infected products to pest free areas/ counties.
- (d) Organizing IPM approaches and strengthening effective system of delivery of biocontrol agents and label expansion of effective pesticides.
- (e) Forging regional and global cooperation on issues related to biosafety and biosecurity.
- (f) Global networking for ensuring availability of diagnostic tools/ vaccines to monitor invasion and spread of invasive pests pathogens and immunization.

Dr Trilochan Mohapatra, DG, ICAR and Secretary, DARE also gave presentation on the issue during the meeting. Agriculture minister directed the officials to incorporate the suggestions given by the members on the issue and to speed up the research on pest control, pesticides etc.