Relevance of epidemiology in integrated disease management*

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There is growing concern all over the world regarding environmental degradation. Out of many factors that contribute to this problem, increased use of pesticides on crop plants is considered to be an important one. Consensus has now built up in favour of Integrated Disease Management (IDM) with the aim to contain the diseases by manipulating environmental, ecological and genetical factors with minimum use of chemical pesticides. To achieve this goal one has to understand the nature and life cycle of the pathogen, host pathogen interaction and the environment that affects the disease development.

Epidemiology encompasses the study of all the factors associated with disease development. The three major components of the disease i.e., susceptible host, virulent pathogen and favourable weather in time and space causes epidemic. A pathologist should look for breaking this nexus among different components by understanding them separately.

For any attempt to limit the spread of the pathogen, one has to know its most vulnerable state when it can be nipped into bud. The loose smut of wheat is controlled effectively only by killing the mycelium in the seed itself, while flag smut by protecting the young germinating seedlings by seed treatment with carboxin and carbendazim.

In case of hard mycelial structures like sclerotia, cleistothecia, zygote, galls etc. that are carried along with the seeds as primary source of inoculum, simple mechanical separation, as in done for ergot of pearl millet or ear cockle galls of wheat, helps to control the disease effectively. Secondly, after breaking the dormancy these structures may be killed easily, as in loose smut pathogen of wheat.

Pathogenic soil inhabitants pose a big challenge to control them by chemicals in face of increasing pollution. However, microbial antagonists viz. Trichoderma, Gliocladium, Streptomyces and Penicillium have shown promise to control them. Plant products have recently been tested in a big way to control pathogens, and certain neem based compounds are already in the market.

Under natural environment of any region an ecological balance has been existing between host and pathogens. Reckless use of crop varieties, fertilizers, pesticides and off season cultivation for better remuneration has disturbed the biological equilibrium and resulted in many new diseases and pest to flare up in epidemic form.

Balanced fertilizers, proper irrigation, timely sowing and need based cultural operations reduce the disease intensity and need for chemical pesticide application. The studies have indicated that cultural operations can be helpful in reducing the

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inoculum density and ultimately the disease. Burning of previous years refuse of host crop in situ and deep sowing of gram seeds have been shown to reduce and inactivate the primary inoculum of Ascochyta blight. Such methods help in avoiding the use of chemical fungicides.

Host resistance is the most easy tool to control diseases, if there is a choice. The matter is further complicated with ever changing strains of pathogen due to variability. Such behaviour is more common with the polymorphic fungi. Appearance of new races and biotypes is quite common in rust, powdery mildews and even in members of Fungi Imperfecti. Not only the isolates of Macrophomina phaseolina from different areas differ among themselves, but isolates from different parts i.e. root, stem, petiole and leaflet of the same cowpea plant also differ in their cultural characters and virulence. Breeders need to keep these behaviour in view while evolving resistant varieties and pathologist while finding out biocontrol agents against such pathogen to give a durable solution to the problem.

In the last we should remember Van-der-Plank’s remarks that “Chemical industry and plant breeders have forged fine tactical weapons but only epidemiology sets the strategy.”