

# Chapter 21

## Biopesticide Techniques to Remediate Pesticides in Polluted Ecosystems

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### ABSTRACT

*Indiscriminate and incessant use of synthetic pesticides is becoming an increasing global concern. No doubt, the application of conventional synthetic pesticides has enhanced the quality and quantity of agricultural products. However, accumulation of pesticides in freshwater resources has negative effects on aquatic ecosystem and human health. The persistent and toxic nature of pesticides has led to direct or indirect exposure on the biota in aquatic ecosystems resulting in acute (mortality of organisms) and chronic effects (decreased production and change in community structure), thus posing serious consequences for the ecosystem. Biopesticides provides a cost-effective and innovative approach employing bioremediation techniques for the removal of pesticides in water because of its advantage linked with*

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*environmental safety, biodegradability, effectiveness, and target-specificity. Furthermore, biopesticides provide an efficient method for detoxification of pesticides and appropriateness in the integrated pest management (IPM) programs.*

## **INTRODUCTION**

The population of the planet earth is showing increasing trend and is projected to grow around 10.12 billion by the end of 21<sup>st</sup> Century. The time demands an intensive farming approach to fulfil the food requirements of the growing population. The highest yield of crops is based on the improved variety, the appropriate pest and disease management, and recommended fertilization (Birch, 2011; Nawaz, 2016). The role of chemical pesticides cannot be ignored in terms of increase in crop protection and production over the years. However at the same time chemical pesticides are considered as main causative agents for accelerated contamination of environment. Similarly, they have been the main cause of insect resistance as well as adverse impacts on natural enemies and humans (Alzaidi, 2011; Ishtiaq, 2012).

Before the use of pesticides, pests were responsible for enormous losses of agricultural produce and had grave impact on farming and agricultural practices. About 30% of agricultural produce is lost due to pests. Hence, the use of pesticides has become indispensable in agriculture. As agricultural production increased over the past few decades, farmers became more and more dependent on synthetic pesticides. Intensive use of pesticides over the years for increasing the overall production has resulted diverse types of hazards and toxicity and thus has affected the environment and non-target organisms (Tripathi & Tripathi, 2000). The pattern of pesticide usage in India is different from that for the world in general. As can be seen in Figure 1, in India 76% of the pesticide used is insecticide, as against 44% globally (Mathur, 1999). The use of herbicides and fungicides is correspondingly less heavy. The main use of pesticides in India is for cotton crops (45%), followed by paddy and wheat.

## **IMPACTS OF PESTICIDES ON ENVIRONMENTAL QUALITY**

### **1. Impact on Humans**

If the credits of pesticides include enhanced economic potential in terms of increased production of food and fibre, and amelioration of vector-borne diseases, then their debits have resulted in serious health implications to man and his environment (Aktar et al., 2009). There is now overwhelming evidence that some of these chemicals do pose a potential risk to humans and other life forms and unwanted side effects to the environment (Forget, 1993; Igbedioh, 1991; Jeyaratnam, 1981). No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden is shouldered by the people of developing countries and by high risk groups in each country (WHO, 1990). The high risk groups exposed to pesticides include production workers, formulators, sprayers, mixers, loaders and agricultural farm workers. During manufacture and formulation, the possibility of hazards may be higher because the processes involved are not risk free. In industrial settings, workers are at increased risk since they handle various toxic chemicals including pesticides, raw materials, toxic solvents and inert carriers (Aktar et al., 2009).

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