Chapter 1

Introductory Chapter: Need of Bioherbicide for Weed Control

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Additional information is available at the end of the chapter

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1. Introduction

Food production is affected by climatic changes and environmental pollutions. The growth and yield of crop plants are significantly declined due to the effect of weed (a plant considered unwanted in a particular location) growth in farming fields. Weeds are strong competitors against crops to the absorption of water and nutrition from the soil, and also occupy more soil area, which result to suppress the crop growth [1, 2]. The integrated approach of weed control management (including tillage, mechanical way of weed removal, and crop rotation) can able to effectively decrease the weed growth [3–5]. The application of chemical-based herbicides, that is, 2,4-dichlorophenoxyacetic acid (2,4-D), glyphosate, and dicamba suppress the germination and growth of weeds, but the prolonged application of those chemicals could not effectively control the weeds and causes to develop the resistant weed germplasms and also pollutes the environment [6]. In addition, Kim et al. [7] reported that 32% of food products in Korea are unsuitable for consumption due to higher accumulation of pesticides. Recently, several biological organisms or their extracts are utilized to integrate weed control strategies [8].

2. Importance of bioherbicides

Bioherbicides are either living organisms or the natural metabolites that have the ability to control weed populations without harming the environment [9, 10]. The numbers of bacterial and fungal species demonstrate their host-specific or nonspecific bioherbicide activities against susceptible weed populations [9]. In 1980, the commercial form of bioherbicide was first introduced in the USA, Canada, Ukraine, and Europe [8, 10, 11]. The microbial agents such as *Alternaria, Bacillus, Chondrostereum, Colletotrichum, Curvularia, Dactylaria, Diaporthe, Drechslera, Enterobacter,*

Epicoccum, Exserohilum, Fusarium, Gloeocercospora, Microsphaeropsis, Mycoleptodiscus, Myrothecium, Phoma, Phomopsis, Plectosporium, Pseudolagarobasidium, Pseudomonas, Puccinia, Pyricularia, Pythium, Sclerotinia, Serratia, Stagonospora, Streptomycetes, Trichoderma, Verticillium, and *Xanthomonas* species and also several plant extracts have been recorded as bioherbicides [12].

Even though numerous plant products and microbes have been successfully showing the positive results against weeds in field trialed, only a few (one plant extract, three bacteria, and nine fungi) of them are commercially available in current markets [8]. Hoagland [13] demonstrated that the crop plants especially tomato produces allelochemicals such as tomatine and tomatidine, which prevent the growth of weeds and pathogenic fungi. Recently, the researchers are interested to know the bioherbicide compounds by extracting DNA fragments obtained from the soil and cloning the genes in vectors to produce phytotoxic compounds [14]. The mode of action of bioherbicide is not well elucidated, but a few studies revealed that the toxic metabolites from the microbes or plant-based products prevent the population of weeds by affecting cell division, pigment synthesis, nutrient uptake, plant growth promoting regulators, antioxidants, stress-mediated hormones, and other metabolites [13]. In organic farming, the bioherbicide approach is used to avoid herbicide resistance and increase crop yield [15]. In this book, the importance of bioherbicides and integrated management of weed control with tillage, mulching, and other eco-friendly methods are enlightened.

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