

## PREFACE

In the last 50 years, the agriculture and crop protection industry has seen the progressive development and application of technology coupled with better chemical innovation that has led to dramatic increase in crop production. Driven by consumer and environmental safety concerns, the regulatory framework for risk assessment and risk management of plant protection products have been refined at the administrative level in many developed and developing countries. During this period, increasing sophistication of crop protection agents to guarantee economic yields and to provide the quality, demanded by consumer markets has raised many challenges to food-safety and has put forth several issues around the frequently asked question — how safe is our food?

An industry in India which depends heavily on pesticide use is tea production. Tea is the most widely consumed non-alcoholic caffeine containing beverage in the world. The health benefits of green tea include alleviation of a wide variety of ailments, such as different types of cancer, heart disease and liver disease. The tea plant, however, is itself disease prone, mainly due to invasive fungal pathogens which attack almost all parts including the harvestable two-and-a-bud region. It has been estimated that 67 million pounds (30 million kg) of tea is lost per annum due to pests and fungal diseases in northeast India. Therefore the growers are forced to rely on huge amount of chemical fungicides for ensuring at least a moderate production.

The chemical inputs to agriculture have contributed substantially to the spectacular improvements in crop productivity and quality over the past 100 years. However, the damage to the environment caused by excessive use and misuse of agrochemicals, as well as fear-mongering by some pesticide-adversaries have led to considerable changes in people's attitudes towards the use of pesticides in agriculture. Apart from strict regulations on chemical pesticide use, there is added political pressure to confiscate the most hazardous chemicals from the market. Tea-decoction is prepared directly from the

processed leaves and drank as a beverage. Consumers may be directly exposed to pesticides present as residues in the drink. The protection of health of consumers, users and the environment is the driving principle behind disease control by environment-friendly ways. Consequently, some pest management researchers have focused their efforts on developing alternative inputs to synthetic chemicals for controlling pests and diseases. These alternatives may be in the form of botanicals or chemicals of plant origin.

Some plants have been found to naturally produce compounds that prevent the growth of fungi. These are basically defense-related secondary metabolites which belong to several classes such as phenolics, coumarins, terpenoids, alkaloids and peptides. These compounds may be extracted to replace the synthetic chemicals as fungicides. Being natural products, these phytochemicals are considered safe and benign to the environment. The in-built advantage of using natural compounds in agriculture is that they are non phytotoxic, easily biodegradable and less detrimental to non target organisms.

The work embodied in this thesis was initiated in the year 2009 with broad objectives of controlling tea diseases by utilizing the plant products that are antifungal and non-phytotoxic. The status of the work and their results and inferences drawn thereof is presented in three major chapters and additional supplementary details given as appendix at the end.