Chapter 17
Plant Extracts as Antimicrobial Agents Against Fungal Food Contamination

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ABSTRACT

Plants are known as a source of secondary metabolites and have been used as antimicrobials in human health, animal health and crop protection. With the development of organic agriculture, new methods have been developed to innovate with plant extracts as herbicides, insecticides and fungicides in agriculture. The aim of this chapter is to review the literature on potential plants that could be used to develop new natural fungicides to combat foodborne fungal contamination. It will describe of the most cited plants as antifungal in agriculture, methods extraction and antifungal tests. Then, it will present newly discovered compounds from plants as effective antimicrobial agents in food manufacturing.

1. INTRODUCTION

Pathogenic fungi are involved in the contamination of humans, crops and livestock (FAO, n.d.; Moumni et al., 2021). Microorganisms are present in food and are the major cause of food spoilage and degradation, including changes in organoleptic properties, spoilage, and loss of flavor and odor emission (Abdel-Khalek et al., 2022). Fungi in sporulation are highly resistant to food processing and other treatments using heat application or pasteurization (Zhou et al., 2023). Certain fungal

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contaminants including those of the genera Aspergillus, Fusarium and Penicillium are capable of producing mycotoxins, which are toxic compounds to consumers (humans and animals). These mycotogenic fungi can be found in crops during pre and post-harvest. According to Food and Agriculture Organization (FAO), mycotoxins are responsible for 25% of crop contamination and can occur at all stages of food manufacturing: transportation, processing, and storage (FAO, n.d.). Contaminated food can cause economic losses due to agricultural contaminants. Consumption of food contaminated by fungi may be responsible for liver and kidney tumors, autoimmune diseases, free radical production, carcinogenic and mutagenic effects (Phuong et al., 2023; Zhou et al., 2021).

To reduce fungal contamination in modern agriculture, synthetic chemicals are commonly used. However, misuse and overuse of these compounds can have adverse effects on both human and environmental health (Basaglia et al., 2021; Xiong et al., 2020).

In addition, the development of the food industry has led to the availability of many ready-to-eat food products in the market. These foods often contain new chemical additives, including antimicrobials, to preserve their sensory properties such as color, flavor, texture and freshness during storage. However, these additives can also alter the consumer's microbiome and lead to adverse health effects such as colorectal cancer, hyperglycemia and high blood pressure (Mohamed, Allagui, & Gianfranco, 2024; Wani et al., 2021). The modern consumer is increasingly aware of the potential risks associated with synthetic chemicals in food production and preservation. As a result, there is a growing demand of natural additives and extended shelf life in ready-to-eat foods. As a result, the food industry has developed new approaches to crop protection and food preservation against fungal contamination based on indigenous ancestral strategies. Traditionally, preservatives such as salt, vinegar or sugar have been used to limit food contamination by fungi and to improve food shelf life. These products are capable of inhibiting bacterial and fungal growth on foods and their derivatives. Plants and mushrooms are potential sources of secondary metabolites that protect against insect or microbial contamination (Ingle et al., 2017; Mohamed, Allagui, & Gianfranco, 2024). These compounds could be natural alternatives to improve food shelf life and crop protection (Azwanida, 2015).

This chapter reviews the literature on potential plants that could be used to develop new natural fungicides to control foodborne fungal contamination. It describes some most cited plants as antifungal in agriculture, methods of extraction and antifungal tests.

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