

Inhibition of *Aspergillus flavus* Link and Aflatoxin Formation by Essential Oils of *Cinnamomum zeylanicum* (L.) and *Cymbopogon nardus* Rendle

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ABSTRACT. The essential oils of *Cinnamomum zeylanicum* (L.) leaf and *Cymbopogon nardus* Rendle were tested for their fungistatic, fungicidal and aflatoxin suppressing efficacy against an isolate of *Aspergillus flavus* Link, isolated from rice. The mycelial growth and the aflatoxin formation in SMKY semi synthetic liquid medium in the presence of different concentrations of two test oils were monitored.

At concentrations varying from 100 to 500 ppm of the essential oil of *C. zeylanicum*, the mycelial dry weight decreased from 0.49 to 0.01 g/50 ml. The percentage inhibition of the mycelial growth of *A. flavus* increased from 50 to 95 when treated with 1000 to 1800 ppm of *C. nardus* oil. The minimum lethal concentrations (MLCs) for the essential oils of *C. zeylanicum* leaf and *C. nardus* were 1000 and 4000 ppm, respectively. Aflatoxins were not present in the medium at or above the concentrations of 400 and 600 ppm *C. zeylanicum* leaf and *C. nardus* oils, respectively.

INTRODUCTION

Fungi on stored grain can cause extensive damage, resulting in the reduction of quantity and quality. In addition, many fungal species can produce mycotoxins, which are highly toxic to animals and humans (Paster *et al.*, 1995). Formation of mycotoxins is linked to the fungal growth. Therefore controlling factors affecting the growth prevent toxin production (Paster *et al.*, 1988).

Aflatoxins are mycotoxins produced by *Aspergillus flavus* and *Aspergillus parasiticus* on many agricultural commodities (Grybauskas *et al.*, 1987). Rice can serve as a good substrate for aflatoxin B₁ (AFB₁) production (Usha *et al.*, 1993). Ammoniation and the use of volatile organic acids are some of the chemical methods used in the detoxification of aflatoxins. However, these chemicals cannot be incorporated to food substrates due to their hazardous nature (Farg *et al.*, 1989). A worldwide trend exists towards limiting the use of chemical fungicides in grain and food. Natural plant extracts (Paster *et al.*, 1995) and volatile products of plant origin (Hamilton-Kemp *et al.*, 2000) may provide an alternative to synthetic chemicals as they contain antifungal compounds (Singh and Tripathi, 1999).

Cinnamomum zeylanicum (L.) (cinnamon) is a spice plant grown in Sri Lanka and its stem, bark and leaves are distilled to obtain essential oils (Wijayarathne and Peiris, 1975). The major constituent of leaf oil is eugenol (77%) (Paranagama, 1991) which has previously inhibited mycelial growth and aflatoxin production of *A. parasiticus* (Farg *et al.*, 1989; Tiwari *et al.*, 1983). Builerman (1974) has reported that the addition of ground cinnamon to the growth medium has completely inhibited aflatoxin formation by *A. flavus*.

Cymbopogon nardus Rendle (citronella) is used in cosmetic industry and the major components in the oil are borneol (5.9%), camphene (8.8%), citronellal (3.8%),