

# RARE

**· ESSENTIAL OIL TREATMENTS TO CONTROL TWO  
 POST-HARVEST DISEASES IN FRUITS OF BANANA  
 (*Musa acuminata* - CULTIVAR EMBUL)**

BY

**C.L.S. ANTHONY (BSc.)**

THESIS SUBMITTED TO THE FACULTY OF GRADUATE STUDIES,  
 UNIVERSITY OF KELANIYA, SRI LANKA, IN REQUIREMENT FOR THE  
 DEGREE OF MASTER OF PHILOSOPHY

ප්‍රවේශ අංකය	284
වග් අංකය	

2003

## ABSTRACT

A considerable post-harvest loss of quantity of banana results during the process of handling from producer to retailer due to post-harvest diseases such as anthracnose, (*Colletotrichum musae*) and crown rot disease caused by *Fusarium moniliforme*, *Lasiodiplodia theobromae* and *Colletotrichum musae*.

*Colletotrichum musae* was isolated from anthracnose-infected banana, collected from twelve localities in Sri Lanka. The crown rot pathogens isolated from the banana samples were *Lasiodiplodia theobromae*, *Fusarium proliferatum* and *Colletotrichum musae*.

Although banana fruits destined for the local and export market should theoretically be free of pesticides, they are being dipped in benomyl to control fungal rots. Since essential oils and their constituents have often been used for their toxicity against insects and plant pathogenic fungi. The effect of the essential oils of *Cymbopogon nardus* (L.) (Ceylon citronella; Heenpengiri), *Ocimum basilicum* (L.) (basil) and *Cymbopogon flexuosus* (L.) (Lemon grass) were tested against the growth of isolated pathogens.

The effect of essential oils on the growth of test pathogens was screened *in vitro*. In the Poisoned food bioassay, essential oils of *C. nardus* and *O. basilicum* showed antifungal activity against the test pathogens at fairly low concentrations (0.2- 0.6) % (v/v), except for *L. theobromae* which required 2% (v/v) of *C. nardus* oil to be fungistatic and 3% (v/v) to be fungicidal on the same.

In liquid bioassay, the efficacy of an additional oil *C. flexuosus* was screened for its antifungal activity. The three oils were fungistatic and fungicidal on test pathogens within a range of 0.05 – 0.2 % (v/v).

The combinations of *C. nardus* oil and *O. basilicum* oil showed slightly higher antifungal activity, both in Poisoned food bioassay and Liquid bioassay. The combinations of two test oils were more effective than benomyl, in suppressing the growth of test pathogens in liquid bioassay.

In the fumigant bioassay, *C. nardus*, *O. basilicum* and *C. flexuosus* oils were fungistatic on the test pathogens at concentrations between 0.03 – 0.60 % (v/v) and fungicidal at concentrations between 0.05 – 0.83 % (v/v).

The antifungal zones of the test essential oils were identified by Thin Layer Chromatography bioassay. Further, the antifungal components were identified and quantified using Gas Liquid Chromatography. Nine, ten and seven chemical components were identified from *C. nardus*, *O. basilicum* and *C. flexuosus* fractions respectively. Alpha-pinene and  $\beta$  - caryophellene were present in the inhibitory zones of all three test oils.

Emulsions of essential oils of *C. nardus*, *C. flexuosus* and *O. basilicum* were tested as a spray on banana *in-vivo*. The essential oil spray treatment of *O. basilicum* controlled crown rot and anthracnose pathogens, facilitating the storage of banana up to 21 days at  $13.5 \pm 1$  °C without any effect on the organoleptic properties. Results of the oil treatment were comparable to the benomyl treatment (0.1% v/w). Quick ripening using ethylene after the cool storage period resulted in better quality banana. The spray of *C. nardus* affected the texture and flavour of the fruit and the *C. flexuosus* oil could not control the crown rot disease completely. The essential oil spray treatment of *O. basilicum* [0.16 % v/v] could be commercially recommended as a safe, cost effective method of treating embul banana to control post-harvest diseases and lengthen storage life.