

0  
581  
WAN

**BIOLOGICAL AND CHEMICAL ELICITORS OF BANANA FRUIT  
DEFENCE**

A THESIS PRESENTED BY

UDA WALAWWE NILUSHA PRIYADARSHANI WANIGASEKARA

To the Board of Study in Plant Sciences of the  
**POSTGRADUATE INSTITUTE OF SCIENCE**

*In partial fulfillment of the requirement  
for the award of the degree of*

**DOCTOR OF PHILOSOPHY**

of the

**UNIVERSITY OF PERADENIYA**

**SRI LANKA**

**November 2009**

**634561**



## BIOLOGICAL AND CHEMICAL ELICITORS OF BANANA FRUIT DEFENCE

U.W.N.P. Wanigasekara

Department of Botany

University of Peradeniya

Peradeniya, Sri Lanka

*Phyllosticta musarum* could infect the developing banana fruits producing minute, pin-head sized freckles. Such infections do not expand into progressive lesions during fruit ripening. Freckle infected fruits show resistance to the anthracnose pathogen, *Colletotrichum musae*. This was previously shown to be due to several defence responses induced in the banana peel tissues following *P. musarum* infection.

In the present study the defence responses in banana (cv. Embul) fruit peel induced due to *Phyllosticta musarum* infection were further characterized. Superoxide ( $O_2^-$ ) production was observed when *P. musarum* infected sites of fruit peel were inoculated with conidia of *C. musae* as an early defence response. The duration of  $O_2^-$  release following *C. musae* inoculation was longer in *P. musarum* infected fruit peel compared to the healthy fruit peel. *P. musarum* infection in banana fruit peel was associated with significant levels of chitinase and  $\beta$ -1,3-glucanase activities. The level of enzyme activity increased with ripening and also upon challenge inoculation with *C. musae*. Constitutive levels of both enzymes were also observed in fruit peel. Two chitinase isozymes were identified with molecular weights 18 kDa and 12 kDa. Significantly enhanced levels of total phenolic acids, free phenolic acids, ester bound and glycoside bound phenolic acids and cell wall bound phenolic acids were observed in *P. musarum* infected peel compared to the healthy peel.

A cell wall derived elicitor was isolated from *P. musarum* and partially purified using bioassay guided gel filtration column chromatography. The elicitor activity of fractions was screened by placing drops on young banana pseudostem where elicitor active fractions induced distinct browning and antifungal compounds. The elicitor was characterized to be a high molecular weight glucan.

The effect of pre- and postharvest application of chemical elicitors, Bion<sup>®</sup>, salicylic acid (SA) and di-potassium hydrogen orthophosphate (K<sub>2</sub>HPO<sub>4</sub>) on anthracnose development during ripening was examined. Postharvest spray of Bion<sup>®</sup> at 200 mg/L or SA at 1000 mg/L reduced severity of anthracnose disease by 68 - 38 % and 41 - 33 % respectively. The study revealed that pre-harvest treatment of developing fruit at a more mature stage (nine weeks after bunch emergence) could make better protection against anthracnose than treating fruit at younger stage. SA (500 mg/L) treatment provided 100 - 58 % control against anthracnose disease while Bion<sup>®</sup> (200 mg/L) gave 75 - 30 % protection. Treated fruits when inoculated with *C. musae* showed enhanced chitinase and β-1,3-glucanase activity. These enzymes are considered to play an important role in plant disease resistance. Application of chemical elicitors had no adverse effect over fruit ripening, physicochemical parameters or sensory qualities of the banana fruit. However, a slight reduction in fruit size was observed in SA or Bion<sup>®</sup> treated fruits.

The study revealed that *P. musarum* infection induces significant chitinase, β-1,3-glucanase activity and phenolic compounds in banana fruit peel. In addition, prolonged superoxide generation in *P. musarum* infected peel following *C. musae* inoculation was established. The cell wall derived elicitor of *P. musarum* is characterized as a high molecular weight glucan. The application of chemical elicitors, SA and Bion<sup>®</sup>, would offer great promise as an alternative method in controlling anthracnose in banana.