

Accumulation of Energy and Nutrients in Pathogenic Fungus

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Description

Botryosphaeria dothidea is an unsafe contagious microorganism that can cause blueberry infection around the world. Streptomyces sp.'s cell-free supernatant antagonistic modes were examined in this study. The effectiveness of CFS as a bio control agent in the field was also evaluated, as was the effectiveness of CX3 against B. dothidea. CFS significantly reduced B. dothidea's mycelium biomass and growth, as well as its morphology, according to *in vitro* bioassay results. Malonaldehyde content in pathogen hyphae and increased electrical conductivity in the culture medium indicate that CFS also had the ability to harm B. dothidea's plasma membrane. CFS significantly increased the activity of B. dothidea's hexokinase, fructose-6-phosphate kinase and Pyruvate Kinase (PK), as determined by the determination of key enzymes in the glycolysis pathway. In addition, the fact that B. dothidea treated with CFS had a significantly lower concentration of glucose and a higher concentration of pyruvate confirmed that CFS may have sped up B. dothidea's glycolysis metabolism, which in turn reduced the pathogenic fungus's accumulation of energy and nutrients. Consequences of field tests showed that CFS could actually diminish the sore region on blueberry branches, and the defensive impact of CFS was better than remedial impact. This is the best of our knowledge, the first report on the use of Streptomyces sp. extracts. To control blueberry canker in the field caused by B. dothidea.

Chemical and Biological Agents

Resistance refers to a plant's capacity to halt or avert infection and pathogen growth. The purpose of this study was to determine whether resistance induction treatments with chemical and biological agents were effective in controlling citrus canker during the establishment of citrus orchards. Products based on *Bacillus subtilis*, bioactive copper, copper hydroxide and acibenzolar-S-methyl were applied via foliar and drench applications at the time of nursery tree transplantation to the field and throughout the citrus orchard's first year of establishment. On mature branches, the prevalence of citrus canker, defoliation, and citrus leafminer injuries was evaluated. Additionally, the citrus trees' vegetative growth, or diameters of the trunk and canopy, was measured. The activation of the systemic acquired resistance by treatments with BioCu and copper sulfate applied by spraying on the leaves of the citrus

trees, as well as by treatments with ASM and Bs applied via drench, was studied under controlled conditions. RT-qPCR was used to measure the expression of the PR-2 gene at 24, 42, 72, and seven days after the treatments were applied. The incidence of citrus canker was lower in the "IAPAR 73" sweet orange trees treated by drench with Bs and foliar applications of Bs+HCu, Bs +BioCu, and HCu with and without ASM in the field. Treatments with HCu decreased defoliation, and treatments with Bs in the leaves decreased the number of CLM injuries. The sweet orange trees "IAPAR 73" that were given ASM had less vegetative growth. During the establishment of the orchard, the BioCu and Bs products were successful in controlling citrus canker in young citrus trees. Additionally, the BioCu product increased the expression of the PR-2 gene, which is the gene that is responsible for the 1,3-glucanase protein, which is linked to plants' Systemic Acquired Resistance (SAR). It is essential to evaluate the apple tree's status for orchard precision management. However, apple valsa canker severely limits apple production and quality in China, particularly in orchards where symptomless branches' skin at the pathogen's early infection stage makes it more difficult to detect the disease quickly and efficiently. For the purpose of identifying plant diseases, hyperspectral imaging is a promising sensing method that is frequently used. High dimensionality, information redundancy, and noise interference make it difficult to find effective HSI analysis methods. Based on spectral and spatial information, the purpose of this research is to develop a Dual-Channel Convolutional Neural Network (DC-CNN) model—an integration of 3D-CNN and 1D-CNN—for early detection of apple valsa canker-infected branches. On the basis of a variety of spectral pre-processing algorithms, DC-CNN models were developed. With constructed saliency maps and gradient histograms, the Gradient-Weighted Class Activation Mapping (Grad-CAM) algorithm was used to visually explain the models' classification mechanism. With an accuracy of 98% for the early detection of apple valsa canker, the results demonstrated that the DC-CNN model based on the images and spectra after Multiple Scattering Corrections (MSC) pretreatment performed the best. This study demonstrated that apple valsa canker could be detected early using HSI and DC-CNN. Additionally, the DC-CNN model's explanation and availability were enhanced by the visual explanation.

Infected Portions of Trees

In numerous southern Iranian cities, the banyan tree *Ficus benghalensis* has been planted as an ornamental tree in parks, landscapes, and along roads and streets. *F. benghalensis* showed an unusual decline during field surveys on Kish Island. Bark necrosis, peeled bark, cankers on branches and aerial roots, yellowing and defoliation, branch dieback, and ultimately death were all seen in affected trees. On infected portions of trees and pruning wood debris, cross-sectional wood discoloration and a black, sooty mass of fungal spores were also observed beneath the bark. For the purpose of testing for the presence of fungal inoculum, samples were taken from all diseased parts of trees, pruning wood debris, and rove arthropods that were within close proximity to the trees. 239 isolates that were similar to

Botryosphaeriaceae were found in the bodies of collected arthropods, discolored wood tissues, and pruning wood debris in this study. Isolates were identified as *Lasiodiplodia theobromae* and *Neoscytalidium dimidiatum* on the basis of their morphological characteristics and DNA sequence data from its and *tef-1* gene regions, respectively. Both species were tested on the branches of banyan trees, and *L. theobromae* was found to be more pathogenic than *N. dimidiatum* based on the length of the necrotic lesions in the wood. This is the first study to link *N. dimidiatum* to *F. benghalensis* dieback and sooty canker worldwide. *L. theobromae* and *N. dimidiatum* can also be associated with some arthropods, as our study demonstrated for the first time. The management strategies for Botryosphaeriaceae species-caused trunk diseases of landscape ornamental trees can benefit from our findings.