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MOLECULAR TOOLS IN THE DIAGNOSIS OF PLANT DISEASES IN SARAWAK

Lily Eng and Teo Chan Hock

ABSTRACT

Plants, like human beings, do get 'sick' or develop a disease. Before they can be cured, there is a need to diagnose the disease correctly. In Sarawak, plant diseases caused by pathogenic fungi, bacteria, nematodes (helminths) or viruses are diagnosed with conventional laboratory methods. However, there are some diseases which cannot be easily identified with these methods. The Research Centre of the Sarawak Department of Agriculture has embarked into the new biotechnology era by adapting molecular tools to tackle these diseases. These techniques are briefly discussed in this article.

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INTRODUCTION

The Research Centre of the Sarawak Department of Agriculture has a laboratory dedicated to carrying out research on diseases affecting agricultural crops. This Plant Pathology Laboratory is quite well equipped to handle major disease problems occurring in agricultural crops. It is manned by senior researchers and supporting staff, with supporting infrastructures like planthouses and fields at the Research Centre. Research plots are also conducted on farmers' land.

The laboratory itself houses equipment like a wide range of microscopes (except for the electron microscopes), incubators (for producing a temperature controlled environment), autoclaves (for sterilising glassware, chemicals and growth media), waterbaths, centrifuges (for spinning samples to separate two ingredients), laminar flows (for a sterile working environment),

fridges, freezers, fume hood (for working with toxic chemicals), ELISA reader (for antibody work), UV transilluminator (for viewing DNA/RNA gels) and a thermal cycler for polymerase chain reaction (PCR).

CONVENTIONAL DISEASE IDENTIFICATION

When a plant is infected with a disease, the cause of the disease or etiology has to be identified before remedial treatment can be applied. Normally, for insect pest damage, the insect can be seen on or around the plant, making the pest identification easier. However in the case of a disease, only the symptoms can be seen. If the disease is not serious enough, like in some cases of viral infection, the plant becomes a carrier of the disease as the plant may look healthy. Sometimes, some fungal structures can be seen at the site of infection, and from experience the plant pathologist can identify the causal organism, which in this case is the fungus. However, in most cases, the plant pathologist has to isolate the causal organism and culture it aseptically to exclude contaminants from the soil or the air. This is done in the laboratory.

Most fungi and some bacteria can be cultured in the laboratory. After the fungus or bacterium has grown for a certain period of time on a specific growth medium, the fungus is usually identified from its morphological structures, while the bacterium is identified using biochemical methods. For plant damage caused by nematodes, the affected plant part is analysed for the presence of these microscopic worms. If they are present, they are then extracted and fixed in chemicals before being identified under the microscope. For the viruses, an immunological method like the enzyme-linked immunosorbent assay (ELISA) is used if antibodies are available. Sarawak does not have a transmission electron microscope (TEM) at present for the identification of viruses. Viruses are the smallest of these