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Foliar Borne Diseases of Tropical Tuber Crops and Its Management

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Abstract

One of the major constraints that affect the yield of plants is biotic stress. Among these, fungi are the most common parasite causing plant diseases that occur primarily on leaves including stem, fruits & roots. Symptoms of fungal foliar diseases in tuber crops include stolon, wilting and chorosis. Tuber crops become infected through diseased stolons and show darkened diseased area on the skin. Starchy roots and tuber crops play a pivotal role in the human diet. Tubers are enlarged structures used as storage organs for nutrients in some plants and also for plants perennation to provide energy and nutrients for regrowth during the next growing season. General management of foliar disease in tuber crops includes using of biofungicides to medium before pouring it into the soil.

Introduction

Roots and tuber crops are important cultivated staple energy sources, second to cereals, generally in tropical regions in the world. They include potatoes, cassava, sweet potatoes, yams, and aroids belonging to different botanical families but are grouped together as all types produce underground food. An important agronomic advantage of root and tuber crops as staple foods is their favourable adaptation to diverse soil and environmental conditions and a variety of farming systems with minimum agricultural inputs. Tuber crops constitute a considerable part of the world's food supply and are a valuable source of animal feed. On a global basis, ~ 45% of tuber crop production is consumed as food, with the remainder used as animal feed or for industrial processing for products such as starch.

Common foliar borne diseases include anthracnose, mosaic and blight can exhibit symptoms such as tissue discoloration, wilting of foliage and sudden death. Foliar borne diseases can significantly reduce yields for many crops, and can decimate the agricultural sectors of large areas if not managed carefully. Pathogens the biological agents responsible for foliar borne diseases, are drawn from several taxonomic groups. The largest groups are the fungi, but plant diseases can also be caused by bacteria, protozoa, viruses and nematodes. Foliar borne plant pathogens considerably reduce crop yields worldwide and are difficult to control due to their "masked" occurrence in the heterogeneous soil environment. This hampers the efficacy of chemical and microbiological control agents.

Foliar diseases of tropical tuber crops are discussed below.

Yam Anthracnose

Yam anthracnose, caused by *Colletotrichum alatae*, is the most devastating fungal disease of yam in West Africa, leading to 50-90% of tuber yield losses in severe cases. In some instances, plants die without producing any tubers or each shoot may produce several small tubers before it dies if the disease strikes early (Figure 1). *C. alatae* affects all parts of the yam plant at all stages of development, including leaves, stems, tubers, and seeds of yams, and it is highly prevalent in the yam belt region and other yam-producing countries in the world.

Figure 1: Yam anthracnose

Management

Traditional methods adopted by farmers to control the disease have not been very successful. Fungicides have also failed to provide long-lasting control. Although conventional breeding and genomics-assisted breeding have been used to develop some level of resistance to anthracnose. To control yam anthracnose, disease avoidance is the key. Practices that encourage disease avoidance include early planting, removal of plants that are alternative hosts for *C. alatae*, field sanitation, planting of healthy seed yams, intercropping with barrier plants, early staking, adopting crop rotation, and monitoring/ screening (*Infonet Biovision*). The control of yam anthracnose has been accomplished mainly with chemical fungicides such as benomyl (benlate), maneb, chlorothalonil and mancozeb which require biweekly or monthly applications (Amusa *et al*., 2003).

Taro Leaf Blight

Taro (*Colocasia esculenta*) a clonally propagated aroid, is grown largely in humid tropical areas of the world. Almost all parts of a taro plant are utilized; corms are baked, roasted, or boiled as a source of carbohydrates, leaves are frequently consumed as a vegetable representing an important source of vitamins, and even petioles and flowers are consumed in certain parts of the world. Taro leaf blight (TLB) caused by the fungus-like Oomycete Phytophthora *Colocasiae rasiborski* (*P. colocasiae*) is of prime importance because it can reduce corm yield by up to 50% and leaf yield by 95% in susceptible varieties. TLB can also deteriorate corm quality. In addition to corm yield losses that occur as a consequence of the reduced leaf area in diseased plants, a corm rot caused by *P. colocasiae* may also occur. Under some circumstances the disease invades harvested corms and causes heavy losses during storage. Affected leaves initially show small dark spots which enlarge rapidly and turn purplish brown with yellowish margins. The lesions frequently form concentric zones and exude drops of yellowish liquid (Figure 2). Some of the diseased tissues may be covered with a whitish fuzz consisting of sporangia. As the disease progresses, the lesions (mostly along the leaf margin) continue to expand and frequently coalesce.

Figure 2: Taro leaf blight

Management

Cultural practices towards disease control include minimizing the source of inoculum, use of disease-free plant material, roguing infected leaves, and avoiding excessive levels of moisture. Fungicidal control is largely practicing against *P. colocasiae* in taro cultivation.

Cassava Mosaic Virus

CMV- a geminivirus first reported in Tanzania - has been recorded throughout the cassava-growing areas in Southern Africa. The disease is spread via an insect vector, the whitefly *Bemisia tabaci* and perpetuated by the use of infected cuttings by farmers. Symptoms of the disease include irregular light-green, yellow or white patches on leaves and leaf deformation, which reduce photosynthesis and stunt plant growth (Figure 3). Effects on yield vary from no reduction to total crop loss depending on the cassava cultivar and environmental conditions. White or pale-yellow or pale-green patches on infected leaves. Some of the symptoms are leaves often twisted, distorted, and stunted. The leaflets have localized mosaic pattern. Heavily infected plant is distorted, retarded, and dwarfed. Whitefly (*Bemisia tabaci*) is the carrier of the virus and transmission is through their feeding habits. The virus is a persistent and significant threat to cassava production and people's food security throughout the region as it can induce yield losses of 20-90%. Factors that influence the development and prevalence of CMV include crop susceptibility virus, inoculum pressure in a specific location, increased use of diseased propagation materials by growers and environmental conditions such as rainfall distribution, light intensity, and temperature (Fauquet and Fargette, 1990).

Figure 3: Cassava mosaic disease

Management

Biological control efforts are hindered by the fact that *B. tabaci* is considered to be indigenous to Africa and already has a well-developed, natural enemy fauna. Cassava cultivars are variably attractive and susceptible to *B. tabaci*; however, there is a poor correlation between these characters and patterns of CMG infection. Alternative potential resistance sources are currently being sought, both from Latin American cassava germplasm (some of which is highly resistant to non-Bemisia whitefly pests) and from wild relatives.

Sweet Potato Feathery Mottle Virus

The main natural host of SPFMV is sweet potato. Sweet potato feathery mottle virus (SPFMV), a Potyvirus, is transmitted by aphids (*Myzus persicae* and *Aphis gossypii*) in a nonpersistent manner. The virus induces symptoms that vary greatly depending on the variety and growing conditions, and symptoms are generally slight or absent. Leaves of infected crops may show irregular chlorotic coloration along midribs (feathering) and faint to distinct chlorotic spots (Figure 4). Both spots and feathering may have purplish margins. Symptom visibility on foliage is influenced by cultivar susceptibility, degree of stress, growth stage, and strain virulence. Increased stress can lead to severe symptom expression, whereas rapid growth of the crop may result in symptom remission. Some strains of the virus induce cracks and external necrotic lesions or internal corking of roots. Between cropping cycles, the pathogen is perpetuated in infected vines (Karyeija *et al*., 1999).

Figure 4: Sweet potato Feathery Mottle Virus

Management

As SPFMV is transmitted in the non-persistent manner by aphids, control of the aphid vectors in field crops is not economically feasible. The main control measures are the production and use of virus-free planting material, sanitation, and the use of resistant varieties. SPFMV is perpetuated between cropping cycles in infected cuttings; the lack of symptoms in the foliage makes it difficult for farmers to select SPFMV-free cuttings. Some wild species of Ipomoea are reservoirs of SPFMV and, if present, should be removed.

Dasheen Mosaic Virus in Elephant Foot Yam

Dasheen mosaic virus (DsMV) the main causative agent of mosaic disease in elephant foot yam (*Amorphophallus paeoniifolius*) belongs to Potyviridae. Leaves of elephant foot yams [*Amorphophallus campanulatus*] showed mosaic symptoms and newly emerging leaves were deformed and pale yellow with parallel chlorotic streaks (Figure 5). Dasheen mosaic virus (DsMV) is disseminated mainly through vegetative propagation of the tubers.

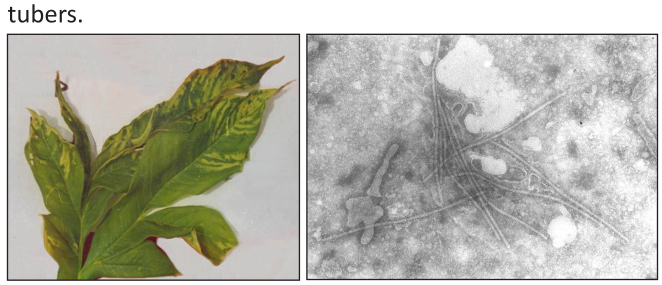

Figure 5: Dasheen mosaic virus

Management

Occasionally, plants with severe symptoms do occur. When plants have leaves with these symptoms, it is important to remove the plants and destroy them.

If aphids are present, put a rice bag over the plant before pulling it out, and then tip the plant into a fire to destroy it and the insects.

Conclusion

Here, we reviewed several major plant foliar fungal pathogens and the factors that induce environmental speciation and host shifts in them. Fungal diseases are responsible for major yield losses in commercially important crops worldwide. In addition to evaluating the agricultural significance of fungal diseases, it is necessary to develop tools that enable the rapid recognition of these disease tools. One possible approach is the identification of environmental speciation in these pathogens.

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