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Foliar Pathogens in Guam: *Fusarium (Gibberella)*

Diseases: Fusarium Wilt, Leaf Spot of Orchid

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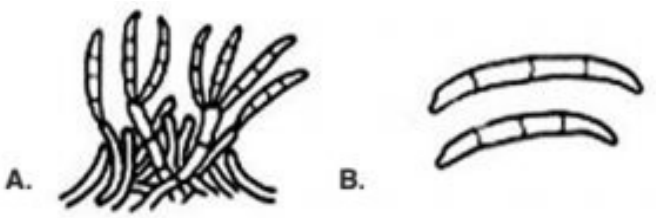

Figure 1. [A] Spores of *Fusarium* produced by short conidiophores. [B] Macroconidia
Source: (Streets, R. 1972). The Diagnosis of Plant Diseases: A Field and Laboratory Manual Emphasizing the Most Practical Methods for Rapid Identification.

Introduction

Most species of ***Fusarium*** are widely distributed, soilborne, non-pathogenic, and active as soil decomposers; however, it is pathogenic on several hundred plant species including economically important food crops such as sweet potatoes, tomatoes, legumes, melons, and bananas (in which the infection is known as Panama disease). As a pathogen, it is most frequently reported to cause root and stem rot and vascular wilt diseases. Less frequently are reports of fruit rot and foliar diseases. The majority of the Fusarium wilt diseases are caused by *Fusarium oxysporum*. Fortunately, it exists as host-specific biotypes; therefore, wilt of watermelon on Guam will not spread to cucumbers, tomatoes, or any other crops. *Fusarium proliferatum* is a major pathogen of orchids on Guam. It causes black and yellow leaf spots on *Cymbidium, Ondontioda, Dendrobium,* and *Cattleya*; and stem and root rots on *Dendrobium, Cymbidium* and *Phalaenopsis.*

Hosts

In the Index of Plant Diseases on Guam *Fusarium* was mentioned on 21 hosts, causing foliar symptoms in 13 of those hosts. This includes some of Guam's major agronomic crops such as watermelon, cucumbers, melon, banana, tomatoes, peppers, and cabbage. In the Diseases of Cultivated Crops in Pacific Island Countries. It was listed as a foliar pathogen on banana, coffee, gerbera, sweet pepper, and peach.

Morphology of *Fusarium* spp.

The genus is large and taxonomically difficult because it is notoriously variable and ubiquitous. Three types of asexual spores are produced by most *Fusarium* spp.: macroconidia (Fig. 3A), microconidia (Fig. 3B), and chlamydospores (Fig. 3 C,D). Mycelium of most *F. oxysporum* species is white and sparse under normal conditions. Short hyaline conidiophores are produced in a sporodochium (cluster of conidiophores) which grows on the surface of infected tissue, which may appear as a salmon-pink crust (Fig. 2). Conidiophores are 10-20 µm and branching with conidia produced singularly at the tips (Fig. 1A). Macroconidia are commonly found. Macroconidia can vary greatly in shape and size, but generally are 3-5 x 15-44 µm, colorless, multicellular (3-5 cells), curved ("sickle" or "canoe" shaped), have 3-5 septa (cross-walls), with an apical cell and foot-shaped basal cell (a constricted area where the spore was attached during formation) (Fig. 3A). Microconidia are colorless, rounded, 1-2 celled, and small (3-4 x 5.5 12 µm) (Fig. 3B). *Fusarium proliferatum* is characterized by producing microconidia in chains. Chlamydospores are thick walled with rounded cells typically found in older mycelium, and are the fungus' survival structure (Fig. 3 C,D).

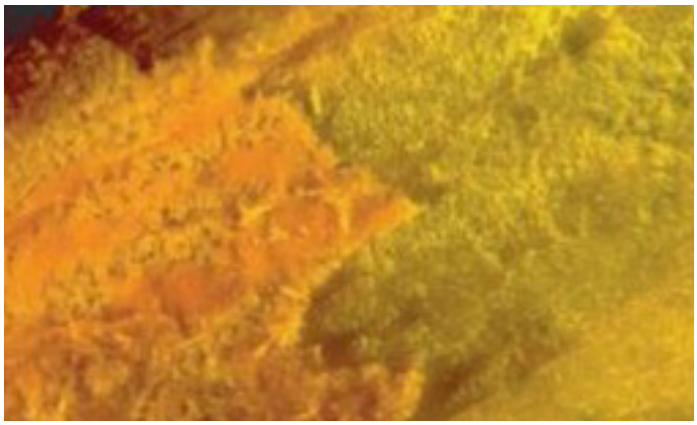

Figure 2. Salmon-pinkish crust of tightly packed spores, typical of *Fusarium*
Photo: R.L. Schlub

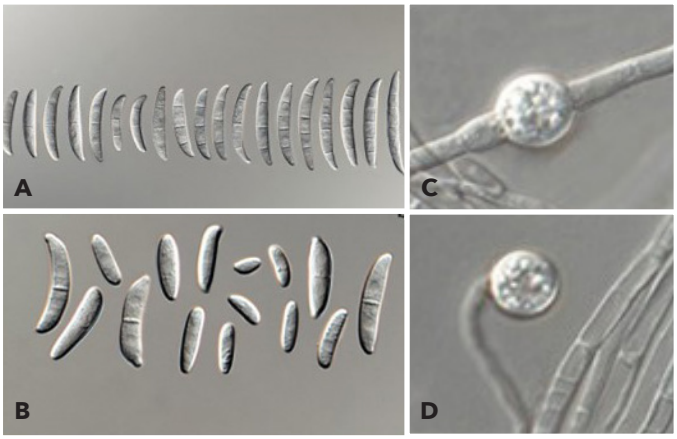

Figure 3. [A] Macroconidia, [B] Microconidia, and [C, D] Chlamydospores of *Fusarium oxysporum*. Scale bars= 10 µm
Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7085860/

Visibility of *F. oxysporum*

- **With the unaided eye:** vines and leaves of a diseased plant appear wilted (Fig. 4, 5).
- **With a 14X coddington hand lens:** a cottony crust of mycelium and clumps of tightly packed spores (sporodochium) may be visible on plant surfaces (Fig. 2).
- **With a dissecting microscope:** macroconidia may be seen (Fig. 3A).
- **With a compound microscope:** microconidia, macroconidia, and chlamydospores are clearly visible if present (Fig. 3).

Disease Development

Fusarium fungus lives in the soil on crop residue and weed hosts. It can survive in the plant for many years, and any plant part that comes in contact with the soil can be susceptible to infection, which can occur at any stage of growth. Movement of infected soil by wind, rain, and equipment are the main means of spread of Fusarium wilt. The disease is most severe in light, sandy soils with a pH of 5.5– 6.5 with low to moderate soil moisture. Optimum temperature is 28-32°C (82.4-89.6°F). Several species of *Fusarium* are associated with orchids; some are pathogenic and cause symptoms of flower spots, leaf or sheath blights, pseudostem or root rots, wilts, and leaf spots (Fig. 6)

Foliar Symptoms

"Wilt" is the symptom used to describe a plant that is drooping from lack of water without any outward sign of infection. At first, only a few vines will show symptoms or only one side of the plant will show symptoms (unilateral development) (Fig. 4). Plants will show what appears to be normal midday drooping (Fig. 5) but are slow to recover and eventually may die. Plants that are not killed show yellowing, stunting, and poor fruit development. Symptoms are most severe during droughts and fruit formation. Symptoms of Fusarium spp. foliar infections of orchids include leaf spots and leaf blotch. The infection spreads worldwide because of international trade and monoculture. Black, small spots occur on leaves at the initial stage of infection (Fig. 6), followed by the spots enlarging and leaves turning yellow.

Figure 4. Unilateral wilting caused by *Fusarium*, shown on watermelon
Source: https://plantpath.ifas.ufl.edu/u-scout/cucurbit/fusarium-wilt---watermelon.html

Figure 5. *Fusarium* causing yellowing and wilting on cucumber vines
Source: https://www.nexles.com/articles/cucumber-cucumis-sativus-treatments-common-diseases-pests-vegetable/

Figure 6. *Fusarium* causing leaf spot on orchid
Source: http://www.extento.hawaii.edu/kbase/crop/Type/f_prolif.htm

For further information

Contact the College of Natural & Applied Sciences, Extension and Outreach at 735-2080 for help or more information. Additional publications can be found on our website at: uog.edu/extension/publications.

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