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Foliar Pathogens in Guam: *Phytophthora*

Diseases: Late Blight, Leaf Spot, Leaf or Canopy Blight

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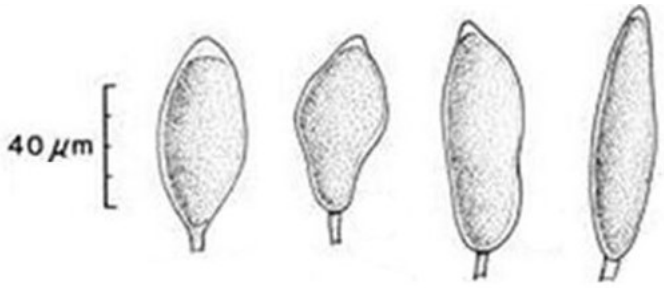

Figure 1. Conidia of *Phytophthora colocasiae*
Source: https://hpc.ilri.cgiar.org/beca/training/IMBB_2016/Phytophtora_CD_update/key/A%20Lucid%20Key%20to%20the%20Common%20Species%20of%20Phytophthora/Media/Html/

Introduction

Phytophthora are among a group of fungi known as oomycetes or "water molds". Other oomycetes on Guam that can infect leaves include *Peronspora* and *Albugo*. Under the right conditions, *Phytophthora* can attack most plants including vegetables, fruits and forest trees, field crops, and ornamentals and all plant parts. As a result of its soilborne nature, most of the diseases it causes are associated with the soil such as root rot, footrot or gummosis, and damping-off. Its foliar diseases include **LATE BLIGHT, LEAF** or **CANOPY BLIGHT,** and **LEAF SPOT.** The ability of the fungus to produce different types of spores make it a formidable pathogen. Some are for short-term survival and spread (sporangia and zoospores), while others spores are involved in long-term survival (chlamydospores and oospores).

Hosts

The genus *Phytophthora* was mentioned as a pathogen on 14 hosts in the Index of Plant Diseases on Guam, but only causing foliar symptoms on 5 of them. Foliar diseases include leaf blight of papaya, taro, and tomato, black rot of orchid, and bud rot of coconut. In the Diseases of Cultivated Crops in Pacific Island Countries, *Phyophthora* was listed as a foliar pathogen on coconut, cocoa, vanilla, and taro.

Morphology of *Phytophthora colocasiae*

Representative of most *Phytophthora* species, hyphae of *P. colocasiae* are elongated, and without cross walls (aseptate). Asexual spores (conidia/sporangia) are produced at the ends of short pedicel (3-10 µm), on unbranched or sparingly branched conidiophores (Fig. 3) at the margins of lesions, and may or may not be present on infected tissue. Conidia are round or lemon-shaped, hyaline, have a distinct apical papillium (small projecting body), and average 17-28 x 40-70 µm (Fig. 1, Fig. 4). Conidia are usually separated from conidiophores by rain, leaving a stalk (pedicel) 3.5-10 µm in length attached to their base (Fig. 1). Sexual spores (oospores) are 18-30 µm in diameter and can sometimes be seen within infected plant tissue.

Figure 2. White fungal growth of *P. colocasiae* on taro
Source: https://www.apsnet.org/edcenter/disandpath/oomycete/pdlessons/Pages/TaroLeafBlight.aspx

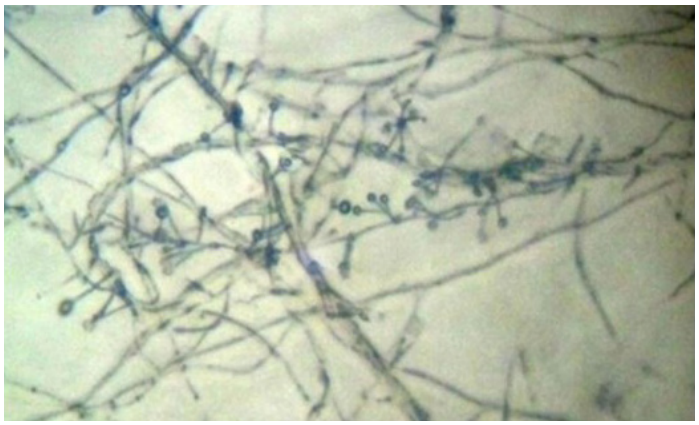

Figure 3. Photomicrograph showing hyphae and branched conidiophores of *P. colocasiae* on taro, 40X
Source: https://www.ijcmas.com/6-10-2017/G.%20Padmaja,%20et%20al.pdf

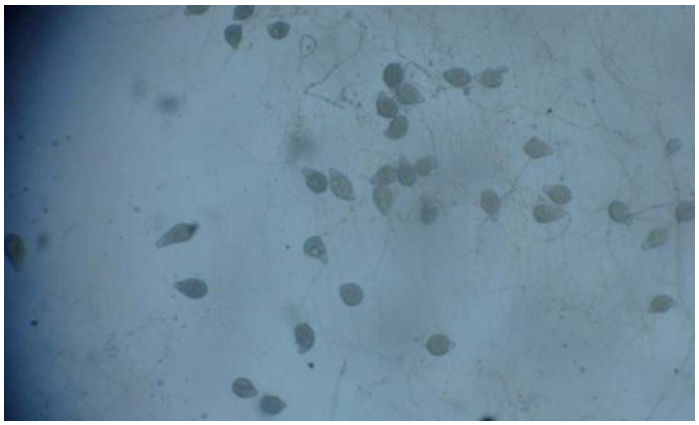

Figure 4. Conidia of *P. colocasiae* on taro, 100X
Source: https://www.researchgate.net/figure/Sporangia-of-Phytophthora-colocasaie-on-Swift-microscope-x100_fig1_297376024

Visibility of *Phytophthora colocasiae*

- **With the unaided eye:** look for brown spots with yellow halos. Red droplets are sometimes seen on the undersurface of the spots (Fig. 5, Fig. 6).
- **With a 14X coddington hand lens:** after extended periods of leaf wetness, white fungal growth can be seen around spot margins (Fig. 2).
- **With a dissecting microscope:** under high magnification mycelial strands and conidia (if present) are visible (Fig. 3).
- **With a compound microscope:** characteristics of individual conidia and oospores (if present) can be observed (Fig. 4).

Disease Development on Guam

Phytophthora foliar diseases are favored by wet, humid conditions which promote the production of asexual spores. On Guam, outbreaks are most likely to occur after a tropical storm or typhoon as the result of wind-driven rain moving spores and creating wounds sites for infection. When the spores land on a new host, the surface must be wet in order for them to germinate. In warmer conditions, the spores germinate by producing one or more germ tubes. In cooler conditions the spores produce zoospores which swim over the plant surface and then settle down to infect, but this means of infection is not common on Guam.

Foliar Symptoms

Taro leaf blight first occurs as brown spots on the upper surface of leaves and water-soaked spots on the lower surface. Early spots are more common along the leaf edges. Spots will enlarge rapidly, become circular and zonate, and often develop yellow halos (Fig. 5). Centers of merge spots may fall out, producing a "shot-hole" appearance (Fig. 5). During a period of extended leaf wetness at night, masses of new spores may lead to the development of a white ring around the margin of an infected spot, which is visible in the morning (Fig. 2). The leaf blight rapidly develops as most of the leaf blade becomes infected and begins to die. Bud rot of betelnut palm often leads to death of the palm by killing the leaf sheath (Fig. 6). *Phytophthora cactorum* and *P. palmivora* are major fungal pathogens of orchids. *Phytophthora* infection of young dendrobium plants often start out as small black, water-soaked spots on leaves (Fig. 7), roots, and pseudobulbs.

For further information

Figure 5. Leaf spots caused by *P. colocasiae* on taro
Source: https://www.apsnet.org/edcenter/Pages/default.aspx

Figure 6. Wilting of spear leaf of Arecanut (betelnut) caused by *Phytophthora palmivora*
Source: https://www.apsnet.org/edcenter/disandpath/oomycete/Pages/default.aspx

Figure 7. Sunken, dark lesions on leaves of dendrobium orchid caused by *Phytophthora*
Source: https://www.ctahr.hawaii.edu/oc/freepubs/pdf/

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