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# Simplified key to foliar, filamentous, pathogens of Guam

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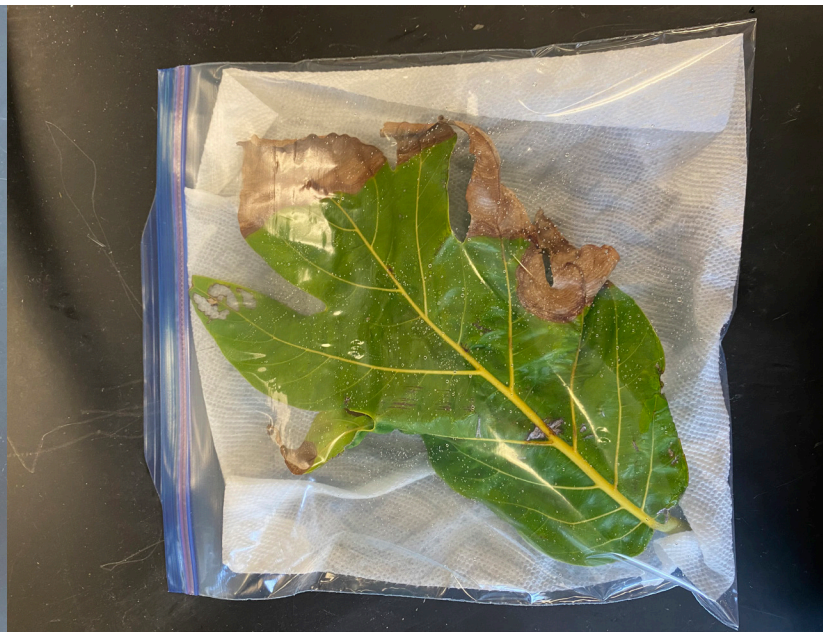

This is a simplified or practical key to Guam's principle foliar, filamentous pathogens. It is intended as a tool to assist current and future plant diagnosticians. The key uses a few structures and other descriptors to place a possible unknow fungus like organism into one of eighteen possible type specimen categories. Some structures can be seen with the unaided eye, while others require a 14X Coddington hand lens, a dissecting microscope 5-50X, or a compound scope 50-500X. To increase the chances of finding key structures, samples should be observed fresh and after incubation in a moisture chamber (such as a closed container with a moist paper towel) for 12, 24, and 48 hours

This key is based upon work that is supported by the University of Guam and the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2019-38640-29880 through the Western Sustainable Agriculture Research and Education program under project number WPDP20-001. USDA is an equal opportunity employer and service provider. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or the University of Guam.

## Glossary: Simplified key to foliar, filamentous, pathogens of Guam

[a]Type specimen: groups of organisms with morphological and developmental similarities.

[b]Morphological characters: shapes, size, and arrangement of the parts that make up the body of a Type Specimen.

[c]Spore: the small reproductive body most commonly associated with the designated fungus. It is a unit of dispersal and germinates to produce new threads of the fungus (mycelium). Examples include conidia, sporangia, oospore, and ascospore.

[c1]Spore formation: Single: typically exists as a single spore at apex of spore support structure (if occasionally in chains, indicated in parenthesis); Chain: typically exists as a chain of spores; (…): number of spores within a chain.

[c2]Spore cells: number of cells or partitions within a spore resulting from the formation of transverse cross walls (septa). A single spore with no cross-walls is indicated by "1." Muriform refers to multicellular spores with both transverse and longitudinal cross-walls.

[c3]Spore shade: Light: commonly reported as colorless or lightly pigmented; Dark: commonly reported as colorful or darkly pigmented.

[c4]Spore shape: Globose: spore has roughly the same length and width (ex: round, lemon-shape, pear shaped, ovide and ovate); Oblong: spore has a length that is 2-6 times its width (ex: ovate, cylindrical, and elliptical). Slender: Length over 6 times its width (ex: fusiform, filiform, filamentous, straight, curved and slender)

[c5]Spore dimension: dimensions of a spore are given in micrometers (μm) as width times length (W x L).

[d]Relative size: E: structures visible with the unaided eye; L: structures visible with a 14X Coddington hand lens; D: structures visible with a dissection microscope; C: structures that require a compound microscope for clear visibility.

[e]Specialized hypha: a specialized single modified thread of fungal tissue (hypha, pl. hyphae), which give rise to one or more spores. Examples include conidiophore, sporangiophore, sporodochium, and synnemata. Length of the hypha structure indicated. Structure may be branched (tree like), or unbranched (not tree like). Spore bearing hypha spacing on the leaf surface may be dispersed or in clusters or clumps.

[f]Fruiting body: a fruiting body is a multicellular structure, of variable shape and size, embedded in leaf tissue or on its surface, containing or bearing spores.

- Closed fruiting body: a fruiting body with a closed spore chamber. Generally spherical or flask-shaped, may contain one spore but generally contains hundreds. Examples include cleistothecium, chasmothecia, perithecium, pycnidium, and sporangium.
- Open fruiting body: a fruiting body with an open face on which spores are formed. Consisting of a saucer-shaped cushion of hyphae, which may be obscured by an aggregation of hundreds of spores which form on its surface. Small eruptions on the leaf surface result if the cushion forms beneath the outer surface of the leaf. Examples include acervulus, apothecium, and basidium. Setae: refers to bristle-like, sharp-pointed, and usually thick-walled sterile modified hyphae often associated with fungal fruiting bodies.

[g]Hyphae matrix: refers to a cushionlike mass of closely interwoven vegetative hypha in or on which fruiting bodies are usually produced. Examples include stroma, ectostroma, endostroma, epistroma, hypostruma, and psedostroma. Hyphae matrix is either present or absent.

[h]Unique feature: a commonly occurring feature of the group that helps distinguish it from other genera.

[i]Foliar disease: a term used to classify plant diseases based on symptoms and or an associated pathogen. They are often found on pesticide labels, seed packets, and in popular literature.

# Simplified key to foliar, filamentous, pathogens of Guam

| Type Specimen[a] / Descriptors | Albugo | Alternaria | Ascochyta | Botrytis | Cephaleuros | Cercospora | Colletotrichum | Corynespora |
|---|---|---|---|---|---|---|---|---|
| **Morphological Characters[b]** | | | | | | | | |
| **Spore formation[c1]** | Chain | Single (1-2) | Single | Single | Single | Single | Single | Single (2-6) |
| **Spore cells[c2]** | 1 | Muriform | 1-2 | 1 | 1 | 5-12 | 1 | 4-20 |
| **Spore shade[c3]** | Light | Dark | Light | Light | Dark | Light | Light | Dark |
| **Spore shape[c4]** | Globose | Slender | Oblong | Globose | Globose | Slender | Oblong | Slender |
| **Spore dimension[c5]** | 12-20 x 12-18 µm | 12-20 x 120-296 µm | 3-5 x 6-10 µm | 6-9 x 8-14 µm | 16-31 x 15-34 µm | 1-5 x 50-220 µm | 4-6 x 13-19 µm | 9-22 x 40-220 µm |
| **Relative size[d]** | D | L | C | C | D | D | C | L |
| **Specialized hypha[e]** | Absent | 50-90 µm branched dispersed | Absent | 750-2,000 µm branched clustered | 245-545 µm branched dispersed | 50-300 µm branched clustered | Absent | 110-850 µm unbranched dispersed |
| **Relative size** | | L | | E | L | D | | L |
| **Fruiting body[f]** | Open | Absent | Closed | Absent | Absent | Absent | Open, setae common | Absent |
| **Relative size** | E | | E | | | | E | |
| **Hyphae Matrix[g]** | Absent | Absent | Absent | Absent | Present | Present | Present | Absent |
| **Unique feature[h]** | Forms while blisters or pustules | Terminal cell of conidium with "tail" | Spores erupt from fruiting budy as "tendril", they may contain oil drops | Tall irregularly branched conidiophores with conidia clusters | Analga, spots velvety, irregularly shaped, and orange | Thickening at point of spore attachment | Fresh spore masses easily visible pink to salmon | Conidia with dark basal scar |
| **Foliar diseases[i]** | | | | | | | | |
| **Algal leaf spot** | | | | | [X] | | | |
| **Anthracnose** | | | | | | | [X] | |
| **Black leaf streak** | | | | | | [X] | | |
| **Bull's eye spot** | | [X] | | | | | | [X] |
| **Downy mildew** | | | | | | | | |
| **Early blight** | | [X] | | | | | | |
| **Frogeye spot** | | | | | | [X] | | |
| **Gray leaf spot** | | [X] | | | | [X] | | |
| **Gray mold** | | | | [X] | | | | |
| **Gummy stem blight** | | | [X] | | | | | |
| **Late blight** | | | | | | | | |
| **Leaf blight** | | [X] | | | | | | [X] |
| **Leaf freckle** | | | | | | | | |
| **Leaf spot** | | [X] | [X] | [X] | | [X] | | [X] |
| **Powdery mildew** | | | | | | | | |
| **Rust** | | | | | | | | |
| **Scab** | | | | | | | | |
| **Southern leaf blight** | | | | | | | | |
| **Target leaf spot** | | | | | | | | [X] |
| **White blister** | [X] | | | | | | | |
| **White rust** | [X] | | | | | | | |
| **Wilt** | | | | | | | | |

| Diplodia | Fusarium | Helminthosporium | Oidium | Peronospora | Pestalotia | Phomopsis | Phyllosticta | Phytophthora | Puccinia |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Single | Single | Single | Chain (3-5) | Single | Single (1-2) | Single | Single | Single | Chain |
| 1-2 | 3-5 | 2 or more | 1 | 1 | 5 | 1 | 1 | 1 | 1 |
| Dark | Light | Dark | Light | Light | Dark | Light | Light | Light | Dark |
| Obong | Slender | Slender | Globose | Globose | Oblong | Oblong | Globose | Oblong | Globose |
| 5-8 x 15-34 µm | 3-5 x 15-44 µm | 14-18 x 66-102 µm | 16-29 x 32-46 µm | 14-25 x 20-40 µm | 5-8 x 17-25 µm | 2-3 x 5-8 µm | 8-9 x 13-16 µm | 17-28 x 40-70 µm | 16-26.5 x 21.5-30 µm |
| C | D | L | D | D | D | C | C | L | D |
| Absent | 10-20 µm branched clustered | 105-470 µm unbranched dispersed | 40-132 µm unbranched dispersed | 180-400 µm branched clustered | Absent | Absent | Absent | up to 50 µm unbranched dispersed | Absent |
| | C | L | L | L | | | | C | |
| Closed | Absent | Absent | Absent | Absent | Open | Closed | Closed | Absent | Open |
| E | | | | | E | E | E | | E |
| Present | Absent | Present | Absent | Absent | Absent | Absent | Absent | Absent | Present |
| Pycnidia separate, unequally celled conidia | Macroconidia with "foot-shaped" basal cell | Spores unusually thick-walled and large | Spores produced by superficial hyphae | End of conidium nipple-shaped | One spore end cell pointed, other end with appendages | Small slender condia may accompany rounded conidia which have oil drops | Spore mass often form a "tendril" (tail) | Apical end of spores nipple-shaped, basal end attached | Large spores give lesions a "rusty" appearance |
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