

Foliar Pathogens in Guam: *Cephaleuros*

Diseases: Algal Leaf Spot, Red Rust

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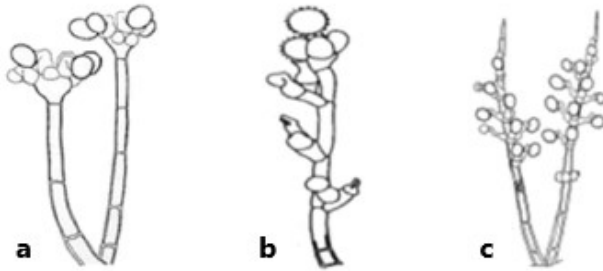


Figure 1. Line drawings showing the variation in the erect sporangiophores and sporangia of the *Cephaleuros* genus: [a] *C. virescens*; [b] *C. biolophus*; [c] *C. minimus*
 Source: https://www.researchgate.net/figure/Line-drawings-showing-the-morphological-characteristics-used-in-taxonomy-of-Cephaleuros_fig4_317836616

Introduction

Algae (singular alga) represent a large group of simple organisms that share characteristics with animals, plants, and fungi. Most live in aquatic habitats; however, a few grow on plant tissue, rocks, and soil. Those within the *Cephaleuros* species are responsible for plant diseases of leaves, stems, and fruits. They are aerial and need free water to germinate. The genus *Cephaleuros* has been known to cause diseases with morphological characteristics similar to those caused by fungi. They are found worldwide in tropical and sub-tropical climates. Unlike foliar fungi, whose sole food source is plant tissue, *Cephaleuros* spp can also obtain nutrition by using light energy (sunlight) and inorganic sources like H₂O and atmospheric CO₂. Leaves with **ALGAL LEAF SPOT** have distinctive orange, fuzzy spots or patches hence its other name, **RED RUST** (Fig. 2). The “fuzziness” is caused by the algal spores and their supporting structures. It is sometimes called green scurf because the spots may have a crusty, or flaky appearance.

Host

C. virescens is most likely the species that occurs on Guam, because it has a broad host range and it commonly occurs in Hawaii. On Guam it is generally a minor disease most often found on hosts with leathery leaves. Leaf spot symptoms on guava can be severe enough to reduce plant vigor and

lead to defoliation. Fruit infections may lead to reduction in yield and marketable fruits. The genus *Cephaleuros* was mentioned on 4 hosts in the Index of Plant Diseases on Guam, causing algal leaf spot on breadfruit, citrus, guava, and mango. In the Diseases of Cultivated Crops in Pacific Island Countries it was only listed on avocado, but likely exist on other hosts as well.

Morphology of *Cephaleuros virescens*

Although both a sexual and an asexual form of reproduction occur, the asexual stage is considered to be important due to it being the more common produced inoculum in the pathogen’s disease cycle. *Cephaleuros* spp. produce a disc like thallus (the plant body of algae) on the leaf surface just below the cuticle, with filaments that bear orange tufts of conidiophores (sporangiophores). Conidiophores of *C. virescens* are cylindrical, erect, form singly, septate (1-6 septa per conidiophore), branched at the terminal end, and long (measuring 10-19 x 245-545 μm) (Fig. 1a, Fig. 3). Conidia (sporangia) are produced on the ends of conidiophores in groups of 2-7 (Fig. 3b, 3c). Conidia are globular, unicellular, 16-31 x 15-34 μm, and white to orange in color (Fig. 3c). Under the right environmental conditions, zoospores (spores that swim) are released from the sporangia.



Figure 2. Filaments of *C. virescens* on mango leaf.
 Source: <https://www.plantsdiseases.com/p/diseases-of-mango.html>

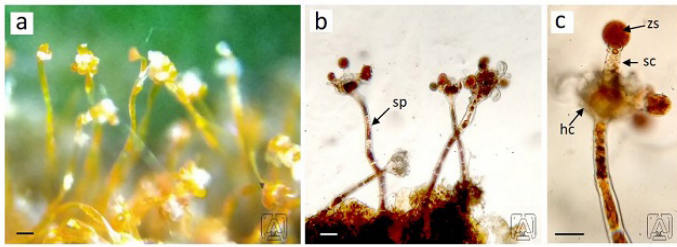


Figure 3. *Cephaleuros virescens*: [a] surface view under dissecting microscope, [b] and [c]: microscopic details (compound microscope) (sp = sporangiophore, zs = zoosporangium, sc = sufflatory (supporting) cell and hc = head cell).
Source: <https://www.plantsdiseases.com/p/diseases-of-mango.html>

Visibility of *C. virescens*

- **With the unaided eye:** grayish-green spots are visible on the upper leaf surface, and “red rust” spots appear on the lower surface. Mature spots may have torn-out centers (Fig. 4, Fig. 5)
- **With a 14X coddington hand lens:** some of the spots may appear fuzzy (Fig. 2)
- **With a dissecting microscope:** you can tell that the “fuzziness” is a result of erect sporangiophores and sporangia (Fig. 3a).
- **With a compound microscope:** microscopic details of conidiophores, head cells, supporting cells, and zoosporangium (conidia) are visible (Fig. 3b, 3c).

Disease Development

Algal leaf spot may occur year-round on Guam. Infection occurs when either the sporangia or thallus filaments are deposited on the tissues of a susceptible plant host. The spores are usually dispersed through splashing or wind. Leaf surface water is required for infection. This disease is favored by wet weather and plants that are already weakened by poor growing conditions. Older, lower leaves and leaves in shaded areas are more likely infected.

Foliar Symptoms

Most commonly, symptoms of *Cephaleuros* appear on the upper surface of leaves as grayish/green small spots with a fuzzy appearance (Fig. 5a). These spots are round, slightly raised but flattened with furry growth and indistinct margins. The spots may merge to form large irregularly shaped patches. Later, spots become reddish-brown giving it a “rusty” appearance (Fig. 5b). In older spots, the center of the spots can tear-out in the form of a hole (Fig. 5b). Scraping away the spots reveals a grayish discoloration of

the leaf lamina underneath. On guava fruit, the spots are more irregular in size and shape, appearing on both sides of the leaf as ashy to dark brown spots with blackened margins (Fig. 6a). The algal thallus and sporangiophores will emerge in yellow-orange clusters within the spots (Fig. 6b). Spots usually combine to form a large irregular patch on the leaf. As the spots mature they take on a dull, grayish green color.

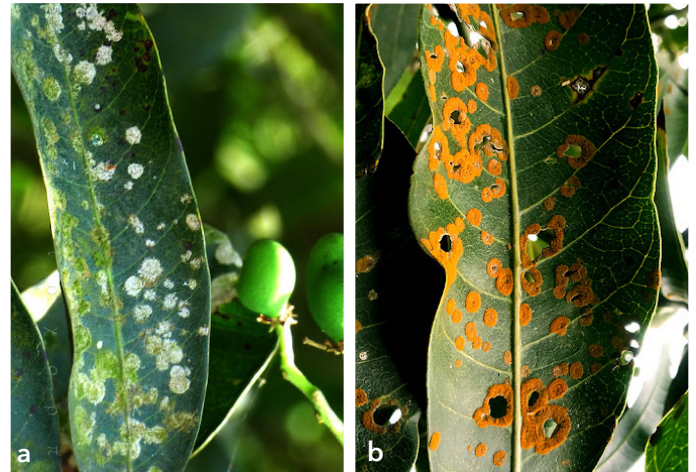


Figure 4. *C. virescens* on mango: (a) Early grayish-green spot on upper surface of leaf, (b) mature symptoms on underside of leaf showing “red rust” color and torn-out center.
Source: <https://www.plantsdiseases.com/p/diseases-of-mango.html>

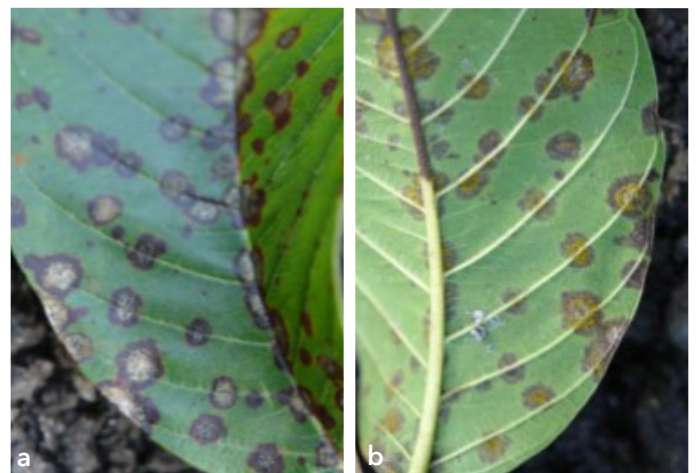


Figure 5. *C. parasiticus* on guava: (a) Ashy brown spots with blackened margins on upper surface of leaf, (b) underside of leaf with orange clusters within spots.
Source: <https://www.ctahr.hawaii.edu/oc/freepubs/pdf/pd-43.pdf>

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