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Leaf Spotting Fungi in Cattleyas Part 2 – Cercosporoid Fungi

by Sue Bottom, sbottom15@gmail.com

Some of my cattleyas have an odd leaf spotting that was suspected to be fungal in origin. The symptoms are a little different on each plant. Sometimes there is chlorotic leaf mottling on the upper leaf surface, and when you turn the leaf over you see blotchy fine spotting. Sometimes the spotting occurs only on the upper or lower leaf surfaces, and sometimes both. Sometimes the spotting seems to coalesce into larger star-shaped spots. The leaf undersides vary from having faint markings to patches of fine spots to uniform spotting throughout the under-leaf. Symptoms are always worst on older leaves; young leaves often have no markings at all. Rarely does the problem cause necrotic spotting or the leaf to die. It does not seem to have a significant impact on plant vigor as the cattleyas grow and bloom well. Even though the plants do not suffer a decline in health, this ugly leaf spotting does not do a thing for their looks.

The leaf samples shown in these pictures were sent to Robert Cating of the Oregon State University Agricultural Experiment Station for identification. His initial assessment based on visual inspection was the leaf spotting was likely caused by *Pseudocercospora odontoglossi*.

He could not culture the fungus, but he did extract the fungal DNA and got a 100% match for one group of samples. This group of cattleyas was determined to be infected by the same Cercosporoid fungus that causes Greasy Spot in citrus, *Mycosphaerella citri* (the sexual stage of *Stenella citri-grisea*, which used to be called *Cercospora citri-grisea*). The upper leaf surfaces have multiple small dark spots that seem to have a longitudinal pattern. As the disease progresses, the spots ultimately coalesce into purplish black patches that have a burned looking appearance, with occasional necrotic spots. The under-leaf surfaces also have a series of fine dots arranged longitudinally, although the spotting is not as pronounced.

Cercosporoid fungus: *Mycosphaerella citri* (causes Greasy Spot in Citrus)

Entire Plant



11a. Blc. Pali Polka Dot 'Nala', a vigorous grower.

Leaf Upper Surface



11b. Black spots coalescing longitudinally with burned appearance, most pronounced purplish black splotches closest to the leaf axil.

Leaf Under Surface



11c. Similar green to purplish black longitudinal spotting on the under leaf surface, not as pronounced as the adaxial surface.



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Cercosporoid fungus: *Mycosphaerella citri* (causes Greasy Spot in Citrus)

Entire Plant

Leaf Upper Surface

Leaf Under Surface



12a. C. David Fairchild coerulea, vigorous grower.

12b. Small black dots are evenly distributed on upper surfaces of older leaves, coalescing into brown burned-looking splotches.

12c. Fungal spores present as fine spotting on leaf undersurfaces, spotting much less pronounced than upper surfaces.



13a. Bc. Deesse x C. Lucille Small, moderate vigor.

13b. Extensive fine spotting coalescing to burned looking brown black splotches on older leaves, some necrotic spots.

13c. Lower leaves have fine spotting in longitudinal pattern, occasional necrotic sunken spots.

Some varieties of citrus are more susceptible to infection from this pathogen than others, and this may also be true in orchids. Copper fungicides are often recommended for control on citrus. Preventative measures include reducing leaf wetness and removing inoculum by collecting and discarding any fallen leaves.

There were many other cattleya leaf samples sent to Cating's lab in the hopes of identifying them. These efforts to identify them were ultimately not successful, so we have only Cating's unconfirmed hypothesis that these were Cercosporoid fungal infections. If you think the orchid taxonomists have been busy categorizing and recategorizing orchids, you should see what the mycologists are doing with fungi. Some fungal species that were once included in the *Cercospora* genera have been recategorized into *Pseudocercospora* and other groups. Until the taxonomists are done reorganizing, we will just call them all Cercosporoid fungi. In the nearby table, there is a listing of Cercosporoid leaf-spotting fungi that infect orchids. These fungi are difficult to work with which may be why so little is known about them.



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Unidentified Pathogens – Possibly *Pseudocercospora odontoglossi*

Entire Plant

Leaf Upper Surface

Leaf Under Surface



14a. *C. skinneri* 'Orchidglade', moderate vigor.



14b. Dark green mottled patches with dark splotches.



14c. Similar blotching to upper surface, no fine spots or spores.



15a. *C. leopoldii*. A vigorous grower.



15b. Small irregular blotches with necrotic edges



15c. Irregular chlorotic patches with sunken necrotic centers corresponding to upper surface

Leonard and Seake provide a good overview of *Pseudocercospora* leaf symptoms in *Growing Dendrobium Orchids in Hawaii*:

This group of fungi primarily causes leaf spots and irregular blemishes. Depending on the Pseudocercospora species and dendrobium cultivar, leaf spots can be circular to nearly circular, reflecting the growth pattern of the fungal colony. These circular blemishes are yellow, with greater amounts of brown to black flecks forming as the spots enlarge. Premature defoliation occurs, and the yellow, detached leaves have brown spots. Other species of Pseudocercospora cause smaller, irregular blemishes. These are 0.12–0.20 inch (3–5 mm) in diameter and generally occur in large numbers. A general mosaic pattern occurs when large sections of the leaf are diseased. Low disease levels occurring in field-grown dendrobium do not affect yield, but high disease levels will reduce yield. Blemishes on potted plants, if numerous, detract from their appearance and marketability. Defoliation is common in environments with less than optimal amounts of light (homes, offices, garden shops, etc.).

The fungus produces hyphae (fungal threads) within the leaf that feed on the plant. Conidiophores (specialized spore-producing hyphae) are produced on the surface of the leaf within the blemished area. These conidiophores produce conidia (spores) that are blown or splashed onto healthy leaves or other parts of the same leaf. The conidia



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germinate when moisture is present on the leaf surface and the pathogen penetrates the host epidermis (skin). Growth and lesion development of this fungus is very slow. Other members of Pseudocercospora require several weeks after penetration before the first symptom of infection is evident.

To reduce disease levels, regularly remove all dead leaves to lower inoculum (spore) levels. If the disease is severe, apply a fungicide (thiophanate methyl is recommended in the Appendix) after removing all infected leaves.

Unidentified Pathogens – Possibly Cercosporoid Fungi

Entire Plant

Leaf Upper Surface

Leaf Under Surface



16a. Blc. Bow Bryce 'Brilliant', a vigorous grower.



16b. Distinct purple spotting over entire leaf surface, almost star like.



16c. Faint to no spotting, where present more obvious closer to leaf axils.



17a. Blc. DiCiommo Gianni, moderate vigor.



17b. Large distinct spots with brown halo spread throughout the leaf.



17c. Few markings, some faint light spotting on the undersurface.



18a. Blc. Bryce Canyon 'Splendiferous', moderate vigor.



18b. Large distinct spots with brown halo extend throughout leaf.



18c. Few markings, some faint light spotting.



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Unidentified Pathogens – Possibly Cercosporoid Fungi

Entire Plant

Leaf Upper Surface

Leaf Under Surface



19a. *L. tenebrosa* 'Bronze Beauty' x '6187', moderate vigor.

19b. Distinct purple spotting covering entire upper surface, some coalescing into star like patterns.

16c. Fine purple spotting covering most of leaf underside.



20a. *C. Claesinter coerulea*, moderate vigor.

20b. Fine purple spotting over entire leaf, some circular purple spots (beginning of necrosis?)

20c. Fine discrete spotting over entire leaf surface



21a. Blc. Lake Murray 'Mendenhall', vigorous grower.

21b. Large, coalescing purple black spots, distributed across leaf, with some chlorotic mottling. Each spot coalesced from smaller spots or is surrounded by a dark halo.

21c. Lower surface has longitudinal, light brown fine spotting coalescing into brown splotchy patches.

What to do, what to do? The cattleyas clearly have some sort of fungal infection, whether it is Cercosporoid or some other leaf spotting fungi. Spraying fungicides would help prevent the spread of the disease, but as long as the fungal hyphae are present in the leaf, the spores spreading the disease will continue to form. The only sure way to get rid of the fungus is to sanitize the plant, a nice way of saying cut off all the infected leaves and destroy them.



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Perhaps some exotic cocktail of fungicides would be able to kill the fungus hiding inside the leaf. Alan Koch of Gold Country Orchids recounts the story of an Ortho Vice President who had an infection of what he called microfungus, and he found this toxic cocktail to have a synergistic effect: spray first with Banrot plus Aliette, then Cleary's plus Subdue, then Banrot plus Subdue, following all label instructions and while wearing protective equipment. These should be 7 days apart in summer and 10 to 14 days apart in winter. Of course, it costs over \$400 to buy all these fancy fungicides.

I am planning a multi-year program to rid my greenhouse of the suspected Cercosporoid fungi. First, periodic sprays of fungicides to protect undamaged leaves and keep the spores from spreading the disease. This will likely include a rotation of fungicides, such as ones having the active ingredients chlorothalonil (Daconil), thiophanate methyl (Banrot, Cleary's 3336, Thiomyl), Azoxystrobin (Heritage) and Pyraclostrobin with Boscalid (Pagaent). Then, as each plant is repotted, any evidence of leaf spotting will be brutally removed and discarded. Only growths that have clean, unmarked leaves will be potted up. I will be looking forward to the day when the plants on my cattleya benches no longer suffer from ugly plant syndrome.

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Citations and Additional Reading:

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Table 1 - Cercosporoid Fungi on *Orchidaceae*

| Species | Symptoms | Hosts |
|--------------------------------------|--|---|
| <i>Cercospora epipactidis</i> | Leaf spots amphigenous, oblong or streak-like, between veins, dark purplish violet to reddish dark brown, 5–40 × 1–2 mm or confluent and larger, margin indefinite. Caespituli hypophyllous, punctiform to minutely pustulate, dark brown to blackish. Mycelium internal. | <i>Cypripedium guttatum</i> , <i>Epipactis (atrorubens [rubiginosa], helleborine [latifolia], palustris)</i> |
| <i>Cercospora habenariicola</i> | Leaf spots amphigenous, circular, subcircular to somewhat angular-irregular, about 3–30 mm diameter, at first pale greenish to ochraceous, later brown to dark brown, finally with greyish brown centre and darker margin, surrounded by a brownish halo, sometimes zonate. Caespituli amphigenous, mainly hypophyllous, punctiform, ochre-yellow, velvety. Mycelium internal. | <i>Habenaria (heyneana, longicorniculata, roxburghii)</i> , <i>Pecteilis susannae [Habenaria susannae]</i> |
| <i>Pseudocercospora angraeci</i> | Leaf spots small to large, 1–25 mm diameter or confluent and larger, subcircular to somewhat irregular, dingy grey to blackish, mainly due to abundant colonies, margin indistinct or darker. Caespituli amphigenous, punctiform, scattered to gregarious, dark brown to blackish. Mycelium internal. | <i>Cattleya (mossiae, Cattleya sp.)</i> , <i>Jumenella fragrans</i> , <i>Laelia sp.</i> , <i>Oncidium (alexandrae [Odontoglossum crispum], Oncidium sp.)</i> , <i>Sobralia (xantholeuca, Sobralia sp.)</i> , <i>Orchidaceae</i> |
| <i>Pseudocercospora cymbidiicola</i> | Leaf spots lacking or amphigenous, subcircular to irregular, later effuse, large, 5–20 mm diameter or even larger, covering large leaf segments or almost entire leaves, dingy greyish brown to dark brown, margin indefinite. Caespituli amphigenous, variable, punctiform to subeffuse, greyish to dark brown or even blackish. Mycelium internal and external | <i>Cymbidium sp.</i> |
| <i>Pseudocercospora cypripedii</i> | Leaf spots oblong, spread between veins, 1–3 mm wide, dark brown to blackish, sometimes in long streaks. Caespituli amphigenous, often epiphyllous, punctiform, dark. Mycelium internal. | <i>Cypripedium (acaule, calceolus, candidum, parviflorum var. pubescens [pubescens], reginae [spectabile], Cypripedium sp.)</i> |
| <i>Pseudocercospora dendrobii</i> | Leaf spots amphigenous, at first small, later forming large patches, 2–30 mm diameter or confluent and larger, covering large leaf segments or almost entire leaves. Caespituli hypophyllous, punctiform, dense, greyish brown to medium dark brown. Mycelium internal and external. | <i>Dendrobium spp.</i> |



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Table 1 - Cercosporoid Fungi on *Orchidaceae*

| Species | Symptoms | Hosts |
|---------------------------------------|---|---|
| <i>Pseudocercospora epidendri</i> | Leaf spots amphigenous, distinct, scattered, irregular, 3–12 mm diameter, pale brown, margin black. Caespituli hypophyllous, punctiform, brown. Mycelium internal. | Only known from the type collection. |
| <i>Pseudocercospora odontoglossi</i> | Leaf spots lacking or indistinct, forming yellowish to brownish discolorations with indistinct margin, turning to dark olivaceous patches by abundant fructification. Caespituli hypophyllous, effuse, thin, velvety, dark olivaceous. Mycelium internal. | <i>Brassia sp.</i> , <i>Cattleya sp.</i> , <i>Cymbidium sp.</i> , <i>Dendrobium sp.</i> , <i>Epidendrum sp.</i> , <i>Laelia sp.</i> , <i>Laeliocattleya sp.</i> , <i>Odontoglossum sp.</i> , <i>Oncidium alexandrae</i> |
| <i>Pseudocercospora orchidacearum</i> | Leaf spots amphigenous, variable, formed as oblong discolorations between veins, to 20 × 5 mm or even longer, pale to darker by abundant colonies. Caespituli amphigenous, punctiform, scattered, dark brown to blackish. Mycelium internal. | Only known from the type collection |
| <i>Pseudocercospora peristeriae</i> | Leaf spots amphigenous, large, oblong to irregular, 5–50 mm diameter, brown, margin indefinite. Caespituli hypophyllous, punctiform to confluent and dense or subeffuse, dingy greyish brown to medium brown. | <i>Peristeria elata</i> |
| <i>Zasmidium cyrtopodii</i> | Leaf spots amphigenous, elliptical, 5–25 × 3–10 mm, sometimes confluent, dark brown. Colonies amphigenous, effuse, velutinous, downy, olivaceous-brown to brown. Mycelium internal and external. | <i>Cyrtopodium eugenii</i> |
| <i>Zasmidium orchidacearum</i> | Leaf spots lacking, diffuse or subcircular to irregular and large, to 4 × 1.5 cm, dingy greyish brown, margin indefinite. Colonies hypophyllous, effuse, thin and inconspicuous to velvety, dull greyish brown. Mycelium internal and external. | Only known from the type collection |

Note: Amphigenous means occurring on upper and lower leaf surfaces, Epiphyllous means occurring on upper leaf surfaces, Hypophyllous means occurring on leaf undersides, Caespituli are fruiting bodies.

Source: Information extracted from *Cercosporoid fungi*, Braun et al.