

Black Rot of Sweet Potato

Disease Cycle and Management

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Diseased sweet potatoes

Outline of Presentation

- Black rot pathogen: *Ceratocystis fimbriata* (biology, life cycle, host range, ecology)
- Black rot disease symptoms
- Black rot disease control
- Other problems

Black rot: The pathogen

- *Ceratocystis fimbriata* (fungus)
- Originally described on *Ipomoea batatas* (sweet potato) in 1890 (Halstead, 1890).
- There are several apparently host-specialized strains that are sometimes called 'types', 'races' or 'forms', and many of these may prove to be distinct species.
- Cross-inoculation studies between *Ceratocystis* from different host plants has proven the host specificity of some of these types

BLACK ROT: a very old problem in Hawaii

1941 publication by Univ. of Hawaii: "Black Rot of Sweet potato"

December, 1941

Agricultural Extension Circular #13

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF HAWAII
UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING
H. H. WARNER, DIRECTOR
Acts of Congress of May 8 and June 30, 1914

BLACK ROT OF SWEET POTATO

Black rot of sweet potato caused by Ceratostomella fimbriata, a fungus, has recently appeared on the islands of Oahu, Kauai, and Hawaii. On the mainland this disease is considered one of the most serious diseases of the sweet potato and occurs wherever it is grown. Because black rot has potentialities of becoming a serious disease of sweet potato its distribution and the amount of damage caused by this fungus should be determined. The following description is given in order to facilitate detection of black rot and is taken from Weber, G.F. and West, E; Diseases of Sweet Potatoes in Florida. Florida Agric. Exp. Sta. Bul. 212, pp. 5-6. 1930.

"Black Rot Symptoms"

"The first indication of the presence of the disease is a yellowing of the leaves of growing plants, which, however, is not a specific symptom for this disease alone. The yellowing progresses rapidly, the leaves become brown, and the plant may wither and die or, when young, the sprout may wilt before it has become entirely yellow. Such plants die quickly because the lower portion of the stem becomes girdled by the fungus near or below the soil surface."

BLACK ROT: a very old problem in Hawaii

1941 publication by Univ. of Hawaii: "Black Rot of Sweet potato"

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The control measures, based on work done on the mainland, that may be found here are enumerated below:

1. Destroy all diseased plants including the roots.
2. Destroy all diseased host plants--wild morning glory and wild sweet potato.
3. Disinfect bags, barrels, and other materials that have been used to handle diseased roots by immersing for 5 minutes in bluestone (1 lb. to $12\frac{1}{2}$ gal. of water) or formaldehyde (1 pt. to 30 gal. of water).
4. Use disease-free seed pieces or seed pieces (stem or roots) that have been dipped in 20-20-50 Bordeaux mixture.
5. Do not mix diseased roots with healthy roots because the disease is easily spread through contact.
6. Store clean roots in clean storage.
7. Do not plant sweet potatoes for several years in infested soil.

Should symptoms appear which, in general, answer the description of the disease as given above, take specimens to your county agricultural agent who will be able to give you further information.

Ceratocystis fimbriata: Host Range¹

(some tropical plants – canker diseases appear on woody plants)

- *Theobroma cacao* (cacao)
- *Mangifera indica* (mango)
- ***Ipomoea batatas*** (**sweet potato**)
- *Coffea* sp. (coffee)
- *Eucalyptus* spp.
- *Citrus* spp.
- *Crotolaria juncea* (sunn hemp)
- *Hevea brasiliense* (rubber)
- *Colocasia esculenta** (taro)
- *Xanthosoma* sp. (dasheen)
- *Syngonium* sp.*
- *Ficus carica* (fig)
- *Spathodea campanulata* (African Tulip tree)
- *Acacia mearnsii*
- *Erythrina* sp.
- *Manihot esculenta* (cassava)

¹CABI Crop Protection Compendium, CABI Publishing (2004)

*Uchida and Aragaki, 1979

C. fimbriata Biology and Ecology

- Dispersal or spread of the black rot fungus:

The fungus is spread by wind, water, soil, on harvesting baskets, on farm machinery, by some insects, by humans (clothing), by contaminated tools

C. fimbriata Biology and Ecology

- Survival of the fungus: The fungus survives in soil, in water, and on decaying organic matter such as sweet potato debris left in the field. It can survive for several years in the soil.



Baskets



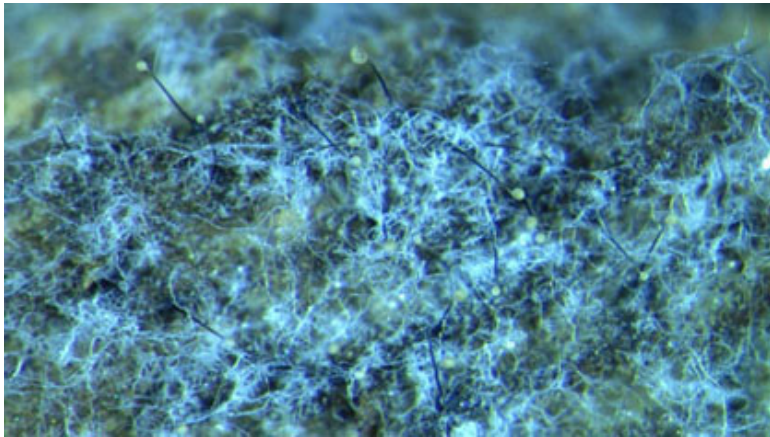
Equipment



Crop debris

C. fimbriata Biology and Ecology

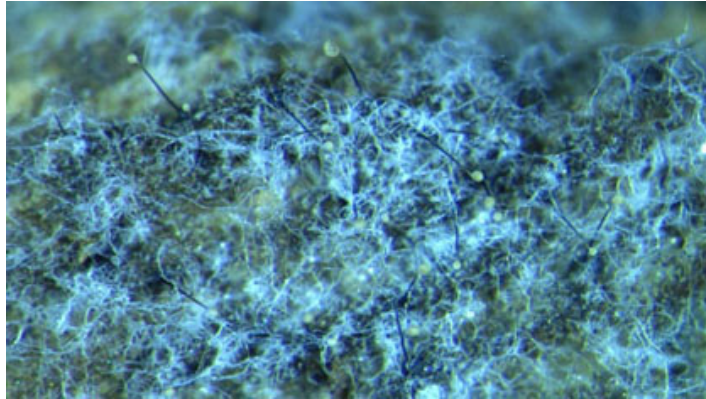
- Infection of sweet potato: **Wounds** on the sweet potato skin are important entry points for infection by the fungus. Sweet potato roots and stems are also susceptible to infection.



The fungus will attack wounds



C. fimbriata life cycle

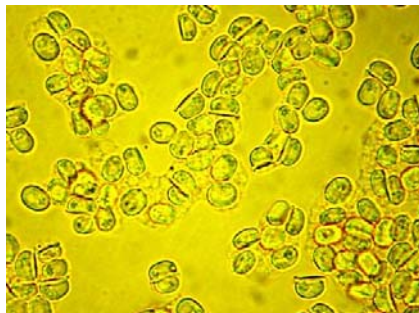


Mycelium and perithecia

<http://et2.unipv.it/omp/ceratocystis/23Gmicr.JPG>

Ceratocystis fimbriata on black-rotted sweet potatoes. The ascospores of the sporulating *C. fimbriata* have accumulated in a sticky drop at the tip of their perithecial necks. The combination of the fruity aroma and the sticky spores is thought to be an adaptation for promoting fungal dispersal by insect vectors.

Ascospores are in these sticky droplets



<http://www.bspp.org.uk/ndr/jan2004/2004-02-2.jpg>



Iowa State University, Thomas Harrington

Black Rot Disease Symptoms

- Early symptoms: small, circular, slightly sunken, dark brown or grey spots on the sweet potato surface.

Right: Sweet potatoes in storage with early symptoms of black rot, including some white, fluffy, mycelial growth of *Ceratocystis fimbriata* on the black rot lesions.



Black Rot Disease Symptoms

- Advanced symptoms: large, circular, sunken, dark brown to black spots on the sweet potato surface.



Photo: *Compendium of Sweet Potato Diseases* (1988). American Phytopathological Society

Black Rot Disease Symptoms

- The brownish colored rot usually remains shallow, but can extend into the inner part of the potato, leading to rot by **secondary** organisms which can destroy the entire root.

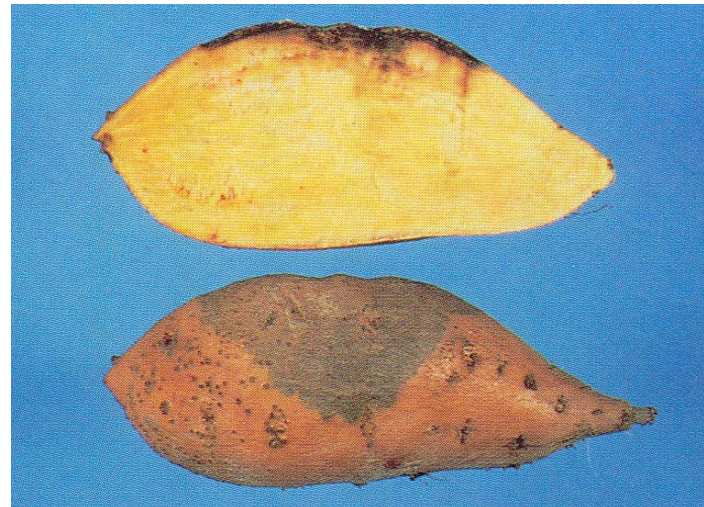


Photo: *Compendium of Sweet Potato Diseases* (1988). American Phytopathological Society

Black Rot Disease Symptoms

- Sunken cankers and lesions appear on sweet potato slips (underground stems); roots can rot.



Infected stem cuttings can be a source of black rot disease for a new bed or field.

Photo: *Compendium of Sweet Potato Diseases* (1988).
American Phytopathological Society

Black Rot Disease Control

- Crop rotation: perhaps the most important practice for controlling black rot.

Sweet potatoes should not be planted in the same field more than once every third or fourth year.

Rotation crops should not be hosts for *C. fimbriata*.

Black Rot Disease Control

- Bedding site selection.

Sweet potatoes should not be bedded in sites that have been used to grow sweet potatoes within the last three years.

New land should be used for bedding.

Some approved rotation crops

- Tea
- Daikon
- Cabbage
- Ginger root
- Yams
- Corn
- Lettuce
- Eggplant
- Cucumbers
- Kava

These crops will grow well on the Hamakua coast in many locations.

“The major bottleneck generally is market consistency and the supply/demand. The market issues between grower and shipper can get complex.” (Dwight Sato, UH-CTAHR)

Black Rot Disease Control

- Selection of seed roots

Only sweet potato cuttings free of disease should be selected for bedding for plant production.

Do not plant infected sweet potato roots.

Black Rot Disease Control

- Cutting of transplants

It is critically important for transplants to be cut at least 2 cm above the soil line, to exclude infected underground portions of the stem.

Black Rot Disease Control

- Fungicide treatment (pre-plant)

Seed roots or slips should be treated with an effective fungicide as a pre-plant dip, such as thiabendazole (Mertect 340-F), to kill spores of the fungus contaminating the root surface.

Mertect 340-F applied at 8 fl.oz /7 ½ gal (seed or root/slip treatment).

Note: The Hawaii Dept. of Agriculture is the final authority on use of fungicides; please check with the HDOA for its interpretation of fungicide labels.

Black Rot Disease Control

- Fungicides registered for Hawaii (check with Hawaii Dept. of Ag. for permission to use):
 - **Mertect 340-F** (root dip, sweet potato sprouts) (active ingredient: Thiabendazole)
 - **Maxim 4FS** (seed treatment) (active ingredient: Fludioxonil)
 - **Botran 75-W** (postharvest application to non-stored commodity). (active ingredient: Dicloran)

Black Rot Disease Control

- Careful handling

The crop should be handled carefully during growth and harvesting operations to minimize wounding to the potatoes.

Black Rot Disease Control

- Field sanitation

The sweet potato crop debris should be removed from the field after harvest.





Sophisticated potato harvester removes all crop debris from the field.

Black Rot Disease Control

- Cull diseased potatoes before washing

Do not wash and package sweet potatoes from crops that show any signs of infection, as the incidence of disease may increase drastically following this operation, and equipment may become contaminated.

Black Rot Disease Control

- Washing

Clean, fresh water should be used to wash the potatoes. The water should not re-circulate.

Dirty, re-circulated wash water allows the fungus to survive



Black Rot Disease Control

- Storage

The potatoes should not be stored or covered when they are wet. Allow them to dry after washing. Store in well-ventilated location.

Shippers: Do not allow boxes to get wet get wet during shipping or at any time. Cover them on trucks with a tarp.

Black Rot Disease Control

- Storage

Ventilated boxes are much better for controlling black rot disease.

Ventilated boxes allow air circulation, which reduces the black rot disease problem.



Black Rot Disease Control

- Curing of potatoes.

Proper curing at 30-35 C and 85-95% relative humidity for 5-10 days immediately after harvest greatly reduces the incidence of infection through wounds incurred during harvesting. Curing allows cuts and scrapes incurred during harvesting to heal.

1941 publication by University of Hawaii: "Curing Sweet potatoes"

January, 1941

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(For use in Extension Clubs)

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CURING SWEETPOTATOES

The table quality of Hawaii-grown sweetpotatoes can be improved by storage. If the freshly dug roots are cooked, the flesh is usually dry and often inferior in quality to the stock shipped from the mainland to Hawaii.

Storing sweetpotatoes 10 to 14 days in a cool, well-ventilated place will permit natural changes to take place in the roots that will improve the table and cooking qualities. Curing will allow the tender skins of the freshly dug roots to harden and so better withstand subsequent bruising and damaging. It also reduces rot to a minimum. During this period the natural sugars in some varieties increase in the freshy roots to a maximum of 20 per cent more than when dug.

Where space will permit, the freshly dug roots should be stored in open crates near the house, as this is often the coolest and best ventilated place on the farm. Another spot, if equally cool and well ventilated would be satisfactory.

No special equipment other than boxes holding from 50 to 60 pounds is necessary, although protection from rat injury must be provided.



A sweet potato curing room

Black Rot Disease Control

- Decontamination of tools and equipment.

Any equipment or materials that come into contact with an infected crop (washing machines, storage crates, storage structures) should be decontaminated. Spray empty washing machines and crates with a fungicide. Storage facilities should be thoroughly cleaned before harvest.

Black Rot Disease Control

- Apply post-harvest fungicide dip

Botran 75-W may be applied to the non-stored commodity.

Other problems

- Sweet potato weevils



Sweet potato crop debris should be removed from the field to break the life cycle

Other problems

- Rats



Do not wash these with the other potatoes

For questions or further information:

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Mahalo!