



## Pacific Pests, Pathogens & Weeds - Fact Sheets

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### Banana black Sigatoka (002)

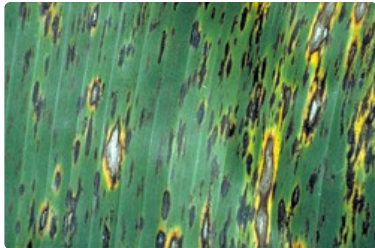


Photo 1. Reddish-brown and black streaks of black Sigatoka, *Mycosphaerella fijiensis*, on the upper surface of a leaf, with some developing white or tan centres where the spores are produced. Note that the spots have bright yellow haloes, or margins.



Photo 2. Long streaks with bright yellow margins typical of infection by black Sigatoka, *Mycosphaerella fijiensis*. Note the blighted areas at the leaf tip and margins where the spots have joined together to cause the blight.



Photo 3. Typical decay of a leaf infected with black Sigatoka, *Mycosphaerella fijiensis*, showing the brown streaks, some with white centres, and the edges of the leaf decaying before other parts where the streaks have joined together.

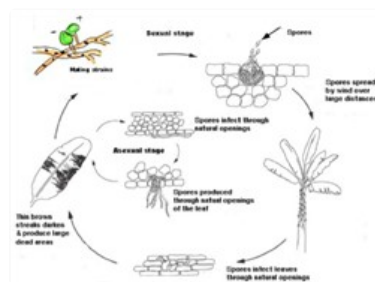


Diagram. Life cycle of black Sigatoka, *Mycosphaerella fijiensis*. Note that there are two types of spores, but it is the sexual stage that produces the ascospores that are considered the most important in disease development. The spores are discharged from the top surface of the leaves and spread by wind.

#### Common Name

Black Sigatoka, black leaf streak

#### Scientific Name

*Mycosphaerella fijiensis*. This is the name of the sexual state; the asexual name is *Paracercospora fijiensis* (previously *Pseudocercospora fijiensis*).

#### Distribution

Worldwide. Asia, Africa, North, South and Central America, the Caribbean, Oceania. It is recorded from Australia (Torres Strait Islands), Cook Islands, Fiji, French Polynesia, Guam, American Samoa, Marshall Islands, Federated States of Micronesia, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu, and Wallis and Futuna.

#### Hosts

The fungus infects bananas and plantains, *Musa* species.

#### Symptoms & Life Cycle

Red-brown or black streaks appear on the underneath of the third or fourth youngest leaf. These form spots, 20-30 mm long, with grey or

light brown centres and dark brown or black margins, best seen on the upper surface (Photo 1). The spots join together, often with yellow areas between. The infected areas invariably form bands several centimetres wide on either side of the midrib. In severe infections, spots do not occur, but large areas of the leaf turn black and die. Generally, the streaks are more common at the tips and edges of the leaves (Photos 2&3).

Young fully expanded leaves on mother plants and suckers are the most susceptible to infection. As the leaves mature, they become resistant. The spores germinate and the germ tubes enter through natural openings in the leaf. The fungus grows within the leaf, killing plant cells, before returning to the surface to produce more spores. There are two types of spores: ascospores and conidia (see diagram); the ascospores are the more important.

Different strains of the fungus (plus and minus) come together to form the sexual ascospore stage (see Diagram). Spores are produced in the dead, grey areas on the upper leaf surface. They are released during rains or during times of high humidity and are blown in wind and rain on the underside of the emerging leaves, and the cycle begins again.

Short distance spread within the plantation is thought to be by conidia, whereas ascospores are responsible for spread over longer distances. Spread also occurs on infected planting material. There is also evidence that the disease can be spread by contaminated fruit shipments, especially if dead plant material is present.

## Impact

Black Sigatoka is a devastating leaf disease of bananas around the world. Infected leaves die early, reducing fruit yield, and causing mixed and premature ripening fruit bunches.

The effect of the disease is a loss of leaves: leaves die early. Instead of lasting 200 days they last only 50 days. This reduces yield by 35-50%, depending on severity of the infection and on the variety. Cavendish varieties are particularly susceptible and these are grown for sale worldwide. About 30% of the production costs in commercial plantations are spent on fungicides to control this disease.

The weight of the bunch and the ripening of the fruit are affected by the number of leaves on the plant: if there are too few at flowering then bunch weight is low; if less than five leaves at harvest, the fruits ripen early. Ideally, 10 leaves are needed for large bunches.

## Detection & inspection

On leaves, look for a rapid development of red-brown and yellow streaks, drying from the margins back to the mid-rib, and early death of leaves. There are other fungi that cause similar symptoms, e.g., yellow Sigatoka (*Mycosphaerella musicola*) and Eumusae leaf spot (*Pseudocercospora eumusae*), therefore, where critical identification is required, samples should be sent to experts familiar with banana diseases.

## Management

### BIOSECURITY

Countries still free from black Sigatoka should take all practical measures to prevent its introduction and further spread. Banana plants should only be transferred between countries as tissue cultures tested to ensure that they are free of all known banana diseases. Plants of many varieties of bananas, tested to internationally agreed standards, can be obtained from the INIBAP transit centre in Belgium, and from IITA, Nigeria. The FAO/IBPGR *Technical Guidelines for the Safe Movement of Germplasm*. No. 15. Musa. 2nd Edition, gives details of the methods to use ([http://www.biodiversityinternational.org/uploads/tx\\_news/Musa\\_spp.\\_2nd\\_edition\\_\\_502.pdf](http://www.biodiversityinternational.org/uploads/tx_news/Musa_spp._2nd_edition__502.pdf)).

### CULTURAL CONTROL

Cultural methods of control are very important; the strategy is to reduce the humidity in the plantation, reducing the time that the leaves are wet and the spores can germinate and infect.

Before planting:

- Choose areas that have good drainage. Avoid areas with heavy clay soils where surface water remains for some time after rains.
- Avoid areas where there is shade from trees.
- If planting on hillsides, choose sites with morning sun to dry leaves rapidly.
- Plant so that the rows run in the direction of the prevailing wind, to allow air into the plantation to dry leaf surfaces, to prevent infection, or to reduce the number of spores.
- Plant at wide spacing, about 2.5 m apart; this is about 1600 plants to the ha.

During growth:

- Weed regularly.
- Cut off leaves (if more than 50% infected), or cut out parts of leaves; take the leaves or parts of the leaves out of the plantation. Leaf pruning should be done weekly.
- Cut out suckers, leaving 3-4 plants of different sizes per mat (or stool); these should be: (i) the mother with fruit; (ii) a sucker about to flower; (iii) one or two small suckers. Pruning in this way lowers the relative humidity in the plantation and produces stronger plants with larger fruit.
- Remove and burn old infected leaves.
- Use a mulch of leaves (but not banana leaves!) to improve plant health.

After harvest:

- Collect infected leaves from the mother plant left after harvest of the fruit, take them out of the plantation and burn them.

#### RESISTANT VARIETIES

Many plantains in Pacific island countries are either tolerant or resistant to black Sigatoka. There are also other plantains elsewhere, e.g., Mysore, Saba and Pisang Awak. Additionally, Yangambi Km5, a dessert banana from West Africa, also has black Sigatoka resistance. However, if farmers want to grow varieties with Cavendish qualities for household use or the market, then they should ask their departments of agriculture for new varieties from the Honduran Foundation of Agricultural Research breeding scheme: varieties FHIA-1, FHIA-2, FHIA-3, FHIA 17, FHIA 18, FHIA 23 and FHIA 25. These are dessert or dessert/cooking bananas with resistance to black Sigatoka. Consult the Secretariat of the Pacific Community (CePaCT lab) for supplies.

#### CHEMICAL CONTROL

Fungicides are only recommended for commercial plantations; examples are:

(i) Protectant fungicides (these stay on the surface of plants) -

- Mancozeb.
- Copper hydroxide.
- Chlorothalonil.
- Banana misting oil.

Mancozeb can be used together with oil or an oil/water emulsion; chlorothalonil is used in water.

(ii) Systemic fungicides (these move inside the plants) -

- Triazoles (e.g. propiconazole, fenbuconazole and tebuconazole).
- Strobilurins (e.g., azoxystrobin).

It is important to rotate the fungicides in the different groups to prevent the build-up of resistant strains of the fungus. No more than two applications of the same systemic fungicide should be made before changing to another group. In drier times, mancozeb can be used alone. Note, it is important to add a sticker to any of the fungicides.

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Information from CABI (2019) *Mycosphaerella fijiensis* (black Sigatoka). Crop Protection Compendium. (<http://www.cabi.org/cpc>); and from Black Sigatoka. Business Queensland. Queensland Government. (<https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/black-sigatoka>).

Photo 1 Kohler F, Pellegrin F, Jackson G, McKenzie E (1997) *Diseases of cultivated crops in Pacific Island countries*. South Pacific Commission. Pirie Printers Pty Limited, Canberra, Australia. Diagram APSnet Education Center. Black Sigatoka of bananas and plantains, American Phytopathological Society. (<http://www.apsnet.org/edcenter/intropp/lessons/fung/ascomycetes/Pages/BlackSigatoka.aspx>).

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