



Banana xanthomonas wilt

Xanthomonas campestris pv. *musacearum*



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BXW produces a distinctive premature ripening of fruit, which eventually rots.



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BXW can be confused with Fusarium wilt, caused by a fungus. The bacterial wilt affects younger leaves, though, and leaves collapse inwards.

SUMMARY: Banana xanthomonas wilt (BXW) is named after the bacterium that infects the plant and eventually kills it. The disease has surged through Uganda since it was first found in 2001 and is now widespread in the region. All banana types are susceptible, though research has produced some promising results for future resistant varieties. The main management option for now is sanitation: planting healthy material, using clean cutting tools and removal of male buds to limit infection by bacteria-carrying insects as they collect nectar. BXW does not occur in West Africa and the other major bacterial wilt on banana worldwide, caused by *Ralstonia solanacearum* (Moko disease), is absent from all of Africa.

KEY SIGNS

The most distinctive feature of BXW is the premature ripening of fruit: individual bananas start to go yellow while others in the bunch remain green. When cut open, the bananas have dark stains, including those that are green. The bananas quickly blacken and eventually the whole bunch decays.

The first signs of infection, however, are when the purple leaves (bracts) of the male flower bud shrivel, go black and die. Also look out for young leaves in the crown that go yellow, fold in the centre and then collapse. Cut the fruit stalk and, once the milky juices stop oozing, look for small yellow dots. These indicate that the bacteria are blocking the flow of water and nutrients. It may, however, be difficult to see these yellow dots.

A fungus disease of banana, known as Fusarium wilt or Panama disease, also causes yellowing but on older leaves. The leaf blade does not become limp and the yellowing is much brighter compared to BXW. The fruit develop normally. The most distinctive symptom of Fusarium wilt is a dark staining inside the trunk, which is absent in bananas with bacterial wilt.

MANAGEMENT

Prevention – what to do before signs are seen

Cultural approaches: BXW is spread in infected planting material and by insects which introduce bacteria through banana flowers. The bacteria can also be transferred on cutting tools. All types of banana are susceptible though it is more difficult for the bacteria to infect some cultivars in the field because of their flowering characteristics. These cultivars can still be infected through contaminated cutting tools.

The key to successful management is careful selection of healthy planting material and keeping cutting tools used for cutting banana fruit bunches and leaves clean and free from bacteria.

Carefully select planting material from areas where the disease is absent. Obtain suckers from trusted sources. Do not use suckers from banana plants affected by BXW, even if the suckers appear healthy.

Removal of the male bud by hand or with a forked stick (to reduce the risk of moving bacteria on cutting tools) will limit the risk of infection via pollen and nectar feeding insects that have previously fed on infected plants. Timing of removal is important; male buds need to be cut off quickly after the fruit has been set. The drawbacks are that the method is time-consuming and some farmers believe the male bud is essential for good juice production in beer types of banana.

Chemical approaches: Cutting tools can be cleaned with household bleach (one part to four parts of water), solutions containing local plants with antibiotic activity, such as tobacco or chilli, or by passing through a flame. Bleach is the most effective method for killing bacteria though few farmers appear to use this method.

Control – what to do after signs are seen

Cultural approaches: Initial advice when BXW was first discovered in Uganda was to dig up and burn the whole banana mat. We now know that bacteria do not completely invade the plant. The current advice is therefore to remove those trunks (pseudostems) showing symptoms of BXW and dispose of these carefully. Single stem removal will reduce the amount of bacteria capable of infecting new plants, but this will not eliminate the disease. Selection of healthy planting material and cleaning of tools remain the key pieces of advice to follow.

Chemical approaches: Once the plant is infected there is no treatment to control the disease.

CAUSE

This is a bacterial disease caused by *Xanthomonas campestris* pv. *musacearum*. The 'pv.' stands for pathovar and indicates a particular type of *X. campestris* that only infects banana and its close relative ensete. Previously it was known as *X. musacearum*.

The bacterium can be spread by insects feeding on flowers of infected plants and then feeding on clean plants, and also via cutting tools contaminated with bacteria.

Globally, there are several bacterial wilts that cause similar symptoms and behave in similar ways to BXW. These wilts are associated with different types of the bacteria *Ralstonia solanacearum*, which does not attack banana in Africa.

IMPACT

BXW is a highly damaging disease affecting all types and varieties of bananas. Plants and fruits are destroyed. The disease can be spread over long distances, presumably in planting material and possibly plant debris: the strong demand for bananas in Kampala attracts imports from far away. Most information about impact comes from Uganda, where the disease has caused the biggest losses and had a major impact in stimulating research and extension efforts to contain and manage outbreaks.

DISTRIBUTION

Wilt symptoms were seen on ensete in Ethiopia, probably as early as the 1930s, but not confirmed as *X. campestris* pv. *musacearum* until the 1960s. Ensete is closely related to banana and is cultivated for food in Ethiopia. It grows wild in other countries in East and Central Africa but there are no recorded wilt symptoms on ensete outside Ethiopia.

BXW appeared on bananas in Uganda in 2001 and in a remote area of North Kivu, DR Congo around the same time. Neither introduction has been fully explained but, since these first recorded outbreaks, the disease has spread to all banana growing areas of East Africa.

In order of confirmation, from 2001 onward, BXW has been found in: Uganda, DR Congo (North and South Kivu), Rwanda, Tanzania, Kenya and Burundi.

FURTHER READING

CABI Crop Protection Compendium (www.cpc.org/cpc).

Promusa (www.promusa.org).

Plantwise Knowledge Bank (www.plantwise.org).

There are several useful reviews of BXW with the most recent being:

Blomme G, Jacobsen K, Ocimati W, Ntamwira J, Sivirihauma C, Ssekiwoko F, Beed F, Nakato V, Kubiriba J, Tripathi L, Tinzaara W, Mbolela F, Lutete L, Karamura E (2014) Fine-tuning banana *Xanthomonas* wilt control options over the past decade in East and Central Africa. *European Journal of Plant Pathology* (in press)

An abstract of Blomme et al. (2014) is available at www.banana.go.ug, which has updates on banana research in Uganda.

Check the Roots, Tubers and Banana project website for current activities on BXW (www.rtb.cgiar.org).