

Tropical race 4 in Africa

In November 2013, tropical race 4 (TR4) was confirmed to be present in a plantation of export bananas located in northern Mozambique. It was the first report of the fungal strain on the African continent. Until then, the distribution of the pathogen had been limited to parts of Asia, Australia's Northern Territory and Jordan. TR4 has since been reported in Lebanon, Oman, Pakistan and Queensland in Australia. In northern Mozambique, the fungus has since been detected in another plantation.



What is TR4?

Tropical race 4 (TR4) is the name given to the strains of the soil-borne fungus *Fusarium oxysporum* f. sp. *cubense* that causes Fusarium wilt (popularly known as Panama disease) in Cavendish cultivars in the tropics. The term TR4 was coined to distinguish these strains from the ones that only affect Cavendish cultivars in the presence of predisposing factors, such as low temperatures, and have since become known as subtropical race 4 (STR4).

What does TR4 mean for African bananas?

Many African countries already have fungal strains – collectively known as race 1 and race 2 – that cause Fusarium wilt in cultivars such as Gros Michel (Bogoya) and Pisang Awak (Kayinja)*. However, since TR4 also causes disease in cultivars susceptible to these races, not only could it have an impact beyond the Cavendish group, some of its spread could also go undetected since a Gros Michel showing symptoms of Fusarium wilt would be assumed to be infected with an already established race 1 strain. The main unknowns are Plantains and East African highland bananas. Preliminary trials in TR4-infested fields suggest useful levels of resistance. The disease incidence was generally low, below 5%, except for one Plantain cultivar that was still disease free after 10 months.

How to avoid spreading TR4

The disease can be spread through infected planting material, infested soil adhering to farm equipment and footwear, and surface water. Once established, the fungus can persist in soil for an indefinite period of time and cannot be managed using chemical pesticides. Using clean planting material, such as tissue-culture plantlets, avoiding sharing farm equipment with other growers, promptly destroying suspected cases, setting up dis-

* In Africa, Fusarium wilt has been reported in Ethiopia, Kenya, Uganda, Rwanda, Burundi, Tanzania, including Zanzibar, Malawi, Mozambique, South Africa, Madagascar, as well as the islands of Mauritius, Comoros and Pemba, DR Congo, Congo Brazzaville, Cameroon, Nigeria, Ghana, Sierra Leone and Guinea Conakry.

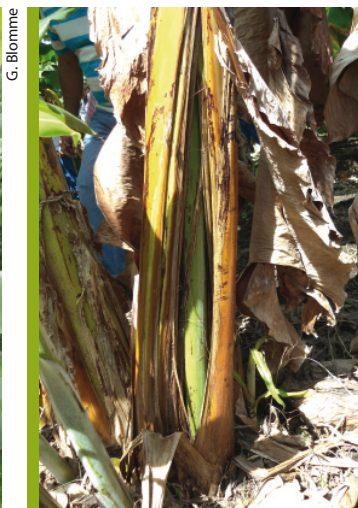
infesting stations, fencing affected areas, managing the movement of water on the plantation and planting a groundcover are among the actions that can be taken to avoid spreading the disease.

How to recognize TR4

TR4 produces characteristic *Fusarium* wilt symptoms. The first visible symptom is usually the yellowing of the older leaves. As the disease progresses, the leaves collapse, forming a skirt of dead leaves around the lower part of the plant. Alternately, leaves may remain green, but collapse as a result of buckling of the petiole. Splitting of the base of the pseudostem is another common symptom, as is wrinkling and distortion of the emerging leaf.



Leaf yellowing and wilting



Splitting of the pseudostem



Emerging leaf symptoms



Pseudostem discolouration

The main internal symptom is vascular discolouration of the rhizome and pseudostem, which varies from pale yellow in the early stages to dark red or almost black in later stages. The fruits do not show any specific disease symptoms. The above- and below-ground parts of affected plants eventually rot and die.

What can it be confused with?

The early wilt symptoms can be confused with nutritional deficiency or water stress. The leaf symptoms can also be confused with those of *Xanthomonas* wilt, better known as BXW. In plants affected by *Fusarium*, yellowing and wilting of the leaves typically progresses from the older to the younger leaves. The wilted leaves may also snap at the petiole and hang down the pseudostem. In plants affected by *Xanthomonas* wilt, the wilting can begin with any leaf and the infected leaves tend to snap along the leaf blade. Another difference is that BXW-infected plants produce bacteria-laden exudates.



BXW-infected plant

How to confirm TR4

The quickest way to confirm a suspected TR4 infection is by analysing tissue samples using a TR4-specific PCR molecular test. Fungal isolates can also be analysed to determine their vegetative compatibility group (VCG), a process that can take one to three months. TR4 isolates belong to the VCG 01213/16 complex, although other VCGs are also known to cause *Fusarium* wilt in Cavendish cultivars.

For more information and access to resources go to www.promusa.org/Tropical+race+4+--+TR4.