

Tropical race 4 in Africa

In November 2013, it was announced that tropical race 4 (TR4) had been confirmed in northern Mozambique, in a plantation of Cavendish bananas for export. It was the first, and so far only, report of the fungal strain on the African continent. Until then, the distribution of the pathogen had been limited to parts of Asia and a region of Australia.

Distribution of tropical race 4 (TR4)



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). Since TR4 also causes disease in cultivars susceptible to these two races, it has the potential of affecting cultivars beyond the Cavendish ones. The main unknown is the reaction of Plantains and East African highland bananas. Since they are normally resistant to races 1 and 2, symptoms of Fusarium wilt in these cooking bananas should be investigated, even if preliminary field trials conducted in Asia suggest that they might also be resistant to TR4.

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. The main internal symptom is vascular discolouration of the rhizome and pseudostem, which varies from pale yellow in the early stages to

* 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.

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.

Leaf wilting	Splitting of the pseudostem	Emerging leaf symptoms	Pseudostem discolouration
			

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.



Leaf snapping in a BXW-infected plant

How to confirm TR4

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

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. The fungus can persist in the soil for decades 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, fencing the affected area, digging a trench to prevent water from flowing out of the area and planting a cover crop are among the actions that can be taken to avoid spreading the disease.

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

ProMusa is a knowledge-sharing network managed by Bioversity International as part of the CGIAR Research Program on Roots, Tubers and Bananas.