Pacific Pests, Pathogens, Weeds & Pesticides - Online edition

Yam mosaic virus disease (526)

Common Name

Yam mosaic disease

Scientific Name

Yam mosaic virus. The virus belongs to the Potyviridae, genus Potyvirus. The virus particles are flexuous rods. The abbrviation is YMV.

Distribution

Africa (Benin, Burkino Faso, Ghana, Ivory Coast, Nigeria), South America (Guyana), the Caribbean. The disease has not been recorded in Oceania.

Hosts

Yam species, *Dioscora cayenensis-rotundata*, *Dioscorea alata*, *Dioscorea dumetorum, Dioscorea esculenta, Dioscorea trifida.*

Symptoms & Life Cycle

Yam mosaic virus is the most important virus of yams. A variety of symptoms are produced depending on the species and variety. Commonly, plants show yellow and green patterns, called mosaics (Photos 1&2); these are mostly between the veins or in narrow green strips bordering them, in which case the symptom is called 'vein-banding'. In more severe cases, the foliage shows 'shoe-string' symptoms, so called because the leaves are long, thin and strap-shaped, and the plants may also be stunted (Photos 3&4). Infected plants may be slower to sprout and show poor vigour.

A common feature of the disease is the apparent recovery of some plants when symptoms disappear. The virus is, however, still living in the plants.

Spread by aphids, e.g., *Aphis fabae*, *Aphis craccivora*, *Rhopalosiphum maidis*, *Toxoptera citricidus*, *Myzus persicae* and *Aphis gossypii*; however, the relative importance of each of these species is unknown. Spread by aphids is done in a non-persistent way; this means that they acquire the virus on their mouth parts after a short feed on an infected plant (less than a minute), infect healthy plants after another short feed, but then lose the ability to infect until they feed on an infected plant once again.

Spread by aphids is important, but so too is spread by vegetative propagation. The virus passes from the planting set to the developing plant and then to its tubers. Farmers may inadvertently help in the process by eating or selling the largest tubers and saving the smallest for 'seed' for next season's crop. The smallest may have not grown well because of virus.

Photo 1. Faint mosaic patterns on leaf infected with *Yam mosaic virus*.

Photo 2. Distortion and mosaic patterns on leaf infected with *Yam mosaic virus.*

Photo 3. Plant with narrow leaves, and mosaic patterns, characteristic of infection by *Yam mosaic virus.*

Photo 4. Plant with narrow leaves, and mosaic patterns, characteristic of infection by *Yam mosaic virus.*

Impact

Yam production is adversely affected by virus diseases. Infection reduces the number and size of tubers and also their starch content. Tests have shown that a 40% loss of yield is possible in susceptible varieties. Apart from affecting the growth of plants, the virus also restricts the international movement of germplasm.

The virus rarely occurs alone and is often associated with, for example, *Yam mild mosaic virus*, yam badnaviruses and *Cucumber mosaic virus*. All four viruses occur in Nigeria, Ghana, Benin and Toga; tests have shown that 100% of the tubers and nearly 70% of the leaves contained at least one of the four and 30% of the tubers had mixed infections. The importance of yam mosaic virus among the four is supported by surveys in the Guinea

Detection & inspection

The virus was first isolated and characterised from *Dioscoea cayenensis* from Ivory Coast in 1979: from serological, molecular and epidemiological analysis, it is now known to be a genetically diverse potyvirus. It can be transmitted to the indicator plants, *Nicotiana benthamiana*, *Nicotiana megalosiphon* and *Chenopodium amanticolor.* There are ELISA-based methods for detection of the virus as well as PCR methods using specific primers.

Management

BIOSECURITY

As there is evidence of different strains of yam mosaic virus, and the unrestricted movement of varieties of yam from one country to another could spread them, transfers of yams should only be made as sterile, pathogen-tested plants growing *in vitro*, following the FAO/IBPGR (1989) *Technical Guidelines for the Safe Movement of Yam Germplasm*.

Major programs for the production of yams of several species free from viruses exist at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria; the Centre for Pacific Crops and Trees (CePaCT), SPC, Fiji; and the Biological Resources Center for Tropical Plants (BRC-TP), Guadaloupe.

CULTURAL CONTROL

Before planting:

- Choose setts carefully. Yams for propagation should be from the healthiest plants, invariably those that produced the largest tubers. 'Seed' yam producers should always choose tubers this way, perhaps using the mini-sett technology to accelerate multiplication:. https://www.ctahr.hawaii.edu/adap/Publications/Ireta_pubs/rapidyams.pdf**.**
- Note, best practtice is not to plant next to plots with the disease or downwind from them, but such is the ease of spread of *Yam mosaic virus*, and the fact that yams are vegetatively propagated, it is likely that plants are infected already.

During growth:

- Rogue any plants that show early severe symptoms. Even though all plants are likely to be infected, some with early symptomns should be removed to prevent their use as sets next season. It is likely that adjacent plants will take advantage of extra space, and yield loss from roguing will be minimal.
- Weeds. Many species are hosts of aphids. Aphid populations build up on weeds before they migrate to yams, probing plants as they go for their suitability as new hosts. Although the aphids may not remain on the yams, they can still spread the virus as they travel through the crop.

After harvest:

- Collect and destroy plant debris. This includes undersized tubers, which should be eaten rather than kept for planting.

RESISTANT VARIETIES

Breeding for resistance to YMV at the International Institute of Tropical Agriculture, Ibadan, Nigeria, has identified several types of inheritance based on DNA markers. In collaboration with national rersearch institutes in Nigeria and Ghana (and other countries of West Africa) lines have been released, and more are being bred. They have multiple pest and disease resistance, wide adaptability, and acceptable taste.

CHEMICAL CONTROL

This is not appropriate for the management of this disease. Insecticides can kill the aphids that spread YMV, but that does not necessarily prevent infection. This is because the time between the virus attaching to an aphid's mouthparts when it feeds on a diseased plant, and spreading the virus as it feeds on a healthy plant, is short; by the time the insecticide has killed the aphid it has spread the virus.

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Information from CABI (2021) Yam mosaic virus. Crop Protection Compendium (https://www.cabi.org/cpc/datasheet/57255); and Asala S, *et al.* (2012) Distribution and incidence of viruses infecting yam (*Dioscorea* spp.) in Nigeria. GJBB, 1(2): 163-167. (https://www.google.com.au/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8 - sourceid=chrome-psyapi2&ie=UTF-8&q=Distribution and incidence of viruses infecting yam). Brunt AA, *et al.* (eds) (1989) *FAO/IBPGR Technical Guidelines for the Safe Movement of Yam Germplasm*. Food and Agriculture Organization of the United Nations, Rome/International Board for Plant Genetic Resources, Rome. (http://ecoport.org/Resources/Refs/IPGRI/yam.pdf); and Eni AO, *et al.* (2008) Survey of the incidence and distribution of five viruses infecting yams in the major yam-producing zones in Benin. Annals of Applied Biology, 153: 223-232. (http://covenantuniversity.edu.ng/Profiles/Eni-Angela/Survey-of-the-incidence-and-distribution-of-five-viruses-infecting-yam-in-the-major-yam-producing-zones-in-Benin); and Legg JP, *et al.*(Undated) Virus diseases of root crops in Africa: an overview. FAO, Rome. (http://www.fao.org/docs/eims/upload/agrotech/2005/sistrc_04_legg.pdf); and Offei SK (Undated) Virus and viral diseases of sub-Saharan Africa: analysis of responses to questionnaires by scientists in sub-Saharan Africa.(https://www.google.com.au/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8 - q=virus+diseases+of+yam+crops+in+africa); and Séka K, *et al.* (2014) Yield loss caused by yam mosaic virus (YMV) and cucumber mosaic virus (CMV) on the varieties of *Dioscorea* spp. International Journal of Agronomy and Agricultural Research, 5(2): 64-71. (https://www.google.com.au/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8 - q=Yield+loss+caused+by+yam+mosaic+virus+(YMV)+and+cucumber); and Umber M, *et al.* (2020) Molecular virus diagnostics and sanitation of yam genetic resources: Implications for safe yam germplasm exchange. Viruses 12: 1101. (https://www.mdpi.com/1999-4915/12/10/1101); and Lopes-Montes A, et al. (2012) Yam breeding at IITA: achievements, challenges, and propsects. Research for development review. (https://biblio1.iita.org/bitstream/handle/20.500.12478/1579/U12ArtLopezmontesYamNothomNodev.pdf?sequence=1&isAllowed=y/); and from Luo GF, *et al.* (2022) A review of viruses infecting yam (*Disoscoea* spp): implications for safe exchange of Pacific yam germplasm. Viruses 14(4): 662. (https://doi.org/10.3390/v14040662). Photos 1-3 Yam infected by yam mosaic virus. IITA. (https://www.flickr.com/photos/iita-media-library/4907182850/in/photolist-8tCAuG-8tFeQC-8tCAuU-8tCAuA-8tCAuS-83SAoU-8tFeQA-cngRqm/), (https://www.flickr.com/photos/iita-media-library/4907698686/in/photolist-8tCAuG-8tFeQC-8tCAuU-8tCAuA-8tCAuS-83SAoU-8tFeQA-cngRqm/), and (https://www.flickr.com/photos/iita-media-library/4907182852/in/photolist-8tCAuG-8tFeQC-8tCAuU-8tCAuA-8tCAuS-83SAoU-8tFeQA-cngRqm/).

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