Some symptoms caused by viruses and virus-like agents in *Ipomoea batatas* and related species

Introduction

Sweetpotato virus diseases, probably the most important component of sweetpotato cultivar decline, have only recently begun to receive the research attention they deserve. But researchers working independently in different parts of the world sometimes use different names and descriptive terms for what appear to be the same viruses and the same virus properties. This has led to confusion over nomenclature. Biological properties such as symptomatology and host range are important characteristics for identifying plant viruses, even in this era of molecular biology.

Discussions at an international workshop on sweetpotato cultivar decline in Miyakonjo, Japan, in September 2000 led to several recommendations. One was to standardize the nomenclature, collaborate on identification, and determine the geographic distribution of sweetpotato potyviruses, criniviruses and geminiviruses. As a first step toward developing a consistent, uniform approach to taxonomy of sweetpotato viruses, a small working group collected together some descriptions of common symptoms caused by sweetpotato viruses on sweetpotato and related species, that may be useful for identifying these viruses.

This booklet is meant to provide guidance in describing the symptoms caused by different viruses; it is not intended to illustrate all the symptoms induced by any particular virus. This is a preliminary effort and we welcome input from all researchers interested in improving this guide.

In developing this subject, we did not attempt to discuss the appropriateness of the name given to any particular symptom; instead, we present a list and description of symptoms observed in sweetpotato and related species without implicating a particular virus as the cause.

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Macroscopic alterations in stems and leaves

Color deviations

Vein clearing

Vein color is lighter than normal. The color change usually starts at the base of leaflets as a result of primary infection. This symptom is transitory and commonly precedes mosaics.

Mosaic or mottle 1

Leaves have pale green or chlorotic areas. Borders of pale green areas are better defined in mottle than in mosaics. These symptoms are the result of decreased production of chlorophyll or destruction of chloroplasts.

Mosaic or mottle 2

Vein banding 1

Light or dark green tissue regularly occurs on the sides of the main veins.

Vein banding 2

Yellowing

The leaves lose green color because of a lack of chlorophyll and an increase in carotenes and xanthophylls. This can be total or partial, or the green can be replaced by bright yellow. There are several variations:

Chlorosis

The normal green color lacks uniformity in part or all of the foliage. The color change usually starts at the top of the plant in leaves that develop following infection.

Interveinal chlorosis

In some cases interveinal areas become yellow and the veins remain green.

Yellow patterns

Yellow lines form defined shapes such as rings, incomplete rings or arcs, and sinuous lines.

Chlorotic spots

Yellowish circular spots appear, often with diffuse margins in interveinal areas or near veins that may continue to enlarge.

Chlorotic ringspots

Systemic spots form, consisting of a distinct yellow ring surrounding an area of green or lighter yellow tissue.

Flecks

Small yellowish spots (<2mm) appear and generally do not continue to enlarge.

Purple ringspots

Purple rings surround an area of lighter green or yellowish tissue. Tissue inside the ring may become necrotic.

Vein yellowing 1

A bright yellow coloration on the veins contrasts greatly with the green color of the leaf lamina.

Vein yellowing 2

(I. aquatica)

Abnormal pigmentation

Anthocyanescense

As a result of abnormal production and accumulation of the pigment anthocyanin, leaves may show a range of pink, purple, red or blue colors. These variations are usually associated with changes in leaf shape. In some cases, the changes are in interveinal areas of the leaf; at other times they may be more general.

Deviations in normal shape, size or texture

Little leaf

Leaves are small compared with those of healthy plants, and there are usually some color changes. When occurring alone (without the color change), these symptoms cannot be detected unless healthy plants are nearby for comparison.

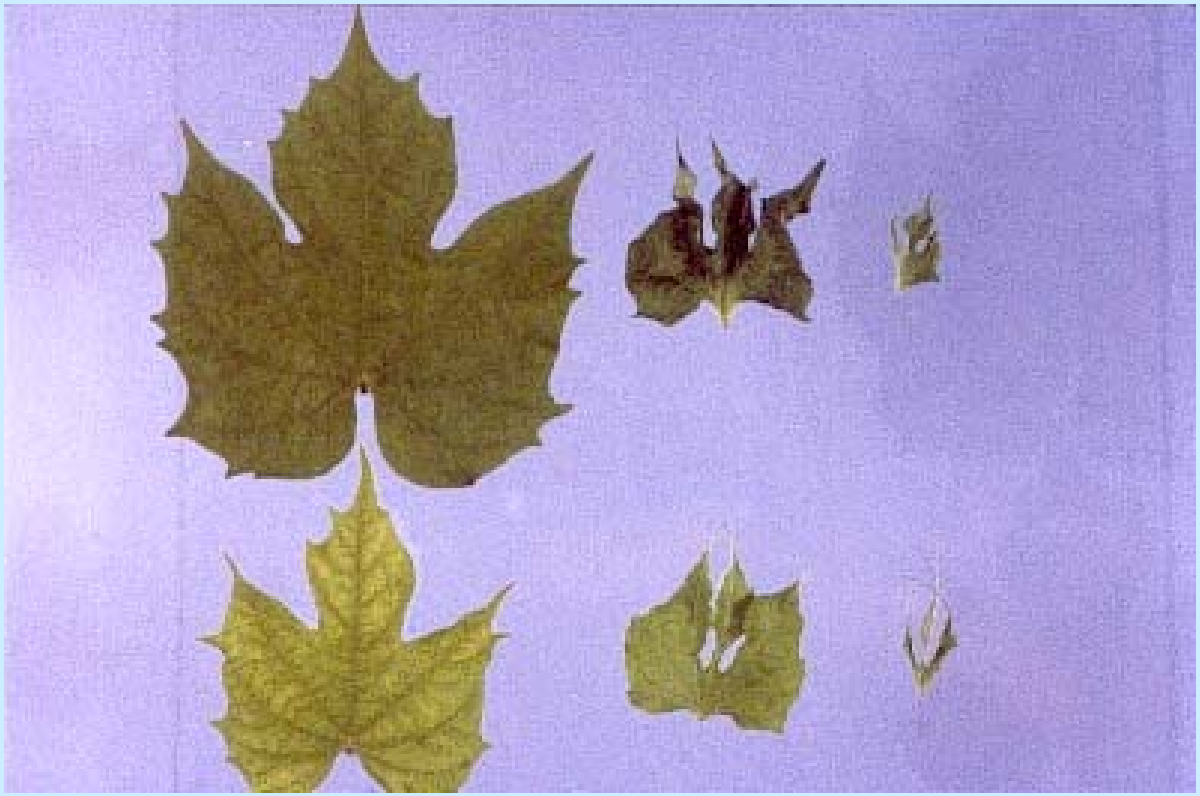
Leaf curl

There is severe upward rolling of leaves, with the central vein as an axis; it is often more acute at the margin. Texture of curled leaves may also be more brittle and/or leathery than that of normal leaves.

Rugosity

The leaf lamina develops blisters or islands of raised green tissue.

Leaf deformation 1



Leaves lose their normal shape by elongation or widening of the leaf lamina. In most cases, this is associated with thickening or another deformation in the main vein.

Leaf deformation 2

In extreme cases (called shoestrings) the leaf becomes so deformed that the lamina is practically eliminated.

Fanleaf

Leaves lose their normal shape and resemble a fan with pronounced veins.

Foliage necrosis

Systemic necrosis

These are necrotic steaks, spots or rings distributed in part or all of the foliage without any definite pattern.

Vein necrosis

As a systemic necrosis in the veins, observed particularly on the underside of leaves, this may occur in the entire length of the veins, partially, or as a necrotic streaks. Leaf drop can occur as a consequence of partial or complete leaf necrosis. It may begin with the lower leaves, with some necrotic leaves left hanging on the stems.

Deviations in the general aspect of the plant

Stunting

Reduction in plant size is a common symptom of virus infections. This symptom is usually confused with dwarfing, but stunted plants do not show deformation.

Witches' broom

This is a proliferation of axillary branches on the main stems. It is usually associated with chlorosis, leaf reduction and stunting.

Flat fasciation

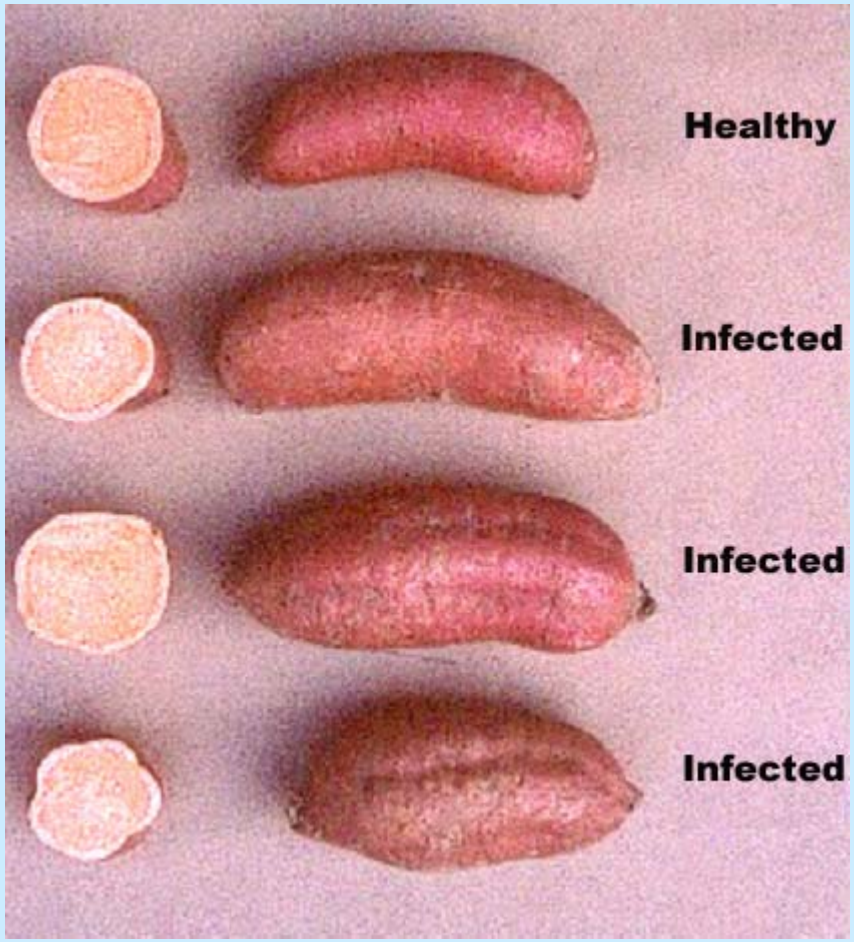
The stem develops the appearance of having multiple stems fused together. The vines are shorter than normal and often have bunches of leaves at the apex.

Macroscopic alterations in storage roots

Russet crack

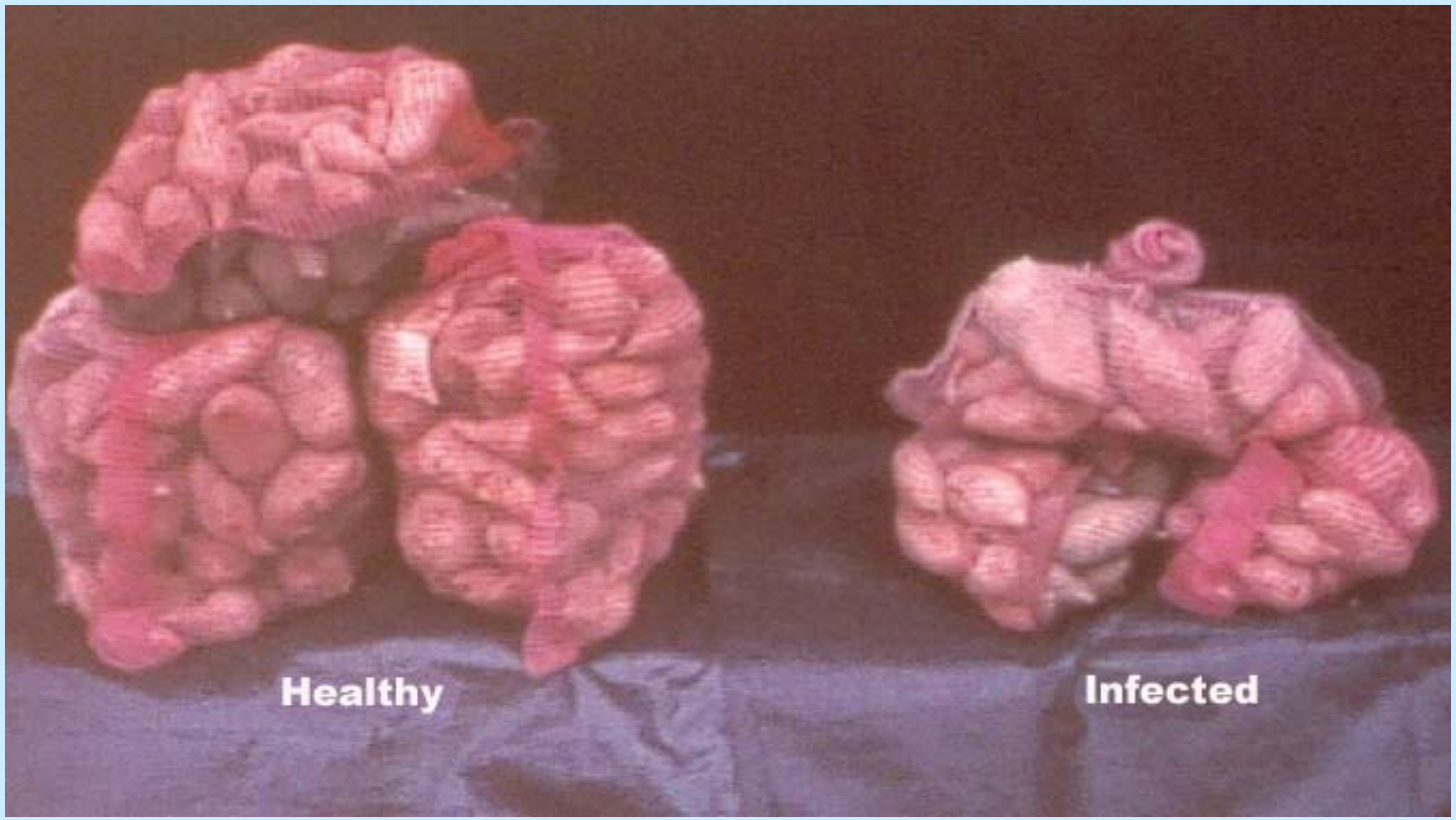
Bands of brown russeting extend laterally around roots with several superficial longitudinal cracks within the bands.

Grooving



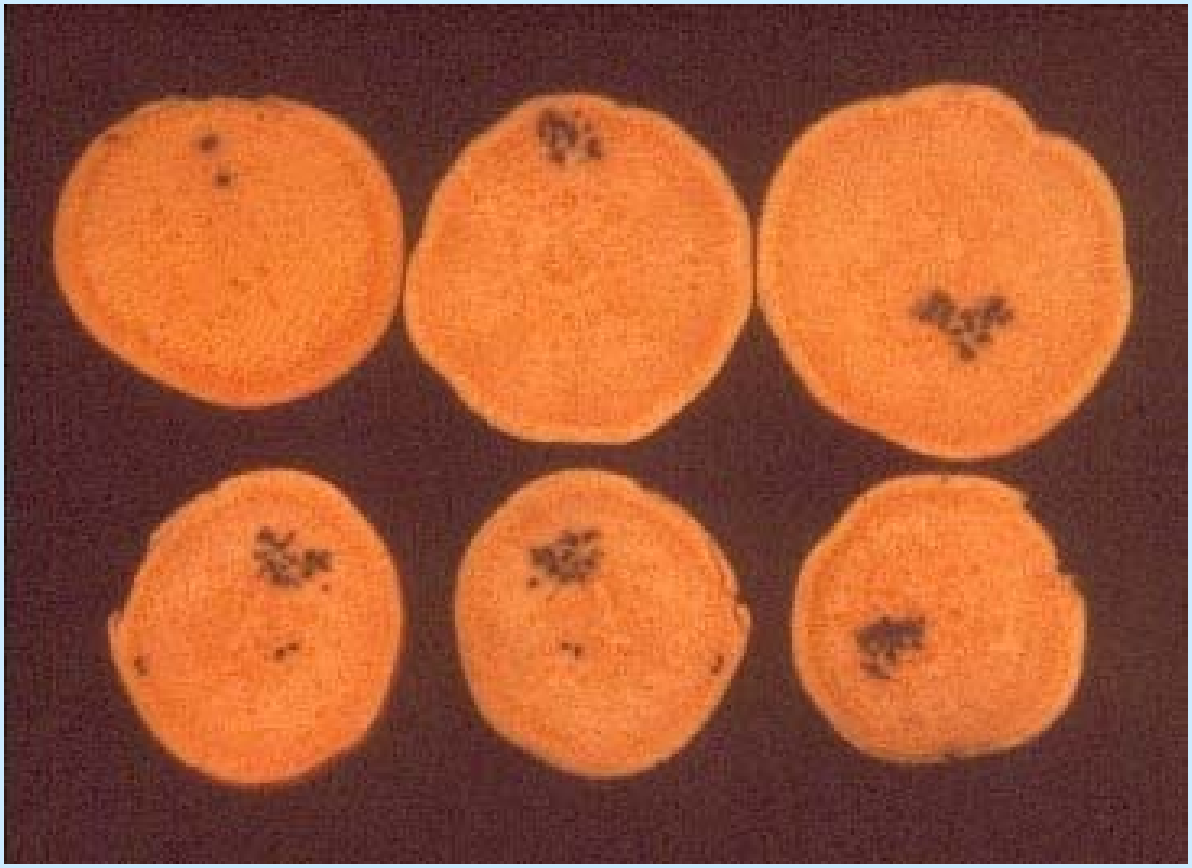
Longitudinal depressions in the surface of the storage roots give the root a lobed or fluted appearance.

Effect on number and size



Most virus infections reduce storage root size, whereas numbers may remain about the same as in healthy plants. These symptoms can be precisely determined only by comparison to healthy plants.

Internal cork



Black necrotic lesions form within the central tissue of the storage root. Lesions often occur in clusters and each lesion consists of a central area of dead cells surrounded by a layer of phellem or cork. Sizes can vary.

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