

AVOCADO SUNBLOTCH DISEASE

Introduction

There was some confusion earlier in determining the causal agent of the Avocado Sunblotch Disease (ASD). Coit (1928) first reported it as a physiological disease manifested on the fruit of the avocado variety “Lyon”. Other researchers, Horne and Parker (1931), Wolfe et al (1934) and Stevens (1941) describing the disease on “Natal” and “Taylor” varieties in Florida indicated that the casual agent was a virus. Similarly, Rondon and Figueroa (1970) described the abnormalities on the leaves avocado varieties, “Booth 7”, “Araira” and Herrera growing in Maracay, Venezuela as a viral disease. These researchers demonstrated that the disease was transmitted through grafting of buds of diseased leaves on to healthy plants. In the 1970s The National Agricultural Research Centre in Maracay, Venezuela determined that the causal agent, ASBVd, is a viroid using a Rapid Sensitive detection and diagnostic method based on RT – PCR (Reverse Transcription Polymerase Chain Reaction). It is not considered a major problem in the Caribbean, especially if strict quarantine measures are in place.

Identity

Classification

Family	: Avsunviroidae
Genus	: <i>Avsunviroid</i>
Role	: Pest

Avocado sunblotch viriod (ASBVd) is not a virus but is a graft transmissible viral-like pathogen now described as a Viroid. A Viroid is known to be the second smallest genome to a Prion that can cause a plant disease.

Signs & Symptoms

Yellow spots appear on mature leaves along with consistent and longitudinal pale bands on young leaves (Horne and Parker 1931,1931a). Deformity and often white blotching of fruits and leaves are outstanding symptoms of the disease. (See Fig. 1).

Stems can have necrotic streaks, twigs have a slight yellow, sunken streak that follows the length of the twig. Affected trees exhibit unthrifty growth, low production and poor vigour, resulting in a reduction in fruit production and fruit quality as well. (See Figs. 2,3,4).

Morphology

A viriod is an unusual infectious agent characterised by having a very small genome (Dodds,2002).A Viroid, unlike a virus, consists only of RNA i.e. it has no protein at all. ASDV is a single stranded, small, circular RNA molecule that does not encode proteins itself (Sengbusch,2001). Avocado sunblotch viroid lacks a central conserved region (CCR) and possesses a ribozyme activity (a ribozyme is a catalytic RNA molecule, in this case RNA cleavage is the ribozyme activity).

Biology & Epidemiology

Viriods are common plant pathogens, mainly of the tropics, and which are serious economic problems to several food crops including white potato, coconut and fruits such as avocado, peach and citrus. There are 25 different viriod sequences determined and numerous variants identified. Viriods are classified into two basic Groups A and B, which is further sub-divided into B1 and B2.

In Group A, there are two known diseases- Avocado sunblotch viroid and Peach latent mosaic viroid.

It is also speculated that Group A viroids e.g. Avocado sunblotch viroid may replicate in chloroplasts, whereas Group B viroids replicate in the nucleus and nucleolus. Three enzymic activities are required for viroid replication, a RNA polymerase, a RNase and a RNA ligase. Group A Viroids probably replicate via a symmetric rolling circle mechanism, whereas Group B viroids probably use an asymmetric mechanism.

These are the fundamental differences between the two groups of viroids presumably because of their different origins.

The + infecting circular RNA strand of a viroid serves as a template to make a large linear multimeric -ve strand: RNA pol II is probably the enzyme, which does this. Group B viroids with an asymmetric replication pathway then make +ve RNA from this long linear molecule. A host RNase activity cleaves the +ve strand into unit viroid lengths. This molecule is then ligated to form a circular viroid. In-Group A viroid replication the long -ve RNA is self-cleaved by the associated ribozyme activity. The RNA circularizes to form a -ve circle. A second rolling circle event makes a long linear +ve strand which is again cleaved by the ribozyme activity. The short viroid RNA is then ligated to the circular form.

Viroid pathogenesis seems to depend on more than one mechanism. Recent evidence suggests that one pathway is due to viroid RNA activating a plant RNA activated protein kinase or PKR (analogous to the PKR enzyme activated by viral RNAs in mammalian cells). Protein synthesis is reduced and this causes pathogenic effects. In the case of Potato spindle tuber viroid, there is a good correlation between a strain's pathogenicity and its ability to activate PKR in vitro.

Dispersal / vectors

The Viroid is dispersed via infected bud wood, wounds caused by contaminated tools and infected pollen. Avocado fruit can become infected with ASBVd by pollen transmission. There is no evidence of insect transmission. ASBVd is transmitted by root grafts and is seedborne.

Management

Diseased free seed and certified young budwood must always be used for grafting for tree improvement. Roguing of infected trees confirmed by identification and diagnosis through the reliable RT-PCR technique can cause reduction of inoculum source and can be an effective means to manage this viroid disease. Application of general cultural practices on a routine basis to maintain sanitation of the orchard will assist to prevent spread of the disease. When pruning trees it is important that pruning tools be disinfected before moving from one tree to another.

Host Notes

Avocado varieties Taylor, Caliente, Clemson, Lula, Fuerta, Lyon, Natal, Araitha, Booth 7, Herrera.

Distribution

USA – California, Florida; Venezuela; Australia, Spain, Peru, South Africa, Israel

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Web Resources -

www.ipm.ucdavis.edu/PMG/r8101011.html

fruitsandnuts.ucdavis.edu/avo3.html

[http://www.ecoport.org/EP.exe\\$PictShow?ID=1573&Subj=E26152](http://www.ecoport.org/EP.exe$PictShow?ID=1573&Subj=E26152)

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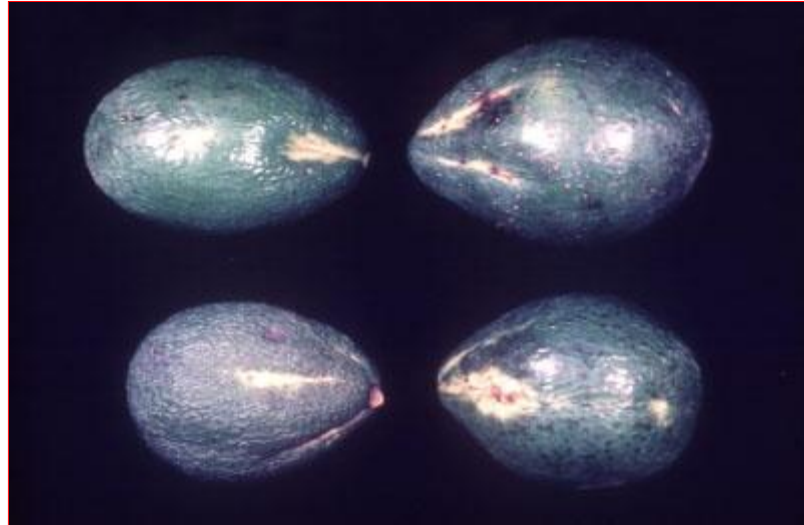


Fig. 1 Avocado fruit from a Sunblotch-infected tree displaying sunken yellow areas.



Fig.2 Avocado cv. Hass grafted to infected cv. Topa seedling - chlorotic spotting and mottle.



Fig.3 Leaf variegation on avocado field tree infected with Sunblotch.



Fig. 4 Yellow depressed streaks and lumps on young stem of cinnamon seedling graft-inoculated with Sunblotch Viroid.