

Emerging Cannabis Viruses and Viroids

Viruses and viroids constitute a segment of plant pathogens, along with fungal and bacterial groups, which contribute to significant losses and reductions in crop performance. Pathogens endemic to *Cannabis sativa L.* are generally well understood in terms of pathology, transmission, and remediation. Additionally, having coexisted throughout a long evolutionary history, plants are typically able to present an immunological defense, often limiting the scope and severity of infection. A subset of these disease-causing agents, called emerging pathogens, have made a jump from their typical host species to cannabis. Emerging viruses and viroids are of concern as we are only just beginning to understand the details around symptoms, transmission routes, prevalence, and possible treatments. Here we discuss three such viruses and viroids; Lettuce Chlorosis Virus, Beet Curly Top Virus, Hops Latent Viroid.

First, it will be useful to briefly define viruses and viroids as there are important differences between the two. A virus is a sub-microscopic entity that typically consists of a nucleic acid molecule (DNA or RNA) encased in a protein coat. Viruses require a living host (plants, animals, bacteria, archaea) to multiply. Viroids, alternatively nearly exclusively infect plants, lack a protein coat and are typically a single molecule of RNA.

Lettuce Chlorosis Virus

LCV was first reported to cause disease in cannabis by Israeli scientists in 2019. LCV is a single-stranded RNA virus that infects a variety of plants with nutrient deficient-like symptoms including yellowing of interstitial leaf veins, brattling of leaf tips and even leaf necrosis. Plant death from LCV infection is unlikely but significant stunting and reduction in yield are common. Transmission routes for LCV include insect vectors such as whiteflies, thrips, aphids and through vertical transmission when cloning from infected shoots. Additional environmental transmission routes such as through infected water have been reported. Treatment options are very limited although tissue culture has been shown to be an option in removing the virus from a genetic line.

Beet Curly Top Virus

BCTV was first reported in hemp plants in 2019. A circular, single-stranded DNA virus, BCTV can result in a variety of symptoms in cannabis. These symptoms range from relatively mild yellowing and leaf curling to more severe cases where the plants turn a pale-yellow color, leaves molt, curl or twist. Infection of BCTV is caused by beet leafhoppers moving from plant to plant. Prevention is the best strategy as treatment options are highly limited. Due to the single vector transmission route, management of leafhopper populations is the primary prevention method.

Hops Latent Viroid

First reported in cannabis in 2019 by a group from California, HLVd is a single-stranded, circular RNA viroid. As its name suggests, HLVd can remain dormant or “latent” for extended periods of time, only to become symptomatic generations later. Symptoms include the colloquially termed “duding” or stunted, irregular growth and reduced yield (terpenes, cannabinoids, and overall flower mass). Horizontal transmission through mechanical fomites is the primary means of infection. Prevention through rigorous tool cleaning, house-keeping and aseptic cloning technique is effective. Remediation using meristem tissue culture is reported to be successful in some cases to preserve genetic lines.

Future of Emerging Pathogens

Advancements and availability of new analytical techniques, policy changes and broader awareness have allowed for more widespread research into emerging pathogens in cannabis. Recent research has led to the identification of several new pathogens found in symptomatic cannabis plants. Cannabis Cryptic Virus (CCV), Cucumber Mosaic Virus (CMV), Arabis Mosaic Virus (ArMV), Tobacco Mosaic Virus (TMV), and Alfalfa Mosaic Virus (AMV) are among the recent pathogens isolated from cannabis. The extent and severity of these emerging pathogens is yet to be determined and should be closely monitored to limit spread. Today, monitoring can be done even at the individual level with simple sample submissions to analytical laboratories. Rimrock Analytical is one such laboratory offering pathogen detection services to identify emerging and endemic pathogens and help the grower limit their spread.