

# Pythium in Cannabis Technical Fact Sheet

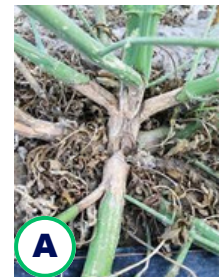
## Background

*Pythium* belongs to a distinct class of fungus-like, parasitic microbes called oomycetes. Primarily a root pathogen, *Pythium* is a common cause of root rot and damping off in cannabis plants and has major economic impacts in the cannabis industry. While there are more than 300 difference types of pathogenic *Pythium*, the subspecies most commonly detected in diseased cannabis plants are *P. aphanidermatum*, *P. catenulatum*, *P. dissotocum* and *P. myriotylum*. *Pythium* is generally considered a water mold. Consequently, standing water in fields, ditches, water tanks, and hydroponic systems are places that *Pythium* can exist, multiply to great numbers and spread. *Pythium* strains are opportunistic plant pathogens that can cause severe damage whenever plants are stressed or at a vulnerable stage. Most *Pythium* varieties are necrotrophs, meaning that infection results in necrotic tissue and can lead to plant death.

## Symptoms

*Pythium* infections can manifest with symptoms in cannabis seeds, roots, or crown and are a major cause of damping-off and failure of seeds to germinate. In older plants, root and crown rot are often observed that can lead to slow growth and plant death. *Pythium* attacks feeder roots reducing the ability of plants to absorb water and salts from the soil, leading to weak plants with low production.

Usually, infected root tissue becomes soft and dark brown or black in color. There may be root tip decay and absence of secondary and tertiary roots at later stages. Symptoms are often very severe in newly rooted clones where weakening of the root system can result in the upper portion of the plant falling over. It is also common to see white, mycelial growth resembling cotton fibers associated with dead or dysfunctional plants that are infected with *Pythium*.



Source: Cannabis Business Times

As a result of infection, plants may have stunted and/or slow growth followed by leaf yellowing, wilting, and necrosis. Typically, the yellowing begins on the lower leaves first, but cases where yellowing begins on upper portions of the plant are also observed. In some situations, the entire plant will become yellow.



Often, infected roots look greasy because of leaking cellular contents from damaged tissues. If plants are showing poor yield, root rot, or yellowing leaves, *Pythium* should be considered as a potential cause.

Source: Emerging diseases of Cannabis sativa and sustainable management, Zamir K Punja

## Origin

*Pythium* is a water and soil pathogen. The most likely point of entry in a facility is via contaminated water or contaminated soil. Infection can also be caused when diseased plants are introduced into a facility where they encounter other plants or recirculating water systems. While less likely, *Pythium* oospores can be carried in on workers' clothing and shoes.

## Spread

*Pythium* is a soil/water-borne organism favoured by excessive soil moisture. Spores are spread by contaminated soil, water, tools, and other implements. As a water mold, *Pythium* is particularly severe when water drainage is limited. The life cycle of *Pythium* passes through several stages including mobile spores called zoospores, which contain two flagella (tails) that allow it to "swim" toward healthy plant roots and establish infection. Zoospores can swim for 20 to 30 hours and move three or more inches through soil. Without free water, mobile spores die rapidly. *Pythium* also forms a different kinds of spores called oospores, which are extremely stable. *Pythium* oospores can survive in soil, plant debris, tools and containers for up to 10 years. Therefore, careful sanitation of surfaces and equipment that encounter infected plant debris, soil or water is critical to limit spread.

## Prevention

The best way to keep your facility safe from *Pythium* is effective prevention through reduction of conditions that favour infection, strict sanitation protocols, and periodic screening to catch potential infections before significant spread occurs.

### **1. Avoid conditions that encourage *Pythium* growth**

- Water-saturated, oxygen-deficient, and highly saline conditions in soil stress plants and make them prone to attack by pathogens, particularly by water molds such as *Pythium*. Soil/ nutrient pH between 5.2 and 5.7 (moderately acidic) helps prevent *Pythium* infections as the pathogen prefers alkaline (basic) conditions.
- Oxygen-deprived roots leak more of the soluble metabolites that attract zoospores (mobile *Pythium* spores) increasing chances of infection. Therefore, careful attention should be given to proper drainage of the soil or planting medium.
- Seed or transplants should not be placed too deep. The longer it takes for seedlings to emerge, the more likely infection can occur.
- Excessively dense plant populations should be avoided. High density plantings create more favorable environment for growth of *Pythium* and certain other pathogens because aeration and drying within the canopy is reduced.
- Excessive humidity encourages *Pythium* growth.
- Avoid watering before taking cuttings or handling plants. The chances of disease transmission are reduced when only dry plants are handled.

## 2. Ensure effective water filtration

The most common cause of a *Pythium* outbreak is contaminated water. *Pythium* thrives in standing water such as well water, ponds and ditches. All water entering the facility should be passed through a filter with a strict enough size selection that spores from common molds and fungi are effectively removed. Samples from different points along with water system should be periodically collected and tested for mold and fungus to avoid buildup of high concentrations of pathogens.

## 3. Implement standard sanitation measures to avoid *Pythium* spread

*Pythium* spores can survive for years in contaminated soil/growing medium, plant debris, and equipment such as pots and tools. Soil or growing medium should be heat sterilized (>1600 F for 30 minutes) prior to use. All materials coming into the contact with plants or growing medium should be thoroughly sanitized before reuse. All cleaning operations should be away from transplant and production areas.

Prior to sanitizing the containers or trays, wash off the clinging soil and plant parts. The washed containers can then be sanitized by soaking them for at least 30 minutes in a commercial bleach (5.25%) solution that is diluted to 10% (one part 5.25% bleach to nine parts water). Surfaces including floors and tabletops should also be thoroughly cleaned with 10% bleach before moving new plants into that space. Cutting tools should be treated in 10% bleach for >60 seconds to remove *Pythium* spores.

Hands should be thoroughly washed with soap and water before handling the planting equipment, containers, or plants. Gloves are recommended when trimming plants and can be sanitized using a 10% bleach spray when moving from plant to plant.

## 4. Preventative testing

Molds and fungi that attack root systems can often go unnoticed until the upper portion of the plant begins to show signs of root dysfunction. Therefore, preventive testing to identify pathogenic molds and fungi before they become a serious threat is critical.

## Misdiagnosis

Because *Pythium* infections hinders the function of the root system, the symptoms can be confused with nutrient and water deficiencies. If plants are showing unexplained signs of nutrient deficiencies, *Pythium* should be suspected as a potential cause.

## Treatment

If *Pythium* is identified or suspected the two most critical steps in effective mitigation is removal all infected plant material and identification of the origin of infection.

Reduction of *Pythium* infections in your facility requires identification of the route of entry of the pathogen. Because *Pythium* is primarily a water mold, the most likely point of entry is via contaminated water. If *Pythium* is identified, samples from the main water tank and along multiple points within the water system should be taken to determine if the pathogen is present in the water supply. If *Pythium* is detected in the water, all tanks, lines and joints should be thoroughly sanitized. Work with the supplier of your water filtration system to confirm that fungus and molds are effectively eliminated.

If plants are showing signs of *Pythium* infection (i.e. yellowing leaves, crown rot or damping off) they should be removed from other plants as quickly as possible. Avoid spreading soil or growing medium from infested areas. Carefully remove disease plants to avoid leaving behind residual plant tissue. Sick plants should be bagged and placed in a covered trash container. All surfaces, tools and equipment should be carefully cleaned with a 10% bleach solution.

Once sick plants are removed and the point of entry determined, screening for *Pythium* in your plants and the water system should continue regularly to immediately detect any re-emergence of the pathogen and minimize potential loss.