

## **Root-parasitic fungi: How to control Pythium in hydroponics?**

**By Noucetta Kehdi**

Roots don't get the attention they deserve. This comment is true for all types of growing methods, but even more in hydroponics where roots are barren and vulnerable. So root management in hydroponics is an extremely important issue.

But don't roots take care of themselves? Generally they do, at least to some extent. But when in adverse situations, they will be easily attacked by several diseases. A good grower must be able to address the problem before hand. The question is how to get and maintain a healthy root system.

A dynamic, well-designed growing system, a clean, highly oxygenated water, a well-drained substrate, good ventilation, and the right temperature and humidity levels, are the main ingredients to success when growing hydroponically. Many more parameters are involved of course. But following these basic directions, and the application charts on the nutrient bottles, will allow you to keep your plants happy and healthy. And basically, this is what you are looking for. Because it is when your plants are stressed that pests and diseases start invading.



The root level is a particularly vulnerable part of the plant, be it in soil or in water. When your temperature is high, and your water circulation is poor, your plants will suffer of lack of oxygen. At the root level this oxygen starvation reduces the permeability of roots to water, and consequently the absorption of mineral salts, which will weaken the plant and eventually lead to a poor crop. Under continuing stress conditions, the roots will emit ethylene, a stress hormone that accumulates in the roots and participates to the slow degradation of the root system. Furthermore, ethylene is recognized by some pathogens as the sign for a weak individual, and a motivation to attack.

### **What's a pathogen?**

It's an organism that can cause sickness.

There is an immense variety of pathogens in our environment, and some of them are fungi like: Fusarium, Pythium, Verticillium, Phytophthora and many more. Fusarium and Pythium are the two common and most destructive root aggressors known to all growers, soil gardeners or hydroponicists. They are very ferocious invaders that are often the reason of total crop destruction.

What we must realize is that a large diversity of microorganisms live all around us.

They live on plants, in soil and water, in the air we all breathe, on our skin, in our food. Some are beneficial and some are pathogens, in the sense that they can “induce sickness”. Most of these organisms will remain harmless as long as the body they live on is in good health. But as soon as they sense the first signs of stress, they will attack.

### **What is Pythium?**

Pythium is a destructive root-parasitic fungus. Under favourable conditions Pythium multiplies very fast and liberates microscopic spores that infect the roots and deprive the plant of food. It attacks mainly seeds and seedlings, which have little resistance to disease. Larger plants are more resistant; they do get injured too, but if quickly detected they can be treated and saved, although your crop will be definitely stunted.

Like other fungi, Pythium exists everywhere in the plant’s environment and will attack practically all plants. The best conditions for its development is high moisture levels and a temperature between 20 and 30°C. Plus poor oxygenation of the nutritive solution in hydroponics, of course. It is a fungal spore that lives in air and water and that will be present in your growing area, no matter how clean it is. It will come in on your shoes, your clothes, your hands, etc. It will come in with your water, especially when your water supply comes from wells or rivers and streams. There are millions of opportunities for this fungus to get into your garden. So it is important to keep your growing environment clean and keep track of the quality of the water you are using.



*Pythium attack!*

Pythium is often described as a “secondary infection”, because it only attacks when the plant has already started to be damaged or when growing conditions are not at best. It takes advantage of sick or wounded tissues to colonize the root and creates damping off and root rot.

### **How do you recognize a pythium attack?**

On a general basis, when Pythium attacks, infected seeds will turn soft, mushy and black, and will die. Seedlings will get soggy stems and collapse. For no apparent reason larger plants and mothers will start wilting and yellowing (which is often incorrectly identified as a nutrient deficiency), sometimes leaves will tend to curl downwards. Your plants will show poor growth and your yields will be reduced; you may even lose your crop entirely.

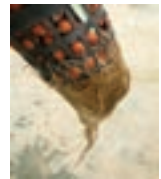
It is not easy to catch a Pythium attack on time, especially when growing in soil, as the first signs of plant stress will not show immediately above ground. Only after a few days will you notice that your plants look unhappy. Meanwhile at the root level the game was started long ago.

In hydroponics Pythium, which loves and thrives in water, is quite a common disease.

If you are not vigilant enough, the consequences can be extremely damaging. But hydroponics brings a new dimension to growing, and offers the grower a priceless advantage: the access to the root system. To have a better grasp on his future crop, a good hydroponicist will regularly check his root system, as roots offer a well of information on the plant's health, the quality of the nutritive solution, and the good functioning of the growing system.

But be careful. In some growing systems like AeroFlos and Dutch Pot Aeros, you can lift your plants out of the growing chamber. When plants are young you can easily extract them to see if the roots are healthy. But once the root system develops, it is better to look at it from a neighbouring access hole to prevent wounding the plant, as wounded roots will attract fungi as surely as a sick plant.

When you look at the roots at that stage, and if *Pythium* started to attack your plants, you will see different symptoms, depending on the damage extent. Infection starts at the tip of the root then slowly disintegrates root hairs and the fine lateral roots which are critical for nutrient uptake. The gleaming white roots will turn into light brown, then to dark brown and then to black. When the infection is severe, the lower portion of the stem can become slimy and black. Usually the soft to slimy rotted portion of the root can be easily separated from the inner core.



Mushy and sad root system

### **How to fight *Pythium*?**

The answer is quite simple: by keeping your plants healthy you will allow them to resist fungi attacks. And to keep them healthy in hydroponics, there are basic and mandatory rules: good water quality, optimal oxygenation of the nutritive solution, good ventilation, a well drained substrate, adequate temperature and humidity levels, suitable feeding programs, and general cleanliness. These are the first preventative measures that all hydroponic growers must keep in mind to start with, as prevention remains the most efficient solution.

But there are moments too when your plant is particularly vulnerable, and when it is good to watch them closely.

1. Keep a close watch on your seedlings and cuttings, as it is often at that stage that your plant will be infected. It is important to choose your germination substrate very carefully and to keep your germination area as clean as possible.
2. When preparing your cuttings for propagation, use clean utensils, and take good care of both cutting and mother plant, as the cuts inflicted during the operation are a wonderful opportunity for pathogen penetration.
3. As to the mother plant, another phenomena takes place when you cut some of its stems off: the root mass becomes too important for its new needs,

and parts of it start decaying. At that time it will release more ethylene, and pathogens, including Pythium, will rush in.

4. So don't hesitate to renew your mothers. After some time your mother becomes old and eventually carries the Pythium spores. And your cutting will carry it too, of course. This is why it is wise to use your mother once or twice, then replace it with one of the newly rooted cutting. This way you will always propagate healthy young mothers and get healthy and vigorous cuttings, devoid of disease.
5. Transplanting is another key operation, as a wounded root is a perfect ground for infection. So when you transplant, use a clean spot and be particularly gentle with the young roots. To avoid transplant stress and root manipulation, you can use Aero-hydroponic propagation systems where you only need to move your plant from one pot to the next, without interfering with the root system.
6. On a general basis, start with disease-free plants and seeds. Avoid overfeeding and overcrowding of plants and keep good ventilation. It seems that Pythium will thrive better at high alkalinity levels, so keep your pH as low as possible, while following the plant's needs, of course.

Some growers have discovered other means of fungi prevention by using wetting agents and chlorination of the nutritive solution, UV light, hydrogen peroxide and ozone. But be careful, some of these methods may be detrimental as they can interfere with some of the mineral salts in the solution, thus endangering the balance of your plant's nutrition.

There are other means to prevent Pythium and other fungi in general. Some companies offer products like special silicate powders, beneficial bacteria or fungi, or different mixes of various strains of both to add to your nutritive solution. Some go further and offer a "biological filter" that will filter all residues, increase water oxygenation, and include a mix of microorganisms that will colonize and form a protective barrier on the roots, thus blocking the invasion of pathogen organisms. A big advantage to these filters is to keep your roots healthy, even when you have a difficult time controlling your temperature levels.



The root system of large plants does recover, ... if you react quickly enough!

Pythium is one among a huge diversity of fungi. Many more exist, like Fusarium, Verticillium, Phytophthora, Rhizoctonia, etc, and all will cause root rot of adults and damping off of seeds and seedlings. They will develop more or less easily, according to temperatures and pH levels, but they will thrive in the same conditions as Pythium. Prevention against their attacks is the same as for Pythium, the most important aspects being again and again, to keep your plants as healthy and vigorous as possible.