Rooted in science

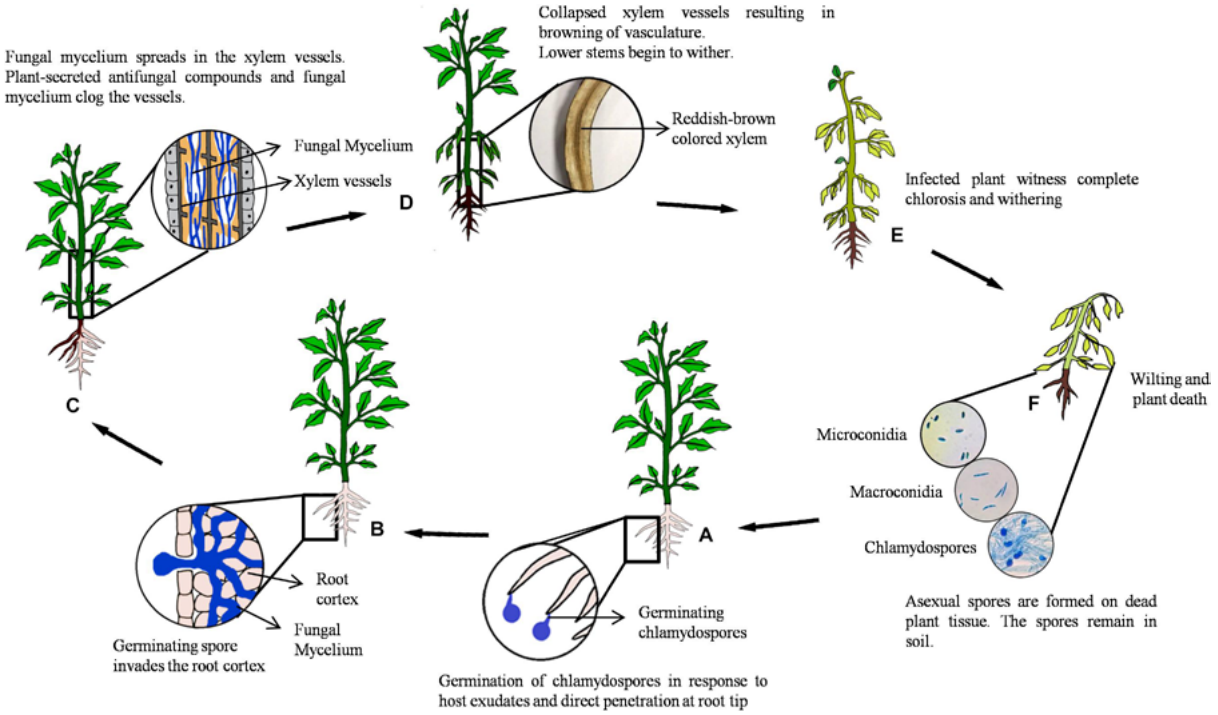
Fusarium oxysporum

***Fusarium oxysporum* is a soil-borne fungus that includes both pathogenic and non-pathogenic species affecting a wide range of plants. It is known for its host-specific strains, meaning specific strains can only affect specific species of plants. This fungus can cause significant damage to crops, particularly in hydroponic greenhouse environments.**

Life-cycle and mode of infection

Fusarium oxysporum (all species) has a complex life cycle that includes sexual and asexual stages. The fungus primarily reproduces asexually, producing three types of spores: macroconidia, chlamydospores, and microconidia. These spores play a crucial role in the propagation and infection of the fungus. The fungus enters plant tissues through wounds or by direct epidermis penetration. Once inside the plant, the fungus invades the xylem vessels, disrupting the translocation of nutrients and leading to the characteristic wilting symptoms.

Figure 1: Fusarium oxysporum life cycle. Image and explanation - see table on next page - from Jangir et al 021).
https://www.frontiersin.org/articles/10.3389/fpls.2021.628611/full



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Fusarium oxysporum life cycle

1. When the host plant releases root exudates, it stimulates the germination of spores, leading to the growth of infection hyphae, which then penetrate the root's epidermal layer at its tip.
2. The hyphae move between cells in the root's cortical region until they reach the xylem tissue, including the parenchymal cells and vessels, entering through xylem pits.
3. The pathogen then occupies the vascular vessels, resulting in blockages and brown discoloration due to the extensive growth of mycelia.
4. Early signs of infection become evident at the base of the stem and then gradually move upwards, causing the young leaves to wither.
5. In mature leaves, either a yellowing at the edges or a total loss of green colour (chlorosis) can be noticed.

Pathogenic and Non-Pathogenic Strains

- Pathogenic Strains: Cause diseases in plants, leading to wilting, yellowing, and plant death.
- Non-Pathogenic Strains: Do not cause harm and can even have beneficial interactions with plants.

Host Specificity

Fusarium oxysporum is highly host-specific, with certain strains only affecting particular plant species. This specificity means that while one strain may devastate a crop of peppers, it might not affect tomatoes or cucumbers.

Specific Strains and Symptoms

- **Fusarium oxysporum f.sp. lycopersici** (affects tomatoes): Wilting, yellowing of leaves, vascular discoloration.
- **Fusarium oxysporum f.sp. capsici** (affects peppers): Yellowing, wilting, stunted growth, vascular discoloration (Picture 1).

Common Symptoms in Affected Plants

- **Wilting:** Sudden or gradual wilting of leaves and stems.
- **Yellowing:** Leaves turning yellow, often starting from the lower parts of the plant.
- **Stunted Growth:** Plants may show reduced growth and development.
- **Vascular Discoloration:** Brown or black streaks in the vascular tissues when stems are cut open.

Picture 1.0: Typical symptom expression of *Fusarium oxysporum f.sp. capsici* in peppers

Mitigating Actions for Hydroponic Greenhouse Growers of Peppers

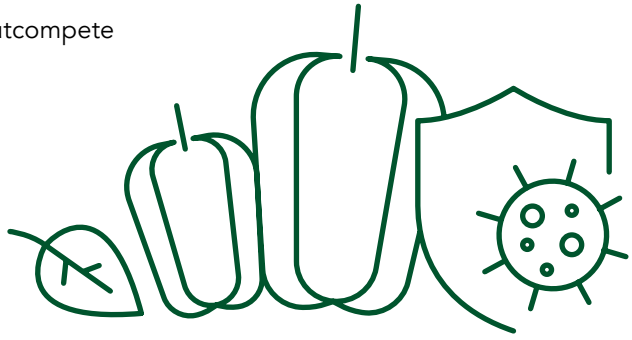
Greenhouse sanitation:
- Regularly clean and disinfect greenhouse facilities and equipment.
- Ensure proper hygiene practices to prevent the spread of pathogens.

Substrate choice:
- Use clean growing media at the start of the cultivation
- Consider using inert substrates that are less prone to harboring plant pathogens.

Water management:
- Use clean, pathogen-free water sources.
- Implement water treatment systems, such as UV sterilization or oxidation, to eliminate potential contaminants.
- Ensure that the substrate WC% and EC are optimized to provide ideal conditions for root growth and nutrient uptake.

Biological Control:
- Introduce beneficial microbes or biocontrol agents that can outcompete or inhibit the growth of Fusarium.

Regular Monitoring:
- Ensure your staff are familiar with the symptoms and get them to report suspicious plants for early signs of infection.
- Implement rapid response protocols to isolate and treat affected plants.



Designed to grow

Grodan is the global leader in supplying soilless rootzone management solutions for Controlled Environment Agriculture. These solutions are applied to the cultivation of vegetables, medicinal crops and flowers such as tomatoes, cucumbers, sweet peppers, eggplants, roses and gerberas.

At Grodan, we aim to help feed and treat the world's growing population by innovating solutions from our stone wool growing media to enable 'more-with-less' growing. Through the method known as out-of-soil, our stone wool substrates, sensor systems, software and expertise support the reliable, informed growing of healthy, fresh, high quality produce. Our material is 100% recyclable, and supports growing methods that use up to 50% less water, 20% less chemical plant protection products and 75% less land. Sustainability plays a prominent role within Grodan, from manufacturing stone wool substrates to recycling solutions and services.

Grodan has more than 50 years of cultivation experience. We pioneered the development of hydroponic growing methods in the 1960s, and today, our soilless rootzone management solutions are used in large-scale commercial greenhouses and indoor facilities in over 70 countries across the globe. The head office is located in Roermond, the Netherlands.

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