



## ZOMBIE PLANTS? HOW FUNGI CONTROL AND KILL THEIR HOSTS

T. Meera<sup>1\*</sup>, L. Vengadeshkumar<sup>2</sup>, P. Amudha<sup>3</sup> and Deepa Simon<sup>4</sup>

<sup>1</sup>Head & Assistant Professor (Plant Pathology), School of Agriculture, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai – 600117

<sup>2</sup>Assistant Professor (Plant Pathology), Tamil Nadu Agricultural University, AC&RI, Keezhvelur, Nagapattinam - 611105

<sup>3</sup>Assistant Professor (Biochemistry), School of Life Sciences, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai – 600117

<sup>4</sup>Assistant Professor (Chemistry), School of Basic Science, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai – 600117

\*Corresponding Author Mail ID: [meera.agriculture@velsuniv.ac.in](mailto:meera.agriculture@velsuniv.ac.in)

### Introduction

Nature can be stranger than fiction, and nowhere is this more evident than in the bizarre world of fungi that manipulate and kill plants. These fungi don't just infect their hosts—some of them turn plants into zombies, controlling their growth and behavior to ensure their own survival and spread. From hijacking plant metabolism to creating structures that resemble horror-movie scenarios, fungi have evolved astonishing strategies that continue to fascinate scientists and farmers alike.

### What Are Zombie Plants?

Zombie plants are not a separate category of plants, but a phenomenon where fungi manipulate their hosts in ways that resemble mind control. These fungi alter the plant's natural processes, redirecting resources, suppressing immune defenses, or even forcing the plant to grow in unnatural ways. The plant becomes a puppet, with the fungus pulling the strings.

### How Do Fungi Hijack Plants?

Fungal pathogens use a combination of chemical signals, physical structures, and enzymes to infiltrate and control plants. Here's how it typically works:

- 1. Infiltration:** The fungus penetrates the plant through wounds, natural openings like stomata, or by directly breaking through the cell walls.

- 2. Secretion of Effectors:** Fungi release proteins called effectors that interfere with the plant's immune system, keeping the host from recognizing and fighting the infection.
- 3. Control of Hormones:** By altering plant hormones like auxins, cytokinins, or gibberellins, fungi manipulate the plant's growth patterns. For example, some fungi cause plants to produce more shoots, flowers, or galls that serve as fungal feeding or reproduction sites.
- 4. Resource Redirection:** Fungi drain nutrients from the host, often redirecting sugars and water to sustain themselves while starving the plant.

### Real-Life Examples of Plant Zombie Makers

#### 1. Rust Fungi ("Puccinia" Species): The Plant Puppeteers

Rust fungi are infamous for turning plants into reproductive factories for their spores. One striking example is *Puccinia monoica*, which infects wild mustard plants. The fungus forces the plant to grow brightly colored pseudo flowers that mimic real flowers, luring pollinators. As insects visit these fake flowers, they pick up fungal spores instead of pollen, spreading the infection to new plants.



## 2. Smut Fungi: The Grain Hijackers

Smut fungi, such as *Ustilago maydis*, infect cereal crops like corn. Instead of producing healthy kernels, infected plants grow tumor-like structures filled with fungal spores. Farmers may see these as destructive, but in some regions, these fungal galls are harvested as a delicacy known as huitlacoche.



## 3. Ergot Fungus (*Claviceps purpurea*): The Grain Poisoner

Ergot fungi infect grains like rye, replacing seeds with fungal structures called sclerotia. These structures are packed with toxic alkaloids that can cause severe health issues in humans and animals if consumed. Infected plants often grow abnormally, ensuring the spread of the fungus to new hosts.



## 4. Fungi That Induce Witch's Brooms

Some fungi, like *Moniliophthora perniciosa*, which causes Witches' Broom Disease in cacao plants, force the plant to produce dense, broom-like clusters of shoots. These malformed structures act as nutrient-rich hubs for fungal growth, eventually leading to the death of the plant.



## Why Do Fungi Manipulate Plants?

The goal of fungal manipulation is survival and reproduction. By hijacking plants, fungi gain access to nutrients, create safe environments for spore production, and ensure that spores are spread to new hosts. These adaptations are the result of millions of years of co-evolution between fungi and plants.

## Implications for Agriculture

Zombie-creating fungi are more than just biological curiosities; they pose serious threats to global food security. Rusts, smuts, and other fungal pathogens are responsible for significant crop losses each year. For example, wheat rusts can wipe out entire fields, while ergot

contamination can render grain harvests unusable.

Farmers and scientists combat these fungi using a combination of methods:

- **Breeding Disease-Resistant Crops:** Developing plant varieties that can recognize and fight off fungal invaders.
- **Fungicides:** Chemical treatments can help, but they must be used carefully to avoid environmental damage and resistance development.
- **Biological Controls:** Beneficial microbes can outcompete or inhibit pathogenic fungi.
- **Monitoring and Quarantine:** Preventing the spread of fungal spores through early detection and isolation of infected crops.

### Zombie Plants and Ecosystem Dynamics

While fungal pathogens can devastate crops, they also play essential roles in natural ecosystems. By breaking down organic matter, fungi contribute to nutrient cycling and soil health. Additionally, some of the relationships fungi form with plants are mutualistic, as seen in mycorrhizal fungi that help plants absorb nutrients.

### Conclusion

The world of zombie plants and their fungal manipulators offers a glimpse into the incredible complexity of nature. These interactions, though often destructive, highlight the ingenuity of evolution and the delicate balance of ecosystems. As we continue to study these phenomena, we not only gain insights into plant pathology but also uncover potential solutions for managing fungal diseases in agriculture. So, the next time you see a plant behaving strangely, consider this: it might just be under the control of a fungal mastermind.

