

FUNGAL METABOLITES: NATURE'S HIDDEN ALLIES FOR PLANT HEALTH

Durgadevi D*, Ranjith S, Vijaya Gowri E, Kalaivanan R and Prabakar K

Department of Plant Pathology, Vanavarayar Institute of Agriculture, Manakadavu, Pollachi- 642104.

*Corresponding Author Mail ID: devi.agri18@gmail.com

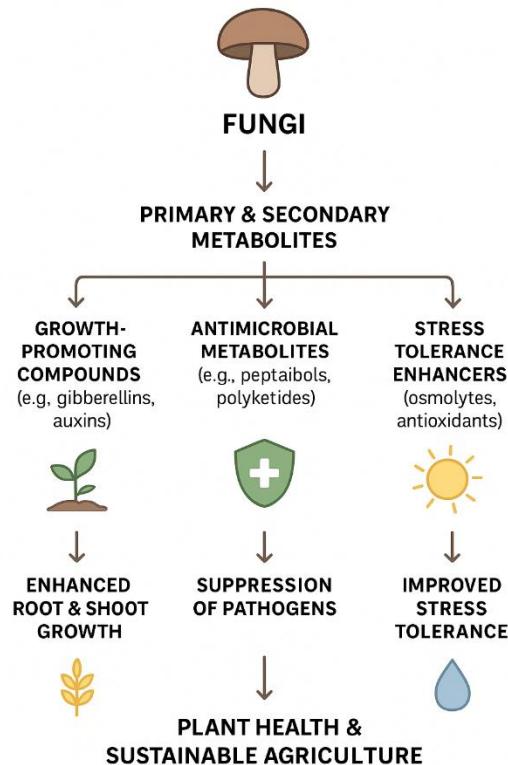
When people hear the word "fungus," they often think of mushrooms, molds, or crop diseases. Yet, beyond their reputation as pathogens, fungi are remarkable producers of natural compounds called metabolites. These substances are increasingly being recognized as powerful tools for promoting plant health and sustainable agriculture.

Fungal Metabolites

Fungi produce a wide range of chemicals during their life cycle. Primary metabolites—like amino acids and enzymes—support growth and survival. But fungi also release secondary metabolites, which are not essential for survival but play crucial ecological roles. These include antibiotics, plant growth regulators, and compounds that suppress harmful microbes (Demain & Fang, 2000). In essence, fungal metabolites are the "language" fungi use to communicate with plants and other microorganisms in the soil ecosystem.

Benefits to Plant Health

1. **Stimulating Growth:** Fungal metabolites such as gibberellins were first discovered in the fungus *Gibberella fujikuroi* and are now used to improve seed germination, stem elongation, and fruit development in agriculture (Brian & Hemming, 1955). *Trichoderma* species, widely used as biofertilizers, release metabolites that enhance root growth and nutrient uptake (Harman *et al.*, 2004).



2. **Suppressing Pathogens:** Many fungi secrete antimicrobial compounds that naturally protect plants. For example, metabolites from *Aspergillus* and *Penicillium* species inhibit soilborne pathogens, reducing disease incidence (Frisvad *et al.*, 2018). *Trichoderma harzianum* produces peptaibols—antifungal peptides that disrupt the cell membranes of plant pathogens (Viterbo *et al.*, 2007).

3. **Priming Plant Defense:** Some metabolites don't directly kill pathogens but instead induce systemic resistance in plants, much like a vaccine prepares the human immune system. For instance, *Trichoderma* metabolites have been shown to trigger defensive gene expression in crops (Shoresh *et al.*, 2010).
4. **Reducing Chemical Use:** Because these natural compounds are biodegradable and eco-friendly, they help reduce dependency on synthetic pesticides and fertilizers—supporting greener farming practices (Mendes *et al.*, 2011).

Impact

- **Gibberellins:** Commercially applied to improve fruit size and quality.
- **Trichoderma-based products:** Widely sold as biopesticides and plant growth enhancers.
- **Mycorrhizal fungi metabolites:** Enhance drought and stress tolerance in crops (Smith & Read, 2008).

With the growing concerns of climate change, soil degradation, and pesticide overuse, fungal metabolites represent a sustainable alternative to maintain crop productivity. They support soil health, protect biodiversity, and align with global goals for eco-friendly agriculture.

Conclusion

Fungal metabolites are much more than chemical curiosities. They are nature's own bioactive toolkit—capable of boosting crop yields, strengthening disease resistance, and paving the way for environmentally responsible farming. As research advances, we are only beginning to uncover the full potential of these fascinating fungal gifts.

References

- Brian, P. W., & Hemming, H. G. (1955). Production of gibberellic acid by *Fusarium moniliforme*. *Transactions of the British Mycological Society*, 38(3), 335–347.
- Demain, A. L., & Fang, A. (2000). The natural functions of secondary metabolites. *Advances in Biochemical Engineering/Biotechnology*, 69, 1–39.
- Frisvad, J. C., Andersen, B., & Thrane, U. (2018). The use of secondary metabolite profiling in chemotaxonomy of filamentous fungi. *Mycological Research*, 112(2), 231–240.
- Harman, G. E., Howell, C. R., Viterbo, A., Chet, I., & Lorito, M. (2004). *Trichoderma* species—opportunistic, avirulent plant symbionts. *Nature Reviews Microbiology*, 2, 43–56.
- Mendes, R., Garbeva, P., & Raaijmakers, J. M. (2011). The rhizosphere microbiome: Significance of plant beneficial, plant pathogenic, and human pathogenic microorganisms. *FEMS Microbiology Reviews*, 37(5), 634–663.
- Shoresh, M., Harman, G. E., & Mastouri, F. (2010). Induced systemic resistance and plant responses to fungal biocontrol agents. *Annual Review of Phytopathology*, 48, 21–43.
- Smith, S. E., & Read, D. J. (2008). *Mycorrhizal Symbiosis*. 3rd ed. Academic Press.
- Viterbo, A., Wiest, A., Brotman, Y., Chet, I., & Kenerley, C. (2007). The 18mer peptaibols from *Trichoderma virens* induce plant defence responses. *Molecular Plant Pathology*, 8(6), 737–746.