

The 9th National Fungus Day of Egypt Online | اليوم الوطنى  
التاسع لفطريات مصر  
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# Endophytic fungi for safe sustainable Agriculture

**Dr. Akram Hassan Mohamed**

**Researcher (PhD)**

**Microbial Genetic Resources Dept.**

**National Gene Bank and Genetic Resources  
Agricultural Research Center**

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According to a recent report by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), a healthy diet is currently out of reach for more than **3.1 billion people** worldwide.



# Challenges faced by current agronomic practices

- Transmissions of pathogens in soil-human microbial loops.
- The dissemination of antibiotic resistance genes in agroecosystems.
- Impacts of chemical pesticides on humans and environmental health.
- Finally, we propose the potential of **utilizing microbiomes** for better **sustainable agronomic practices** to contribute to **key goals of the One Health concept**.

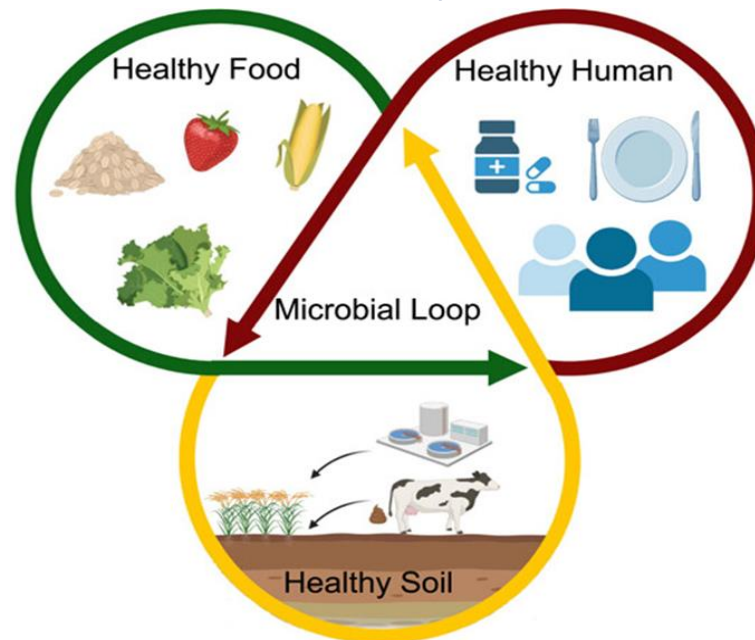
# One Health Approach

The One Health Concept emphasizes the Connections between humans, animals, and the environment and provides a global strategy that highlights the need for holistic and transdisciplinary approaches to improving the health and well-being of all components of an ecosystem (van Bruggen et al., 2019).



# Soil

- Corner Stone of **One Health** approach.
- Soil is reservoir of **pathogens, beneficial microorganisms**.
- Microorganisms link **soil, plant, animal and human health**, and microbial communities connect the different ecosystems.
- Bulk soil is the greatest contributor to plant **endophytic microbiota**, providing more than two-thirds of the bacterial and fungal diversity (Rocheffort, 2021).



- One fundamental threat to **food security** is the **degradation of the soil microbiome**. the disruption of the soil microbiome threatens our ability to **cultivate food**.



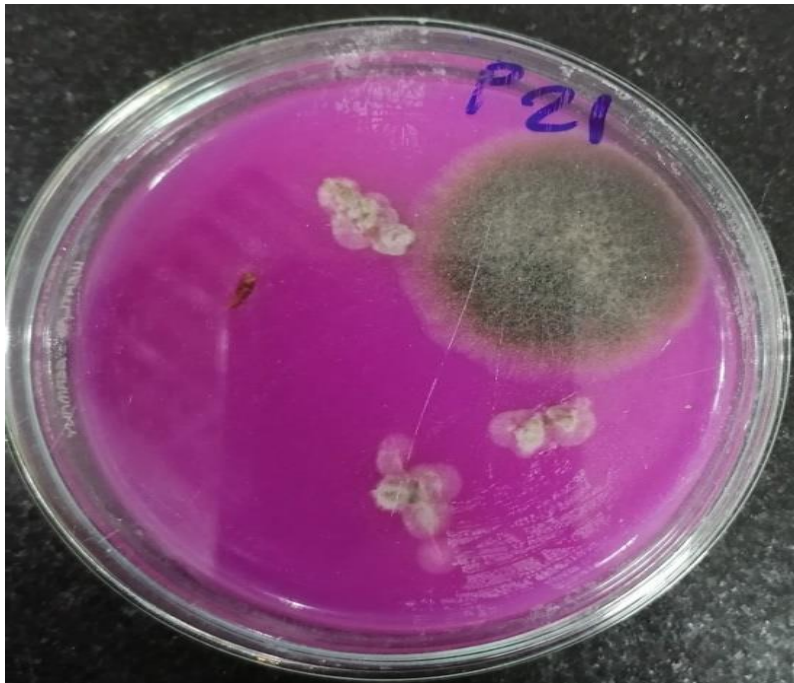
# Future Hope ????

The Use of Endophytic Fungi as Plant Growth Promoting Agent is the Future



# Endophytes

- These microorganisms are defined as endophytes that can not cause any symptomatic disease for their host plant (Manon et al., 2015).
- Beneficial endophytes, which may consist of bacteria and fungi, can be isolated from asymptomatic plant tissues and comprise one of the most taxonomically and functionally diverse microorganisms (Santoyo et al. 2016)





# Where Endophytes?

- The diversity of endophytic fungi associated with plants can greatly vary according to environmental conditions, arctic environments, hot deserts, and mangrove, temperate and tropical forests (Vega et al., 2010).

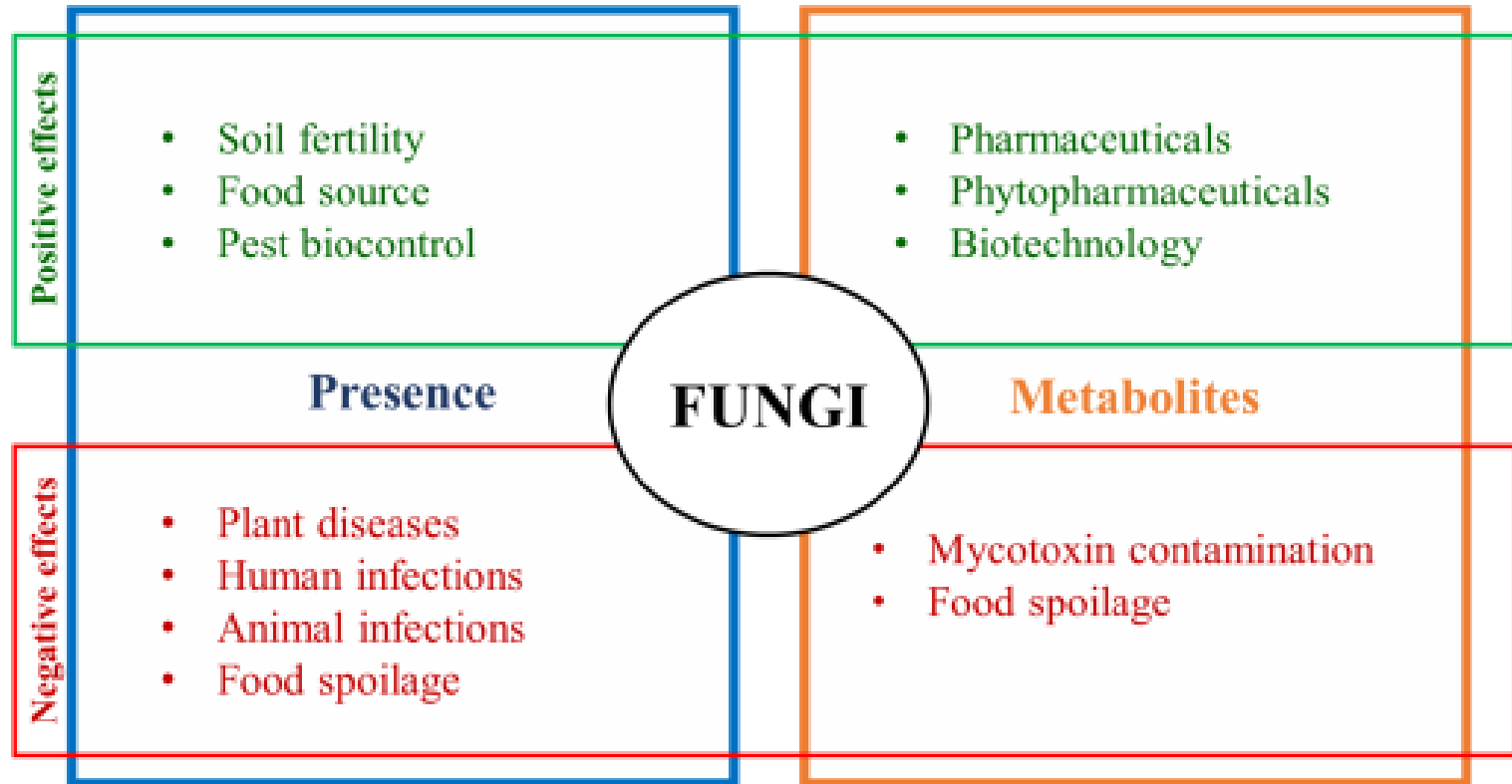


# Why wild plants?

- **Microbial communities** colonizing **wild medicinal plants** under extremely harsh conditions play an important role in mitigating many **biotic and a biotic stresses** within arid regions such as salinity, heat, drought and **low input of chemical fertilizers** (Alsharif et al., 2020).
- Plant growth-promoting microorganisms improve plant health and productivity under many extreme conditions through **forming symbiotic interactions** with their **plant host** (Abdelaal and Sahar, 2015; Torre-Ruiz et al., 2016 ).



# Fungi in a One Health Perspective



# Benefits of endophytic colonization by fungi

## Direct benefits and Indirect benefits

### **Nutrient acquisition**

N, P, K, Mg, other macronutrients and also micronutrients

### **Secondary metabolites**

Alkaloids, steroids, terpenoids and others including VOCs

### **Protection to biotic stress (pathogens, herbivores and nematodes)**

secondary metabolites, activation of systemic resistance, parasitism and competition

### **Phytohormones Production**

IAA, GAs and cytokinins

### **Activation of systemic resistance**

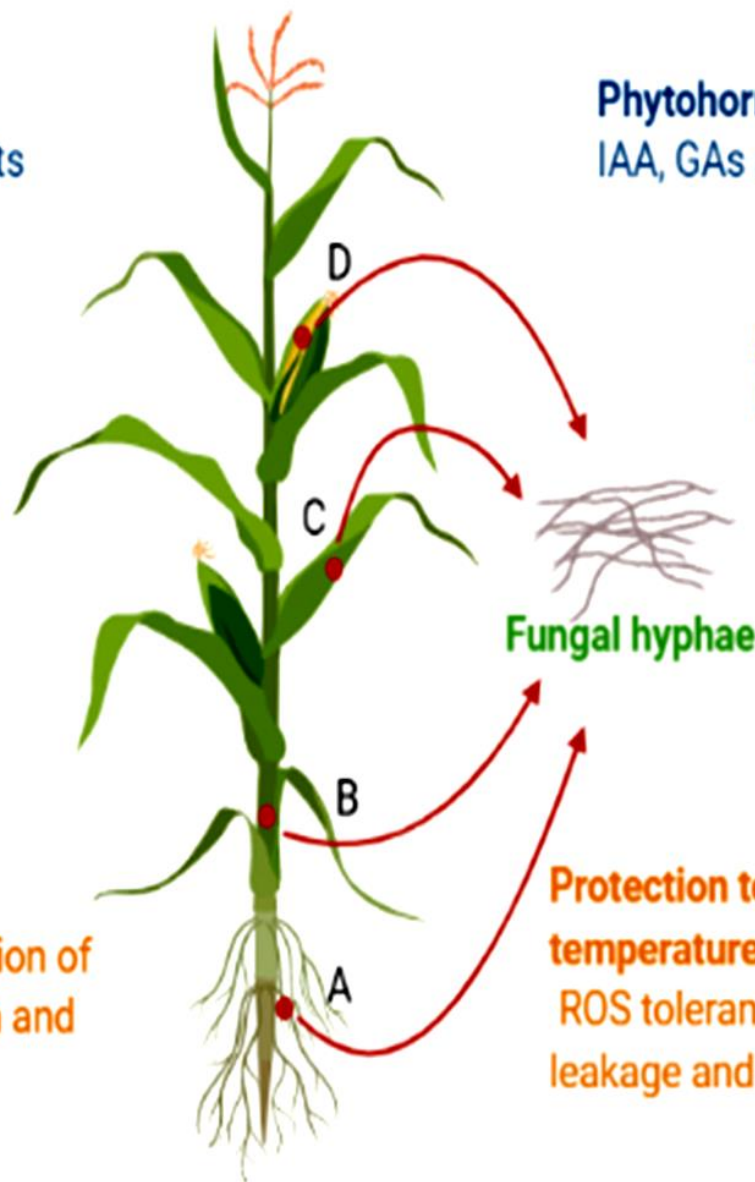
ISR and ASR

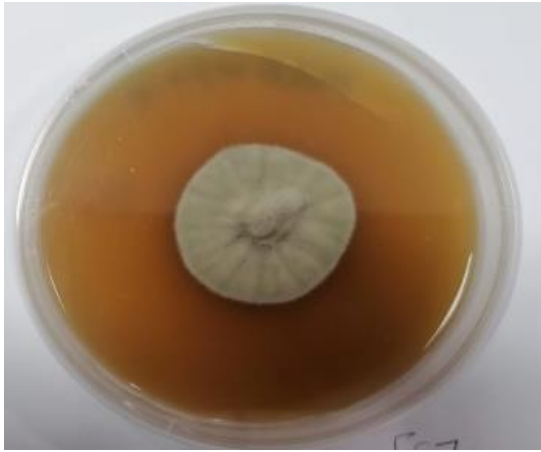
### **Siderophores**

Iron acquisition and ISR (?)

### **Protection to abiotic stress (drought, salinity, temperature and heavy metals)**

ROS tolerance, ↓lipid peroxidation, ↓electrolyte leakage and regulation of phytohormones





# IAA Determination in Endophytic Culture Filterate

- **IAA** determination using Salkovisky reagent in presence or absence of **Tryptophan** as precursor of **IAA** production
- Presence of pink or **red color** revealed presence of **IAA**



# Phosphate Solubilization Efficiency



**Blue color** indicates the presence of organic acids and solubilized phosphorus in the **Pikoviskays** liquid broth using chloromolbydic acid

# Antagonistic effect of tested fungal isolates against phytopathogen



Control (*A. alternata*)

NGB-WFS 14

NGB-WFE16

*Alternaria alternata* in dual culture assay. (1) Control (*A. alternata*) (2) NGB-WFS 14, (3) NGB-WFE16.



# Applied ways as biofertilizers

Foliar application



Soil amendment



Seed imbibition



# Evaluation of Active plant Growth-promoting (PGP) Isolates for Enhancement of Wheat Plants Growth in Pot Experiment under low Nitrogen (N) inputs





**Control  
(0%N)**

**Control  
(50%N)**

**Control  
(100%N)**

**NGB-WFE16**

- **Wild plants is a promising source for plant growth promoting fungi**
- **isolation sources affect significantly on the PGP traits of microorganisms.**
- **Wild plants associated microbes are efficient alternatives for achieving sustainable agriculture and reducing the reliance on chemical N-fertilizers.**
- **Make further studies to explore the effect of this inoculants as PGP microorganisms under field conditions.**
- **Formulate the effective PGP fungi of this study as bio-inoculants for wheat crop enhancement.**



# Thank you

