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Call for Bio-prospecting on *Fusarium venenatum* for Industrial Application through Ethiopia's Access and Benefit Sharing (ABS) Scheme

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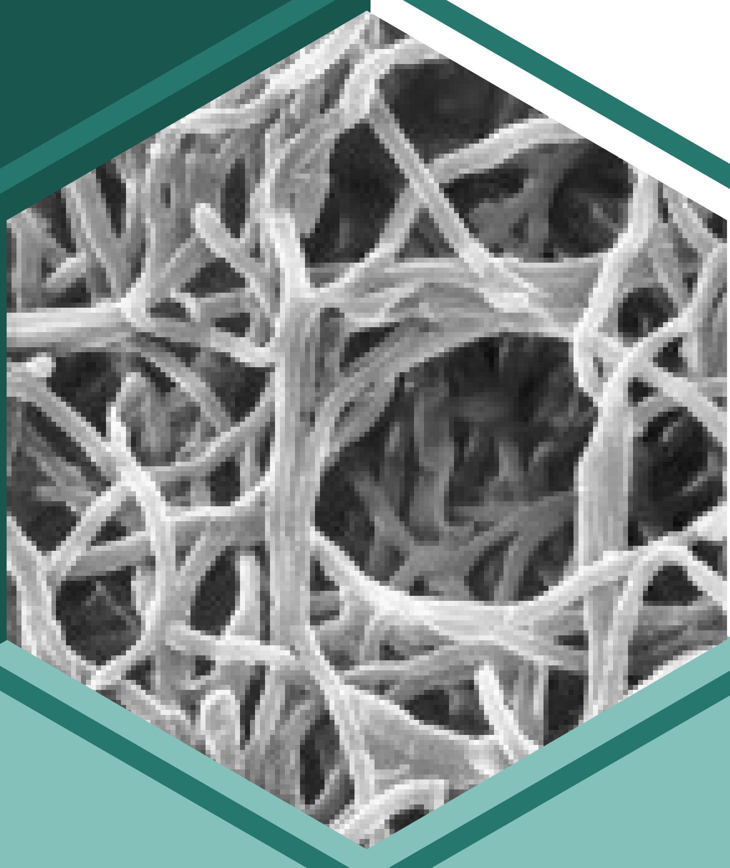
Genetic Resource Access and Benefit Sharing Research LE



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Ethiopian Biodiversity Institute

1. Introduction

Ethiopia is endowed with a rich diversity of genetic resources, which are essential for sustainable development and innovation across various sectors, including agriculture, pharmaceuticals, and biotechnology. The Ethiopian Access and Benefit-Sharing (ABS) laws have been established to ensure the equitable sharing of benefits derived from the utilization of genetic resources. These laws align with the Convention on Biological Diversity (CBD) and the Nagoya Protocol and emphasize the need to respect indigenous knowledge and community rights while promoting bio-prospecting activities.

Fusarium venenatum is a filamentous fungus that has gained significant attention for its industrial applications, particularly as a source of mycoprotein (Kour *et al*., 2019). This organism is known for its high protein content and is utilized in the production of meat substitutes, making it a valuable resource for addressing food security and dietary needs globally. It is particularly favored in meat alternatives due to its fibrous texture and rich nutritional profile (Lee *et al*., 2014).

This mini-review aims to promote the bio-prospecting of *Fusarium venenatum* within Ethiopia, highlighting its distribution, potential industrial applications, and the significance of utilizing this organism through the country's ABS framework.

2. Biology of the Organism

Fusarium venenatum is a filamentous fungus belonging to the Ascomycota phylum and the Nectriaceae family. It is characterized by its ability to grow in a variety of substrates, particularly those rich in carbohydrates, which it utilizes for energy and growth. The organism exhibits a mycelial structure, consisting of a network of hyphae that can spread extensively through its environment (O'donnell *et al*., 1998).

Morphology

The morphology of *Fusarium venenatum* includes:

- **Hyphal Structure**: The hyphae are typically septate, meaning they are divided into compartments by cross-walls (septa). This structure allows for efficient nutrient transport and growth.
- **Conidia**: The fungus produces asexual spores known as conidia, which are crucial for its reproduction and dissemination. These spores can survive in adverse conditions, allowing the organism to colonize new environments effectively (O'donnell *et al*., 1998).

Growth Conditions

Fusarium venenatum thrives in environments with:

- **Temperature**: Optimal growth occurs at temperatures between 25°C and 30°C, making it suitable for cultivation in various climates.
- **pH Levels**: The fungus prefers slightly acidic to neutral pH levels (around 5.5 to 7.0), which are common in many agricultural soils.
- **Moisture**: High moisture levels are essential for its growth, as the organism requires water for metabolic processes (O'donnell *et al*., 1998).

Metabolism

The metabolic capabilities of *Fusarium venenatum* :

- **Carbohydrate Utilization**: It can metabolize a wide range of carbohydrates, including glucose, starch, and other polysaccharides, which are abundant in agricultural waste products (Lee *et al*., 2014).
- **Protein Synthesis**: The organism is capable of synthesizing high-quality protein, making it an excellent candidate for mycoprotein production. The protein content can reach up to 45% of its dry weight, providing a rich source of essential amino acids (Prakash *et al*., 2014).

Genetic Characteristics

The genetic makeup of *Fusarium venenatum* has been studied to understand its fermentation capabilities and protein production. Advances in molecular biology techniques have allowed researchers to explore its genome, identifying genes responsible for metabolic pathways that enhance its growth and protein synthesis (O'donnell *et al*., 1998). This genetic information is crucial for optimizing cultivation conditions and improving yields in industrial applications.

3. Distribution of the Organism

Fusarium venenatum is primarily found in soil and plant materials, thriving in various environmental conditions (Bourdichon *et al*., 2012). In Ethiopia, it can be isolated from diverse ecosystems, including agricultural lands, forest soils, and grasslands. Potential sampling sources include:

- **Agricultural Fields**: Areas where legumes, grains, and other crops are cultivated, as these environments are conducive to fungal growth.
- **Forest Soils**: Rich in organic matter, forested regions may harbor diverse fungal communities, including *Fusarium venenatum*.
- **Grasslands**: These ecosystems provide suitable conditions for the growth of this fungus, especially in regions with moderate rainfall.

Sampling efforts should focus on regions known for their agricultural diversity, such as the Oromia and Amhara National Regional States, where traditional farming practices may contribute to the presence of this organism.

4. Industrial Application

Fusarium venenatum has significant industrial applications, particularly in the food sector. Its key uses include:

1. **Mycoprotein Production**: *Fusarium venenatum* is the primary organism used in the production of Quorn, a popular meat substitute. The fermentation process involves cultivating the fungus on carbohydrate substrates, resulting in a high-protein, low-fat product that mimics the texture of meat. This mycoprotein is recognized for its health benefits, including its ability to improve hyperlipidemia in animal models, indicating its potential for human health applications (Lee *et al*., 2014).

2. **Nutritional Supplement**: Due to its high protein content, *Fusarium venenatum* serves as a valuable dietary supplement, particularly in vegetarian and vegan diets. It provides

essential amino acids and is an excellent alternative to animal protein (Prakash *et al.*, 2014).

3. **Food Industry Applications**: The versatility of *Fusarium venenatum* extends to various food products, including snacks, ready-to-eat meals, and protein bars. Its fibrous structure can enhance the texture of plant-based foods, making it an attractive ingredient for food manufacturers (Wiebe, 2002).

4. **Sustainable Food Production**: As a mycoprotein, *Fusarium venenatum* offers a sustainable protein source that requires fewer resources compared to traditional livestock farming. Its cultivation has a lower environmental impact, contributing to food security and sustainability efforts (Lee *et al.*, 2014).

5. **Potential in Bioremediation**: Emerging research suggests that *Fusarium venenatum* may play a role in bioremediation efforts, particularly in the degradation of pollutants in agricultural soils. This application could further enhance its value by contributing to environmental sustainability (Kour *et al.*, 2019).

5. Conclusion

The bio-prospecting of *Fusarium venenatum* presents a unique opportunity to harness the potential of this organism for industrial applications, particularly in the food sector. Its rich nutritional profile and versatility make it an attractive candidate for sustainable protein sources, addressing global challenges such as food security and environmental sustainability. Ethiopia's ABS framework provides a structured approach to responsibly access and share the benefits derived from this genetic resource. Industries, manufacturers, and researchers are encouraged to engage in collaborative efforts to explore the potential of *Fusarium venenatum* through the ABS scheme. By doing so, we can promote sustainable development while respecting the rights of local communities and indigenous peoples and contributing to Ethiopia's rich biodiversity.

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