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FUNGI ECOLOGY

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ABSTRACT

In balancing the ecosystems fungi plays an indelible role. There are several habitats for it on this earth. The dark and the moist condition are the havens to it, and even it grows in tundra also. It has an hostile environment here, and a most successful symbiosis with photosynthetic organism like alga to produce lichens. Yeasts, moulds, and mushrooms are included in the fungi kingdom. These are heterotrophy in living organisms. The fungi convert nutrients make available to the plants. there are decomposing fungi is also there which can decompose animal, and plant material breakdown, and helps in cycling nutrients to increase the worth of soil.

KEY WORDS: *Balancing Ecosystem, Habitats, Moist, Symbiosis, Yeasts, Moulds, Mushrooms, Decomposing*

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INTRODUCTION

In balancing ecosystems, fungi play a crucial role. It colonizes most habitats on Earth, preferring dark, moist conditions. It can thrive in seemingly hostile environments, such as the tundra, thanks to a most successful symbiosis with photosynthetic organisms like algae to produce lichens. It is eukaryotic organisms that include microorganisms such as yeasts, molds, and mushrooms. It is classified under the kingdom of fungi, and found in the kingdom, it contains a cell wall and is omnipresent. It is classified as a heterotroph among living organisms. Fungi can transform nutrients in a way that makes them available for plants. A few species are decomposers. It breaks down plant and animal dead material into nutrients and increases nutrient availability in the soil. “Fungi can also function as nutrient cyclers, pathogens, and mutualisms that mutually associate with plants and other organisms.” typically, fungi as decomposers, but they are cryptic and do many different things.

In general, fungi are in there in its kingdom; coming to reality, it has a close association with animals only than plants. It has chemicals in its cell wall shared with lobsters and crabs. A fungus has been discovered to break down plastics in weeks rather than years. The two ecological roles of fungi are decomposing other organisms and providing a food source for other living things. They do not have chlorophyll, so heterotrophic organisms absorb foods into their hyphae. Examples of fungi are yeasts, rusts, stinkhorns, puffballs, truffles, molds, mildews, and mushrooms. In ecosystems, balance fungi play a crucial role in the balance of ecosystems. They colonize most habitats on Earth, preferring dark, moist conditions. They can thrive in seemingly hostile environments, such as the tundra, thanks to a most successful symbiosis with photosynthetic organisms like algae to produce lichens. It is inevitable in how large animals or tall trees appear, like bacteria. It is a significant decomposer of nature. With their versatile metabolism, fungi break down organic matter, which would not otherwise be recycled.

Primarily fungi associate with humid and relaxed environments. They supply organic matter. Its habitats are surprising. These are from seawater to human skin and mucous membranes. Chytrids are found primarily in aquatic environments. Other, like *Coccidioides immitis*, cause pneumonia when their spores are inhaled, and thrive in dry and sandy US soil. In a few cases, fungi parasitize coral reefs and live in the ocean, but most members of Fungi grow on the forest floor, where the dark and damp weather prevails. It is rich in decaying debris from plants and animals. In these environments, fungi play a significant role by decomposing carcasses and supplying nutrients.

Without a decomposer, the food web is incomplete in gaining organic material (Figure.1). Some elements, such as nitrogen and phosphorus, are required in significant quantities by biological systems. It may not be abundant in the environment. Its cation releases N and P elements by decaying matter; in return, it is available to organisms. In many habitats, fungus bacteria are essential for growth and remain in rotting organic matter.

Figure 1: Fungi has Important Part of Ecosystem Nutrient Cycles. It bracket Fungi Growing on the Side of a Tree are the Fruiting Structures of a Basidiomycete, and Receive their Nutrients through their Hyphae, which Invade and Decay the Tree Trunk. (credit: Cory Zanker).

Fungi's ability to degrade many large and insoluble molecules is due to its nutrition mode. It produces a variety of exoenzymes to digest nutrients. These are released into the substrate or bound to the outside cell wall. Large molecules break down into small molecules. These are transported into the cell by a system of protein carriers embedded in the cell membrane; since the movement of small molecules and enzymes depends on water percentage, active growth depends on relatively high environmental moisture. As saprobes, fungi help maintain a sustainable ecosystem for the animals and plants with the same habitat; besides replenishing the environment with nutrients, fungi interact directly with other organisms in beneficial and sometimes damaging ways (Figure .2).

Figure 2: Shelf Fungi, So called because they Grow on Trees in a Stack, Attack and Digest the Trunk or Branches of a Tree. While some Shelf Fungi are Found only on Dead Trees, others can Parasitize Living Trees and cause Eventual Death, so they are Considered serious Tree Pathogens. (credit: Cory Zanker).

The ecological interaction between two organisms is symbiosis. Generally, they live together. The definition does not describe interaction quality. if both are beneficial, it is called the symbiotic relationship "Mutualism." Fungi form mutualistic associations with many organisms, including cyanobacteria, algae, plants, and animals. One of the most remarkable associations between it and plants is the establishment of mycorrhizae. Mycorrhiza is from the Greek words *myco*, meaning fungus, and *rhizome,* meaning root. It indicates the association between vascular plant roots and their symbiotic fungus. Eighty to ninety percent of plant species have mycorrhizal partners. In a mycorrhizal association, it uses for its extensive network of hyphae and large surface area in contact with the soil and channelizes water and mineral content to plants. In exchange, the plant supplies photosynthesis products to fuel the fungus's metabolism.

Mycorrhizae are Ectomycorrhizae ("outside" mycorrhiza) that depend on fungi enveloping the roots in a sheath (called a mantle) and a Hartig net of the hypha. It extends into the roots between cells (Figure 1). The fungal partner can belong to the Ascomycota, Basidiomycota, or Zygomycota. In a second type, the Glomeromycete fungi form vesicular–arbuscular interactions with arbuscular mycorrhiza (sometimes called endo mycorrhizae). In these mycorrhizae, the fungi form arbuscules that penetrate root cells. The metabolic site exchanges between the fungus and the host plant (Figure 1 and Figure 2). The arbuscular (from the Latin for little trees) is shrub-like. Orchids rely on mycorrhiza. *Orchids* are epiphytes with tiny seeds and no storage for germination and growth. These seeds germinate without a mycorrhizal partner. After nutrients in the seed depleted, fungal symbionts support orchid growth by providing necessary carbohydrates and minerals. Some orchids continue to be mycorrhizal throughout their lifecycle.

Figure 24.3.424.3.4: The (a) infection of *Pinus radiata* (Monterey pine) roots by the hyphae of *Amanita muscaria* (fly amanita) causes the pine tree to produce many tiny, branched rootlets. *Amanita* hyphae cover these small roots with a white mantle. (b) Spores (round bodies) and hyphae (thread-like structures) are evident in this light micrograph of an arbuscular mycorrhiza between a fungus and the root of a corn plant. (credit a: modification of work by Randy Molina, USDA; credit b: modification of work by Sara Wright, USDA-ARS; scale-bar data from Matt Russell).

Plant fungi mutualism and other examples include endophytes. The fungi live inside tissue damaging the host plant. These release toxins that repel and confer resistance to environmental stress factors. Microorganisms, drought, or heavy metals in soil cause it.

The mutually beneficial Mycorrhizae has a symbiotic association between the vascular roots of plants and fungi. A theory proposes that fungi were instrumental in plant root system evolution and contributed to Angiosperms' success. The bryophytes (mosses and liverworts), considered very primitive plants, are the first to survive on dry land with inaccurate root systems. A few vesicular-arbuscular mycorrhizae and some do not. It depends on a simple rhizoid and cannot survive in dry areas. In vascular plants, the actual roots appeared. These have developed a system of thin extensions from the rhizoids thought has a selective advantage because it has a greater surface area of contact with the fungal partners than the mosses and liverworts, thus availing themselves of more nutrients in the ground.

Fossil records indicate that fungi preceded plants on dry land. Its photosynthetic organisms associated with land involve endophytes and moss-like plants. It had developed before roots appeared in plants. Gradually, endophytes use, and rhizoid interactions for both partners led to present-day mycorrhizae. Today 90% of vascular plants have associations with fungi in their rhizosphere. It involved in mycorrhizae display many characteristics of primitive fungi; they produce simple spores and show negligible diversification. It has an asexual reproductive cycle and cannot live outside the mycorrhizal association. Plants benefited from the association because mycorrhizae allowed them to move into new habitats due to the uptake of nutrients, giving them a selective advantage over plants that did not establish symbiotic relationships.

Lichens display various colors and textures. It survives in the most unusual and hostile habitats. It covers rocks, gravestones, tree bark, and the ground in the tundra, and it survives extended periods of drought when they become entirely desiccated and then rapidly becomes active once water is available. These appear in several forms, like crust-like, hair-like, and leaf-like. (Coy Zanker)

Lichens are not a single organism but rather a mutualism example. In it, a fungus lives in close contact with a photosynthetic organism. Usually, outside the symbiotic relationship, neither the fungus nor the photosynthetic organism survives. Its body is referred to as a thallus, from hyphae, wrapped around the photosynthetic partner. The photosynthetic organism provides carbohydrates energy. Cyanobacteria fix N from the atmosphere, contributing nitrogenous compounds to the association, in due it supplies minerals and protection from dryness and excessive light by encasing the algae in their mycelium. The fungus also attaches the symbiotic organism to the substrate.

The lichen cross-section thallus shows the upper cortex of fungal hyphae, which provides protection; the algal zone where photosynthesis occurs; the medulla of fungal hyphae; and the lower cortex, which also provides protection and may have rhizines to anchor the thallus to the substrate. Its thallus has stunted growth from diameter to millimeters per year. Both these participate in dispersal unit formation for reproduction. Lichens produce soredia, clusters of algal cells surrounded by mycelia. Soredia dispersed by wind and water and form new lichens. These are extremely sensitive to air pollution, especially abnormal nitrogen and sulfur levels. These fulfill several ecological roles. Caribou and reindeer eat lichens. They provide cover for small invertebrates. In the production of textiles, weavers used these to dye wool for several centuries until synthetic dyes discover.

Fungi evolved mutualisms with numerous insects in Phylum Arthropoda. These animals depend on the fungus to protect themselves from predators and pathogens. It obtains nutrients and a way to disseminate spores into new environments. A good example is the association between species of Basidiomycota and scale insects. It covers and protects fungal mycelium covers the insect colonies. The scale insects foster a flow of nutrients from the parasitized plant to the fungus, and another example is leaf-cutting ants. They cut leaf disks from plants and pile them up in gardens. Fungi are cultivated in these disk gardens, digesting the cellulose in the leaves so the ants cannot break down. Once smaller sugar molecules are produced and consumed by the fungi. In turn, it becomes a meal for an ant. These insects patrol their garden, preying on competing fungi, and from this association, both benefit. It receives a steady supply of leaves and freedom from competition while the ants feed on the fungi.

Animal dispersal is vital for some fungi because an animal may carry spores considerable distances from the source. Fungal spores are rarely wholly degraded in the gastrointestinal tract of an animal, and many can germinate when passed in the feces. Some dung fungi require passage through the digestive system of herbivores to complete their lifecycle.

CONCLUSION

Fungi have colonized nearly all environments on Earth but frequently found in cool, dark, moist places with a supply of decaying material. It absorbs decomposed organic matter. Several successful mutualistic relationships involve a fungus and another organism. A few of them establish complex mycorrhizal associations with the roots of plants. A few Farmicidaes supply of food. Lichens symbiotic relationship between a fungus and a photosynthetic organism, usually an alga. This organism provides energy from light and carbohydrates while supplying minerals and protection.

REFERENCES

1. *Ben-Ami R, Olshtain-Pops K, Krieger M, et al. Antibiotic exposure as a risk factor for fluconazole-resistant* Candida *bloodstream infection. Antimicrobial agents and chemotherapy 2012;56:2518–23.*
2. *Vallabhaneni S, Cleveland A, Farley M, et al. Epidemiology and Risk Factors for Echinocandin Nonsusceptible* Candida glabrata *Bloodstream Infections: Data From a Large Multisite Population-Based Candidemia Surveillance Program, 2008–2014. Open Forum Infect Diseases 2015;2(4):ofv163.*
3. *Lockhart SR, Iqbal N, Cleveland AA, et al. Species identification and antifungal susceptibility testing of* Candida *bloodstream isolates from population-based surveillance studies in two U.S. cities from 2008 to 2011. Journal of clinical microbiology 2012;50:3435–42.*
4. *Hajjeh RA, Sofair AN, Harrison LH, et al. Incidence of bloodstream infections due to* Candida *species and in vitro susceptibilities of isolates collected from 1998 to 2000 in a population-based active surveillance program. Journal of clinical microbiology 2004;42:1519–27.*
5. *Kao AS, Brandt ME, Pruitt WR, et al. The epidemiology of candidemia in two United States cities: results of a population-based active surveillance. Clinical infectious diseases 1999;29:1164–70.*
6. *Alexander BD, Johnson MD, Pfeiffer CD, et al. Increasing echinocandin resistance in* Candida glabrata*: clinical failure correlates with presence of FKS mutations and elevated minimum inhibitory concentrations. Clinical infectious diseases 2013;56:1724–32.*

7. *Baddley JW, Patel M, Bhavnani SM, Moser SA, Andes DR. Association of fluconazole pharmacodynamics with mortality in patients with candidemia. Antimicrobial agents and chemotherapy 2008;52:3022–8.*

8. *Lortholary O, Desnos-Ollivier M, Sitbon K, et al. Recent exposure to caspofungin or fluconazole influences the epidemiology of candidemia: a prospective multicenter study involving 2,441 patients. Antimicrobial agents and chemotherapy 2011;55:532–8.*