International Journal in Management and Social Science
Volume 09 Issue 11, November 2021 ISSN: 2321-1784 Impact Factor: 7.088
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

A STUDY OF DISTRIBUTION OF LICHEN BIODIVERSITY FROM BIO-PROSPECTION

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ABSTRACT

Formed by the symbiotic relationship of representatives of as many as three kingdoms—fungi and a protista or a monera—lichens are a distinct class of perennial cryptogamic creatures. Theophrastus, the "father of botany," used the name "lichen" in 300 B.C. to describe the thin layer of lichens that forms on the outer layer of olive tree bark. When first characterized, lichens were classified with other algae and mosses based on their outward appearance. On the other hand, de Tournefort (1700) classified "lichens" as a distinct genus within the plant kingdom. Erik Acharius, the "father of lichenology," invented various words based on the unusual structures of lichens, and he classified many new genera and species based on exterior morphology in his enormous works. After the invention of the microscope, the dualistic theory of lichens was discovered, and since then, other definitions have been developed for use in modern writings. Until the publication of "Introductory Mycology," lichens were understood to be any relationship between a fungus and an alga in which the two organisms were so entangled as to form a single thallus. Nevertheless, lichens were properly characterized by Kirk et al. (2001) as an ecologically obligatory, persistent mutualism between an exhabitant fungal partner and a resident population of extracellularly situated unicellular or filamentous algal or cyanobacterial cells.

KEYWORDS: Lichen Biodiversity, Bio-Prospection, cyanobacterial cells

INTRODUCTION

The word symbiosis has shown to be quite effective in describing the interaction between the two different species present in lichens, since it entails the primary attribute of living in a synchronized and well-mixed fashion so as to create a single biological unit. When the algal partner (photobiont) absorbs moisture and carbon dioxide from the atmosphere through the tissues of the mycobiont, it acts as a heterotroph and the fungus (mycobiont) gain photosynthetic products from the algae. It has been demonstrated physiologically and ultrastructurally that the fungus parasitizes the algae in a regulated manner, and in a few cases, kills the algal cells, making lichen relationships an example of commensalism or even parasitism, depending on the species.

For the most part, lichenized fungi are ecologically obligatory biotrophs yet physiologically flexible. In lichens the mycobiont accounts for most of the thallus's volume and provides the lichen's form, structure, and color, with some help from the algae. As a result, lichens are classified according on how their mycobionts are classified, and are not traditionally considered to be a distinct taxonomic category. Less than half of all ascomycetes and one-fifth of all fungus live in lichens.

Lichens' photobiont consists of both prokaryotic (Cyanophyceae) and eukaryotic (Chlorophyta) organisms, and they are typically basic photosynthetic organisms (Tribophyceae, Phaeophyceae, Chlorophyceae and Pleurostrophyceae). Except for the thalli of cyanolichens, where the photobionts are evenly dispersed, the photoautotrophic mass is often less than 10% of the total thalline mass. Over 100 species of photosynthetic partners from 43 genera and 5 classes have been identified as main or secondary constituents of lichen taxa. Ninety percent of all lichens belong to the genus Trebouxia, followed by the green alga Trentepohlia and the oxygenic photosynthetic bacterium Nostoc.

Reproduction, structure and classification of lichens

Lichens are capable of sexual and asexual reproduction. Although the photobiont of lichens can reproduce in a limited fashion, the mycobiont has the potential to completely express itself through both sexual and asexual reproduction. Nevertheless, horizontal or vertical transmission of the photobiont is necessary for lichens to reproduce, as both the fungal and photosynthetic partners must be passed on from one generation to the next. The mycobiont, which is responsible for horizontal transmission of the photobiont, reproduces sexually by way of fusion and meiosis, resulting in the formation of spores. This kind of reproduction is frequently viewed as unreliable since the fungus spores, upon germination, seek out a suitable photobiont and resynthesize the lichen symbiosis. Most fungi produce one of three distinct kinds of spore bodies: apothecia (a cup- or disc-shaped fruiting body), perithecia (a globe- or flask-shaped structure that remains immersed in the thallus), or pycnidia (pear-shaped or globose receptacles within which conidia are formed).

When the mycobiont reproduces asexually, the photobiont is passed down from generation to generation vertically. Soredia (groups of algal cells encircled by fungal filaments) and isidia (delicately attached, elongated outgrowth on the surface of thallus which gets easily detached) are two examples of specialized vegetative propagules that can be used to pass on the photobiont and mycobiont to the next generation.

Lichens are extremely unusual organisms because their fungal and algal cells are entangled in a spongy thallus. Foliose lichens are characterized by having three or four layers of cells or hyphae in their thallus (Hebert, 2010). The fungal hyphae's outermost layer of the epicortex agglutinates tightly to form a tough, impenetrable barrier. Next to the epicortex is the thicker, several hundred micrometer-thick cortex, and below that is the algal layer, where the algae cells are encased in strands of tightly interwoven fungal hyphae, either wrapped singly by hyphae or in some cases perforated by a haustorium. After the algal layer comes the medulla, a layer of loosely packed hyphae that stores many of the lichen's specialized chemicals. The lower cortex, found below the medulla, is similar to the upper cortex except that it contains rhizines, which resemble fungal roots.

Lichens can be broken down further based on their development habits, shape, size, and substrate. Crustose lichens (like Arthoniainconspicua and Pertusariatetrathalmia) and foliose lichens (like Dirinariaapplanata and Parmotremasubarnoldii) have a flat, crust-like appearance, whereas fruticose lichens have a shrubby, branching appearance (e.g. Ramalinaconduplicans, Usneapectinata). There are several other types of lichen growth, including the leprose, powdery lichens (like Leprariacoriensis), the squamulose, lichens with small scale-like structures that lack lower cortex (like Normandina sp.), the placonoid, lichens that are closely attached to the substratum at the center and lobate or free at the margin (like Phyllopsoracorallina), and the dimorphic,

Microlichens include crustose, leprose, placodioid, and squamulose lichens, which are smaller and require microscopic studies for identification. Macrolichens, on the other hand, include foliose, dimorphic, and fruticose lichens, which are comparatively larger and can be identified with a hand lens or stereo zoom microscope.

Corticolous lichens are those that thrive on the bark and trunks of trees; saxicolous lichens are those that thrive on rocks; muscicolous lichens are those that thrive on moss; terricolous lichens are those that thrive in soil; foliicolous lichens are those that thrive on leaves; and omnicolous lichens are those that thrive on everything (growing on more than one substratum).

Diversity and ecological realm of lichens

Lichens are the first terrestrial organisms to colonize new environments after a global disaster. Primary succession begins with lichens because they thrive in the extreme circumstances of the lithosere and other settings with low precipitation, high UV radiation, and great temperature swings. Lichens break down rocks and create soil by secreting organic acids, paving the way for the growth of subsequent plant life.As lichens do not have roots and do not needs to tap continuous reservoirs of water like higher plants do, they are capable of flourishing in a broad range of natural settings, from the coldest Arctic tundra to the hottest deserts and from the hardest rocky beaches to the most poisonous slag heaps. Lichens, however, are abundant in temperate and alpine regions and abundant in the tropics.

One of the strangest species, lichens has the capacity to live for thousands of years yet develop very slowly. The annual linear expansion might be negligible or it can be many millimeters. As lichens grow so slowly, their contribution to the ecosystems primary output is minimal. Lichens are also notable for being poikilohydric. Desiccation causes lichens to undergo a cryptobiosis, or metabolic suspension, when the symbiont cells are sufficiently dehydrated to cease most biochemical activity.A forest's lichens may only make up a small percentage of its total biomass, but they play a crucial role in the forest's ecosystem by regulating soil erosion and affecting the local climate.

Yet, a select group of fast-growing lichen species—particularly cyanolichens—can make a substantial contribution to forest nitrogen fixation (Slack, 1988) and mineral cycling patterns in the ecosystem, boosting biomass by as much as 20-40% annually. That's why lichens are so important; they boost the soil's nutrient levels, making them more accessible to other plants. As lichens are often long-lived creatures that are quite picky about their environment, they may be used to make year-round estimates of species richness and habitat potential.

Lichens as biomonitors of ambient air quality

As lichens have been shown to be very sensitive to air pollution, they are sometimes dubbed the "litmus for air pollution" and the "permanent control system" for determining the effects of air pollution. It is possible to determine the biological consequences of a pollutant by using changes at the community or population level, or by analyzing the trace elements content of lichens. Because they soak up anything that floats their way (like little sponges), lichens may be used to foretell pollution levels and assess the state of an ecosystem. This includes water, gases, and other chemicals in the air. Lichens have extremely high ion exchange capabilities, quite similar to those of ion exchange resin, which allows them to capture and store metals from the air. It has been shown that lichens may store up to three times their body weight in a variety of contaminants in their tissues.

Studying the presence/absence and dominance of a species or group of species in a given location may be used to infer whether or not the air quality in that area has changed as a result of air pollution or microclimatic changes. Because lichens are simple to evaluate, inexpensive, and the most effective indicator of air quality, their usage as a bio-monitoring tool has expanded dramatically in recent years.

Many researchers have looked at the effects of air pollution on lichens by measuring changes in things like net photosynthesis, chlorophyll degradation, chlorophyll content and spectral reflectance response, and trace element concentrations in lichen thalli. Lichens may be sampled and analyzed for their mineral content, which might be used to track the elements that are being deposited to the ground from the atmosphere.

The physiology and morphology of lichens, their growth rates, reproduction, and the makeup of lichen communities can all be negatively affected by even modest quantities of sulphur, nitrogen, and fluorine-containing pollution (particularly SO2, acidic or fertilizing substances). Chlorophyll breakdown, which causes bleaching of the thalli, is the most visible symptom of pollution harm to lichens. Environmental conditions, such as air pollution, can have a significant impact on lichen chlorophyll. Typically, the quantity of chlorophyll a, chlorophyll b, and total chlorophyll is inversely related to the concentration of sulphur dioxide (Le Blanc et al., 1974). The levels of nitrogen oxides (NO2) in an area have a significant effect on the fungi population there. NO2 in the air, often caused by traffic, can either reduce lichen variety or boost the growth of a few resistant lichen species.

CONCLUSION

Lichen diversity surveys have shown the Eastern Himalayas to be one of the world's richest lichen-rich regions. In addition to being a potential hotspot, the area provides a wide range of habitats and favorable environmental conditions for the flourishing development of lichens. In contrast, lichens from this region have been the subject of far less floristic and taxonomic research. According to the list, there are a total of 131 lichen species, spread throughout 47 genera and 22 families.An additional 71 species were discovered to add to Manipur's lichen flora, representing 32 genera and 19 families, while 20 species were reported for the first time from anywhere in North East India thanks to this study. Moreover, the study revealed the region's richness in both species and variety.

Reports of as many as 71 new species suggested that previous research had just scratched the surface, and that there are still more undiscovered parts of the state to be revealed. Hence, more detailed documentation and analysis of biodiversity requires a large-scale, in-depth research.The research locations have a diversified and rich species makeup, as evidenced by analyses of diversity, species richness, and species turnover. There was no total similarity or difference in the lichen species composition between the linked locations. This, in turn, suggests that the temperature, terrain, geology, dominant land use (roads or farm), habitable space fragmentation, and pollution levels vary considerably among the areas of research.

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