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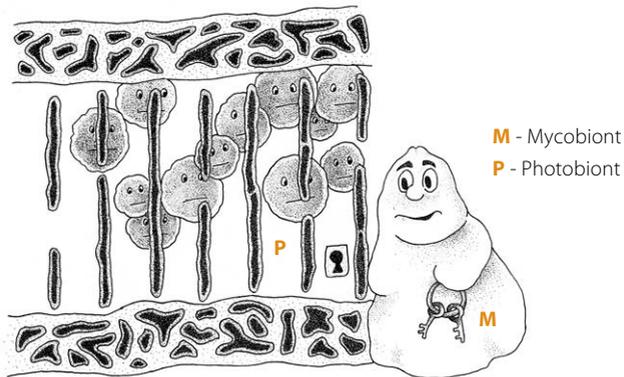


Heterodermia queensberryi

1. Lichens and Their Role

1.1 What is a Lichen?

Lichens are not a single organism, but a combination of two (or a few): a fungus and either an alga or a cyanobacterium. The fungus is called the **mycobiont**. The alga or cyanobacterium is known as the **photobiont**. The relationship between the mycobiont and photobiont is mutually beneficial and is termed as **symbiosis**. The mycobiont and some of the lichen forming photobionts do not or only rarely occur in a free-living state. They are **obligate symbionts**, meaning that symbionts depend on each other for survival. The fungus obtains food from the photobiont. The photobiont acquires additional sources of nutrients and a stable home within the lichen body (thallus), so it is protected from the vagaries of the environment.



Is the lichen thallus a controlled form of **parasitism** ?

Recent research has found that lichens have a diverse community of microbiological organisms inside them; namely, an assortment of bacteria and fungi that are different from the main symbiotic partners. The role of bacteria within the lichen requires extensive research to understand their functions.

The lichen symbiosis is a successful relationship which allows lichens to thrive in almost all terrestrial habitats. Lichens live on sunlight, air and water. They do not have roots, and thus do not absorb nutrients or water. This allows lichens to grow on a wide variety of substrates. Lichens are fully adapted to function as miniature ecosystems. Therefore, lichens are found from the tropics to the Polar Regions, in built-up areas and even in extreme environments where a separate mycobiont and photobiont would be rare or nonexistent. Lichens flourish on old paint, rusty metal, glass, plastic, old shoes, and on tops of vehicles that have been parked in the same place for years. In fact, some lichen individuals which continue to exist in the arctic regions are reported to be **over 3000 years old**.

Fungi are not plants, but organisms with an ancient lineage of their own, closer to animals than plants. Lichens have evolved from various groups of non-lichenized fungi at different times in the history of evolution. Therefore, diverse groups of lichens exist in nature.

Although lichens have a simple construction, they cannot be considered as primitive. According to their DNA sequence data, **lichens are older than dinosaurs** and would have first appeared about 300 to 250 million years ago during the **Permian** period on the single supercontinent **Pangaea**. These early lichen groups continue to exist today.

The **Permian** is a geologic period extended from 300 to 250 million years ago. It is the last period of the Paleozoic Era. At the time, the world was dominated by a single supercontinent known as **Pangaea**, surrounded by a global ocean called Panthalassa. The Permian Period (along with the Paleozoic Era) ended with the largest mass extinction in Earth's history, in which nearly 90% of marine species and 70% of terrestrial species died out.

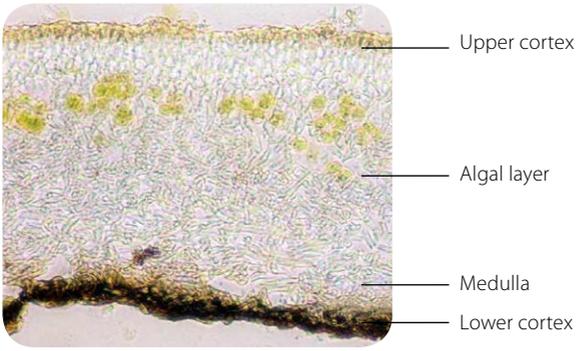
Lichen Structure

The body of the lichen is called the **thallus** and is composed of the cells of the mycobiont and the photobiont. The thallus of a lichen is treated as an individual.

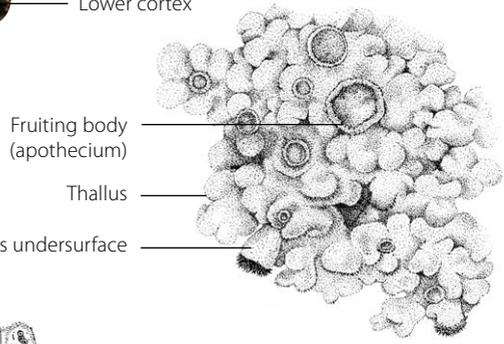
The mycobiont is mostly a member of the Ascomycota (cup fungi) and is typically the dominant partner. What a lichen looks like is strongly influenced by the photobiont. The resultant thallus is unlike either of the individual symbionts. Every lichen has its own unique thallus. The **taxonomic nomenclature (name of the lichen) is assigned on the basis of the fungus of the lichen**.

The main body of the lichen, the thallus, consists mainly of microscopic threads of fungus, known as hyphae. In most lichens, the algal or cyanobacterial cells lie among the hyphae, in a layer just beneath the surface. The thallus usually consists of several distinct layers in many lichens;

- 1. Upper Cortex** - outermost layer: composed of densely packed fungal cells; often brightly coloured, containing pigments that protect the thallus from radiation. The cortex forms a sort of skin on the lichen's surface.
- 2. Algal Layer** - concentration layer of photobiont cells, cells of algae and/or cyanobacteria.
- 3. Medulla** - loosely interwoven, thread like fungal cells (hyphae).
- 4. Lower cortex** - in some lichens root-like structures or rhizines, attach the thallus to the substrate.



Cross section of the lichen thallus
(Source: Indian lichens)



(Above) Diagrammatic representation of a lichen, (Left) with a section through the thallus and apothecium

