

The crop is susceptible to diseases like dry bubble (brown spots), wet bubbles (white mould), cobweb, green mould, bacterial blotch etc. So professional helps can be taken for this and for a successful mushroom cultivation.

Government of India and as well as the states are encouraging young entrepreneurs for mushroom cultivation and providing subsidies on loans, and technical know-hows for the purpose. India is now one of the leading mushroom export countries.

6.10. BIOLUMINESCENCE

Bioluminescence is the phenomenon of emission of visible light by living organisms. This phenomenon has been reported from the period of Aristotle (384-322 BC) and Pliny, the Elder (23-79 AD). The phenomenon is found to occur in distantly related organisms like insects, fishes, dino flagellates, bacteria and fungi.

Some of the fungi that mainly grow in temperate and tropical climates exhibit this phenomenon

and are known as bioluminescent fungi. Nearly 75 species of fungal members mostly of the order Agaricales and only one from the Ascomycetes (Xylariales order) show bioluminescence.

Bioluminescent fungi emit a greenish light at wave length 520-530 nm in continuous manner only from the living cells. It occurs in both mycelial structures and fruiting bodies. Some common fungal species showing bioluminescence are *Mycena haematophs*, *M. epipterygia*, *M. polygramma*, *Armillaria species* (Mycelia), *Dictyopanus foliicolus* (both mycelia and fruiting bodies) *Omphalotus species*, *Pleurotus decipiens*, *Xylaria hypoxylon* etc. Maximum number of species belonging to genus *Mycena* show bioluminescence.

The light emitted by the fungi is very faint and requires deep dark condition to be seen unlike the glow worm. However, in *Poromyceia manipularis* fruiting body, the light emission is bright and can be seen even at a distance of 40 metres.

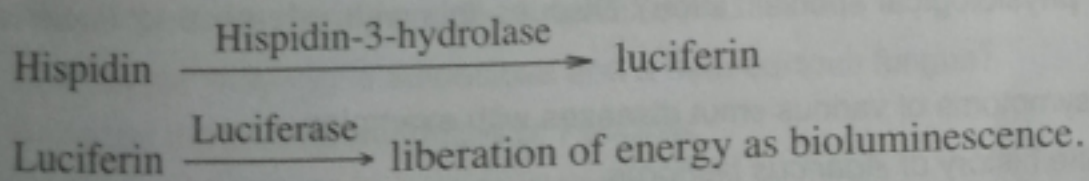
Mechanism of bioluminescence

Bioluminescence is an oxygen dependent reaction. A team of Russian and Japanese scientists has unraveled the chemistry of bioluminescence in fungi. According to them luminescence in many fungi, if not all, is based on the antioxidant **hispidin**. A hydrozylase enzyme converts the hispidin to a substance that glows when it is further oxidized by another enzyme.

At the end of 19th century F.R. Dubois found a substance in bioluminescent beetles and termed it as **luciferin** (light bringer). It requires another component to glow and this is known as **luciferase**. Today the glowing substance from bioluminescent organisms are known as luciferins and their corresponding enzymes are known as luciferases.

It remained unclear as to which luciferin/luciferase systems in fungi causes bioluminescence. A team of Russian scientists have unravelled the mystry.

According to them hispidin-3-hydrolase converts hispidin to the actual luciferin (3 hydroxylhispidin) by means of a hydroxylation reaction that involves NADPH. The second enzyme is the luciferase which catalyzes the oxidation of luciferin to produce luminescence.



Hispidin is thus a precursor of luciferin and has been isolated from bioluminescent fungi. This is a strong antioxidant with antidiabetic and antitumour effects.

All bioluminescent fungi share the same enzymatic mechanism which suggests that a bioluminescent pathway arose early in the evolution of mushroom forming Agraricales.

The bioluminescent Agaricales belong to four distinct evolutionary lineages—(i) The *Omphalotus* lineage containing 12 species (*Omphalotus*, *Neonothopanus*), (ii) *Armillaria* lineage containing 10 species, (iii) Mycenoid lineage containing more than 50 species (*Mycena*, *Peneallus*, *Prunulus*); (iv) *Lucentipes* lineage containing two species (*Mycenea lucentipes*, *Gerronema viridilucens*). *Armillaria mellea* is the most widely distributed luminescent fungus.

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Although the physiological and ecological significance of bioluminescence has not been known perfectly, however it is suggested that

- (i) the bioluminescent fruiting bodies attract insects, arthropods that may help in dispersal of spores.
- (ii) on the other hand it is suggested that the phenomenon prohibit the grazing.
- (iii) it is also viewed that bioluminescence may have evolved as a method to consume the oxygen produced in the cell of organisms during other metabolic processes.

Fortunately, these hypotheses are not all mutually exclusive. It is possible that bioluminescence may have arisen as a byproduct of a beneficial metabolic process and subsequently been coopted by a relatively small number of taxa for secondary use in attracting spore dispersal agents, or detritivores and fungivores.

Whatever role bioluminescence may play in the life of fungal species, in which it occurs, it is all means an intriguingly beautiful phenomenon to observe and study.