MYCOLOGY ANSWERS

MOULDS, MILDEWS AND OTHER FUNGI ARE OFTEN FOUND IN SHADED AND DARK SITUATIONS – IS THEIR DEVELOPMENT INFLUENCED BY LIGHT?

Several examples might persuade us that light has little influence on fungal development. For example, the old shoes stored in darkness under the stairs, perhaps put away slightly damp, become covered by fungal mycelium in an apparently short time; or fruiting bodies pushing up from under newly laid tarmac cannot receive any light as encouragement. However, some fungi do require light for particular stages of development although the situation varies between species and in addition, responses of individual mycelia may be moderated by environmental effects. Many observations have been made, in the field and under controlled laboratory conditions, although we are still a long way from fully understanding the biochemical and metabolic causes of the observed responses. It is certain, that light does affect spore germination, growth, development and reproduction.

The influence of light on the growth of individual hyphae (vegetative growth) is often limited but it has a great deal more effect on the development of reproductive structures and the formation of spores (sporulation). Both the quantity (intensity) and quality (wavelength) of light are important and may stimulate and/or inhibit fungal reproduction. Depending on the species the production of spores may be inhibited by some wavelengths but promoted by others. For example, reproduction may be stimulated by ultraviolet (220–320 nm) wavelengths in *Botrytis cinerea* and *Septoria nodorum*; by near uv/blue light (330–500nm) in *Trichoderma viride, Neurospora crassa* and *Saccharomyces cerevisiae*; and by red/far-red (550–675nm) wavelengths in *Saccharomyces carlsbergensis*.

Cycles of light and darkness can influence patterns of reproduction. This effect appears as alternating concentric rings of sporulating and vegetative mycelium across a colony and can sometimes be seen on the surface of infected fruits. As it grows, mycelium extends across and through the substrate but in the light the extension of surface hyphae is inhibited. Submerged hyphae receive less light and therefore continue to extend, eventually emerging from underneath the surface mycelium. The resulting hyphal zones have different capacities for reproduction and alternating rings of sporulating and vegetative mycelium are formed. Light effects such as these can be modified by the influence of environmental parameters, particularly changes in temperature, humidity, nutrient availability and oxygen levels. Flushes of fruit body formation, such as those which occur during the commercial production of mushrooms (*Agaricus bisporus*) are probably linked to the distribution of carbohydrates and other nutrients within the mycelium.

Some reproductive structures grow towards the light source (phototropism) and also away from gravity (negative geotropism). The overall effect of this ensures that developing spores are held above the surface of the substrate, from where dispersal can occur. When light falls unevenly on developing structures unequal growth results, which has the effect of orienting that structure symmetrically to the light source. Sporangiophores of *Phycomyces* are particularly responsive and grow vigorously towards the light. In elongating stipes of basidiomycetes (e.g. *Coprinus*) hyphae located on the darker side grow faster than those on the light side and so the whole stipe bends toward the light. Growth away from light (negative phototropism) has also been recorded, particularly in fungal pathogens of plants. It is important for hyphae of such species to reach a nutrient source (plant cells) as quickly as possible, and additionally, desiccation on a plant surface must be avoided.

The release of fungal spores from reproductive structures is commonly associated with light effects, in conjunction with changes in humidity, temperature and wind velocity. Stimulation of spore discharge may be influenced particularly by light of specific wavelengths (e.g. blue light encourages spore discharge in *Sordaria*).

The presence of photoreceptors (molecules that absorb light of particular wavelengths) has been reported in fungi and it has been suggested that since light effects occur over a wide range of wavelengths several photoreceptor molecules may operate. Photoreceptors (probably membrane bound flavoproteins) for near uv and blue light are the most common (mycochrome). Responses to these wavelengths include sporulation, development of fruiting structures, phototropic responses and inhibition of germination. The metabolic processes which ensue, following light absorption, are not clear but probably include a range of biochemical activities, such as changes in membranes (membrane potential), synthesis of specific proteins and pigment production.

Although many fungi favour growth in shaded situations it is clear that light has important influences on their development and reproduction.

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