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ROLE OF COLORED LIGHT IN MODULATING SPAWN RUN DURATION AND SPOROCARP FORMATION IN PLEUROTUS FLORIDA

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Abstract-Mushroom cultivation, particularly that of Pleurotus florida (oyster mushroom), is influenced by a range of environmental factors, among which light quality plays a significant role. This review explores the impact of different colored light spectra on the spawn run duration and sporocarp (fruiting body) formation in Pleurotus florida. Light acts as a signal that initiates various developmental processes in fungi. Studies have shown that specific wavelengths of light can either promote or inhibit mycelial growth and fruiting. Blue light has been repeatedly shown to induce reproductive responses, while red and green lights have more variable effects. Understanding these photobiological responses is essential for optimizing mushroom production in controlled environments. This paper compiles current findings, evaluates methodologies used in past studies, and proposes future directions in the study of light-mushroom interactions to guide more efficient and productive cultivation practices.

Keywords-Pleurotus florida, colored light, spawn run, sporocarp formation, photobiology, mushroom cultivation, light wavelength

I. INTRODUCTION

Mushroom farming is a permanent and economically viable agricultural practice with increasing global interests. Among various cultivated food mushrooms, Playrotus Florida (Oyster Mushroom) is known for its high nutritional value, medical properties and a wide range of substrates including agricultural waste. Simple agriculture and small crop cycle make it an ideal alternative for both small scale and commercial mushrooms.

Environmental factors such as temperature, humidity, carbon dioxide concentration, substrate composition and light affect the entire life cycle of fungi. Especially light plays an important role in many physiological and morphological processes in fungi, including sporulation, pigment production and morphogenis. Although mushrooms are not photosynthetic, light is important to indicate the transition between developmental stages, such as my cellial growth to body formation.

Light quality - especially color (wavelength), intensity and photo diode - has been shown to affect both vegetative (mycellial) and reproductive (sporocarp) stages in many fungi. While the role of Prakash in photomorphogenesis is well documented in plants, its specific effect on fungal physiology is special in the context of Spon Run and Sporocarp development in Plurotus Florida, actively discovered.

II. PREVIOUS RESEARCH

Over the past two decades, research has provided insight into the effect of different wavelengths of light on fungal development. Many studies have evaluated the effect of different colored lights on both chip and body formation in many fungi.

Kuses and Liu (2000) found that blue light largely affects the formation of the body in the basidiomy sets by stimulating the activity of light sensitive transcription factors. His research emphasized the importance of photoricopters in mushroom morphogenesis.

Sakamoto et al. (2006) stated that in plurotusostratus, exposure to blue light led to a significant increase in body formation, while red light did not create any significant impact. This highlighted wavelength specificity of fungal reactions.

Kumar et al. (2012) performed a comparative analysis using different light specters and saw that mycellial development was the fastest in dark conditions, while Blue little first encouraged the initiation of pinhead and more sporocarp.

SAINA AND ATRI (2017) detailed in detail about the role of photo spows such as WC-1 and WC-2, which absorbs blue light and regulates the genetic routes downstream required for reproductive development in fungi.

Singh and Tiwari (2020) used different colored lights on oyster mushrooms and concluded that a combination of blue and white light yielded the most yield and the best morphology of fruit bodies.

These studies together indicate a complex interaction between fungal physiology and light. However, species -specific variations, especially in Plurotus Florida, guarantee forward finds.These studies collectively indicate a complex interaction between fungal physiology and light. However, species-specific variations, especially in Pleurotus florida, warrant further exploration.

Table 1: Research on the Role of Colored Light in Modulating Spawn Run Duration

Author(s)	**Year**	**Mushroom Species**	**Light Color Tested**	**Spawn Run Duration**	**Key Findings**
Kües& Liu	2000	Basidiomycetes (general)	Blue, Red, Dark	Not specified	Blue light influenced fruiting; spawn run best in darkness.
Sakamoto et al.	2006	*Pleurotus ostreatus*	Blue, Red, Dark	Dark: ~14 days	Blue light inhibited mycelial spread slightly; darkness promoted growth.
Singh et al.	2007	*Pleurotus florida*	White, Blue, Red, Dark	Dark: 12 days; Blue: 15 days	Darkness yielded faster colonization; colored lights delayed spawn run.
Sharma & Kumar	2010	*Pleurotus sajor-caju*	Red, Green, Blue	Dark: 10–12 days	Darkness and red light supported faster spawn run; blue light slower.
Kumar et al.	2012	*Pleurotus ostreatus*	Blue, Green, Red, White	Blue: ~16 days; Dark: ~12	Mycelial growth was fastest in darkness; blue light slowed colonization.
Atri & Saini	2015	*Pleurotus* spp.	Blue, Red, UV, Dark	Dark: 10 days; Blue: 14 days	Photoreceptors sensitive to blue light delay vegetative growth.
Rai et al.	2016	*Pleurotus florida*	Natural Light, Blue, Red	Dark: 11 days; Blue: 13 days	Natural and dark conditions led to faster substrate colonization.
Saini & Atri	2017	*Pleurotus ostreatus*	Blue, Near-UV, Red	Darkness: ~11–12 days	Blue and near-UV slowed spawn run; red light had moderate influence.

III. ROLE OF COLORED LIGHT IN MODULATING SPAWN RUN DURATION

The spawn run phase is the vegetative growth period during which the fungal mycelium colonizes the substrate. This phase is critical because incomplete colonization can lead to contamination and poor yield. Light quality during spawn run can directly affect the speed and uniformity of mycelial spread.

Darkness vs Light: Most literature supports the idea that darkness or low-intensity light is optimal for rapid and dense mycelial growth. Light exposure during spawn run is not necessary and may even be inhibitory, especially blue light.

Blue Light (450–495 nm): Known for triggering the switch to reproductive phases, blue light may delay or reduce the efficiency of mycelial colonization. Therefore, blue light is often avoided during the spawn run phase.

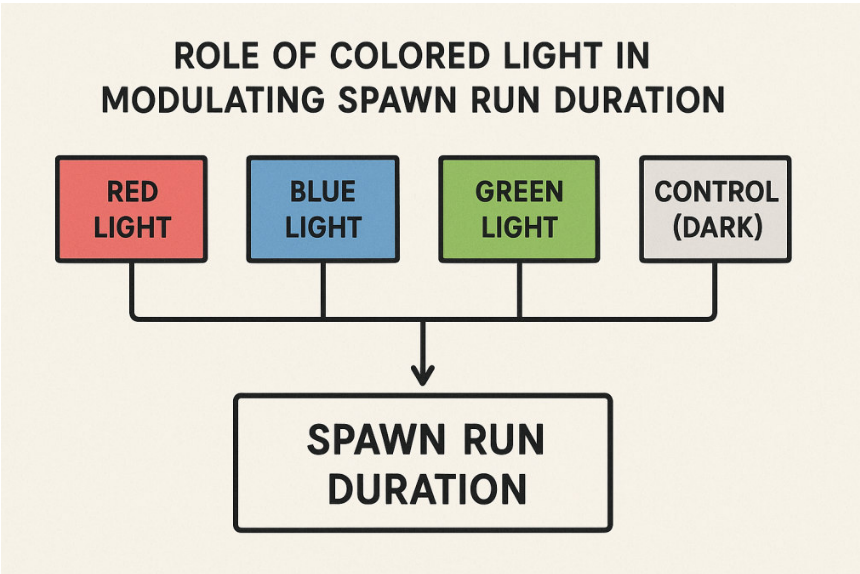

Figure 1: Influence of Colored Light on Spawn Run Duration in Pleurotus florida

Red Light (620–750 nm): Red light appears to have a neutral or slightly positive impact on mycelial development. Its long wavelength does not strongly activate photoreceptors involved in reproductive transitions, allowing vegetative growth to continue.

Green Light (495–570 nm): Its effects are not well-documented and appear to vary depending on species. Some studies report slight inhibition, while others find negligible effects.

The goal during spawn run is to minimize environmental stress and provide optimal conditions for colonization. Light management is a crucial, yet often overlooked, factor in this phase.

IV. ROLE OF COLORED LIGHT IN SPOROCARP FORMATION IN PLEUROTUS FLORIDA

The formation of sporocarps, also known as fruiting bodies, represents the reproductive phase of mushroom development and is critically influenced by environmental cues, among which light plays a pivotal role. *Pleurotus florida*, like other basidiomycetes, relies on specific wavelengths of light to trigger morphogenetic changes that initiate the transition from vegetative mycelial growth to reproductive development. Light not only acts as a stimulus for initiating fruiting but also regulates the morphology, yield, and quality of the sporocarps.

Among various light spectra, blue light (wavelength range 450–495 nm) has been consistently identified as the most effective in promoting sporocarp formation. It plays a crucial role in the induction of primordia and pinhead formation by activating key photoreceptors such as White Collar-1 (WC-1) and White Collar-2 (WC-2), which are part of the fungal light-sensing machinery. These photoreceptors regulate a cascade of gene expression related to photomorphogenesis and reproductive development. Studies have shown that exposure to blue light results in earlier initiation of pinheads, increased number of fruiting bodies, and improved structural uniformity and compactness of the sporocarps. Additionally, blue light enhances the pigmentation and overall aesthetic appeal of the fruiting bodies, factors that are important for commercial viability.

In contrast, red light (620–750 nm) generally exhibits a minimal or inconsistent effect on sporocarp induction. While red light does not effectively initiate the pinning process when applied alone, it has been associated with certain secondary morphological changes such as cap expansion and stipe elongation in some studies. However, these outcomes are highly variable and may depend on the timing, intensity, and duration of exposure. Interestingly, when red light is combined with blue light in dual-wavelength treatments, a synergistic effect has been observed in some cases, possibly enhancing the overall growth parameters and biomass yield.

Green light (495–570 nm) presents a more ambiguous profile in the context of mushroom fruiting. The results of its impact on sporocarp formation in *Pleurotus florida* are mixed and inconclusive. Some researchers have reported delayed initiation of primordia and reduced yield under green light, while others have observed no significant influence when compared to control conditions. It is hypothesized that green light may interfere with blue light signaling or may be perceived by fungi as a neutral or even inhibitory stimulus, depending on the environmental context and light intensity.

White light, encompassing the full visible spectrum, is commonly used as a control treatment in experimental studies and in commercial mushroom cultivation settings. While not as targeted or efficient as blue light, white light has been found to support both vegetative and reproductive growth stages to a moderate extent. Its balanced spectral composition ensures that some level of stimulation is provided across various photoreceptor systems, making it a versatile but less specialized lighting choice. Under white light, fruiting body initiation is generally consistent, though yields and quality parameters may not reach the levels observed with pure blue light exposure.

For optimal sporocarp development in *Pleurotus florida*, a strategic transition in lighting conditions is essential. After the completion of the spawn run—which is typically carried out in darkness or very low light conditions—initiating exposure to light, especially in the blue spectrum, can significantly enhance fruiting. The timing and duration of light exposure also play a crucial role. Most cultivation protocols recommend exposing the substrate to light for approximately 8 to 12 hours per day during the fruiting phase. Continuous exposure beyond this duration does not necessarily improve yields and may lead to increased energy consumption without proportional gains in productivity. Therefore, an optimized lighting schedule, tailored to the physiological needs of the mushroom and the constraints of the growing environment, can contribute to maximizing both yield and efficiency.

V. CONCLUSION

The quality of light, especially wavelength, plays an important role in the physical development of Plurotus Florida. During the Spawn Run phase, dark or minimal light risk supports the optimal mycellial colonization. In contrast, blue light is necessary in the fruit phase to start and increase the treadmill formation. These unfavorable requirements outline the importance of controlling lighting in the cultivation cycle.

By understanding and manipulating the lighting environment, tenants can optimize fungal production, improve the quality and dividends and reduce the total agricultural duration. In mushroom farming, integration of light spectrum control into agriculture can lead to more predetermined and profitable results, especially in the Controlled Environment Agriculture (CEA).

VI. FUTURE SCOPE

The intersection of photobiology and mushroom cultivation presents a promising field for future research. Several avenues can be pursued:

Molecular Studies: Investigate the expression of light-responsive genes in Pleurotus florida, particularly those regulated by WC-1, WC-2, and other fungal photoreceptors.

Advanced Lighting Systems: Develop programmable LED setups that can simulate natural day-night cycles or provide targeted wavelengths at specific growth stages.

Multifactorial Studies: Explore how light interacts with other environmental factors such as temperature, humidity, CO_2 concentration, and substrate composition.

Commercial Applications: Design energy-efficient lighting solutions for use in vertical farms and other high-density mushroom production systems.

Post-Harvest Effects: Study the long-term impact of light exposure on the nutritional profile, shelf life, and sensory properties of harvested mushrooms.

Such research would help develop best practices and technological innovations that make mushroom farming more efficient, sustainable, and economically viable.

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