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Influence of Temperature Regimes and Fungicide Compatibility on Mycelial Growth of Pink Oyster Mushroom (*Pleurotusdjamor*)

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Abstract

The present study investigated the impact of temperature regimes and fungicide compatibility on the growth of pink oyster mushroom (*Pleurotusdjamor*) at CoA, NAU, Waghai (2022–24). In vitro trials on Potato Dextrose Agar (PDA) revealed that the fungus thrives optimally between 25 °C and 30 °C, with maximum radial growth (87.25 mm) recorded at 30 °C. Among seven fungicides tested, Carbendazim 50 WP and Copper Oxychloride 50 WP exhibited the lowest growth inhibition (19.17% and 19.56%, respectively) at 50 ppm using the poisoned food technique. These results indicate that chemical sterilization of substrates using compatible fungicides at low concentrations is an effective method for managing competitor molds while ensuring optimal mycelial development. This study provides a practical, cost-effective alternative for tropical mushroom cultivation by optimizing environmental and chemical parameters.

Keywords:*Pleurotusdjamo*r, Pink Oyster Mushroom, Thermal optimization, Fungicide compatibility

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Introduction

Mushrooms are globally valued for their dual role as nutritional food and medicine, ranking high in protein and essential amino acids while remaining low in starch [1, 2]. As high-quality functional foods, they offer an ideal dietary alternative for mitigating protein deficiencies, particularly within vegetarian and calorie-restricted diets [3, 4]. Among these macrofungi, the pink oyster mushroom (*Pleurotusdjamor*) is a popular tropical species known for its vibrant fan-shaped caps and high content of vitamins B and C [5, 6]. Beyond its baseline health benefits—including potential antioxidant and antimicrobial properties—its cultivation promotes environmental sustainability by converting agricultural waste into nutrient-rich food [7, 8]. Recent studies indicate that *P. djamor* contains unique bioactive compounds such as specialized polysaccharides, phenolics, and terpenoids that exhibit distinct antidiabetic, anti-inflammatory, and selective anticancer activities against human tumor cell lines [9, 10].Despite its extensive pharmacological and nutritional benefits, successful cultivation of *P. djamor* requires precise environmental conditions and effective management of competitor molds [11]. In intensive commercial setups, pathogenic fungi such as *Trichoderma* spp. present a severe threat to yield stability, thriving in the warm, humid atmospheres necessary for oyster mushroom propagation [12, 13]. Originally classified in 1750 and later transferred to the *Pleurotus* genus in 1959 [14], this species thrives as a saprophyte on diverse lignocellulosic organic matter. Effective colonization relies on maximizing mycelial expansion rates while suppressing antagonistic microflora before spawn running finishes [15]. While traditional substrate preparation relies heavily on energy-intensive steam sterilization, finding viable, resource-efficient chemical alternatives remains a structural priority for global cultivators [16]. Consequently, the present study evaluates the optimal temperature regimes and fungicide compatibility to enhance the growth and development of *P. djamor*, providing a reliable chemical alternative to traditional substrate sterilization methods [17].

Experimental Material and Method

An active culture of *P. djamor* was obtained from the Directorate of Mushroom Research, Solan. Petri plates (9.0 cm) were cleaned with chromic acid, dried, and sterilized in a hot air oven at 160 °C for two hours[18].Temperature Studies: Using a CRD design with four repetitions, the fungus was inoculated onto 20 ml of Potato Dextrose Agar (PDA) using 5 mm mycelial discs. Inoculated plates were incubated at five temperature regimes (15, 20, 25, 30, and 35 °C) under 85% relative humidity.Radial growth was measured after seven days.Fungicide Compatibility: Using a

CRD design with three repetitions, The compatibility of seven fungicides (thiophanate methyl, carbendazim, carboxin + thiram, copper oxychloride, fosetyl AL, propineb, and tebuconazole) was evaluated at 50, 75, and 100 ppm using the poisoned food technique [19]. PDA was supplemented with the respective fungicides and incubated at 25 ± 2 °C. Percent growth inhibition was calculated using the formula:I = [(C - T) / C] × 100.The Potato Dextrose Agar (PDA) medium was prepared by boiling 200 g of sliced peeled potatoes in 1000 mL of distilled water, filtering the extract, and mixing it with 20 g of dextrose and 20 g of agar before autoclaving at 121 °C for 15 minutes. To prepare the fungicide stock solutions, a calculated amount of each commercial formulation was dissolved in sterile distilled water to achieve a 10,000 ppm concentrated standard baseline, which was then added to the molten PDA to achieve the final required concentrations of 50, 75, and 100 ppm. Data thus obtained was recorded for each treatment and repetition and analyzed by CRD design.

Results and Discussions

Thermal Optimization

The thermal profiling of *Pleurotusdjamor* showed that environmental temperature significantly influences vegetative growth (**Table 1**). The fungus preferred warmer regimes, achieving its maximum radial growth of 87.25 mm at 30 °C (T_4), followed by 79.50 mm at 25 °C (T_3). Conversely, growth was severely restricted at extreme limits, dropping to 22.50 mm at 15 °C (T_1) and 34.50 mm at 35 °C (T_5).

Table 1 Effect of temperature on *P. djamor* radial growth

Treatment	Temperature	Radial growth (mm)
T_1	15°C	22.50
T_2	20°C	36.00
T_3	25°C	79.50
T_4	30°C	87.25
T_5	35°C	34.50
S.Em. ±		0.79
C.D. at 5%		2.39
C.V. %		3.05

These results confirm that while *P. djamor* remains viable between 15–35 °C, it grows fastest in the 24–30 °C range [20]. The growth decline at 35 °C stems from enzyme denaturation and cell membrane stress [21], while the slowdown at 15 °C is due to reduced metabolic activity [22]. Unlike temperate *Pleurotus* species that prefer 25 °C [23], *P. djamor* is specifically adapted to tropical climates. This heat tolerance makes it highly suitable for commercial cultivation in warm regions without the need for costly artificial cooling [24].

Table 2 Fungicide Compatibility with *P. djamor* Growth

Treatment	Fungicide	Radial growth (mm)			Growth inhibition (%)		
		50 ppm	75 ppm	100 ppm	50 ppm	75 ppm	100 ppm
$T_{1,2,3}$	Thiophanate methyl 70 % WP	65.33	46.67	26.67	26.32	47.37	69.92
$T_{4,5,6}$	Carbendazim 50 % WP	71.67	55.67	33.67	19.17	37.22	62.03
$T_{7,8,9}$	Carboxin 37.5% + Thiram 37.5% DS	55.33	40.00	17.33	37.60	54.89	80.46
$T_{10,11,12}$	Copper Oxychloride 50 % WP	71.33	52.67	30.67	19.56	40.60	65.41
$T_{13,14,15}$	Fosetyl Al 80 % WP	59.67	40.00	23.00	32.71	54.89	74.06
$T_{16,17,18}$	Propineb 70 % WP	49.67	38.67	18.00	43.98	56.39	79.70
$T_{19,20,21}$	Tebuconazole 25.9 % EC	63.00	43.67	23.67	28.95	50.75	73.31
T_{22}	Control (No Treatment)	88.67			-		
S.Em. ±		1.13					
C.D. at 5%		3.23					
C.V. %		4.25					

Fungicide Compatibility

The in vitro compatibility screening of various fungicides with *Pleurotusdjamor* demonstrated statistically significant variations in radial growth and inhibition metrics across all concentrations (**Table 2**). Carbendazim 50% WP (T_4–T_6)

and Copper Oxychloride 50% WP (T_{10}–T_{12}) exhibited exceptional compatibility with the mushroom mycelium. At 50 ppm, Carbendazim 50% WP and Copper Oxychloride 50% WP allowed the highest radial expansion of 71.67 mm and 71.33 mm, respectively, translating to the lowest inhibition rates of 19.17% and 19.56% compared to the untreated control (88.67 mm). Conversely, the combination of Carboxin 37.5% + Thiram 37.5% DS (T_7–T_9) and Propineb 70% WP (T_{16}–T_{18}) showed poor compatibility, suppressing growth to 17.33 mm and 18.00 mm at 100 ppm, resulting in high inhibition levels of 80.46% and 79.70%.

The high vegetative tolerance observed with Carbendazim 50% WP and Copper Oxychloride 50% WP highlights their excellent potential for integrated disease management, as they can suppress competing weed molds without harming the *P. djamor* crop [25]. The superb compatibility of Carbendazim suggests that this tropical mushroom possesses an inherent physiological tolerance or enzymatic mechanism to detoxify benzimidazole compounds during vegetative growth [26]. Similarly, the high growth rates sustained under Copper Oxychloride exposure indicate that *P. djamor* can withstand copper-based contact formulations at lower thresholds [27]. In contrast, the severe toxicity caused by the Carboxin + Thiram mixture reflects a strong, multi-site disruption of the mushroom's respiratory chain, making it unsuitable for cultivation use [28]. Because all treatments showed a clear dose-dependent response, utilizing highly compatible fungicides like Carbendazim or Copper Oxychloride at lower concentrations (50 ppm) provides an ideal chemical strategy to protect production substrates while ensuring unhindered mushroom development [29].

Conclusion

The study concludes that 30 °C is the optimal temperature for the growth of *P. djamor*. Carbendazim 50 WP and Copper Oxychloride 50 WP at 50 ppm are the most compatible fungicides, making them ideal candidates for the chemical sterilization of substrates.

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