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**OPTIMUM CONDITIONS FOR MYCELIA GROWTH AND BASIDIOCARP  
PRODUCTION OF *Pleurotus djamor* ON CORN BASED MEDIA**

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**ABSTRACT**

*Pleurotus djamor* is a new introduced species of mushroom in the Philippines. This paper demonstrated the utilization of corn based media for efficient mycelial growth and corn based substrate on the fruiting body production of this mushroom. The maximum mycelial growth was observed in both sweet corn grit decoction sucrose gelatin and yellow corn sucrose gelatin, with pH of 8.0 incubated in sealed or unsealed; light or dark condition at room temperature (29°C). Moreover, sweet corn and yellow corn can be used as grain spawning materials. Among the different substrate formulations evaluated in fruiting body production, 75% corn stalk and leaves + 25% sawdust registered the shortest incubation period and number of days to primordial initiation. The longest incubation period and period to primordial initiation were recorded in 25% corn stalks and leaves + 75% sawdust. Among corn based formulation, 100% corn stalks and leaves produced the highest yield and biological efficiency but significantly comparable to 75% corn stalks and leaves + 25% sawdust. However, 70% rice straw + 30% sawdust (control) exhibited the highest diameter of pileus, length of stipe, weight of fruiting bodies and biological efficiency.

**Keywords: corn stalks and leaves; pink oyster mushroom; biomass; corn grit sucrose gulaman**

## INTRODUCTION

Mushrooms are becoming popular culinary ingredients among Filipinos. Mushrooms are considered as both nutraceutical and functional food. The fruiting bodies of mushrooms are rich in protein, crude fiber and ash but low in fat [1, 2]. Mushroom production in the Philippines is a lucrative business undertaking due to the favorable climatic conditions, available manpower resources and abundant supply of biomass that can be used as substrates. The paddy straw mushroom (*Volvariella volvacea*) and oyster mushroom (*Pleurotus florida*) are the most widely cultivated species of mushroom in the country.

*Pleurotus djamor*, also known as pink oyster mushroom, is a newly introduced exotic species in the Philippines. Most Filipinos are fascinated by its pink color and prolific growth on rice straw based substrate formulations. This mushroom can grow on various lignocellulosic wastes materials due to its ability to secrete enzymes such as cellulase, hemicellulase, xylanase, lignin peroxidase and laccase [3]. *P. djamor* exhibits both nutraceutical and medicinal attributes. It contains ergosterol, triacylglycerols, fatty acid methyl esters which have been reported to exhibit anti-tumor and antioxidant properties [4].

Moreover, Dulay et al. [5] revealed that the extract possess radical scavenging activity and antibacterial property against *Staphylococcus aureus*.

Corn (*Zea mays*) is second to rice as the most important crop in the Philippines, with one-third of Filipino farmers, or 1.8 million, depending on maize as their major source of livelihood [6]. During corn production, large amount of agricultural biomass are produced such as corn husks, corn cobs, stalks and leaves. Usually, these materials are left in the field to decompose; some are used as animal feeds while majority are burned in the field.

Herein, we evaluated the possibility of using corn based media for mycelial growth and corn stalks and leaves for basidiocarp production of *P. djamor*.

## MATERIALS AND METHODS

### Source of Pure Culture

Pure culture of *P. djamor* was obtained from the germplasm collection of Center for Tropical Mushroom Research and Development (CTMRD) of the Department of Biological Sciences, College of Arts and Sciences, Central Luzon State University, Science City of Munoz, Nueva Ecija, Philippines. The culture was revived by aseptically transferring approximately 10 mm

mycelial disc into sterile potato dextrose agar (Hi media) plate.

### **Preparation of Corn Grit Decoction Gelatin**

Corn grit decoction gelatin (CDSG) using three varieties of corn namely: sweet corn (SCDSG), glutinous corn (GCDSG) and yellow corn (YCDSG) were used in the preparation of culture media for the *P. djamor*. Fifty grams corn grit was boiled in 1 L of distilled until tender. Then, the decoction was strained to remove cooked con grit and reconstituted to 1 L by adding distilled water. Ten grams of sucrose and 20 g of white gelatin bar were dissolved and mixed over low flame until the mixture is homogenous. The prepared media were sterilized in an autoclave at 121°C, 15 pounds per square inch for 30 minutes.

### **Influence of Corn Based Media on Mycelial Growth**

To determine the influence of corn based media on mycelial growth of *P. djamor*, approximately 10 mm mycelial disc of seven day old pure culture of *P. djamor* was aseptically inoculated to the center of sterile corn grit sucrose gelatin plates. The inoculated plates were sealed with parafilm and incubated in alternating light and dark condition at room temperature. The mycelial growth was measured using vernier caliper.

The incubation period was noted and mycelial density was determined qualitatively using the following scale: + (very thin (++) thin, (+++) thick and (++++)) very thick.

### **Evaluation of Physical Conditions**

The influence of physical conditions such as pH, aeration, illumination and temperature on the mycelial growth was evaluated following the protocol described by Dulay et al. (2012) with minor modifications. Sweet corn grit decoction sucrose gelatin, the best culture medium based on the results of the previous experiment, was used as assay medium. The initial pH of the medium was adjusted to varying levels namely: 5.5, 6.0, 6.5, 7.0, 7.5 and 8.0 using 0.1 M HCl or 0.1 M NaOH. Each plate with varying pH levels was inoculated with 10 mm mycelial disc of one week old culture of *P. djamor*. The best medium and pH were used in the determination of the influence of aeration on mycelial growth. In this experiment two aeration conditions were evaluated: sealed and unsealed conditions. In the sealed condition the plates were wrapped with parafilm to prevent the entrance of air while in the unsealed condition the plates were not wrapped with parafilm. The petri plates were incubated at room temperature. The best medium, pH and aeration were used in the

evaluation of the effect of light on mycelial growth. The plates were incubated in dark and lighted condition at room temperature. Finally, the optimum medium, pH, aeration and light conditions were used in determining the influence of temperature on mycelial growth of *P. djamor*. The culture plates were separately incubated at room temperature, air condition temperature and refrigeration temperature. The mycelial diameter, mycelial density and incubation period were determined.

#### **Evaluation of Corn Seeds as Mother Spawn**

Five hundred grams of corn seeds was boiled in a liter of water until tender. The moisture content was adjusted to approximately 65%. Forty grams of corn seeds was dispensed in a petri dish and then autoclaved at 121°C on 15 pounds per square inch for 30 minutes. After sterilization the plates were allowed to cool down. A 10 mm mycelial disc of the pure culture of the *P. djamor* was inoculated to the center of the plates. The mycelial diameter was measured using vernier caliper and the incubation period and mycelial density were determined.

#### **Fruiting Body Production of *Pleurotus djamor* on Different Corn stalks- Sawdust Substrate Formulations**

Dried corn stalks and leaves were collected from the corn field and cut into smaller pieces using the multi-purpose shredder machine. The shredded materials were soaked in water in a tank for 3 days. To remove the undesirable odor, the soaked corn stalks and leaves were washed continuously with tap water and then transferred to the composting area. The substrates were piled and covered with plastic to create an aerobic condition and to ensure the growth of natural decomposers. The piled corn stalks and leaves were turned every day until they became pliable and turn into dark brown. The substrates were prepared by adding shredded corn stalks and leaves with sawdust using the following proportions: (T1) 100% corn stalks and leaves; (T2) 75% corn stalks and leaves + 25% sawdust; (T3) 50% corn stalks and leaves + 50% sawdust; (T4) 25% corn stalks and leaves + 25% sawdust; (T5) 100% sawdust; (T6) 70% rice straw + 30% sawdust (control). Five hundred grams of the formulated substrates were placed and compacted in a 6 x 12 inches polypropylene bag with cut PVC pipe, plugged with cotton and sealed with a rubber band. The fruiting bags were sterilized in an autoclave at 121°C in 15 psi for 60 minutes. The sterilized bags were allowed to cool before inoculation of the grain spawn. After cooling, 40 g of grain

spawn of *P. djamor* was inoculated into each fruiting bag and incubated at room temperature to allow spawn run. Matured fruiting bags were transferred to the growing house and opened at one end to allow the growth of the fruiting bodies. The fruiting bags were watered three times a day using a sprinkler. The incubation period, number of day to primordial initiation, weight of fruiting bodies, and the percentage biological efficiency were determined.

### Statistical Analysis

The experiment was laid in a completely randomized design. All treatments were replicated three times. The data were analysed using analysis of variance. The means were compared using least significant difference at 5% level of significance. SAS program version 9.1 was used in statistical analysis of the data.

## RESULTS AND DISCUSSION

### Evaluation of Corn Based Media

The culture medium is important because it supplies necessary nutrients for the growth of mushroom mycelium [7]. The ideal culture medium contains all the necessary nutrients needed by the organism for its normal growth and development. The rapidity of mycelial growth of mushroom depends on the appropriate culture medium [8]. In this study, the possibility of using corn grit based

culture medium in cultivating *P. djamor* was evaluated. Three commonly available varieties of corn namely: sweet corn, glutinous corn and yellow corn were used in the formulation of culture medium. Potato dextrose agar, a semi-synthetic dehydrated medium was used as the control. Table 1 and Figure 1 show the mycelial growth, incubation period and mycelial density of *P. djamor* on different culture media. Results showed that glutinous corn grit decoction sucrose gelatin and yellow corn grit decoction sucrose gelatin exhibited significantly faster mycelial growth rate and shorter incubation period. Potato dextrose agar recorded significantly lower mycelial growth and longer incubation period. In terms of mycelial density, all the corn based media recorded thick mycelial density while potato dextrose agar showed very thick mycelial density. The results of the present study indicated that corn based culture media, specifically glutinous corn and yellow corn varieties can be used as alternative to the semi-synthetic medium. This could be attributed to the nutrient composition of corn. Enyisi et al. [9] found that maize and maize products contain 1.10-2.95% ash, 4.50-9.87% protein, 2.17-4.43% fat, 2.10-26.70% fiber, 44.60-69.60% carbohydrate and minerals such as phosphorus, magnesium, potassium,

zinc, calcium, copper, sodium, manganese and iron. The result of the present study is in agreement with the findings of Tolentino et al. [10] who reported that corn based culture medium is suitable for the mycelial growth of *Pleurotus sajor caju*, *Pleurotus florida*, and

*Pleurotus ostreatus*. Arif et al. [11] observed that yellow corn agar can be used for the culture establishment of shiitake mushroom. Moreover, Luangharna et al. [12] successfully cultivated *Laetiporus sulphureus sensu lato* in corn meal agar.

**Table 1: Mycelial growth rate, incubation period and mycelial density of *Pleurotus djamor* on different culture media**

Corn Based Media	Mycelial Growth (mm/day)	Incubation Period (day)	Mycelial Density
Sweet Corn Grit Decoction Sucrose Gelatin	15.00 <sup>b</sup>	6.00 <sup>c</sup>	+++
Glutinous Corn Grit Decoction Sucrose Gelatin	18.00 <sup>a</sup>	5.00 <sup>b</sup>	+++
Yellow Corn Grit Decoction Sucrose Gelatin	18.00 <sup>a</sup>	5.00 <sup>b</sup>	+++
Potato Dextrose Agar (Control)	10.42 <sup>c</sup>	8.67 <sup>a</sup>	++++

Means with the same superscript are not significantly different from each other at 5% level of significance. The mycelial density was evaluated based on: very thin (+), thin (++) , thick (+++), very thick (++++).

**Table 2: Mycelial growth rate, incubation period and mycelial density of *Pleurotus djamor* at different pH levels**

pH of the Medium	Mycelial Growth (mm/day)	Incubation Period (day)	Mycelial Density
5.5	11.25 <sup>c</sup>	8.00 <sup>a</sup>	+++
6.0	13.57 <sup>ab</sup>	6.67 <sup>bc</sup>	+++
6.5	13.57 <sup>ab</sup>	6.67 <sup>bc</sup>	+++
7.0	12.86 <sup>b</sup>	7.00 <sup>b</sup>	+++
7.5	13.57 <sup>ab</sup>	6.67 <sup>bc</sup>	+++
8.0	15.00 <sup>a</sup>	6.00 <sup>c</sup>	+++

Means with the same superscript are not significantly different from each other at 5% level of significance. The mycelial density was evaluated based on: very thin (+), thin (++) , thick (+++), very thick (++++).

**Table 3: Mycelial growth rate, incubation period and mycelial density of *Pleurotus djamor* as affected by aeration (sealed and unsealed), illumination (lighted and dark), and temperature (29°C, 22°C, and 10°C) conditions**

Physical Factors	Mycelial Growth (mm/day)	Incubation Period (day)	Mycelial Density
Sealed	12.86 <sup>a</sup>	7.00 <sup>a</sup>	+++
Unsealed	12.86 <sup>a</sup>	7.00 <sup>a</sup>	+++
Lighted Condition	12.86 <sup>a</sup>	7.00 <sup>a</sup>	+++
Dark Condition	12.86 <sup>a</sup>	7.00 <sup>a</sup>	+++
Room Temperature ( 29°C )	12.86 <sup>a</sup>	7.00 <sup>b</sup>	+++
Air Condition ( 22°C )	11.25 <sup>b</sup>	8.00 <sup>a</sup>	+++
Refrigerator ( 10°C )	0.00 <sup>c</sup>	---	---

In each physical factor, means with the same superscript are not significantly different from each other at 5% level of significance. The mycelial density was evaluated based on: very thin (+), thin (++) , thick (+++), very thick (++++).

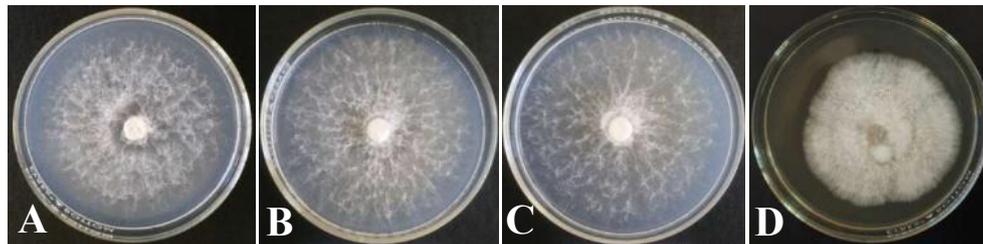


Figure 1: Mycelial growth of *Pleurotus djamor* on the different culture media: (A) sweet corn grit decoction sucrose gelatin; (B) glutinous corn grit decoction sucrose gelatin; (C) yellow corn grit decoction sucrose gelatin; and (D) potato dextrose agar

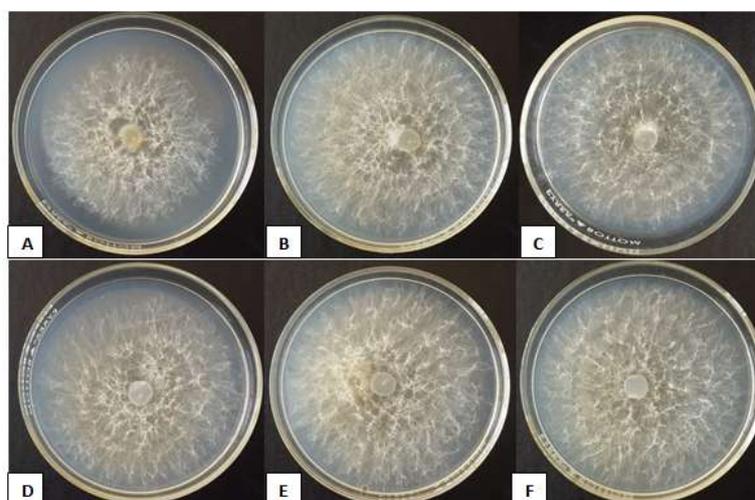


Figure 2: Mycelial growth of *P. djamor* on glutinous corn grit decoction sucrose gelatine at different pH levels: (A) 5.5; (B) 6.0; (C) 6.5; (D) 7.0; (E) 7.5; and (F) 8.0.

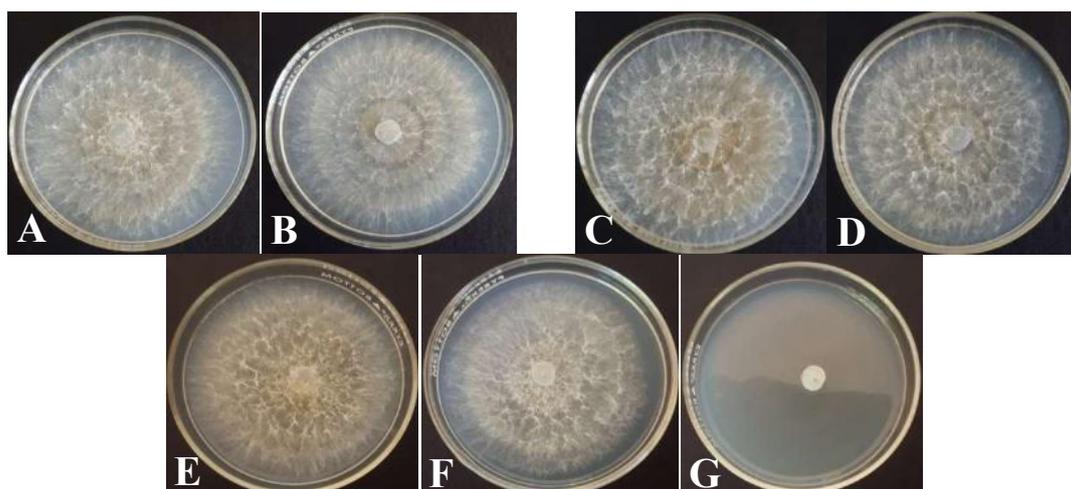


Figure 3: Culture plates of *Pleurotus djamor* as affected by aeration [(A) sealed and (B) unsealed], illumination [(C) lighted and (D) dark], and temperature [(E) 29°C, (F) 22°C, and (G) 10°C] conditions.

### pH of the Medium

The initial pH of the growing medium is an important parameter to be considered in culturing mushroom. Generally, mushrooms require specific range of pH for optimum mycelial growth and proliferation. To determine the optimum pH requirement of *P. djamor*, the initial pH of the medium was adjusted to different pH ranging from 5.5 to 8.0 with an interval of 0.5. The mycelial growth response of *P. djamor* to varying levels of pH is presented in Table 2. Among the different pH levels evaluated, pH 8 recorded significantly faster mycelial growth and shorter incubation period which is comparable to pH 7.5, 6.5 and 6.0. On the other hand pH 5.5 exhibited the lowest mycelial growth and longest incubation period. Moreover, thick mycelial density was observed in all pH levels (Figure 2). Based on the data collected, *P. djamor* prefers slightly acidic and slightly alkaline medium. The result of the present study is not in agreement with the Ahmad et al. [7] who observed the best mycelial growth of *P. djamor* in slightly acidic medium (pH 6.5). Imtiaj et al. [13] disclosed that mushrooms have a broad pH range of 5 to 9 for their mycelial growth but the most favorable pH was between pH 6 and 7. Belletini et al. [14] disclosed that each mushroom has its optimal

pH range for development. For instance Klomklung et al. [15] reported that the optimum pH range for mycelial of *Lentinus connatus*, *Lentinus roseus*, and *Pleurotus giganteus* was 5 to 7. Peksen et al. [16] reported that pH 5 to 6.5 is the most suitable pH for mycelial growth of *Hydnum repandum*. Finally, the maximum mycelial growth of *Lentinula edodes* was observed at neutral pH to slightly acidic [11].

### Aeration

Oxygen and carbon dioxide are important gases for the growth of fungi. Most fungi are obligate aerobes, but many will also grow in reduced levels of oxygen [1]. The influence of aeration on the mycelial growth of *P. djamor* was evaluated by growing the mycelia in sealed and unsealed petri plates. Table 3 presents the mycelial growth rate, incubation period and mycelial density in sealed and unsealed petri plates. Results showed no significant difference in mycelial growth performance on the two aeration conditions. Similar mycelial growth and incubation period were observed in the two conditions. Thick mycelial density was observed in both aeration conditions (Figure 3). This finding indicated that aeration did not influence the mycelial growth rate of this mushroom species. The result of the present study is in agreement with De Leon et al.

[17] who obtained no significant difference in mycelial growth rate of *Lentinus sajor caju* in aerated and unaerated conditions. However, it does not conform to the findings of Tolentino et al. [18] who disclosed that *Pleurotus sajor caju*, *Pleurotus pulmonarius* and *Pleurotus florida* cultured on sealed condition produced larger mycelial diameter than the unsealed condition. Moreover, Park et al. [19] found out that aeration rate was an important factor for exo-biopolymer production controlling the growth of *Cordyceps militaris* in a more compact pelleted form. Maddau et al. [20] demonstrated the important role of CO<sub>2</sub> and of O<sub>2</sub> on mycelium development and productivity of *Pleurotus eryngii*. They found that in order to reduce the incubation period and to achieve complete substrate colonization, frequent gas exchange between compost and the environment is recommended to ensure a continuous and adequate oxygen rate.

### **Illumination**

Khan and Chandra [21] reported that light positively affects both aggregation of hyphae and maturation of the fruiting body. Photoperiod is not necessary to induce the primordial formation but it is needed for fruiting body production [14]. Light exerts a significant impact on the growth and

development processes of carpophores of mushrooms from the *Pleurotus* genus [22]. There are species that develop in the dark while others in partial light [14]. In this study, the influence of light on mycelial growth was evaluated by separately incubating the culture plates in lighted and dark conditions. Table 3 also shows the mycelial growth, incubation period and mycelial density of *P. djamor* in the two illumination conditions. No difference in the mycelial growth response was obtained which indicated that the mycelial growth is not affected by light. The result of the present study conforms to the observation of De Leon et al. [23] that illumination conditions have no effect on mycelial growth of *Lentinus sajor caju*. However, Khandakar et al. [24] disclosed that the highest mycelial growth of *Grifola frondosa* was obtained in the absence of light. On the other hand, Rout et al. [25] reported that 200 lux light produced significantly highest linear mycelial growth of ten species of oyster mushrooms. Finally, Kuforiji and Fasidi [26] disclosed that light is important for sporophore formation of *Pleurotus tuberregium*.

### **Temperature**

Fungi can be classified based on their temperature requirement. Different species of

mushrooms have specific temperature requirement for optimum mycelial growth. The influence of temperature for the mycelial growth of *P. djamor* was assessed by incubating the cultures in three temperature conditions such as room temperature (29°C), air conditioned temperature (22°C) and refrigerated condition (10°C). The mycelial growth, incubation period and mycelial density are presented in Table 3 and Figure 3. Among the three temperature conditions, room temperature registered faster mycelial growth and shortest incubation period with means of 12.86 mm/day and 7 days, respectively. It is interesting to note that no growth was obtained in refrigerated condition. Statistical analysis revealed significant influence of temperature on mycelia growth of *P. djamor*. The absence of growth in the refrigeration temperature implied that low temperature can retard/inhibit the mycelial growth of mushrooms. This finding is in conformity with Khandakar et al. [24] who reported the significant effect of temperature on mycelial growth of *Grifolia frondosa*. Rout et al. [25] reported that mycelial the growth of ten species of *Pleurotus* was reduced drastically beyond 30°C and completely inhibited at a temperature of 40°C while at 10°C the growth declined drastically. Hoa and Wang

[27] reported that the optimum temperature for mycelial growth of in *Pluerotus ostreatus* and *Pleurotus cytidiosus* was found to be 28°C.

#### **Assessment of Corn Seeds as Spawn for Mother Culture of *Pleurotus djamor***

Spawn is pure culture of mycelium growing on a solid substrate such as cereal grain [28]. Grains rich in protein and carbohydrate are usually prepared as media to produce spawn of edible mushrooms [27]. At present, different grain spawning materials such as sorghum, barley, corn, wheat, unmilled rice, etc are used as grain spawning materials in mushroom production. In this study, three varieties of corn were used as grain spawning materials. Unmilled rice, which is commonly used as spawning material in the Philippines, was used as the control. The mycelial growth response of *P. djamor* in different varieties of corn is presented in Table 4. Among the different varieties of corn evaluated, sweet corn registered faster mycelial growth and shorter incubation period which are comparable to yellow corn and unmilled rice (control). Glutinous corn exhibited slower mycelial growth and longer incubation period. Moreover, sweet corn and glutinous corn produced thick mycelial density while the yellow corn showed thin mycelial density (Figure 4). Statistical analysis revealed

significant influence of corn variety on mycelial growth. Sweet corn and yellow corn are most suitable spawning material which is comparable to unmilled rice. The difference could be due to the difference in the nutrient content of the different varieties of corn used. This finding is in concurrence with the report of Stanley [29] who disclosed that white maize (Bende Local) was found to be most favorable to mycelial extension and mycelial fresh weight of *Pleurotus tuber-regium* and *Pleurotus pulmonarius*. Elhami and Ansari

[30] reported maximum mycelial growth rate of *Pleurotus florida* and *Pleurotus ostreatus* in corn. Moreover, Sofi et al. [31] found maximum mycelial growth of *Pleurotus ostreatus* in corn. They explained that the faster mycelial growth rate in corn could be due to large surface area and pore of the substrate. However, Hoa and Wang [27] stated that brown rice was the most favorable to the mycelium growth of mushroom *Pleurotus ostreatus* and *Pleurotus cystidiosus*.

**Table 4: Mycelial growth rate, incubation period and mycelial density of *Pleurotus djamor* on different grain spawn materials.**

Grain Spawn	Mycelial Growth (mm/day)	Incubation Period (day)	Mycelial Density
Sweet Corn	11.25 <sup>a</sup>	8.00 <sup>b</sup>	+++
Glutinous Corn	10.00 <sup>b</sup>	9.00 <sup>a</sup>	+++
Yellow Corn	10.83 <sup>a</sup>	8.33 <sup>b</sup>	++
Unmilled Rice (Control)	11.25 <sup>a</sup>	8.00 <sup>b</sup>	++++

Means with the same superscript are not significantly different from each other at 5% level of significance. The mycelial density was evaluated based on: very thin (+), thin (++), thick (+++), very thick (++++).

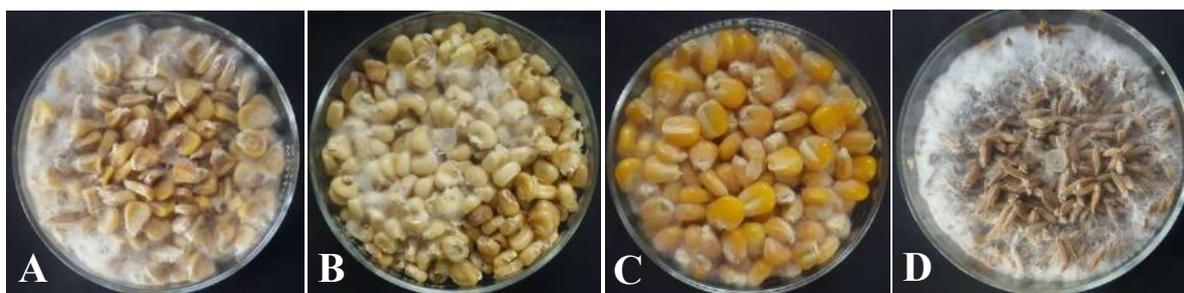


Figure 4: Mycelial growth of *P. djamor* on (A) sweet corn, (B) glutinous corn, (C) yellow corn, and (D) unmilled rice.

### Fruiting Body Production of *P. djamor* on Corn Based Substrate Formulations

In this study, corn stalks and leaves were mixed with sawdust in varying proportions. The fruiting body performance of *P. djamor*

on different substrate formulations was assessed.

### Incubation Period

The incubation period refers to mycelial running of the substrate from inoculation to

full ramification. The incubation period of *P. djamor* on different substrate formulation is presented in Table 5. Significantly shorter incubation period was recorded in 70% rice straw + 30% saw dust (control) with a mean of 20 days. However, this was comparable with 100% corn stalks and leaves and 75% corn stalks and leaves + 25% saw dust. On the other hand, significantly longer incubation period was noted in 25% corn stalks and leaves + 75% saw dust with a mean of 24.89 days which is comparable to 50% corn stalks and leaves and 50% saw dust. The observed differences among treatments used could be due to the composition of the substrates. It has been observed that higher amount of saw dust added to the corn stalks and leaves could prolong the incubation period due to the small particle size of the sawdust. Small particle size resulted to a more compressed substrate that can interfere with mycelial growth of the mushroom organism. This finding is congruent to the report of Stamets [32] that longer spawn run can be attributed to the compactness of the substrate. The values obtained were within the 19 to 25 days incubation period reported by Kalaw and Albinto [2] on different species of *Pleurotus*.

#### **Number of days to primordial initiation**

The appearance of the primordia signals the start of fruiting body formation. In this study, the number of days to formation of primordial was determined from the inoculation of the substrate to the appearance of the fruiting initials. Substrate formulation consisting of 25% corn stalks and leaves + 75% sawdust registered the longest period with a mean of 27.89 days while the 70% rice straw + 30% sawdust (control) exhibited the shortest period with a mean of 20 days. Statistical analysis revealed significant effect of the substrate formulations on the primordial initiation. The result of the present study indicated that different proportions of corn stalks and leaves and saw dust could significantly influence the appearance of the primordial. Higher amounts of saw dust (50% and 75%) delayed the appearance of the primordia. The small particle size of the sawdust made the substrates more compressed which lessen the amount of air present in the substrate and difficulty of the mycelia to penetrate the substrate.

#### **Diameter of the pileus**

The pileus is the cap of the mushroom fruiting bodies. The diameter of the pileus of *P. djamor* as influenced by the different substrate formulations is also presented in Table 6. Statistical analysis showed significant difference in the pileus diameter

in different substrate formulations. Highest diameter was observed in 70% rice straw + 30% saw dust with a mean of 46.60 mm and the lowest was recorded in 25% corn stalks and leaves + 75% saw dust with a mean of 36.01 mm. The significant difference in the size of the pileus could be due to the difference in the nutrient content of the different substrate formulations. A significant difference in diameter of pileus was also observed by Tolentino [18] in *P. florida* grown on different combinations of corn cobs and stubbles. She observed highest diameter of the pileus in 7parts corncobs: 3 parts corn stubbles.

#### **Length of the stipe**

The stipe is the stem- like or stalk - like structures of the mushroom that supports the pileus. The length of the stipe varies from species to species of mushrooms. The length of the stipe as affected by different substrate formulations is also presented in Table 6. Statistical analysis showed significant effect of the substrate formulations on the length of the stipe. The highest value was obtained in 70% rice straw + 30% sawdust (control) with a mean of 14.10 mm while the lowest value was noted in 25% corn stalks and leaves + 75% saw dust with a mean of 10.80 mm. This finding suggested that the length of the stipe is affected by the substrate formulation.

#### **Weight of fruiting bodies**

The weight of fruiting bodies is the most important parameter in mushroom production. The total weight of the fruiting bodies produced in the different substrate formulations is also shown in Table 6. The highest value was obtained in the control (70% rice straw + 30% saw dust) with a mean of 81.11 g while the lowest value was recorded in 25% corn stalks and leaves + 75% saw dust with a mean of 28.39 g. Among the different substrate formulations, 100% corn stalks and leaves produced the highest yield. Statistical analysis revealed significant influence of substrate formulations on the yield of *P. djamor*. The difference in the yield could be attributed to the nutrients present in the formulated substrates. For instance, Dulay et al. [33] reported highest yield of *Lentinus tigrinus* in 8 parts rice straw + 2 parts saw dust. On the other hand, De Leon et al. [17] found out that *Lentinus squarrosulus* produced the highest yield in 100: 400 rice straw saw dust substrate formulation.

#### **Biological Efficiency**

The biological efficiency is a measure of the effectiveness of the mushroom organism to convert the substrate into mushroom fruiting bodies. This parameter is important in selecting the substrate to be used in

mushroom production. The biological efficiency of *P. djamor* on different substrate formulation is likewise presented in Table 6. Among the different substrates used, the control (70% rice straw and 30% saw dust) registered the highest biological efficiency with a mean of 16.22% while the lowest value was exhibited by 25% corn stalks and leaves + 75% saw dust with a mean of 5.67%. Statistical analysis revealed significant differences among the treatments. Based on the result, the best corn based substrate formulations are 100% corn stalks and leaves and 75% corn stalks and leaves +

25% saw dust. However, this is significantly lower than the control. The biological efficiency obtained in this study is relatively lower than the reported value of 50% by Hassan et al. [34] in *P. djamor* grown on sugar cane bagasse supplemented with 10% wheat bran. Adjapong [35] obtained 39% biological efficiency of *Pleurotus ostreatus* cultivated on maize stalk supplemented with rice bran. However, the value obtained in the present is higher than the reported biological efficiency of *Lentinus squarrosulus* by De Leon et al. [17].

**Table 5: Incubation period and number of days to primordial initiation of *P. djamor* on different corn based substrate formulations.**

Substrate Formulation	Incubation Period (day)	Number of Days to Primordial Initiation
100% corn stalks and leaves	20.22 <sup>b</sup>	23.22 <sup>b</sup>
75% corn stalks and leaves + 25% saw dust	20.00 <sup>b</sup>	23.00 <sup>b</sup>
50% corn stalks and leaves + 50% saw dust	24.44 <sup>a</sup>	27.44 <sup>a</sup>
25% corn stalks and leaves + 75% saw dust	24.89 <sup>a</sup>	27.89 <sup>a</sup>
70% rice straw + 30% saw dust (control)	20.00 <sup>b</sup>	23.00 <sup>b</sup>

Values are mean of three replicates. Means having the same letter of superscript are not significantly different from each other at 5% level of significance.

**Table 6. Diameter of the pileus, length of stipe, total yield of fruiting bodies per bag, and percentage biological efficiency of *P. djamor* grown on the different corn based substrate formulations.**

Substrate Formulation	Diameter of the Pileus (mm)	Length of Stipe (mm)	Total Yield per bag (g)	Biological Efficiency (%)
100% corn stalks and leaves	41.42 <sup>b</sup>	12.76 <sup>ab</sup>	54.67 <sup>b</sup>	10.93 <sup>b</sup>
75% corn stalks and leaves + 25% sawdust	36.12 <sup>c</sup>	11.75 <sup>bc</sup>	54.11 <sup>b</sup>	10.82 <sup>b</sup>
50% corn stalks and leaves + 50% sawdust	38.76 <sup>bc</sup>	11.01 <sup>c</sup>	41.11 <sup>bc</sup>	8.22 <sup>bc</sup>
25% corn stalks and leaves + 75% sawdust	36.01 <sup>c</sup>	10.80 <sup>c</sup>	28.39 <sup>c</sup>	5.67 <sup>c</sup>
70% rice straw + 30% sawdust (control)	46.60 <sup>a</sup>	14.10 <sup>a</sup>	81.11 <sup>a</sup>	16.22 <sup>a</sup>

Values are mean of three replicates. Means having the same letter of superscript are not significantly different from each other at 5% level of significance.

## CONCLUSION

It can be concluded that the optimum culture conditions for efficient mycelial growth of *P. djamor* was observed in both sweet corn grit decoction sucrose gulaman and yellow corn sucrose gulaman, with pH of 8.0 incubated in sealed or unsealed; light or dark condition at room temperature. Both sweet corn and yellow corn can be used as spawning material. Among the corn based substrate formulations, 75% corn stalk and leaves + 25% sawdust registered the shortest incubation period and number of days to primordial initiation whereas 100% corn stalk and leaves produced the highest yield and biological efficiency and this is statistically comparable to 75% corn stalks and leaves + 25% sawdust. Therefore, this study successfully demonstrated the utilization of corn based media and substrate for the culture and fruiting body production of *P. djamor* in the tropical conditions of the Philippines.

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