



# Cultivation of *Pleurotus sajor-caju* (Oyster Mushroom) on Different Substrates (Paddy Straw, Coconut Mesocarp and Coconut Leaf)

Lini, J.J., Dhanusree, K.P., Jenisha, J., Mary Vini Mol, V., Monisha, J. and Monisha, S.

Department of Botany and Research Centre, Scott Christian College (Autonomous), Nagercoil,  
Kanyakumari District, Tamil Nadu - 629 003, India

## ABSTRACT

Edible mushroom *Pleurotussajor-caju* was selected for the present study. The paddy grain spawn on *Pleurotussajor-caju* was obtained from Kerala, Agricultural College, Vellayani. Selection of suitable substrate for their cultivation among paddy straw, coconut leaves, coconut mesocarp like spawn running, pinhead formation, maturity of fruiting bodies, yield, growth characteristics of basidiocarp from pinhead stage to maturity were analysed. In paddy straw, the spawn running was on 5th day after the incubation of the spawn. In coconut mesocarp, the spawn running was on 7th day after the incubation of the spawn. The maximum number *Pleurotussajor-caju* mushroom pinheads were formed in paddy straw (18) followed in coconut mesocarp (20) and no bud formation in coconut leaf in the 15-25 days interval. The maximum number *Pleurotussajor-caju* mushroom pinheads were matured at 18 to 21 days interval in paddy straw, followed coconut mesocarp were matured. However, no buds produce coconut leaf. The maximum yield was obtained on paddy straw (204gms). The lowest yield was obtained on coconut mesocarp (156gms). There was no growth in coconut leaf. Mushroom cultivation represent one of the economically viable process for

bioconversion of agricultural and agro - industrial wastes into protein rich food making it a protein weapon against malnutrition.

**Keywords:** Oyster mushroom, fungi, medicinal, nutritional, polysaccharide

## INTRODUCTION

Mushrooms are basidiomycetous fungi that grow quickly and produce fleshy fruit bodies. The mushrooms may be umbrella - like or button- like or fan - shaped. They are high in minerals, vitamins and proteins. They are consumed as energy rich food. Oyster mushrooms, with their flavor, texture, nutritional food and medicinal value. (Dubey *et al.*, 2019). These fungi live as saprophytes in dead organic matter in the form of a mat of intertwined hyphae. They begin to open up as they mature, forming mature fruit. *Lentinusedodes* and *Pleurotus spp.* are the most widely cultivated edible macrofungi (Bellettini *et al.*, 2019). It has numerous advantages over conventional solid culture, including a short incubation period, easy control of culture conditions, and ready availability of active metabolites and specific culture components. (Rathore *et al.*, 2019).

*Pleurotus* mushrooms are a diverse group of saprotrophic fungi (Kong, 2004). This study found that these mushrooms are a good source of non-starchy carbohydrates, and that they are also rich in fibre, as well as most amino acids, minerals, and vitamins (Croan 2004). The protein content ranges from 1.6 to 2.5 percent, while the niacin content is 10 times higher than any other vegetable on the market (Randive, 2012). Different societies around the world have long regarded mushrooms as a tasty and nutritious food. In addition to energy-producing carbohydrates, fats and water, the other nutritional categories are essential to good health (Adebayo *et al.*, 2014 a).

Extractions from *Pleurotus* species have been used traditionally to treat certain ailments (Iduet *et al.*, 2007; Osemwegie *et al.*, 2010). In solid culture, the goal is to produce fruit bodies. Several authors have also studied the submerged culture of *Pleurotus* with a variety of objectives, including the production of liquid inoculums, extracellular enzymes, and virulence factors (Garzillo *et al.*, 1994), flavoring agents (Martin, 1992), B-glucosidases (Marosis *et al.*, 2002), antimicrobials (Wisbeck *et al.*, 2002), vitamins (Solomko and Eliseeva, 1998), and extracellular polysaccharides (EPS) (Adebayo *et al.*, 2012b). There are

many species of *Pleurotus* in cultivation and they exhibit the typical life cycle found in Basidiomycetes. Details of *Pleurotus* species' taxonomy and cultivation are provided by Oloke and Adehayo (2015).

“*Pleurotus*” means beside the ear and “*Ostreatus*” means oyster shaped and in Nepal it is often called “*Kanyachayu*” due to the ear like appearance *Pleurotus* species are rich source of proteins, minerals and vitamins C and B Complex (Caglanmark, 2007; FAOSTAT, 2019). They can be used to over-come nutrient deficiency in the developing countries where the diet lacks quality proteins and minerals (Kumar *et al.*, 2020). Integrated Rural Development Program (IRDP) mushroom farming has become a very important cottage industrial activity. Eating mushrooms not only fills the nutritional void in India, but it also provides a source of income for small farmers and small businesses. (Karthick and Hamsalakshmi.2020).

## MATERIALS AND METHODS

### Collection of spawn

The experiment was conducted on cultivation of *Pleurotussajor-caju* using various substrates collected from Nagercoil. The pure culture (Spawn) was obtained from Kerala, Agriculture college, Department of plant pathology, Vellayani.

### Systematic Position of *Pleurotussajor-caju*

<b>Sub-division</b>	:	<b>Besidiomycotina</b>
<b>Class</b>	:	<b>Hymenomycetes</b>
<b>Sub class</b>	:	<b>Holobasidiomycetidae</b>
<b>Order</b>	:	<b>Agaricales</b>
<b>Family</b>	:	<b>Trichlomataceae</b>
<b>Genus</b>	:	<b>Pleurotus</b>
<b>Species</b>	:	<b>sajor-caju</b>

### Biology of *Pleurotussajor-caju*

*Pleurotussajor-caju* is a basidiomycetes in which the basidiocarp is edible and nutritious. It comes under the order Agaricales and family Trichoimataceae. The

sporophores of *Pleurotussajor-caju* usually grown in groups. Food-grade mushrooms are the most efficient bioremediation method for the large amount of lignocellulosic waste generated annually by agriculture and related activities (Stamets, 2000). The cultivation technology is very simple, involves little cost, and does not require special compost.

### **Substrate Preparation**

The material on which the mycelium of mushrooms grows is called substrates. Agricultural wastes are used as substrate for cultivation of oyster mushroom. Three different substrates are selected viz Paddy straw, coconut mesocarp, coconut leaf.

### **Cropping and Watering**

After the spawning process is complete, the temperature in the growing room is maintained between 16 and 25°C. The fruit body was started as soon as the substrate was fully impregnated with mycelium. Humidity in the growing room was maintained at 80-90 percent by sprinkling water on the floor, while the bags were kept moist with sprinkler water applied three times daily. During the cropping process and after the previous step was completed, the moisture content of the substrate was visually checked daily. Water was sprinkled on the bags twice a day during the cropping period.

### **Cultivation**

*Pleurotus* species were known to grow relatively well on cellulosic / Carbohydrate materials. They require sugars protein etc. for their growth. Further more, they grow at a PH of 5 - 7 and 65 - 80% substrate moisture content. This is a protein rich materials. The cultivation of this mushroom also needs only agricultural waste as saw material.

### **Spawn**

The cereal kernels overgrown by mushroom mycelium is called spawn. The spawn prepared from paddy grains is used for the present study. The spawn *Pleurotussajor-caju* was obtained from Agriculture college, Vellayani, Thiruvananthapuram.

## Substrate

Substratum is the material on which the mycelium of mushrooms grows. Agricultural wastes and easily available plant leaves can be used as substrate for cultivation to oyster mushroom species were selected and three different substrates selected Paddy straw, coconut mesocarp waste, coconut leaf.

### Paddy straw

Paddy is normally grown as an annual plant. According to the variety and soil fertility, rice plants can grow up to 1-1.8 m (3.3- 5.9 ft) tall. It has long, slender leaves that range in length from 20 to 39 inches and are 2 to 2.5 inches wide. A branched inflorescence 30 - 50 cm (12 - 20 in) long produces the small wind-pollinated flowers. Paddy straw is cheaply available in Kanyakumari District.

### Coconut mesocarp waste

India is the third coconut cultivation country in the world. Coconut and coir are valuable raw materials and the pith are treated as waste. In India, the production of coconut is high in Kerala and in Tamilnadu. In Tamilnadu, Tanjavor and Kanyakumari districts are the maximum producers of coconut and coir products.

### Coconut leaf

The coconut palm (*Cocos nucifera*) is a member of the palm family (Arecaceae). Coconut leaves are found in mat form. The leaf sheaths collected from the trees were soaked in water for a week, washed thoroughly with tap water, then distilled water, and dried in the sun for a week. For 24 hours at 105-110 c, the leaf sheath was divided into inner and outer layers and placed in a hot air oven to remove moisture.

### Polythene Bags

Polythene bags are used as a container for mushroom cultivation. Polythene bags with 60 x 30 cm size and 80to100 gauge thickness were obtained from Trivandrum.

## Preparation of culture substrates

Three different substrates viz paddy straw, coconut mesocarp, coconut leaf separately were prepared following the method described by Bhaskaran *et al.*, (1978) in the case study.

The three substrates are separately cut into small bits (3 to 5 cm) and are soaked in add water for 12 hours to soften the tissues. Then they are boiled in separate contains for 30 minutes, water is drained and the boiled substrates should contain around percentage moisture.

## Mushroom House / Mushroom shed

Mushroom shed should be preferably thatched. It should have a door the thatched portions can be covered with chicken mesh to squirrels. The floor of the shed can be filled with sand to a height of 15 cm and watered. The mushroom beds will be placed on racks inside the mushroom house. The inner side of the mushroom shed can be lined with gunny bags and sprayed with water twice daily to keep the shed cool. The shed may be laid in east west to avoid direct effects of sun and to reduces the temperature inside the cropping room.

## Preparation of mushroom beds

Polythene bag of 60 x 30 cm size is taken and 2 holes of km diameter made in the center to ensure ration. The bottom of the polythene bags is tied a threat to provide a flat circular bottom to the mushroom beds. The mushroom spawn in dug out and places on a clean plastic tray. The spawn is divided into 2 halves and can be used for preparing two mushroom beds. The substrates paddy straw, were uniformly placed in the bottom of polythene bags separately to a height of about 5 cm. One portion of the spawn in sprinkled over the entire surface of the substratum. Similarly, four such layers are fills with the subtraction. Every time before spawning, press the leaf with hand for making it compact. Finally, the bag in closed tightly with twine. The prepared cylindrical running under semi dark condition in a clean room, spawn run at 30 to 35°C.

## Incubation

After spawn running the polythene cover was removed and the bed was kept length wise. From the second day onward's clean water was sprayed thrice a day. A elation and

light were allowed for 20 minutes in the morning and evening by opening windows of the growing room. After 3 to 5 days the basidiocarps grow 5 to 8 cm and we're readily for harvest.

### **Spawn running**

Growth of mycelium is called spawn running. Spawn running took 2 - 3 weeks after inoculation. The inoculation of all substrates took place on the same day.

### **Pinhead formation**

The pinheads formation is the second stage of mycelial growth during cultivation of mushroom, Small pinheads like structure were observed.

### **Harvesting**

The harvest was done after the maturation of 22 days. The basidiocarps are matured the collection can be made by hand picking.

## **RESULTS AND DISCUSSION**

Various agricultural wastes were utilized to produce *Pleurotussajor – caju*. The production of food from wastes is not restricted to the use of food crop residues. However a variety of wastes from farms, industries and even animal sources can represent potential substrate for conversion into food.

### **Spawn running**

After inoculation, spawns began to appear 2 to 3 weeks later. The inoculation of all substrates took place on the same day. Tan (1981) reported that the spawning process took three weeks, and fruiting bodies appeared after 2-3 days. The present study showed the spawn running was on the 5 day. This work correlate with the findings of Tan (1981).

### **Pinhead formation**

Pinhead formation is the second stage of mycelial growth in mushroom cultivation. These pinhead-like structures appeared 6-7 days after the spawning event. Ahmad (1986) reported that the *Pleurotussajor-caju* completed spawning in 17-20 days on different

substrates, and that pinhead formation took 23-27 days. The present work also showed the pinhead formation on 18th day. This work correlate with the findings of Ahmad (1986).

### Harvesting the fruiting body

This is the third and final stage in the mushroom-growing process. Fruiting bodies appeared 3-6 weeks after pinhead formation, and 27-34 days after spawn inoculation. Quimio (1976, 1978) who reported that fruiting bodies formation takes place in 3-4 weeks after inoculation of spawn. In the present work paddy straw showed 18-22 day after inoculation. The work correlate with the findings of Quimio (1976, 1978).

### Yield of oyster mushroom

Paddy straw showed high amount among different substrates such as coconut leaves, coconut mesocarp. First the maximum yield was obtained in paddy straw. Maximum average yield 204gms estimated from the paddy straw. Second the minimum yield was obtained in coconut mesocarp.

Minimum average yield 156gms estimated from the coconut mesocarp. So paddy straw is best substrate for the cultivation of oyster mushroom.

### Substrate used

The substrates used for the cultivation of edible *Pleurotussajor-caju* was Paddy straw, Coconut mesocarp, Coconut leaf.

**Table 1: Substrates used for the cultivation of mushroom *Pleurotussajor-caju***

S.No	Substrates
1	Paddy straw
2	Coconut mesocarp
3	Coconut leaf



**Table 2: Spawn running of *Pleurotussajor-caju* in different substrates**

S.No	Substrates	Spawn running
1	Paddy straw	5
2	Coconut mesocarp	7
3	Coconut leaf	Nil

Result on the spawn running of *Pleurotussajor-caju* in different substrates were present in Table 2. In paddy straw the spawn running was on 5<sup>th</sup> day after the incubation of the spawn. In Coconut mesocarp waste the spawn running was 7<sup>th</sup> after the incubation of the spawn. Spawn running was absent in Coconut leaf.

**Table 3: Pin head formation after casing in *Pleurotussajor-caju* cultivation on different substrates**

S.No	Substrate	Pin head formation (in days)
1	Paddy Straw	18
2	Coconut mesocarp	20
3	Coconut leaf	Nil

The number of pinhead formation in *Pleurotussajor-caju* present in table 3.

The number of pinhead formation of *Pleurotussajor-caju* mushroom from the date of spawning exhibited significant difference between different substrate (Table 2). The pinheads first appeared between 15 to 25 days by using all the experimental wastes. The physical characteristics of the bed varied depending on the selected organic wastes when used for the preparations of bed for the cultivation of mushroom.

The maximum number *Pleurotussajor-caju* mushroom pinheads we're formed in paddy straw (18) followed in Coconut mesocarp (20) and no bud formation in Coconut leaf in the 15-25 days interval.

**Table 4: Maturation of *Pleurotussajor-caju* cultivated on different substrates**

S.No	Substrates	Maturation (in days)
1	Paddy straw	18-22
2	Coconut mesocarp	20-25
3	Coconut leaf	Nil

The number of buds matured in *Pleurotussajor-caju* present in Table 4.

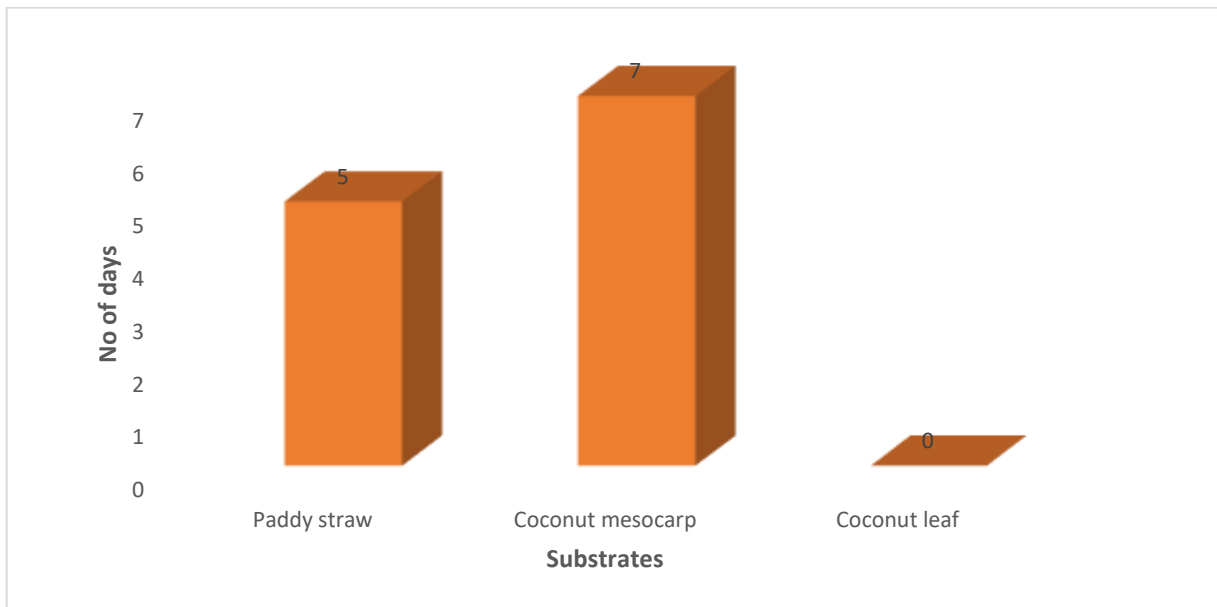
The maximum number *Pleurotussajor-caju* mushroom pinheads were matured at 18 to 21 days interval in Paddy straw (10), followed Coconut mesocarp waste were matured. However, no buds produce Coconut leaf.

**Table 5: Fresh weight of *Pleurotussajor-caju* cultivated on different substrates at maturation stage**

S.No	Substrate	Fresh weight (in gm)
1	Paddy straw	204
2	Coconut mesocarp	156
3	Coconut leaf	Nil

The Fresh weight of *Pleurotussajor-caju* cultivated on different substrates at maturation stage present in Table 5.

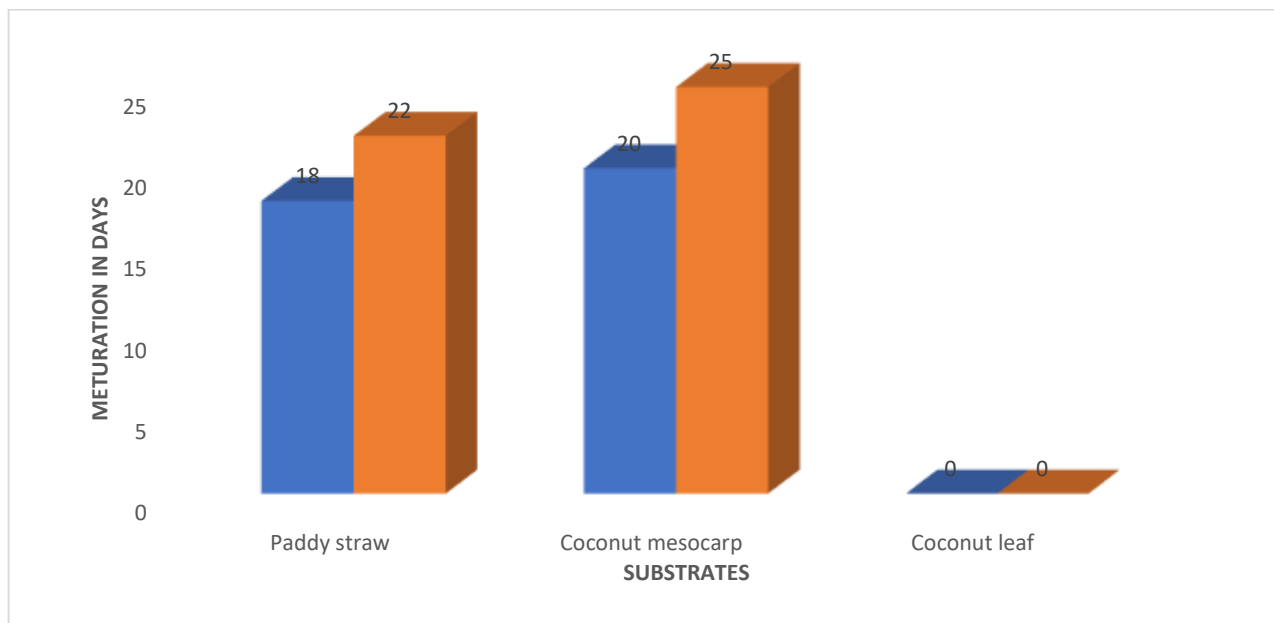
The maximum fresh weight of *Pleurotussajor-caju* mushroom cultivated on Paddy straw substrates was (204 gms), followed Coconut mesocarp waste was (156 gms). However, no buds produce Coconut leaf.



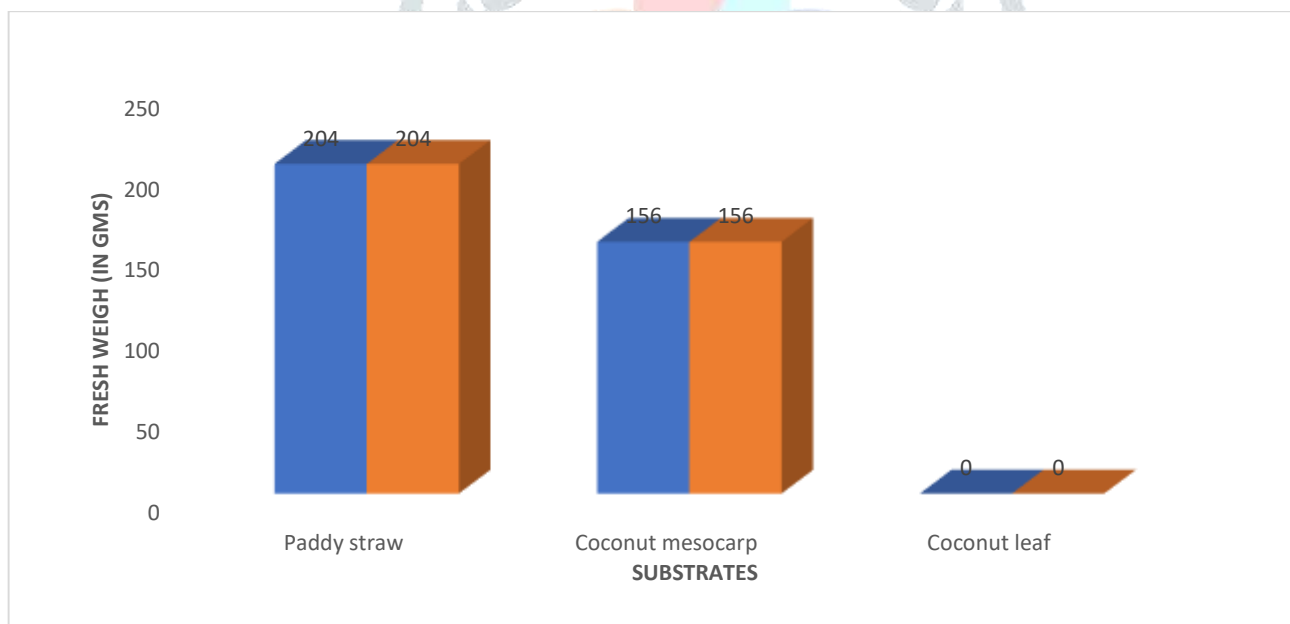
**Figure 1:Spawn running of *Pleurotussajor-caju* in different substrates**



**Figure 2: Pin head formation after casing in *Pleurotussajor-caju* cultivated on different substrates**



**Figure 3: Maturation of *Pleurotussajor-caju* cultivated on different substrates**



**Figure 4: Fresh weight of *Pleurotussajor-caju* cultivated on different substrates at maturation stage**

## CONCLUSIONS

The present study established the significance of *Pleurotussajor-caju* is an edible oyster mushroom develop in large numbers as a group was cultivated under local

condition sink the available lingo cellulosic waste paddy straw as growing substrate. The paddy straw was not very rough but aerated firm and it favors the growth of the mushroom mycelium. The development of the basidiocarp is the most important factor in the yield. The normal basidiocarp with maximum weight fine texture and pleasing shades with more food value and without toxic material may have a good market.

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