ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Comparative Study on Mycelia growth rate of G*anoderma lucidum* and *Pleurotus flabellatus* on Agro-wastes

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Manuscript Info

Manuscript History:

Received: 11 June 2013
Final Accepted: 25 June 2013
Published Online: July 2013

Key words:
Agricultural wastes,
Ganoderma lucidum,
Mycelium,
pleurotus flabellatus.

Abstract

The research experiment was carried out to investigate the mycelial growth rate of *Ganoderma lucidum* and *Pleurotus flabellatus* on agro-wastes. The following agro-wastes were used: banana leaves, tea waste and corn waste. The steps involved in the mycelial growth were prepared agro-wastes medium**,** sterilized, inoculation, incubation, measured. The growth of mycelium (linear length) in each plate was measured by a scale at every day.The results indicated that the highest mycelial growth in *Ganoderma lucidum* was achieved on tea waste 7.4cm/0.5g concentration and in *pleurotus flabellatus* Corn waste 8.7cm/0.5g concentration. In *Ganoderma lucidum* the poor mycelial growth rate 3.96cm/2g concentration and in *Pleurotus flabellatus* 5.26cm/2.5g concentration was found in Corn waste.

Introduction

Mycelial cultivation has received great interest as an efficient method for industrial production of valuable metabolites, and various agro-industrial by-products have been tried as inexpensive growth substrates Fang (2002) and Hatvani (2001) .Several agricultural residues have been used to produce the edible mushroom *Pleurotus* sp., also known as "oyster mushroom", "hiratake", "shimeji", or "houbitake" Bononi (1995) and Mizuno (1995).Successful utilization of agro-wastes for both mycelia and sporophore formation of macro fungi, supplies the nutrients needed by these fungi to convert them to protein-rich palatable food. It also helps in reducing the environmental and health hazards posed by indiscriminate dumping of the wastes Fasidi (1996) and Villario *et al.*(1995),.Oyster mushroom cultivation can play an important role in managing Organic wastes whose disposal has become a problem, Oyster mushroom can be cultivated in any type of lignocelluloses material like straw, sawdust, rice hull etc., Chang (1999). Edible mushrooms are low in fat and calories, rich in vitamin B and C contain more protein than any other food of plant origin and are also a good source of mineral nutrients Bahl (1998) . *Ganoderma* is one of the most beautiful mushrooms in the world. It is a genus of polypore's which grow on wood and includes over 250 species, many from tropical regions Ryvarden (2001) Because of their extensive use in traditional Asian medicines, and their potential in bioremediation, they are a very important genus economically. *Ganoderma* can be differentiated from other polypores because they have a double walled basidiospore. *Ganoderma lucidum* is popular as an ingredient in health foods and medicines because of its perceived health benefits Bao Xing Feng (2001) and Eo *et al*.,(1999b) .It is traditionally cultivated in solid cultures. Solid cultures are used to obtain basidiocarps for tonic or tea. *G. lucidum* mycelium or spawn have normally been produced in solid cultures using substrates such as grain, saw dust or wood. The advantage of solid state fermentation (SSF) over other technique is that a concentrated product can be obtained from a cheap substrate such as an agricultural residue with little pre-treatment or enrichment Wagner et al.,(2003). *Pleurotus spp*. can be grown on various agricultural waste materials, with the use of different technologies. They grow well on different types of ligno cellulosic materials, converting the materials into digestible and protein-rich substances suitable for animal feeds. Among the substrates used to produce *pleurotus sp* are worth mentioning rice hulls mixed with cotton residues for the production of *pleurotus* sajor-caju banana leaf, mixed with

sugarcane bagasse or corn cob for the production of *pleurotus sp* and also cassava residues with sugarcane bagasse for the production of *pleurotus ostreatus* Felinto (1999). The aim of this study was to investigate the most suitable agro wastes at specific concentration for fastest growth of mycelium and avoid the chemical medium to preparation of tissue culture plates. To find a proper combination of medium of these materials.

MATERIALS AND METHODS

Collection of samples

Two types of mushroom selected for this study was king mushroom (*Ganoderma lucidum*) and oyster mushroom (*Pleurotus flabellatus*).The strain of *Ganoderma lucidum* was collected from the Chozhavanthan at Madurai district. The strain *Pleurotus flabellatus* was collected from the Killikulam at Thirunelveli District. The Selected substrates like banana leaves, tea waste and corn waste were collected from Tuticorin district.

Preparation of agro-wastes media

Culture media containing different concentration of agro wastes. Disease-free agro- wastes was collected which were cut in small pieces (2-3cm) and sun-dried in order to achieve proper drying, then crushed to make powder form. The media prepared by dissolving dried powder of agro- wastes at different concentration (0.5, 1, 1.5, 2, 2.5 gm) in distilled water (20ml/each concentration), adding agar, mixing and autoclaving at 121 ^{0}c for 60 min. Then medium were poured in to petridishes and allowed to solidify. The experiment was setup as a complete randomized design with three replicates.

Tissue Culture Technique

A large healthy mushroom (*G.lucidum* and *pleurotus flabellatus)* should be chosen. It should be cleaned with 75% alcohol. The mushroom should be split in half by hand longitudinally and some inside tissue taken from the upper part of the stripe. It should be placed centrally on the surface of the sterilized agro-wastes medium with a sterilized needle and kept at room temperatures (28°C ± 2) for 8 days. Within two or three days some white, delicate mycelia will be produced from the small piece of the tissue. About eight days later the mycelium will grow rapidly and cover the surface of the agar medium. The mycelial growth was measured by means of mycelia diameter. Then it is ready to transfer to spawn substrate to make spawn. This spawn was used as inoculums for cultivation of mushroom.

RESULTS AND DISCUSSION

Mycelial growth range in G.lucidum

Eight days after inoculation, the strains reached different mycelial length according to the concentration of substrate. In *G.lucidum* the highest mycelium growth rate 7.4cm/0.5g concentration was found in tea waste (Table-1 and Fig 1a) followed by corn waste 6.16cm/1.5concentration (Table-2 and Fig 2a) and banana leaf 7.0cm/1 g concentration(Table-3 and Fig 3a) and In lowest running rate of mycelium was observed in tea waste 5.7cm/2g concentration followed by banana leaf 4.03cm/2g concentration corn waste 3.96cm/2g concentration. Various substrates for *G. lucidum* cultivation has been investigated as a supplement for substrate mixture. A successful artificial cultivation has been reported on solid substrates, utilizing sawdust and agricultural wastes as the main media components Triratana *et al., (*1991).

Table 1 Mycelial growth Parameters in Tea waste (Mean± SD)

Days	*Ganoderma lucidum*					*Pleurotus flabellatus*				
	0.5g	1.0g	1.5 g	2.0g	2.5g	0.5g	1.0g	1.5 g	2.0g	2.5g
2nd day	1.33±0.15	1.80±0.10	1.86±0.05	2.1±0.10	1.46±0.05	1.40±0.10	1.86±0.05	1.73±0.05	1.96±0.15	1.46±0.05
3rd day	4.06±0.11	3.46±0.15	3.13±0.15	3.46±0.15	3.36±0.05	3.96±0.15	3.4±0.20	3.16±0.15	3.33±0.15	3.36±0.05
4th day	5.53±0.15	4.46±1.19	4.63±0.15	4.83±0.05	5.0±0.10	5.56±0.11	5.26±0.15	4.66±0.15	4.76±0.15	4.96±0.15
5th day	6.13±0.15	5.73±0.15	5.36±0.05	5.36±0.15	5.4±0.10	6.16±0.20	6.03±0.15	5.36±0.05	5.63±0.15	5.26±0.15
6th day	6.43±0.15	6.16±0.05	5.53±0.11	5.6±0.10	5.6±0.10	6.43±0.20	6.26±0.11	5.56±0.05	5.66±0.05	5.50±0.10
7th day	7.1±0.10	6.23±0.15	5.80±0.10	5.66±0.15	6.0±0.10	6.96±0.15	6.33±0.15	5.76±0.05	5.76±0.05	6.03±0.05
8th day	7.4±0.10	6.36±0.05	5.96±0.15	5.7±0.10	6.13±0.11	7.40±0.10	6.56±0.15	5.96±0.15	5.80±0.00	6.20±0.00

Fig. 1 Mycelial growth in tea waste: (a) 0.5 g *G.lucidum;* (b) 0.5g *p.flabellatus;* (c) 2.5g *p.flabella*

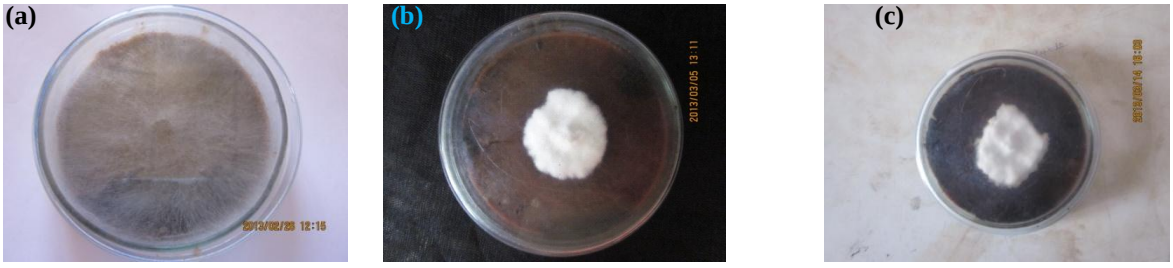
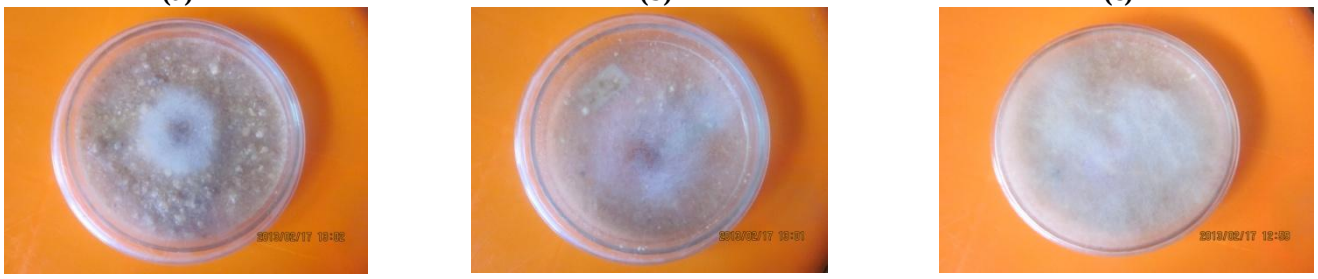


Table 2. Mycelial growth Parameters in Corn waste (Mean± SD)

Days	*Ganoderma lucidum*					*Pleurotus flabellatus*				
	0.5g	1.0g	1.5 g	2.0g	2.5g	0.5g	1.0g	1.5 g	2.0g	2.5g
2nd day	3.2±0.20	3.80±0.10	2.63±0.15	3.20±0.20	2.80±0.10	1.53±0.15	4.30±0.20	2.03±0.05	3.10±0.10	1.53±0.05
3rd day	4.03±0.05	4.43±0.11	4.93±0.11	2.96±0.20	3.30±0.17	1.96±0.15	5.03±0.15	4.10±0.10	3.40±0.10	4.46±0.15
4th day	5.36±0.15	4.50±0.10	5.16±0.15	3.13±0.15	3.50±0.10	5.33±0.15	5.16±0.15	4.56±0.15	3.70±0.10	4.36±0.20
5th day	5.63±0.11	4.90±0.10	5.23±0.15	3.30±0.20	3.70±0.20	5.66±0.20	5.36±0.15	4.63±0.15	4.10±0.10	4.50±0.10
6th day	5.86±0.05	5.10±0.10	5.26±0.15	3.40±0.20	4.06±0.11	6.66±0.15	6.36±0.05	5.10±0.10	4.40±0.10	4.76±0.05
7th day	6.0±0.10	5.13±0.25	5.40±0.10	3.63±0.15	4.26±0.15	7.53±0.15	7.16±0.15	6.13±0.15	5.06±0.15	5.06±0.11
8th day	6.06±0.15	5.20±0.20	6.16±0.20	4.03±0.15	4.33±0.15	8.70±0.10	8.40±0.10	7.10±0.10	5.96±0.15	5.26±0.15

Fig. 2 Mycelial growth in corn wastes: (a) 1.5 g *G.lucidum;* (b) 1 g *p.flabellatus* ; (c) 0.5 g *p.flabellatus*

(a) **(b)** **(c)**



Mycelial growth range in P.flabellatus

Eight days after inoculation, the strains reached different mycelial length according to the concentration of substrate. In *pleurotus flabellatus* the better mycelium growth rate 8.1cm/0.5g concentration was found in Corn waste (Table-2 and Fig 2c) followed by Banana leaf 7.5cm/1g concentration(Table-3 and Fig 3c) Tea waste 7.4cm/0.5g concentration (Table-1and Fig 1a) and the lowest running rate 5.8cm/2g concentration was found in Tea waste followed by Banana leaf 5.43cm/2.5g concentration, Corn waste 5.26cm/2.5g concentration. *Pleurotus spp*. can be grown on various agricultural waste materials, with the use of different technologies. They grow well on different types of ligno cellulosic materials, converting the materials into digestible and protein-rich substances suitable for animal feeds. *Pleurotus spp.* may be produced in the tropics on a mixture of sawdust and rice bran, rice straw and rice bran, saw dust and ipil-ipil leaves and other combinations of tropical wastes. Other wastes such as corncobs, cotton waste, sugarcane bagasse and laves, corn leaves, grasses, rice hulls, and water hyacinth leaves are also good substrates for growing this mushroom

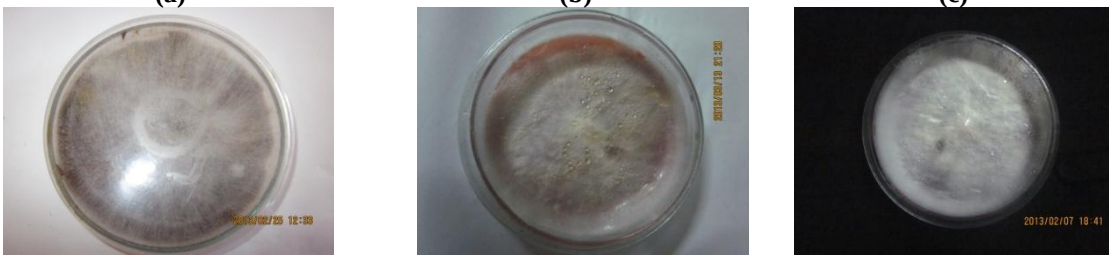
Quimio T.H. (1986).

Table 3 Mycelial growth Parameters in Banana waste(Mean± SD)

Days	*Ganoderma lucidum*					*Pleurotus flabellatus*				
	0.5g	1.0g	1.5 g	2.0g	2.5g	0.5g	1.0g	1.5 g	2.0g	2.5g
2nd day	0.50±0.10	2.50±0.30	2.56±0.11	1.60±0.10	2.86±0.05	0.46±0.05	0.40±0.10	0.10±0.00	0.30±0.10	0.53±0.15
3rd day	2.36±0.40	2.60±0.20	2.83±0.11	2.10±0.17	2.96±0.15	1.0±0.10	0.90±0.10	1.16±0.05	0.80±0.10	1.10±0.10
4th day	4.53±0.25	6.00±0.10	3.10±0.10	2.63±0.11	3.30±0.20	1.16±0.15	1.10±0.10	3.36±0.15	1.16±0.15	1.73±0.15
5th day	4.56±0.35	6.16±0.15	3.73±0.20	3.03±0.15	3.70±0.20	2.36±0.15	2.46±0.05	4.20±0.10	3.06±0.05	2.13±0.15
6th day	4.7±0.17	6.40±0.10	4.10±0.10	3.53±0.25	4.06±0.11	3.53±0.15	3.56±0.11	5.16±0.15	4.23±0.15	4.10±0.00
7th day	5.0±0.20	6.66±0.05	4.40±0.10	3.63±0.15	4.33±0.15	4.56±0.05	4.46±0.11	6.66±0.15	5.63±0.15	5.20±0.20
8th day	5.33±0.20	7.0±0.10	4.90±0.10	4.03±0.15	4.66±0.15	5.43±0.15	7.50±0.10	7.10±0.10	6.0±0.10	5.73±0.15

Fig. 3 Mycelial growth in banana waste: (a) 1g *G.lucidum;* (b) 0.5g *G.lucidum;* (c)1 g *p.flabellatus*

(a) **(b)** **(c)**



Conclusion

From the results, it may be concluded that tea waste is most suitable substrate in comparison with the other substrate for mycelial growth of G*anoderma lucidum* in 0.5g concentration.In *pleurotus flabellatus* corn waste(0.5g concentration))was found to be the most efficient agro wastes for fastest growth of Mycelium development compared to other agro wastes. The use of this substrate affected positively completion of mycelium running, primordia initiation and harvest required minimum days. The findings made in the present study may be useful for large scale production of mushroom.

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