Journal of Applied and Natural Science
15(1), 211 - 219 (2023)
ISSN : 0974-9411 (Print), 2231-5209 (Online)
journals.ansfoundation.org

Research Article

Using food residues (potato peels) as an alternative to potato dextrose agar in the growth of edible food fungi

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Article Info
https://doi.org/10.31018/jans.v15i1.3989
Received: August 27, 2022
Revised: January 31, 2023
Accepted: February 8, 2023

How to Cite
Almjalawi, B.S.A. *et al.* (2023). Using food residues (potato peels) as an alternative to potato dextrose agar in the growth of edible food fungi. *Journal of Applied and Natural Science*, 15(1), 211 - 219. https://doi.org/10.31018/jans.v15i1.3989

Abstract
Due to the great importance of edible fungi, their rapid life cycle, and the possibility of their production throughout the year, their cultivation has become a vital resource that many countries depend on in their pursuit of economic growth and food security. The present study aimed to devise a local nutrient media for primary mycelium growth of nine species of fungi belonging to *Pleurotus eryngii* , *Pleurotus floridanus* , *Pleurotus ostreatus* (white strain) , *Agaricus heterocystis* , *Agaricus bispous* (brown strain), *Agaricus bispous* (white strain), *Lentinula edodes*strain No. 1, *Lentinula edodes* strain No. 2, *Flammulina velutipe* (yellow strain) using culture mycelium inoculation for reproduction and production of edible fungi. Different natural materials used for this purpose involved potato peels in a concentration ranging from 5 to 20 g/ L and compared with the commercial medium Potato Dextrose Agar at a rate of 39 g/Land according to the manufacturer's instructions. The study also focused on the effect of physical factors such as temperature and pH on the growth rate of fungal mycelium. The results showed that the media prepared from potato peels at 5 g/L and 10 g/L concentrations achieved the best growth rate for the studied fungi compared to Peptone Dextrose Agar (PDA). The increase in the growth rate of fungi on media prepared from potato peels was attributed to the effect of nutrients for the prepared medium because it contained effective and necessary compounds for the growth in addition to their ease of absorption and consumption to be ready for food for agricultural fungi. The effect on the growth and production of edible fungi or any other type of fungi has not previously been studied and compared to the commercial medium PDA.

Keywords: Edible Food Fungi, Food residues, Potato peels, Potato Dextrose Agar (PDA), Mother culture preparation

INTRODUCTION

Edible fungi have been characterized by their palatable taste and high nutritional value, encouraging the consumers for more than two thousand years to consume them (da Silva *et al.*, 2013; Chechan *et al.*, 2020a; 2020b). The increasing need for food due to the increase in the world population has encouraged interest in eating fungi, including oyster mushrooms. What increases the importance of its medicinal value besides its high nutritional value is the shortness of its life cycle and the possibility of its continuous production throughout the year, as it is characterized by its high content of proteins and essential amino acids. Necessary for the human body, B vitamins are nominated to occupy a middle position between beef, sheep, chicken, and fish on the one hand and vegetables on the other. In addition to its content of carbohydrates, fiber, and a small percentage of fat, it contains good amounts of potassium, magnesium, and phosphorous and medium amounts of iron, calcium, manganese, sodium, copper, and zinc (Alhusseini *et al.*,2021; Zhang *et al.*,2014; Anna *et al.*, 2015).

A study by Abirami and Ananthi (2015) described Oyster mushrooms as a healthy, balanced food. Their medical importance is represented by their containing several compounds and enzymes that were classified as biologically active, which made them a substance that prevents the growth of tumors and cancer, anti-allergic and anti-aging, in addition to the role it plays in the

treatment of immunodeficiency disease hypertension. It was found that it contributes to treating depression and mental illness (Farhan *et al.*, 2018; Farhan and Chechan, 2020; Farhan *et al.*, 2020; Hadwan *et al.*, 2021).

The genus Pleurotus ranks second in terms of production at the global level after the white agricultural fungus, *Agricus bisporus* (Adjapong *et al.*, 2015; Chechan *et al.*, 2020a). Its production represents approximately 14% of the global production of all fungi, and its cultivation is inexpensive, can be carried out at home, and is suitable for small farmers, those with limited capabilities, and beginners who do not have much experience (Owaid *et al.*,2014; Almjalawi *et al.*, 2022). Therefore, there is an increasing need for healthy food in Iraq due to the increasing world population. It has encouraged the interest in wild agricultural fungi that are particularly widespread in the Iraqi environment due to their high nutritional value. Most of these have not been highlighted by subjecting them to extensive scientific studies, precisely the types of food fungi. The current study aimed to elicit natural, economic culture media from local natural residues that are suitable in their nutritional content for the growth of mycelium and study their effect on the quality of mycelium.

MATERIALS AND METHODS

Potato residues

The potato peels as residues were collected from the residues of the chips factories (Baghdad, Iraq), then dried and crushed, and the potato peels' chemical composition was estimated. Then a chemical analysis of the food residues from potato peels was carried out, which included the estimation of ash, moisture, protein, carbohydrates, and fat (AOAC, 2000).The fat and ash were estimated according to methods cited by Paez *et al.* (2016).

The percentage of carbohydrates was estimated with the use of the following eq.:

Total Carbohydrates = 100-(Ash% + Fat + Protein)

….Eq.1

Reagents used

A solution of hydrochloric acid HCl at a concentration of 0.1 N: The solution was prepared by adding 8.73 ml of the concentrated hydrochloric acid to a quantity of distilled water and completing the final volume to a litre of distilled water. The resulting solution was used to adjust the pH of the media used in the study.

Sodium hydroxide solution NaOH at a concentration of 0.1N: The solution was prepared by the dissolution of 4g of sodium hydroxide in distilled water, and the volume was completed to a litre of distilled water. The resulting solution was used to adjust the pH of the media used in the study.

Edible food fungi

The strains were obtained locally from different cities such as Baghdad, Anbar, Karbala, and Maysan in Iraq. This included one of the most common oyster mushrooms worldwide, such as the following strains:

Preparation of media

Potato dextrose agar media

Potato dextrose agar (PDA) media was prepared according to the manufacturer's instructions (Himdia) by dissolving 39g in a liter of distilled water.The medium was sterilized in an Autoclave at 15min for a temperature of 121^{o}C and a pressure of 15 Ib/in^{2}.The medium was used to activate and preserve the isolates and for comparison.

Natural medium (Potato peels)

The natural materials included potato peels which were used to prepare solid media for the development of the fungi. The peels, one of the residues of the chips production factories, were obtained from the local markets of Baghdad, which were dried in an oven at 60 ° C, ground well, distributed in nylon bags, closed and then kept in the refrigerator until use.

The natural medium was prepared using dried potato peels. In four different concentrations of 5,10, 15, and 20g/L, of distilled water and agar were added to it at a concentration of 15g/L, in addition to the medium of PDA at a rate of 39g/L, according to the manufacturer's instructions and used as a medium for comparison. The media was then sterilized with an autoclave for 15min at the temperature of 121^{o}C and a pressure of 15 Ib/in^{2} and poured into 8.5 cm diameter dishes of equal sizes in an Inoculation chamber. The previously prepared plates were inoculated with mycelium from the growth of the mentioned fungi, cut with a 7 mm diameter cork borer, and prepared on the pre-prepared PDA culture

Table 1. Isolates used in the study

S. No.	Oyster Food Fungi Type	Strain Number
1	*Pleurotus eryngii*	MF898428.1
2	*Pleurotus floridanus*	MH634078.1
3	*Pleurotus ostreatus* (white strain)	MF065714.1
4	*Agaricus heterocystis*	MK208482.1
5	*Agaricus bispous* (brown strain)	MK208476.1
6	*Agaricus bispous* (white strain)	MK967453.1
7	*Lentinula edodes*strain No. 1	MN121186.1
8	*Lentinula edodes*strain No. 2	MW375036
9	*Ganoderma lucidum*	MN888753.1
10	*Flammulina velutipe* (yellow strain)	F19

medium. The plates were incubated, and the growth of the mycelium was monitored until its growth was completed on the plate and compared with the medium of PDA and the growth rate (Chechan *et al.*, 2017) was estimated as follows:

Growth rate (cm/day) = x/y. ….Eq. 2

x: denotes the diameter of the plate of 8.5cm.

y: denotes the time that is required for the fungal growth to reach the edge of the plate or for the plate to be filled with growth.

Estimation of the growth density of the mycelium

The above mentioned fungi were grown in natural media with the previously prepared concentration without adding agar under ideal conditions for the development of each fungus (pH and incubation temperature) until growth was completed in both PDA and Potato peels Media, each separately.

The mycelium was scraped from the media and transferred to a clean, dry basin, and weighed to estimate the mycelium weight on a sensitive scale, which was considered a value that expresses the growth density as in the following equation:

Growth Density (g/plate) = y – x …..Eq. 3

Note that: x = the weight of the basin + the weight of the mycelium

Y = weight of the basin when it was empty.

Statistical analyses

The statistical program SPSS (version 24) was used to analyze the data, representing the mean and standard deviation, and a one-way analysis of variance (ANOVA) was used.

RESULTS AND DISCUSSION

The results of the chemical analysis of potato peels showed that they contained moisture (13.37%), ash (2.51%), fibers (41.71%), protein (1.65%), fat (0.59%) and carbohydrates (40.179%). Besides, the percentage of the total solid (86.64%), energy (172.63%), and pH (6.01). The presence of effective chemical compounds was in addition to the fact that potato peels contained high nutrients for the prepared culture media for the preparation of the mother culture for food fungi.

The study's results in Table 2 and Fig. 1 showed significant differences in the growth rate of different fungal strains when using different concentrations of the locally prepared media from potato peels. The highest growth rate was for strains No. 1 and 2, *L. edodes*, with pH 6.5 at a temperature 23 °C at concentrations of 5 and 10g/L, while the lowest growth rate when the concentration was 20g/L.

The results showed significant differences between the concentrations 15 and 20g/L, while no significant differences appeared between the concentrations 5 and 10g/L.The highest growth rate of the fungus *F. velutipe* was at pH 6.5 at a temperature of 23 °C at a concentration of 5g/L, while the lowest growth rate was when using concentrations 15 and 20g/L, and the results showed that there were significant differences between the concentrations five and 10g/L. In contrast, no significant differences appear between the concentrations 15 and 20g/L.

The results showed the best growth rates of the fungi in the media prepared locally from potato peels at a concentration of 5g/L (0.611, 0.621, 1.215) cm/day for the fungi (*L. edodes*, strain No. 1 and strain No. 2, *F. velutipe*), the concentration was 10 g/L.The growth rates of fungi were (0.611, 0.621,1.201) cm/day, respectively. While the growth rates of fungi decreased (0.567, 0.568, 1.063) cm/day at a concentration of 15 g/L and a concentration of 20 g/L, growth rates were (0.501, 0.501, 1.063) cm/day, respectively. In contrast, the growth rates were (0.501, 0.501, 0.001) cm/day for the commercial medium PDA at a concentration of 39 g/L for the same fungi.

The study's results in Table 3 and Fig. 1 showed significant differences in the growth rate of fungal strains when using different concentrations of media prepared locally from potato residues. The highest growth densities were for strains No. 1 and No. 2, *L. edodes*, with a pH of 6.5 at a temperature of 23° C at a concentration of 5 and 10g/L, while the lowest growth rate was when using a concentration of 20 g/L. The results showed significant differences between the concentrations of 15 and 20 g/L, while there have not been any significant differences between concentrations of 5 and 10 g/L. The highest growth rate of the fungus *F. velutipe,* with a pH of 6.5 was at a temperature of 23° C at a concentration of 5g/L, while the lowest growth rate when using both concentrations was 20 g/L.

The results showed the best growth rates of fungi in media that had been prepared locally from (potato peels) at a concentration of 5g/L (0.605, 0.609, 1.098) cm/day for fungi (*L. edodes*, strain No. 1 and strain No. 2, *F. velutipe*),the concentration of 10g/L. The growth rates reached (0.605, 0.610, 0.922) cm/day for the fungi, respectively, while the growth rates of the fungi decreased at the concentration of 15g/L. It reached (0.553, 0.553, 0.922) cm/day, then 20g/L. The growth rates were (0.502, 0.502, 0.489) cm/day for fungi, respectively, while the growth rates of fungi were (0.512, 0.517, 0.489) cm/day for the commercial medium PDA at a concentration of 39g/L for the same fungi for the purpose of comparison.

Table 4 and Fig. 1 showed statistically significant differences in the growth rate of fungal strains when using different concentrations of media prepared locally from (potato peels).The highest growth rate of the fungi was

the growth rate of the oyster mushrooms, *P. ostreatus*, *P. eryngii*, *P. sfloridanus* with a pH of 6.5 at a temperature of 25 °C at concentration of 5g /L, while the lowest growth rate was when using a concentration of 20 g /L. The best growth rates of fungi in media that were prepared locally from potato residues (potato peels) at a concentration of 5g/L (1.215) cm /day for the oyster mushrooms, *P. ostreatus*, *P. eryngii*, *P. sfloridanus* with a pH 6.5 at a temperature of 25° C. A concentration of 10 g /L, the growth rates were (1.215, 0.945, 1.201) cm/day for fungi, respectively, While the growth rates of the fungi decreased at a concentration of 15g/L, reached 1.061, 0.945, 1.064 cm/day, the concentration was 20g/L. The growth rates were 1.062, 0.945, 1.063 cm/day for fungi, respectively. As for the growth rates reached 1.063, 0.944, and 1.063 cm/day for PDA commercial medium at a concentration of 39g/L for the same fungi for comparison.

Table 5 and Fig. 1 showed statistically significant differences in the rate of growth density of fungal strains when using different concentrations of media prepared locally from potato residues (potato peels).The highest growth rate of the fungi was the growth rate of the oyster mushrooms *P.ostreatus, P. eryngii, P. floridanus* with a pH of 6.5 at a temperature of 25°C at a concentration of 5g/L, while the lowest growth rate of a fungus was when using a concentration of 20g/L. The best growth densities of fungi in media prepared locally from (potato peels) at a concentration of 5g/L was 1.102, 1.199, 1.099 cm /day for the fungi *P. ostreatus, P. eryngii* and *P. floridanu* with pH 6.5 at a temperature of 25° C at the concentration of 10g/L. The growth rates were 0.934, 0.941, 0.924 cm/day for the fungi, respectively, while the rates of the growth density of the fungi decreased 0.933, 0.941, 0.924 cm/day at a concentration of 15g/L and then the rates of growth density were 0.499, 0.452, 0.489 cm/day at a concentration of 20g/L for the fungi, respectively. In contrast, growth was 0.501, 0.544, 0.489 cm/day for the commercial medium PDA at a concentration of 39g/L for the same fungi.

Table 6 and Fig. 1 showed statistically significant differences in the growth rate of fungal strains when using different concentrations of locally prepared media from (potato peels) in the growth rate of oyster fungi *A. bisporus*(white), *A. heterocystis*, *A. bisporus* (brown), *G.lucidum* with pH 6 at temperature 27°C.The highest growth rate of fungi was at the concentration 5g/L, while the lowest growth rate was when using the concentration of 20g/L. The results showed the best growth rates of fungi in media that were prepared locally from potato residues (potato peels) at a concentration of 5 g/L were 0.899, 0.919, 0.888, 1.215 cm/day for oyster fungi *A.*

Table 2. Effect of different media and concentrations on the growth rate of the fungi with pH 6.5 at a temperature of 23°C

Media type	**Growth rate (cm/day)** ***L. edodes*** **strain No. 1**	**Growth rate (cm/day)** ***L. edodes*** **strain No. 2**	**Growth rate (cm/day)** ***F. velutipe***
	Mean ± SD	**Mean± SD**	**Mean± SD**
PDA	0.501±0.001a	0.501±0.001a	1.064±0.001a
Natural Media Conc.: Con. 5g/L	0.611±0.001c	0.621±0.002c	1.215± 0.001c
Con. 10g/L	0.611±0.002c	0.621±0.001c	1.201± 0.002b
Con. 15g/L	0.567±0.001b	0.568±0.001b	1.063±0.001a
Con. 20g/L	0.501±0.001a	0.501±0.001a	1.063±0.001a
P value	0.000	0.000	0.000

Similar letters mean no significant difference; different letters mean significant differences

Table 3. Growth density of the fungi in the PDA and natural media, based on the weight of the mycelium with pH 6.5 and a temperature of 23 °C

Media type	**Growth Density (g)** ***L. edodes*** **strain No. 1**	**Growth Density (g)** ***L. edodes*** **strain No. 2**	**Growth Density (g)** ***F. velutipe***
	Mean± SD	**Mean± SD**	**Mean± SD**
PDA	0.512±0.001a	0.517±0.005 a	0.489±0.001 a
Natural Media Conc.: Con. 5g/L	0.605±0.001 d	0.609±0.001 d	1.098±0.001 c
Con. 10g/L	0.605±0.001 d	0.610±0.002 d	0.922±0.001 b
Con. 15g/L	0.553±0.001 b	0.553±0.002 b	0.922±0.002 b
Con. 20g/L	0.502±0.002 c	0.502±0.001 c	0.489±0.002 a
P value	0.000	0.000	0.000

Similar letters mean no significant difference; different letters mean significant differences.

bisporus (white), *A. heterocystis*, *A. bisporus* (brown), *G. lucidum* with pH 6 at temperature 27°C. At the concentration of 10g/L, the growth rates were 0.899, 0.889, 0.888, 1.215 cm/day for fungi, respectively. While the growth rates of the fungi decreased (0.801, 0.888, 0.868, 1.061) cm/day at a concentration of 15g/L. Then at the concentration of 20g/L, the growth rates were 0.601, 0.801, 0.801, 1.061 cm/day for fungi, respectively. In contrast, the growth rates were 0.566, 0.580, 0.570, 1.063 cm/day for the commercial medium PDA at a concentration of 39g/L for the same fungi.

Table 7 and Fig. 1 showed significant differences in the growth rate of fungal strains when using different concentrations of locally prepared media from potato peels in the growth rate of oyster mushrooms *A. bisporus* (white), *A. bisporus* (brown), *A. heterocysts*, *G.lucidum* with pH 6 and at temperature 27°C. The highest growth rate of fungi was at the concentration of 5g/L, while the lowest growth rate was when using 20g/L. The best rates of fungal growth densities in potato peels media were at a concentration of 5g/L were 0.301, 0.301, 0.311, 1.101 cm/day for *A. bisporus* (white), *A. bisporus* (brown), *A. heterocystis, G.lucidum* with a pH 6 at a temperature of 27°C. Then a concentration of 10g/L, the growth density rates were 0.209, 0.301, 0.312, 0.933 cm/day for fungi, respectively. The fungi's growth rates decreased by 0.231, 0.209, 0.301, 0.933 cm/day at a concentration of 15g/L. Then the concentration was 20g/L, and the growth density rates were 0.119, 0.110, 0.206, 0.499 cm/day for fungi, respectively. As for the growth density, the rates were 0.105, 0.115, 0.108, 0.501 cm/day for the commercial medium PDA with a concentration of 39g/L for the same fungi for comparison.

The increase in the growth rates of food fungi in the locally prepared media from potato residues (potato peels) is attributed to the nutritious effect of these media because they contained effective and necessary compounds for growth and in addition to being easy to absorb materials and availability in the Iraqi environment, ease of preparation and low price. This is what was confirmed by the present study that the chemical and food materials in the potato peels residues could be a food for agricultural mushrooms better than the potato pulp, the effect of which has not previously been studied on the growth and production of edible fungi or any other type of fungi. Moreover, Media commercial PDA was compared with Media Potato peels in preparing the mother culture of the fungi (Chechan *et al*. , 2017).

The present study observed that the medium prepared from food residues gave the best growth rates for the mentioned fungi with the lowest concentration compared to the commercial medium. This facilitates the spread of fungal growth to obtain the necessary nutrients for fungi in the culture medium because the medium contains effective and necessary compounds for the growth of fungi. In the case of an increase in the concentration of the prepared medium, the fungal growth decreases due to the hardening of the prepared medium, and thus fungus obtains a lesser amount of nutrients needed for growth due to the hardening of the culture medium. The study proved that the best growth results were obtained with the lowest concentration of pure prepared media and with simple local capabilities, as an alternative to mother culture imported from abroad in hard currency compared to commercial medium in the preparation of the mother culture. Also, the concentration of organic compounds in media prepared from potato peels was positively reflected in the growth rates of the mycelium and the time required to complete growth on the plate to the completion of growth with the medium PDA (Hussein and Chechan, 2022).

It was also noted that the growth of edible fungi on natural media represented by potato peels is characterized by its rapid growth and high density compared to the PDA medium. The density of mushroom spinning in the

Table 4. Effect of different media and concentrations on the growth rate of the oyster mushrooms with pH 6.5 at a temperature of 25°C

Media type	**Growth rate (cm/day)** ***P. ostreatus***	**Growth rate (cm/day)** ***P. eryngii***	**Growth rate (cm/day)** ***P. floridanus)***
	Mean± SD	Mean± SD	Mean± SD
PDA	1.063±0.001a	0.944±0.001a	1.063±0.001a
Natural Media Conc.: Con. 5g/L	1.215±0.001b	1.215±0.001b	1.215±0.001c
Con. 10g/L	1.215±0.001b	0.945±0.001a	1.201±0.002b
Con. 15g/L	1.061±0.002a	0.945±0.001a	1.064±0.002a
Con. 20g/L	1.062±0.002a	0.945±0.002a	1.063±0.002a
P value	0.000	0.000	0.000

Similar letters mean no significant difference; different letters mean significant differences.

mentioned media was estimated based on the weight of yarn growing in the medium after the end of the scheduled incubation period for fungus. It was noticed that there were significant differences in the density of the growth of the fungal yarns, where the potato peeling medium excelled in giving the highest level of density. In contrast, the commercial medium PDA gave the lowest density level due to the potato peels containing many chemicals and food materials that can be ready for the food fungi under study (Sabri *et al.*,2019; Sabri *et al.*,2020).

This result indicates the appropriate degree of potato peeling in the mycelium production of edible fungi and the growth rate indicator. Both of these factors, speed and density of growth, will achieve an economic return for the producers of edible fungi by reducing the time factor in terms of the number of tissue pieces that can be obtained from the development of fungi in these two media. The potato peels contain high nutrients for fungi, especially food fungi, to produce pure mother culture for these species. With simple local capabilities, it can be an alternative to the mother culture imported from abroad in currency.

Conclusion

The results showed that the media prepared from potato peels at concentrations of 5 and 10g/L achieved the best growth rate for the studied fungi compared with PDA. The increase in growth rates of fungi on media prepared from potato peels was attributed to the effect of nutrients for the prepared medium because it contained effective and necessary compounds for the growth in addition to their ease of absorption and consumption to be ready food for agricultural fungi

Conflict of interest

The authors declare that they have no conflict of interest.

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Table 5. Growth density of oyster mushrooms in the media estimated based on the weight of the mycelium and compared with the media PDA and pH 6.5 at a temperature of 23° C

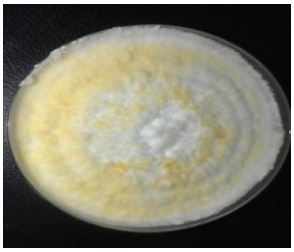
Media type	Growth Density (g) *Pleurotus ostreatus*	Growth Density (g) *Pleurotus eryngii*	Growth Density (g) *Pleurotus floridanus)*
	Mean± SD	Mean± SD	Mean± SD
PDA	0.501±0.001a	0.544±0.001a	0.489±0.001a
Natural Media Conc.: Con. 5g/L	1.102±0.002d	1.199±0.001d	1.099±0.001c
Con. 10g/L	0.934±0.001c	0.941±0.002c	0.924±0.001b
Con. 15g/L	0.933±0.002c	0.941±0.001c	0.924±0.001b
Con. 20g/L	0.499±0.001b	0.452±0.001b	0.489±0.001a
P value	0.000	0.000	0.000

Similar letters mean no significant difference; different letters mean significant differences.

Table 6. Effect of different media and concentrations on the growth rate of oyster mushrooms with pH 6 at 27°C.

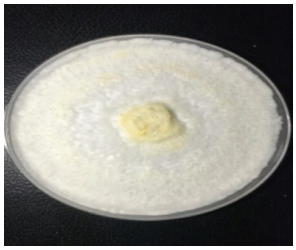
Media type	Growth rate (cm/ day) *Agaricus bisporus* (white strain)	Growth rate (cm/ day) *Agaricus bisporus* (brown strain)	Growth rate (cm/ day) *Agaricus heterocystis*	Growth rate (cm/ day) *Ganoderma lucidum*
	Mean± SD	Mean± SD	Mean± SD	Mean± SD
PDA	0.566±0.002a	0.580±0.001a	0.570±0.001a	1.063±0.001B
Natural Media Conc.: Con. 5g/L	0.899±0.002d	0.919±0.001d	0.888±0.001d	1.215±0.001C
Con. 10g/L	0.899±0.002d	0.889±0.001c	0.888±0.001d	1.215±0.001C
Con. 15g/L	0.801±0.001c	0.888±0.001c	0.868±0.001b	1.061±0.001A
Con. 20g/L	0.601±0.001b	0.801±0.001b	0.801±0.001c	1.061±0.001A
P value	0.00	0.00	0.00	0.00

Similar letters mean no significant difference; different letters mean significant differences.



Pleurotus ostreatus **(MF065714.1) Media potato peels (Con. 10g/L)**

Pleurotus ostreatus **(MF065714.1) Media potato peels (Con. 5g/L)**



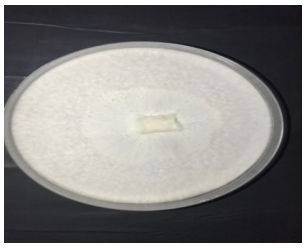
Pleurotus ostreatus **(MF065714.1) Media PDA.**

Pleurotus eryngii (MF 898428.1) **Media potato peels (Con. 10g/L)**

Pleurotus eryngii **(MF 898428.1) Media potato peels (Con. 5g/L)**

Pleurotus eryngii **(MF 898428.1) Media PDA**

Ganoderma lucidum **(MN888753.1) Media potato peels (Con.**

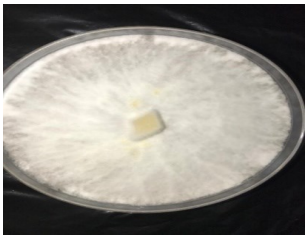


Ganoderma lucidum **(MN888753.1) Media potato peels (Con. 5g/L)**

Ganoderma lucidum **(MN888753.1) Media PDA.**

Lentinula edodes **strain No. 1** (MN121186.1) **Media potato peels (Con. 10g/L)**

Lentinula edodes **strain No. 1**(MN121186.1) **Media potato peels (Con. 5g/L)**



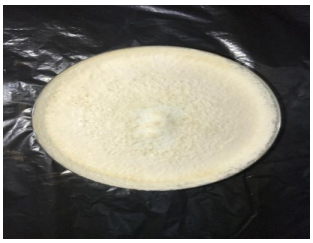
Lentinula edodes **strain No. 1**(MN121186.1) **Media PDA.**

Lentinula edodes **strain No. 2** (MW375036) **Media potato peels (Con. 10g/L)**

Lentinula edodes **strain No. 2** (MW375036) **Media potato peels (Con. 5g/L)**

Lentinula edodes **strain No. 2** (MW375036) **Media PDA.**

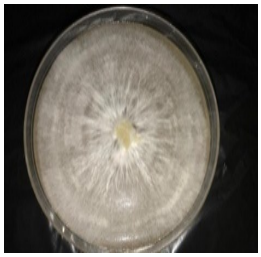
Flammulina velutipe (F19) **Media potato peels (Con. 10g/L)**



Flammulina velutipe (F19) **Media potato peels (Con. 5g/L)**

Flammulina velutipe (F19) **Media PDA.*Agaricus heterocystis*** (MF065714.1) **Media potato peels (Con. 10g/L)**

Agaricus heterocystis (MF065714.1) **Media potato peels (Con. 10g/L)**



Agaricus heterocystis (MF065714.1) **Media potato peels (Con. 5g/L)**

Fig. 1. Contd…….

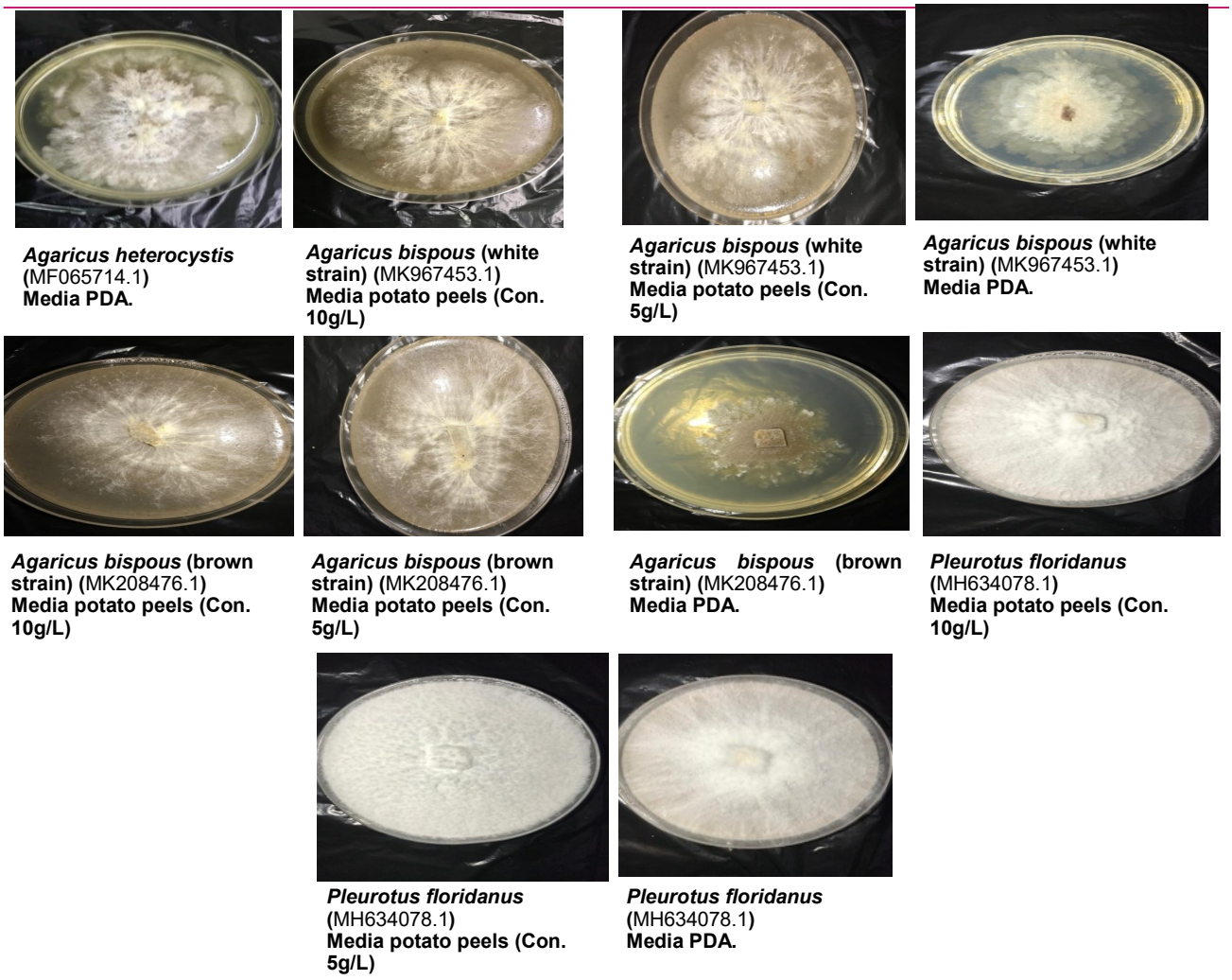


Fig. 1. *Mycelium growth of different strains on the media i) Natural media , ii) PDA media at optimum conditions for the production of the mother culture of fungi*

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