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Research paper

Total Biomass Benefits due to a Plant Hormone (Kinetin) Application on Oyster Mushroom (*P. Sajor-caju*) Cultivated on Wheat Straw

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ABSTRACT

Pleurotus sajor-caju is an important edible mushroom species due encompassing significant medicinal and nutritional values, popularly cultivated worldwide. It contains several essential components such as proteins, fiber, vitamins, and minerals. Therefore, present study evaluated the growth and yield of oyster mushroom (*Pleurotus sajor-caju*) after the treatment of various doses of a plant hormone, Kinetin. *Pleurotus sajor-caju* was cultivated on wheat straw and sprayed with different doses of kinetin i.e. 10 ppm, 50 ppm and 100 ppm three times. All three flushes were collected and measured for total biomass production of mushroom. The results indicate that the hormonal treatment was able to enhance the biomass production in mushroom. Yield was found to increase from 8% to 27% as compared to control and the mushroom biomass from various treatment was 10 ppm (414 g), 50 ppm (482 g) and 100 ppm (298 g).

1. Introduction

Mushrooms are widely known for their wild availability and are being cultivated and harvested in natural condition at outdoor fields (Gupta, 1986). However, due to the increased mushroom consumption and its high nutrition values, indoor cultivation has been started where environmental condition can be controlled for the better productivity of mushrooms as it may provide suitable climatic and other conditions for its growth and dev-elopment (Sarker & Chowdhury, 2013).

Mushrooms have long been used for medicinal and food purposes. Mushrooms are known to be rich source of proteins, minerals and vitamins (Caglarirmak, 2007). Protein content in mushroom is commonly 19 to 35% which is higher whereas fat content is reported to be very low with respect to the carbohydrates (Wani et al, 2010). *Pleurotus* species contain high potassium to sodium ratio, which makes

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mushrooms an ideal food for patients suffering from hypertension and heart diseases. Previous studies about the medicinal impact of various species of mushrooms detected that the mushrooms are found to be effective in order to reduce cholesterol level in serum and reduce high blood pressure. In addition, shitake mushroom have been reported to show anti-cancerous properties (Leutinan) too (Mori et al, 1986).

Nowadays, various species of mushrooms have been grown in indoor environment, *Pleurotus*, is one of them, generally known as oyster mushroom. It is one of the important species as it may convert most of the agro residue into the protein (Banik & Nandi, 2004). In addition, oyster mushroom production requires lesser inputs and has shorter cultivation cycles time and takes smaller area for cultivation. These properties make them most popular for their production and cultivation (Gupta, 1986; Maniruzzaman, 2004). Moreover, presence of various biochemical factors i.e. plant growth hormones, nutrient supplements may influence the growth of the mushrooms hence their application may increase the productivity of mushrooms (Khandakar, 2004). Total biomass of the mushrooms and their development depends on the type of substrate and biochemical application (Khandakar, 2004). Hence, effect of hormones on the total biomass yield is needed to be evaluated for better production of mushrooms.

A plant hormone substance, kinetin (KIN) has been reported to have influence in the growth and total biomass yield of various agriculture crops (Guha and Banerjee, 1974) and it is also known to increase the protein content of mushroom. Various plant hormones including kinetin are found to increase the total biomass production of food yeast *Kluyveromyces fragilis* when used in ideal concentration (Paul et al, 1994). Some growth regulators at different concentrations affect the yield and size of mushroom (Halbert & Schisler, 1987). Therefore, it is suggested that along with the chemical substance its concentration is also crucial for the good results.

Hence, in the present study, we used *Pleurotus sajor-caju* grown on wheat straw in the natural condition. We have evaluated the influence of the various doses of a plant hormone, kinetin in growth and total biomass production of *Pleurotus sajor-caju*.

2. Methodology

Spawn sample of *Plurotus sajor-caju* was procured from the national horticulture research institute, Janakpuri, New Delhi. Fresh wheat straw was collected from the nearby farmers to cultivate mushroom. Substrate (wheat straw) was sterilized by 40% formalin before use (Sagar et al, 2014). Spawn was mixed in pasteurized wheat straw and transferred to polythene bags for the growth. Spawn bags were kept in incubation rooms at 22 ±2 °C. The growth of the mycelium in the bags was monitored, and the mycelium run was noticed in the bags. After 14 days bags were opened and moulds were kept at 20 ±2 °C in the growing room. After two days moulds were treated with various doses of kinetin i.e. 10 ppm, 50 ppm and 100 ppm thrice at interval of three days. All appropriate conditions like temperature and humidity (75-80%) were maintained. Different solutions of hormones were prepared by dissolving the kinetin powder in 0.1 M HCl, further diluting it with distilled water. Hormone was sprayed with spray bottle. Four different groups were identified for the study where the one which was not treated with hormone, was considered to be control and other three groups were treated with different doses of the hormone 10 ppm, 50 ppm and 100 ppm etc. Growth and development was observed daily and total biomass production in grams was recorded of three flushes.

3. Results

Growth and development of *Pleurotus sajor-caju* was observed daily and monitored carefully until all three flushes were collected and measured. Photographs of different stages of the growth have been recorded to show the visible growth changes after different time interval (Fig. 1). The effect of Kinetin was observed in growth and yield of the *Pleurotus sajor-caju*. Total yield is shown in Fig. 2 where lower doses were found to be effective however, maximum yield was recorded in 50 ppm dose. Both the doses i.e. 10 ppm and 50 ppm were found to be more effective as compared to the control one. However, 100 ppm dose was found to be ineffective as it resulted in less yield of *Pleurotus sajor-caju*. Kinetin was able to increase the yield of *Pleurotus sajor-caju* by 27% in 50 ppm doses however, 100 ppm dose was found to inhibit the growth and thus resulted in the decreased yield of the *Pleurotus sajor-caju*. 50 ppm was found to be

most effective dose as resulted in the best yield and the highest productivity with respect to all the groups (Table 1). A visible decrease in yield was observed in 100 ppm sprayed substrate as compared to control which indicates that it may also have negative effects on the growth of *Pleurotus sajor-caju* if applied concertation of Kinetin is too high.

Fig. 1 Different stages of *Plurotus sajor-caju's* growth. 1). Spawn run throughout the wheat substrate after 14 days, 2). Development of pinning can be seen by appearance of young basidiocarps on wheat substrate, 3). Magnified view of basiocarps appearance, 4). Mature mushroom/ mature basidiocarps can be seen on the compost, 5). Full grown basidiocarp with gills on their surface are ready to harvest, 6). Mature *Pleurotus sajor-caju* fruits

Table 1 Table depicts all three flushes and yield in grams collected from each treatment groups after *Pleurotus sajor-caju*'s fruits got mature. Yield of control and Kinetin sprayed groups have been summarized from each treatment

Treatment (ppm)	First flush (g)	Second flush (g)	Third flush (g)	Total Yield (g)
Control	136	121	123	380
KIN 10	124	182	108	414
KIN 50	244	81.8	156.2	482
KIN 100	109	108.8	80.2	298

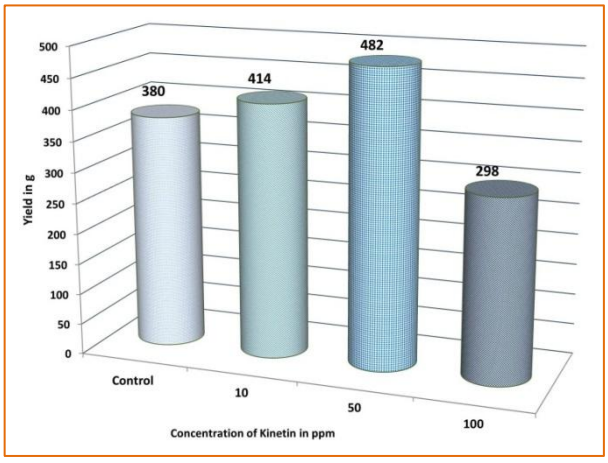

Fig. 2 Total biomass production of *Pleurotus sajor-caju* after the exposure of the Kinetin

4. Discussion

Oyster mushroom's growth has been reported to be affected with the application of plant hormone (Cheng et al, 2007). Plant growth hormone may influence the growth of plants during various stages i.e. growth and development, uptake of nutrient, cell division, and their interaction with abiotic and biotic stress (Carabelli et al, 2007). Similar effects were expected in mushroom production also. In the present study, we found kinetin as a growth stimulator and resulted in high yield of *Pleurotus sajor-caju* when applied with different doses. However, too high doses (100 ppm) may also have inhibitory effect on *Pleurotus sajor-caju* total biomass yield as resulted in decreased yield of it. Our results are in line of previous study by Guha and Banerjee (1974) who reported that kinetin affected the growth and also influenced the productivity of the mushroom. Moreover, lower concentrations of hormone such as 10 ppm and 50 ppm showed positive effects on biomass production of *Pleurotus sajor-caju.*

5. Conclusion

Present study indicated that kinetin can be used to increase the production of *Pleurotus sajor-caju*. However, doses should be chosen carefully as doses above the certain concentration may also induce negative changes and affect the yield. Therefore, before field application, dose optimization is crucial step for better results.

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Declaration of Conflict

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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