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Studies on some fungi in button mushroom cultivated in Akola (Amanatpur)

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Abstract

Agaricus bisporus (button mushroom) is an edible Basidiomycetes mushroom native in Europe & North America. It is cultivated in more than 70 countries. It is one of the most commonly widely consumed mushrooms in the world having medicinal value. India produces 20,000 tons of button mushrooms. The reasons for such a low production can be attributed to lack of awareness among masses, shortage of quality spawn, and use of traditional methods of cultivation inadequacy of post harvest disposal facilities. A number of harmful fungi are also encountered in compost & casing soil during the cultivation which causes damage to mushrooms directly or indirectly which can adversely affect the final yield. In present investigation studies on some fungi in Button mushroom cultivated at Akola and some preventive measure were taken into consideration during processing.

Keywords: *Agaricus bisporus*, cultivation processing and fungal diseases.

INTRODUCTION

Button Mushroom (*Agaricus bisporus*) belonging to Basidiomycetes and family Agaricaceae is the most popular mushroom variety grown and consumed by the world over such as in Europe (mainly Western part), North America (USA, Canada) and S.E. Asia (China, Korea, Indonesia, Taiwan and India).In India the major producing states are Himachal Pradesh, Punjab, Haryana, Maharashtra, Andhra Pradesh, Tamil Nadu and Karnataka.[4, 11]

The national annual production of mushroom is estimated to be around 50,000 tones with 85% of this production being of Button mushroom. They are highly proteinaceous and are used as food. Vitamin D1, D2, ergo sterol, Na, K, P, Lineolic acid and all essential amino acids are also present in Button mushroom.[10] It has medicinal properties also. A high amount of retene is present in the button mushroom which is supposed to have an antagonistic effect on some forms of tumors. [6, 7, 9, 12, 18] The demand for fresh mushroom is increasing in international market. Some inhibiting factors are high cost of transportation and absence of proper pre cooling techniques and storage facilities. Fresh mushroom have very short shelf life and therefore cannot be transported to long distances without refrigerated transport facility. Majority of growers in India do not have pasteurization facility and sophisticated machinery / infra-structure for round the year production. The growers can take on an average 3-4 crop in a year depending upon the type and varieties cultivated. It requires 20-28^{0}C for vegetative growth (spawn run) and 12-18^{0}C for reproductive growth. Besides that it requires relative humidity of 80-90% and enough ventilation during cropping.

Factors affecting the yield of the crop both in terms of quality and quantity are incidence of pests/pathogens and non-availability of pure quality of spawn. The crop is suspect to several diseases like Dry Bubble (brown spot), Wet Bubble (White Mould), Cobweb, Green Mould, Brown Plaster Mould and Bacterial Blotch.[2,14,15,16,19]Among them most common are Deuteromycetes members.[5, 8, 13, 20, 21, 22]

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MATERIAL AND METHODS

Cultivation Technology

Spawn production

Pawn is produced from fruiting culture or stocks of selected strains of mushrooms under sterile conditions. Stock culture obtained from Solon (Himachal Pradesh).Ooty1and Ooty (BM) 2 (released in 2002) S-11, TM-79, and Horst H_3.

Compost Preparation

The substrate on which button mushroom grows is mainly prepared from a plant wastes (soybeans straw) or Bagasse (sugar cane straw), salts (gypsum), supplements (chicken manure or cottonseed cake) and water. In order to produce 1kg of mushroom 220g.of dry substrate material are required. It is recommended that each ton of compost should contain 6.6kg nitrogen, 2.0kg phosphate and 5.0kg.potassium (N: P: K-33:10:25) which would get converted into 1.98% N, 0.62% P and 1.5% K on a dry weight basis. The ratio of C: N in a good substrate should be 25-30:1 at the time of staking and 16-17:1 in the case of final compost.

Method of Composting

During the 1st phase of compost preparation, soybean straw or sugar cane straw is placed in layers and sufficient water is added to the stack along with fertilizers, chicken manure or cotton seed etc. The whole thing is mixed thoroughly with the straw and made into a stack. (Almost 5 feet high, 5feet wide and of any length can be made with the help of wooden boards). The stack is turned and again watered on the second day. On the fourth day the stock is again turned for the second time by adding gypsum and watered. The third and final turning is given on the sixteen day when the colour of the

compost changes into dark brown and it starts emitting a strong smell of ammonia.

The second phase is the pasteurization phase. The compost prepared as a result of microbe mediated fermentation process needs to be pasteurized in order to kill undesirable microbes and competitors and to convert ammonia into microbial protein. The whole process is carried out inside a steaming room where an air temperature of 50^0 C is maintained for 8 hours. On 2nd day the temperature should raise upto 60^0 C and again next 4 days it should be decreases upto 50^0 C. The compost finally obtained which is granular in structure with 70% moisture and 7.5 pH. It turns into dark brown colour, sweet unobnoxious smell and free from ammonia insects and nematodes. After the process is complete the substrate is cooled down to 25^0C.

Spawning

The process of mixing spawn with compost is called spawning. Both surface and layer spawning were done.

Surface Spawning

The spawn is evenly spread in the top layer of the compost and then mixed to a depth of 3.5cm. The top portion is covered with a thin layer of compost.

Layer spawning

About 3-4 layers of spawn mixed with compost are prepared which is covered with a thin layer of compost like in surface spawning. The spawn is mixed through the whole mass of compost at the rate of 7.5ml/ kg. compost or 500 to 750g/ 100kg compost (0.5 to 0.75%).

Spawn Running

After the spawning process is over, the compost is filled in polythene bags (90x90cm, 156 gauge thick having a capacity of 20-25kg.per bag) .The fungal bodies grow out from the spawn and take about two weeks (12-14 days) to colonies. The temperature maintained in cropping room is 23^0C ($\pm$2). Higher temperature is detrimental for growth of the spawn and any temperature below than that specified for the purpose would result in slower spawn run. The relative humidity should be around 90% and a higher than normal CO2 concentration would be beneficial.

Casing

The compost beds after complete spawn run, should be covered with a layer of soil (casing) about 3-4 cm thick to induce fruiting. The casing material should be having high porosity, water holding capacity and the pH should range between 7-7.5. Coco beats, red soil, lime or cole powder is commonly used.

The casing soil before application should be either pasteurized (at 66-70^0 C for 7-8 hours) treated with formaldehyde (2%) and bavistin (75ppm) or steam sterilized. The treatment needs to be done at least 15days before the material is used for casing. After casing is done the temperature of the room is again maintained at 23-28^0 C and relative humidity of 85-90% for another 8-10days. Low CO_2 concentration is favorable for reproductive growth at this stage.

Fruiting

Under favorable environmental condition viz. temperature (initially 23 ± 2^0C for about a week and then 16 ± 2^0C), moisture, (2-3 light sprays per day for moistening the casing layer) humidity (about 85%) proper ventilation and CO_2 concentration (0.08-0.15%) the fruit body initials which appear in the form of pin heads start growing and gradually develop into button stage.

Harvesting and yield

Harvesting is done at button stage and caps measuring 2.5 to 4 cm across and closed are ideal for the purpose. The first crop appears about three weeks after casing. Mushroom need to be harvested by light twisting without disturbing the casing soil once the harvesting is complete the gaps in the beds should be filled with fresh sterilized casing material and then watered. About 15-20 kg fresh mushroom per 100 kg fresh compost can be obtained in three months crop.

Post harvest management
Packing and storage
Short Term storage

Button mushroom are highly perishable. Harvested mushrooms are cut at the soil line and washed in a solution of 5g KMS in 10L.of water. Use of excess water is done for removing the soil particles as well as to induce whiteness. After that these bags are packed in perforated poly bags each containing around 250-500 g of mushrooms. They can be stored in polythene bags at 4-5^0C for a short period of 3-4 days.

Identification and isolation of the diseases

Asthana and Hawker's medium A is prepared by using glucose -5gm, KH2PO4 -1.75g, MgSO4 .7H2O -0.75g, KNO3 -3.5g ,agar agar-15g and distilled water 1 litre. Pure chemical supplied by B.D.H .Apex or Sarabhai Mark were used for this purpose. Medium were allowed to sterilize at 15 lbs of autoclave for 15 minute. Medium was poured in sterile petri dishes. Plates were inoculated by 3 days, 25 days, 45days, 60 days compost and casing soil as well as fruiting bodies samples[1, 17, 23]. Plates were incubated at 30^o C for 7 days. After incubation of 7 days the filaments and fruiting bodies were observed. Microscopic studies were carried out for identification of specific fungi. Fungal identification was done by using the book written by Barnett, HL and Hunter Barry B "Illustrated genera of fungi imperfectii".

RESULT AND DISCUSSION

Like all other crops, mushrooms are also affected adversely by a large number of biotic and abiotic agents/factors. Among the biotic agents, fungi, bacteria, viruses, nematodes, insects and mites cause damage to mushrooms directly or indirectly. A number of harmful fungi are encountered in compost and casing soil during the cultivation of white button mushroom. Many Deuteromycetes fungi adversely affecting spawn run whereas others attacks the fruit bodies at various stages of crop growth producing distinct disease

symptoms. At times there is complete crop failure depending upon the stage of infection, quality of compost and environmental conditions.

It reveals from above table that most of the fungi such as Fusarium, Aspergillus, Penicillium Curvularia and Black mould such as Mucor,Rhizopus contaminated the compost, casing soil as well as fruiting bodies of mushroom.

Mushroom is a very delicate crop and curative measures are often difficult. The mushroom itself being a fungus, when fungal diseases appear, it is often very difficult to control as the chemicals used against the disease may affect the mushroom itself. Sanitation and hygienic condition must be properly maintained. The room must be washed with lime and the surrounding must be clean with formalin solution. The workers should be clean. The plastic bags also washed properly in formalin and dried out. Sterilized casing soil, proper temperature and some biocontrol reagent can reduced the growth of this fungi.[3]

Table 1. Isolation of fungi during cultivation and fruit bodies formation of mushroom.

Sr. No.	Specimen	Fungi	Percentage (%) of Fungi
1	3 days compost	1. *Aspergillus* spp. 2. *Mucor* spp. 3. Unknown	57.1 14.2 -
2	25 days compost and casing soil	1. *Mucor* spp. 2.*Rhizopus* 3.*Curvularia* 4.*Fusarium* 5.*Penicillium* 6 Unknown	5.8 5.8 11.6 5.8 5.8 -
3	45 days casing soil and growing mushroom	1.*Rhizopus* 2.Unknown	4.6 -
4	60 days casing soil and growing mushroom Fruit bodies	unknown 1.*Mucor-2* 2.*Penicillium*	- 9 90.9

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