Notes

9

DISEASE MANAGEMENT IN CULTIVATED MUSHROOM

Like other crops mushrooms are also affected by several diseases. We have seen that in commercial cultivation same crop is grown at same place throughout the year. Hence, if proper precautions are not taken there are high chances of disease establishment. Inocculum once developed in the room will stay there if proper precautions are not taken. Hence, disease may not affect the current crop only but will impact the subsequent crops. Hence, at times disease management becomes important to save subsequent crops instead of getting higher yield from the current crop by spraying some chemicals or other methods. In fact, in mushrooms once disease appears, it is very difficult to control it. Better approach is prevention that requires very high degree of hygiene, proper pasteurization, sterilizing rooms before start of crop cycle, educating the labour about various precautions that are must in a mushroom unit. In this lesson we will talk about some of the diseases, their reasons for appearance and mode of transmission and methods of control.

OBJECTIVES

After reading this lesson you will be able to

- explain the commonly occurring diseases in mushrooms;
- discuss how some of the diseases can indicate the shortcomings in the method of composting;
- analyse that prevention is better than control;
- learn about the control of different fungal and bacterial diseases
- understand the significance of cook out;
- demonstrate production of mushrooms without use of chemicals.

Notes

Diseases can be due to biotic or abiotic factors. Some diseases occur due to mistakes in preparation of compost or casing while others are the result of lack of hygiene. Abiotic disorders are essentially due to mistakes in environmental control. The diseases can be classified as:

- Competitive moulds
- Fungal diseases
- Bacterial diseases
- Viral diseases
- Abiotic disorders

9.1 COMPETITOR/INDICATOR/WEED MOULDS AND OTHER INDICATORS

Some of the disease symptoms appear due to errors in substrate preparation. We call these as indicator moulds as by looking at the symptoms we can understand the mistake made. Some of the indictor moulds and what they indicate is tabulated in Table 9.1.

Table 9.1: Moulds encountered during mushroom cultivation and their indication

S.No.	Mould	Indication
1.	Ink caps	Presence of ammonia in compost after Phase II or end of compositing (incomplete conditioning), high nitrogen in the compost, Use of old wheat straw for compost preparation/cultivation,High moisture content in the compost/ substrate
2.	Olive green mould	Lack of aeration during compost preparation especially during Phase- II, Temperature exceeding 60°C during pasteurization
3.	Brown plaster	Use of poor and old straw, high moisture content in compost, high temperature, less gypsum or poor quality gypsum
4.	White plaster mould	High pH of the compost

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5.	Cinnamon mould/Peziza	Casing and compost too wet, Casing strongly disinfected with formaldehyde
6.	*Sepedonium*/Yellow mould (Tikki)	Improper pasteurization, Use of old chicken manure, Most common in long method of compositing especially, when chicken manure is used
7.	False truffle	High temperature during spawn run, Improper pasteurization
8.	Rose comb	Use of petroleum products, fumes and some other unwanted chemicals
9.	Cracked/malformed cap	Fluctuations in humidity and temperature
10.	Long stems	High carbon dioxide during fruiting/ cropping

Ink Caps (*Coprinus spp.*)

It is must to ensure that there is no ammonia smell in the compost at the time of spawning. It has to be less that 10 ppm in any case. Otherwise we will see growth of delicate mushrooms of *Coprinus* species which change into black mass due to auto-digestion. Ammonia may be left if there are clumps in the compost, less gypsum has been added, moisture is more, too much nitrogen/urea has been added at initial stage or compost has not been pasteurized properly at phase II.

Most of us cannot detect ammonia below 10 ppm by smelling the compost. It is, however, better to use Dragger tubes to check the presence of ammonia. In case of any doubt, it is better to wait. In case of long method of compositing, pile can be made again and turned next day or after two days. Also use fresh straw and avoid excessive watering.

Olive Green Mould (*Chaetomium olivaceum, C. globosum*)

Olive green coloured mould inside the bags is first indication of improper spawn run of the bags. If we cut open the bags, we can see masses of olive green coloured fungus inside the bag (Fig. 9.1). It indicates lack of fresh air mainly in Phase II. Hence, if this fungus is observed, supply of fresh air may be increased and at no stage the fresh air supply may be cut completely. We may spray Dithane Z-78 (0.2%) and increase aeration in cropping rooms to get some relief.

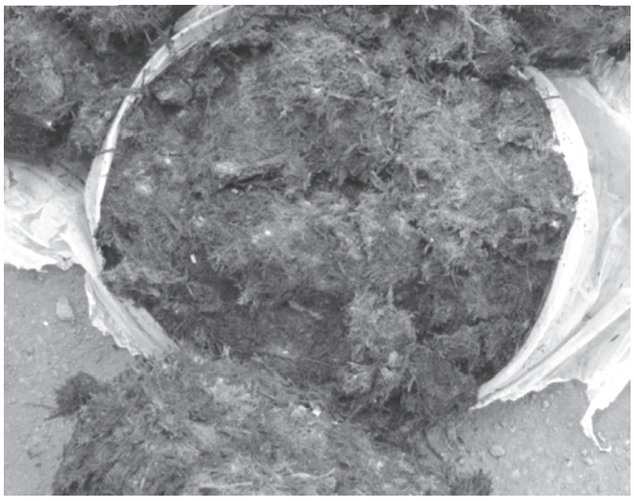

Fig. 9.1: Olive green mould

Brown Plaster Mould (*Papulaspora byssina*)

This fungus in the beginnings appears as whitish mycelial growth on the exposed surface of compost and casing soil on top as well as on sides in bags. It further develops into large dense patches and colour changes to tan to light brown to cinnamon brown to rust colour. Appearance of brown plaster mould indicates use of poor and old straw, high moisture content in compost, less gypsum or poor quality gypsum. No mushroom mycelium grows where brown plaster mould occurs. On rubbing the infected area in hands we can feel sand like particles (Fig. 9.2).

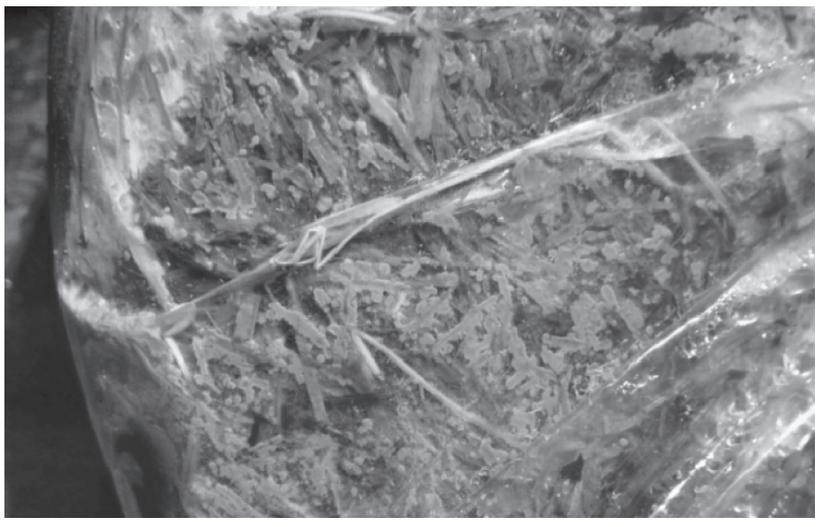

Fig. 9.2: Brown plaster mould

Notes

Some of the steps that should be looked are that composting should be carried out carefully using sufficient gypsum and not too much water. Peak heating / pasteurization should be for sufficient duration and at proper temperature. The compost should not be too wet before or after peak heating/ pasteurization. Localized treatment of infected patches may be done with 2% formalin.

White Plaster Mould (*Scopulariopsis fimicola*)

This mould appears as white patches on the compost or casing soil. It indicates high pH of the compost which may occur due to under or over-composting, which still retains the smell of ammonia and has high pH (>8.0). Spawn run is reduced significantly and under severe conditions complete crop failure may occur.

It is important to undertake proper composting and add optimum quantities of water and gypsum. Sprays of bavistin (0.1%) and local application of formalin (2%) after the removal of the mat may be partly helpful in controlling the mould.

Cinnamon Mould (*Chromelosporium fulva,* Perfect status *Peziza ostrachoderma)*

Firstly, this mould appears as large circular patches of white aerial mycelium on the compost or casing. Within few days the spores are formed and the colour changes from white to light yellow or light golden brown or cinnamon and the colony develops a granular appearance. Later the fungus produces numerous cup-like fleshy fruit bodies on beds. Too wet casing soil mixture, over sterilized casing, over pasteurized compost, high moisture content of the compost and excess of ammonia present in the compost favour the disease development.

Thus, casing soil should be properly sterilized by steam or formaldehyde. Newly cased beds may be sprayed with Dithane Z-78 and proper moisture content in casing layer may be maintained.

Yellow Mould (*Sepdonium* spp, *Myceliophthora lutea, Chrysosporium luteum, C. sulphureum)*

In long method compost on beds in huts having clear polythene at the base, you may see yellow mould below the beds as small yellow circles (Fig. 9.3). This mould also develop into a layer below the casing (Mat disease). In case of mat formation, mushroom production is severely inhibited.

To check yellow moulds, it is important to use properly pasteurized compost made by short method. Further, spawning may be done in clean area. Chicken manure is major carrier of this disease and old chicken manure may not be used. Use of chicken manure based formulae may be avoided when making compost by long method. Carbendazim (0.05%), Blitox (0.04%) and calcium hypochlorite solution (15%) can be sprayed for the control of this disease.

Addition of triple phosphate fertilizers @ 0.5% in compost (wet wt basis) or even single super phosphate @ 1% at the time of spawning have also been reported to be beneficial for control of this disease and may increase yield.

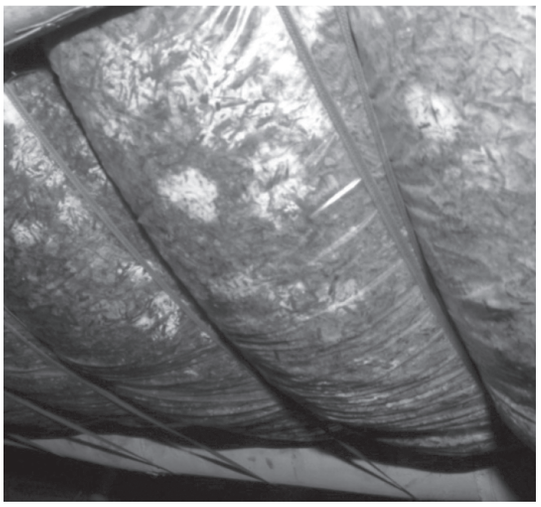

Fig. 9.3: Yellow mould (Tikdi) below the compost

False Truffle (*Diehliomyces microsporus)*

False truffle manifests at a temperature above 23°C. It also appears in white button mushrooms when temperature is high. This fungus, which produces walnut like masses, is mainly found during cultivation of high temperature button mushroom (*A bitorquis*). It can be avoided by proper pasteurisation followed by proper hygiene. Temperature should be kept low to avoid growth of this mushroom.

INTEXT QUESTIONS 9.1

Answer the following questions

(i) Which fungus indicates lack of aeration during compost preparation especially during Phase-II.

(ii) Which fungus appears if ammonia is left in the compost.

(iii) What abnormality occurs by use of petroleum products, fumes and some other unwanted chemicals.

(iv) Long stems of button mushroom indicate high ..... In the room.

(v) Yellow mould occurs more when compost is made by using chicken manure in ..... method of compositing.

The fungal, bacterial, viral and nematodal diseases cause significant production losses. Certain abiotic factors also reduce the quality and quantity of mushrooms. Diseases appear due to improper compost, casing, water quality, defective farm design and inadequate hygiene practices. Diseases may appear at different stages. Primary source of infection is soil, water, compost, casing, spawn and it may spread by air currents, flies (spores stick to feet, legs and wings), workers or visitors, water splashing, equipment that is moved from one cropping room to another and materials such as compost and casing. Diseases can be controlled by using chemicals, biologicals, environmental manipulation or by using genetically resistant cultivars. Normally we have to follow Integrated disease management. Integrated control strategy involves hygiene, structures, the use of pesticides and crop management at pre-cropping, cropping and post- cropping stage. At pre-cropping stage we must ensure that casing is pasteurized properly, it is protected from contamination after pasteurization and proper care is taken while transporting compost and casing. We should always follow hygienic principles like proper sterilization of cropping rooms, use of foot dips etc. During cropping do not brush a dry floor, detect and remove disease early, remove stumps promptly, and terminate diseased crops early. After cropping cook out, closing the air intake of other cropping rooms while removing bags and proper disposal of spent compost is important.

9.2 FUNGAL DISEASES

Wet Bubble (*Mycogone perniciosa)*

This is caused by fungus *Mycogone* and disease results in large undifferentiated irregular malformed masses of tissue on which amber coloured droplets can be seen (Fig. 9.4). It produces two types of spores: a small fragile short-lived spores and a larger. Tougher long-lived chlamydospores. The tough spores can survive in soil and primary source of the disease can be infected casing soil. This is a dreaded disease that can lead to almost complete crop loss. It is transmitted through casing soil. In case casing soil is infected the disease will appear in the very first flush. If it appears in later flushes, it means that it is spreading via insects, workers, etc. It is important that if this disease appears, every hygiene relation caution should be adopted. It is must to remove such mushrooms before watering and picking by a separate team of workers.

The precautions include the following:

- Remove all infected mushrooms and never spray water before their removal. The removed infected mushrooms should be dipped into copper sulphate or formalin and disposed off at faraway place in a pit.

- Always spray benomyl @ 0.1% immediately after casing or spray formalin (0.8%) and Carbendazim (0.1%) after casing.
- Control flies as these are the carrier of spores of many diseases. Fine nets at exit points are must and so is the sealing of the doors.
- Sterilising all the knives, equipments and dresses.
- Regulate the movement of workers from new cropping room to old cropping room and never backwards. The workers should be properly educated about importance and methods of hygiene. This should be strictly followed.
- Cover the infected mushrooms with plastic glasses before harvest and after removal the area may be treated with salt or fungicides.
- Sanitize cropping rooms before starting the next crop cycle.
- It is highly important that the casing soil be pasteurized using steam for 4-6 hours at 65°C.
- Wherever possible, proper cook out is must. It is also important to close one cropping room before opening the other one and keep corridor clean and sterilized.

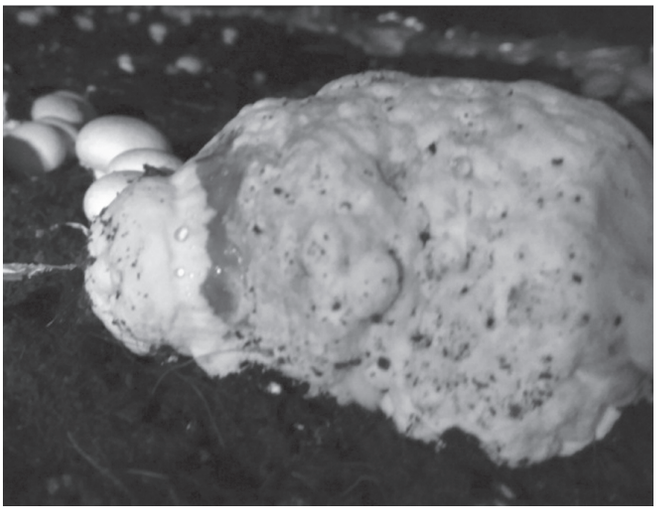

Fig. 9.4: Mushroom infected with wet bubble

Dry bubble (*Verticillium fungicola)*

The symptoms will depend on the time of infection. Infection of mushroom pins results in abnormal bubble like mushrooms; infection during early mushroom development leads to split stipes and partial mushroom malformation; wart like

Notes

growths can occur when older developing mushrooms are infected; and grey-brown spots on mushroom may develop when fully formed mushroom is infected for example by water splash. At times symptoms of dry and wet bubble can be overlapping.

The spores fungus causing wet bubble are sticky and may spread through flies or anything that comes into contact with infected area like knives, hands, clothes, tools. These may stick to door handles and canteen tables and chairs and spread from there to other areas. Hence proper fly control and hygiene is must. The primary source of the disease is normally contaminated casing soil or casing equipment. This can happen due to improper pasteurisation of casing soil, dust, flies, people and so on.

If we try to remove diseased mushrooms, the spores will stick to our hands and we may inadvertently become spreader of the disease. It may be apt to cover it or treat with salt or chemical. Flies and water splashes can be the major cause of it dispersal. Hence in extreme cases we may have to stop watering to check spread of the disease.

Cobweb (*Cladobotryum dendroides)*

This disease appears like a cottony growth around mushrooms on the casing soil which later on spreads over the mushroom and discolours it. In severe attacks, a dense white mould develops over casing and mushrooms and it change from a fluffy cobweb to a dense mat of mycelium. The white colour can turn pink or even red with age.

We can use salt over the infected areas to check the disease. Regular cleaning, removal of cut mushroom stems and young half dead mushrooms after each break is required. Controlling temperature and humidity helps in controlling the disease. Cook out and regular disinfection of unit and surrounding areas with 5% formalin solution or fumigation with formalin is helpful in controlling disease. Immediate spray after casing with benomyl @ 0.1% may also help in controlling the disease.

Green Mould *(Trichoderma sp*)

Number of *Trichoderma* species causing typical green growth in compost or on casing have been reported. Green mould generally appears in compost rich in carbohydrates, deficient in nitrogen or having acidic pH and when the humidity is high. Frequent use of formalin also tends to promote the development of green moulds. It can spread via dust particles, contaminated clothing, animal vectors especially the mite and sciarid flies.

Carbendazim is reported to provide good control. It may be apt to mix lime in casing to adjust it pH around 7.5. Proper pasteurisation, hygiene is important.

INTEXT QUESTIONS 9.2

Fill in the blanks

(i) Deformed mass of button mushroom from which at later stage brown water drops may start oozing in due to ..... disease.

(ii) Acidic pH normally favours the occurrence of ..... mould.

(iii) ..... and ..... is commonly sprayed after casing for checking various diseases.

(iv) Casing soil is the main carrier of wet bubble and proper ..... of casing soil is must for control of this disease.

(v) Symptoms of dry bubble will vary with the stage of infection. (True or False)

9.3 BACTERIAL AND VIRAL DISEASES

Major bacterial disease is bacterial blotch and major viral disease affecting mushrooms is dieback disease.

9.3.1 Bacterial Blotch (*Pseudomonas tolaasii*)

This disease is also called bacterial spot disease. It is caused by bacteria *Pseudomonas tolassi*, which produces brown sunken lesions on the cap of the fruit body and thus reduces the quality of the mushroom (Fig 9.5). The enlargement of the spots on the cap surface is dependent upon environmental conditions and is favoured by temperature of and above 20°C together with the presence of water film. In heavy infection, mushrooms are distorted and splitting of the cap might occur at the site of infected spot. The bacterial blotch spots are slimy. Casing and dust are the primary source of inoculum for the blotch pathogen into a mushroom house. High humidity and improper hygienic conditions promote this disease. Sciarid and phorid flies as well as mites also transmits the pathogen.

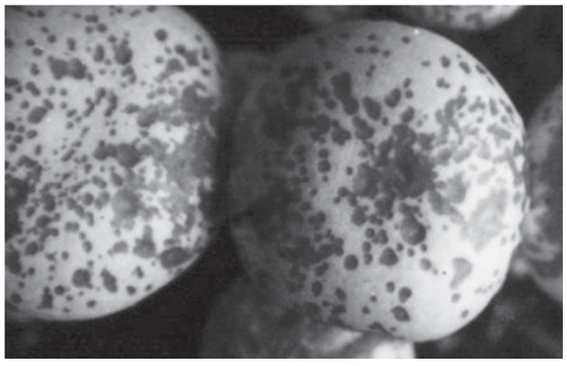

Fig. 9.5: Bacterial Blotch

Notes

Management of humidity and watering the beds in the mushroom houses are crucial factors in controlling blotch. Lowering the humidity (<85%) and temperature (<20°C) helps in checking the spread of the disease. Ventilation and air circulation after watering helps in quick drying of mushrooms. Application of bleaching powder @ 0.15% is effective in managing the disease. Spray of streptomycin @ 200ppm or oxytetracycline @ 300 ppm is recommended. Bacterial antagonists such as *Pseudomonas putida, P. reactants, P. fluorescens* and *Bacillus subtilis* are potential bio-control agents for biological promotion of the health and growth of button mushroom. In places where the disease occurs constantly, the treatment of casing layer with formalin (0.5%) or steam might be necessary.

9.3.2 Die Back

This is the most common viral disease where mycelium does not permeate the casing layer or disappears after the normal spread. Mushrooms appear only in dense clusters, maturing and opening too early.

In case this disease appears. It is must to cook out of the compost for 12 hours at 70°C after the termination of the crop. It is also necessary to disinfect doors, little holes in the floor, shutters, racks, floors and walls with formalin (2 %); use proper filters during phase II operation of the composting; spray malathion @ 0.05% immediately after spawning. Proper hygiene and regular spray of formalin can help in checking the spread of disease.

INTEXT QUESTIONS 9.3

State True or False

(i) Bacterial blotch is the most common bacterial disease on button mushroom.

(ii) High temperature and high humidity do not favour the growth of bacterial blotch.

(iii) Casing and dust are the secondary source of inoculum for the blotch pathogen into a mushroom house.

(iv) Application of bleaching powder @ 0.15% is effective in managing the disease.

(v) **Die back** is the most common viral disease where mycelium does not permeate the casing layer or disappears after the normal spread.

Notes

9.4 ABIOTIC DISORDERS

Deviations in environmental parameters can cause many abnormalities in mushrooms. Deviations in temperature, relative humidity, moisture content and pH of the substrate, CO_2 concentration in the room, air velocity, petro-chemicals/ smoke/fumes, etc.

Cracked/malformed Mushrooms

Fluctuations in humidity and temperature lead to cracking and malformed mushrooms (Fig. 9.6)

Fig.9.6: Fluctuations in temperature, carbon dioxide and humidity in cropping room leads to formation of cracked/ malformed mushrooms

Storma

Sometimes we may observe stroma/sectors/ thick strands of mycelia on surface of spawned compost or the casing. This can occur due to use of old or repeatedly spawn to spawn multiplied spawn. This is more common in some strains. Changes in moisture and humidity may also cause these symptoms. Excessive CO_2, with high water content in the compost and prolonged spawn run period may also result in stroma. Such patches should be removed and corrections in carbon dioxide and humidity may be made.

Rose Comb

Sometimes we may observe pinkish gills on the cap in an abnormal manner giving the appearance of the comb. Such mushrooms are not marketable. The abnormality is caused by smoke or gases or vapours of kerosene oil, petrol, diesel paint or oil products etc.

Notes

Long Stemmed Mushrooms

High CO_2 during cropping results in the formation of mushroom with long stems and small caps that may look like drum sticks. We can correct this abnormality by the improvement of aeration. Very high carbon dioxide may not only lead to formation of long stemmed mushrooms but also lead to loss of yield.

Mass Pinning

Mass pinning or pinning below the casing are common, especially during seasonal cultivation. Sudden fall in temperature, excessive aeration or early lowering of CO_2 concentration than recommended can lead to such symptoms. Many of the abiotic disorders are strain specific and some high yielding strains may be more sensitive.

INTEXT QUESTIONS 9.4

State True or False

(i) Fluctuations in humidity and temperature lead to cracking and malformed mushrooms.

(ii) Excessive CO_2, with high water content in the compost and prolonged spawn run period may result in stroma formation.

(iii) Mushroom with long stems and small caps that may look like drum sticks are often the result of high CO_2.

(iv) Many of the abiotic disorders are strain specific and some high yielding strains may be more sensitive.

(v) Smoke or gases or vapours of kerosene oil, petrol, diesel paint or oil products etc. may cause long stems in button mushroom.

9.5 SANITATION AND HYGIENE

In mushrooms 'prevention is better than cure' is much more important than in other crops. Hygiene covers all the measures, which are necessary to minimize the possible incidence of the pests and pathogens. Thus, hygiene and sanitation go hand in hand at all stages of mushroom growing. Farm hygiene is the best defence for a mushroom grower against mushroom pests and diseases particularly during the present time, when use of chemicals on food crops is being discouraged. Based on the critical observations during all the stages of mushroom production, the

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following steps should be adopted as a routine practice for successful mushroom cultivation.

- Use fresh substrate for preparation of compost. Do not use straw exposed to rains and having fungal growth.
- Floor for the preparation of compost should be cemented/ tiled and covered with a roof.
- The location of mushroom unit should be away from chemical industries and should be free from toxic fumes or gases.
- Pasteurization and conditioning of the compost should be for optimum duration at right temperatures as over/under pasteurization may produce poor quality compost and invite disease problems.
- Do not allow free access of persons working in composting yards to spawning and other cleaner areas without changing the dress and foot-dip.
- Spawn should be fresh and free from all contaminants.
- Spawning area must be washed and disinfected with 2% formalin.
- The fresh air should be filtered before it enters the growing rooms to exclude all particles of 2 micron and above.
- Casing area, operations and casing soil should be kept in a location here it can be protected from spore contaminated water, dust, debris, flies, etc. Casing mixture should be properly sterilized (65°C for 5-6 hours). It is important to clean all the equipment and area before casing. Workers involved in harvesting can also be the carriers of spores and hence may not visit the casing area. Personnel involved in casing operations should have no contact with the rest of the farm before casing operations start to prevent picking up any contamination.
- Rooms should always be clean and it is important to regularly clean/ whitewash/spray/repair these so that areas where spores can persist or enter the room are taken care of. There is lot of debris after rooms are filled and bags are cased. Remove the debris carefully. Don't sweep or use water jets to clean.
- A separate team of workers may check the beds/bags before watering and picking and remove infected mushrooms or treat disease before watering to prevent spread of the disease. During this stage we may also turn off air circulation to check dispersal, of air borne spores.
- Flies are carriers of many diseases and hence it is important to monitor and control the flies. Flies may lay eggs at the time of spawning and hence

Notes

spawning should be done in protected place. Flies easily enter through faulty door seals. Control insect-pests well in time to avoid the spread of pathogen by them. Use fine nets and air curtains.

- It is important to clean corridors with disinfectant, clean all knives and equipment, use foot dips, clean overalls, hand gel for disinfection. It is also very important to check the movement of workers and follow other hygiene related instructions. Picking should start from new or cleaner crop towards older crops. In no case any worker or equipment may be moved from old to new rooms. All the knives, trays and other equipment should be sterilized daily to avoid dispersal of spores.
- Wherever possible, we may cook out the room at 70 °C for 8 hours before emptying the room. Otherwise we may spray chemicals to kill all the spores and flies. Properly clean and disinfect the room after emptying. While emptying we should keep other rooms closed and also fresh air intake to avoid sucking of spores. It is important to use filters at the fresh air entry point in Air Handling Unit.
- Reducing humidity, less watering, taking only two flushes and terminating crops in case of severe infection are some of the other options. Disease control may not always mean increase in yield but it is must for subsequent crops. Once disease is present on the farm, action will be needed to limit the spread of the disease and this will need integrated efforts. Training the workers will be important.
- Maintain optimum environmental conditions in the cropping rooms to avoid abiotic disorders.
- Avoid surface condensation of water on developing mushrooms. You may add bleaching powder (150ppm) at every watering to manage bacterial disease.
- Remove heavily infected bags from the cropping rooms or treat the patches by spot application of 2% formalin or 0.1% Carbendazim.
- Dispose off spent compost, casing soil, mushroom stalks, unsalable mushrooms away from the farm as these can be sources of spores of different diseases and flies. Waste from picking, trash, stems, unsaleable mushrooms should be carefully collected not allowing to fall on the floor and be disposed off carefully.

Some of the most common fungicides recommended for the control of major fungal pathogens of mushrooms and used in mushroom industry are:

Notes

- Benomyl (Benlate 50 wp) – For control of *Cladobotryum, Mycogone, Trichoderma, Verticillium,* mix 240 g/100 m² with casing or dissolve in water at 240 g/200 litres/100 m² during first watering. Carbendazim (Bavistin) same as for benomyl.
- Chlorothalonil (Bravo or Repulse) – to control *Mycogone* and *Verticillium*. Apply as spray 2 week after casing and repeat after 2 weeks later @ 200 ml in 100-200 litre water/100 m^2.
- Prochloroz Manganese (Sporgon) – Presently sporogon is not available in India. World-wide it is used to control *Mycogone, Verticillium, Cladobotryum*, as a single application of 300 g/100 litres/100 m², 7-9 days after casing.
- Zineb – to control *Dactylium, Mycogone*, *Geotrichum* and *Verticillium*, Use 350 g/ 100 m² every week after casing. For wettable powder, 1 kg/1000 litres @ 5 litre/ 100 m² after casing and between flushes.
- As a general practice, cook out of compost, fumigation of cropping rooms after cropping with formaldehyde and spray with copper fungicides helps in removing primary inoculum.
- Similarly it may be appropriate to spray 0.5% formalin or 0.1% bavistin just after casing to check the primary inoculum. The chances of infection are much higher at these stages as there is lot of movement of air, materials and persons and all are potential carrier of diseases.

9.5.1 Cook Out after Cropping

As said earlier, in mushroom cultivation prevention is better than cure. Material left after cropping is a potent source of diseases and flies. It is important that before emptying the rooms, the compost is cooked out, that is heat treated by raising the temperature to 70°C for at least 6-8 hours and preferably for 12 hours.

After removal compost as well as the buts of stipes need to be disposed off at far of place and preferably buried. If left in the vicinity of the unit, these become a potent source of infections. Similarly the rooms need to be disinfected with formalin/$KMnO_4$ or other chemicals before the start of the cropping. Many farmers do white washing after every one or two crops and mix fungicides/ insecticides in the lime.

To prevent dispersal of diseases from one room to another, it is important that the moment of the workers should be strictly from new room to the older rooms so that there is no backward spread of the diseases. The room should be closed before opening another room and the corridor should have disinfectants like common salt on floor.

Notes

Maintaining clean area is important. One common mistake is that while emptying the rooms after cropping we do not bother to close other rooms and suction of fresh air. In many units farmers do not use filters for fresh air and most of the diseases come via this source.

Flies get attracted towards the smell of the compost and many of these lay eggs while spawning is being done. It is thus important that spawning should be done in clean conditions and the area for spawning should preferably be sealed and having positive pressure.

INTEXT QUESTIONS 9.5

State True or False

(i) Over/under pasteurization may produce poor quality compost and invite disease problems.

(ii) All the knives, trays and other equipment should be sterilized daily to avoid dispersal of spores.

(iii) Cook out at 70°C for at least 6-8 hours is must for preventing build up of inocculum at the mushroom unit.

(iv) Flies get attracted towards the smell of the compost and many of these lay eggs while spawning is being done.

(v) To check spread of diseases, the moment of the workers should be strictly from old room to the new rooms.

WHAT YOU HAVE LEARNT

Let us recapitulate the important points we have learnt in this lesson:

- Indicator moulds appear when there is defect in preparation of compost or any other cultural practice
- Prevention is better than cure
- More diseases appear in long method compost than in short method
- Disease incidence generally low in initial years due to which growers stop taking precautions and suffer

- Wet bubble and yellow mould are two most common diseases
- Many diseases are indication of poor quality compost and mistakes in climate control
- All diseases may not be due to infection but happen due to poor management and fluctuations in temperature, humidity and increase in carbon dioxide
- There is hardly any chemical having label claim for mushroom and hence prevention is must
- Even after use of chemicals the possibility of getting normal yield is not there. The chemicals and cook out is used for protection of subsequent crops
- Flies, humans and equipments used daily act a carrier of diseases.
- Mushroom flies are much smaller in size and hence the mesh normally used in houses may not be enough.
- Without cookout the chances of long time survival of the project are very low.

TERMINAL EXERCISE

1. What happens if ammonia is left in the compost at the time of spawning?
2. How you will identify that the crop is giving less yield due to less aeration at the time of making compost?
3. Name one dreaded disease coming via casing soil and spread by flies and water splashes.
4. Why wet bubble infected mushrooms should be removed before watering?
5. What precautions should be taken up to check spread of bacterial blotch?
6. At what temperature we should do the cook out and for how long?
7. List some of the steps that should be adopted at mushroom unit to prevent the occurrence and spread of diseases.

ANSWERS TO INTEXT QUESTIONS

9.1

(i) Olive green mould (ii) Inky caps (iii) Rose Comb

(iv) Carbon dioxide (v) Long

Notes

9.2

(i) Wet bubble (ii) Green

(iii) Formalin and carbendazim (bavistin) (iv) Pasteurization

(v) True

9.3

(i) True (ii) False (iii) False

(iv) True (v) True

9.4

(i) True (ii) True (iii) True

(iv) True (v) False

9.5

(i) True (ii) True (iii) True

(iv) True (v) False

SUGGESTED ACTIVITY

- Visit nearby mushroom unit and try to identify commonly occurring diseases.
- Prepare a report on the status of hygiene and suggest the changes required for better hygienic conditions.
- Calculate the amount of insecticide required for 10 litres of water when the recommended dose of the insecticide is 0.5% and concentration of the insecticide is 40%. {Hint: Insecticide required (in ml or gram) = Conc. of insecticide recommended for spray (%) × Amount of liquid to be sprayed (litres) × 1000/Strength of commercial insecticide (Active ingredient) %.}

Key Learning Outcomes

- Indentify and manage diseases affecting mushroom.