

Abiotic Diseases of Mushroom and Their Management

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Stroma

Common name: Stroma, Sectors, Sectoring.

- Stroma is noticeable aggregations of mushroom mycelium on surface of spawned compost or the casing. Discrete aerial patches of white mycelium form a dense tissue layer on the substrate surface. Stroma form on the compost in small localized areas and the smaller patches can coalesce into larger areas. Stroma can be easily peeled from the surface of compost or casing.
- A sector is a portion of spawn that is distinctive when compared to the general appearance of spawn. A sector may be extra-white, extra-dense or extra-ordinary fluffy and is always different from the normal spawn. Sectors appear on or in the compost and on the casing, and tend to disappear as the crop ages.
- Stroma and sectors are related to the genetic character of the spawn but are sometimes induced if spawn is mishandled or exposed to harmful petroleum based fumes or chemicals or certain detergents during preparation, storage and transit or at the farm.
- Production practices during cropping also affect the appearance of these abnormalities but specific relationship has not been elucidated.
- Excessive CO₂ and prolonged spawn run period also result in stroma formation. A few sectors will not affect yield adversely but the presence of excessive stroma may reduce yield.
- Large patches of stroma 8 to 12 inches are often removed from the compost or casing surfaces.

Flock, hard cap and Open veil:

Common names: Flock, Hard cap, Open Veil, Saggine socks.

- Flock is a physiologically induced malformation of the mushroom's cap and gill tissue. The cap opens pre-maturely and the gills of the affected mushrooms are

rudimentary, poorly developed and have little pigmentation. The flocked mushrooms generally appear in first flush and may disappear in subsequent flushes but in some cases it continues increasing in subsequent flushes.

- The mechanism that causes the mushrooms to be flocked is genetic and certain strains have a greater tendency to develop the abnormality.
- Environmental conditions including diesel exhaust, oil-based point fumes and certain anticorrosive chemicals in steam boilers or certain diseases like die-back, brown plaster mould and false truffle induce flock symptoms.
- Hard cap is a variation of flock syndrome. With hard cap and gills are as described for flock and the cap tends to be disproportionately small in relation to stem diameter. Hard cap mushrooms are restricted to a limited area on the casing but at times 30% areas may produce hard caps.
- Open veil is the premature opening of veil with abnormal gill development. Open veil sometimes occurs when a period of water stress of 1 to 3 days - is followed by a generous watering. It also occurs when fumes of certain organic chemicals drift into or are released in a growing room. Overall, if open veil appears, it is safe to conclude that the mushroom had been under stress during its development. This abnormality is of common occurs during the termination of the crop or under high temperature conditions.

Hollow core and Brown pith

- These two disorders seem to afflict cream strains much more than other strains, although off-white strains can have hollow core. When the bottoms of the stems are trimmed after harvesting, a circular gap is seen in the centre of the stem. This hole may extend the length of the stipe or it may be shorter. When the hollow cut end portion is brown in colour the sale price is considerably reduced. This abnormality seems to be related to watering and water stress.

Purple stem:

Common names: Purple stem, Black leg, Storage bum.

- Cut stems of the mushrooms develop a deep purple colour within few hours of harvest or after being in cold storage (36°F) overnight. At times colour is closer to black than

purple and it occurs in all strains-smooth white, off-white, cream and brown. Generally mushrooms from 3rd break to the end of the crop are most susceptible.

- Polyphenol oxidase, an enzyme increases in later-break mushrooms and this enzyme influences pigment formation.
- Conditions that predispose mushrooms to this phenomenon are unknown but the frequency and the amount of water applied before harvest seems to affect its occurrence.

Rose Comb

- Large lumps and swelling are visible on the mushroom cap. The gills often grow in the top of the cap tissue and even on the top of the cap. These mishappen gills make the swellings look spongy. The mushrooms can even burst or split and then turn brown.
- The abnormality is caused by gases or vapours coming from solvents, paint or oil products and polluted casing soil.

Scales or crocodiles.

- Scales arise through the surface tissue failing to grow while the cap develops further. As the mushroom continues to grown, the skin bursts and so-called `crocodile' skin is formed. The off-white and cream mushroom strains are more sensitive to scalyness than white mushrooms.
- The main reason for scales being formed is poor climate control, in particular too much drying out or too great air velocities. Strong vapours of formaldehyde or pest-control products in excess can also cause the outer layer of the skin of half-grow mushrooms to tear off.

Long stemmed mushrooms

- The presence of long stems in combination with a number of other symptoms can indicate virus diseases but it is often the result of too high CO₂ concentration so that the stems extend more (drumsticks).
- With the improvement of aeration such conditions can be avoided.

Brown Discolouration

- Browning of small pin heads or half grown mushrooms is very common on seasonal mushroom farms.

- This may be caused by high temperature, sprinkling at high water pressure, chlorinating with too high a chlorine rate [maximum rate is 500ml (10%) per 100 litre of water per 100m²] or incorrect use of formalin, e.g. by spraying the mushrooms with a formalin solution.

Oyster mushroom disorders

- As compared to white button mushroom, there are few physiological disorders recorded in oyster mushrooms.
- Reduced light in the cropping room results in longer and thicker stipes and pileus is partly reduced.
- Insufficient ventilation (1-2% carbon dioxide) and low light exposure induce bunched growth of mushrooms.

Integrated approach for mushroom disease management

In order to decide the most effective measures for controlling a disease in mushroom, it is necessary to understand the amount of initial inoculum, density, the rate of disease development, disease spread and infection time. Therefore, an integrated approach is to be followed which includes ecological factors as manipulations of environmental factors such as temperature, humidity and ventilation, biological factors as use of antagonistic organisms through incorporation of biocontrol agents and organic amendments such as leaf extracts of *Callistemon lanceolatus*, *Cannabis sativus*, *Citrus* sp., *Euclyptus* sp., *Dhatura* sp., *Urtica dioica*, *Solanum khasianum* and *Thooja compacta*; use of bio fungicide and lastly judicious fungicides application. Besides all these sanitation and hygiene of farm, farm equipments and farm worker is the best defense against mushroom pests and diseases which a mushroom growers have to strictly adopt. For successfully cultivating mushroom following steps with routine practice has to be applied during all the stages of mushroom production.

- The mushroom unit should be located in an area where effluents of chemical industries and toxic fumes or gases do not pollute water and air.
- Cemented/ tiled floor with a roof should be used for the preparation of compost.
- Substrates used for compost preparation should be fresh, protected from rain and mixed in exact proportion.

- Pasteurization and conditioning of the compost should be done for optimum duration at right temperatures as over/under pasteurization leads to bad quality compost and initiate many diseases.
- Persons working in composting yards to spawning and other cleaner areas should change the dress and foot-dip; i.e strict hygiene should be maintained.
- Spawn should be fresh and free from all the contaminants.
- All equipment and machinery used for spawning, casing, floor and walls of spawning area, must be washed and disinfected.
- Air filters and ventilators should be used in the growing rooms to exclude all insects.
- Casing mixture should be properly pasteurized (60-65°C for 5-6 hours) and should be stored in a clean and disinfected place.
- During spawn run and after spot disinfestation, beds are to be covered with papers, should be moistened twice a week with 0.5% formalin, it reduces the chances for further transmission of diseases.
- Avoid surface condensation of water on developing mushrooms.
- Add bleaching powder (150ppm) at every watering to manage bacterial disease.
- Remove all infected mushrooms before picking and watering and take them away in plastic bags. Spray the affected patch with 2% formalin.
- Remove heavily infected bags from the cropping rooms or treat the patches by spot application of 2% formalin (2ml in 100lit water) or 0.05% Bavistin.
- Application of formaldehyde (2 litre/100 litres of water/100m³) immediately after casing
- Maintain optimum environmental conditions in the cropping rooms to avoid abiotic disorders.
- At the end of crop, cooking out at 70°C for 12 hours is very essential to eliminate all pests and pathogens.
- For control of dry bubble, wet bubble, green mould, mix Benomyl (Benlate 50WP) @ 240g/100m² with casing or dissolve in water at 240g/ 200litres/100m² during first watering or can use Carbendazim (Bavistin), Thiabendazole (Tecto) same as for benomyl.
- Apply Chlorothalonil (Bravo or Repulse) as spray 2week after casing and repeat not less than 2 weeks later @ 200ml in 100-200litre water/100m².

- Give a single application of Prochloroz manganese (Sporgon) 300g/ 100litres/100m², 7-9 days after casing. For double application, use 113g/100litres/100m², 7-9 days after casing and repeat again between second and third flushes. For triple application, use 57g/100litres/100m², 7-9 days after casing and after first and third flushes.
- Just after spawning, spray dichlorovos @ 30 ml in 300 litre water/140 m³ against the flies.
- The pickers should use clean overalls and gloves. Picking should start from new or cleaner crop towards older crops.
- Waste from picking, chogs, trash, stems, unsaleable mushrooms should be carefully collected and be disposed off carefully.

All these points one in another way manage fungal, bacterial, viral, nematode diseases as well as flies and mites during mushroom production.

Conclusion

The demand of growing mushroom is increasing day by day, with an increasing awareness of people regarding its palatability and high food value. The use of pesticides in mushroom crop is not advisable due to residual hazards as mushroom is a short duration crop. There is a need to exploit the use of some plant products which have fungicidal properties and at the same time are safe for mushroom mycelium. Therefore use of organic amendments, plant extract, bio agents and bio fungicides should be implemented in mushroom cultivation as mushroom growing is a young progressive industry all over the world today.