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Plant-protection and biosafety measure

in micro-farming

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Systematic and careful inspection of micro-farming crops and vegetables is essential to prevent introduction of mycoplasmal disease and limit its spread within and from contaminated micro-farming multitier. The fungal pathogen must be detected early, while it spread in low area or present at very low levels. This discussion focuses on detecting fungal pathogen Rhizopus *species; a more comprehensive scouting program is needed for general disease management. This article suggests micro-farming management practices to help prevent the introduction and development of the disease in micro-farming.*

Key words: *Agrobacterium*, Biosafety, Micro-farming, *Phytophthora*, Plant-protection, *Rhizopus* sp.

GROWING of crops/small plants at small level in ambient or modified conditions is called micro-farming. These are harvested at 8 to 12 cm plant height which includes stem and leaves. The average cropping time for producing these small plants is 7 to 12 days. These are grown in soilless media. The trays are kept in a modular micro-farming unit in multi-tier system. They are very rich in nutrients like vitamins, minerals and other beneficial bioactive compounds. Recently, fungal growth on soil-less medium was detected which damage the crop as well as soil-less medium. This type of fungal infection caused considerable damage in micro-farming. Moreover, many pathogenic fungi are regarded as opportunist pathogen of human being as it causes fungal infection called zygomycosis. This may include real consequences for person who consumes infected small plants to make a part of living. Thus, disease management programme in micro-farming is needed which includes detection, prevention and control of disease.

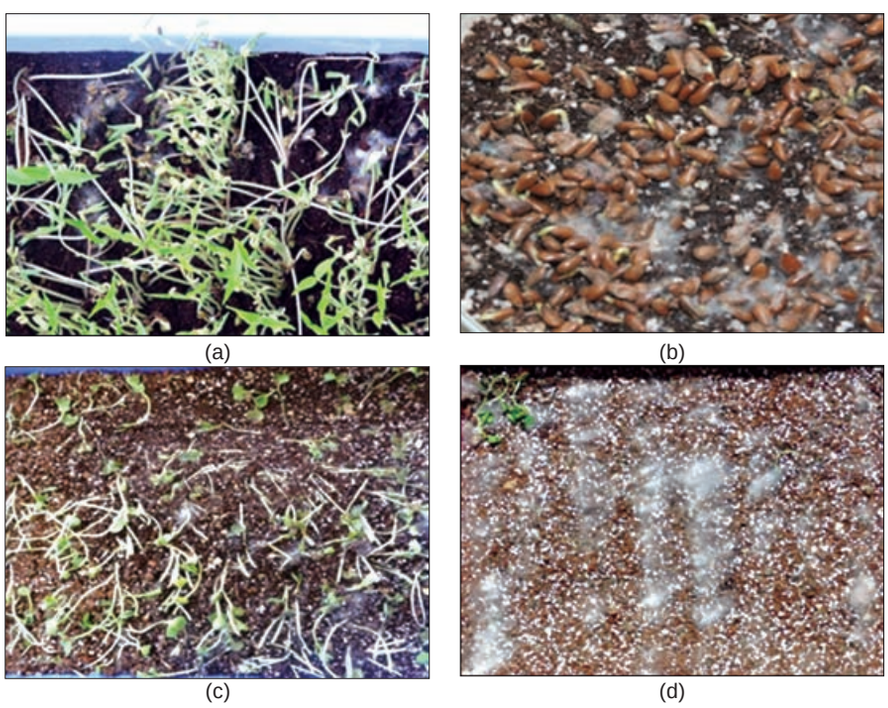


Fig. 1. Infected plant and plant debris/litters showing in (a) mungbean, (b) seabuckthorne, (c) pea, and (d) radish

Plant disease in micro-farming

The sources of plant difease in micro-farming areas discussed here.

Infested media : Many plant fungal pathogens can be found in growing media having cocopeat, vermiculite, perlite, saw dust as its components which is generally used for micro-farming. When micro-farming crops are growing in a media containing these pathogens, the pathogens are stimulated into activity by nutrients that leak from the plants roots and disease may begin. Therefore, the media must be free of pathogens before sowing. A growing media that has been treated to kill plant pathogens or which prevent growth of fungal pathogen with the assurance of being free of pathogens

should be used so that unwanted organisms are kept out. It should be stored in clean containers, moved with clean implements, and placed in clean trays. Care must be taken to avoid getting contaminated media into the fresh media. Tools that have the potential of moving pathogen-containing media into a pathogen-free growing media must be thoroughly cleaned and disinfested.

Plant debris: A disease may re-occur, if infested debris is left in the micro-farming media where it may come in contact with the crop. Some fungal pathogens have evolved a strategy of becoming dormant in the dead leaves, stems, branches, and roots where they previously caused disease. Inside those tissues they are protected from the hostile environments of the growing media and are away from competition with other organisms in the growing media. When conditions become favourable again, disease may begin.

Seeds: The seeds act as reservoirs of pathogens and should be under strict disease control. Recognize that the seeds which were buy from a supplier to grown in micro-farming operation may already be infected with fungal pathogens including *Agrobacterium*, *Rhizopus* and *Phytophthora*. If contamination persist due to infected seed, change suppliers and seeds. However, it is necessary to inspect purchased material carefully. Therefore, trained employees/ research fellows play an important role in resolving this type of problem.

Water and air: Some fungal pathogen can be spread through water and air. For example if surface water supplies may contain fungal pathogens which cause disease in micro-farming when conditions become favorable. If an occurrence of fungal pathogen is an ongoing problem in micro-farming, water source should be changed or water quality tested for contamination. The spores of certain fungi can be carried by air currents for long distances outdoors. Infected plants in nearby trays can supply enormous numbers of spores. Thus, even if great care is taken to eliminate other sources of pathogens, due to the contaminated air which may carry certain disease-causing organisms into the micro-farming. This is another reason why trays with infected plants that harbour pathogens of crops plants in healthy trays should be eliminated from within and around the micro-farming tier.

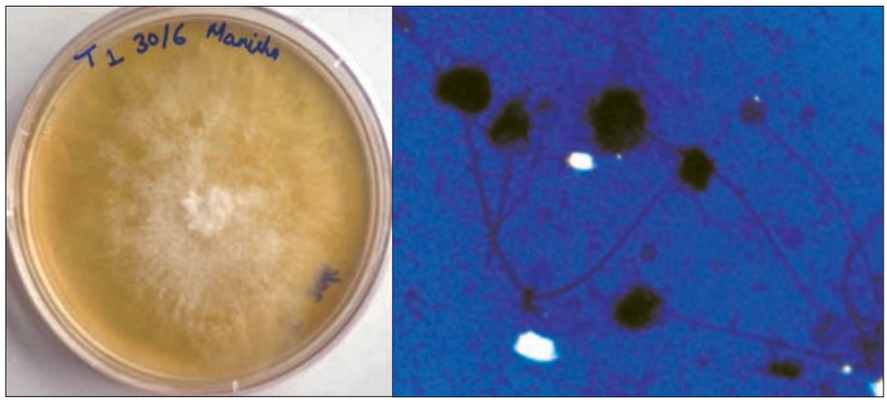


Fig. 2. Growth and morphological character of *Rhizopus* species (a) *Rhizopus* growth on potato dextrose agar pate, and (b) microscopic view (40X).

Plant disease

Collection and isolation of fungal pathogens: Diseased plant from three different crops was collected. Infected plant tissues were surface sterilized in 1% sodium hypochlorite solution for 1 min and rinsed twice in water. Using a sterile scalpel, infected plant tissue were placed onto potato dextrose agar (PDA) and incubated at 28°C. The incubated diseased plant tissue were observed and the fungal species associated with disease symptoms were transferred to new PDA plates and left to grow for 5 to 7 days prior to macroscopic and microscopic identification.

Causal organism: The most predominant pathogenic fungus isolated from the micro-farming samples was *Rhizopus* species based on macroscopic and microscopic identification. Members of *Rhizopus* belong to a large group of fungi called Zygomycetes, true fungi with well-developed mycelium. This plant pathogen is responsible for causing disease in many vegetables, fruits and recognized as pathogen with wide host range. This fungus is regarded as opportunist pathogen of human being as it causes fungal infection called zygomycosis.

Pathogenicity testing: Single spore isolation of fungal species that were associated with disease symptoms within micro-farming tiers were made separately on PDA medium contained in Petridishes. Further, PDA slants containing fungal isolates, which were tested again and their identification, was confirmed. Spore suspensions were prepared from six-day-old culture on PDA. Above spore suspension were tested in healthy plants in sterilized condition in triplicates. Disease symptoms on inoculated healthy plants were found similar to those occurring on seedling in micro-farming tier.

Type of injury: Growth reduction; leaves may become badly distorted;



Fig. 3. Effect of fungal isolates on growth of mungbean seedlings on 7-day of growth.



Fig. 4. Effect of *Rhizopus* species on different micro-farming multitier (a) Mungbean, (b) pea, and (c) radish.

mortality of seedlings, if infection occurs low on the stem and shoot death are reported in severe cases.

Damage: Generally, the disease is of little importance in micro-farming. However, if there is a nearby infection source widespread infection may occur, leading to considerable damage in micro-farming. Average of 84% disease incidence (DI) was observed in mungbean crop. Similarly, average of 28 and 50% DI was observed in mustard and pea, respectively.

$$\text{Percentage of disease incidence (PDI)} = \frac{\text{Total number of infected plants}}{\text{Total number of plants assesed}} \times 100$$

Diagnostic feature

It includes wilting and death of stem above the point of infection. Poorly germinated seed and sometimes healthy seedling were covered with white fungi. Initially growing media have visible white fungal growth which is turn into gray to dark green after sporulation.

Host

Rhizopus species caused disease on characterstic host plant such as mustard, mungbean, pea, cucumber, bitter-gourd, seabuckthorne, radish and cabbage.

Economic importance

Under suitable climatic conditions large numbers of plants grown in micro-farming multi-tier can be affected in a short time, and these seedlings must be discarded. However, one instance has been reported where over 84% of seedlings of mustard in a single tray were affected by the disease Table 1. The disease is usually confined to micro-farming multitier where there is an infection source nearby.

Table 1 Effect of *Rhizopus* species on percentage of disease incidence in different crops.

Host crop	(DI) disease incidence
Mungbean	84%
Mustard crop	28%
Radish	61%
Seabuckthorne	45%
Cabbage	48%
Pea	50%
Cucumber	65%
Bittergourd	47%

Disease management

This organism has the potential to cause severe disease in plants lead to death of stem. So that disease management is necessary step to be taken. For most micro-farming multi-tier, the foremost objective of disease management programmes is to prevent the introduction of pathogen into the micro-farming via infected plant material or other means. These helpful practices include:

Systematic inspection: Begin an inspection with an overview of different micro-farming multi-tier. If suspicious symptoms are apparent, immediately examine them more closely to attempt to identify the disease. Immediately control measures/precautions should be taken if plants were found infected with white/green/gray patches of fungi on media.

Sanitation: The disease is usually confined to micro-farming tiers where there is an infection source nearby, such as fungal infected trays. Fungal infected trays should be destroyed immediately to prevent further fungal infection. Thus, sanitation in and around the micro-farming trays should be necessary.

Other cultural practices which can be useful to reduce disease risk:

- Sterilization of the media by sun drying/autoclave technique.
- Seed should not be planted too deep as etiolated seedling are very susceptible to the pathogens.
- Avoid excessively wet growing media because seed decay, damping –off (the destruction of seedlings at the soil line), and other seedling diseases are favored by wet soil or planting material.

SUMMARY

Every micro-farming fellow should be aware of the sources of pathogens for each crop grown in their particular operation and should plan to eliminate those sources of disease to the greatest extent possible. The fungal infection is common disease problem in micro-farming during 2 to 5 days after sowing. The *Rhizopus* species are relatively mild pathogen that require environmental conditions that favour infection.

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