

Soil Microflora Associated with the Bryophyte *Targionia hypophylla* in the Melghat Region of Amravati District (MS)

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Abstract:

Soil is a dynamic natural system that supports diverse microbial communities and plays an important role in nutrient cycling, decomposition and ecosystem functioning. Bryophytes, particularly liverworts and mosses, occupy specialized ecological niches and may interact with the microorganisms present in their immediate soil environment. The present study was undertaken to investigate the culturable soil fungal flora associated with the bryophyte *Targionia hypophylla* in selected areas of the Melghat region of Maharashtra, India. Soil samples associated with *T. hypophylla* were collected from four locations, namely Chikhaldara, Ghatang Road, Chikhaldara Road and Semadoh Road, during the late monsoon and winter seasons. Fungi were isolated using the soil dilution plate method and cultured on potato dextrose agar (PDA). Morphological characterization was carried out using macroscopic colony characteristics and microscopic features after staining with lactophenol cotton blue. Eight fungal taxa were recorded from the investigated soil samples: *Aspergillus niger*, *Rhizopus stolonifer*, *Cladosporium cladosporioides*, *Fusarium oxysporum*, *Mucor hiemalis*, *Alternaria alternata*, *Penicillium notatum* and *Curvularia clavata*. The findings demonstrate the presence of a diverse culturable fungal community in the soil associated with *T. hypophylla*. Such fungal communities may contribute to decomposition, nutrient cycling and maintenance of soil ecological processes. The study provides preliminary information on the association between bryophyte habitats and soil fungi in the Melghat region.

Keywords: *Targionia hypophylla*, Soil Microflora, Melghat

Introduction:

Soil is a complex natural body composed of mineral particles, organic matter, water, gases and living organisms. It provides physical support to vegetation and serves as an important reservoir of microorganisms involved in decomposition, mineralization and nutrient cycling. Soil microorganisms are influenced by several environmental factors, including pH, moisture, temperature, aeration, organic matter and nutrient availability. Among soil microorganisms, fungi occupy an important ecological position. They participate in decomposition of organic materials and contribute to the release and recycling of

nutrients. Fungi may also interact with plant roots, bryophytes and other soil organisms, thereby influencing ecosystem processes[1-3].

Bryophytes are small, non-vascular plants that include mosses and liverworts. They are frequently associated with moist, shaded and environmentally specific habitats. Because of their capacity to retain water and accumulate substances from their surroundings, bryophytes have considerable ecological importance. They also contribute to soil stabilization, moisture conservation and development of microsites suitable for other organisms. *Targionia hypophylla* is a liverwort belonging to the family Targionaceae. It generally occurs in seasonally dry habitats, particularly on limestone rocks, thin soils, rocky banks and crevices. The specific microhabitat occupied by *T. hypophylla* may provide conditions suitable for the development of particular microbial communities[4-5].

The Melghat region of Maharashtra is characterized by diverse topography, vegetation and soil types. The region includes dry mixed deciduous forests dominated by *Tectona grandis* and contains considerable biological diversity. However, comparatively little information is available concerning the culturable fungal flora associated with soils supporting bryophytes such as *T. hypophylla*. Therefore, the present study was undertaken to isolate and identify soil fungi associated with *T. hypophylla* from selected localities of the Melghat region[6-8].

Materials and Methods:

Study area:

The study was conducted in the Melghat region of Amravati District, Maharashtra, India. Melghat forms part of the Satpura landscape and is characterized by varied topography, vegetation, temperature, rainfall and soil conditions. The study sites selected for soil collection were Chikhaldara, Ghatang, Semadoh.

Collection of Soil Samples:

Soil samples were collected from Melghat areas immediately associated with *Targionia hypophylla*. Sampling was carried out during the late monsoon and winter seasons. Samples were collected while considering the local edaphic conditions and transferred into clean, airtight containers. The samples were stored under refrigerated conditions until further processing [09-11].

Preparation of Culture Media:

Preparation of Potato Dextrose Agar:

Potato dextrose agar was used for fungal isolation. The medium consisted of peeled potato, 200 g; dextrose, 20 g; agar, 20 g; and distilled water, 1000 ml. Potatoes were cut into small pieces and boiled in distilled water for approximately 30 minutes. The extract was filtered through muslin cloth. Dextrose and agar were added to the filtrate and heated gently until completely dissolved. The volume was adjusted to 1000 ml with distilled water. The pH was adjusted to approximately 6.8–7.0. The medium and glassware were sterilized by autoclaving at 121°C and approximately 15 lb/in² pressure. Streptomycin was incorporated into the medium to suppress bacterial growth.

Isolation of Fungi:

The soil dilution plate method described by Waksman [12-13] was employed. One gram of soil was suspended in 10 ml of sterile distilled water and serially diluted. Appropriate dilutions were plated on sterile agar medium. Plates were incubated at approximately $28 \pm 2^\circ\text{C}$ and examined periodically for fungal growth.

Identification of Fungi:

Fungal colonies were examined macroscopically for colony colour, texture, growth pattern and other characteristics. Microscopic preparations were made using lactophenol cotton blue and examined under a compound microscope. Identification was based on characteristics of hyphae, conidiophores, sporangia, conidia and other reproductive structures with the help of relevant taxonomic literature.

Results:

The investigation revealed eight cultured fungal taxa associated with the soil surrounding *Targionia hypophylla*. The recorded fungi were:

Table 1.

Sr. No.	Fungal species
1.	<i>Aspergillus niger</i>
2.	<i>Rhizopus stolonifer</i>
3.	<i>Cladosporium cladosporioides</i>
4.	<i>Fusarium oxysporum</i>
5.	<i>Mucor hiemalis</i>

1. *Aspergillus niger*

Colonies were characterized by dark to black conidial heads. Conidiophores arose directly from the substratum and were smooth, non-septate and thick-walled. Vesicles were globose and supported phialides and metulae. Conidia were globose to subglobose and darkly pigmented.



Fig. 1. *Aspergillus niger*

2. *Rhizopus stolonifer*

Colonies initially appeared white and later became brownish-black. Stolons were spreading and associated with branched rhizoids. Sporangophores occurred in clusters and supported globose sporangia. The mature sporangia became dark, while sporangiospores were irregular to rounded or oval.

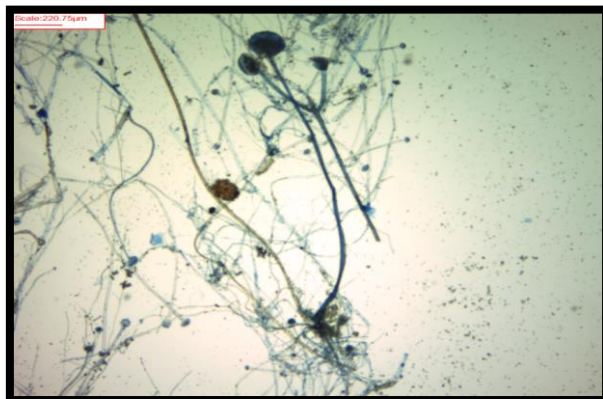


Fig: 2. *Rhizopus stolonifer*

3. *Cladosporium cladosporioides*

Colonies developed olive-green to brown coloration. Conidia were produced in branched chains and were generally ellipsoidal to limoniform. Conidia were olive-green to brown and possessed prominent scars.

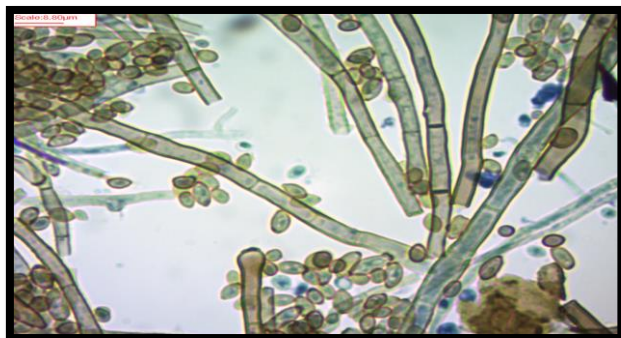


Fig: 3. *Cladosporium cladosporioides*

4. *Fusarium oxysporum*

Colonies developed white to peach aerial mycelium, frequently showing violet or purple coloration. Microconidia were produced from phialides, while macroconidia were spindle to fusiform and septate. Chlamydospores were also observed.

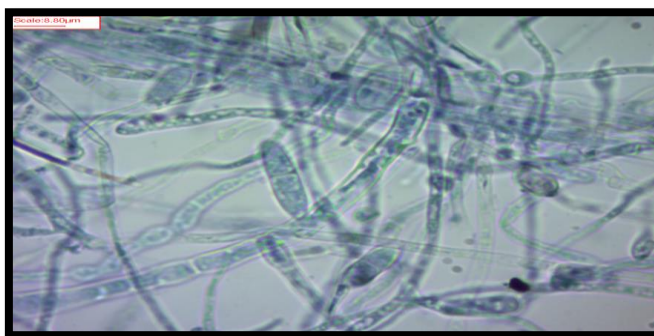


Fig: 4. *Fusarium oxysporium*

5. *Mucor hiemalis*

Colonies were greyish-yellow to pale in colour. Sporangophores were somewhat sympodially branched, with globose sporangia. Columellae were globose to oval. Chlamydospores and zygospores were observed in the described cultures.

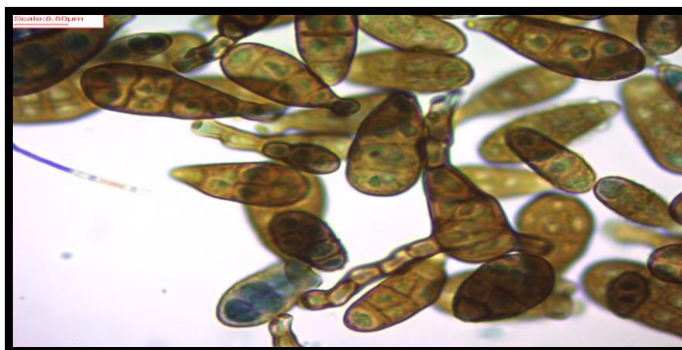


Fig: 5. *Mucor hiemalis*

Conclusion and Discussion:

The present investigation demonstrated the presence of a diverse culturable fungal community in soil associated with *Targionia hypophylla*. The eight fungi recorded belong to genera commonly encountered in soil and plant-associated environments. The occurrence of *Aspergillus*, *Penicillium*, *Mucor* and *Rhizopus* suggests the availability of organic substrates capable of supporting saprophytic fungi. These organisms may contribute to decomposition and nutrient release in the soil. The occurrence of *Fusarium*, *Alternaria* and *Curvularia* is also ecologically significant because members of these genera include species associated with plants and soil.

Soil fungal communities are strongly affected by environmental conditions such as temperature, moisture, pH, aeration and organic matter. The Melghat region possesses considerable variation in topography and vegetation, which may contribute to differences in soil microbial communities. The association of these fungi with soil surrounding *T. hypophylla* does not by itself establish a direct symbiotic or pathogenic relationship with the bryophyte. Rather, the results indicate that *T. hypophylla*-associated soil represents a habitat supporting a range of culturable fungi. Further studies involving quantitative enumeration,

molecular identification and seasonal monitoring would be required to determine the strength and ecological nature of these associations.

The study recorded eight culturable fungal taxa from soil associated with *Targionia hypophylla* in selected areas of the Melghat region. The fungi included *Aspergillus niger*, *Rhizopus stolonifer*, *Cladosporium cladosporioides*, *Fusarium oxysporum*, *Mucor hiemalis*. The findings indicate that bryophyte-associated soil supports a heterogeneous fungal community and may represent an important microhabitat for soil microorganisms. Further quantitative and molecular studies are recommended to understand the ecological interactions between *T. hypophylla*, soil properties and associated microorganisms.

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