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Phytopathogenic fungi study of cultivated infected plant samples collected in the Dhule Tahsil

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Abstract
A comprehensive survey was conducted in the Dhule district to assess the prevalence of fungal diseases, including powdery mildews, downy mildews, leaf spot, red rot, and smut fungi, from cultivated area. By examining the survey results, we can gain valuable insights into the extent of their presence in the region. The analysis revealed insights into the frequency of these diseases, camera lucida illustrated by various structures such as powdery mildew's mycelium networks and downy mildew's complex biofilm. Specific characteristics of groundnut leaf spot, red rust fungus on jowar, and maize fruit smut were highlighted, showcasing their reproductive mechanisms and interactions with plant tissues.

Keywords: Phytopathogenic fungi, cultivated plants, microscopic study, dhule tehsil

Introduction

In Dhule District, Maharashtra, India, Dhule Tehsil is a major administrative subdivision. Khandesh's core is Dhule Tehsil in the northwest (Deshmukh, S. K., *et al*. 2016) [1]. This region is rich in historical and cultural relics. The administrative headquarters of the Dhule tehsil and district is Dhule city (Patil, M. S., and N. B. Pawar 2013) [3]. In Maharashtra's northwestern area, Dhule's terrain is diversified and lovely (Sharma, P. D. 2014) [4]. The terrain ranges from stony flats to gentle slopes. This backdrop includes several plant diseases that threaten production. Since an agri-economy drives the local economy, controlling these illnesses is crucial to maintaining economic stability and food supply (Agrios, George N. 2005) [5]. Several rural variables cause phytopathogenic illnesses. These include climate changes, crop variety, and agricultural management (Mehrotra, R. S., and Ashok Aggarwal 2013) [7]. Dhule Tehsil crops are plagued by powdery mildew, downy mildew, leaf spots, red rot, and smut (Bilgrami, K. S., Jamaluddin, and M. A. Rizwi 1991) [6]. Powdery mildew pathogens (Erysiphe spp., Podosphaera spp.) and downy mildew pathogens (Pseudoperonospora spp., Hyaloperonospora spp.) across diverse host-pathogen interfaces can be documented using Dhule's agro-climatic variability and the presence of key crop species susceptible to oomycete- and fungal-based foliar diseases. The rich terrain of Dhule, Maharashtra, India, grows a variety of crops. Unfortunately, fungal infections have significantly increased in recent years and become a big danger to farmers' sustainable agricultural revenue. An intensive research study was conducted by collecting and evaluating a broad variety of local crops under controlled settings to address this critical issue. This research examined phytopathogenic fungus distribution and prevalence in Dhule's farmed regions. This research will identify local phytopathogenic fungal species and their effects on crop health and yield.

Study of cultivated plant samples collected in the Dhule Tahsil area

In order to understand the prevalence of powdery mildews and downy mildews, leaf spot, red rot and smut fungi in Dhule district, a comprehensive survey was conducted and samples were collected from cultivated area. The collected data was carefully analyzed to determine the frequency of occurrence of these fungal diseases in both wild and cultivated plants. By examining the survey results, we can gain valuable insights into the extent of their presence in the region.

Fig 1: Collection of infected plant samples and coding

Microscopic analysis of the selected plant samples

Microscopy was employed to identify and examine phytopathogenic fungi in various plant samples. Diseased leaf samples were cleaned with distilled water and prepared for observation by cutting impacted fragments and staining with lactophenol cotton blue dye. Under the microscope, thread-like hyphae and various spore types were observed, indicating fungal growth. Signs of infection, such as spore masses and conidiophores, were evident, alongside tissue damage characterized by cell disintegration, chlorosis, and necrotic lesions. This study successfully documented the presence of phytopathogenic fungi in the examined specimens.

Experimental section and Camera lucida observation write-up

The photograph was taken in the plant's natural environment to depict its shape as well as making it available for identification. A part of the plant that had been infected was removed and set aside, so that a microscope slide could be made for identifying the phytopathogenic fungi.

Powdery Mildew (DH-C1): Type of phytopathogenic fungi - Powdery Mildew; Host plant - Bottle Guard; Plant species (scientific name) - Lagenaria siceraria; Family – Cucurbitaceae; Infected part of the plant – Leaf, Month of collection – December; Area of collection - Dhule (Kheda Anand)

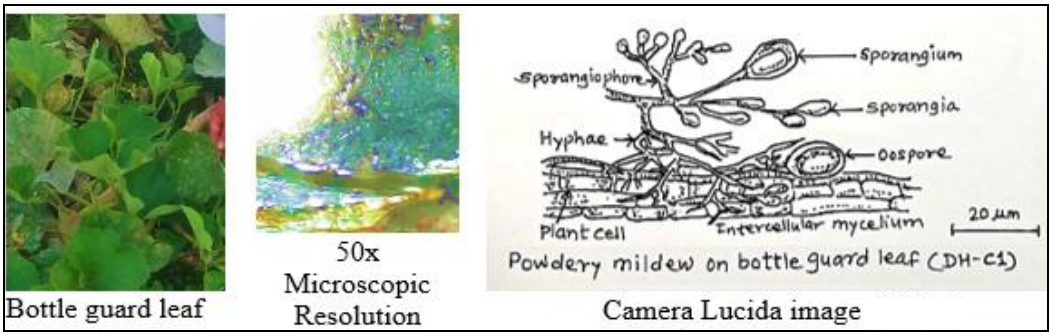

Fig 2: Powdery Mildew on Bottle Guard Leaf (DH-C1)

The camera lucida painting depicts powdery mildew fungus on bottle gourd leaves (DH-C1). The graphic demonstrates how fungal hyphae propagate between plant cells. The fungus produces sporangiophores with sporangia that produce spores. Mycelium between plant cells in infected tissue receives nutrients from the host plant. The picture also depicts thick-walled oospores, which develop during sexual reproduction. It can also observe host leaf plant cells, indicating fungus-host tissue interaction.

Downy Mildew (DH-C2): Type of phytopathogenic fungi: Downy Mildew; Host plant: Sponge Guard; Plant species (scientific name): Luffa aegyptiaca Mill; Family: Cucurbitaceae; Infected part of the plant: Leaf; Month of collection: February; Area of collection: Dhule (Nagaon).

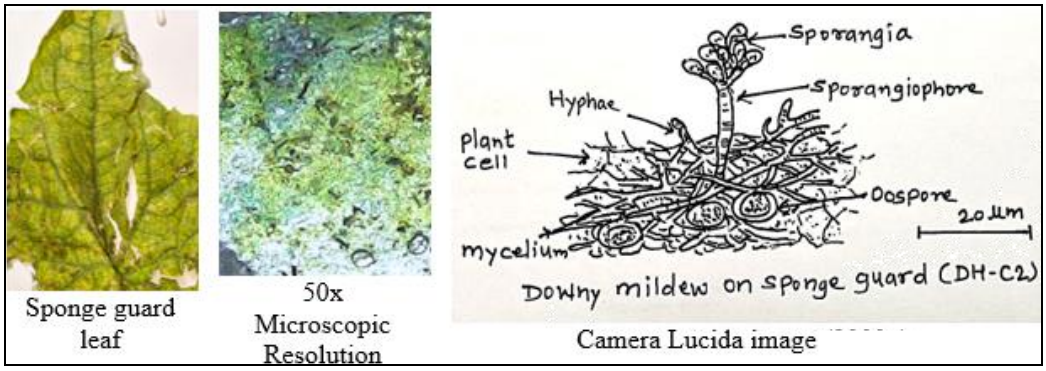

Fig 3: Downy Mildew on Sponge Guard Leaf (DH-C2)

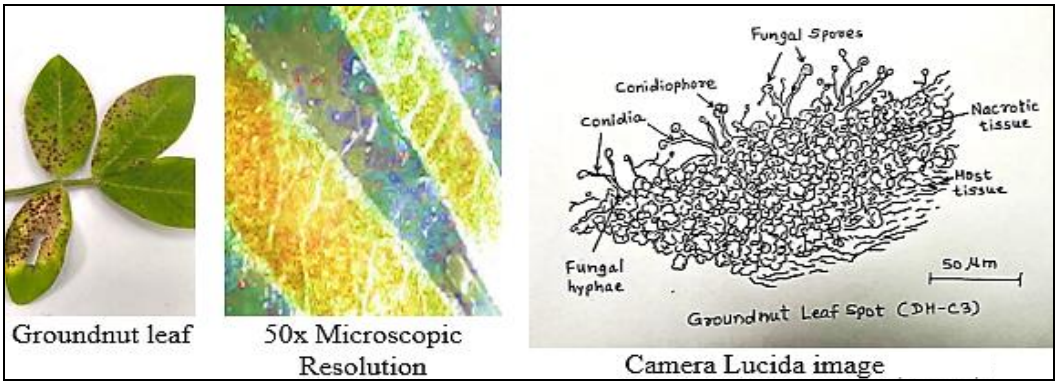

Fig 4: Leaf Spot Fungi on Groundnut Leaf (DH-C3)

The downy mildew fungus on sponge gourd leaves (DH-C2) is clearly visible in the camera lucida photograph. A very detailed depiction of a microscopic fungus' frail hyphae and its mycelium, which weaves in and out of host tissue plant cells. A sporangiophore rises from the mycelium with numerous sporangia for asexual reproduction. The figure illustrates the thick-walled oospore, which rests during sexual reproduction, in sponge gourd tissue.

Leaf Spot (DH-C3): Type of phytopathogenic fungi: Leaf Spot; Host plant: Groundnut / Peanut; Plant species (scientific name): Arachis hypogaea; Family: Fabaceae (Leguminosae); Infected part of the plant: Leaf; Month of collection: February; Area of collection: Dhule

The morphology of groundnut leaf spots (DH-C3) is as shown in the appended illustration: It illustrates the morphological features of the pathogenic fungus causing leaf spots in groundnut. A scale bar of 50 µm is provided, showing the microscopic scale of the structure. The figure contains of fungal hyphae growing so as to cover host tissue that was infected. The fungus produces conidiophores. Conidia (asexual spores) are carried on these. Mycelia are many growing in the infected area. It can clearly understand that a particular section of the leaf carries necrotic tissue. This damaged caused by the pathogen whereas host material may be found underneath samples from infected plants in structure.

Red Rust (DH-C4): Type of phytopathogenic fungi: Red Rust / Red Rot; Host plant: Jowar / Sorghum; Plant species (scientific name): Sorghum bicolor (L.) Moench; Family: Poaceae; Infected part of the plant: Leaf; Month of collection: February; Area of collection: Dhule (Gondur)

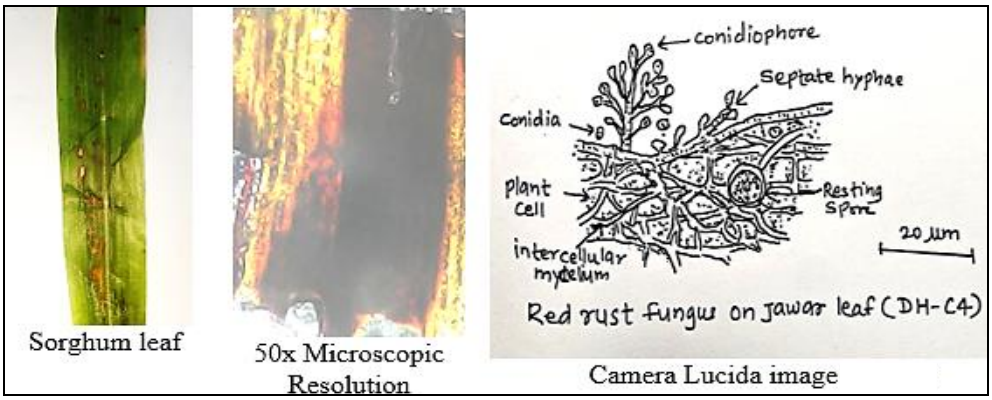

Fig 5: Red Rot Fungus on Sorghum Leaf (DH-C4)

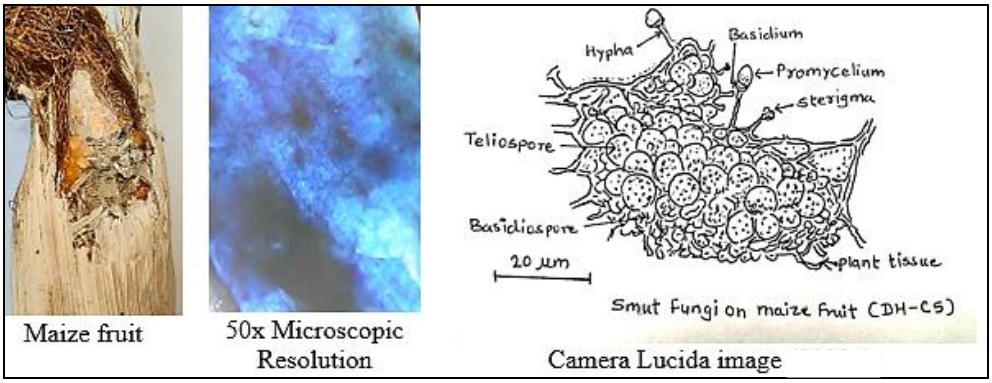

Fig 6: Smut Fungi on Maize Fruit (DH-C5)

Red rust fungus on a jowar leaf (DH-C4) is seen in the camera lucida drawing. Fungal structures are tiny, as seen by a 20 µm. Septate fungal hyphae develop above and between plant cells in the host tissue. Fungal mycelium develops between plant cells and feeds on the host. Conidia, asexual spores that propagate the disease are produced by hyphae-derived conidiophores. The image shows a resting spore, which helps the fungus survive.

Smut Fungi (DH-C5): Type of phytopathogenic fungi: Smut Fungi; Host plant: Corn / Maize; Plant species (scientific name): Zea Mays L.; Family: Poaceae (Gramineae); Infected part of the plant: Fruit; Month of collection: February: Area of collection: Dhule (Ner-Kusumba)

Camera lucida drawing of maize fruit smear fungus (DH-C5). The figure shows the structure of smut fungus-produced thick-walled resting spores, teliospores. The length of 20 µm shows that fungal components within this clustering singularity are microscopic slide in scale. A promycelium forms from these spores. Small projections (sterigmata) on the basidium create basidiospores. Infected plant tissue has fungal hyphae. Microscopically small structures show the smut fungus' sexual life cycle and connection with plant host tissue.

Conclusion

The graphic illustrates powdery mildew mycelium networks with large hyphae above and below tissues. These vertical sporangiophores with sporangia pointing in all directions to

spread oospores, which are clustered around plant tissue nodes to survive till spring.

Downy mildew on sponge gourd has a rich, complicated mycelial network and hyphal threads in plant tissue. The somewhat random mass of this biofilm blurs scenarios that should be clear based on hard evidence and major findings by persistent sporangiophores bearing sporangia and producing spores that enable asexual propagation and intercellular growth.

The groundnut leaf spot has dense, filamentous fungus hyphae spreading within the leaf, many conidiophores and conidia for asexual reproduction, and tissue necrosis plant material that has died or is dying from pathogen spores.

Red rust fungus of jowar leaf has intercellular mycelium, a thick network of septate hyphae containing conidiophores that carry asexually generated conidia and resting spores for survival. Maize fruit smut fungus are clusters of thick-walled teliospores buried in plant material with hyphae between host cells and basidia that generate solitary basidiospores on sterigmata.

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