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Pathogenic Fungal Diversity Affecting Vegetables and Pulses in Amravati Region (M.S.)

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Abstract
India, a tropical country, boasts a rich fungal diversity, contributing nearly one-third of the global total. This study aimed to present an overview of fungal diseases affecting commonly cultivated vegetable and pulse crops in the Amravati region of Maharashtra.Various agricultural food and vegetable crops were selected for investigation. Plants were assessed based on disease symptoms, and samples were collected for photographic documentation and laboratory analysis. Fungal pathogens were identified through microscopic examination, Agar culture isolation, and relevant literature references. Prevalent fungal diseases included powdery mildews, leaf spots, and white rust;also wilt, leaf blights, black smut, and brown rust, all of which significantly impact economically important crops. A total of 36 diseases were observed, with 27 affecting vegetables and 9 affecting pulse crops. Dominant pathogens included *Erysiphe* (10), *Cercospora* (6), *Alternaria* (5), *Albugo* (3), and *Fusarium* (3), along with single occurrences of *Pythium*, *Plasmodiophora*, *Rhizopus*, *Peronospora*, *Urocystis*, *Phomopsis*, *Colletotrichum*, *Uromyces*, and *Leveillula* species. The study revealed notable fungal diversity among host plants, encompassing both ubiquitous forms and host-specific species.

Keywords: Vegetables, pulses, fungal diseases, survey, Amravati region

Introduction
Vegetables are an essential component of a balanced diet, serving as an affordable source of vital vitamins and minerals. Pulses, on the other hand, are a primary source of protein. Together, they play a crucial role in maintaining the nutritional balance of the human diet. Major categories of vegetables include Solanaceous crops, Cucurbitaceous crops, root vegetables, leguminous vegetables, and leafy greens.

However, both vegetables and pulses are susceptible to a variety of diseases, impacting their production as both fresh market produce and processed commodities. These crops can be cultivated under field conditions or in controlled environments. A wide array of fungal diseases afflicts these vegetable crops, significantly compromising yield and quality (Howard *et.al.*, 1994). Such fungal infestations are responsible for substantial crop losses. In countries like India and Iran, these diseases are a major factor contributing to inconsistent and low yields as well as compromised quality (Kaisen and Daneol, 1971b; Nene *et.al.*, 1978; Sen Gupta, 1974).

Moreover, the consumption of contaminated crops poses serious health risks to humans. Given these concerns, a comprehensive survey was conducted to investigate the contamination of vegetables and pulse crops with pathogenic fungi. The study aimed to assess the diversity of fungal pathogens present in raw vegetables and pulses.

Materials and Methods

Study Location:

This study was conducted during 2009-2011in the Department of Botany at Shri Shivaji Science College, Amravati.

Sample Collection:

Diseased plant parts were collected from various sites within the Amravati region. Each plant infection was individually placed in a labelled plastic bag and securely sealed to prevent contamination. Infected plant parts at different stages of maturity were carefully examined, and the associated symptoms were documented.

Detection of Mycoflora:

Fungal identification was performed using both direct and indirect methods. Direct observation involved microscopic examination of infected tissues, while indirect detection was achieved through fungal isolation on Agar culture. Infected plant tissues were excised and subjected to surface sterilization by immersing them in 4% Sodium hypochlorite for one minute, followed by rinsing in sterile distilled water for another minute. Subsequently, small tissue segments were placed on Potato Dextrose Agar (PDA) medium and incubated at a temperature range of 25-27°C.

Identification of Fungi:

Preliminary identification of fungi present in all infected samples was based on colony morphology and sporulation characteristics, including the presence of sexual or asexual spores. Observations were made using a stereoscopic binocular microscope. For precise identification, slides were prepared from pure fungal cultures and examined under a compound microscope. Identification was supported by consulting relevant literature (Walker, 1952; Mehrotra, 1980; Sohi, 1982; Jamaluddin *et. al.,* 2004; Rangaswami and Mahadevan, 2006). Pure cultures of the identified fungi were subsequently maintained on PDA slants for future reference.

Observations:

Table 1 : List of Fungal Diseases and Pathogens on Vegetables and Pulses

SN	Name of Host	Family of Host	Name of Disease	Fungal Pathogen
Vegetables Crops				
1	*Brassica oleracea* var. *botrytis* L.	Brassicaceae	Damping off (seedlings)	*Pythium aphanidermatum*(Eds.) Fitz.
2	*Brassica oleracea* var. *botrytis* L.	Brassicaceae	Club root	*Plasmodiophora brassicae* Woronin
3	*Brassica oleracea* var. *botrytis* L.	Brassicaceae	Head rot	*Rhizopus stolonifer*(Ehrenb.Fr.) Lind.
4	*Brassica oleracea* var. *capitata* L.	Brassicaceae	White rust	*Albugo candida* (Pers. Ex Chev.) Kuntze
5	*Brassica oleracea* var. *italica* L.	Brassicaceae	Downy mildew	*Peronospora parasitica* (Pers.) De Bary
6	*Raphanus sativus* L.	Brassicaceae	White rust	*Albugo candida* (Pers. Ex Chev.) Kuntze

7	*Raphanus sativus* L.	Brassicaceae	Leaf spot	*Alternaria brassicae* (Berk.) Sacc.
8	*Daucas carota* L.	Apiaceae	Powdery mildew	*Erysiphe polygoni*DC.
9	*Beta vulgaris* L.	Amaranthaceae	Powdery mildew	*Erysiphe polygoni*DC.
10	*Allium cepa* L.	Liliaceae	Leaf blight	*Alternaria porri*(Ell). Neergaard
11	*Allium cepa* L.	Liliaceae	Black smut	*Urocystiscepulae*Frost.
12	*Lycopersicon esculentum* Mill.	Solanaceae	Leaf blight	*Alternaria solani*(Ell & Mart.) Jones & Grout.
13	*Lycopersicon esculentum* Mill.	Solanaceae	Wilt	*Fusarium oxysporum*(Sacc.) Snyder & Hansen
14	*Solanum tuberosum* L.	Solanaceae	Leaf blight	*Alternaria solani*(Ell. & Mart.) Zones & Grout.
15	*Solanum melongena* L.	Solanaceae	Leaf spot	*Alternaria melongenae*Rang. & Samb.
16	*Solanum melongena* L.	Solanaceae	Fruit rot	*Phomopsis vexans*(Sacc& Syd.) Harter.
17	*Capsicum annuum* L.	Solanaceae	Leaf spot	*Cercosporacapsici*Heald & Wolf
18	*Capsicum annuum* L.	Solanaceae	Fruit rot	*Colletotrichum capsici*(Syd.) Butl. & Bisby
19	*Hibiscus esculentus* L.	Solanaceae	Leaf spot	*Cercosporaabelmoschi*Ell. & Ev.
20	*Hibiscus esculentus* L.	Solanaceae	Powdery mildew	*Erysiphe cichoracearum*DC.
21	*Cucurbita pepo* L.	Cucurbitaceae	Powdery mildew	*Erysiphe cichoracearum*DC.
22	*Momordica charantia*L.	Cucurbitaceae	Leaf spot	*Cercosporamomordicae*Mc Rae
23	*Momordica charantia*L.	Cucurbitaceae	Powdery mildew	*Erysiphe cichoracearum*DC.
24	*Coccinia indica* L.	Cucurbitaceae	Powdery mildew	*Erysiphe cichoracearum*DC.
25	*Coriandrum sativum* L.	Apiaceae	Powdery mildew	*Erysiphe polygoni*DC.
26	*Trigonella foenum-graecum* L.	Fabaceae	Powdery mildew	*Erysiphe polygoni*DC.
27	*Amaranthus viridis*L.	Amaranthaceae	White rust	*Albugobliti*(Biv.) Kuntze.

Pulse Crops				
28	*Cajanus cajan*(L.) Millsp.	Fabaceae	Leaf spot	*Cercospora indica* Singh
29	*Cajanus cajan*(L.) Millsp.	Fabaceae	Wilt	*Fusarium oxysporum*(Sacc.) Snyder & Hansen
30	*Cicer arietinum* L	Fabaceae	Wilt	*Fusarium oxysporum*(Sacc.) Snyder & Hansen
31	*Phaseolus vulgaris* L.	Fabaceae	Brown rust	*Uromyces phaseoli* Arth.
32	*Dolichos lablab* L.	Fabaceae	Leaf spot	*Cercosporadolichi*Ell. &Evr.
33	*Cyamopsis tetragonoloba*(L.) *Taub.*	Fabaceae	Powdery mildew	*Leveillulataurica*(Lev.) Arnaud
34	*Pisum sativum* L.	Fabaceae	Powdery mildew	*Erysiphe polygoni*DC.
35	*Phaseolus mungo* L.	Fabaceae	Leaf spot	*Cercosporacanescens*Ell. & Mart
36	*Phaseolus mungo* L.	Fabaceae	Powdery mildew	*Erysiphe polygoni*DC.

Results and Discussion:

Early detection and accurate diagnosis of plant pathogens play a crucial role in effective disease management. In the present study, pathological screenings were conducted on plants from various families, including Fabaceae, Solanaceae, Brassicaceae, Apiaceae, Liliaceae, Chenopodiaceae, Amaranthaceae, and Cucurbitaceae. Among different diagnostic methods, visual identification remains the fastest and most cost-effective approach (Jalali, 2008).

Microscopic analysis identified a total of 36 fungal diseases, with 27 affecting vegetables and 9 occurring in pulse crops. Various fungal infections were observed, with powdery mildews, leaf spots, and white rusts being the most prevalent, followed by wilt, leaf blight, black smut, and brown rust. Powdery mildew fungi have been widely studied worldwide, particularly on Cucurbitaceae (Wani, 2011).

The study identified *Erysiphe* sp. as the most frequently occurring fungal pathogen, with 10 recorded instances. This was followed by *Cercospora* sp. with 6 occurrences and *Alternaria* sp. with 5 occurrences. *Albugo* sp. and *Fusarium* sp. were observed in 3 cases each. Additionally, single occurrences of *Pythium*, *Plasmodiophora*, *Rhizopus*, *Peronospora*, *Urocystis*, *Phomopsis*, *Colletotrichum*, *Uromyces*, and *Leveillula* were recorded, indicating a diverse fungal presence across the studied plant species.

Previous studies align with these findings. Hedawoo *et. al.* (2012) documented 33 fungal diseases on medicinal and ornamental plants in the Amravati region, with the majority belonging to Hyphomycetes. Similar observations were made on Solanaceous vegetables by Sohi (1982). Recent research by Vashisht *et. al.* (2023) highlighted the susceptibility of pulses to foliar fungal diseases, including *Ascochyta* blight, anthracnose, leaf rot, powdery mildew, leaf yellowing, stem canker, and downy mildew. Additionally, a field survey of tomato diseases in four districts of West Bengal found blight caused by *Alternaria* sp. to be the most prevalent, with crop losses ranging between 70-100% (Kanjilal*et. al.*, 2000).Atnafu and Keskse (2019) reported *Botrytis fabae*, *Uromyces vicia-fabae*, and *Fusarium solani* as major fungal pathogens affecting pulse crops, causing severe yield losses. Iqbal *et.al.* (2020) identified *Botrytis cinerea* and *Sclerotium rolfsii* as significant contributors to foliar and stem infections. Houasli*et.al.* (2020) highlighted *Ascochyta rabiei* as a major threat to chickpea production, while Sang*et.al.*(2019) documented *Sclerotinia sclerotiorum* as a key pathogen responsible for white mold disease. These fungi not only infect crops but also produce phytotoxins, further exacerbating plant damage and productivity loss.

Conclusion

This study revealed a diverse range of fungal pathogens affecting various host plants, including both ubiquitous and host-specific species. Intake of fungal-infected vegetables can be risky, potentially leading to food poisoning or mycotoxin exposure, causing illness.Therefore, early diagnosis of plant pathogens is essential for effective disease management. The highest incidence of powdery mildew was recorded during the early to mid-summer period, highlighting the seasonal influence on fungal disease prevalence.

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