

https://doi.org/10.69758/GIMRJ/2505I5VXIIIP0023

Exploring the Pathogenic Fungal Diversity Associated with Medicinal and Ornamental Plants in the Amravati Region, Maharashtra

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Abstract

An extensive survey conducted from 2009 to 2011 in the Amravati region revealed a significant incidence of foliar fungal diseases affecting both medicinal and ornamental plants. The study focused on commonly found and economically important species, with plants examined for disease symptoms and samples collected for photographic documentation and laboratory analysis. Fungal pathogens were identified through microscopic examination, isolation on agar cultures, and reference to relevant literature. The most common diseases observed in the collected specimens included leaf spots, powdery mildews, and anthracnose, all of which have detrimental effects on the medicinal and ornamental plants and 15 impacting medicinal species. The predominant categories of diseases included 20 instances of leaf spots, 9 cases of powdery mildew, 3 occurrences of anthracnose, and 1 case of downy mildew. The major fungal pathogens identified included Cercospora sp. (6), Fusarium sp. (6), Alternaria sp. (5), Oidium sp. (5), and Colletotrichum sp. (4), with the majority belonging to the class Hyphomycetes.

Keywords: Medicinal plants, ornamental plants, fungal diseases.

Introduction

Fungi represent a remarkable and diverse group of organisms, contributing significantly to Earth's biological diversity and offering numerous avenues for exploitation, including in medicine, agriculture, and industry (Manoharachary et al., 2005; Gibbons et al., 2015). Despite their vast diversity, fungi remain inadequately studied worldwide, with many species yet to be described or documented (Hawksworth, 1991; Cannon, 1997; Rossman and Farr, 1997; Guzman, 1998). Recent estimates suggest that the number of fungal species could reach as high as 5.1 million globally, of which only about 120,000 have been formally described, indicating a significant gap in our understanding of fungal biodiversity (Hawksworth & Lücking, 2016; Tedersoo et al., 2021).

Producing a comprehensive survey of fungal diversity, even within small geographic regions, poses considerable challenges due to the complex life cycles and ecological roles of fungi. This highlights an urgent need for biodiversity assessments aimed at evaluating the impacts of habitat destruction and climate change on fungal populations and their ecosystems (National Research



e-ISSN No. 2394-8426 Monthly Issue MAY-2025 Issue-V, Volume-XIII

https://doi.org/10.69758/GIMRJ/2505I5VXIIIP0023

Council, 1993; Cannon, 1997; Rossman and Farr, 1997; Stajich et al., 2021). Furthermore, studies have shown that understanding fungal diversity is essential for developing effective conservation strategies for both fungi and the ecosystems they inhabit (Hawksworth, 1991; Lee et al., 2023).

Among plant diseases, foliar diseases are particularly prevalent and often thrive in cool, damp weather conditions. These diseases, which include a variety of symptoms such as leaf spots, blights, and powdery mildew, generally cause minimal immediate damage to the host plants. However, their cumulative effects can significantly impact plant health and productivity over time (Benson, 1990; Ebel et al., 2008). Ornamental plants, which serve as symbols of beauty, love, and tranquility, are notably affected by various fungal pathogens. These pathogens can impair the vigor, growth, yield, and quality of ornamental species. Unfortunately, many growers remain unaware of these diseases and the pathogens responsible for them, leading to inadequate control measures (Schoeneweiss, 1975; Akinwumi et al., 2023). In the context of a growing ornamental plant industry, this ignorance can result in significant economic losses and reduced plant health.

Similarly, medicinal plants face detrimental effects from fungal pathogens that can compromise the quality and potency of therapeutic parts, posing potential health risks when these infected materials are utilized in herbal remedies. The use of contaminated plant materials can lead to adverse health outcomes, including toxic reactions or ineffectiveness of the treatment (Ravindran, 2005; Tiwari et al., 2020). Therefore, identifying the fungi that infect medicinal plants is essential for ensuring both the safety and efficacy of the medicinal products derived from these species.

By elucidating the diversity of pathogenic fungi affecting both medicinal and ornamental plants, this research aims to fill the gaps in knowledge surrounding these important organisms. The findings are expected to contribute valuable insights that will inform effective management practices and promote the conservation of plant health.

Materials and Methods

Sample Collection

Diseased leaves were collected from various locations within the Amravati region, ensuring representation of different plant species. Each leaf sample was placed individually into labeled plastic bags, which were subsequently sealed to prevent contamination. Leaves at various maturity stages displaying distinct symptoms of fungal infection were examined, and relevant symptoms were documented.

Detection of Mycoflora

Fungal detection was performed using two primary methods: direct microscopic examination and culture-based isolation techniques. Infected plant tissues were excised and subjected to surface sterilization in 1% sodium hypochlorite solution for 1 minute, followed by thorough rinsing in sterile distilled water for 1 minute. Small segments of the sterilized tissues were then plated onto Potato Dextrose Agar (PDA) medium and incubated at 20-25°C, allowing for the growth of fungal pathogens (Jiang *et al.*, 2021; Tefera *et al.*, 2022).



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Identification of Fungi

The fungi present in the infected samples were identified preliminarily based on their colony morphology and reproductive structures, including characteristics of sexual and asexual spores. A stereoscopic binocular microscope facilitated this preliminary identification. For further confirmation, slides of pure fungal cultures were prepared and examined under a compound microscope. Fungal identification was supported by consulting relevant literature, including recent taxonomic keys and guides (Kirk *et al.*, 2018; Tedersoo*et al.*, 2021; Samarakoon *et al.*, 2023). Pure cultures of the identified fungi were prepared and maintained on PDA slants for future reference and study.

Observations

Sr.	Name of Host	Family of	Name of	Fungal Pathogen			
No		Host	Disease				
Ornamental Plants							
1.	Polyalthia	Annonaceae	Anthracnose	Colletotrichum			
	<i>longifolia</i> Thw.			gloeosporioides Penzig.			
2.	Nerium indicum Mill.	Apocynaceae	Leaf spot	CercosporaneriallaSacc.			
3.	Impatiens balsamina	Balsaminacea	Powdery	Erysiphe cichoracearum			
	Linn.	e	mildew	DC. ex Merat			
4.	Impatiens balsamina	Balsaminacea	Downy mildew	Peronospora			
	Linn.	e		abducensSchroet.			
5.	Tecoma stans (Linn.)	Bignoniaceae	Leaf spot	Alternaria Nees ex Wallr			
	H.B. & K.						
6.	Bauhinia variegata	Caesalpiniace	Anthracnose	Colletotrichum			
	Linn.	ae		gloeosporioidis Penzig			
7.	Chrysanthemum	Asteraceae	Leaf spot	Cercosporachrysanthemi			
	<i>indicum</i> Linn.			Heald & Wolf			
8.	Gerbera jamesonii	Asteraceae	Powdery	Oidium Link ex Fr.			
	Bolus ex Hook. f.		mildew				
9.	Zinnia elegans Jacq.	Asteraceae	Leaf spot	Alternaria zinnia Pape			
10.	Hibiscus rosa-sinensis	Malvaceae	Leaf spot	Cercosporahibisci P.			
	Linn.			Henn.			
11.	Clitoriaternatea Linn.	Papilionaceae	Anthracnose	Colletotrichum			
				dematium Pavgi & Mukh			
12.	Rosa multiflora Thunb.	Rosaceae	Black spot	Diplocarponrosae Wolf			
13.	Rosa multiflora Thunb.	Rosaceae	Powdery	Sphaerothecapannosa			
			mildew	var. rosae(Wallr.) Lev.			
14.	Petunia axillaris	Solanaceae	Leaf spot	Cercosporapetunae			
	(Lamk.) B.S. & P.		1	(Saito) Muller & Chupp			
15.	Petunia axillaris	Solanaceae	Powdery	Oidium Link ex Fr.			
	(Lamk.) B.S. & P.		mildew				
16.	Lantana camara Linn.	Verbenaceae	Leaf spot	CercosporalantanaeKul			
			_	hara& Singh			

 Table 1: Fungal diseases and pathogens on Medicinal and Ornamental plants

Gurukul International Multidisciplinary Research Journal (GIMRJ)*with* International Impact Factor 8.357 Peer Reviewed Journal



e-ISSN No. 2394-8426

Monthly Issue MAY-2025 Issue–V, Volume–XIII

https://doi.org/10.69758/GIMRJ/2505I5VXIIIP0023

17.	Verbena hybrida Hort.	Verbenaceae	Powdery mildew	<i>Erysiphe cichoracearum</i> DC.			
18.	<i>Lagerstroemia indica</i> Linn.	Lythraceae	Powdery mildew	<i>Erysiphe</i> <i>lagerstroemiae</i> (Pers.) Karst.			
Medicinal Plants							
19.	<i>Azardirachta indica</i> A. Juss.	Meliaceae	Leaf spot	Fusarium graminearumSchwabe.			
20.	<i>Azardirachta indica</i> A. Juss.	Meliaceae	Powdery mildew	<i>Oidium azadirachtae</i> Narayan &Ramakr.			
21.	<i>Curcuma longa</i> Linn.	Zingiberaceae	Leaf spot	<i>Fusarium pallidoroseum</i> (Cooke)Sacc.			
22.	Ocimum sanctum Linn.	Lamiaceae	Leaf spot	<i>Alternaria alternata</i> (Fr.) Keissler			
23.	Ocimum sanctum Linn.	Lamiaceae	Powdery mildew	Oidium Link ex Fr.			
24.	<i>Eucalyptus globules</i> Labill.	Myrtaceae	Leaf spot	Cercosporaepicoccoides Cooks. & Massee.			
25.	Catharanthus roseus (Linn.) G. Don	Apocynaceae	Leaf spot	Curvularialunata Boed.			
26	<i>Catharanthus roseus</i> (Linn.) G. Don	Apocynaceae	Leaf spot	<i>Fusarium oxysporum</i> Schlecht.			
27.	Achyranthus aspera Linn.	Amaranthacea e	Leaf spot	Fusarium equiseti(Corda)Sacc.			
28.	Phyllanthus emblicaLinn.	Euphorbiacea e	Leaf spot	<i>Fusarium moniliforme</i> J. Sheld.			
29.	Adathodavasica Nees.	Acanthaceae	Leaf spot	Alternaria Ness.			
30.	Aloe barbadensis Mill.	Liliaceae	Leaf spot	<i>Fusarium solani</i> (Mart.) Sacc.			
31.	Aloe barbadensis Mill.	Liliaceae	Dry rot of leaf	<i>Alternaria alternata</i> (Fr.) Keissler			
32.	Calotropis procera(Willd) Dryand ex W. Ait.	Asclepediacea e	Leaf spot	Colletotrichum dematium (Pers. ex Fr.) Grove			
33.	Ailanthus excelsaRoxb.	Simaroubacea e	Powdery mildew	Oidium ailanthi			

Results and Discussion

Fungi constitute a highly diverse group of organisms, exhibiting significant variability in terms of host specificity and geographical distribution. In the current investigation, a total of 26 plant species were screened for pathological observations, comprising 15 ornamental plants and 11 medicinal plants, representing various families such as Annonaceae, Apocynaceae, Balsaminaceae, Asteraceae, Papilionaceae, Malvaceae, Solanaceae, Lamiaceae, Verbenaceae,



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and Rosaceae. These families underline the rich biodiversity of plant species and their potential susceptibility to fungal pathogens.

In total, 33 fungal diseases were identified, with 18 affecting ornamental plants and 15 impacting medicinal plants. The predominant symptoms included 20 cases of leaf spots, 9 incidences of powdery mildew, 3 examples of anthracnose, and 1 instance of downy mildew. The diversity of symptoms highlights the complexity of fungal diseases affecting both ornamental and medicinal species. This finding is consistent with previous studies emphasizing the prevalence of foliar diseases in these categories of plants (Huang *et al.*, 2021; Redmond *et al.*, 2023).

The dominant fungal pathogens recorded included *Cercospora* sp. (6 occurrences), Fusarium sp. (6 occurrences), *Alternaria* sp. (5 occurrences), *Oidium* sp. (5 occurrences), and *Colletotrichum* sp. (4 occurrences). Notably, the majority of the identified pathogens belong to the class Hyphomycetes, which is known for its diverse array of saprophytic and pathogenic fungi (Harrison *et al.*, 2022).

Earlier studies have similarly reported significant associations between specific fungal pathogens and medicinal plants. For instance, Krishnamurthy *et al.* (2008) documented analogous findings in the Maland Region of Southern India, while Chavan and Korekar (2011) noted similar pathogenic occurrences in the Osmanabad district of Maharashtra. Recent research by Sharma et al. (2022) reinforced these findings, indicating that various fungal pathogens adversely affect medicinal and ornamental plant health, often leading to substantial economic losses in agriculture and horticulture.

Moreover, understanding the dynamics of these fungal pathogens is critical for implementing effective management strategies. The prevalence of leaf spot diseases is particularly concerning, as such symptoms can lead to diminished aesthetic value in ornamental plants and reduced efficacy in medicinal plants, which is essential for therapeutic applications (Arora *et al.*, 2023). As highlighted by Gupta *et al.* (2024), proactive monitoring and management of these pathogens can significantly enhance plant health and productivity.

Conclusion

In conclusion, the results of this study reveal a significant presence of fungal diseases affecting both ornamental and medicinal plants. It is imperative to continue investigating these pathogens to develop effective control measures and programs that can safeguard the health of plants, thus preserving their ecological and economic importance

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Monthly Issue MAY-2025 Issue–V, Volume–XIII

e-ISSN No. 2394-8426

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e-ISSN No. 2394-8426

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