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# Phyllosphere Fungal Diversity in Common Genera of Family Asteraceae

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**Abstract: Phyllosphere, an above ground plant surface acts as habitat for microorganisms. Such microhabitat is active having inadequate nutrient but supports a range of microbial communities, especially fungi, which significantly contribute in plant health and functioning of ecosystem. The present study investigates the fungal diversity of the phyllosphere associated with common genera of the family Asteraceae viz. *Tagetes*, *Parthenium*, *Ageratum*, *Launaea*, *Eclipta* and *Chrysanthemum*, widely distributed across varied agro-climatic regions. The study revealed a rich and diverse assemblage of phyllospheric fungi dominated by members of the genera *Absidia*, *Mucor*, *Rhizopus*, *Alternaria*, *Cladosporium*, *Aspergillus*, *Penicillium*, *Bipolaris*, *Curvularia*, *Fusarium*, *Nigrospora* etc. along with several sterile mycelia and unidentified forms. Variations in associated fungal taxa were influenced by host plant species, leaf exudates, leaf surface characteristics i.e. cuticle, stomata type and distribution, trichomes, surface texture etc. and seasonal factors. Saprophytic fungi viz. *Aspergillus* sp., *Penicillium* sp. and some mucorales genera were found more prevalent than pathogenic forms such as *Alternaria* sp. and *Fusarium* sp., indicating their contribution to maintain ecological balance and nutrient recycling on the leaf surfaces. The findings revealed that selected plants of family Asteraceae acts as reservoirs of diverse phyllospheric fungi and emphasizes their potential implications in plant disease epidemiology, biological control and environmental monitoring. Assessment of phyllosphere fungal diversity may contribute to sustainable plant protection strategies and deeper insights into plant–microbe interactions.**

***Keywords:*** *Phyllosphere; Asteraceae; Fungal diversity; Aspergillus; Absidia; Alternaria.*

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## I. INTRODUCTION

Plants in usual habitat acts as complex biological systems involved a range of diverse microbial communities. The phyllosphere, an above ground plant surface acts as one of the largest microbial on the Earth. It contains a variety of microorganisms including bacteria, actinomycetes, fungi, yeasts, algae, and viruses that provides a vast ecological niche as well as collectively influences plant health and productivity [1]. Among these associated microbes, fungi constitute a significant and functionally diverse component, occurring as epiphytes on leaf surfaces or as endophytes within internal tissues without causing visible harm. Such fungal taxa perform some important ecological roles such as nutrient recycling, mutualistic associations, and pathogenic interactions, thereby influencing plant fitness and ecosystem stability [2].

The diversity and composition of phyllosphere fungal communities are influenced by several biotic and abiotic factors including associated microbes, plant species, leaf morphology, leaf exudates and nutrient availability, microclimate, as well as seasonal variations, often showing strong host specificity [3]. The family Asteraceae, one of the largest angiosperm families with more than 1,600 genera and about 25,000 species worldwide [4], includes economically and medicinally important genera such as *Helianthus*, *Tagetes*, *Ageratum*, *Artemisia*, *Parthenium*, *Tridax*, *Calendula*, *Eclipta* etc. The presence of bioactive compounds such as terpenoids, flavonoids, alkaloids, and phenolics in these plants significantly influences microbial colonization on leaf surfaces [5,6].

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Despite their importance, phyllosphere fungal diversity in Asteraceae remains poorly explored, particularly in tropical regions like India. These fungi may act as pathogens, antagonists, or contributors to nutrient cycling and plant growth. The present study aims to investigate the phyllosphere fungal diversity associated with common genera of Asteraceae through isolation and identification of leaf-inhabiting fungi, thereby providing baseline data on fungal ecology, host specificity, and plant–fungus interactions for improved disease management and sustainable agriculture.

## II. MATERIALS AND METHODS

- *Sample Collection*

Healthy leaves of selected plant species were collected aseptically from the Botanical Garden, Deen Dayal Upadhyaya Gorakhpur University, using sterilized forceps, scissors and polythene bags. The collected samples were brought to the laboratory for further analysis [7].

- *Isolation and Identification of Fungi*

Collected leaf segments are aseptically inoculated on sterile Petri plates containing Potato Dextrose Agar (PDA) medium supplemented with streptomycin to inhibit bacterial growth. The inoculated Petri plates were incubated at 25±2°C for 5–7 days under controlled laboratory conditions to allow fungal growth. Emerging fungal colonies from leaf segments are sub-cultured onto fresh PDA plates using the hyphal tip technique to obtain pure cultures. Pure fungal cultures are identified based on their macroscopic (colony morphology, colour, texture) and microscopic characteristics (conidia, conidiophores, hyphae) using standard taxonomic manuals [8,9].

## III. RESULT

The investigation of phyllospheric fungi associated with selected members of family Asteraceae revealed considerable qualitative variations in fungal communities inhabiting the leaf surfaces of different host plants. A total of twelve different fungal genera were isolated from healthy leaves of *Eclipta alba*, *Ageratum houstonianum*, *Tagetes erecta*, *Chrysanthemum cinerariifolium*, *Parthenium hysterophorus* and *Launaea procumbens* (Fig 1). The predominant fungal genera recorded during the study included *Absidia*, *Mucor*, *Rhizopus*, *Alternaria*, *Aspergillus*, *Cladosporium*, *Curvularia*, *Fusarium*, *Penicillium*, *Nigrospora*, *Bipolaris*, *Colletotrichum* and *Trichoderma* (Table 1, Fig 2-3).

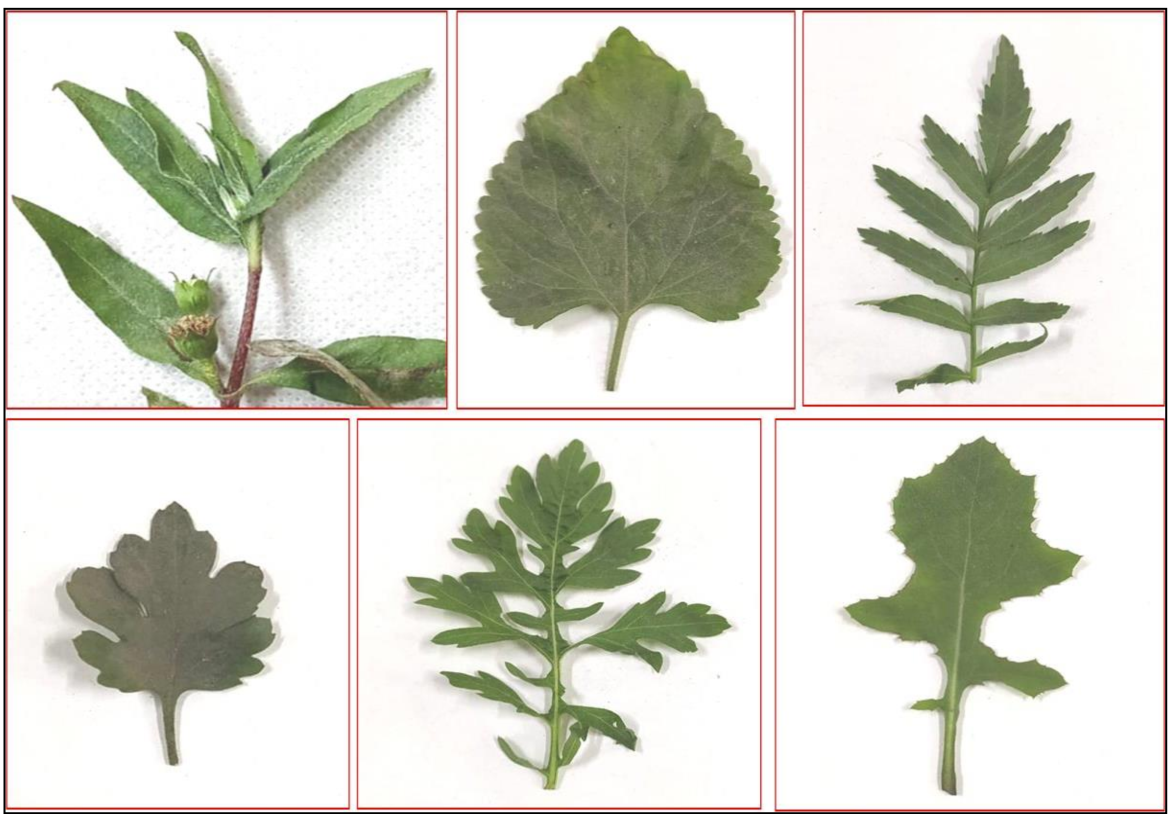

Fig 1: Leaves Collected for Phyllospheric Mycobiota Analysis: *Eclipta alba*, *Ageratum houstonianum*, *Tagetes erecta*, *Chrysanthemum cinerariifolium*, *Parthenium hysterophorus*, *Launea procumbens*

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Table 1: List of Phyllospheric Fungi Isolated from Leaves of Different Plant Species of Asteraceae Family

| Plant Species | Isolated Phyllospheric Fungi |
|---|---|
| ***Eclipta alba*** | *Absidia* sp., *Mucor* sp., *Rhizopus* sp., *Alternaria* sp., *Aspergillus flavus, A. niger, A. fumigates, Cladosporium* sp., *Curvularia* sp., *Fusarium* sp., *Penicillium* sp., *Nigrospora* sp., Unifentified fungi |
| ***Ageratum houstonianum*** | *Mucor* sp., *Rhizopus* sp., *Alternaria* sp., *Aspergillus flavus, A. niger, A. fumigates, A. ochraceus, Cladosporium* sp., *Curvularia* sp., *Colletotrichum* sp., *Fusarium* sp., *Penicillium* sp., *Trichoderma* sp., Unifentified fungi |
| ***Tagetes erecta*** | *Absidia* sp., *Rhizopus* sp., *Alternaria* sp., *Aspergillus flavus, A. niger, A. fumigates, Bipolaris* sp., *Cladosporium* sp.,*Curvularia* sp., *Fusarium* sp., *Penicillium* sp., *Nigrospora* sp., Unifentified fungi |
| ***Chrysanthemum cinerariifolium*** | *Absidia* sp., *Mucor* sp., *Rhizopus* sp., *Alternaria* sp., *Aspergillus flavus, A. niger, A. fumigates, A. ochraceus, Cladosporium* sp., *Curvularia* sp., *Fusarium* sp., *Penicillium* sp., *Nigrospora* sp., Unifentified fungi |
| ***Parthenium hysterophorus*** | *Rhizopus* sp., *Aspergillus flavus, A. niger, A. fumigates, Cladosporium* sp., *Curvularia* sp., *Fusarium* sp., *Penicillium* sp., Unifentified fungi |
| ***Launea procumbens*** | *Absidia* sp., *Mucor* sp., *Rhizopus* sp., *Alternaria* sp., *Aspergillus flavus, A. niger, A. fumigates, A. ochraceus, Bipolaris* sp., *Cladosporium* sp., *Curvularia* sp., *Fusarium* sp., *Penicillium* sp., Unifentified fungi |

Among the host plants, *Ageratum houstonianum* and *Launaea procumbens* exhibited maximum fungal diversity with the presence of thirteen fungal species, whereas *Parthenium hysterophorus* showed comparatively lower diversity, harbouring only eight fungal forms. Species of *Aspergillus* (*A. flavus*, *A. niger*, *A. fumigatus* and *A. ochraceus*) were found to be the most dominant and widely distributed fungi occurring on almost all the plant species studied. Similarly, *Rhizopus*, *Cladosporium*, *Curvularia*, *Fusarium* and *Penicillium* were consistently isolated from most of the phyllospheric samples, indicating their ecological adaptability to the nutrient-limited leaf surface environment (Table 1; Figure 2-3).

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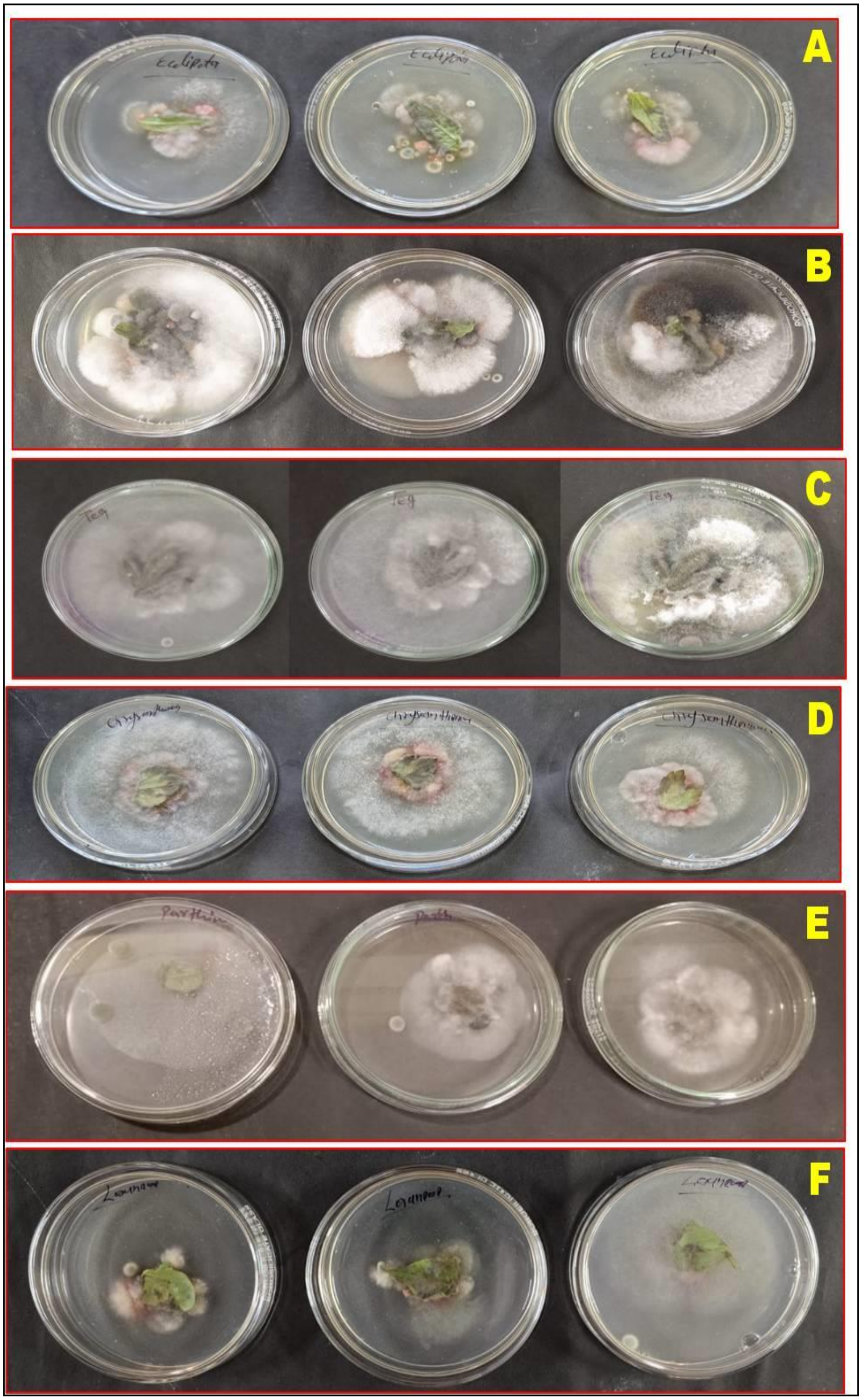

Fig 2: Isolation of Phyllospheric Fungi from Leaves; (A) *Eclipta alba*, (B) *Ageratum houstonianum*, (C) *Tagetes erecta* , (D) *Chrysanthemum cinerariifolium*, (E) *Parthenium hysterophorus*, (F) *Launea procumbens*

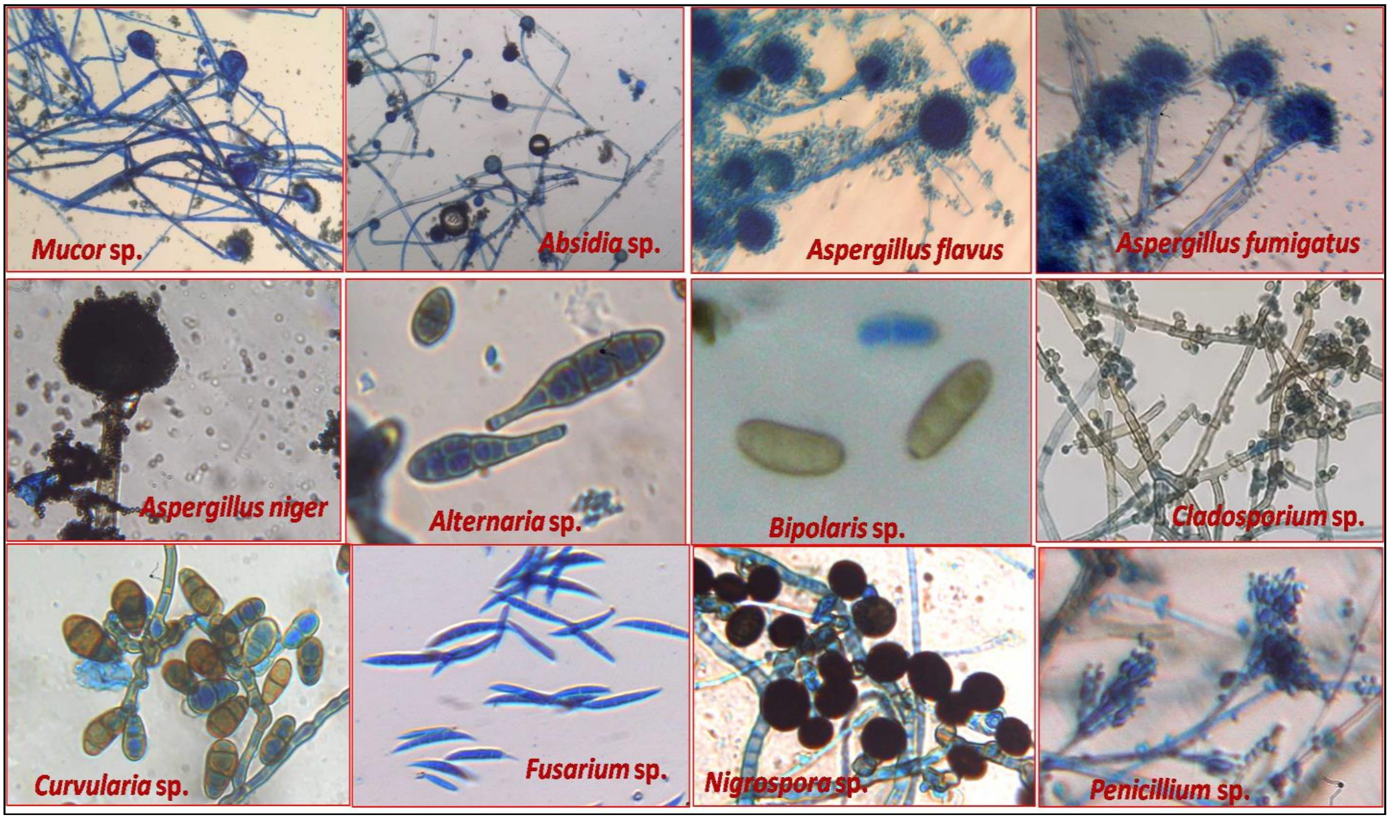

Fig 3: Isolated Phyllosphere Fungi (Microscopic)

## IV. DISCUSSION

The present study revealed that the phyllosphere of common genera of the family Asteraceae supports a rich and diverse fungal community, confirming leaf surfaces as important ecological habitats for fungal colonization. The phyllosphere is characterized by fluctuating environmental conditions, including temperature, humidity, ultraviolet radiation, and nutrient availability, which influence fungal diversity and community structure [4,10,11]. Dominant fungal genera, including *Aspergillus*, *Cladosporium*, *Penicillium*, *Curvularia*, *Fusarium*, and *Nigrospora*, are widely recognized as common phyllosphere inhabitants due to their efficient aerial dispersal, stress tolerance, and ecological adaptability. While many species function as saprophytes, several are opportunistic pathogens capable of causing foliar diseases under favourable conditions [12,13,14].

Variations in fungal diversity among Asteraceae genera are likely associated with host-specific traits such as leaf morphology, trichome density, epicuticular waxes, and the production of antimicrobial secondary metabolites, including terpenoids, flavonoids, and sesquiterpene lactones [15,16]. These characteristics create distinct microhabitats that shape fungal community composition, with host identity being a major determinant of phyllosphere microbiota [4,14]. Environmental factors such as seasonality, relative humidity, and airborne spore load further influence fungal abundance and diversity [17]. Presence of potential antagonistic fungi such as *Trichoderma* further indicates the ecological significance of phyllosphere mycobiota in suppressing plant pathogens [18]. The coexistence of beneficial and pathogenic fungi highlights the ecological complexity of the phyllosphere, where microbes contribute to nutrient cycling, pathogen suppression, and plant defense while also serving as potential disease agents. Collectively, these findings demonstrate that Asteraceae species represent valuable reservoirs of fungal biodiversity and emphasize the need for integrated culture-based and molecular approaches to better understand fungal ecology and exploit beneficial phyllosphere microorganisms for sustainable agriculture and biological disease management [10,19,20].

## V. CONCLUSION

The present study confirms that Asteraceae members harbour diverse phyllospheric fungi, predominantly saprophytic in nature, contributing to nutrient recycling and ecological balance. Variation in fungal diversity among host plants reflects the influence of leaf characteristics and microclimate. These plants act as reservoirs of beneficial and pathogenic fungi affecting plant health and disease dynamics.

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## REFERENCES

[1]. Liu, J., Zhang, W., Liu, Y., Zhu, W., Yuan, Z., Su, X., & Ding, C. (2023). Differences in phyllosphere microbiomes among different *Populus* spp. in the same habitat. Frontiers in Plant Science, *14*, 1143878. doi: 10.3389/fpls.2023.1143878

[2]. Oubohssaine, M., Rabeh, K., & Hnini, M. (2026). Phyllosphere epiphytic fungi: Diversity, environmental interactions, and selection factors. The Microbe, *11*, 100708. https://doi.org/10.1016/j.microb.2026.100708

[3]. Rolnik, A., & Olas, B. (2021). The plants of the *Asteraceae* family as agents in the protection of human health.International Journal of Molecular Sciences, *22*, 3009. doi: 10.3390/ijms22063009

[4]. Sivakumar, N., Sathishkumar, R., Selvakumar, G., Shyamkumar, R., & Arjunekumar, K. (2020). Phyllospheric microbiomes: Diversity, ecological significance, and biotechnological applications. Plant Microbiomes for Sustainable Agriculture, *25*, 113–72. doi: 10.1007/978-3-030-38453-1_5

[5]. Lv, J., Yang, S., Zhou, W., Liu, Z., Tan, J., & Wei, M. (2024). Microbial regulation of plant secondary metabolites: Impact, mechanisms and prospects. Microbiological Research, *283*, 127688. https://doi.org/10.1016/j.micres.2024.127688

[6]. El-Saadony, M.T., Saad, A.M., Mohammed, D.M., Korma, S.A., Alshahrani, M.Y., Ahmed, A.E., Ibrahim, E.H., Salem, H.M., Alkafaas, S.S., Saif, A.M., Elkafas, S.S., Fahmy, M.A., Abd El-Mageed, T.A., Abady, M.M., Assal, H.Y., El-Tarabily, M.K., Mathew, B.T., AbuQamar, S.F., El-Tarabily, K.A., & Ibrahim, S.A. (2025). Medicinal plants: Bioactive compounds, biological activities, combating multidrug-resistant microorganisms, and human health benefits - A comprehensive review. Frontiers in Immunology, *16*, 1491777.

[7]. Isiaka, I.D., Tiamiyu, Z., Adedamola, O.L., Abdullahi, A.M., & Muhammad, H.A. (2020). Isolation, identification and characterization of phyllosphere fungi from vegetables. International Journal of Innovative Science and Research Technology, *5*, 715-720.

[8]. Gilman, J.C. (1998). A manual of soil fungi. Biotech Books, New Delhi.

[9]. Mukerji, K.G., &Manoharachary, C. (2010). Taxonomy and ecology of Indian fungi. IK International Pvt. Ltd.

[10]. Bashir, I., War, A.F., Rafiq, I., Reshi, Z.A., Rashid, I., &Shouche, Y.S. (2022). Phyllosphere microbiome: Diversity and functions. Microbiological Research, *254*, 126888. https://doi.org/10.1016/j.micres.2021.126888

[11]. Li, M., Hong, L., Ye, W., Wang, Z., & Shen, H. (2022). Phyllosphere bacterial and fungal communities vary with host species identity, plant traits and seasonality in a subtropical forest. Environmental Microbiome, *17*, 29. https://doi.org/10.1186/s40793-022-00423-3

[12]. Leveau, J.H. (2019). A brief from the leaf: latest research to inform our understanding of the phyllosphere microbiome. Current Opinion inMicrobiology, *49*, 41-49. doi: 10.1016/j.mib.2019.10.002

[13]. De Mandal, S.D., & Jeon, J. (2023). Phyllosphere microbiome in plant health and disease. Plants, *12*, 3481. doi: 10.3390/plants12193481

[14]. Yang, F., Pu, X., Matthew, C., Nan, Z., & Li, X. (2024). Exploring phyllosphere fungal communities of 29 alpine meadow plant species: Composition, structure, function, and implications for plant fungal diseases. Frontiers in Microbiology, *15*, 1451531. doi: 10.3389/fmicb.2024.1451531

[15]. Al-Khayri, J.M., Ramakrishnan, R., Toppo, V., Chole, P.B., Banadka, A., Wudali, N.S., Nagella, P., Shehata, W.F., Al-Mssallem, M.Q., Alessa, F.M., Almaghasla, M.I., & Rezk, A.A. (2023). Plant secondary metabolites: The weapons for biotic stress management. Metabolites, *13*, 716. doi: 10.3390/metabo13060716

[16]. Ariyan, M., Mikryukov, V., Khalil, H., Gohar, D., Hosseyni Moghaddam, M.S., Drenkhan, R., &Tedersoo, L. (2026). Impact of plant species, mycorrhizal type, and leaf traits on foliar fungal communities (in a common garden experiment). IMA Fungus, *17*, e173358. doi: 10.3897/imafungus.17.173358

[17]. Lu, Y., Wang, X., Almeida, L.C.S.S., & Pecoraro, L. (2022). Environmental factors affecting diversity, structure, and temporal variation of airborne fungal communities in a research and teaching building of Tianjin University, China. Journal of Fungi, *8*, 431. doi: 10.3390/jof8050431

[18]. Guzmán-Guzmán, P., Etesami, H., & Santoyo, G. (2025). Trichoderma: A multifunctional agent in plant health and microbiome interactions. BMC Microbiology, *25*, 434. doi: 10.1186/s12866-025-04158-2

[19]. Cadavid, I.C., Capelari, É.F., Salvati, C., & Margis, R. (2026).Phyllosphere microbiomes uncovered: Research trends, geographic disparities, and key microbial players. Genetics and Molecular Biology, *49*, e20250083. doi: 10.1590/1678-4685-GMB-2025-0083

[20]. Negi, R., Sharma, B., Jyothi, R.S., Gupta, A., Parastesh, F., Kaur, T., Jhamta, S., Thakur, N., Singh, S., Yadav, N., & Yadav, A.N. (2026). Phyllosphere microbiome: Exploring the unexplored frontiers for precision agricultural and environmental sustainability. World Journal of Microbiology and Biotechnology, *42*, 50. doi: 10.1007/s11274-026-04788-2