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EDITORIAL

MycoIndia: Advancing Academic Insights into Indian Mycology

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India has a rich history of mycological research, education, and entrepreneurship (Fig. 1). This deep-rooted knowledge of fungi is evident in the Khajuraho Temples located in Madhya Pradesh state of India, where depictions of the mushroom *Amanita muscaria* can be found. Built between 900 and 1130 AD, these sculptures bear testament to the understanding of fungi in India during that period (Maillart-Garg and Winkelman 2019). Interestingly, the earliest known record of Indian fungi in Western literature dates back to the early 19th century. Fries' report on *Podaxis pistillaris* (L.) Fr. (syn. *Scleroderma pistillare*), commonly known as the desert shaggy mane, originates from Tharangambadi in Tamil Nadu state of southern India (Fries 1829). The initial stage of mycology in India, especially before the Independence, had a great influence of British mycologists, especially E. J. Butler (Sarma 2021). Hence, generally Indian mycologists divide Indian mycology into pre- and post-Butler eras. Following Fries (1829), numerous scholars including D. D. Cunningham, J. D. Hooker, M. J. Berkley, J. F. C. Montagne, A. C. J. Corda, F. Currey, K. R. Kirtikar, F. Theissen, G. R. Bisby, M. J. Thirumalachar, T. S. Ramakrishnan, C. V. Subramanian and others conducted extensive studies on the fungi of the Indian subcontinent (Subramanian 1986, Mahadevakumar et al. 2021, Satyanarayana et al. 2021). Over the last two centuries, the field of Indian mycology has undergone a significant transformation. The focus has shifted from taxonomic research based on morphology to plant pathology to molecular information, reflecting the evolution and advancement of scientific understanding in this domain. Mycology flourished in the departments of universities and colleges where there were experts available for a group of fungi. For instance, Prof. K. S. Thind at Punjab University explored mushrooms of northern India, Prof. K. Natarajan at the University of Madras explored mushrooms of southern India and Prof. Kamal at DDU Gorakhpur University worked on *Cercospora* and *Pseudocercospora*. This editorial briefly discusses some of the key issues that require attention in Indian mycology.

Geographical Diversity of the Indian Subcontinent

From a historical perspective, it is essential to acknowledge how India's diverse geographical settings have fostered a deep understanding of mycology. The Indian subcontinent, a blend of tropical and temperate geographic zones, is home to a myriad of climates and biogeographical dimensions. These range from tropical environments to those akin to Arctic conditions, encompassing mountains, plains, wetlands, and significant bodies of freshwater (Singh and Chaturvedi 2017). Such geographical diversity naturally supports a variety of ecosystems teeming with rich biodiversity. In this context, India, recognized as one of the world's 17 megadiverse countries, serves as a global microcosm for fungal diversity. Four of the global biodiversity hotspots can be found in India: the Western Ghats, the Himalayas, the Indo-Burma, and the Sundaland region. The Indian subcontinent is home to a broad spectrum of mycota, from those inhabiting ocean sediments to those populating the atmosphere, and from coastal salterns to the towering heights of the Himalayas.

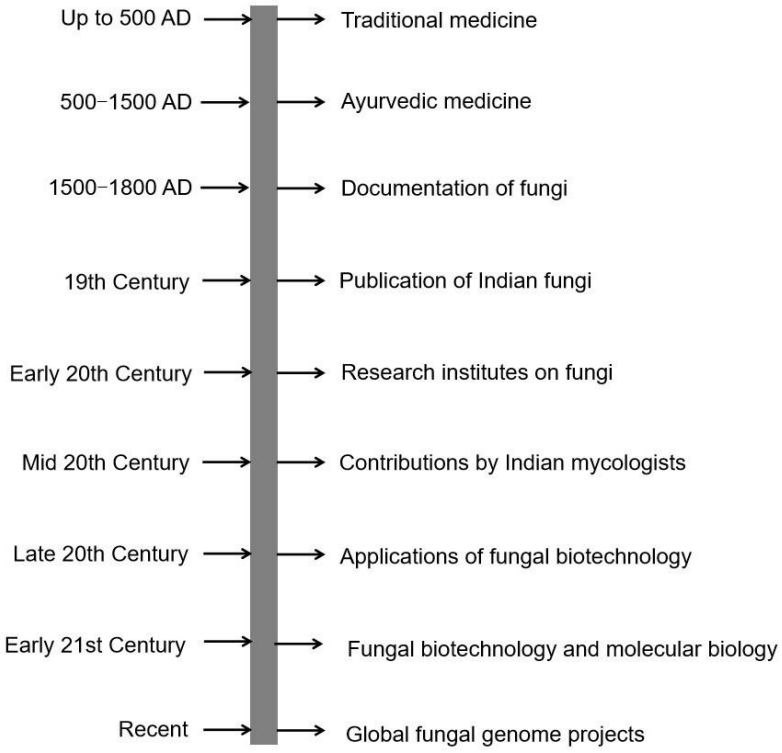

Fig. 1. Snapshot of milestones in Indian mycology

This mycological diversity within the Indian subcontinent is an invaluable resource, enhancing our understanding of regional fungi and offering insights into global mycological implications. Considering the estimated global biodiversity of fungi, which ranges between 2.2 and 3.8 million species (Hawksworth and Lücking 2017), the Indian subcontinent's fungal diversity warrants a thorough reexamination. This necessity stems from the vast richness of species and the diversity of plant and animal species across different ecosystems on the subcontinent. In the 1990s and early 2000s, mycology flourished because of several biodiversity exploration

projects funded by Indian funding agencies. This helped in the exploration of diverse habitats in the country, coinciding with the development of Indian fungal culture collections.

Knowledge Gap and Exploration

Even though substantial work has been undertaken to document the fungal diversity of India, there exists a significant knowledge gap, which highlights the pressing need for further exploration and examination (Manoharachary et al. 2005, Hawksworth 2019). Numerous institutions and universities across the country are actively engaged in investigating fungi in various ecosystems, with a primary focus on plant pathology (Satyanarayana et al. 2021). But the lack of fungal experts and committed taxonomists is also playing a spoil sport in the taxonomic and population studies on fungi. To gain a comprehensive understanding of the mycobiota in diverse ecosystems, such as freshwater, marine, and wetland biospheres, extensive expeditions are required (Amend et al. 2019, Sridhar 2019, Seena et al. 2023).

In India, fungi are widely utilized for food and medicinal purposes. Studies related to this traditional expertise can not only bolster the economy but also pave the way for the development of nutraceuticals and health protection measures. Tribal mycology, in particular, has proven to be a crucial area of study. The consumption of wild mushrooms includes up to 283 species in India, among over 2000 species recorded worldwide (Purkayastha and Chandra 1985). Therefore, it is evident that Indian ethnomycological traditions warrant a careful review and further scrutiny (Winkelman et al. 2022), underscoring the importance of this field in understanding and preserving the country's unique mycological heritage.

Climate Change and Fungal Conservation

Fungi, as significant players in the natural carbon cycle, are intrinsically linked to the dynamics of climate change. They serve dual roles as decomposers, releasing carbon dioxide, and as mutualistic partners with plants aiding carbon sequestration. However, our understanding of their exact roles, particularly in marine ecosystems, is rather poor (Amend et al. 2019). Enhancing our knowledge of fungal ecology, especially in understudied areas like the Indian Ocean, could reveal new strategies for managing carbon emissions and mitigating climate change. There is also a need to carry out in-depth studies to understand the evolution of emerging human and plant pathogenic fungi. In this context, the conservation of ecologically and economically beneficial fungi is of paramount importance. The ecological significance of fungi is often overlooked in conservation efforts (Sadiković and Kuštera 2013). Implementing effective conservation policies, including comprehensive surveys, dedicated programs, and protective legislation, is urgently needed in the Indian subcontinent. Citizen science offers a promising avenue for improving our understanding and conservation of fungal diversity (Jarvis et al. 2015). By harnessing public participation, we can gather extensive data, enhance our knowledge of Indian mycota, identify conservation needs, and foster a greater appreciation for fungi, driving forward the broader goals of fungal conservation and biodiversity preservation.

Fungal Taxonomy and Biotechnological Potential

Fungal taxonomy, crucial for following fungal diversity, aids in identifying, classifying, and studying different species, playing a fundamental role in conservation efforts (Liu et al. 2015).

The advent of molecular techniques like DNA sequencing has enhanced our ability to classify and study fungi, leading to the discovery of new species and reclassifications (Liu et al. 2016). The integration of Whole Genome Sequencing data with Machine Learning and Artificial Intelligence tools is projected to revolutionize fungal taxonomy in the near future (Stengel et al. 2022), further expanding our knowledge of fungal biodiversity. Fungal diversity can offer rich dividends as it presents enormous biotechnological potential, with applications ranging from the production of enzymes, antibiotics, and other bioactive compounds to the development of sustainable technologies for waste management and bioenergy production. Fungi have an immense role in the bio-based economy of India, along with the sustainable and resource-saving development of society (Meyer et al. 2020). Fungi have the ability to transform diverse types of organic materials, which in turn will help biofuel, enzyme industries, and others. This potential is particularly relevant in India, where mycology could significantly contribute to the country's green economy. However, realizing this potential necessitates a deeper understanding of fungal biology, ecology, and biotechnology. Moreover, target-based fungal isolation strategies are key to obtaining potential wild strains with desired properties.

With this background, MycoIndia (https://mycoindia.org/) has embarked on a novel journey into the world of mycology. MycoIndia Journal of Indian Fungi is devoted to uncovering the rich, yet underexplored, realm of Indian fungi. This initiative seeks to harness the intellectual prowess of Indians, fostering a global dialogue on mycology. By eliminating publication fee, MycoIndia democratizes access to scientific discourse, catalyzing research collaborations, and propels advancements in fungal perception. MycoIndia aspires to transcend its role as a journal, aiming to become a global platform for studying and appreciating the intricacies of Indian fungi. In this endeavor, MycoIndia extends a global invitation to scholars and researchers, encouraging them to delve into the captivating world of fungi and contribute to the progressive narrative of mycology, both within India and beyond.

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