

Contents

<i>Preface to the Second Edition</i>	(vii)
<i>Preface to the First Edition</i>	(ix)
<i>Acknowledgements</i>	(xi)

PART I: MORPHOLOGY AND RELATIONSHIPS OF FUNGI

1. Fungi—Introduction and Classification	1–48
2. Historical Roots of Mycology	49–71
• Chronology of Chief Milestones in the Development of the Subject of Mycology.....	49
• The Middle or Dark-ages	55
• The Renaissance	55
• The Systematists	56
• Christiaan Hendrik Persoon, Elias Magnus Fries, Lewis David von Schweinitz, August Carl Josef Corda, P.A. Saccardo, Tulasne Brothers	
• The 3 Great Experimenters	58
• The Development of the Subject of Mycology and Plant Pathology in the Middle of the 19th Century	58
• Heinrich Anton de Bary, E.A. Bessey, Alexander Fleming, G.W. Martin, E.A. Gäumann, A.H.R. Buller, Charles Thom, Vincent W. Cochrane, Kenneth Bryan Raper, Charles Drechsler, G.C. Ainsworth, C.J. Alexopoulos, J.N. Couch	
• History of Mycology and Plant Pathology in India	63
• Lt. Col. Kirtikar, E.J. Butler, H.P. Sydow, S.R. Bose, K.C. Mehta, Manoranjan Mitra, B.B. Mundkar, R.K. Saxena, K.D. Bagchee, M.N. Kamat, K. Ramakrishnan, K.S. Thind, T.S. Sadasivan, M.J. Thirumalachar, S.N. Das Gupta, S.B. Saxena, R.N. Tandon, K.S. Bilgrami, C.V. Subramanian, K.S. Bhargava, B.S. Mehrotra, R.S. Dwivedi, G.P. Agarwal, J.N. Rai, K.G. Mukerji, M.S. Pavgi, Ram Dayal, S.N. Dixit, C. Manoharachary	
<i>Review Questions</i>	70
<i>Selected References</i>	71
3. Kingdom: <i>Fungi</i> Phylum <i>Chytridiomycota</i> Class <i>Chytridiomycetes</i> (Zoosporic Fungi)	72–109

4. Kingdom: <i>Fungi</i> Phylum <i>Zygomycota</i> Class <i>Zygomycetes</i>	110–151
5. Kingdom: <i>Fungi</i> Phylum <i>Zygomycota</i> Class <i>Trichomycetes</i>	152–157
6. Kingdom: <i>Fungi</i> Phylum <i>Ascomycota</i> —Introduction	158–176
7. Kingdom: <i>Fungi</i> Phylum <i>Ascomycota</i> Class <i>Pneumocystidomycetes</i>	177–179
8. Kingdom: <i>Fungi</i> Phylum <i>Ascomycota</i> Class <i>Schizosaccharomycetes</i>	180–182
9. Kingdom: <i>Fungi</i> Phylum <i>Ascomycota</i> Class <i>Taphrinomycetes</i>	183–187
10. Kingdom: <i>Fungi</i> Phylum <i>Ascomycota</i> Class <i>Saccharomycetes</i>	188–198
11. Kingdom: <i>Fungi</i> Phylum <i>Ascomycota</i> Class <i>Eusascomycetes</i>	199–290
12. Kingdom: <i>Fungi</i> Phylum <i>Basidiomycota</i> —Introduction	291–304
13. Kingdom: <i>Fungi</i> Phylum <i>Basidiomycota</i> Class <i>Urediniomycetes</i>	305–334
14. Kingdom: <i>Fungi</i> Phylum <i>Basidiomycota</i> Class <i>Ustilaginomycetes</i>	335–353
15. Kingdom: <i>Fungi</i> Phylum <i>Basidiomycota</i> Class <i>Basidiomycetes</i>	354–412
16. Kingdom: <i>Fungi</i> Anamorphic Fungi (Deuteromycetes)	413–471
17. Lichens	472–491
18. Kingdom <i>Straminipila/Chromista</i> Phylum <i>Oomycota</i> Class <i>Oomycetes</i>	492–530
19. Kingdom: <i>Straminipila</i> Phylum <i>Hyphochytriomycota</i> Class <i>Hyphochytriomycetes</i>	531–536
20. Kingdom: <i>Straminipila</i> Phylum <i>Labyrinthulomycota</i> (Net Slime Molds)	537–541
21. Kingdom <i>Protozoa</i> Phylum <i>Plasmodiophoromycota</i> (Endoparasitic Slime Molds)	542–550
22. Kingdom <i>Protozoa</i> Phylum <i>Dictyosteliomycota</i> (Dictyostelid Cellular Slime Molds)	551–556

23. Kingdom <i>Protozoa</i> Phylum <i>Acrasiomycota</i> (Acrasid Cellular Slime Molds)	557–559
24. Kingdom <i>Protozoa</i> Phylum <i>Myxomycota</i> (Plasmodial or True Slime Molds)	560–571
25. Heterothallism, Heterokaryosis and Parasexual Cycle	572–586
• Homothallism	573
• Heterothallism (Sexual Incompatibility)	574
• Bipolar (unifactorial) Heterothallism or Two-factor Heterothallism	574
• Multi-factor Heterothallism	575
• Bipolar multiple- factor heterothallism	575
• Tetrapolar (Multi-factor) heterothallism	575
• Octopolar (trifactorial) Heterothallism	577
• Pseudocompatibility (Secondary Homothallism)	577
• Heterogenic Incompatibility (Semi-incompatibility)	578
• Heterokaryosis	579
• Parasexual Cycle	580
<i>Review Questions</i>	585
<i>Selected References</i>	585
26. Fungal Hormones, Physiological Specialization and Phylogeny	587–604
• Fungal Hormones	587
• Sirenin	588
• Antheridiol and Oogoniol	588
• Trisporic Acid	590
• Yeast α -Factor	590
• Physiological Specialization	591
• Phylogeny of Fungi	593
• Theories of Algal Ancestry	593
• Protozoans Ancestry of Fungi	595
• Sparrow's View with Regard to the Origin of Lower Fungi	596
• Biochemical Support For Evolutionary Relationships	597
• Origin of Zygomycetes	599
• Origin of Ascomycetes	600
• Origin of Basidiomycetes	601
• Recent Concept on Origin and Phylogeny of Fungi	601
<i>Review Questions</i>	602
<i>Selected References</i>	603

PART II: ECOLOGY AND ECONOMIC IMPORTANCE

27. Role of Fungi as Saprotrophs	605–625
• Fungi as Decomposers in Nature	605
• Return of Carbon Dioxide to the Atmosphere	608
• Humus Formation	608
• Types of Organic Compounds Decomposed	609
• Cellulose Structure and its Decomposition	609
• Hemicellulose Decomposition	612
• Decomposition of Pectic Compounds	612
• Decomposition of Lignin	613
• Fungi in Biodeterioration	616
• Fungi in Bioremediation	619
• Fungi in Food Spoilage	620
<i>Review Questions</i>	624
<i>Selected References</i>	624
28. Fungi in Pathological Relationships with other Organisms	626–639
• Fungi as Plant Parasites	626
• Fungi as Human Pathogens	627
• Entomogenous Fungi	632
• Fungi Parasitic on other Fungi	634
• Fungi Parasitic on Lichens	635
• Allergenic Fungi	635
• Poisonous Fungi	636
• Toxins from Fungi	637
<i>Review Questions</i>	638
<i>Selected References</i>	639
29. Industrial and Biotechnological Applications of Fungi	640–664
• Medicinal Uses	643
• Transformation of Steroids	643
• Enzymes from Fungi	645
• Vitamins from Fungi	646
• Fungi as Source of Organic Acids	647
• Fungi in Fermentation and Food Processing	649
• Asian and Oriental Foods	650
• Edible Fungi	653

• Mycoproteins	654
• Fungi in Cheese Production	655
• Fungi in Biological Assay	655
• Fungi in Biological Control of Pests	656
• Myconematicides	657
• Mycoinsecticides	657
• Other Applications of Fungal Biotechnology	659
Review Questions	663
Selected References	664
* Appendix Classification of Fungi and Fungal-like Protists (Based on Circa-2009)	665-666
* Index	667-696

Fungi, familiar to almost everyone, is white button mushroom. *Agaricus bisporus*, which is cultivated commercially on a very large scale. Almost all of us encounter fungi in our daily life, although some of us may not know much about them. The child is familiar with puffballs, mushrooms or toadstools growing outside, and housewife is familiar with them as these often grow in jams, jellies, pickles and bread. She may even use yeasts to leaven her bread. Farmers are familiar with fungi because they often cause diseases like rusts, smuts, mildews, blight and root rot and may spoil stored grains, fruits and vegetables, causing millions of dollars' worth of spoilage. A layman and forester is familiar with the large polypores that form bracket and shelf on trees; and the puffballs, toadstools and mushrooms that grow in gardens and forests. Urban people may not have seen fungi in their natural habitat but they may have suffered from fungal diseases such as ringworm, athlete's foot, mycetoma, madura foot, cryptococcosis, histoplasmosis, candidiasis, aspergillosis or fungal allergies.

The fungi and their allies include the chytrids, molds, yeasts, water molds, powdery mildews, mushrooms, bracket fungi, puffballs, morels, truffles, cup fungi, rusts, smuts, jelly fungi, dermatophytes, and many more for which there are no common names. The total variability and value of life on Earth is termed biological diversity or biodiversity. Biodiversity is not simply the total number of species; it encompasses the complexity, richness and abundance in nature at all levels from the genes carried by local populations to the layout of communities and ecosystems across the landscape. The fungal kingdom offers enormous biodiversity. Based on the 10th edition of the *Dictionary of the Fungi*, there are one million named species of fungi and at least 1200 new species are described every year. In 2007, Schmidt and Mueller suggested that 742000 species of fungi worldwide was a very conservative lower limit of global fungal diversity. Prof. C.V. Subramanian of CAS in Botany, Chennai (TN) said that every fungus has relevance, we may not know it, but time will tell. (Singh and Anuja, 1999; Kirk et al., 2008; Subramanian, 2013)

No matter which aspect of fungi we look at, they are highly diverse and versatile organisms adapted to all kinds of environments. These are ubiquitous organisms found on earth, in water, in dust, and in compost, or in decomposing organic matter as saprotrophs (or saprophytes) meaning that they obtain nutrients (organic materials) from the remains of dead organisms. Fungi release hydrolytic enzymes that digest external substrates and then absorb the soluble products. They are heterotrophic and use organic compounds as a source of carbon, electron and energy.