

Contents

Preface to the first edition	page xiii
Preface to the second edition	xv
Preface to the third edition	xvii
Acknowledgements	xix

Chapter 1	Introduction	1
1.1	What are fungi?	1
1.2	Physiology of the growing hypha	3
1.3	Hyphal aggregates	14
1.4	Spores of fungi	22
1.5	Taxonomy of fungi	32

Chapter 2	Protozoa: Myxomycota (slime moulds)	40
2.1	Introduction	40
2.2	Acrasiomycetes: acrasid cellular slime moulds	40
2.3	Dictyosteliomycetes: dictyostelid slime moulds	41
2.4	Protosteliomycetes: protostelid plasmodial slime moulds	45
2.5	Myxomycetes: true (plasmodial) slime moulds	47

Chapter 3	Protozoa: Plasmodiophoromycota	54
3.1	Introduction	54
3.2	Plasmodiophorales	54
3.3	Control of diseases caused by Plasmodiophorales	62
3.4	<i>Haptoglossa</i> (Haptoglossales)	64

Chapter 4	Straminipila: minor fungal phyla	67
4.1	Introduction	67
4.2	The straminipilous flagellum	68
4.3	Hyphochytriomycota	70
4.4	Labyrinthulomycota	71

Chapter 5	Straminipila: Oomycota	75
5.1	Introduction	75
5.2	Saprolegniales	79
5.3	Pythiales	95
5.4	Peronosporales	115
5.5	Sclerosporaceae	125

Chapter 6	Chytridiomycota	127
6.1	Introduction	127
6.2	Chytridiales	134
6.3	Spizellomycetales	145
6.4	Neocallimastigales (rumen fungi)	150
6.5	Blastocladales	153
6.6	Monoblepharidales	162
Chapter 7	Zygomycota	165
7.1	Introduction	165
7.2	Zygomycetes: Mucorales	165
7.3	Examples of Mucorales	180
7.4	Zoopagales	200
7.5	Entomophthorales	202
7.6	Glomales	217
7.7	Trichomycetes	222
Chapter 8	Ascomycota (ascomycetes)	226
8.1	Introduction	226
8.2	Vegetative structures	226
8.3	Life cycles of ascomycetes	228
8.4	Conidia of ascomycetes	230
8.5	Conidium production in ascomycetes	231
8.6	Development of asci	236
8.7	Types of fruit body	245
8.8	Fossil ascomycetes	246
8.9	Scientific and economic significance of ascomycetes	246
8.10	Classification	247
Chapter 9	Archiascomycetes	250
9.1	Introduction	250
9.2	Taphrinales	251
9.3	Schizosaccharomycetales	253
9.4	<i>Pneumocystis</i>	259
Chapter 10	Hemiascomycetes	261
10.1	Introduction	261
10.2	<i>Saccharomyces</i> (Saccharomycetaceae)	263
10.3	<i>Candida</i> (anamorphic Saccharomycetales)	276
10.4	<i>Pichia</i> (Saccharomycetaceae)	281
10.5	<i>Galactomyces</i> (Dipodascaceae)	281
10.6	<i>Saccharomycopsis</i> (Saccharomycopsidaceae)	282
10.7	<i>Eremothecium</i> (Eremotheciaceae)	284

Chapter II	Plectomycetes	285
11.1	Introduction	285
11.2	Ascosphaerales	286
11.3	Onygenales	289
11.4	Eurotiales	297
Chapter I2	Hymenoascomycetes: Pyrenomycetes	315
12.1	Introduction	315
12.2	Sordariales	315
12.3	Xylariales	332
12.4	Hypocreales	337
12.5	Clavicipitales	348
12.6	Ophiostomatales	364
12.7	Microascales	368
12.8	Diaporthales	373
12.9	Magnaporthaceae	377
12.10	Glomerellaceae	386
Chapter I3	Hymenoascomycetes: Erysiphales	390
13.1	Introduction	390
13.2	Phylogenetic aspects	392
13.3	<i>Blumeria graminis</i>	393
13.4	<i>Erysiphe</i>	401
13.5	<i>Podosphaera</i> and <i>Sphaerotheca</i>	404
13.6	<i>Sawadaea</i>	405
13.7	<i>Phyllactinia</i> and <i>Leveillula</i>	405
13.8	Control of powdery mildew diseases	408
Chapter I4	Hymenoascomycetes: Pezizales (operculate discomycetes)	414
14.1	Introduction	414
14.2	<i>Pyronema</i> (Pyronemataceae)	415
14.3	<i>Aleuria</i> (Pyronemataceae)	417
14.4	<i>Peziza</i> (Pezizaceae)	419
14.5	<i>Ascobolus</i> (Ascobolaceae)	419
14.6	<i>Helvella</i> (Helvellaceae)	423
14.7	<i>Tuber</i> (Tuberaceae)	423
14.8	<i>Morchella</i> (Morchellaceae)	427
Chapter I5	Hymenoascomycetes: Helotiales (inoperculate discomycetes)	429
15.1	Introduction	429
15.2	Sclerotiniaceae	429
15.3	Dermateaceae	439

15.4	Rhytismataceae	440
15.5	Other representatives of the Helotiales	442
Chapter 16	Lichenized fungi (chiefly Hymenoascomycetes: Lecanorales)	446
16.1	Introduction	446
16.2	General aspects of lichen biology	447
16.3	Lecanorales	455
Chapter 17	Loculoascomycetes	459
17.1	Introduction	459
17.2	Pleosporales	460
17.3	Dothideales	480
Chapter 18	Basidiomycota	487
18.1	Introduction	487
18.2	Basidium morphology	487
18.3	Development of basidia	488
18.4	Basidiospore development	490
18.5	The mechanism of basidiospore discharge	493
18.6	Numbers of basidiospores	495
18.7	Basidiospore germination and hyphal growth	496
18.8	Asexual reproduction	501
18.9	Mating systems in basidiomycetes	506
18.10	Fungal individualism: vegetative incompatibility between dikaryons	510
18.11	Relationships	511
18.12	Classification	512
Chapter 19	Homobasidiomycetes	514
19.1	Introduction	514
19.2	Structure and morphogenesis of basidiocarps	517
19.3	Importance of homobasidiomycetes	525
19.4	Euagarics clade	532
19.5	Boletoid clade	555
19.6	Polyporoid clade	560
19.7	Russuloid clade	566
19.8	Thelephoroid clade	572
19.9	Hymenochaetoid clade	573
19.10	Cantharelloid clade	574
19.11	Gomphoid–phalloid clade	575
Chapter 20	Homobasidiomycetes: gasteromycetes	577
20.1	Introduction	577
20.2	Evolution and phylogeny of gasteromycetes	578

20.3	Gasteromycetes in the euagarics clade	581
20.4	Gasteromycetes in the boletoid clade	585
20.5	Gasteromycetes in the gomphoid–phalloid clade	588

Chapter 21	Heterobasidiomycetes	593
-------------------	-----------------------------	------------

21.1	Introduction	593
21.2	Ceratobasidiales	594
21.3	Dacrymycetales	598
21.4	Auriculariales	601
21.5	Tremellales	604

Chapter 22	Urediniomycetes: Uredinales (rust fungi)	609
-------------------	---	------------

22.1	Urediniomycetes	609
22.2	Uredinales: the rust fungi	609
22.3	<i>Puccinia graminis</i> , the cause of black stem rust	620
22.4	Other cereal rusts	627
22.5	<i>Puccinia</i> and <i>Uromyces</i>	629
22.6	Other members of the Pucciniaceae	631
22.7	Melampsoraceae	634

Chapter 23	Ustilaginomycetes: smut fungi and their allies	636
-------------------	---	------------

23.1	Ustilaginomycetes	636
23.2	The 'true' smut fungi (Ustilaginomycetes)	636
23.3	Microbotryales (Urediniomycetes)	652
23.4	Exobasidiales (Ustilaginomycetes)	655

Chapter 24	Basidiomycete yeasts	658
-------------------	-----------------------------	------------

24.1	Introduction	658
24.2	Heterobasidiomycete yeasts	660
24.3	Urediniomycete yeasts	666
24.4	Ustilaginomycete yeasts	670

Chapter 25	Anamorphic fungi (nematophagous and aquatic forms)	673
-------------------	---	------------

25.1	Nematophagous fungi	673
25.2	Aquatic hyphomycetes (Ingoldian fungi)	685
25.3	Aero-aquatic fungi	696

References	702
------------	-----

Index	817
-------	-----

Colour plate section appears between pages 412 and 413