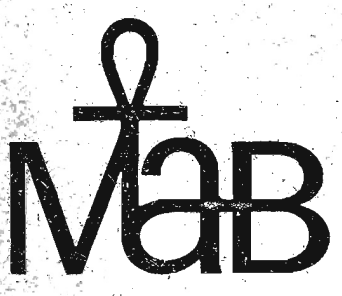

UNESCO: Man and the Biosphere National Committee for Sri Lanka

Publication No: 7

A HAND BOOK

to the

SOIL FUNGI OF SRI LANKA

by **Umarany Coomaraswamy and R. N. de Fonseka**

Department of Botany, University of Colombo, Colombo 3, Sri Lanka.

with illustrations by **Suneetha Medis**

Published by the National Science Council of Sri Lanka.
47/5, Maitland Place,
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PUBLICATIONS OF
UNESCO-MAB NATIONAL COMMITTEE FOR SRI LANKA.

The absence of Handbooks and Guides to most groups of plants and animals of Sri Lanka has limited the development of interest in our flora and fauna, and this has also been a very serious handicap to ecological studies in this island.

The UNESCO-MAB Committee set up jointly by the Ministries of Science and Education is sponsoring therefore the publication of Check lists of species and Hand books to the identification of Genera of various groups of plants and animals. The committee welcomes any additions and corrections and suggestions for improvement of these publications.

B.A. Abeywickrema
Chairman MAB Committee.

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FAMILIES OF THE FLOWERING PLANTS OF SRI LANKA
B.A. Abeywickrama

C O N T E N T S

****

INTRODUCTION

The UNESCO-MAB National Committee of Sri Lanka has in its programme the compilation of checklists and handbooks as essential guides to the identification of the flora and fauna of Sri Lanka. Already several have been published and the present work is concerned with the soil fungi.

Among the great assemblage of the micro-organisms that live or partly live in the soil, are the fungi which are largely responsible for the early stages of breaking down plant and animal material, fixing a great amount of nitrogen as microbial protein and for cycling and transformation of carbon and minerals within the soil. The soil fungi are also of interest to animal and plant pathologists since some of the pathogens live or survive in the soil. Serious studies on the fungi of Sri Lankan soils are relatively recent. The present work is of a preliminary nature and is an attempt to bring together all the existing information, both the published and the unpublished, and compile a guide to facilitate future work. This work is primarily intended to under-graduate and post-graduate students dealing with Agriculture, Plant Pathology, Animal Pathology, Soil Ecology, Soil Microbiology and Soil Science. The authors would welcome any information which have escaped their notice and any suggestions towards the improvement of this work.

The fungi included here are those that usually appear in plates of culture media made from soil samples. The only exceptions are those members of the family Endogonaceae. Although the Endogonaceae does not come under our definition of soil fungi we have included in this hand book the results of a recent study on the Endogonaceae of the rubber growing soils of Sri Lanka. This information became available only after the final manuscript was prepared and for this reason the Endogonaceae is included as an addendum. The fungi reported from the ground, litter, wood, or other substrata which have not become fully incorporated into the soil have been excluded from this work. The identification of those fungi which have been isolated in our laboratories have been confirmed by the Commonwealth Mycological Institute.

The classification and arrangement of the genera is based on the schemes set forth by Ainsworth (1963) and Ainsworth et al (1973). In devising simple dichotomous keys to the sub-divisions, classes, orders, families and genera, already existing keys have been selected with appropriate modification to fit the material covered. The mumbers after the generic names in the keys refer to the serial number of the genera. For the taxonomic data of the genera, a brief description of the characters and important synonyms as cited by Ainsworth (1963): Dorothy I .Fennel (1973): Kendrick and Carmachael (1973): and Mueller & Von Arx (1973), are given. After each generic description the local species are listed, locality indicated and source of information cited. No attempt has been made to devise keys to the species level. The authors hope to extend this work later on. In order to provide a better understanding of the structure of the fungi listed, many of them have been illustrated by camera lucida drawings. Few of them have been adapted from the work of Webster (1970). For the convenience of the user a glossary of terms and illustrations of some are given at the end of the text. The authors would like to express their sincere thanks to the Director and staff of the Commonwealth Mycological Institute for their help with the identification of many of the fungi described; Dr. O.S. Peries, Mrs. N.I.S. Liyanage, Dr. Ranjith Mahindapala, Dr. S.N. de S. Seneviratne, Mr. B. Sivakadadcham and Mrs. R.S. Jayasinghe for their kind permission to use their unpublished data in this work.

List of the Genera

1. Allomyces Butler
2. Phytophthora de Bary
3. Pythium Pringsh.
4. Absidia van Tiegh.
5. Rhizopus Ehren. ex Corda
6. Actinomucor Schost.
7. Circinella van Tiegh.
8. Mucor Mich. ex Fr.
9. Zygorhynchus Vuill.
10. Helicostylum Corda
11. Choanephora Currey
12. Syncephalastrum Schroet
13. Cunnighamella Matr.
14. Mortierella Coemans
15. Cochliobolus Drechsler
16. Monascus van Tiegh.
17. Eupenicillium Ludwig
18. Allescheria Sacc. & Syd.
19. Pseudoeurotium van Beyma
20. Thielavia Zopb.
21. Chaetomium Kunze ex Fr.
22. Achaetomium Raj, Tewari & Mukerji
23. Petriellidium Malloch
24. Sordaria Ces de Not.
25. Neurospora Shear & Dodge
26. Nectria Fr.
27. Schizophyllum Fr.
28. Rhizoctonia Dc. ex Fr.
29. Botryodiplodia Sacc.
30. Coniothyrium Corda
31. Phoma Sacc.
32. Macrophomina Petrak
33. Pestalotia de Not.
34. Myrothecium Tode ex Fr.
35. Fusarium Link ex Fr.
36. Cylindrocarpon Wollenw.
37. Geotrichum Link ex Fr.
38. Trichoderma Pers. ex Fr.
39. Aspergillus Mich. ex Fr.
40. Gliocladium Corda
41. Paecilomyces Bain
42. Penicillium Link ex Fr.
43. Verticillium Nees ex Wallr
44. Monosporium Bon.
45. Tritirachium Limber
46. Metarhizium Sorok.
47. Botrytis Pers. ex Fr.
48. Acremonium Link ex. Fr.
49. Sporotrichum Link ex. Fr.
50. Rhinocladiella Nannf.
51. Stachybotrys Corda
52. Nigrospora Zinnm.
53. Humicola Traaen
54. Cladosporium Link ex Fr.
55. Curvularia Boedijn
56. Helminthosporium Link ex Fr.
57. Alternaria Nees ex. Waller
58. Pithomyces Berk. & Br.
59. Endogone Link
60. Gigaspora Gerdemann & Trappe
61. Acaulospora Gerdemann & Trappe
62. Glomus Tul. & Tul.
63. Sclerocystis Berk. & Br.

SIMPLIFIED KEY TO THE SUB-DIVISIONS OF THE SOIL FUNGI

1.	Motile cells (zoospores) present; perfect state spores typically oospores	MASTIGOMYCOTINA	p - 4
	Motile cells absent; perfect state spores when present not oospores	 2	
2.	Perfect state present	 3	
	Perfect state absent	DEUTEROMYCOTINA	p - 45
3.	Perfect state spores zygospores	ZYGOMYCOTINA	p - 8
	Perfect state spores not zygospores	 4	
4.	Perfect state spores ascospores	ASCOMYCOTINA	p - 26
	Perfect state spores basidiospores	BASIDIOMYCOTINA	p - 43

SUB-DIVISION - MASTIGOMYCOTINA

Thallus is unicellular or mycelial. Mycelium when young is aseptate, irregular septa appearing with age, with delimitation of reproductive structures and under unfavourable conditions. Asexual reproductive spores motile(zoospores), with one or two flagella. Sexual reproduction by means of isogamous or anisogamous planogametes or by oogamous gametic or gametangic copulation. Sexual (perfect) spores are either resting spores or oospores.

KEY TO THE CLASSES OF THE SUB-DIVISION MASTIGOMYCOTINA

Zoospores uniflagellate	CHYTRIDIOMYCETES	p - 4
Zoospores biflagellate	OOMYCETES	p - 6

CLASS CHYTRIDIOMYCETES

Members are typically found in aquatic habitats. Many of them inhabit soil. Some are parasitic on plants. Thallus is a unicellular body getting converted as a whole into a reproductive structure

(holocarpic), or a rhizomycelium with reproductive structures, or a well developed coenocytic mycelium with reproductive structures (eucarpic). Asexual reproductive structure is a sporangium, giving rise to uniflagellate zoospores. Sexual reproduction is by conjugation of planogametes, aplanogametes or gametangia.

A single order treated.

ORDER - BLASTOCLADIALES

Mostly fresh water or terrestrial, saprophytic fungi. Thallus is differentiated into a trunk like portion, bearing rhizoids below and branching above and bearing sporangia of various kinds at the tips of branches. Sterile setae are sometimes present. Protoplasm is frequently alveolate or reticulately vacuolate. The fungus is sometimes differentiated into similar gametophytic and sporophytic phases; the sexual or gametophytic plant bearing thin walled gametangia; the asexual or sporophytic plant bearing thin walled zoosporangia and thick walled generally brownish resting spores. Zoospores posteriorly uniflagellate. A characteristic feature of the zoospores is a large nuclear cap and the presence of small lipoid globules. Gametes posteriorly uniflagellate, isogamous or anisogamous. The biflagellate planozygote without a period of rest, germinates to form an asexual plant.

A single family treated.

FAMILY - BLASTOCLADIACEAE

Characters are those of the order.

A single genus treated.

1. Allomyces Butler (Plate I, Fig. I)

Mycelium with the stalk not conspicuously differentiated, branching usually dichotomous, often verticillate in groups of

three to five. Zoosporangia oval, terminal, sympodially arranged, sometimes in chains. Zoospores biflagellate. Resting bodies borne in the same way as the sporangia and of the same size and shape. At maturity they are enclosed in a thin hyaline sheath.

A single species recorded in Sri Lanka.

A. arbusculus Butler

near Nuwara Eliya (13)

Also reported from India, Mexico, Panama, Phillipines, USA (6)

CLASS - OOMYCETES

Most oomycetes are aquatic, although some grow in soils, and others parasitise vascular plants. Vegetative body is typically mycelial, coenocytic and very extensive. Cell walls are unusual for fungi in that chitin is absent, principal component being glucans. Asexual spores are biflagellate zoospores, one flagellum of the whip-lash type and the other of the tinsel type. In some advanced members, the sporangium assumes the function of a spore, gets detached from the sporangiophore and germinates directly. The male sex organs (antheridia) are readily distinguishable from the female sex organs (oogonia). The oogonium when ripe, consists of one or more oospheres or eggs. Oospheres are fertilised by the male cells liberated by the antheridium or by the antheridium itself. After fertilisation the oospheres round up and develop cell walls to form the oospores, which lie free within the oogonium.

A single order treated.

ORDER - PERENOSPORALES

The order includes aquatic, amphibious and terrestrial fungi. Mycelium delicate, well developed and much branched. Asexual reproduction is by means of deciduous sporangia which vary greatly in shape. The sporangia either form zoospores or germinate directly

by germ-tubes. Antheridia and oogonia, are morphologically different and are borne on the ends of lateral branches. Antheridia clavate and smaller than the oogonia to which they become attached. Antheridium pierces oogonium with a fertilisation tube. A feature of the oogonia of the order is that the residual cytoplasm left after the differentiation of the central oosphere, persists as the periplasm. Oogonium, large sac-like or spherical with a single egg. Oospore spherical with a many layered wall.

A single family treated.

FAMILY - PYTHIACEAE

Zoosporangia, either undifferentiated portion of the mycelium or an irregularly lobed structure with an evacuation tube, or a spherical, ovoid or lemon shaped structure without an evacuation tube. Zoospores either formed outside the sporangia in a vesicle or free in the water or produced within the sporangium. In some species the sporangium germinates as one unit by means of a tube.

KEY TO THE GENERA OF THE FAMILY PYTHIACEAE

Zoospores form within the sporangium	Phytophthora	2
Zoospores form not within the sporangium but within a vesicle	Pythium	3

2. Phytophthora de Bary (Plate I, Fig. 2)

Mycelium richly branched with hyaline, thin walled hyphae. Sporangiophores sparingly to irregularly branched, indeterminate. Sporangium, egg or lemon shaped, with an apical papilla, germinating by zoospores formed within the sporangium and escaping by a terminal pore. Zoospores oval, laterally flattened with two flagellae, monoplanetic. Oogonia spherical; antheridia clavate perigynous or amphigynous.

A single unidentified species recorded from the rubber growing soils in Sri Lanka. (12)

3. Pythium Pringsh. (Plate I, Figs. 3-5)

Mycelium richly paniculately branched. Sporangia terminal or intercalary; shape not very different from the mycelial branches, spherical or lemon shaped. Mature sporangium empties the contents into a vesicle, where zoospore differentiation takes place. Zoospores kidney shaped. Sex organs like in Phytophthora.

A single species recorded in Sri Lanka.

P. butleri Subramanium
Gannoruwa (14)

SUB-DIVISION - ZYGOMYCOTINA

Mycelium coenocytic, well developed, richly branched. Cell walls contain chitin. Most species have a creeping vegetative mycelium on which the sporangiophores arise. Asexual spores are always non-motile. Spores contained in sporangia which may be violently projected but more usually passively dispersed by wind, rain or animals. Sexual reproduction results from the fusion of isogamous gametangia. The resulting zygote gives rise to the zygospore.

A single class treated.

CLASS - ZYGOMYCETES

Some members are normally encountered as contaminants in a laboratory. Some members are ubiquitous in soil and in dung as saprophytes. Most of the common species are readily recognised as belonging to this group by their rapid rate of growth and their characteristic appearence, the colonies usually being

floccose and of a grey or brown-grey in colour. Asexual reproduction is by spores contained in pear shaped or round sporangia. The gametangia may be similar in size or markedly dissimilar. The zygospore is usually round, thick walled and dark coloured. In several genera the zygospores have never been observed.

A single order treated.

ORDER - MUCORALES

A great majority of species are saprophytic on a wide variety of organic substrates. Usual mode of sexual reproduction is by spores in globose sporangia borne on sporangiophores which may be branched in various ways. In most genera the tip of sporangiophore is swollen, the swollen end (columella) projecting into the sporangium. Columella may be of various shapes. In a number of species various modifications of the typical many spored, globose sporangium occur. Sporangia are also known in which there are fewer spores (sporangioles). In some cases the sporangium has a single spore and is dispersed as a unit (conidium). In still others the spores are arranged in a row inside a cylindrical sac termed merosporangium. Chlamydospores are of frequent occurence. The zygospore which result from the sexual reproduction is naked in most genera but in some it is protected by stiff hairs or appendages. In the higher mucorales the cover become so thick, that a fruit body is formed. The key to the families is based on that of Martin (1961).

KEY TO THE FAMILIES OF THE ORDER MUCORALES

1. Sporangia all columellate and alike — MUCORACEAE — p-10
   Sporangia generally non - columellate, if columellate accompanied by sporangioles or conidia — 2

2. Columellate sporangia usually present, accompanied by, few-spored sporangioles in which spores are never formed in linear series, or by conidia — 3

Columellate sporangia never present, sporangioles 1-spored, conidium like, or bearing spores in linear series, or modified non-columellate sporangia functioning as propagules — 4

3. Sporangioles borne in clusters on lower part of sporangiophore, the latter usually, tipped by a columellate sporangium or a spine — THAMNIDIACEAE p - 19

Sporangioles or conidia never borne on sporangiophore as columellate sporangia — CHOANEPHORACEAE p - 22

4. Merosporangia borne on tips of sporangiophores — PIPTOCEPHALIDACEAE p - 23

Merosporangia lacking or not clearly defined — 5

5. Conidia present on inflated tips of sporophores; sporangia lacking — CUNNINGHAMELLACEAE p - 24

Conidia lacking; sporangia non-columellate — MORTIERELLACEAE p - 25

FAMILY - MUCORACEAE

Members are abundant in soils, dung and on moist fresh organic matter in contact with the soil. They play an important part in the early colonisation of substrate in soil. They are also known to cause diseases of man and animals. Spores are contained in

Plate I Figs. 1 - 6

Fig 1 Allomyces arbuscula.

a. Gametangia at tips of branches of gametophyte x 400;
b. resting sporangia and zoosporangia at tips of branches of sporophyte x 400;
c. rupture of a resting sporangium x 400;
d. zoospores x 1000

Fig 2 Phytophthora sp.

a. sporangiophores x 400;
b. sporangia showing apical papilla x 500;
c. sporangium with zoospores x 500;
d. zoospores x 1000;
e. androgynous oogonium x 1000;
f. paragynous oogonium x 1000;

Fig 3 Pythium debaryanum

a. sporangium with a vesicle containing zoospores x 1000;
b. oogonium and antheredia x 1000.

Fig 4 Pythium aphanidermatum

a. lobed sporangium with long tube and a vesicle x 1000;
b. vesicle showing zoospores, much enlarged;
c. zoospores, much enlarged;

Fig 5 Pythium spp.

a. oogonium showing spiny out-growths oogonial wall x 1000;

Fig 6 Absidia spp.

a. habit showing rhizoids, stolon, and whorls of sporangiophores x 5;
b. the same x 50;
c. pyriform intact sporangium x 400;
d. dehisced sporangium x 400;
e. zygospore showing curved appendages arising from the suspensor.

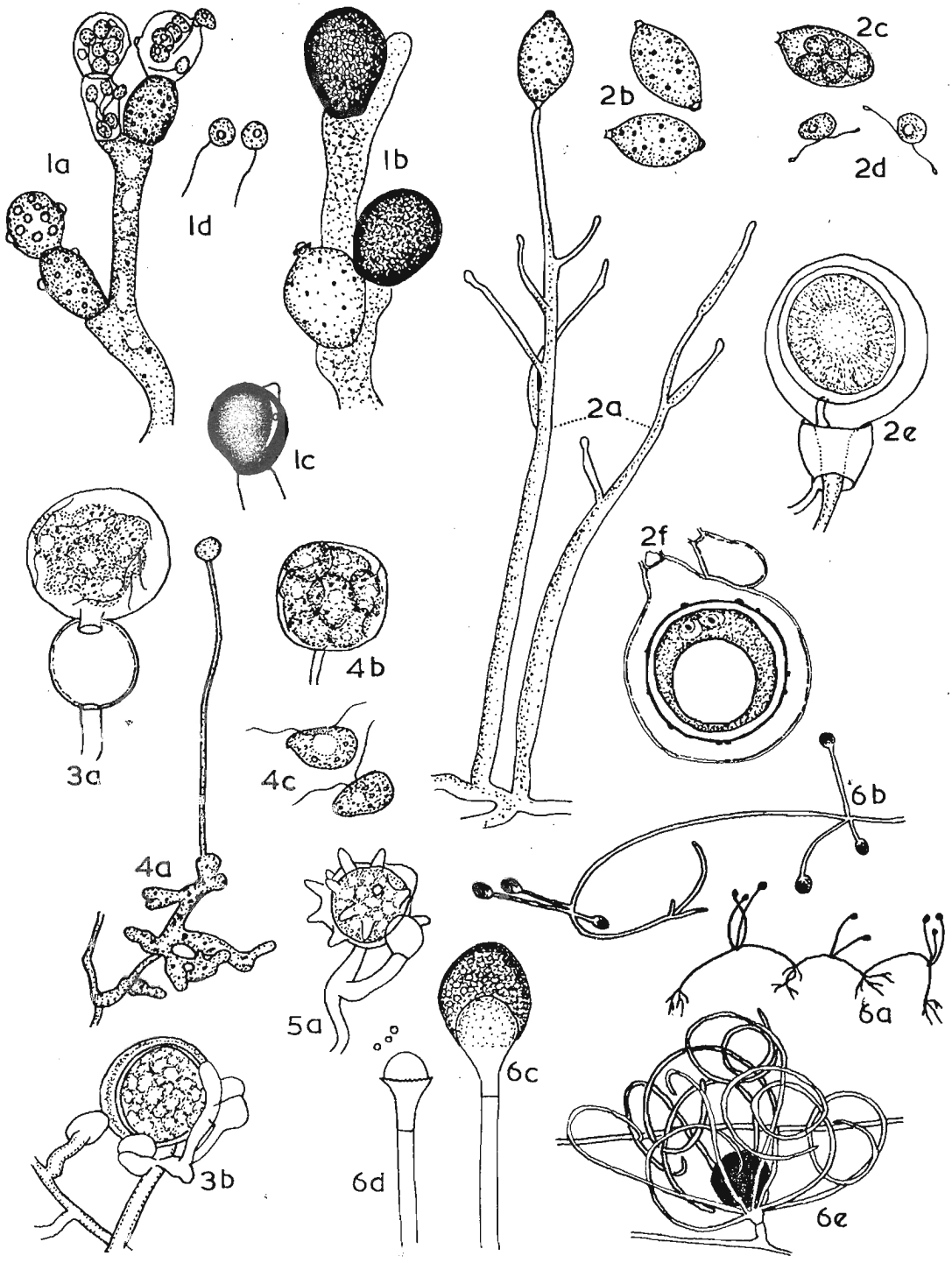

Plate I - Figs. 1 - 6

globose or pear shaped sporangia. Sporangia may be borne singly at the tip of a simple or branched sporangiophore. Sporangiophores are commonly phototropic. Number of spores very variable. Sporangial wall often darken and may develop a spiny surface due to the formation of crystals. Zygospore naked or only loosely covered.

KEY TO THE GENERA OF THE FAMILY MUCORACEAE

1.	Sporangia pear shaped	Absidia 4
	Sporangia spherical	2
2.	Sporangiophores produced in groups on a stolon	3
	Sporangiophores emerging singly from the mycelium	4
3.	Sporangiophores unbranched	Rhizopus 5
	Sporangiophores verticillately branched	Actinomucor 6
4.	Sporangiophores branched, side branches strongly curved	Circinella 7
	Sporangiophores unbranched, or side branches not markedly curved	5
5.	Zygospores with equal suspensors	Mucor 8
	Zygospores with very unequal suspensors	Zygorrhynchus 9

4. Absidia van Tieghem (Plate I, Fig. 6)

Mycelium with frequently branched stolons, producing at the point of contact with the substratum, richly branched rhizoids. The sporangiophores are produced in partial whorls at intervals

Plate II Figs 7 - 12

Fig 7 Rhizopus nigricans

a. habit showing stolon, rhizoids and tufts of sporangiophores x 5;
b. group of sporangiophores and basal rhizoids x 100;
c. dehisced sporangium showing columella and attached spores x 400;
d. dehisced sporangium with invaginated columella x 400;
e. zygospore x 400;

Fig 8 Circinella sp.

a. habit x 5;
b. mature sporangia x 400;
c. dehisced sporangia showing columella x 400;
d. zygospore x 400;

Fig 9 Zygorrhynchus spp.

a. sporangiophore with young and mature sporangia x 400;
b. sporangiophore with dehisced sporangia x 400;
c. zygospore x 400;

Fig 10 Mucor assamensis,

a. sporangiophore with mature sporangium x 400;
b. sporangiophore with dehisced sporangium x 400;

Fig 11 Mucor racemosus,

a. Branched sporangiophore containing dehisced sporangium, undehisced mature sporangium and intercalary chlamydospores x 400;
b. dehisced sporangium with an oval columella x 400;
c. dehisced sporangium with pyriform columella x 400;

Fig 12 Helicostylum spp.

a. Habit showing terminal sporangium and lateral sporangioles x 40;
b. branch ending in a spine and lateral sporangioles x 400;

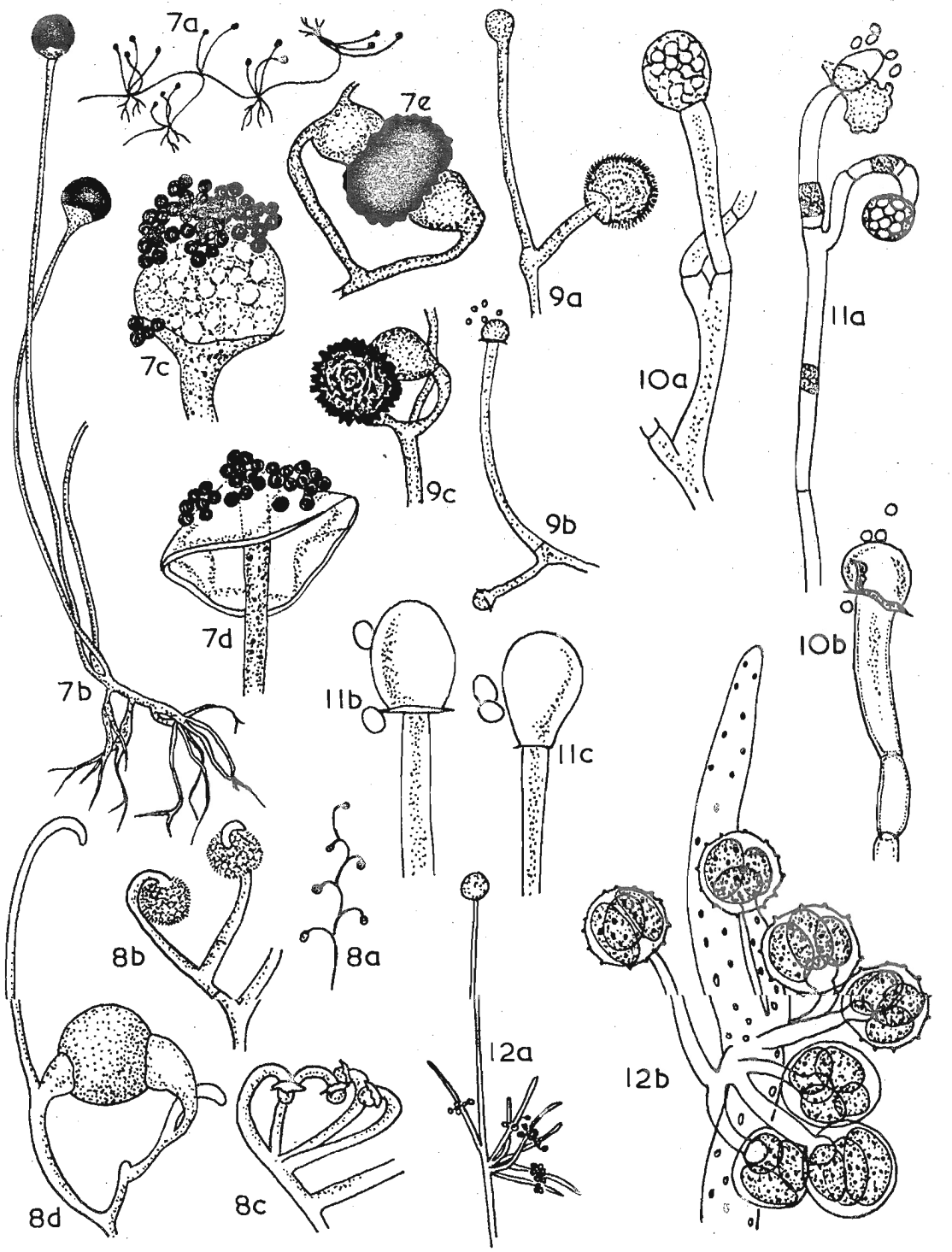

Plate II Figs. 7 - 12

along stolons, not opposite the sporangiophores. The sporangia are pear-shaped. Columella hemispherical, conical or mammiform, sometimes terminated by a single long prolongation. Zygospores formed on the stolons and are surrounded by curved unbranched appendages which may arise from one or both suspensors. Most species are heterothallic.

4 species recorded in Sri Lanka.

(i) A. blakesleana
Montane grasslands (11)

(ii) A. corymbosa Lichth.
Agalawatta, Boralu, Deniya, Matale, Parambe (12)
Montane grasslands (11)

(iii) A. cylindrospora Hagem
Agalawatta, Homagama, Parambe, Ratnapura (12)
Montane grasslands (11)
Also reported from soils in Norway, Greenland, Yugoslavia, Tunis, Somalia, Mexico, Brazil, Hawaii, Tasmania (4)

(iv) A. sp.
Agalawatta, Deniya, Matale (12)

5. Rhizopus Ehrenberg ex Corda (Plate II, Fig. 7)

Occurs in soil, fruits, other foods, decaying materials and as a laboratory contaminant. Characteristic feature is the presence of rhizoids at the base of the sporangiophores which grow in clusters and the stoloniferous habit (an aerial hypha, the stolon grows out and where it touches the substratum bears rhizoids). Sporangia columellate, white at first, becoming bluish-black at maturity. Columellae broadly subjacent, hemispherical, forming after dehiscence by collapse, an organ of the shape of the pileus of a mushroom. Zygospores naked, formed in the substratum and on the stolons.

2 species recorded in Sri Lanka.

(i) R. elegans Eidam. (See Actinomucor elegans)

(ii) R. nigricans Ehren.
Deniya , Homagama, Matale (12)
Montane grasslands (11)
World-wide in distribution (6)

6. Actinomucor Schostakowifisch

Sporongiophores with terminal sporangia or with sterile tips, then serving as hold fasts. When a hold fast comes in contact with the substrate, it forms at that point a system of branching rhizoids like those found in the Genus Rhizopus. The lateral sporangiophores short, usually stout, whorled, with sporangia smaller but similar to those on primary axis. The species is easily recognizable by its stolon and rhizoid formation and by the verticillate branching.

A single species recorded in Sri Lanka.

A. elegans (Eidam) Benjamin et Hesseltine
Syn: Mucor botryoids Lendner
Mucor corymbosus Harz
Actinomucor repens Schost
Rhizopus elegans Eidam,

7. Circinella van Tieghem & Le Monnier (Plate II, Fig. 8)

Mycelium strongly branched, with the lateral branches becoming more and more delicate. Sporangiophores erect on the mycelium, branching sympodially. Lateral branches united into whorls or single, curved and carry at their tips, sporangia. Sporangium spherical many-spored with a large columella. Zygospores naked.

3 species recorded in Sri Lanka.

(i) C. mucoides
Montane grasslands (11)

(ii) C. simplex van Tieghem
Agalawatta, Boralu, Parambe, Ratnapura (12)

Also recorded from Brazil, USA (6)

(iii) C. umbellata
Montane grasslands (11)

8. Mucor Micheli (Plate II, Fig. 10-11)

This is the largest genus of the order. It is cosmopolitan and widespread in soil, dung and other organic substrates. Mycelium widespread in and around the substratum, richly branched without rhizoids and stolons. Irregular cross walls appear with age. Sporangiophores arise singly from the mycelium, branched or unbranched. When branched branching in part monopodial. Sporangia terminal, spherical or globose, many-spored. Zygospores naked. Most species are heterothallic.

7 species recorded in Sri Lanka.

(i) M. assamensis Sydowia
Kottawa forest (3)

(ii) M. flavus Pain
Agalawatta, Boralu, Deniya , Homagama, Matale, Parambe, Ratnapura (12)

Also reported from Europe, USSR, USA (6)

(iii) M. genevensis Lendn.
Agalawatta, Parambe, Homagama, Boralu (12)
Montane grasslands (11)

Also reported from Europe, USSR (6)

(iv) M. microspora Namysl
Agalawatta, Boralu, Homagama, Matale, Parambe, Ratnapura (12)
Montane grasslands (11)

Also reported from Europe, USSR, USA (6)

(v) M. racemosus

Montane grasslands (11)

Also worldwide in distribution (4, 6)

(vi) M. sp_1

Deniya, Homagama, Parambe, Ratnapura (12)

(vii) M. sp_2

Agalawatta, Homagama, Parambe, Ratnapura (12)

9. Zygorrhynchus Vuill. (Plate II, Fig. 9)

Mostly reported from soil, often from considerable depth. Hyphae branched unequal, often nodose, prostrate or forming a cottony aerial turf. Sporangiophores usually branched, solitary or in a irregular sympodial system. Sporangia many-spored with a columella, often broader than high. All species homothallic and have heterogametangia. Gametangia produced on unequally bifurcated hyphae; one branch small and other curved and thick.

2 unidentified species recorded in Sri Lanka.

(i) Z. $sp._1$

Agalawatta, Homagama, Ratnapura (12)

(ii) Z. $sp._2$

Montane grasslands (11)

FAMILY - THAMNIDIACEAE

Two kinds of sporangiophores and sporangia are found; Long sporangiophores are simple or slightly branched and terminate either in a sterile tip or in a large Mucor-like primary sporangium. Short sporangiophores which may be simple or dichotomously branched, occur in whorls on the long sporangiophores and bear few-spored sporangioles which typically lack a columella. In some cases the branch bearing the sporangioles is terminated by a spine. The sporangiole may be reduced to a single-spored condition. Zygospore formation is like in the Mucoraceae.

Plate III Figs 13 - 16

Fig 13 Choanephora cucurbitarum

a. Sporangiophore with a sporangium x 40;
b. conidiophore and conidia x 40;
c. apex of conidiophore showing primary and secondary vesicles and conidia x 400;
d. dehisced sporangium and sporangiospores x 400;
e. conidium x 1000;
f. sporangiospore x 1000;

Fig 14 Syncephalastrum racemosu,

a. habit x 10;
b. sporangiophore bearing vesicle and many merosporangia (note the resemblance to Aspergillus) x 400;
c. sporangiophore with empty spore heads x 400;
d. merosporangia and merospores x 400;

Fig 15 Cunninghamella elegans,

a. simple sporangiophore with young 'conidia' x 100;
b. branched sporangiophore with young 'conidia' x 400;
c. mature sporangiophore showing mature 'conidia' x 400;
d. mature sporangiophore showing scars of attachment of conidia x 400;
e. conidia x 400;

Fig 16 Mortierella spp.

a. branched sporangiophore x 400;
b. intact sporangium x 100;
c. stipe of sporangiophore after sporangium dehisced (note the absence of a columella) x 1000;
d. stylospore x 1000;
e. developing zygospore x 1000;
f. older zygospore x 1000;

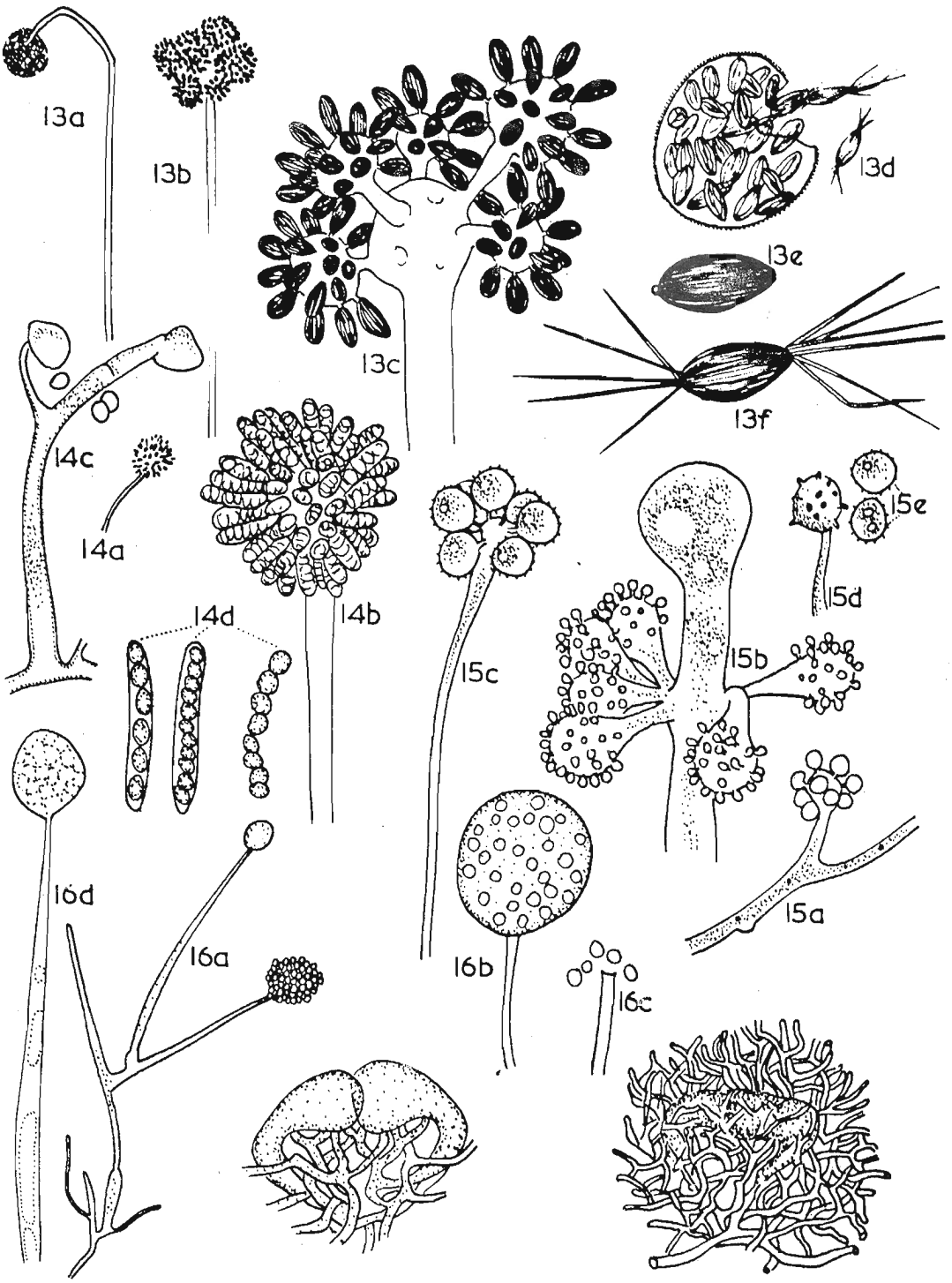

Plate III Figs. 13 - 16

A single genus treated.

10. Helicostylum Corda (Plate II, Fig.12)

The long sporangiophore terminates in a Mucor-type sporangium. Unforked lateral branches arise from the long sporangiophore and bear short circinate branchlets bearing sporangioles. The sporangioles are columellate.

A single species recorded in Sri Lanka

H. pyriforme
Montane grasslands (11)

FAMILY - CHOANEPHORACEAE

In this family asexual reproductive structures are sporangia, sporangioles or conidia. Sporangia typical of Mucoraceae are present in some genera and absent in others. The sporangia often hang downwards. They contain dark brown sporangiospores with a striate epispore and bristle-like appendages. The sporangioles cover vesicular enlargements of the sporangiophorea and contain two to few spores of similar construction. The conidia are single spored sporangioles borne on vesicles. The sporangiospores are dark brown with longitudinally striated epispore and bearing bristle-like appendages. The conidia are striate but without appendages. Zygospores dark brown with striate walls.

A single genus treated.

11. Choanephora: Currey (Plate III, Fig. 13)

Species of Choanephora are found in warmer soils. C. cucurbitarum causes a rot of fruits and vegetables and blossom blight of some vegetables. Colonies white or grey white showing sporulation in concentric zones, later becoming sterile, sporangiophores unbranched, sporangia and sporangioles white at first, later turning black and contain few to many sporangiospores.

Sporangiospores light colored, becoming brown, later on, striate, and bear bristle-like appendages. In C.cucurbitarum the sporangiole contains only a single spore, showing the characteristic striations and a papilla at the end. Such monosporous sporangiola are termed conidia. Conidiophores and in a primary vesicle from which secondary vesicles arise on short stalks. Secondary vesicles bear conidia.

Zygospores between equal suspensors, dark brown with large oil globule and striate walls.

The genus Blakslea formely regarded as distinct, is treated by some authorities as a synonym of Choanephora (Webster 1970)

1 species recorded from Sri Lanka

C. cucurbitarum (Berkelay and Ravenel) Thaxter
From Colombo (3)

Also reported from America (6)

FAMILY - PIPTOCEPHALIDACEAE

The species of this family are largely parasitic on other Mucorales although some are saprophytic. The characteristic feature of this family is the narrow and more or less clavate or cylindrical sporangia (merosporangia) containing typically a single row of spores, often appearing, when mature, like chains of conidia. Number of spores in a merosporangium vary from 2 to 30. Usually the sporangium breaks into monosporous segments, the spore being enclosed in the sporangial wall. In some cases the merosporangium may break off and the spores escape individually from the opening. The merosporangia may be formed directly on the sporangiophore or on basal cells which in turn make up the head. Zygospore formation is like in Mucoraceae.

A single genus treated.

12. Syncephalastrum Schroeter (Plate III, Fig. 14)

Sporangiophore is mostly branched as in the racemose type of Mucor. The branches terminate in club shaped spherical or globose heads, sometimes separated from the sporangiophore by a wall. Merosporangia arise radially on the heads, without the intervention of sterigmata. The merosporangia break up into monosporous segments, so that spores appear in chains like in Aspergillus.

A single species recorded in Sri Lanka.

S. racemosum Chon. ex Schroeter
Montane grasslands (11)
Kottawa forest (3)

Also reported from Canada, Canalzone, Germany, India (6)

FAMILY - CUNNINGHMELLACEAE

Asexual reproduction entirely by means of indehiscent monosporous sporangioles (conidia) found crowded on the surface of swollen apical portion of a large sporangiophore or of its branches. Zygospore formation and structure is much like that in Mucoraceae.

A single genus treated.

13. Cunninghamella Matruchot (Plate III, Fig. 15)

Species found in soil in the warmer regions of the world. Mycelium white floccose, slightly thickened. Rhizoids very delicate. Asexual 'conidia' are hyaline, spherical or oval, often with an irregular, outline, the external membrane spiny with needle like crystals. 'Conidia' borne on small swellings, singly, on globose or spherical vesicles on branched or unbranched conidiophores. Chlamydospores globose and intercalary in the mycelium.

5 species recorded in Sri Lanka.

5 species recorded in Sri Lanka.

(i) C. elegans Lendh.
Agalawatta, Boralu, Deniya , Homagama, Matale, Parambe, Ratnapura (12)

Also reported from Mediterranean and sub-tropics (4,6)

(ii) C. echinulata Thaxt.
Agalawatta, Homagama, Matale (12)

Also reported from Canal zone, Egypt, India, Yugoslavia, Panama, USA (6)

(iii) C. phaeospora Boedizn
Agalawatta, Boralu, Deniya Homagama, Matale, Parambe, Ratnapura (12)

(iv) C. sp.
Agalawatta, Deniya Homagama, Matale (12)

(v) C. sp.
Montane grasslands (11)

FAMILY - MORTIERELLACEAE

Characteristic feature of this family is that the spherical sporangia lack columellae. In some species, sporangioles which are reduced to conidia also occur. Zygospore enclosed in a felt of interwoven hyphae.

A single genus treated.

14. Mortierella Coemans (Plate III Fig. 16)

Occur widely in soil and on plant and animal remains in contact with soil. Mycelium very thin and delicate and often shows a characteristic series of fan-like zones. Sporangiophore branched and usually tapering. Sporangium non-columellate. Wall of sporangium delicate and may collapse around the spores. In a number of species there may be only two or three spores per

sporangium. In addition to the sporangia there occur indehiscent, monosporous sporangioles ('Conidia' or Stylospores') which are easily detached and can germinate to form a new mycelium. The zygospores of some species may be surrounded by an investment of sterile hyphae.

4 species recorded in Sri Lanka.

(i) M. isabellina (Oud.) Zycha
Agalawatta, Boralu, Deniya, Homagama, Matale, Parambe, Ratnapura (12)

Also reported from Canada, Europe, New Zealand, USA (6)

(ii) M. ramanniana (Moell.) Lin.
Agalawatta, Deniya, Homagama, Matale, Parambe, Ratnapura (12)

Also reported from India (6)

(iii) M. vinaceae Dixon - Stewart
Agalawatta, Boralu, Deniya, Homagama, Ratnapura (12)

Very widely distributed (4)

(iv) M. sp[1]
Agalawatta, Homagama, Matale (12)

SUB-DIVISION - ASCOMYCOTINA (Ascomycetes)

Largest class of fungi containing some 15,000 species. Mycelium well developed (except in some Hemiascomycetes), usually richly branched and septate. The sexually produced spores (sometimes called the 'perfect' spores) are borne in a sac or ascus, typically containing 8 spores. Asci may be formed on the vegetative mycelium, but typically formed from ascogenous hyphae surrounded by sterile hyphae to form an ascocarp. The form of the ascocarp is very varied. When globose evanescent asci are borne at all levels from ascogenous hyphae ramifying

irregularly throughout the central tissue of a closed ascocarp, they are termed cleistothecia. Flask shaped or globose, closed or ostiolate fruit bodies with asci arranged in a basal or peripheral layer, are termed perithecia. When asci are arranged in a layer on open saucer shaped ascocarps, they are termed apothecia. When the asci are individually and irregularly distributed in the stromatal tissue or grouped in locules, ascocarps are termed ascostroma. In many, ascocarps are seated on or in a mass of tissue termed a stroma. Wall of a mature ascus is either single layered (unitunicate) or two-layered (bitunicate). Whilst some mebers of Ascomycotina reproduce by means of ascospores only, many have one or more conidial states and these are more important than the ascospores in disseminating the species. In warm places the sexual state may seldom be formed in some species and reproduction and dissemination remain predominantly asexual. The conidial state is also referred to as the 'imperfect' state. Different authorities hold widely different views about the classification of Ascomycetes. For the purpose of this key, the system proposed by Ainsworth (1973) is followed.

1.	Asci unitunicate or if bitunicate, then as an exposed hymenium of an apothecium	2	
	Asci bitunicate, formed in an ascostroma but not in an apothecium	LOCULOASCOMYCETES	P 28
2.	Asci indehiscent, evanescent, scattered at various levels within a cleistothecium	PLECTOMYCETES	P 34
	Asci dehiscent, persistent, forming a hymenium or arising as a fascicle at a common level in a perithecium	PYRENOMYCETES	P 38

CLASS - LOCULOASCOMYCETES

The asci are bitunicate. Ascocarp is an ascostroma with the asci individually and irregularly distributed in the stromal tissue or grouped in locules; the ascostroma then becomes a perethecioid or less commonly an apothecioid, pseudothecium. The pseudothecia are separate,

grouped on a common basal stroma in which they are more or less immersed, or else they are completely immersed and appear as unwalled locules in a multilocular stroma. Ascocarps may be entirely superficial, erumpent or immersed in the substratum. The centrum is composed of asci interspersed with persistent pseudoparaphyses or of fasicles of aparaphysate asci in disintegrating centrum tissue. Perethecioid forms have ostioles. Apothecioid forms open by splitting. Usually the ascospores are septate. Loculoascomycetes appear as superficial epiphytes, parasites, or hyperparasites of superficial fungi and insects, as internal parasites fruiting on green leaves and stems and as saprophytes.

A single order treated.

ORDER - PLEOSPORALES

Pseudothecia middle - sized to large, perethecioid, containing cylindrical asci among persistent pseudoparaphyses. Pseudothecia are solitary but may be gregarious or seated on a basal stroma in which they are partially immersed. Ascospores are commonly phragmosporous (spores with transverse septa) or dictyosporous (spores with transverse and longitudinal septa). Some genera cause 'leaf spot' and 'blight' diseases with which their conidial states are associated.

A single family treated.

FAMILY - PLEOSPORACEAE

Members occur chiefly on wood, dead herbaceous stems and dung. Pseudothecia middle sized to large, somewhat flattened containing broad sac like asci, Ascospores transverse and longitudinally septate, slipper shaped; hyaline to dark brown.

A single genus treated,

Plate IV Figs 17 - 22

Fig 17 Cochliobolus lunatus,

a. conidiophores x 400;
b. conidia x 400;
c. ascus with ascospores much enlarged.

Fig 18 Monascus sp.

a. conidiophore and conidia enlarged;
b. surface view cleistothecium enlarged;
c. section of cleistothecium enlarged;
d. ascus enlarged.

Fig 19 Eupenicillium

a. cleistotheciumx 75;
b. thick walled cells of cleistothecium enlarged;
c. asci produced in chains enlarged; and mature ascospores enlarged;
d. variety of Penicillium imperfect states, enlarged.

Fig 20 Pseudoeurotium spp.

a. condiophores (sympodulae) x 1000;
b. conidia x 1000;
c. burst cleistothecium x 100;
d. portion of cleistothecium wall x 400;
e. asci x 1000;
f. ascospores x 1000.

Fig 21 Thielavia terricola

a. cleistothecium x 400;
b. ascospores x 500;

Fig 22 Chaetomium globosum

a. perithecum x 1000;
b. ascus much enlarged;
c. ascospores much enlarged.

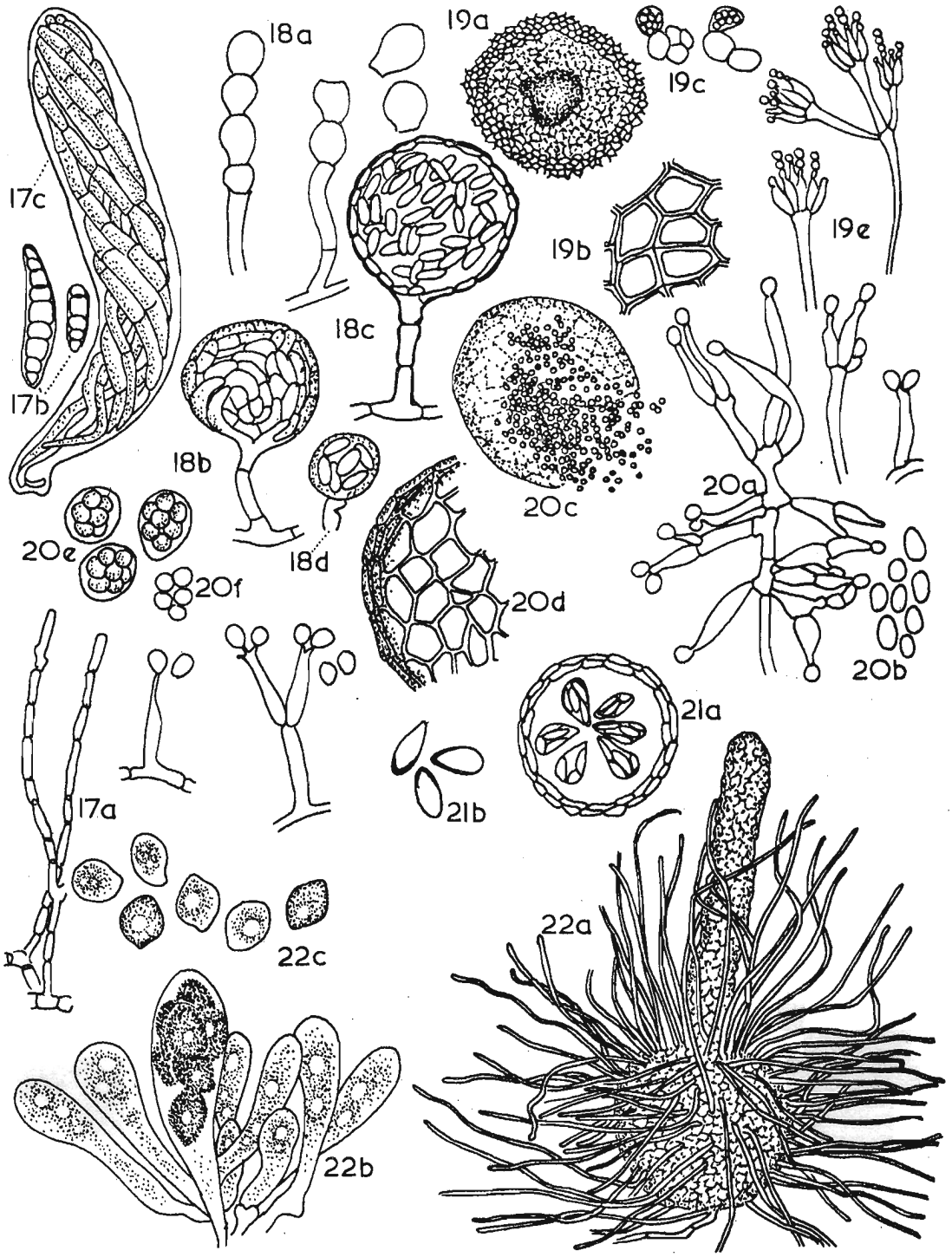

Plate IV Figs. 17 - 22

15. Cochliobolus Drechsler (Plate IV, Fig. 17)

Ascostroma usually solitary but may also be in groups, seated on a basal stroma; ascostroma perithecioid, erect with apical round ostiole, black, beak not compressed, setae absent; asci cylindrical among persistent pseudoparaphyses which arise near the upper end of the cavity and grow downwards; ascospores hyaline, filiform with numerous but often inconspicuous septa, without germ slit or pore, of uniform diameter more or less spirally coiled within the ascus. Conidial stages as in the form-genus Helminthosporium and Curvularia. Conidiophores short, septate, simple or sparingly branched bearing conidia successively on new growing tips; geniculate at points below the conidia; conidia dark, typically containing more than three cells, cylindrical or ellipsoid, sometimes slightly curved or bent, ends rounded. Parasitic on grasses and cereals.

A single species recorded in Sri Lanka.

C. lunatus
Lunuwila (8)

PLECTOMYCETES

In this group are included ascomycetes with ascocarps which are rudimentary, or consisting of a loose investment of hyphae, or globose cleistothecia. Paraphyses are absent and asci are irregularly distributed, produced from fertile hyphae ramifying throughout the centrum. The asci are globose or broadly club shaped and typically 8 - spored and thin walled. They are envanescent i.e. release the ascospores by deliquescing and setting them free in the ascocarp. Ascospores are unicellular without germ pores or germ slits. Asexual reproduction by conidia. Many plectomycetes have conspicuous and characterestic imperfect states, which are encountered in nature more frequently than the perfect states.

A single order treated.

ORDER - EUROTIALES

Members of the order occur in soil and on a variety of plant and animal debris. They are primarily saprophytic but may be parasitic on plants and are the causative agents of dermatomycoses of animals. Majority are among the most common and widespread of all fungi. Characters of the ascocarp and the asexual states are like those described for the class plectomycetes.

KEY TO THE FAMILIES OF THE ORDER EUROTIALES

Imperfect state arthrospores	MONASCACEAE	P -- 35
Imperfect state not as above	2	
Cleistothecia light or bright coloured; imperfect state catenate phialospores	EUROTIACEAE	P -- 36
Cleistothecia dark brown to black; imperfect state phialospores in gloeoid masses or sympodulospores	PSEUDOEUROTIACEAE	P 37

FAMILY - MONASCACEAE

Peridium of cliestothecium composed of flattened cells. Imperfect state spores arthrospores.

A single genus treated.

16. Monascus Van Tieghem (Plate IV, Fig. 18)

Mycelium red, pink or purple in mass; arthrospores in short chains. The mature cleistothecium consist of one or two layers of cortical layers around a cavity, enclosing

numerous ellipsoid or globose ascospores, the interior cleistothecial tissues and the walls of the eight - spored asci having dissolved rather early. Conidial state is under the genus Basipetos.

A single unidentified species recorded in the montane grasslands of Sri Lanka (11)

FAMILY - EUROTIACEAE

Many of the members are known, or known only in their asexual states comprising the form genera Aspergillus and Penicillium which are ubiquitous. Imperfect states are catenate conidia on phialides. Ascocarps vary from the soft poorly delimited and often confluent ascocarps to the sclerotoid fructifications, but in most genera, a more or less firm peridium is present. The peridium may be prosenchymatous or pseudo-parenchymatous.

KEY TO THE GENERA OF THE FAMILY EUROTIACEAE

Cleistothecium sclerotioid	Eupenicillium	17
Cleistothecium soft membranous	Allescheria	18

17. Eupenicillium Ludwig (Plate IV, Fig.19)

= Carpenteles (5)

Imperfect state Penicillium. Cleistothecia sclerotioid, yellow or light brown, maturing slowly from the centre outward. The thick peridium is usually with outer layers of heavy - walled cells and inner layers of thinner - walled cells. Asci single on short branches of ascogenous hyphae or in short chains. Ascospores hyaline or pale yellow, one - celled. 4 species recorded in Sri Lanka.

(i) E. shearii Stock and Scott

Agalawatta, Homagama, Parambe, Matale, Ratnapura (12)

(ii) E. sp_1
Agalawatta, Boralu, Ratnapura (12)

(iii) E. sp_2
Agalawatta, Deniya Parambe, Ratnapura (12)

(iv) E. sp_3
Kottawa forest (3)

18. Allescheria Sacc. & Syd.

Cleistothecia, soft membranous, and globose, Asci globose. Ascospores ovate, acute on both sides. Conidia catenulate on acrogenous conidiophores. On account of the lateral branching conidiophores may appear compressed.

A single species recorded in Sri Lanka.
A. boydii Shear
Agalawatta, Boralu, Deniya Homagama
Matale, Parambe, Ratnapura (12)

FAMILY = PSEUDOEUROTIACEAE

Cleistothecia brown to black with thin or thick parenchymatous peridia. Ascospores are hyaline or dark. A single genus treated.

19. Pseudoeurotium van Beyma (Plate IV, Fig. 20)

Cleistothecia dark brown to black; peridium one-cell-layer thick. Ascospores hyaline at first, then brown, globose or elliptical, smooth. Imperfect state spores sympodulospores. Imperfect state : Sporothrix (6)

Two species recorded in Sri Lanka.

(i) P. ovale Stolk
Agalawatta, Homagama, Ratnapura (12)

(ii) P. sp.
Boralu, Deniya Parambe, Ratnapura (12)

CLASS PYRENOMYCETES

The pyrenomycetes are defined here, as ascomycetes with the ascocarp entirely surrounded by perithecial wall, containing unitunicate asci which primarily are arranged in a hymenial layer. In many, the perithecia are provided either apically, or rarely laterally with an opening (ostiole) which is covered inside by hyphae-like paraphyses. Exceptionally it may be completely closed (astomatous) but ascus wall is persistent. Asci spherical, club shaped or cylindrical. Spores of various shapes, one - celled to many - celled, hyaline brightly coloured or black at times with gelatinous sheath or appendages. Paraphyses may or may not be present. Many ar saprobic on stumps, deak twigs and branches, leaves and stems of herbaceous plants. Few are coprophilous. A large number cause serious diseases of plants. Pyrenomycetes include a number of different evolutionary lines which are presently placed in several orders. The present classification of pyrenomycetes is based on Ainsworth (1973).

A single order treated.

ORDER - SPHAERIALES

Perithecia spherical, hemispherical or flask-shaped (botuliform); mostly ostiolate and rarely astomatous (no opening), having a bright fleshy or dark membranous or carbonous wall. Ostiole provided with ostiolar hairs (periphyses). Perithecia solitary, or aggregated and connected by stromatic structures or found on a subiculum (compact cottony mycelium). Asci spherical, clavate, fusiform or cylindrical. Ascospores one-celled, or septate, hyaline or coloured. Many species include conidial and/or spermatial states in their life cycle. These belong mainly to the form-order moniliales, less frequently to Sphaeropsidales and Melanconiales. Conidia are mostly blastoconidia blown out of conidiogenous cells.

KEY TO THE FAMILIES OF THE ORDER SPHAERIALES

1.	Asci evanescent, ascospores becoming free in the cavity and often discharged in a slimy mass	MELANOSPORACEAE	- P 39
	Asci with a persistent membrane, ascospores mostly not liberated in a slimy mass, but ejaculated	2	
2.	Ascospores with germ spores or germ slits	SORDARIACEAE	- P 43
	Ascospores without germ pores or germ slits	HYPOCREACEAE	- P 45

FAMILY - MELANOSPORACEAE

A small group with simple perithecia often with long projecting necks but sometimes entirely lacking. Asci are club-shaped, thin walled, and break down within the perithecium so that the ascospores ooze out in long tendrils and are not violently discharged. Ascospores unicellular and black in colour.

KEY TO THE GENERA OF THE FAMILY MELANOSPORACEAE

1.	Ascospores with prominent germspores at either ends	Thielavia 20
	Ascospores without prominent germspores	2
2.	Perithecium provided with long hairs or bristles	Chaetomium 21
	Perithecium without such hairs	3
3.	Asci cylindrical	Achaetomium 22
	Asci not cylindrical	Petriellidium 23

20. Thielavia Zopf. (Plate IV, Fig. 21)

Perithecia non-ostiolate, globose, walls brown and pseudoparenchymatic, and without appendages. Asci oval, eight spored. Ascospores brown, one-celled, and irregularly arranged in the ascus.

3 species recorded in Sri Lanka.

(i) T. terricola (Gil & Abb.) Emm.

= Coniothyrium terricola Gil. Abb.
Agalawatta, Boralu, Deniya Homagama, Parambe, Ratnapura (12)

Also recorded from China, U.S.A. (6)

(ii) T. sp.
Agalawatta, Homagama, Ratnapura (12)

(iii) T. sp.
Montane grasslands (11)

21. Chaetomium Kunze & Schmidt (Plate IV, Fig. 22)

The species are very numerous on damp straw, paste board etc. as well as on manure. Some species are destructive to cloth and other vegetable fabrics. Perithecia superficial, barrel shaped and ostiolate. Ostiolar hairs present which may be stiff and straight, or waxy or loosely or tightly coiled depending on the species. When the perithecia are ripe a column like mass of dark, lemon-shaped ascospores arise from the apex. Asci clavate.

Over 80 species, widespread.

2 species recorded in Sri Lanka.

(i) C. globosum Kunze ex Fr.
Agalawatta, Boralu, Deniya Homagama, Matale, Parambe, Ratnapura (12)

Also reported from Canada, Canalzone, Egypt, India, USA (6)

Plate V Figs 23 - 26

Fig 23 Sordaria fimicola

a. a perithecium in optical section x 400;
b. L.s. perithecium x 600;
c. Ascus x 1000;
d. ascospore showing mucilagenous coat much enlarged.

Fig 24 Neurospora spp.

a. macroconidia x 400;
b. enlarged view showing the origin of macroconidia;
c. microconidia in clusters x 400;
d. ascus with ascospores much enlarged;
e. ascospores showing ribbed surface much enlarged.

Fig 25 Nectria

a. Phialides bearing macroconidia x 400;
b. macroconidia of the Fusarium type x 400;
c. phialides bearing microconidia x 400;
d. micro conidia x 400;
e. perithecium enlarged;
f. ascus enlarged;
g. ascospores enlarged

Fig 26 Schizophyllum commune

a. mycelium showing clamp connections x 600;
b. basidiocarp x 10

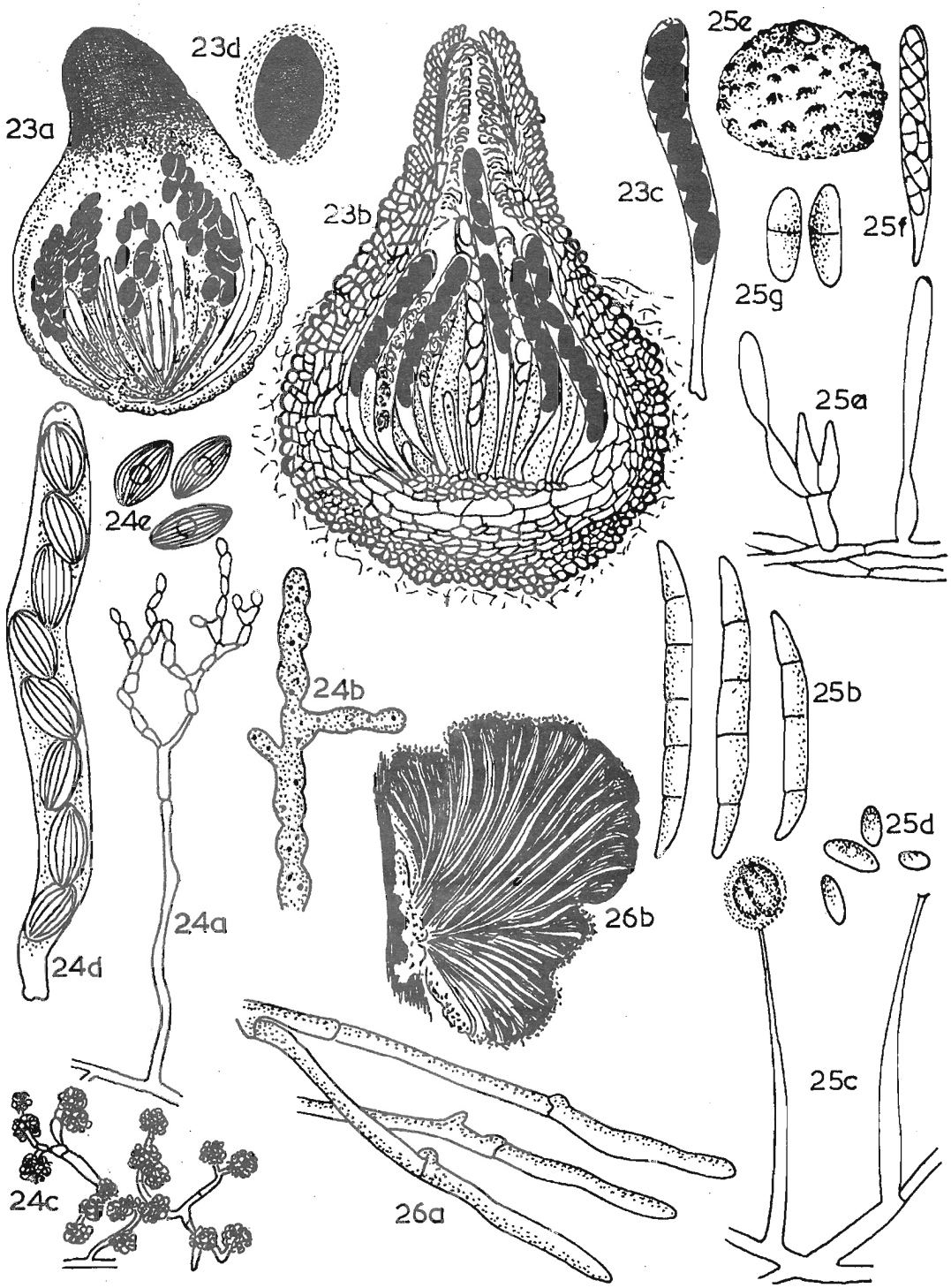

Plate V Figs. 23 - 26

(ii) C. sp.

Agalawatta, Boralu, Deniya Homagama, Matale, Parambe, Ratnapura (12)

22. Achaetomium Raj, Tewari, & Mukerji

Perithecia superficial, ostiolate, dark, smooth or setose and not hairy. Asci cylindrical. Ascospores roundish with a prominent germ pore.

A single unidentified species recorded in the rubber growing soils of Sri Lanka (12)

23. Petriellidium Malloch

Perithecium not ostiolate, thin walled, smooth and setose and not hairy. Ascospores without a prominent basal germ pore.

A single species recorded in Sri Lanka.

P. boydii (Shear) Malloch

Agalawatta, Homagama, Matale, Parambe (12)

FAMILY - SORDARIACEAE

Members are saporphytic on dung or on decaying plant-parts. ithecia are separate, beaked, dark brown or black, membranous or carbonous and either glabrous or covered with soft hairs. Asci long, club-shaped or cylindrical, thin walled, and the apical apparatus is in the form of a thickened annulus or apical plate which does not stain blue with iodine. Asci may be interspersed with paraphyses. However in many, paraphyses are evanescent before the spores are mature. Ascospores unicellular, dark brown to black, and sometimes surrounded by a mucilagenous epispore or have mucilaginous appendages. Most species do not produce conidia.

KEY TO THE GENERA OF THE FAMILY SORDARIACEAE

Ascospores with a gelatinous sheath and with one germ-pore — Sordaria 24

Ascospores without a gelatinous sheath and with more than one germ-pore — Neurospora 25

24. Sordaria Ces. de Not. (Plate V, Fig. 23)

Common on dung of herbivorous animals and occasionally on other substrates. The genus is heterogenous, including species with pale coloured perithecia often with darker necks, through the walls of which the ascospores can be seen, and also species with dark opaque perithecia. Spores are always dark coloured and either surrounded by mucous sheath or have definite appendages at one or both ends. Several species on dung or in soil.

3 species recorded in Sri Lanka.

(i) S. clerogenia Fields & Grear
Nuwara Eliya (16)

(ii) S. fimicola (Roberge) Ces. de Not.
Agalawatta, Boralu, Homagama, Matale (12)

Has a worldwide distribution (4)

(iii) S. sp.
Agalawatta, Deniya Homagama, Parambe, Ratnapura (12)

25. Neurospora Shear & Dodge (Plate V, Fig. 24)

Species colonise burnt ground and charred vegetation. Mycelium rapidly growing, white or pigmented, amount of pigment varying with the substratum. Produces multinucleate large conidia and uninucleate microconidia, from branched conidiophore, the cells of conidiophore differing little from the

older conidia. Chains of conidia can also arise by budding of terminal conidia and when the terminal conidia give rise to two buds the chain branches. Conidia of this type belong to the form-genus Monilia. Conidia form pink grey or tan masses, and if released into a lab can cause serious contamination of other cultures, Mature perithecia dark coloured, pyriform , beaked and contain asci without paraphyses. The spores are dark brown to black , with ridges on the outer wall which characterise the genus and give its name. Some species do not have a conidial state.

A single species recorded in Sri Lanka.

N. sitophila Shear & Dodge

Kottawa forest (3)

FAMILY - HYPOCREACEAE

A number of species are parasitic on green plants, fungi or insects and also a large number are saprophytic. The conidial states are typically phialospores. Perithecia ostiolate, white or bright coloured (yellow, red or violet), with relatively soft or waxy walls; single or seated on a stroma. Asci thin walled. Ascospores often two or more-celled and may break up within the ascus to form part-spores.

A single genus treated.

26. Nectria Fries (Plate V, Fig. 25)

= Lasionectria (Sacc.) Cooke (1)

The genus contains many species which are serious pathogens of trees. Some are saprophytes. Conidial states are classified in several form genera of fungi imperfecti, including Cephalosporium, Cylindrocarpon (P-), Fusarium (P-) and Verticillium (P-) (6). Perithecia distinct, clustered or scattered, sometimes produced on a fleshy stroma that

has previously borne conidia, clear coloured, usually red and orange. Asci cylindric or club-shaped, 8-spored. Ascospores hyaline, elongate, 2-celled.

A single species recorded in Sri Lanka.

N. hematocoocca. Berk. & Br.
(Conidial state Fusarium solani)
Kottawa, forest (3)

The imperfect state has a worldwide distribution (4)

SUB - DIVISION - BASIDIOMYCOTINA

Although some members exist mainly in the form of mycelia or as small fructifications on wood or litter, or under clods of soil, the majority form conspicuous fruitbodies (basidiocarps). Mycelium is septate and is extensive though usually inconspicuous and hyphae encrusted with crystals of calcium oxalate are common. Hyphal strands or rhizomorphs are often found. Clamp connections are present in the large proportion of species. Asexual reproduction by conidia or thallospores and are not prominent in most members. Characteristic feature is the basidium, bearing spores exogenously, usually on projections termed sterigmata. Number of spores per basidium is typically four. Basidia may be simple, septate or deeply divided. Basidiospore is typically unicellular, uninucleate, hyaline or pigmented and of various shapes.

A single class treated.

CLASS - HYMENOMYCETES

All produce their basidia on a more or less definite, orderly, hymenial layer, but the shpae and size of the basidiocarp vary greatly, as does the manner in which the hymenium is borne. All expose their hymenia before the spores are

mature. They bear their usually apiculate basidiospores perched obliquely on sterigmata and discharge them violently by the water drop method.

A single order treated.

ORDER - APHYLLOPHORALES

This order comprise a vast number of genera and species most of which are saprobes. Most have a tough context which renders them inedible, but a few are sufficiently fleshy to be eaten. Fruit body gymnocarpous, hymenium unilateral or amphigenous, smooth or covering dentate processes or lining cups or tubes, if tubular, the tubes may be discrete or coalesced but are firmly united with the tissue of the basidiocarp.

A single family treated.

FAMILY - SCHIZOPHYLLACEAE

Traditionally the members of this family have been classified in the agaricales but details of fruitbody development and the development of the gill are so peculiar that homology with the agar gill is out of the question.(Webster 1970)

Fruitbody cupulate in origin, attached by a narrow stalk like base, sometimes becoming discoid, sometimes with adjacent cups proliferating and uniting at the margins to form a pseudolamellate agaricoid fruitbody with radially split gills; spores hyaline non amyloid.

A single genus treated.

27. Schizophyllum Fr. (Plate V, Fig. 26)

Fruitbody fan shaped, coriaceous, resupinate, with a furry upper surface, stem lateral or none, gills coriaceous,

fan-wise branched united above the tomentose pellicle, bifid, split longitudinally at the edge, the two lips of the split edge of the gills, commonly revolute; spores white. Active destroyers of wood. Grows saprophytically or parasitically on woody substrata.

A single species recorded in Sri Lanka.

S. commune Frier
Parambe (12)

SUB - DIVISION - DUETEROMYCOTINA

This is an assemblage of fungi where many reproduce by spores which are formed without nuclear fusion and meiosis.ie. no sexual reproduction. Not all are found in the sporing condition. Some species of great economic importance occur regularly as sterile mycelia on natural substrate and remain sterile when isolated in culture. This sub-division is not a part of the main taxonomic classification of the fungi. It is a part of an additional special purpose classification in which the imperfect states (sterile states and conidial states) of Ascomycotina, Basidiomycotina and sometimes certain Zygomycotina are grouped together. It also includes states whose perfect state is unknown or lacking. The imperfect states are grouped into form genera and form species for convenience in identification and nomenclature. The form species included in a form-genus are related to each other by the form of their conidia and conidiogenous apparatus but not necessarily by phylogeny. The form-genera in this group are not taxa of the same kind as the genera in the main taxonomic classification. In practice however the prefix 'form' is understood but usually omitted.

The form-genera are grouped into form-families, form-orders and form-classes.

The classification presented here is that of Saccardo with slight modifications (Ainsworth 1973).

Plate VI Figs 27 - 30

Fig 27 Rhizoctonia solani

a. sclerotium and mycelium in a tube culture x 5;
b. section of loose sclerotium x 1000;
c. cells of mycelium x 400

Fig 28 Botryodiplodia theobromae

a. confluent pycnidia x 400;
b. section through pycnidia x 400;
c. conidiophores x 1000;
d. conidia x 1000;

Fig 29 Coniothyrium spp.

a. pycnidia entire x 400;
b. conidiophores x 1000;
c. conidia x 1000;

Fig 30 Phoma sp.

a. pycnidium side view x 400;
b. pycnidium top view x 400;
c. L.S. pycnidium x 1000;
d. chlamydospore chains x 400;
e. conidia x 1000.

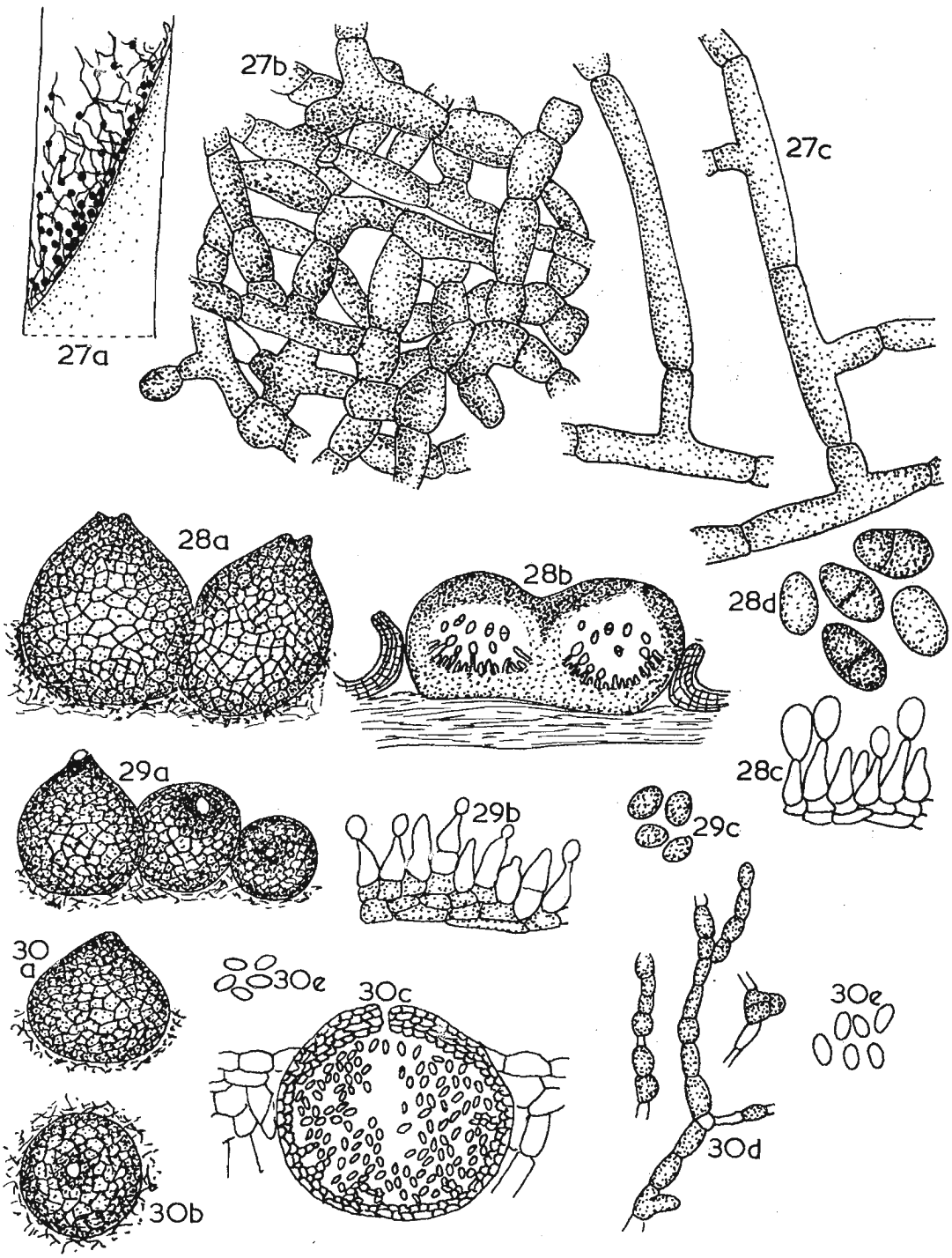

Plate VI Figs. 27 - 30

KEY TO THE CLASSES OF THE SUB-DIVISION DEUTEROMYCOTINA

1.	Reproduction by thallospores or conidiospores		2
	No reproductive structures known	AGONOMYCETES or MYCELIA STERILIA	P- 51
2.	Thallospores or conidiospores borne in a pycnidium or acervulus	COELOMYCETES	P- 52
	Thallospores or conidiospores not borne in any form of pycnidium or acervulus	HYPHOMYCETES	P-58

CLASS - AGONOMYCETES

This includes those fungi whose mycelium is sterile. Many form hyphal aggregates known as sclerotia. Some of the sclerotial forms (eg. Rhizoctonia) are known to be Basidiomycetous forms whereas others (eg. Sclerotium) contain species proved to be imperfect stages of Ascomycotina. A single form order treated.

ORDER - AGONOMYCETALES

Characters are those of the form-class. A single form-genus treated.

28. Rhizoctonia de Candolle (Plate VI, Fig. 27)

Many species are notable pathogens with a wide host range, but also able to exist saprobically, Mycelium brown, sclerotia without definite form, often growing together, horny, fleshy, with thinner undifferentiated edges, frequently embedded in the mycelium and bound together by mycelial strands. Hyphae rather wide, with wide angled branching and with the lateral branches

narrowed and septate near their junctions with main axis. Perfect states of some of these species have been obtained and have been found to be distributed over a wide range of Basidiomycotina. Some form mycorrhizas with the underground organs of orchids.

Basidio state = Thanatephorus or Ceratobasidium

Syn: = Allosphaerium Link (7)

= Bryochisium (7)

= Thanatophytum (7)

3 species recorded in Sri Lanka.

(i) R. solani Kuhn

Agalawatta, Boralu, Deniya Parambe, Ratnapura (12)

Also has a worldwide distribution (4)

(ii) R. sp.

Agalawatta, Boralu, Parambe, Ratnapura (12)

(iii) R. Sp.

Boralu, Deniya Homagama, Ratnapura (12)

CLASS - COELOMYCETES

This includes those fungi which bear the spores in fructifications called acervuli or in pycnidia. An acervulus is a compound sporophore composed of a basal stromatic layer and short erect conidiophores arranged in a palisade, the whole forming a flat bed covered at first by host tissues and later becoming exposed by their rupture, A pycnidium is a globose or a flask shaped structure with a pseudoparenchymatous peridium, lined on the inside by tissue giving rise to simple or branched conidiophores. Pycnidia may be closed, rupturing at maturity irregularly or they may be ostiolate. In general the type of

fructification is more constant in nature than in culture. But cultures often have to be used for the isolation of fungi which lack characteristic natural fruit bodies and in this case may be difficult to match the fruit bodies formed in culture with those of the ones formed in nature.

Genera are world wide in distribution. Although they are most commonly reported from living or dead plant material and from soil, they are known from a wide variety of substrates.

KEY TO THE ORDERS OF THE CLASS COELOMYCETES

Conidia in pycinidium	___	SPHAEROPSIDALES	P- 53
Conidia in acervulus	___	MELANCONIALES	P- 57

ORDER = SPHAEROPSIDALES

The order consists of parasites or saprobes of plant material, pycnidia are superficial, semi-immersed or immersed, globose, discoid or hemispherical, eustromatic or pseudo stromatic, unilocular, multi locular or convoluted, forming conidia from the locular walls: dehiscing by a circular or longitudinal ostiole or by disintegration of the upper walls. The conidia usually have a somewhat mucilaginous coating and tend to adhere to one another and to be extruded in long sticky tendrils from the ostiole.

A single family treated.

FAMILY - SPHAEROPSIDACEAE

Pycnidia dark, leathery, or membranous, never fleshy or brightly coloured; globose, club shaped or lens shaped remaining closed or opening by an ostiole; superficial or immersed with or without stroma. Conidiophores of various types, often very short, usually simple. Conidia of various shapes, hyaline or coloured, 1-many celled.

KEY TO THE GENERA OF THE FAMILY SPHAEROPSIDACEAE

1.	Pycnidia separate	2
	Pycnidia aggregated	Botryodiplodia 29
2.	Conidia hyaline, often curved	3
	Conidia dark; often not curved	Coniothyrium 30
3.	Conidia less than 15 μ in length	Phoma 31
	Conidia more than 15 μ in length	Macrophomina 32

29. Botryodiplodia Sacc. (Plate VI, Fig. 28)

Pycnidia caespitose or botryose, confluent, embedded in a stroma, ostiolate, erumpent, membranous, carbonous, globose, often papillate. Conidia dark, 2-celled at maturity, ovoid to elongate. This genus may be confused with Macrophoma or Dothiorella if only immature conidia are present.

A single species recorded in Sri Lanka.

B. theobromae Paton.

Agalawatta, Homagama, Matale, Parambe, Ratnapura (12)

30. Coniothyrium Corda (Plate VI, Fig. 29)

Pycnidia immersed, globose or flattened below with papillate mouth, black or dark brown membranous to almost carbonous. Conidia globose or ellipsoid, small, brown, thick walled to verrucate 1-celled or 2-celled conidiophores short, simple or almost lacking.

2 species recorded in Sri Lanka

(i) C. fuckelii Sacc.

Agalawatta, Boralu, Matale, Parambe, Ratnapura (12)

Has a world-wide distribution (4)

(ii) C. sp

Agalawatta, Matale, Parambe, Ratnapura (12)

Plate VII Figs 31 - 35

Fig. 31 Macrophomina spp.

a. cells from mycelium x 400;
b. pycnidium entire x 400;
c. conidia x 1000;

Fig 32 Pestalotia spp.

a. conidia x 500 (note central dark cells and appendages)

Fig 33 Myrothecium verrucria

a. habit of sporodochium x 100;
b. conidiophore with conidia x 400;
c. conidia x 400;

Fig 34 Fusarium spp.

a. loose sporodochium formed by branched conidiophores x 400;
b. hyphae with simple conidiophores x 400;
c. variable conidiophores x 400;
d. macroconidia x 400;
e. chlamydospores in mycelium x 600;
f. chlamydospores in macroconidia x 600;
g. microconidia x 600;

Fig 35 Cylindrocarpon tenue

a. conidiophores of various types x 400;
b. conidia x 400;

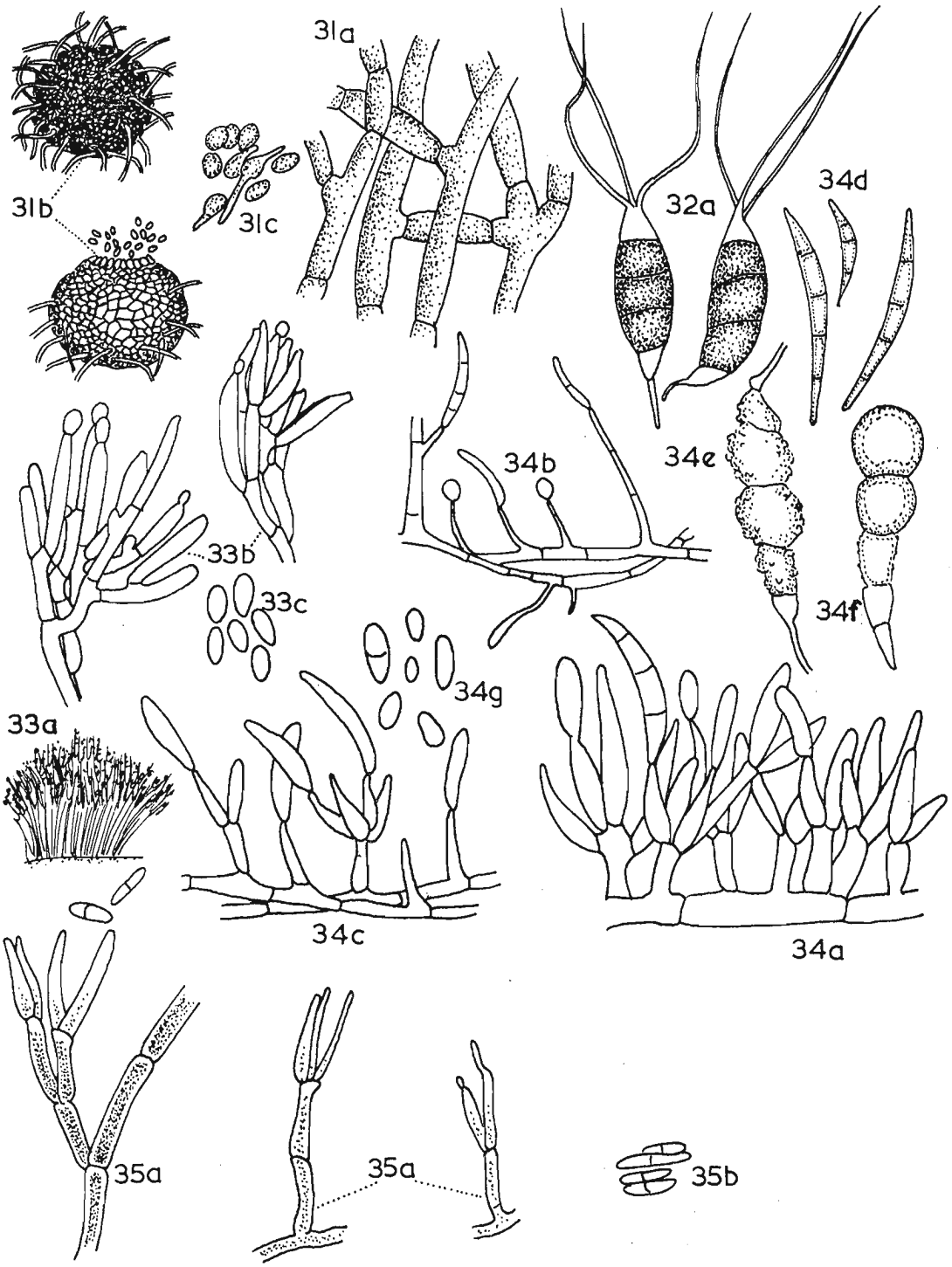

Plate VII Figs. 31 - 35.

31. Phoma Sacc. (Plate VI, Fig. 30)

= Aposphaeria Berk (1)

Pycnidia more or less flask shaped, immersed, sometimes irregular with short necks, dark brown, fairly thin walled and easily crushed; ostiolate, immersed in host tissue, erumpent with a short beak piercing the epidermis; conidiophores short or obsolete; conidia small, 1-celled, hyaline ovate to elongate.

2 unidentified species recorded in Sri Lanka.

(i) P. sp.[1]

Deniya - Parambe, Ratnapura (12)

(ii) P. sp.[2]

Patana grasslands (11)

32. Macrophomina Petrak (Plate VII, Fig. 31)

Pycnidia and sclerotia are commonly mixed, pycnidia nonstromatic; structure of conidiophore and conidia resemble those of Macrophoma. Fungus is highly variable and non-pycnidial forms are common.

A single species recorded in Sri Lanka.

M. phaseolina (Maubl.) Ashby

= Rhizoctonia bataticola Taubenh & But

Gannoruwa (14)

Also recorded in India (6)

ORDER - MELANCONIALES

Parasites or saprobes of plant material. Acervuli superficial or sub-epidermal or subcuticular dark or light coloured, waxy, horny or even submembranous. Stromatic tissue restricted to the base of fructification. Conidia are formed on the upper

surface; and when mature, pycnidia are erumpent. Conidia released in characteristic droplets which may be white, cream pink, orange black or other colour, depending on the pigmentation of the conidia.

A single family treated.

FAMILY MELANCONIACEAE

Characters are those of the order

A single genus treated.

33. Pestalotia de Not. (plate VII, fig. 32)

Acervuli dark, discoid or cushion shaped; subcuticular; conidiophores short, erect, simple. Conidia dark, several celled, with hyaline (or nearly so) pointed end cells, median cells dark coloured, lower end of the spore bearing a hairlike pedicel and upper end furnished with a crest of 2-5 long colourless hairs. (Appendages show up well in water but not easily in lactophenol mounts). Some species are weak parasites of plants, whilst several have been found as causes of damage to materials made of cellulose.

2 unidentified species recorded in Sri Lanka.

(i) P. sp.
Montane grasslands (11)

(ii) P. sp.
Boralu, Homagama, Matale, Parambe, Ratnapura (2)

CLASS HYPHOMYCETES

This constitute the largest form-class of the Deuteromycotina including over 10,000 form-species. This form-class includes many of the fungal pathogens of man, a number of serious plant pathogens, pathogens of insects and arthropods, many of the industrially important fungi, common contaminants of microbiological laboratories and many soilfungi which are saprophytic playing a significant part in the soil economy. Conidiophores may be simple or branched; in form

they may or may not be greatly different from somatic hyphae. The conidiophores may be annellophores (page 92) sympodulae (page 101) or phialides (page 99). The spores can be thallospores or conidia. The conidiophores may be discrete and simple arising from the mycelium or sometimes grouped into compound sporophores called synnema (page 93) or a sporodochium (page 100) Conidia of various shapes, hyaline or pigmented, 1-many celled.

A single form-order treated

ORDER - MONILIALES

Characters are those of the form-class Hyphomycetes.

KEY TO THE FAMILIES OF THE ORDER MONILIALES

1.	Conidiophores discrete	2	
	Conidiophores in sporodochia	TUBERCULARIA-CEAE	P 59
2.	Mycelium and conidia hyaline or light coloured	MONILIACEAE	P 62
	Mycelium and/or conidia dark coloured	DERMATIACEAE	P 86

FAMILY TUBERCULARIACEAE

Characteristic feature is the sporodochium which is a cushion shaped fruitbody, composed of a stromatic base giving rise to closely grouped erect conidiophores. On natural substrata the conidiophores usually erupt through bark or epidermis so that the stromatic part of the fruitbody is immersed while the fertile part is exposed. The sporodochium may be waxy or gelatinous sometimes horny or cottony. Frequently the hyphae and conidia become embedded in mucus.

KEY TO THE GENERA OF THE FAMILY TUBERCULARIACEAE

1.	Conidia and hyphae hyaline or brightly coloured	2	
	Conidia and hyphae dark in colour	Myrothecium	34
2.	Conidia sickle shaped	Fusarium	35
	Conidia not sickle shaped	Cylindrocarpon	36

34. Myrothecium Tode ex Fr. (Plate VII, fig. 33)

Conidial layer shield or cushion-shaped, black, surrounded at the edge by fine hyaline hairs. Conidiophores short rod-shaped. Conidia very small, ovate or cylindrical, dark.

A single species recorded in Sri Lanka.

M. verrucaria (Alb. & Schw.) Ditmer ex fr.

Agalawatte, Boralu, Parambe (12)
Has a worldwide distribution (4,6)

35. Fusarium Link. ex. Fr. (Plate VII, Fig. 34)

Mycelium cottony in culture, often with some tinge of pink, purple or yellow in the mycelium or medium. Some produce conidia in sporodochia, others in smooth gelatinous layers, and still others in scattered clusters on all parts of the mycelium. Conidiophores variable, slender and simple, or more stout, branched irregularly or bearing a whorl of phialides. The one feature common to the different types of culture is the conidia. Macroconidia, many celled with indistinct or distinct cross walls, canoe or sickle shaped with pointed ends, colourless or pale coloured, never dark, and are quite unlike that of any other fungi. In addition, many species have microconidia, which are small, ovate, elongate, pyriform or comma shaped, usually non-septate, more rarely 1-3 septate. A number of species form chlamydospores both on the mycelium and on the macroconidia. Sclerotia are common and brightly coloured. The perfect stages of a considerable number of species of Fusarium are now known. They are all Ascomycetes and belong to the genera Hypomyces Gibberella, Nectria and Calonectria

Syn :	=	Sporotrichella Kars.	(7)
	=	Discofusarium Petch.	(7)
	=	Fusidomus Grova	(7)
	=	Lachnidium Giard	(7)
	=	Picnnotes Fries	(7)
	=	Pseudomicrocera Petch	(7)
	=	Rachisia Lind.	(7)
	=	Selenosporium Corda	(7)

7 species recorded in Sri Lanka

(i) F. equiseti Syn : Gibberella intricans

Gannoruwa (14)
Cosmopolitan (4,6)

(ii) F. lateritium Nees

Agalawatta, Deniya, Homagama, Matale, Parambe, Ratnapura (12)

(iii) F. semitectum

Montane grassland (11)

(iv) F. oxysporum Schl.

Agalawatta, Boralu, Matale, Parambe (12)
Also widely distributed (4,6)

(v) F. solani (Mart.) Sacc.

Agalawatte, Boralu, Deniya, Homagama, Ratnapura (12)
Also widely distributed (4,6)

(vi) F. vasinfectum Atkinson

Agalawatta, Boralu, Deniya, Matale, Homagama, Ratnapura (12)
Also reported from Canada, India (6)

(vii) F. sp.

Agalawatta, Deniya, Homagama, Matale, Parambe, Ratnapura (12)

36. Cylindrocarpon Wollenweber (Plate VII, fig. 35)

Mycelium white, cream, yellow, pink or rose, Conidia usually formed at the apex of the conidiophore or on short phialides. Conidia are like those of Fusarium but are more nearly cylindrical and have rounded ends. Conidiophore simple or branched. Sporodochia tuberculate, globose, smooth or rough, radially erumpent, hyaline or coloured.

Asco state : Nectria

Syn :
= Euricoa Batista et Maia (7)
= Hyaflorea Batista et Maia (7)
= Moeszia Bubak (7)
= Coleosporium Moreon et Morea (7)
= Allantospora Wakker (7)

A single species recorded in Sri Lanka.

C. tenue Buginicourt
Kottawa forest (3)

FAMILY - MONILIACEAE

This is the largest of all in the Monilales. It includes all imperfect fungi which produce conidia on unorganized hyaline conidiphores, or directly on hyaline hyphae. Most species are sapro - phytic, but many are well known pathogens on plants and animals including man. Conidia are of different shapes always hyaline or bright colored.

KEY TO THE GENERA OF THE FAMILY MONILIACEAE

1.	Conidiophore short or obsolete or little differentiated from vegetative hyphae	Geotrichum	37
	Conidiophores long and distinct from the vegetative hyphae	2	
2.	Branching of conidiophores confined to the tip;	3	
	Branching of conidiophores not confined to the tip	7	
3.	Conidia in chains	4	
	Conidia not in chains	Trichoderma	38
4.	Conidiophore distinctly swollen at the tip; foot cells prominent	Aspergillus	39
	Conidiophore not swollen at the tip or only slightly; foot cells not differentiated	5	

Plate VIII Figs 36 - 38

Fig 36 *Geotrichum spp.*

a. mycelium showing arthrospore formation x 600;

Fig 37 *Trichoderma viride*

a. conidiophores and clusters of conidia x 100;
b. group of phialides x 1000;
c. conidia x 1000;

Fig 38 *Trichoderma hamatum*

a. conidiophores with conidia x 1000;
b. conidia

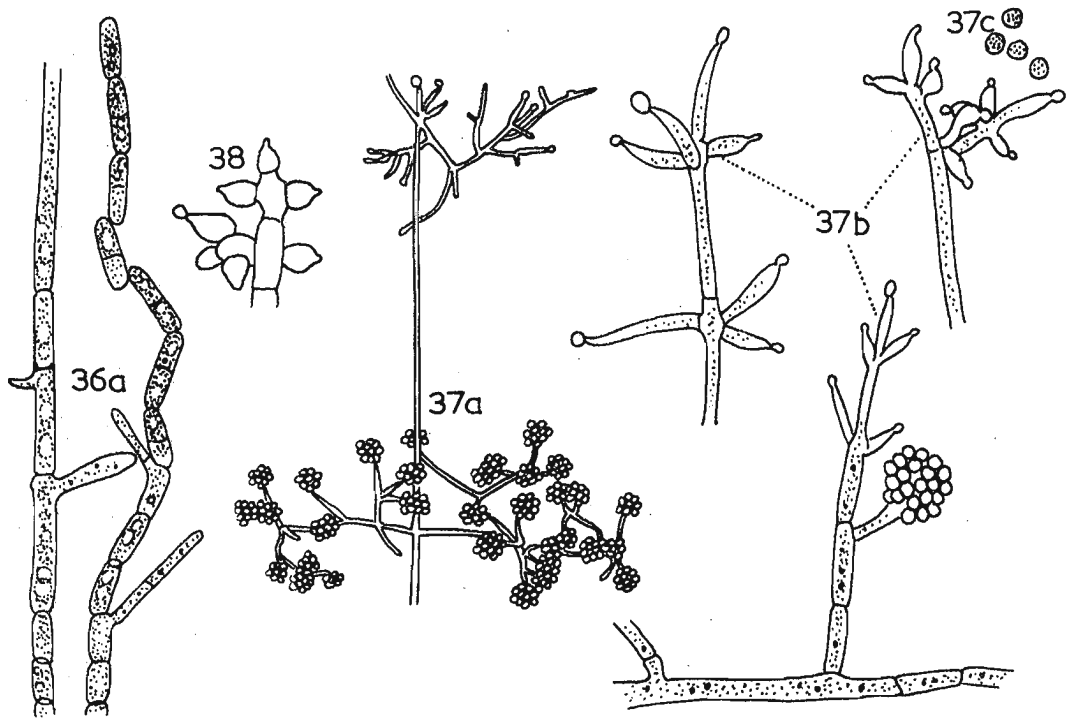

Plate VIII Figs. 36 - 38

5.	Conidia enclosed in mucus	Gliocladium	39
	Conidia not enclosed in mucus	6	
6.	Phialides with a swollen base and a tapering apex, the apex bent away from the main axis	Paecilomyces	41
	Phialides not as above	Penicillium	42
7.	Branching of conidiophores principally in whorls	Verticillium	43
	Branching of conidiophores various, not in whorls	8	
8.	Conidiophores erect	9	
	Conidiophores decumbent	12	
9.	Conidia borne singly	10	
	Condia borne in chains or in head	11	
10.	Conidia terminal on the branchlets	Monosporium	44
	Conidia both terminal and lateral on branchlets	Tritirachium	45
11.	Conidia in chains	Metarhizium	46
	Conidia in heads	Botrytis	47
12.	Lateral branches erect with a single terminal conidium	Acremonium	48
	Lateral branches prostrate with terminal and lateral conidia	Sporotrichum	49

37. Geotrichum Link ex Pers. (Plate VIII, fig. 36)

Mycelium white, septate, prostrate forming a turf. Conidiophores short, erect, ascending, septate, producing spores formed by segmentation of hyphae, in chains at their apices. Spores short, cylindrical, truncate at both ends or slightly rounded, hyaline or pale.

Ascostate : Endomyces (7)

Syn. = Cosporoidea Sumstine (7)
= Coprotrichum Bon. (7)
= Polymorphomoces Coupin (7)

A single species recorded in Sri Lanka

G. candidum Link

- Kottawa forest (3)
- Also reported from Canada, USA, Europe (6)

38. Trichoderma (Pers.) Fr. (Plate VIII, Figs. 37 - 38)

Mycelium hyaline, creeping, septate, forming a flat turf. Conidiophores erect arising form short, branched side branches, branching usually opposite. Conidia 1-celled ovoid, borne in small terminal clusters; usually easily recognised by its rapid growth and green patches or cushions.

Ascostate : Hypocrea (7)

Syn :
- = Aleurisma Link (7)
- = Pyreniopsis Kunt. (7)
- = Pachybasium Sacc. (7)
- = Soporderma Mont. (7)
- = Tolypomyria Preuss (7)
- = Tolypocladium Gams (7)

7 species recorded in Sri Lanka.

(i) T. aureovirideae Rifen
Agalawatta, Boralu, Deniya, Homagama, Parambe, Ratnapura (12)

(ii) T. hamatum (Bon.) Bain. aggr.
Gannoruwa (14)
Kottawa forest (3)
Has world-wide distribution (4)

(iii) T. harzianum Rifai. aggr.
Agalawatta, Homagama, Parambe, Ratnapura (12)
Gannoruwa (14)
Kottawa forest (3)

Plate IX Figs 39 - 45

Fig 39 Aspergillus repens

a. conidiophore with a foot cell x 800;

Fig 40 Aspergillus niger

a. tip of conidiophore with a vesicle, primary and secondary sterigmata and conidia x 400;

Fig 41 Aspergllus aculeatus

a. tip of conidiophore with primary sterigmata x 400;

Fig 42 Aspergillus giganteus

a. tip of conidiophore covered with conidia x 100;

Fig 43 Aspergillus chevalieri

a. conidiophore with a basal cell and sterigmata x 400;
b. ruptured cleistothecium x 400;

Fig 44 Aspergillus amstelodani

a. tip of conidiophore with sterigmata x 400;
b. ruptured cleistothecium x 400;

Fig 45 Aspergillus cervinus

a. conidiophore with sterigmata and conidia x 400;

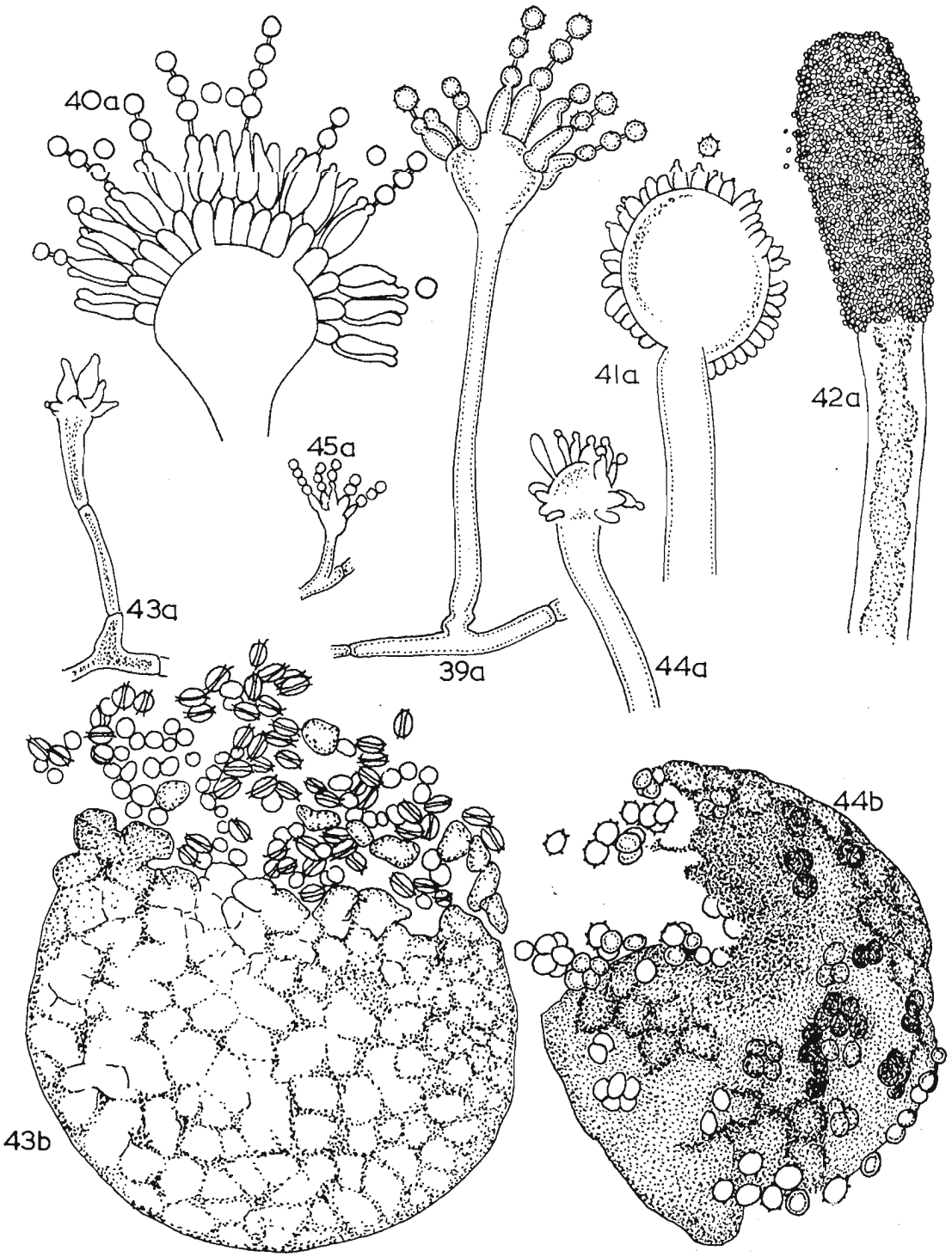

Plate IX Figs. 39 - 45

(iv) T. koningii Ond. Aggr.

Agalawatta, Boralu, Deniya, Homagama, Parambe, Ratnapura (12)
Gannoruwa (14)

(v) T. seudokoningi Bain. Aggr,

Gannoruwa (14)

(vi) T. viride Pers. ex Gray

Agalawatte, Boralu, Deniya, Homagama, Perambe, Ratnapura (12)
Montane grasslands (11)

(vii) T. sp.

Agalawatte, Boralu, Deniya, Homagama, Perambe, Ratnapura (12)

39. Aspergillus (Mich.) Fr. (Plate IX, Figs. 39-45)

A large genus containing many species saprophytic on a wide variety of substrata. Vegetative mycelium colorless. Conidial apparatus develop as stalks and heads from specialised enlarged, thick walled foot cells, producing conidiophores as branches approximately perpendicular to the long axis of the foot cells. Conidiophores upright, septate or non-septate, usually enlarging toward apex and broadening into elliptical hemispherical or globose fertile vesicles. Vesicles bear phialides either paralle and clustered in terminal groups or radiating from the entire surface. Phialides in one series or as a primary series each bearing a cluster of 2 to several secondary phialides at the apex. Conidia cut off basipetally from the top of the phialida, form unbranched chains arranged into radiate heads of packed into columner masses. Conidia vary greatly in colour, size, shape and markings, Sclerotia regularly found in some strains.

Asco State : Eurotium or Emericella (7)

Syn: = Aspergillopsis Speg. (7)
= Cladaspergillus Ritg (7)
= Euaspergillus Ludwig (7)
= Rhopalocystis Grove (7)
= Sterigmatocystis Cramer (7)
= Alliospora Pim (7)
= Cladosarum Yuill et Yuill (7)
= Gutturomyces Rivolta (7)
= Redaellia Ciferri (7)
= Sceptromyces Cords (7)
= Spermatoloncha Speg (7)
= Sphaeromyces Mont. (7)

16 Species recorded in Sri Lanka

(i) A. aculeatus Iizuka

Kottawa forest (3)
Agalawatta, Boralu, Homagama, Parambe, Ratnapura (12)

(ii) A. amstelodami Thom. & Church

Kottawa forest (3)

(iii) A. candidus Link. ex Fr.

Agalawatta, Boralu, Deniya, Homagama, Matale, Parambe, Ratnapura (12)
Also reported from Europe, India, USSR, USA (6)

(iv) A. cervinus Masses

Kottawa forest (3)

(v) A. cestus (Bain. & Sart.) Thom & Church

Agalawatta, Boralu, Homagama, Parambe, Ratnapura (12)

(vi) A. cevalieri (Margin) Thom & Church

Eurotium chevalieri
Kottawa, forest (3)
Also reported from Costa Rica, India (6)

(vii) A. clavatus Des.

Agalawatta, Deniya, Parambe, Ratnapura, (12)
Montane grasslands (11)
Also reported from USA (6)

(viii) A. flasherii Wehmer

Agalawatta, Deniya, Homagama, Matale, Parambe, Ratnapura (12)

(ix) A. flavipes (Bain. & Sart.) Thom & Church

Kottawa forest (3)
Agalawatta, Boralu, Deniya, Homagama, Matale, Parambe, Ratnapura (12)
Also reported from Canada, China, Egypt, Costa Rica, India, USA (6)

(x) A. flavus Link. ex Fr.

Kottawa forest (3)
Agalawatta, Boralu, Deniya, Homagama, Parambe, Ratnapura (12)
Also reported from Canada, China, Egypt, England, India, USA (6)

(xi) A. fumigatus Fresenius

Montane grasslands (11)
Also reported from Europe, China, Canada, USA (6)

(xii) A. giganteus wehmer

Kottawa forest (3)
Also reported from Panama (6)

(xiii) A. niger van Tieghem

Kottawa forest (3)
Agalawatta, Boralu, (2)
Has a worldwide distribution (6)
Homagama, Parambe, Ratnapura (12)
Montane Grasslands (11)

(xiv) A. quercinus (Bainier) Thom & Church

= A. mellans Yukawa

Kottawa forest (3)

Plate X Figs 46 - 48

Fig 46 Gliocladium spp.

a. conidiophore showing gloeoid mass of conidia x 100;
b. conidiophores x 400;
c. conidia x 600;
d. Gliocladium roseum conidiophore and young conidia x 400;

Fig 47 Paecilomyces lilacinus

a. conidiophores and conidia x 400;
b. same of P. marquandil x 400;
c. same of P. elegams x 40;

Fig 48 Penicillium spinulosum

a. showing simple conidiophore x 400;
b. P. janthinellum showing asymmetric - divaricate type of penicillus x 400;
c. P. citrinum showing asymmetric - velutina type of penicillus x 400;
d. P. wortmanni showing biverticillate symmetric type of penicillus x 400;

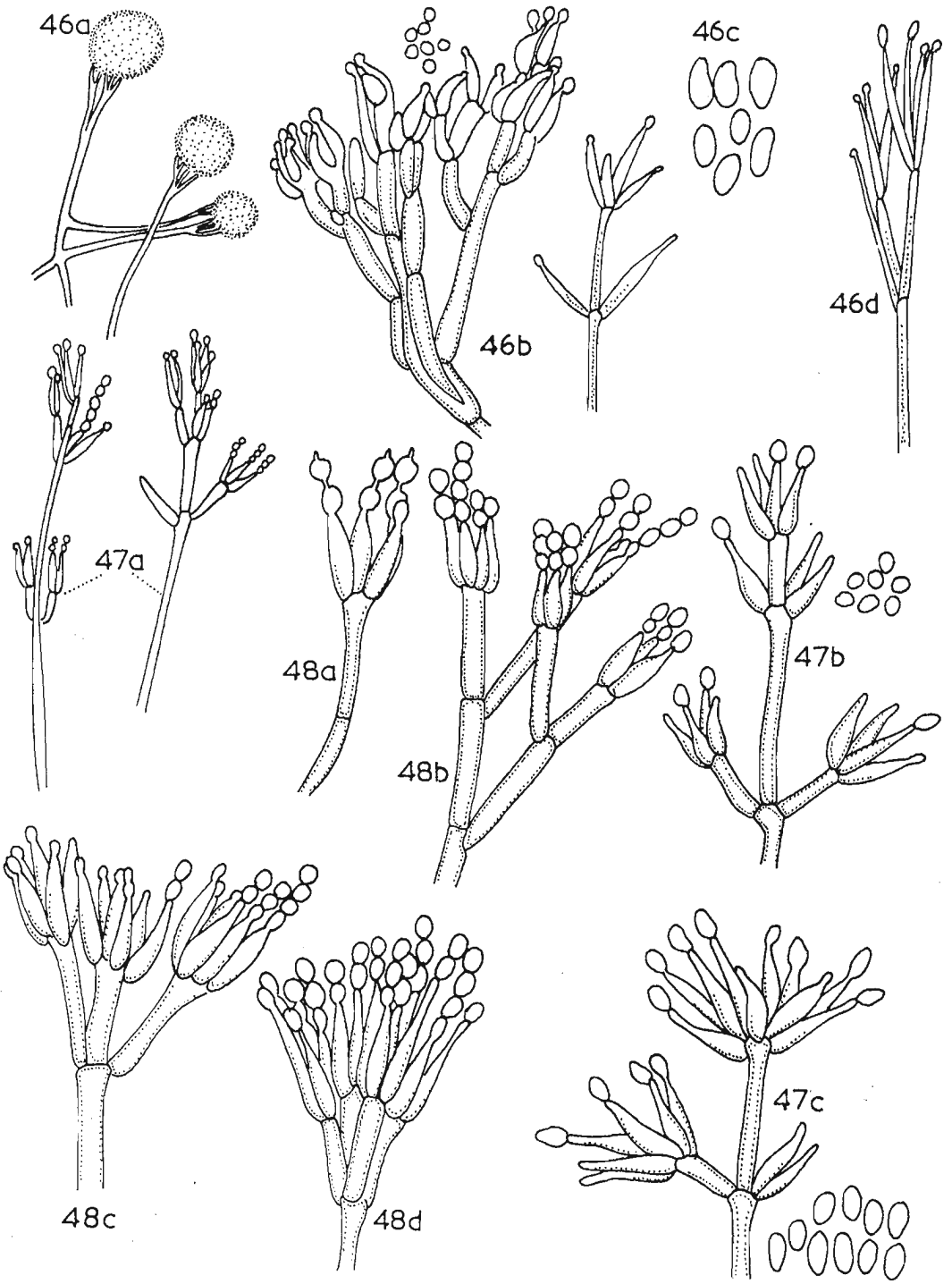

Plate X Figs. 46 - 49

(xv) A. sydowi (Bain. & Sart.) Thom & Church

Agalawatta, Boralu, Deniya, Homagama, Matale, Parambe, Ratnapura (12)
Also reported from Austria, Canada, Canal zone, China, England, USA, India (6)

(xvi) A. versicolor (Vuill). Tiraboschi

Agalawatta, Boralu, Deniya, Homagama, Matale, Parambe, Ratnapura (12)
Has a world-wide distribution (4,6)

40 Gliocladium Corda. (Plate X fig. 46)

Conidiophores erect, septate, penicillate above, branches and branchlets septate; conidia hyaline or brightly coloured in mass, 1-celled acrogenous, massed together.

This genus differs from Penicillium in that a mucilagenous substance is produced by the fruiting organs and the conidia, and therefore instead of standing in chain, they adhere together or in most typical species lose entirely the catenulate formation and form slimy balls. The line of separation from Penicillium is not a sharp one.

Asco state : Nectria (7)

Syn: = Corymbomyces Appel et strunk (7)
= Flaha ultia Arnand (7)

A single species recorded in Sri Lanka

(i) G. roseum Baing

Kottawa forest (3)
Agalawatta, Boralu, Deniya, Homagama, Ratnapura (12)
Has a world-wide distribution (4,6)

41. Paecilomyces Bainier (Plate x, fig. 47)

Colony colour white, or brightly coloured, texture closely matted, loosely, floccose or funiculose, conidiogenous apparatus, vary considerably in complexity. Near Penicillium but the phialides are of very characteristic shapes; narrow flask - shaped at the base, and terminating in long slender conidia bearing tips which bend away from the main axis. Mycelium also produces the so called "macrospores" which are comparatively large,

globose or ovate, aleuriospores, borne singly or in small clusters, and usually found on the mycelium close to the substrate or even in the submerged mycelium. Perfect state where khown is Bysochlamys West (4).

4 species recorded in Sri Lanka.

(i) P. elegans (Corda) Mason & Hughes

Homagama, Matale, Ratnapura (12)
Has a world-wide distribution (4,6)

(ii) P. fumoso - roseus (wize) Brown et G. smith

Montane grassland (11)
Also reported from Brazil, Kiel (4)

(iii) P. lilacinus (Thom) Samson

Kottawa forest (3)

(iv.) P. marquandii (Massee) Hughes

Syn : Spicaria violacea

Matale, Parambe (12)
Has a world-wide distribution (4)

42. Penicillium Link ex Ft. (Plate x, fig. 48)

= Coremium Link in part

Mycelium creeping, septate, conidiophores erect, either detached from one another, to some degree aggregated into fascicles or compacted into definite coremia, septate, smooth or rough, terminating in a broom like whorl of branches, the latter consisting of a single whorl of phialides, or twice to several times verticillately branched; branching symmetrical or asymmerical; final branches bear the phialides; conidia in dry unbranched chains, globose, ovoid, elliptical,or pyriform, smooth or rough, hyaline or brightly coloured

Asco state = Eupenicillium or Talaromyces (7)

Syn: = Floccaria Grev. (7)
= Pritz eliella Henn. (7)
= Moniliger Letel. (7)
= Rhodocephalus Corda (7)

19 species recorded in Sri Lanka

(i) P. Brefeldionum Dodge

Montane grasslands (11)
Also from Egypt (6)

(ii) P. brevicompactum Dierokz

Agalawatta, Deniya, Homagama, Parambe, Ratnapura (12)
Has a world-wide distribution (4,6)

(iii) P. charlesii Smith

Agalawatta, Deniya, Parambe, Ratnapura (12)
Also from Poland and USA (6)

(vi) P. citrinum Thom

Agalawatta, Boralu, Homagama, Parambe, Ratnapura (12)
Montane grasslands (11)
Has a world-wide distribution (4,6)

(v) P. coryophilum Dierckz

Agalawatta, Boralu, Homagama, Matale, Parambe, Ratnapura (12)
Also from USA (6)

(vi) P. crustosum Thom

Agalawatta, Homagama, Parambe, Ratnapura (12)

(vii) P. ehrlichii Klebahn

Montane grasslands (11)
Also from England (6)

(viii) P. funiculum Thom

Agalawatta, Deniya, Homagama (12)

(ix) P. funiculosum Thom

Kottawa forest (3)
Patana grasslands (11)

(x) P. herquei Bainier & Sartary

Montane grasslands (11)
Also from Canada, Egypt, USSR? USA (6)

(xi) P. javanicum van Beyme

Agalawatta, Homagama, Parambe, Ratnapura (12)
Montane grasslands (11)
Also from Argentina, Brazil, Central America, Germany, India (6)

(xii) P. janthinellum Biourge

Agalawatta, Boralu, Deniya, Homagama, Parambe, Ratnapura (12)
Lunuwila (8)
Montane grasslands (11)
Has a world- wide distribution (4,6)

(xiii) P. lilacinum Thom

Agalawatta, Boralu, Deniya, Homagama, Matale, Parambe, Ratnapura (12)
Has a world-wide distribution (4,6)

(xiv) P. oxalicum Currie & Thom

Kottawa forest (3)
Also from India, USA (6)

(xv) P. rugulosum Thom

Montane grasslands (11)
Has a world-wide distribution (4,6)

(xvi) P. simplicissimum (Oud.) Thom

Agalawatta, Homagama, Parambe, Ratnapura (12)
Also from Canada, Canalzone, Parama, USA (6)

Plate XI Figs 50 - 54

Fig 50 Verticillium spp.

a. habit x 100;
b. whorled phialides bearing conidia x 800;

Fig 51 Monosporium spp.

a. conidiophore with conidia x 400;

Fig 52 Tritirachium oryzae

a. conidiophore x 400;
b. a portion bearing conidia x 800;

Fig 53 Metarrhyzium anisopliae

a. conidiophores and conidia x 400;

Fig 54 Botrytis spp.

a. conidiophores with masses of conidia x 100;
b. apex of conidiophore showing origin of conidia x 500;
c. conidium germinating to produce phialides and conidia x 500;

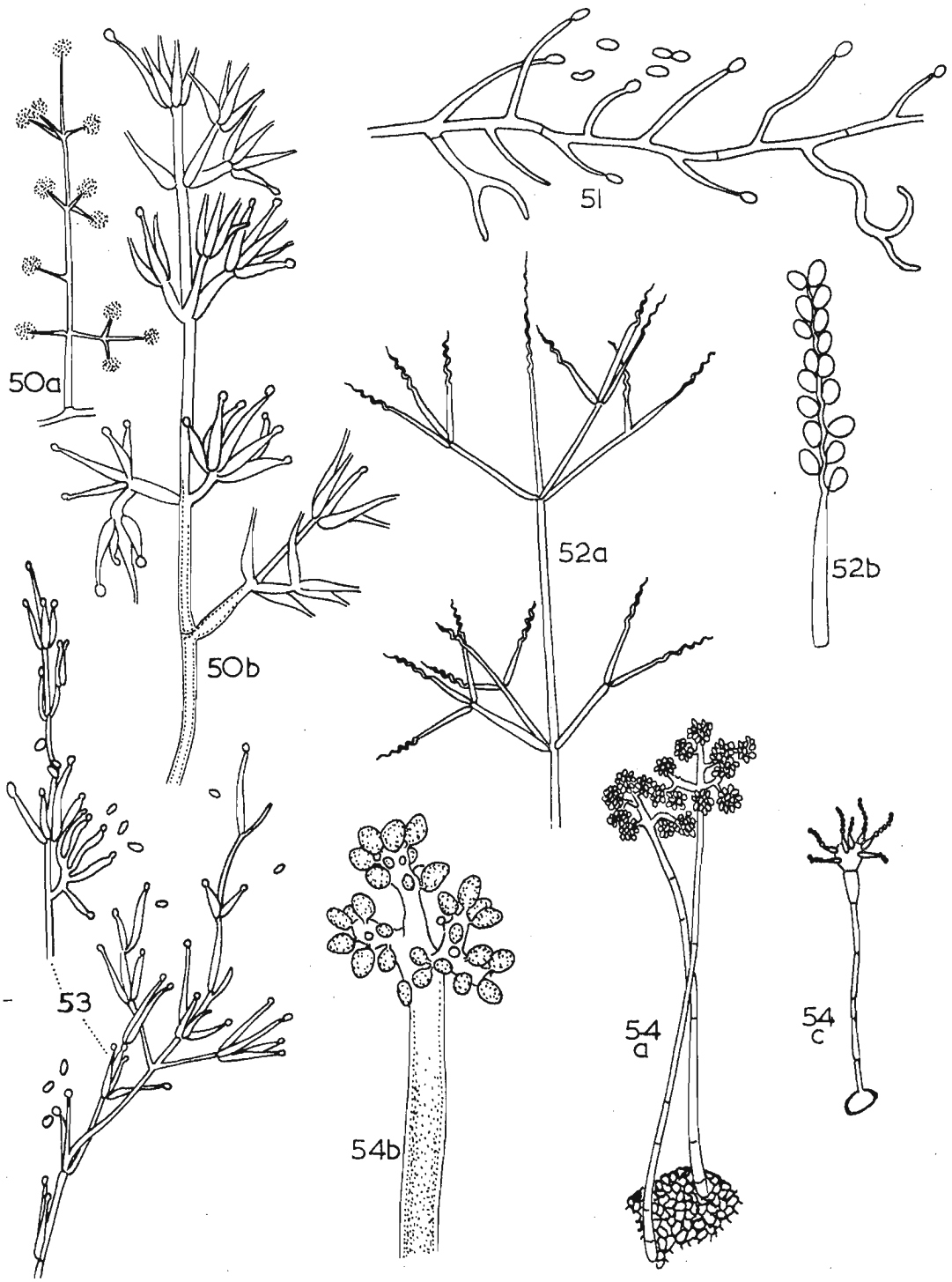

Plate XI Figs. 50 - 54

(xvii) P. steckii Zaleski

Montane grasslands (11)
Also from Canalzone, Costa Rica, Poland, USA (6)

(xviii) P. vermiculosum Peyronal

Agalawatta, Homagama, Parambe, Ratnapura (12)

(xix) P. Wortmanii Klecker,

Syn : Talaromyces wortmanni

Montane grasslands (11)
Has a world-wide distribution

43. Verticillium Nees ex. wallr. (Plate XI, fig. 50)

Sterile hyphae septate, creeping, branched, hyaline or brightly coloured. Conidiophores hyaline, slender, erect, branched. Branches of the first order whorled, opposite or alternate; branches of the second order whorled dichotomously or trichotomously on the branches of the first order; further branching similar; terminal branchlets usually flask shaped and distinctly pointed at the apex; Conidia ovoid to ellipsoid, not in chains, hyaline or pale coloured, 1-celled, borne singly or under moist conditions in slimy balls.

Asco state = Nectria (7)

Syn: = Acrostalagmus Corda (7)
= Gibellulopsis Batista (7)

A single unidentified species recorded from rubber soils of Sri Lanka (12)

44. Monosporium Bon. (Plate XI, fig. 51)

= Scedosporium Sacc. (1)

Sterile hyphae, creeping, branched, forming a turf. Conidiophores erect, septate, to non septate, branched in a tree - like form (dendroid) usually with two or more erect or horizontal branches occuring above one another, which may often branch again at the tip into two or three short branches. Conidia on the final branchelets of the conidiophore, borne singly, terminal, hyaline or bright coloured, smooth, thin - walled, rather large ovate to

spherical, 1 - celled. Differs from Sporotrichum by the erect conidiophores and from Verticillium by complete absence of whorled branches, some perfect states in Allescheria P. Henn.

A single species recorded in Sri Lanka as Scedosporium bisby at Lunuwila (8)

45. Tritirachium Limber (Plate XI, fig 52)

Conidiophores upright, long, slender, verticillately branched apical branches tapering to a rachis - like zig-zag, conidia - bearing portion; conidia apical and lateral, hyaline, 1 - celled globose or ovoid.

A single species recorded in Sri Lanka.

T. oryzae (vincens) de Hoog
Kottawa forest (3)

46. Metarhizium Sorok (Plate XI, fig 53)

Non-septate, coloured Sterile hyphae, gregarious, conidia formed in chains, basipetal, hyaline, 1-celled.

Syn: = Myrotheciella speg. (7)
= Chromostylum Giard (7)

A single species recorded in Sri Lanka.

M. anisopliae (Metsch.) Sorok.

Kottawa forest (3),
Boral, Deniya, Matale, Ratnapura (12)
Also reported from Canada, USA? Honduras, Congo, Kiel (4)

47. Botrytis Pers. ex fr. (Plate XI, fig. 54)

Mycelium grey, growing rapidly in culture. Sterile hyphae creeping. Conidiophores long, slender, erect, pigmented, irregularly branched at the top; branches either thin or thicker narrowing to a point, truncate, or with swollen warts on the tips or toothed - comb like. Condia borne each on little peg or sterigmata on the ends of final branches, globose, ellipsoid or long, hyaline or bright coloured, 1-celled. Sclerotia frequently produced on the mycelium.

Asco state = Sclerotinia (7)

Plate XII Figs 55 - 65

Fig 55 Acremonium spp.

a. Conidiophore showing clusters of conidia x 400;
b. conidia x 600;

Fig 56 Sporotrichum spp.

a. habit x 10;
b. conidiophores and conidia enlarged;

Fig 57 Rhinocladiella elater

a. conidiophore and conidia x 400;
b. Rhinocladiella sp. conidiophore and conidia enlarged;

Fig 58 Stachybotrys spp.

a. conidiophores with phialides enlarged;
b. conidia enlarged;

Fig 59 Nigrospora sphaerica

a. mycelium with conidia and hyaline vesicles x 400;

Fig 60 Humicola grisea

a. aleuriospores x 500;
b. Humicola spp. microconidia x 500;

Fig 61 Cladosporium herbarum

a. conidiophores and conidia x 400;
b. conidiophore and conidia x 400;

Fig 62 Curvularia pallescens

a. Conidiophore with conidia x 400;
b. Curvularia lumata conidiophores and conidia x 200;
c. C.lunata conidia x 600;

Fig 63 Helminthosporium spp.

a. conidiophores and conidia x 400;

Fig 64 Alternaria

a. chains of conidia x 200;;
b. conidia x 600;

Fig 65 Pithomyces

a. mycelium and donidia, enlarged.

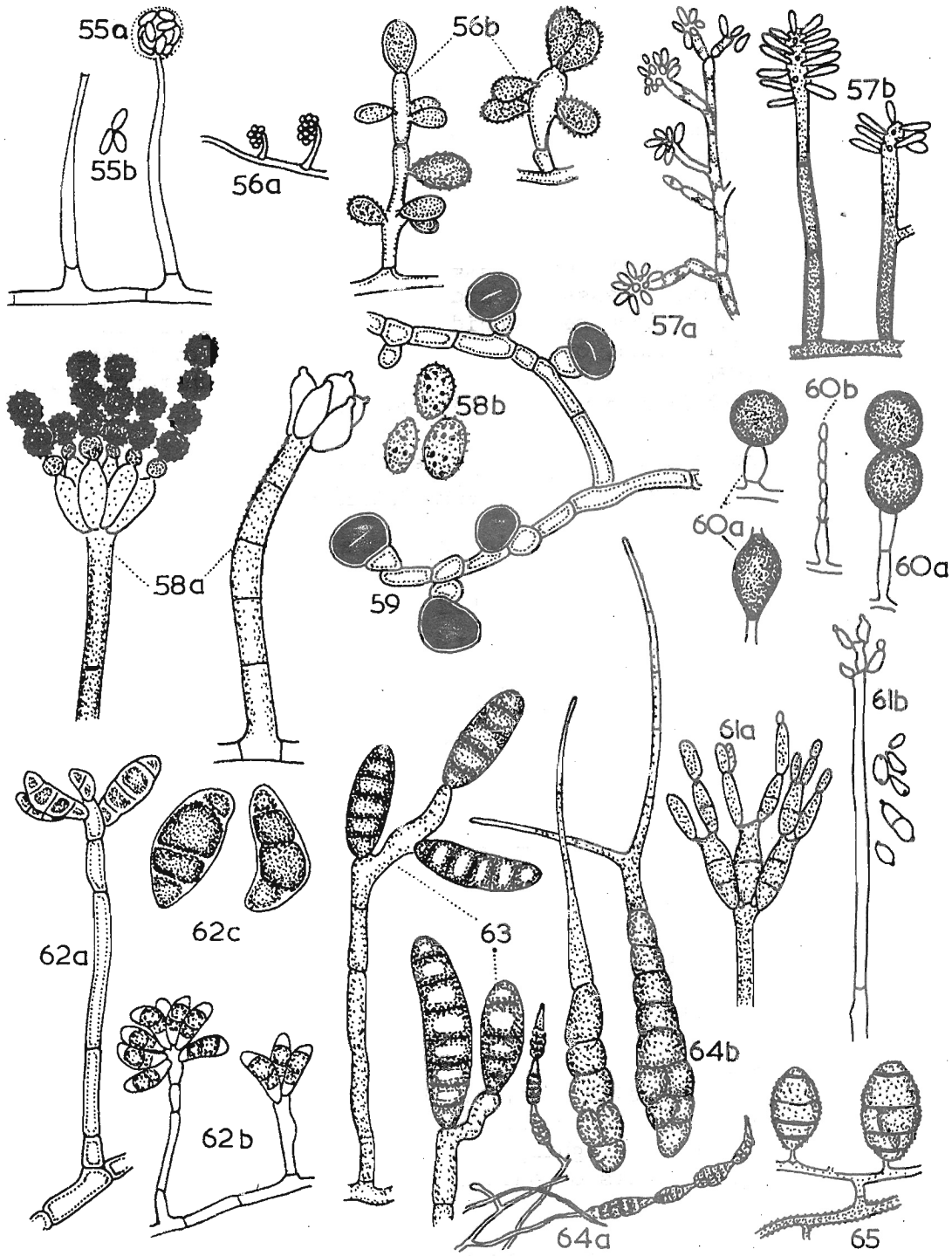

Plate XII Figs. 55 - 65

Syn: = Cephalocladium Reich. (7)
= Pterodinia Chev. (7)

A single unidentified species recorded in rubber growing soils of Sri Lanka (12)

48. Acremonium Link ex fr.)Plate XII, fig. 55)

Mycelium prostrate, forming a turf, septate, branched, slender, possessing side branches which become erect and serve as conidiophores. Conidia single on the conidiophores, terminal hyaline, or bright coloured, usually ovate small. The genus differs from Sporotrichum by the erect, unbranched laterals which bear single conidia at their tips.

Asco state = Emericelliopsis or Nectria (7)
Syn: = Cephalosporium Afuet. (7)

3 species recorded in Sri Lanka.

(i) A. minutisporum (Sukap & Thirum.) W. Gams.
Kottawa forest (3)

(ii) A. Sclerotigeneum (F.R. Morean ex Valende) W. Gams.
Boralu, Deniya, Matale, Parambe, Ratnapura (12)

(iii) A. Strictum W. Gams.
Syn : Cephalosporium acremonium
Kottawa forest (3)
Has a worldwide distribution (4)

49. Sporotrichum link ex fr. (Plate XII, fig. 56)

Hyphae creeping, irregularly branched, but never in whorls; branches repeatedly branched. Conidiophores not formed or only as projections from the side branchlets, Conidia borne laterally and terminally on the hyphae or the branches, usually very numerous in clusters, sessile or on small phialides, ovate or globose, hyaline or brightly coloured. Saprophytic in soil, parasitic on higher plants or pathogenic on animals and man causing "sporotrichoisis"

Syn: = Oidium Link (7)

A single unidentified species, recorded from rubber growing soils of Sri Lanka. (12)

FAMILY - DERMATIACEAE

Majority of forms are saprophytic, but some are plant parasites and a few are parasitic on animals and man; sterile hyphae septate, usually prostrate, seldom short, dark to black, seldom bright coloured or hyaline and in that case having dark conidia. Conidiophores either not sharply differentiated from the mycelium or differentiated, erect, simple or much branched, usually dark or brightly coloured. Conidia dark or hyaline, in the latter case the conidiophores, and hyphae are dark.

KEY TO THE GENERA OF THE FAMILY DERMATIACEAE

1.	Conidia one - celled	2		
	Conidia more than one-celled	5		
	Conidia and conidiophores both dark	3		
2.	Conidia hyaline or bright coloured conidiophores dark	-	Rhinocladiella	50
3.	Conidia in terminal heads	-	Stachybotrys	51
	Conidia not in terminal heads	4		
4.	Conidia on lateral branchlets of the mycelium	-	Nigrospora	52
	Conidia on truly branched conidiophores	-	Humicola	53
5.	Conidia 2-celled	-	Cladosporium	54
	Conidia more than 2-celled	6		
6.	Conidia with cross walls only	7		
	Conidia with both cross and longitudinal walls	8		
	Conidia 3-5 celled with middle cell enlarged, dark and curved	-	Curvularia	55
7.	Conidia typically 5 or more celled not bent as above	-	Helminthosporium	56
	Conidia with a distinct beak and produced in chains	-	Alternaria	57
	Condia not beaked; not in chains	-	Pithomyces	58

50. Rhinocladiella Nannf. (Plate XII, fig. 57)

Elongating conidiogenous axis is relatively wide compared to the width of the conidial attachment; axis is clavate or somewhat inflated rather than zig-zag. Conidia are initially lateral as well as terminal. Conidia 1-celled, produced singly, hyaline or dark, elongate with a narrow base.

A single species recorded in Sri Lanka

R. elator Mangenot

Kottawa forest (3)

51. Stachybotrys Corda (Plate XII, fig. 58)

Mycelium creeping, spreading over substratum, conidiophores erect, variously branched, septate, first hyaline then dark, bearing at the apex of the main stalk and its branches phialides; phialides borne in whorls or arise irregularly below the point of the branch appearing singly or more or less grouped; hyaline at first then browning; conidia slimy and collect in a dense irregular mass, ellipsoid - subglobose, often slightly curved, dark brown to black, smooth when young but mostly becoming rough in old culture. Species are common on paper and other cellulosic materials.

Asco state = Melanopsamma or chactosphaeria (7)

Sync = Memnoniella Hohnel (7)
= Gliobotrys Hohnel (7)
= Hyalobotrys Pidoplichka (7)
= Hyalostachybotrys Srinivasan (7)
= Fuckelina Sacc (7)
= Synsporium Preuss (7)

A single species recorded in Sri Lanka

S. bisby Lunuwila (8)

52. Nigrospora Zimm. (Plate XII, fig. 59)

Mycelium extensive, hyaline at first and later dark; ultimate branchlets of hyphae bearing jar shaped conidiophores with er laterally or terminally. Conidia solitary, black 1-celled, globose to somewhat flattened, smooth. Perfect state is Khuskia Hudson

Syn: = Phaeoconis Clements (7)
= Basisporium Moll. (7)
= Dichotomella Sacc. (7)

2 species recorded in Sri Lanka

(i) N. Sphaerica (Sacc. Mason

Kottawa forest (3)
Also reported from Canal Zone, Costa Rica, England USA (6)

(ii) N. sp.

Agalawatte, Boralu, Deniya, Homagama Parambe, Ratnapura (12)
Montane grasslands (11)

53. Humicola Traaen (Plate XII, fig. 60)

Mycelium creeping, branched, septate. Conidiophore erect, straight, septate, unbranched, rather long, brown. Conidia single, apical, globose or subglobose, brown, 1-celled.

Syn: = Melanogone Woll. (7)
= Cremasteria Meyers (7)

7 species recorded in Sri Lanka.

(i) H. Grisea Traaen. Syn; Monotospora daleal

Agalawatta, Deniya, Homagama, Matale, Parambe (12)
Has a worldwide distribution (4)

(ii) H. fuscoatra Traaen

Agalawatta, Matale, Parambe (12)
Has a worldwide distribution (4)

(iii) H. sp. 1

Agalawatta, Boralu, Parambe, Ratnapura (12)

(iv) H. sp. 2

Agalawatta, Boralu, Deniya, Matale, Ratnapura (12)

(v) H. sp. 3

Deniya, Homagama, Matale, Parambe, Ratnapura (12)

(vi) H. sp. 4

Agalawatta, Parambe, Ratnapura (12)

(vii) H. sp. 5

Agalawatta, Boralu, Ratnapura (12)

54. Cladosporium Link ex. fr. (Plate XII, fig. 61)

Mycelium creeping on the surface of the substrate, conidiophores dark, almost erect, branched variously, floccose, often forming a turf, olive coloured, conidia usually greenish, at first 1-celled then usually with a cross wall, shape variable, terminal at first and then pressed to a side.

Perfect state Mycosphaerella or Amorphotheca or Venturia (7)

Syn: = Heterosporium Klotz. (7)
= Hormodenrum Bon. (7)
= Didymotrichium Bon. (7)
= Fulvia Ciferri (7)
= Mydonosporium Corda (7)
= Myxocladium Corda (7)
= Sporocladium Chov. (7)
= Tandonella Prasad (7)

5 species recorded in Sri Lanka.

(i) C. closporioides (Fres) de Vries

Agalawatta, Boralu, Deniya, Homagama, Matale, Parambe, Ratnapura (12)

(ii) C. herbarum (Pers.) Link.

Agalawatta, Deniya, Matale (12)
Also from Austrio, Canada, England, USSR, USA (4)

(iii) C. oxysporum Berk. & Curt.

Boralu, Matale, Parambe (12)

(iv) C. sp. 1

Agalawatta, Homagama, Matale, Parambe, Ratnapura (12)

(v) C. sp. 2

Boralu, Deniya, Matale (12)

55. Curvularia Boedijn (Plate XII, fig. 62)

Mycelium sub-hyaline, or brown. Conidiophore simple, septate, when conidia have been shed appears knobby or tortuously bent along the conidia bearing part. Conidia spirally arranged or in tight clusters, dark, 3-5 celled mostly curved or bent about the third cell from the base, this cell being broader and darker in colour than the others.

Perfect; state Cochliobolus (7)

Syn: = Curvisporium Corbetta (7)
= Malustella Batista (7)

2 species recorded in Sri Lanka.

(i) C. lunata (Wakk.) Boedijn, Syn: Acrothecium lunatum

Agalawatta, Boralu, Matale, Parambe, Ratnapura (12)

Montane grasslands (11)

also recorded from Canal Zone, Egypt, India (6)

(ii) C. pallescens Boediyn

Kottawa forest (3)
Also from India (6)

56. Helminthosporium Link ex fr. (Plate XII, fig. 63)

A large genus. In culture some species grow normally with dark coloured hyphae and typical spores; others appear sterile and produce considerable amounts of hyaline or pale coloured mycelium; others on certain media produce red or purple pigments.

Mycelium light to dark in culture, extensive. Conidiophores short or long, brown to black, septate, simple or sparingly branched, arising in groups, more or less irregular or bent, bearing conidia successively on new growing tips geniculate at points below conidia. Conidia terminal or lateral on the geniculations, roughly cylindrical but often somewhat attenuated at the ends, smooth, dark coloured, appears several septate, spores of some species are truly septate whilst some of the others have no real septa but contain, a central row of structures termed 'protoplasts'.

Syn: = Helmisporium Link (7)

2 unidentified species recorded from the soils in Sri Lanka.

(i) H. sp

Agalawatta, Boralu, Homagama, Matale (12)

(ii) H. sp 2

Montane grasslands (11)

57. Alternaria Nees. ex Wallr. (Plate XII, fig. 64)

Mycelium creeping, dark. Conidiophores single or in groups, mostly unbranched, short. Conidia inverted or club-shaped mostly elongate, at tip forming a spindle, muriform in the lower portion, dark coloured, lighter at the points, frequently borne in acropetal chains and connected by slender portions, soon separating.

Perfect state = Clothrospora or Leptosphaeria or Pleospora (7)

Syn: = Macrosporium Fries (7)
= Prathoda Subramaniam (7)
= Rhopalidium Mont. (7)
= Dictyocephala Med. (7)

2 unidentified species recorded in Sri Lanka.

(i) A. sp. 1

Agalawatta, Deniya, Homagama, Parambe, Ratnapura (12)

(ii) A. sp.

Montane grasslands (11)

58. Pithomyces Berk. & Br. (Plate XII, fig. 65.)

The conidiogenous cells resemble vegetative hyphae, not morphologically specialised; only transversely septate or both transversely and longitudinally septate, conidia solitary and dark.

Syn: = Bioconiosporium Batista (7)
= Scheleobrachea Hughes (7)
= Neomichelia Penzig (7)
= Polyschema upad. (7)

A single species recorded in Sri Lanka.

(i) P. maydicus (Sacc.) M.B. Ellic

Agalawatta, Homagama, Parambe, Ratnapura (12)

NA-80-5

GLOSSARY

Acervulus - Subcuticular or subepidermal, never superficial, determininate fruiting body, without a peridium or covering of fungous tissue; usually a discoid, or a flat mass of condiophores arising from a thin hyphal weft, and prolifically producing conidia in a moist mass (Plate XIV, Fig. 73).

Acrogenous - Growing at the apex; borne at the tip; (Plate XIII, Fig. 69 J)

Acropleurogenous - Spores borne at the tip and the sides

Acropetal - Produced in succession toward the apex.

Aleuriospore - A term coined by Vuillemin for certain terminal chlamydospores of conidioid nature, which differ from true conidia in that they are freed only by the destruction of the hyphae which bear them. (Plate XIII, Fig. 69 G)

Allantoid - Sausage - shaped; somewhat curved with rounded ends (Plate XIII, Fig. 68 A)

Allentospore - Unicellular with rounded ends and a curved outline

Alveolate - Pitted like a honey comb

Amerosporous - Having one-celled spores

Amphigynous - With the oogonium growing through the antheredium so that the latter sits like a collar on the oogonial stalk

Plate XIII Figs 66 - 69

Fig 66 A - G - Spore ornamentation

A - reticulate;
B - C - verrucose;
D - punctate;
E - striate;
F - echinulate;
G - alveolate;

Fig 67 A - L - Spore shapes

A - spherical;
B - ovate;
C - obovate
D - pyriform;
E - obpyriform-
F - ellipsoid;
G - cylindrical;
H - oblong;
I - allantoid;
j - filiform (or scolecoid);
K - falcate;
L - fusoid

Fig 68 A - H - Saccardo's spore terminology

A - allantosporous;
B - amerosporous;
C - didymosporous;
D - phragmosporous;
E - Dictyosporous (muriform);
F - scolecosporous;
G - helicosporous;
H - staurosporous;

Fig 69 Spore types

A - arthrospore;
B - chlamydospore;
C - blastospore (catenate in chains);
D - radulospore;
E - sympodiospore;
F - porospore;
G - a leuriospore;
H - annellophore with aleuriospores;
I - exogenous dry phialospores in chains;
J - acrogenous phialospores in slimy ball;
K - phialide producing conidia by transverseptation;
L - endophialospores;

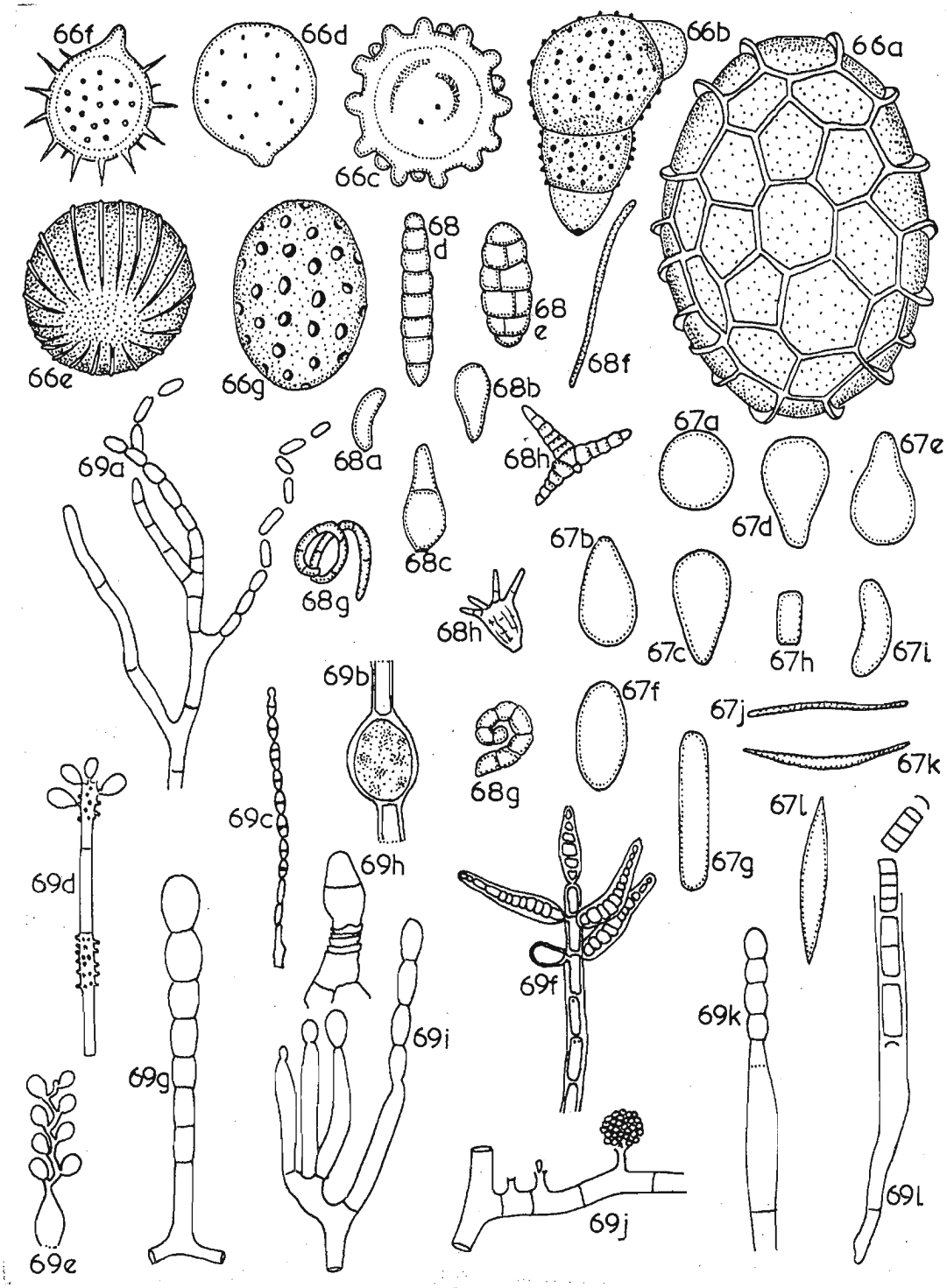

Plate XIII Figs. 66 - 69

Amyloid - Staining greyish - to blackish - violet in Melzers reagent, because of the presence of starch or starch-like compound,

Androgynous - Having antheredia arising on the same hyphae as the oogonia that they fertilise

Annelospore - A spore produced by annellophore, See annellophore (Plate XIII, Fig, 69 H)

Annelophore - A conidiophore which becomes banded (annellated) due to the production of a succession of single terminal conidia

Aplanospore - A non-motile spore, usually sporangiospore, having the spore wall free from the cell wall or sporangial wall

Arthrospore - A seriate or jointed spore; a spore resulting from the fragmentation of a hypha (Plate XIII, Fig, 69 A)

Ascigerous - Having asci,

Ascocarp - The ascospore bearing structure of the fungi

Ascostroma - A simple type of fructification of the ascomycetes, which consists of an undifferentiated mass of tissue or stroma on or in which the asci develop, (Plate XIV, Fig, 78),

Astomous - Fruit body without an ostiole

Blastospore - Bud spores formed by budding of somatic cells of a hyphae or conidiophore or by budding from the cells of other types of spores

Botuliform - Sausage shaped or as allantoid

Carbonous, Carbonaceous - (of colour) dark coloured, almost black; (of consistency) consisting chiefly of substances in which carbon predominates, black and brittle; charcoal-like

Catenate - In chains (Plate XIII Fig. 69 G)

Catenulate - Formed in parts, united or linked as in a chain

Chlamydospore - A thick walled, secondary spore developed from the hyphae, usually intercalary, but not on basidia or conidiophores (Plate XIII, Fig. 69 B)

Claviform, Clavate - Club - shaped

Cleistothecium - A closed ascocarp, ascospores being freed by rupture or decay of the ascocarp and asci scattered at various levels (Plate XIV, Fig. 76)

Concrescent - Growing together

Confluent - Running into one another

Coremium - A fascicle of parallel conidiophores, (Plate XIV, Fig. 70)

Cylindrical - Of the same diameter throughout the length.

Decumbent - Lying against the substratum

Dendroid - Tree like; having lateral branches

Dictyosporous - Muriform, with transverse and longitudinal septa. (Plate XIII, Fig. 68 E)

Didymosporous	-	Having two celled spores
Echinulate	-	Covered with small pointed processes of finely pointed spines (Plate XIII, Fig. 66 F)
Ellipsoid, elliptic	-	Having the shape of an ellipse i.e. of a foreshortened circle (Plate XIII, Fig.67 F)
Erumpent	-	Breaking through; to burst out
Endophialospores	-	One of a series of spores formed successively endogenously to produce chains or spore heads on phialides
Eustromata	-	A stroma consisting of fungous tissue only
Evanescent	-	Only slightly developed and soon dissappearing
Falcate	-	Sickle shaped
Fascicle	-	A little bundle
Filiform	-	Slender as a thread
Floccose	-	Loose cottony or downy - wooly and more or less tufted like cotton flannel
Funiculose	-	Occuring in ropes or bundles; rope-like
Fusiform	-	Spindle shaped, tapering at both ends
Fusiform - elliptical	-	Fundamentally elliptical, but somewhat fusiform; more elliptical than fusiform
Fusoid	-	Somewhat fusiform
Geniculate	-	Bent like a knee
Globose, globoid	-	Globular, globulose - spherical or nearly so

Gloeoid	-	Slimy
Helicosporous	-	Having spores coiled in two or three directions forming a flat or spiral coil
Hyaline	-	transparent or transluscent; clear and colourless
Immersed	-	Below the surface
Innate	-	Forming a part of the surface tissue; not superficial
Isogamous	-	Producing or possessing morphologically similar gametes
Loculoascostroma	-	a ascostromatic ascocarp where asci are borne in unwalled locules.
Merosporangium	-	A cylindrical out growth from the swollen tip of the sporangiophore, the contents usually becoming divided into a chain-like series of sporangiospores
Metulae	-	The outermost branches from which phialides radiate
Monoplanetic	-	Having one motile phase, with no resting period
Monopodial	-	Having the characterestics of or pertaining to a monopodium
Monopodium	-	An axis that continues to grow at the apex in the direction of previous growth, while lateral structures of like kind are produced beneath it in a acropetal succession

Plate XIV 70 - 79

Fig 70 Synnema

a. Light colored, cylindrical to clavate synnemata enlarged;
b. lateral conidia bearing portion of the same, further enlarged;
c. dark cylindrical synnema with apical conidia bearing portion, enlarged;
d. same further enlarged to show conidia;

Fig 71 Sporodochium

a. with extensive stroma erupting from host bark and bearing conidiophores and conidia;
b. with loose embedded stroma bearing condiophores and conidia.

Fig 72 Pycnidium

a. black separate pycnidium in section showing ostiole, pseudoparenchymatous peridium short conidiophores lining the peridium and conidia enlarged,
b. black confluent pycnidia in section.

Fig 73 Subepidermal acervulus

a. in section showing ruptured host epidermis, conidiophores, setae and conidia;

Fig 74 Oospore

Fig 75 Zygospore

Fig 76 A section through a cleistothecium showing the continuous peridium and scattered asci

Fig 77 Perithecium

a. a non - ostiolate perithecium in section.
b. an ostiolate perithecium in section showing the ostiole, peridium and the hymenium of asci.

Fig 78 Disc shaped apothecium in section showing the sterile excipulum and an upper layer of hymenium.

Fig 79 A loculoascostroma in section showing the stroma, a locule, and asci dispersed in the locule.

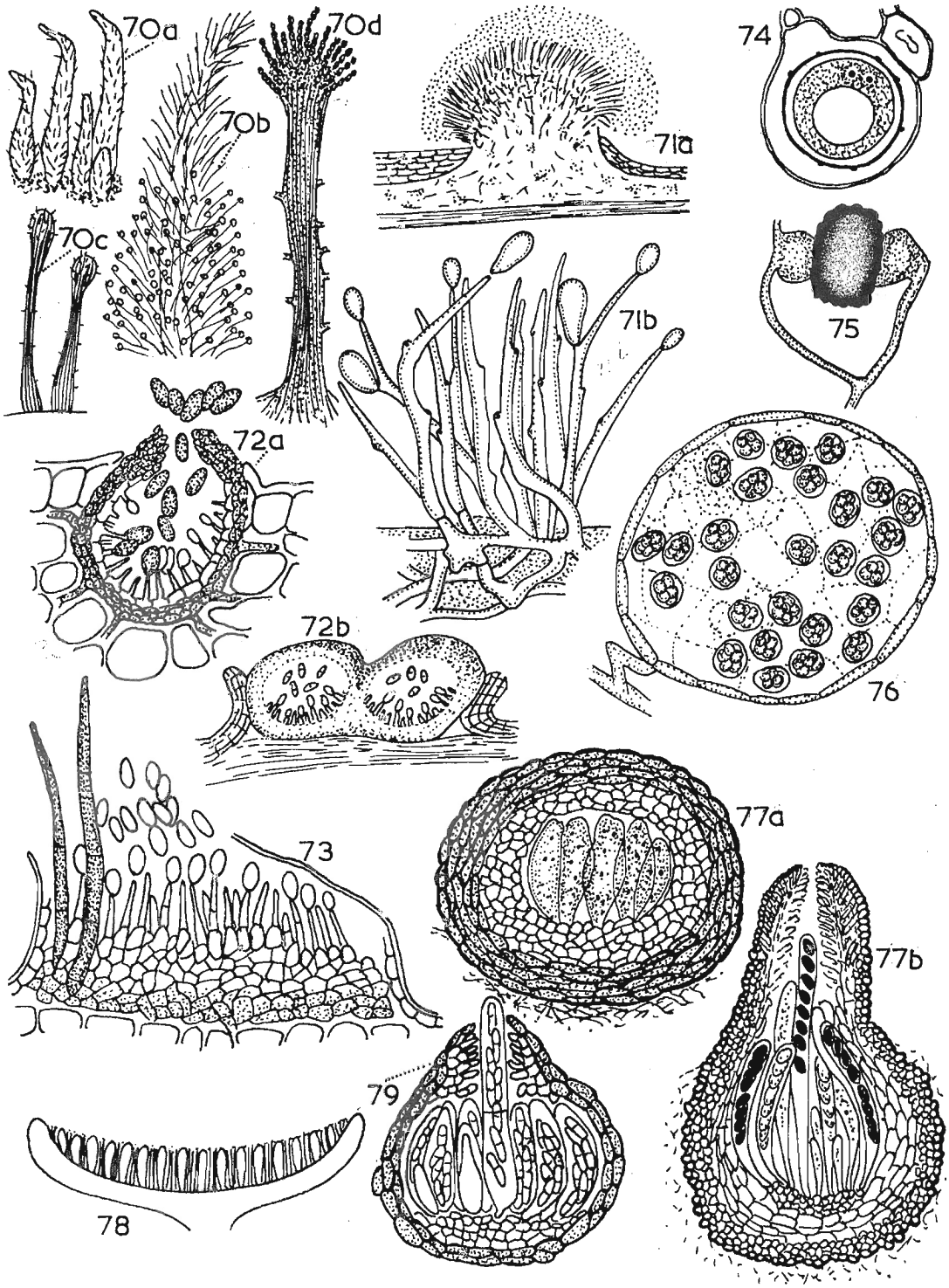

Plate XIV Figs. 70 - 79

Muriform - Having cells arranged like bricks in a wall with both longitudinal and transverse septa (Plate XIII, Fig. 68 E)

Obclavate - The reverse of clavate

Obovate - Reversely ovate, with broader end uppermost.

Obpyriform - Reversely pear shaped

Oospore - Immediate product of fertilisation of an egg or oosphere (Plate XIV, Fig. 74)

Ostiolate - Having a mouth or an ostiole

Oval, Ovate, Ovoid - Egg shaped with a large end at the base

Papillate - Having one or more papillae

Paragynous - Having the antheredia placed at the side of the oogonium, into which they force a fertilization tube

Penicillate - Like a little brush; pencil shaped

Penicillus - One of the complex systems of branches bearing conidia producing organs in Penicillium

Perfect - Of the stage or state of pleomorphic fungi in which spores are produced as the result of some sort of sexual process

Periderm - A covering

Peridium - The outer, enveloping coat of a sporangium or fruit body.

Perithecium - A rounded, oval, pyriform or beaked ascocarp which opens by a pore or slit and within which asci are borne in a characterestic manner. (Plate XIV, Fig. 77)

Phialide	-	Fusiform - truncate, fusiform - beaked or acuminate terminal portion of a hypha from the apex of which or within which, conidia are abstricted.,
Phialiform	-	Saucer - shaped; cup shaped
Phialospore	-	Spore formed on a phialide (Plate XIII, Fig. 69 I)
Phragmospore	-	A spore with two or more transverse septa (Plate XIII, Fig. 68 D)
Porospore	-	Develops as a bud extruded through a distinct pore in the wall of the conidiophore
Prostrate	-	Lying flat
Pseudostroma	-	A false stroma; a stroma consisting of host and fungous tissue
Pseudostromatic	-	Resembling a stroma; consisting of host and fungal tissue
Pseudothecium	-	Globose, perithecium like, fruit bodies possessed by the loculoascomycetes
Punctate	-	Marked with very small structures such as small dots, points, scales
Pycnidium	-	A perithecium-like flask shaped fruit body bearing conidia (Plate XIV, Fig. 72)
Pyriform	-	Pear-shaped (Plate XIII, Fig. 67 D)
Radulospore	-	A spore borne on a small sterigma or a radula
Reniform	-	Kidney-shaped

Rhizoidiferous - Having rhizoids

Sclerotium - A resting body of variable size composed of a hardened mass of hyphae with or without host tissue

Scolecoid - Long and filiform many times as long as they are broad.

Scolecosporous - Having scolecoid spores

Setose - Bristly; beset with bristles

Sporangiole - A reduced sporangium in which a columella is lacking and the number of spores is reduced

Sporocarp - A many-celled body serving for the formation of spores; a fruit-body

Sporodochium - An erumpent, determinate, pulvinate cluster of conidiophores, typically stromatic (Plate XIV, Fig. 71)

Staurosporous - Having a stellate spore

Stolon - A runner; a horizontal hypha that sprouts where it touches the substrate and forms rhizoids in the substrate and an aerial mycelium or sporophore above it

Stoloniferous - Bearing stolons

Striate - Having longitudinal lines or minute furrows

Stroma - A cushion-like mass of fungous cells, or mixed fungous cells and host tissue in or on which fructifications develop

Stylospore - A spore borne on a filament or hypha

Subcutaneous - Under the epidermis

Subiculum - Subicle - a more or less dense felt of hyphae covering the substrate, from which the fruit bodies, perithecia etc. arise

Superficial - On the surface and easily removable, as opposed to innate,

Suspensor - A club-shaped or conical portion of a hypha suspending a gamete or gametangium and finally the zygospore

Sympodial - Growing by means of a sympodium

Sympodula - Conidiophore with subterminal proliferation, which forms an apical conidium, continues its growth from a new active area developed to one side of the conidium and then forms another apical conidium. This results in a zig zag conidiophore

Sympodulospore - Spore formed from a sympodulum

Synnema - See coremium

Verrucose - Covered or marked with small rounded process or warts (Plate XIII, Fig. 66 C)

Verticillate - Whorled

Zygospore - The thick walled resting spore resulting from the fusion of gametangia of the zygomycetes. (Plate XIV, Fig. 75)

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INDEX TO THE GENERA

ADDENDA
FAMILY ENDOGONACEAE

The complete life cycles of most species of the endogonaceae are still in doubt. The spores formed by them are of four kinds: chlamydospores (spores borne on vegetative hyphae); sporangiospores (those formed within true non-columellate sporangia); zygospores (those formed by the fusion of gametangia); azygospores (resemble zygospores but formed without sexual fusion). They all form subtarranean fruit bodies (sporocarps) from 1-25 mm. in dia meter, consisting of aggregations of coarse coenocytic hyphae enclosing several spores of one or more types. It is uncertain if these fungi can be grown in axenic culture.

Many early investigators assumed that the large globose zygospores, azygospores, chlamydospores or sporangia were asci and placed the family in the Ascomycotina. However, the classic studies of Bucholtz (1912) on the sexual reproduction of these forms indicated that the family belonged to the order Mucorales in Zygomycotina. Thaxter (1922) in his monograph of the family, recognised 4 genera: *Endogone*, *Sphaerocrea*, *Sclerocystis* and *Glaziella*. The genus Endogone as recognised by Thaxter (1922) and several others consisted of several diverse elements that may not be closely related but share one character of producing sporocarps that were similar in appearence. Taxonomic studies of Gerdeman and Trappe (1974, 1975) therefore resulted in a division of the genus *Endogone sensus lato;* the largest and the most heterogenous group in the family into 4 genera: *Endogone*, *Glomus*, *Gigaspora* and *Modicella*.

Interest in this family has been aroused by the discovery that many species produce endomycorrhizae of the vesicular-arbuscular type and the development of techniques such as wet sieving and decanting (Gerdemann and Nicholson 1968) and adhesion and floatation (Sutton and Barron 1972) to extract spores and sporocarps from soil has led to the

realisation that such species are among the most common of all soil-borne fungi (Gerdemann 1971).

In Sri Lanka 2 members of this family were recorded by Petch (Petch and Bisby 1950). This compilation is based on a more recent detailed studies of the Endogonaceae of the rubber growing soils of Sri Lanka by Jayasinghe (1978). The key to the local genera is adapted from Gerdemann and Trapp (1974).

KEY TO THE GENERA OF THE FAMILY ENDOGONACEAE

1. Zygospores or azygospores, borne terminally on gametangia, or suspensors, or on a single, bulbous suspensor-like cell, or laterally on a broad hypha that terminates nearby a large vesicle (spore bearing cells often dissappearing by maturity, so spores often lacking an attachment) ---- 2
   Chlamydospores or sporocarpic sporangia borne terminally on persistent, undifferentiated hyphae ---- 4

2. Zygospore borne in sporocarps; two gametangia or suspensors evident in young specimen, but generally by maturity, no hyphal attachment perceptible ---- Endogone
   Azygospore borne free in soil, terminally on a persistent single suspensor-like cell or laterally on a large, readily collapsing hyphae that terminates nearby in a large vesicle ---- 3

3. Azygospore terminal on a single suspensor-like cell from which a slender hypha generally project to the spore ---- Gigaspora

Plate XV 80 - 84

Fig 80 Endogone spp.

a. Zygospore showing a thin outer wall and a thick inner wall x 625;
b. sporocarps attached to roots of a plant x 1.5;

Fig 81 Gigaspora spp.

a. spore detached from subtending hypha x 1000;
b. subtending hypha showing attachment to a spore. Note fine pore as tip of bulb and slender hyphal projection and septate hypha x 1000;

Fig 82 Acaulospora laevis

a. young azygospore budding laterally from stalk of vesicle;
b. vesicle nearly empty of contents as azygospore matures;
c. mature azygospore attached to emplty collapsed vesicle x 500;

Fig 83 Glomus spp.

a. sporocarp with spores randomly arranged within peridium x 250;
b. dissected protion of sporocarp x 500;
c. fractured spore showing released oil globules x 500;
d. diagram showing lignituber ingrowths in wall layer of spore x 1000;

Fig 84 Sclerocystic spp.

a. diagram of a intact sporocarpic mat showing protruding spores x 10;
b. sporocarp with spores arranged in radial symmetry around a central axis. Note crescent shaped thickenings across spore x 2000;
c. single spore showing the details of subtending hypha x 2000; Note thick wall at base of spore, fine pore at entrance to subtending hypae and crescent shaped surface marking.

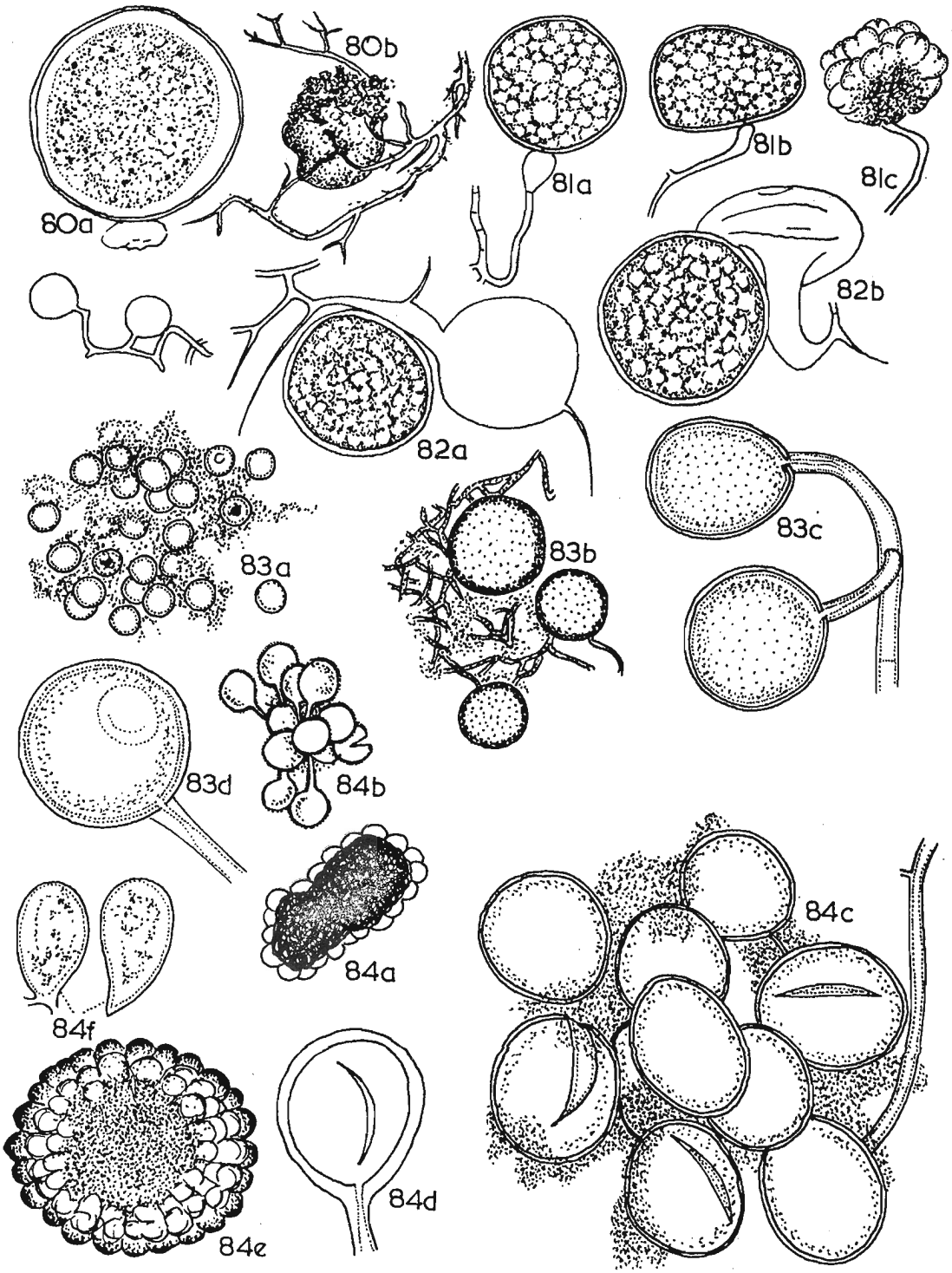

Plate XV Figs. 80 - 84

Azygospore borne laterally in a large, readily collapsing hypha that terminates nearby in a large vesicle --- Acaulospora

4. Chlamydospores borne free in soil or distributed at random or in several rows on solid sporocarps --- Glomus
Chlamydospores tightly arranged in a single layer around a central plexus of sterile hyphae or borne in the wall of a large hollow sporocarp --- Sclerocystis

59 Endogone Link ex. Fries

In the endogonaceae sexual reproduction has been definitely established only for this genus (Bucholtz 1912). Zygospores have been found only in sporocarps, and their germination has never been observed (Godfrey 1957). In none of the species included in this genus by Gerdemann and Trappe (1974) have spores other than zygospores been found in or associated with the sporocarps. Until sporangial stages are found, the relation-ship of these fungi to other Mucorales will remain obscure.

All Endogone species form sporocarps hypogeously except for *E. pisiformis*, *E. incrassata* and *E. acrogena* which produce sporocarps that may be either hypogeous or epigeous. There do not appear to be any records of their collection in strictly tropical climates. *E. alba*(Petch., Gerdemann & Trappe, (= Sclerocystis alba Petch, Ceylon J. Sci. Sec. A. Ann. Roy. Bot. Gard. Peradeniya 9 : 322-323 1925)is the only species that has been found in a tropical region. However, it is of interest to note that it has been recorded on Mount Hakgala at 5,600 ft. elevation with a cool temperate climate with a mean annual termperature of 61° F where exotic species like *Fagus*, *Quercus* and *Betula* were grown.

It is sometimes difficult to distinguish zygosporic species from chlamydosporic species. Gametangia are generally thin walled, ephemeral, and are seldom discernible on mature zygospores. Only *E. lactiflua*

produces thick walled gametangia that at times persist on mature spores most chlamydospores on the other hand, have a single, persistent hyphal attachment which is easily recognisable, Mature zygospores always have double walls and the outer wall is usually thickened and not membranous. Chalmydospores may have either single or double walls. If they are double, the outer wall is usually thin and membranous. In young zygospores the outer walls are continous with the walls of the gametangia. As the spores mature, the gametangia generally dissappear, leaving an opening in the outer wall. A continuous inner wall develops that completely occludes this opening, In both zygospores and chlamydospores, the walls are often formed from an indefinite number of tightly fused layers. True double walls are generally distinct and easily distinguishable from such laminate walls. The oil globules contained in zygospores are usually smaller and much more uniform in size than those in chlamydospores.

One species *E. lactiflua* has been shown to form ectomycorrhiza experimentally and evidence from association suggests that many other *Endogone* species are ectomycorrhizal (Gerdemann & Trapp 1975).

One species recorded in Sri Lanka.

(1) *E. alba.* (Petch) Gerdemann & Trappe,
= *Sclerocystis alba* Petch, Ceylon J. Sci. Sec. A, Ann. Roy. Bot. Gard. Peradeniya 9 : 322-323. 1925
from Hakgala (Petch 1950)

This species resembles *Sclerocystis coremioides* Berk. & Broome in having small ovoid sporocarps aggregated and fused together in masses. However, the spores appear to be azygospores rather than chlamydospores, and they are distributed at random within the gleba. No traces of gametangia are evident from the spores; however the absence of

hyphal attachments and the spore contents consisting of oil globules of nearly uniform size are good evidence for their zygosporic nature. This species is unusual in several respects. It produces the smallest sporocarps of any *Endogone*, and it is the only species with sporocarps fused in masses. This is the only species that has been found in a tropical region.

60 Gigaspora Gerdemann and Trappe

The azygospores are borne singly in soil. They are large, generally globose or subglobose, and borne terminally on a bulbous suspensor like cell. A slender hypha usually extends from the bulbous suspensor to the spre. The spore walls are continuous except for a very small ocluded pore. The spores formed by members of this genus have been previously called zygospores (Nicolson and Gerdemann 1968). Although they resemble zygospores in many respects, they do not appear to form from sexual fusion and hence regarded as zygospores (Gerdemonn & Trappe 1974), In contrast to chlamydospores which 'germinate' by regrowth of subtending hyphae, the spores produce germ tubes directly through the spore wall on the base region.

The species of this genus produce distinctive vesicles on coiled hyphae in the soil. They may represent sporangial stages. These structures are filled with oil globules and their function appears to be temporary storage of food. The hyphae of these species have a type of wound healing that has not been reported for any other fungi (Gerdemann 1955).

Gigaspora species are world wide in their distribution. They produce endomycorrhizae with arbuscules. Vesicles within roots have been noted for one species. *Gigaspora* species are likely to be present wherever endomycorrhizal hosts occur, ie. cultivated fields, native grasslands and forests.

2 unidentified species recorded from rubber soils of Sri Lanka (Jayasinghe 1978).

61. Acaulospora Gerdemann & Trappe

The azygospores of this genus are similar to those of *Gigaspora* sp. However, they are formed in a distinctive way. A large thin-walled vesicle with dense contents is produced terminally on a broad funnel-shaped hypha. After the vesicle reaches its maximum size the azygospore buds laterally from the stalk, and the contents of the vesicle are transferred to the spore. As the spore reaches its mature size, the emptied vesicle collapses. The vesicles frequently have dissappeared from spores wet-sieved from soil, leaving no evidence of the spores' origin.

Spore wall is very complex. Germ tubes are produced from 'compartments' within the spores.

Azygospore occur singly in soil and are likely to be found wherever endomycorrhizal hosts occur. The genus produces endomycorrhiza with arbuscules and vesicles.

3 species recorded from Sri Lanka.

(i) *A. laevis* Gerdemann & Trappe from rubber soils (Jayasinghe 1978)

2 unidentified species recorded from rubber soils (Jayasinghe 1978)

62. Glomus Tulsane & Tulsane

Some species are known only from sporocarps while others produce loose open clusters of spores and isolated single spores as well as sporocarps. One variety of *Glomus macrocarpus* Tul. & Tul. is known only to form single spores.

Chlamydospores are borne on undifferentiated non-gametangial hyphae. Spores are generally terminal; however intercalary spores and spores with more than one basal attachment sometimes occur, The spore walls may be single or double. Mature spores contain oil droplets that are highly variable in size. At maturity, spore contents are separated from attached hyphae by a septum or occluded by spore wall thickening. Chlamydospores are formed in sporocarps, roots or free in soil. They are generally hypogeous. Chlamydospore germination in all species in which it has been observed is by renewed growth from subtending hyphae. Smaller spores occasionally form within chlamydospores, In one species *G. radiatus* (Thaxter) Gerd. & Trappe, the chlamydospores usually fill with glebal hyphae.;

The genus *Rhizophagus* is regarded as a probable synonym of *Glomus* (Gerd. & Trappe 1974).

Glomus species are generally associated with endomycorrhizae which produce both vesicles and arbuscules. It occurs on nearly all crop plants, ornamentals and wild herbaceous plants as well as many shrubs and trees. *Glomus* species are found in moist habitats in nature. They may in fact be the most common of all soil-borne fungi. 16 species recorded in Sri Lanka.

(i) *G. fasciculatus* (Thexter sensu Gerd.) Gerd. & Trappe,
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recorded from rubber soils of Sri Lanka - Jayasinghe 1978

(ii) *G. fragilis* (Berk. & Brooms) Trappe & Gerd. Comb. Nov.

= *Paurocotylis fragilis* Berk & Brooms, J. Linn. Soc. Lond. 14 137, 1875

This is known only from the type collection from Ceylon (Petch 1950)

(iii) *G. fulvus* (Berk. & Broomo) Trappe & Gerd, Comb. Nov.

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= *Endogone fulva* (Berk. & Broomo) Pat. Bull . Soc. Mycol. France 19 : 341, 1903

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= *Endogone lignicola* Pat. Bull. Soc. Mycol. France. 18 :183 1902

from (Petch 1950)

from rubber soils of Sri Lanka (Jayasinghe 1978)

(iv) *G. macrocarpus* var. *macrocarpa* Tul & Tul

= *Endogone marcrocarpa* (Tul & Tul) Tul & Tul, fungi Hypogear. p. 182 1851

= *Endogone australis* Berk in Hook, Bot, Antarct, voy. 3 : 282, 1860

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from Hakgala (Petch 1950)
from rubber soils (Jayasinghe 1978)

(v) *G. microcarpus* Tul. & Tul.

= *Endogone microcarpa* (Tul & Tul) Tul & Tul., Fungi Hypogae, P. 182. 1851

= *Endogone neglecta* Rodway, Proc. Roy. Soc. Tasmania 1917 ; 107, 1918
from rubber soils in Sri Lanka (Jayasinghe 1978)

(vi) *G. mosseae* (Nicol. & Gerd.) Gerd. & Trappe, comb. nov.

= *Endogone mosseae* Nicol & Gerd. Mycologia 60 ; 314 - 315 1968
from rubber soils of Sri Lanka (Jayasinghe 1978)

10 Unidentified species recorded from the rubber soils of Sri Lanka (Jayasinghe 1978)

63 Sclerocystis Berk. & Br.

Chlamy dospores arranged side by side in asingle layer, elongate radiating out from a central plexus of hyphae. As a chlamydosporic genus, *Sclerocystis* differs from *Glomus* only in having its spores arranged in a single orderly layer around a central spore-free plexus. Probably all *Sclerocystis* species form vesicular arbuscular mycorrhizae. (Gerdemann and Trappe 1974)

5 unidentified species recorded in the rubber soils in Sri Lanka (Jayasinghe 1978)

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