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THE CLASSIFICATION OF THE HYPHOMYCETES

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ABSTRACT

The classification of the Hyphomycetes is discussed with special reference to spore types, conidiophore behaviour and initiation and development of spores. Eight basic morphological spore types are recognized : the blastospore, the gangliospore, the phialospore, the porospore, the arthrospore, the meristem-arthrospore, the spiculospore and the chlamydospore. No taxonomic significance is attached to the chlamydospore. It is pointed out that the forms now placed in the *Mucedinaceae*, the *Dematiaceae*, the *Tuberculariaceae* and the *Stilbaceae* of Saccardo may be placed in six Families as suggested by the author earlier : (i) the *Torulaceae* (Type genus, *Torula* Pers. ex Fries) for forms producing blastospores ; (ii) the *Bactridiaceae* (Type genus, *Bactridium* Kunze ex Fries) for those producing gangliospores ; (iii) the *Tuberculariaceae* (Type genus, *Tubercularia* Tode ex Fries) for those producing phialospores ; (iv) the *Helminthosporiaceae* (Type genus, *Helminthosporium* Link ex Fries) for those producing porospores ; (v) the *Geotrichaceae* (Type genus, *Geotrichum* Link ex Sacc.) for those producing arthrospores ; and (vi) the *Coniosporiaceae* (Type genus, *Coniosporium* Link ex Fries) for those producing meristem-arthrospores. The Families are subdivided into Sections on the basis of characters of the conidiophore related to spore initiation and development, the presence or absence and nature of "sporogenous cells", the presence or absence of "separating cells" and certain distinct modes of spore formation which are outlined. Twenty-four Sections are delimited and tentatively keyed out : thirteen in the Torulaceae, four in the Bactridiaceae, two each in the Tuberculariaceae, the Helminthosporiaceae and the Geotrichaceae, and one in the Coniosporiaceae. A separate Section is provisionally suggested for forms producing spiculospores. Typical examples of genera for each Section are given together with illustrations. Some of the difficulties still requiring solution are mentioned, including those relating to speculations about the classification of the Hyphomycetes *vis-a-vis* their perfect stages so far as known. It is emphasized that critical and thorough studies on generic types inadequately or imperfectly understood are an urgent necessity.

Although Saccardo's (1880, 1886) classification of the Hyphomycetes has been in wide use ever since it was first proposed and later elaborated in the *Sylloge*, there has been much general dissatisfaction with it. It is now generally agreed that the primary criteria on which the Mucedinaceae, the Dematiaceae, the Tuberculariaceae and the Stilbaceae were separated by Saccardo are not sufficiently reliable (see Hughes 1953a ; Subramanian, 1958). In the search for better criteria for classification, which are a pre-requisite for good taxonomy, significant approaches have been made by Vuillemin (1910a, 1910b, 1911 ; see also Langeron & Vanbreuseghem, 1952), by Mason (1933, 1937, 1940, 1941), by Hughes (1953a, 1958) and by Tubaki (1958). Of these, the most outstanding and original contributions came from Vuillemin and Mason : the former initiated sound thinking about the different morphological categories of spores aimed at serving as a sound basis for a good classification ; the latter extended these ideas further to include the biological spore types—the "slimy spore" and the "dry spore" —and made the first serious attempt to fix generic concepts based on nomenclatural types. It is no exaggeration to state that Mason also inspired much critical work aimed at a solution of the pressing problem of classification of this important group, of which the most notable has been that of Hughes, paving the way for the scheme later proposed by him (Hughes, 1953a). The concepts of the "slimy spore" and the "dry spore" (= the Gloiosporae and the Xerosporae respectively of Wakefield & Bisby, 1941) and the "aquatic spore" (Ingold, 1942), although very significant biologically, may not provide a more satisfactory basis for classification than the morphological features that are seen in the twin processes of initiation and development of spores. I have indicated elsewhere (Subramanian, 1962) the need to apply Hughes' system, suitably modified where necessary, to those genera of the Hyphomycetes whose nomenclatural types are adequately known. I believe that an analysis of the spore types seen in the Hyphomycetes should be the first step towards arriving at an arrangement of these genera.

What then are the basic spore types which may be recognized for purposes of classification ? I believe that the following six distinct morphological categories of spores (see Subramanian, 1962) may be recognized :

1. the *blastospore*, formed as a blown-out end from any cell on a fertile hypha or, where spores develop in acropetal chains, from the previously formed spore as well ;
2. the *gangliospore*, developed by the transformation of the swollen tip of a hypha into a spore : a spore initial may or may not be delimited ;
3. the *phialospore*, abstricted from the tip of a phialide in succession, exogenous or endogenous, sometimes grouped in false heads at the tips of the phialides, sometimes forming basipetal chains. The phialospores are usually thin-walled. The phialide is a unicellular structure which is usually terminal on simple or branched conidiophores and is oval to sub-cylindrical to flask-shaped or subulate, often

with a distinct basal swelling and a narrow distal neck, with or without a terminal collarette ;

4. the *porospore*, formed through minute terminal or lateral pores on the wall of the conidiophores : such spores are usually rounded at the base and even in contour except for a basal pore corresponding in position to its point of attachment to the conidiophore ;

5. the *arthrospore*, formed as a result of septation and breaking up of simple or branched hyphae ;

6. the *meristem-arthrospore*, formed at the tip of the conidiophore which remains meristematic, and differentiated in basipetal succession: such spores may or may not form chains. The conidiophore is sometimes poorly differentiated and its tip imperceptibly merges with the chain of conidial initials which exhibit a gradual maturation towards the distal end of the chain.

A seventh spore type, the *spiculospore* (Subramanian, 1962) may also be delimited: such a spore is formed at the tip of a pointed structure often elongate and so resembling a spike, as in *Hirsutella* and *Akanthomyces*. Further work appears necessary, however, before this spore category can be accepted for any formal taxonomic grouping. Besides these, an eighth spore type, the *chlamydospore* (Fig. 39), may also be recognized. The chlamydospore is a thick-walled thallospore formed from pre-existing elements of the vegetative hyphae (and sometimes of spores) and biologically serving for perennation and not meant for dispersal. In contrast to the other seven spore types delimited here, which are "dispersal spores" the chlamydospore is a "sedentary spore" (Gregory, 1952); it is found in all groups of fungi and is not of particular taxonomic significance even in the delimitation of genera.

It has been suggested (Subramanian, 1962) that, on the basis of spore types, the Hyphomycetes may be divided into six Families as follows:

1. *Torulaceae* : Hyphomycetes producing blastospores. Type genus *Torula* Pers. ex Fries.
2. *Bactridiaceae*: Hyphomycetes producing gangliospores. Type genus *Bactridium* Kunze ex Fries.
3. *Tuberculariaceae* : Hyphomycetes producing phialospores. Type genus *Tubercularia* Tode ex Fries.
4. *Helminthosporiaceae* : Hyphomycetes producing porospores. Type genus *Helminthosporium* Link ex Fries.
5. *Geotrichaceae* : Hyphomycetes producing arthrospores. Type genus *Geotrichum* Link ex Sacc.
6. *Coniosporiaceae* : Hyphomycetes producing meristem-arthrospores. Type genus *Coniosporium* Link ex Fries.

The main purpose of this paper is to present the further classification of the Hyphomycetes at the sub-family level.

Although the basic spore types already referred to have been delimited on the basis of their mode of initiation and development, certain well-defined differences in spore development within each of these spore types can be recognized. Thus, there can be:

1. production of a *single solitary spore*, terminating the growth of the conidiophore ;
2. production of *successive solitary spores* by
   (a) meristematic activity of a sporogenous cell such as a phialide ;
   (b) proliferation of the conidiophore through scar of fallen spore ;
   (c) sympodial growth of the conidiophore and formation of spores repeatedly from new growing points produced sympodially ;
3. production of *successive spores in chains* by
   (a) acropetal budding (acropetal chains) ;
   (b) meristematic activity of the conidiophore tip or sporogenous cell such as a phialide (basipetal chains) ;
   (c) sympodial growth of the conidiophore and formation of spores repeatedly from new growing points : basipetal chains different in ontogeny from those of 3(b).

Although in 3(a) the spores are formed in acropetal chains and the younger spores are usually found towards the tips of the chains, in some Hyphomycetes the spores in the chain may mature from the apex of the chain backwards. It may be noted that these different modes in spore formation are primarily derived from two components : (i) the behaviour of the conidiophore, and (ii) the presence or absence of sporogenous cells and their behaviour when present. The growth of the conidiophore may be terminated by the production of a solitary spore or spore chain formed by acropetal budding. In the formation of these acropetal chains, the conidiophore is not involved except for the formation of one primary spore which is the oldest and the lowest in position in the chain. However, in the formation of basipetal chains of spores, continued activity of a conidiophore or a sporogenous cell is always involved. In the same way, production of successive spores, either solitarily or in chains, is made possible only by the meristematic activity of the conidiophore tip or of a sporogenous cell such as a phialide, or the proliferating behaviour or sympodial growth of conidiophores except, of course, for the formation of acropetal chains of spores already referred to. The term "sporogenous cell" can be applied to any spore-bearing cell, but it is better to restrict its application to a spore-bearing cell which is morphologically distinguishable from other ordinary sporiferous cells of conidiophores or hyphae. Their presence may be significant. Sporogenous cells may be simple or may be formed in acropetal chains. In the case of species of *Arthrinium* and *Dictyoarthrinium* the conidiophore may be interpreted as producing a chain of sporogenous cells in basipetal order although it can be interpreted also as a conidiophore with a basal elongating region. In the latter case it would be a *basauxic conidiophore* as suggested by Hughes (1953a). This is yet another feature of the conidiophore which is significant, although apparently not very common. These are some of the characters of the conidiophore which appear to be of value in classification since they are closely connected with features in the development of spores which are suggested here as a basis for classification. Characters of the conidiophore such as their arrangement or aggregation to form sporodochia or synnemata, and their branching in various ways, both of which are not closely connected with the initiation of spore development, and also the arrangement of sporogenous cells on conidiophores are perhaps of subsidiary importance in the subdivision of the Families into groups. These and other characters would, however, be of value in classification at the level of the genus and subgeneric taxa.

Yet another character which is important is the mode of insertion of the spore on the conidiophore. It is noteworthy that Costantin (1888) attached importance to this in a classification he proposed for over one hundred genera now placed in the Mucedinaceae and the Dematiaceae of Saccardo. The presence of a separating cell separating the spore from the conidiophore is a feature seen in some Hyphomycetes. Such separating cells may be seen in forms producing blastospores and gangliospores. Although their significance is not clear, their presence would be of taxonomic value. Spores may be acrogenous or acropleurogenous; they may be exogenous or produced endogenously. The endogenous type of development may be seen in many forms classified in the Tuberculariaceae and in some of the Geotrichaceae, as defined here.

I believe that all these characters may be usefully employed in classification of the Families delimited here into Sections, of which a summary is given below with suitable examples and illustrations. No formal taxonomic groups are proposed, but only an attempt is made to delimit a number of Sections which I believe would permit suitable disposition of the majority of the genera adequately known.

Family 1. TORULACEAE Corda emend. Subram., 1962, Curr. Sci., 31:410 Corda, 1837, Icon. fung. 1:8.

The family is divided into 13 Sections:

Section I: The main feature of the forms placed in this Section is the presence of a "separating cell" separating the spore from the conidiophore. The spores may be solitary, e.g. *Beltrania* Penzig (Fig. 1), *Beltraniella* Subram., or in simple or branched acropetal chains, e.g. *Bahusandhika* Subram. (Fig. 3). The spores may be *terminus spores* (Hughes, 1953a) as in *Conoplea* Pers. ex Fries (Fig. 2). They may be acrogenous or acropleurogenous. When in chains, the spores are separated from each other by distinct separating cells.

Section II: The hallmark of this Section is the production of spores in basipetal chains which are the result of the sympodial growth of the conidiophore and repeated formation of spores, e.g. *Trichothecium* Link ex Fries (Fig. 4).

Section III: The spores are terminus spores that are mostly solitary and are produced at the tip of the conidiophore and its sympodially formed successive growing points; they are pointed or apiculate at their point of attachment to the conidiophore, e.g. *Harpographium* Sacc., *Drumopama* Subram., *Tharoopama* Subram., *Tritirachium* Limber, *Beauveria* Vuill. (Fig. 5).

Section IV: Similar to Section III except that, instead of being pointed or apiculate at the base, the spores have a distinct flat basal scar, e.g., *Pleurophragmium* Cost. (Fig. 6), *Polythrincium* Kunze & Schm. ex Fries. The scars on the conidiophores are also flattened.

Section V: The spores are borne on sporogenous cells which may or may not be vesicle-like, e.g. *Dwayaloma* Subram., *Nigrospora* Zimm. (Fig. 7), *Zygosporium* Mont. (Fig. 8). The sporogenous cells may sometimes be formed in acropetal chains, e.g. *Sadasivania* Subram. (Fig. 9).

Section VI: The spores are developed acrogenously or acropleurogenously in simple or branched acropetal chains and mature in acropetal order, e.g. *Torula* Pers. ex Fries (Fig. 10), *Septonema* Corda, *Cladosporium* Link ex Fries, *Lacellina* Sacc., *Lacellinopsis* Subram.

Section VII: The spores are formed in acropetal chains as in Section VI, but mature from the apex backwards in the chains, e.g. *Periconia* Tode ex Schw. (Fig. 11), *Dwayamala* Subram.

Section VIII: The spores are produced in basipetal chains, without any sympodial growth of the conidiophore as in Section II, e.g. *Scopulariopsis* Bain. (Fig. 12). The conidiophores (*annellophores*) show annellations.

Section IX: The spores are produced successively from the tip of the conidiophore by proliferation, but do not form chains; the conidiophores are annellophores showing typical annellations, e.g. *Annellophora* Hughes (Fig. 13), *Stigmina* Sacc., *Septoidium* Arnaud.

Section X: Similar to Section IX except that the conidiophores do not show typical annellations, but repeated proliferation of the conidiophore often gives it a beaded appearance, e.g. *Sporidesmium* Link ex Fries (Fig. 14), *Deightoniella* Hughes, *Edmundmasonia* Subram., *Endophragmia* Duv. & Maire.

Section XI: The spores are produced acropleurogenously on conidiophores. Some of the forms classified in Section VI may also show this type of development; however, the spores of Section VI form chains, whereas those of Section XI are solitary, e.g. *Oedocephalum* Preuss (Fig. 15), *Botrytis* Pers. ex Fries, *Cephaliophora* Thaxter (Fig. 16).

Section XII: The diagnostic feature of the forms classified here is the characteristic basal elongation of the conidiophore. These conidiophores are termed *basauxic* conidiophores by Hughes (1953a). The conidiophore may arise from a flask-shaped or barrel-shaped basal cell; the basal cell may bear a terminal, often atypical, spore prior to the elongation of the conidiophore. The spores are solitary and are borne apically and in whorls laterally between characteristically thickened septa of the conidiophore. The oldest conidia are usually produced at the apex and the youngest near the base of the elongating conidiophore, e.g. *Arthrinium* Kunze ex Fries, *Dictyoarthrinium* Hughes (Fig. 17).

Section XIII: The salient feature of the forms placed here is the characteristic development of an inverted funnel-like cell wall within the funnel-shaped apex of the conidiophore, resulting in a characteristic, conspicuous scar which is typically cupuliform, as in *Hansfordiella* Hughes (Fig. 18). The spores are solitary; a succession of these may sometimes be produced sympodially or by proliferation of the conidiophore.

Family 2. BACTRIDIACEAE Corda emend. Subram., 1962, Curr. Sci. 31: 410. Corda, 1837, Icon. fung., 1: 12.

The family is divided into 4 Sections.

Section XIV: The spores are subtended by separating cells, e.g. *Balanium* Wallr. (Fig. 20), *Anguillospora* Ingold (Fig. 21), *Tetrachaetum* Ingold.

Section XV: The growth of the conidiophore is determinate and is terminated by the production of a solitary apical spore. The spore initial is invariably cut off early from the parent cell or conidiophore and the wall of the spore is continuous with that of the conidiophore on which it is attached, e.g. *Bactridium* Kunze ex Fries (Fig. 24), *Dictyodesmium* Hughes (Fig. 19), *Petrakia* Sydow, *Articulospora* Ingold.

Section XVI: Similar to Section XV, but in contrast, the spores are seldom deciduous. They are always terminal. Mostly they remain attached to the hypha on which they are borne and, if detached, part of the hypha on which they are borne remains attached to them, e.g. *Aegerita* Pers. ex Fries, *Chlamydomyces* Bain., *Monodictys* Hughes (Fig. 22), *Pithomyces* Berk. & Br. (Fig. 23).

Section XVII: The spores are *isthmospores* (see Hughes, 1953b), e.g. *Isthmospora* Stevens (Fig. 25).

Family 3. TUBERCULARIACEAE Ehrenberg emend. Subram., 1962, Curr. Sci., 31: 410. Ehrenberg, 1818, Sylv. mycol., p. 12.

The family is divided into 2 Sections.

Section XVIII: All spores are endogenous, e.g. *Thielaviopsis* Went, *Sporoschisma* Berk. & Br., *Chalara* (Corda) Rabenh. (Fig. 26), *Endosporostilbe* Subram.

Section XIX: Usually only the first-formed spore is truly endogenous, e.g. *Tubercularia* Tode ex Fries (Fig. 27), *Memnoniella* Hoehnel (Fig. 28) *Fusarium* Link ex Fries, *Cephalosporium* Corda.

Family 4. HELMINTHOSPORIACEAE Corda emend. Subram., 1962, Curr. Sci., 31:410. Corda, 1837, Icon. fung., 1:12.

The family is divided into 2 Sections.

Section XX: The spores are produced acrogenously and acropleurogenously, e.g. *Helminthosporium* Link ex Fries (Fig. 29). The conidiophore may proliferate through scar of fallen spore and produce further spores at successively higher levels, e.g. *Stemphylium* Wallr., *Corynespora* Güssow (Fig 30). Sometimes they may be formed in acropetal chains, e.g. *Corynespora*.

Section XXI: Similar to Section XX, but the spores are always acrogenous and successive production of spores is by sympodial growth of the conidiophore. Thus the spores are terminus spores. The spores may be solitary, e.g. *Drechslera* Ito, *Curvularia* Boedijn, *Dendryphiopsis* Hughes ((Fig. 31), or may form simple or branched acropetal chains, e.g. *Dendryphion* Wallr. (Fig. 32), *Alternaria* Nees ex Wallr.

Family 5. GEOTRICHACEAE Subram., 1962, Curr. Sci., 31:410.

The family is divided into 2 Sections.

Section XXII: The spores are differentiated endogenously within the outer wall of the hyphae, the hyphae then fragmenting into units; each unit carries at either end a projecting frill formed by the hyphal wall, e.g. *Coremiella* Bubak & Krieger (Fig. 33), *Bahusakala* Subram. (Fig 34).

Section XXIII: The spores are not formed endogenously, but by septation and simple fragmentation, e.g. *Geotrichum* Link ex Sacc. (Fig. 35).

Family 6. CONIOSPORIACEAE Subram., 1962, Curr. Sci., 31:410.

Only one Section is recognized.

Section XXIV: The spores are developed basipetally usually from poorly differentiated conidiophores which have a meristematic region towards the tip so that the conidiophore merges imperceptibly with the spore initial. The spores may be solitary or, more usually, in chains, e.g. conidial *Erysiphe* (Fig. 36), *Coniosporium* Link ex Fries (Fig. 37).

Apart from the twenty-four Sections classified in the six Families, a separate Section (XXV) is tentatively provided to accomodate forms producing spiculospores, e.g. *Insecticola* Mains (Fig. 38), but these require further study.

A tentative Key to the Families and Sections is given below.

Key to Families and Sections

Producing blastospores	*Torulaceae*
Conidiophores of the basauxic type	Section XII
Conidiophores not of the basauxic type	
Separating cells present	Section I
Separating cells absent	
Conidiophores with characteristic cupulate scars	Section XIII
Conidiophores without characteristic cupulate scars	
Spores in acropetal chains	
Spores maturing acropetally	Section VI
Spores maturing from the apex backwards in the chains	Section VII
Spores not in acropetal chains	
Spores borne on distinct sporogenous cells	Section V
Spores not borne on distinct sporogenous cells	
Spores produced acrogenously	
Spores in basipetal chains	
Chains formed by sympodial growth of conidiophore	Section II
Chains formed by meristematic activity of conidiophore tip	Section VIII
Spores not in chains	
Spores terminus spores	
Spores pointed or apiculate at base ; scars on conidiophores minute	Section III
Spores with flattened basal scars ; scars on conidiophores flattened	Section IV
Spores not terminus spores	
Conidiophores showing annellations	Section IX
Conidiophores without annellations but often having a beaded appearance	Section X
Spores produced acropleurogenously	Section XI
Producing gangliospores	*Bactridiaceae*
Separating cells present	Section XIV
Separating cells absent	
Spores isthmospores	Section XVII
Spores not isthmospores	
Spore initial cut off by septum early, spores detached easily	Section XV
Spore initial usually not cut off early ; spores not detached easily, but when shed part of the conidiophore remaining attached to them	Section XVI
Producing phialospores	*Tuberculariaceae*
Spores endogenous	Section XVIII
Only the first formed spore usually endogenous	Section XIX
Producing porospores	*Helminthosporiaceae*
Successive spores usually produced by proliferation of conidiophore through scars of fallen spores	Section XX
Successive spores usually produced by sympodial growth of conidiophores	Section XXI
Producing arthrospores	*Geotrichaceae*
Spores differentiated endogenously within the outer wall of the hypha	Section XXII
Spores not differentiated endogenously	Section XXIII
Producing meristem-arthrospores	*Coniosporiaceae*
a single Section	Section XXIV
Producing spiculospores	(Section XXV)

Notwithstanding what has been proposed, the problem of classifying certain Hyphomycetes producing spores of more than one basic type would remain. There does not appear to be an ideal solution for this problem (Subramanian, 1962). The scheme proposed here is tentative and will doubtless have to be amended to include examples not known to me and not covered by the Sections or to reclassify those which have probably been misinterpreted by me. There is no pretence of having aimed at the elucidation of natural relationships either. Tubaki (1958) has discussed critically the possibility of ascertaining the real relationships of the members of the nine Sections which he recognized amongst the Hyphomycetes with members of the various Families of the Ascomycetes and the Basidiomycetes. However, while correlations between the nature of the Hyphomycete imperfect stages with the Perfect stages with which they are known to be connected at first sight may be interpreted to convey certain relationships, an analysis of the distribution of the various basic Hyphomycetous spore types in the different Orders of the Ascomycetes and the Basidiomycetes (see Table I), for instance, would soon dispel hopes of a satisfactory solution of the taxonomic problem of the Hyphomycetes by this approach. It is also significant that in ascomycetous or basidiomycetous fungi which are considered to be closely related and are therefore classified together in a system of classification, different Hyphomycetous spore types are seen (Table II). Blastospores, gangliospores, Phialospores and arthrospores are seen in

TABLE I

Occurrence of the different basic types of Hyphomycetous spores in the Ascomycetes and the Basidiomycetes

Blastospores :	ASCOMYCETES : Endomycetales, Eurotiales, Hemisphaeriales Hysteriales, Dothideales, Hypocreales, Sphaeriales, Pezizales, Helotiales BASIDIOMYCETES : Ustilaginales, Polyporaceae, Thelephoraceae
Gangliospores :	ASCOMYCETES : Eurotiales, Hemisphaeriales, Hypocreales, Sphaeriales, Pezizales BASIDIOMYCETES : Thelephoraceae
Phialospores :	ASCOMYCETES : Eurotiales, Hypocreales, Sphaeriales BASIDIOMYCETES : Agaricaceae
Porospores :	ASCOMYCETES : Sphaeriales
Arthrospores :	ASCOMYCETES : Eurotiales, Helotiales BASIDIOMYCETES : Thelephoraceae
Mersitem arthrospores :	ASCOMYCETES : Erysiphales, Hysteriales
Spiculospores :	ASCOMYCETES :Hypocreales, Sphaeriales

TABLE II

The Sections into which the Hyphomycete imperfect stages of the Ascomycetes and the Basidiomycetes may be classified, as far as is known

Endomycetales :	Blastospores (Sections 4, 6)
Eurotiales :	Blastospores (Sections 6, 11) Gangliospores (Section 15) Phialospo res (Section 19) Arthrospores (Section 22)
Erysiphales :	Meristem arthrospores (Section 24) Blastospores (Section 13)
Hemisphaeriales :	Gangliospores (Section 17)
Hysteriales :	Blastospores (Section 6) Meristem arthrospores (Section 24)
Dothideales :	Blastospores (Sections 3, 4)

Hypocreales :	Blastospores (Sections 3, 8, 11, 12) Gangliospores (Sections 15, 16) Phialospores (Section 19) Spiculospores (Section 25)
Sphaeriales :	Blastospores (Sections 3, 4, 6, 9, 10, 11) Gangliospores (Section 15) Phialospores (Sections 18, 19) Porospores (Sections 20, 21)
Pezizales :	Blastospores (Sections 3, 11) Gangliospores (Section 16)
Helotiales :	Blastospores (Sections 6, 11) Arthrospores (Section 23)
Ustilaginales :	Blastospores (Section 6)
Thelephoraceae :	Blastospores (Section 11) Gangliospores (Section 16) Arthrospores (Section 23)
Agaricaceae :	Phialospores (Section 19)
Polyporaceae :	Blastospores (Section 11)

both the Ascomycetes and the Basidiomycetes. While it is interesting to note that porospores and meristem arthrospores are so far known to be associated only with Perfect stages in the Ascomycetes, similar clear-cut correlations are not available in the majority of connections known. Imperfect forms corresponding to those classified in Section XVI for example, are seen in such widely separated groups as the Eurotiales, the Hypocreales, the Pezizales and the Thelephoraceae. Other similar examples would be apparent from the data presented in Table II. It is obvious that any arrangement of the Hyphomycetes based on speculations regarding their probable relationships to Perfect stages would be beset with serious difficulties, especially in view of the fact that we do not yet have a satisfactory "phylogenetic" classification of the Perfect forms. Our knowledge of the interrelationships of the forms classified in the Ascomycetes and the Basidiomycetes is not such as would permit generalizations regarding the interrelationships of the Hyphomycetes as a whole. For the present we shall have to be content with an artificial arrangement of the genera of the Hyphomycetes in which those which are basically similar in certain features which are considered significant are brought together. Even if it were possible to evolve a perfect classification of the Ascomycetes and the Basidiomycetes, it may still be that we may never be able to predict the likely niche of any Hyphomycete in a Perfect classification. All the same, we have a good deal yet to do towards the detailed study of generic types in this group which, if carried out with precision and thoroughness, would provide the basis for a complete and improved classification of the Hyphomycetes which is urgently needed.

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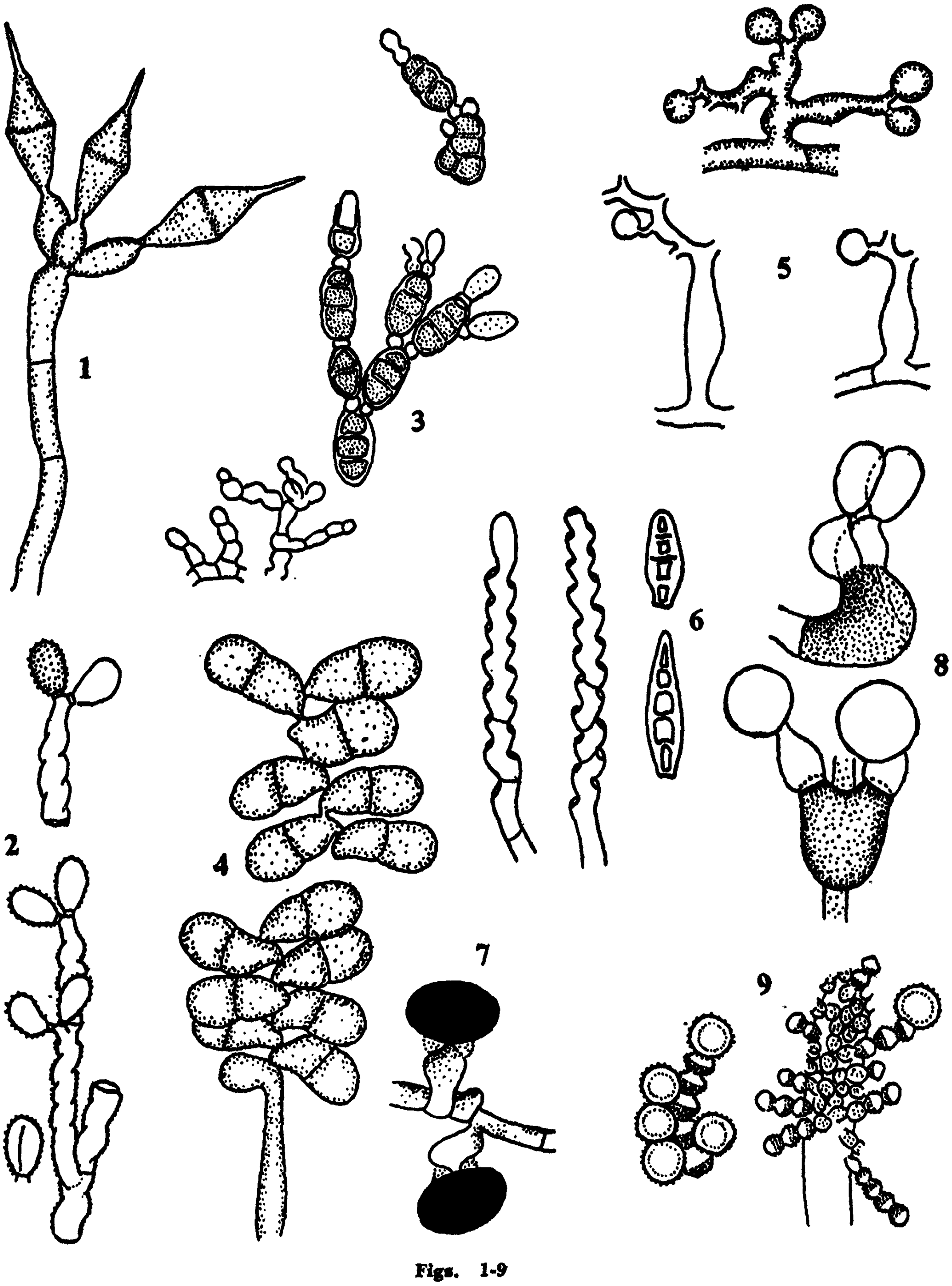
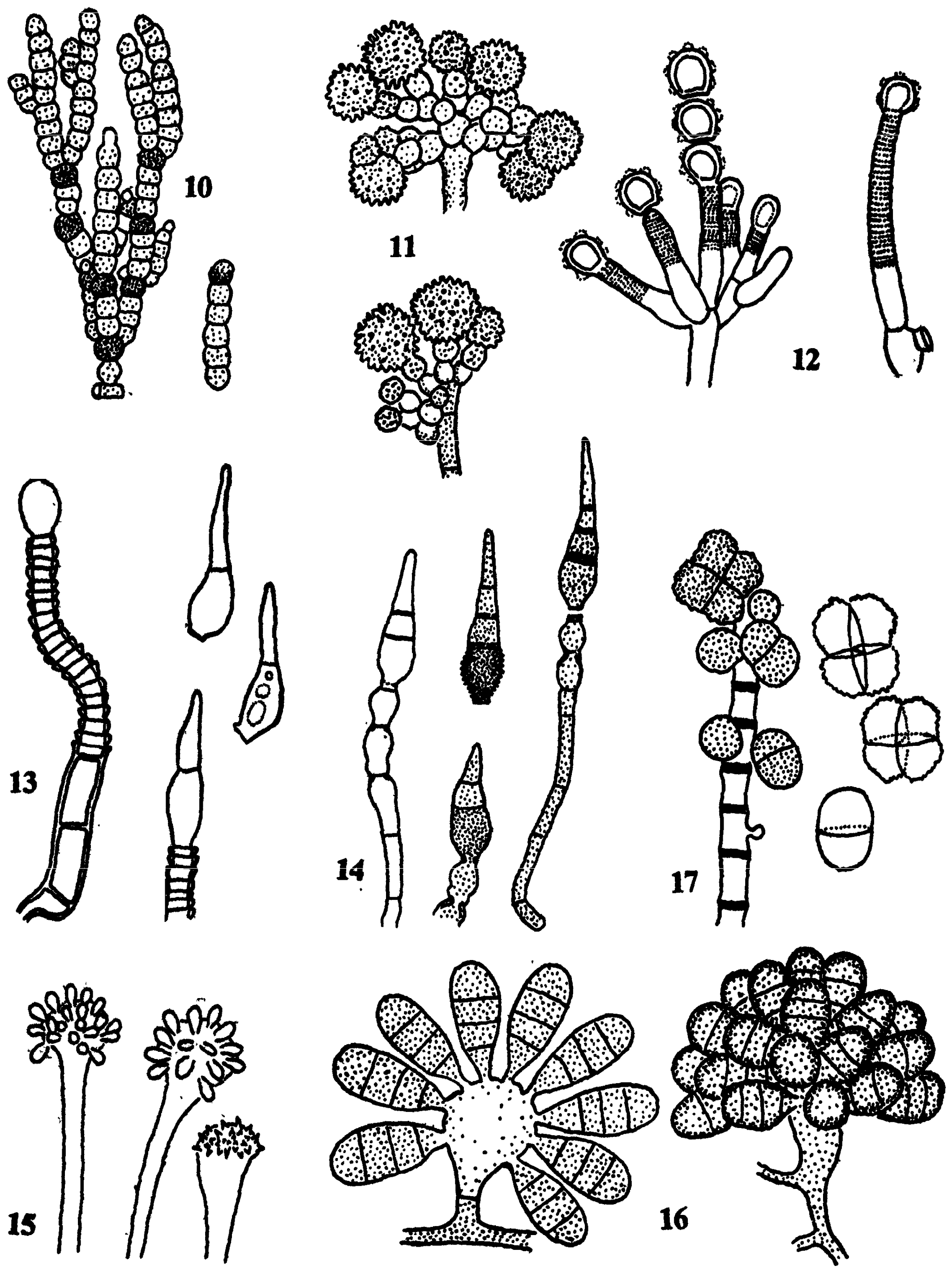


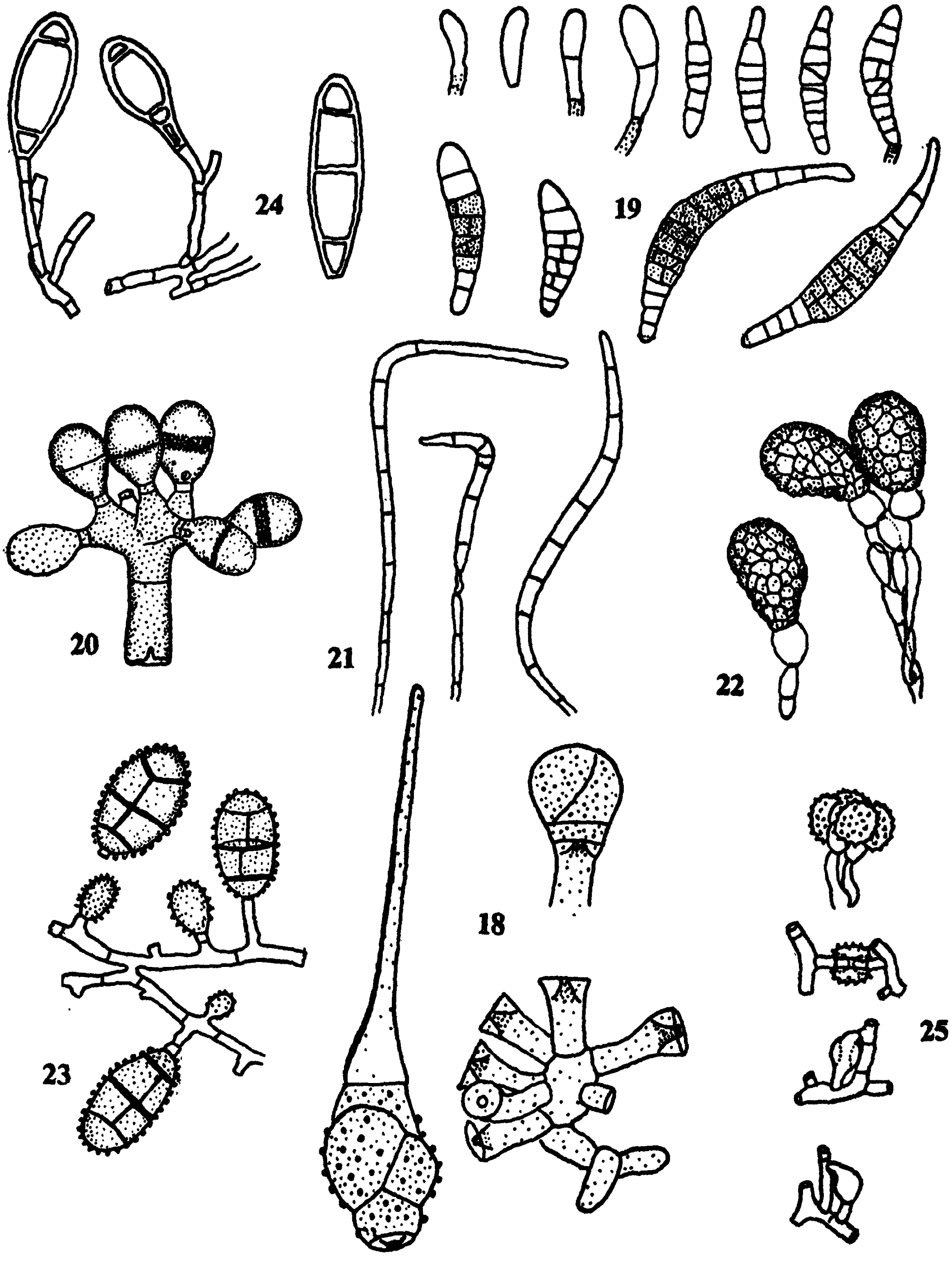
Figs. 1-9

Illustrating genera of the Torulaceae : 1. *Beltrania* ; 2. *Conoplea* ; 3. *Bahusandhika* ; 4. *Trichothecium* ; 5. *Beauveria* ; 6. *Pleurophragmium* ; 7. *Nigrospora* ; 8. *Zygosporium* ; 9. *Sadasivania*. (1, 4 after Tubaki ; 2, 6 after Hughes ; 5 after Lefebvre ; 7 after Mason ; 3, 8, 9 after Subramanian)



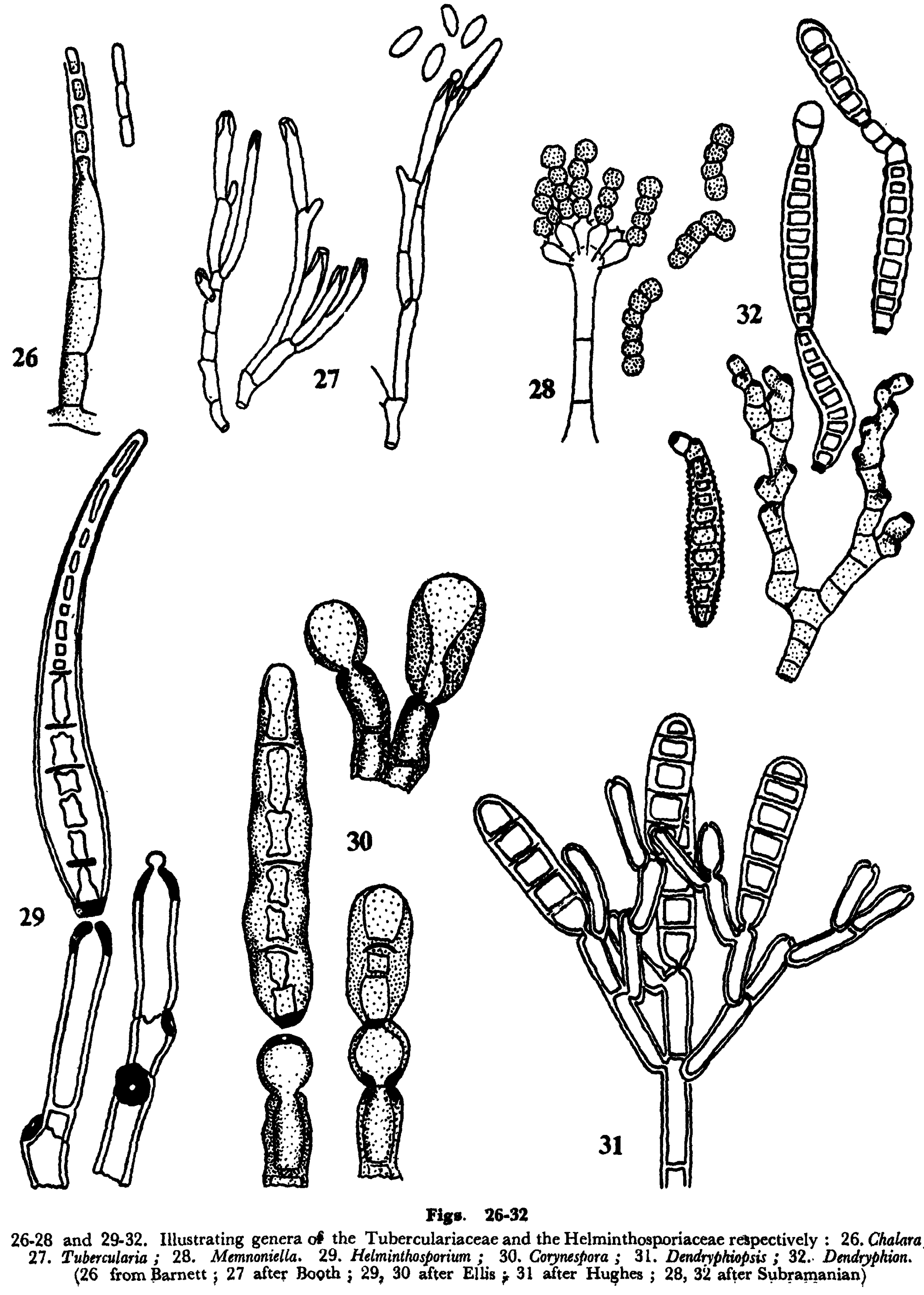
Figs. 10-17

Illustrating genera of the Torulaceae : 10. *Torula* ; 11. *Periconia* ; 12. *Scopulariopsis* ; 13. *Annellophora* ; 14. *Spori-desmium* ; 15. *Oedocephalum* ; 16. *Cephaliophora* ; 17. *Dictyoarthrinium*. (10, 12, 15 after Hughes ; 11 after Mason and Ellis ; 14 after Ellis ; 16 from Barnett ; 13, 17 after Subramanian)



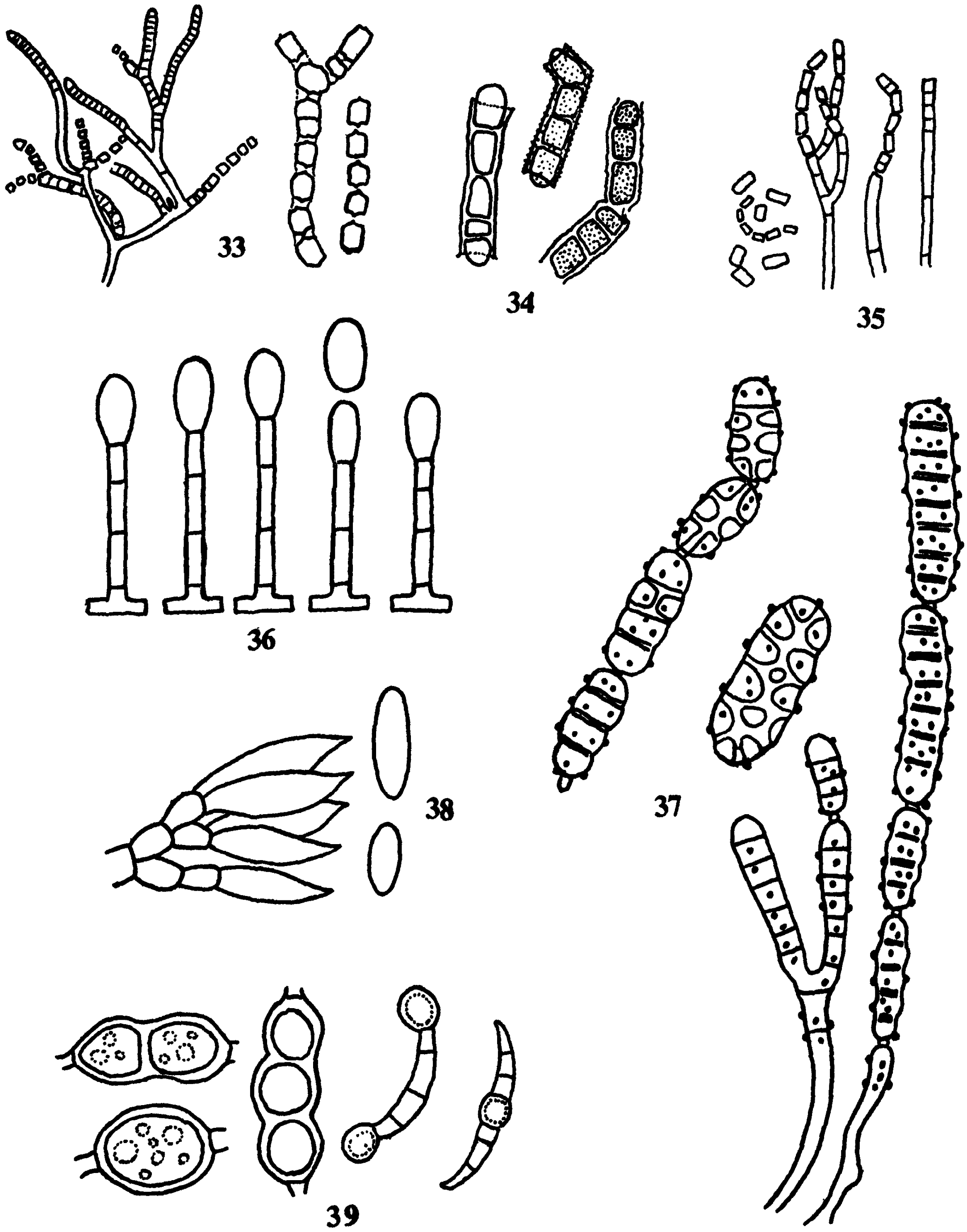
Figs. 18-25

18. *Hansfordiella* (Torulaceae). 19-25. Illustrating genera of the Bactridiaceae: 19. *Dictyodesmium*; 20. *Balanium*; 21. *Anguillospora*; 22. *Monodictys*; 23. *Pithomyces*; 24. *Bactridium*; 25. *Isthmospora*.
(18 after Deighton; 19, 22, 24, 25 after Hughes; 20 after Hughes and Hennebert; 21 from Barnett; 23 from Ellis).



Figs. 26-32

26-28 and 29-32. Illustrating genera of the Tuberculariaceae and the Helminthosporiaceae respectively : 26. *Chalara;* 27. *Tubercularia ;* 28. *Memnoniella.* 29. *Helminthosporium ;* 30. *Corynespora ;* 31. *Dendryphiopsis ;* 32. *Dendryphion.* (26 from Barnett ; 27 after Booth ; 29, 30 after Ellis ; 31 after Hughes ; 28, 32 after Subramanian)



Figs. 33-39

Illustrating genera of the Geotrichaceae : 33. *Coremiella* ; 34. *Bahusakala* ; 35. *Geotrichum*. 36-37. Illustrating genera of the Coniosporiaceae : 36. conidial *Erysiphe* ; 37. *Coniosporium*. 38. *Insecticola* (Section 25). 39. Chlamydospores of *Fusarium*. (33, 35, 37 after Hughes ; 36 after Yarwood ; 38 from Barnett ; 34, 39 after Subramanian)