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STUDIES ON INDIAN HELIOLINAE

BY

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CERTIFICATE

This is to certify that the thesis entitled "Studies on Indian Meliolinae" submitted in partial fulfilment of the requirements for the award of the Degree of Doctor of Philosophy in Mycology and Plant Pathology, Faculty of Post-Graduate School, Indian Agricultural Research Institute, New Delhi, is a faithful record of the bonafide research work carried out by Shri J.N. Kapoor, under my guidance and supervision. No part of the thesis has been submitted for any other degree or diploma.

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C O N T E N T S

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I. INTRODUCTION

The Meliolinae, popularly known as sooty molds or black mildews, comprise the phaeophragmous genera of the Meliolaceae. These fungi are obligate parasites having dark superficial mycelium which produces both capitate and mucronate hyphopodia (except in Meliolina). The Meliolinae as a rule, are confined to leaves but in severe attacks tender twigs may also be involved. The species forming dense colonies are conspicuous and hence often collected, but some species have very thin colonies, scarcely visible to the naked eye and hence escape attention. These fungi are widely distributed, abounding in the warmer regions of the world, but extend outwards from these into the Southern U.S.A. and Chile in America, to almost the Southern tip of Africa, to Central Europe and Scotland, to Japan, i.e. to cooler regions. A large number of species have been collected in Tropical America by F.L. Stevens, R. Ciferri and H. Sydow. Several regions in South America are still unexplored. Collections from South Africa were made mainly by MacOwen and Doidge. The tropical Africa is still largely unexplored for these fungi, except Sierra Leone, Ghana (Gold Coast) and Uganda, where collections were made mainly by Deighton and Hansford. The most systematically explored parts of Asia are Philippine Islands, and Java, while only a few records have been made from India, Malaya, China and Japan. Few or no records have yet been made from the islands of the Indian Ocean.

Within the tropics these fungi are most common on scrub vegetation, and in the dense tropical forests, they are comparatively rare on the under growth and lower trees, though probably quite common on the inaccessible top canopy. The group is absent from the arid regions of the subtropics.

Many species are known only from single collection and are apparently of very limited geographical distribution, but on the other hand some species viz. Meliola mangiferae Earle, Meliola palmicola Winter, Meliola trichostroma (Kunze) Toro, etc. are very widely distributed through the tropics, occurring on their host plants wherever these grow.

Many specimens of Meliola and related genera are frequently parasitised by other fungi. These parasites usually inhibit or even completely prevent the development of setae and perithecia of their hosts. Much confusion in morphology and taxonomy has resulted from failure to discriminate between the members of meliolinae and its numerous parasites. The pycnidia and conidiophores and even the perithecia of the parasites on meliolinae have been repeatedly described as the organs of Meliola. Due to such errors, Helminthosporium, Arthrobotryum etc, have been ascribed as the conidial stage of Meliola. This error occurs throughout the Gaillard's Monograph and in other early descriptions and in quite a number of recent descriptions. Most species merely send haustoria into the epidermis, cause no visible ill effect upon the host. The more strongly parasitic species e.g. Meliola morbosa Stev., Meliola parasitica Stev. may cause definite yellow to brown areas beneath their colonies.

The ascospore on germination from the lower cell, forms a capitate hyphopodium. These capitate hyphopodia are short lateral branches of the mycelium, closely adpressed to the host cuticle, and each consists of a short stalk cell bearing a single terminal or 'head cell'. Each capitate hyphopodium forms only one haustorium. The next stage in germination of ascospore is the formation of first hyphae, from the same or a different cell of the parent spore. Each cell of the hypha or hyphae thus produced forms either capitate hyphopodia or gives rise to one or two branches, according to the species. As the mycelium develops from the germinating spore, it becomes septate, and forms hyphopodia. The mucronate hyphopodia are single celled, usually swollen below and attenuated more or less suddenly into a short or long 'neck' which stands invariably erect on the leaf surface; in young hyphopodia the neck is closed but opens with maturity. There is no evidence of the formation of any kind of spermatium or 'conidium', within these organs, nor of the extrusion of any body or substance from apparently open ends. The function of mucronate hyphopodia is a complete mystry.

The mycelial setae arise as lateral outgrowths from usually the middle of mycelial cells, and almost turn away from the host surface to continue upward growth. The function of the mycelial setae in Meliola is quite unknown.

No form of asexual reproduction by conidia is known for any species of Meliolinae, all such cases reported by workers in the past have proved to be based on confusion of

various hyperparasites with their Melioline hosts.

Graff (1932) has studied the development of perithecia in Meliola circinans Earle. Here the sexual organs arise as branches from the lower surface of a flat, subradiate, circular shield developing from the terminal cell of a hyphopodium, on the superficial mycelium. They consist of a short stalked, unicellular ascogonium and a similar antheridium. Hyphae from the stalk cell of the ascogonium form a perithecial wall. The stromal shield increases in thickness and extends down the sides and partially under the base of perithecium. The ascogonium elongates into a filament of 3 or 4 cells, and from two or more of these cells, uninucleate ascogenous hyphae are produced. The centrum is composed of a pseudoparenchymatous tissue in which the ascogenous hyphae are embeded. The asci form a single layer in the base of the perithecium and are interspersed with a few paraphyses. The details of internal structure at the various stages of growth of perithecium, as well as the origin of asci are vague and await further investigation. Until these are accurately known, the relationship of Meliolinae to other orders of Ascomycetes remains doubtful.

It was felt that there undoubtedly exist a large number of species of Meliolinae, which have not yet been collected from India. There are a few scattered records of Indian Meliolinae, notably by Sydow and Butler, and Thirumalachar who in collaboration with Dr. Hansford has described a large number of Indian species. No consolidated

work on this group relating to Indian species exists, as also there have been some taxonomic revisions particularly at the generic level, the time was therefore, considered opportune that the members of this group be restudied and a consolidated account presented. Since the hyperparasites have been found to be frequently associated with the members of this group and are responsible for the variation in the morphology of these fungi, it was considered proper to include their account wherever possible.

In this work, standardized descriptions have been drawn up from my own preparations from the type specimens and this has been indicated under the head "Material examined". In a few cases, where the type specimen was not available for study, authentic Indian specimens were studied and particulars of type have been given under the head "Type" in the text. The location of the type has also been indicated. Where Indian specimens were not available, the descriptions and drawings were taken from the original publication, and this has been indicated at the appropriate places in the text. Description of each species is accompanied by camera lucida drawings from my own preparations of available representative specimens. The drawings were made at a magnification of x540 times, unless otherwise indicated on the plates. The description of each species is followed by host range, geographical distribution and remarks wherever found necessary. Specimens available in the Herbarium Cryptogamae Indiae Orientalis are indicated in the text by H.C.I.O. numbers.

The species are arranged according to the family of the host-plants on which they occur. The host families in turn are arranged alphabetically under the respective classes viz., Dicotyledons, Monocotyledons and Gymonosperms. Where more than one species occurs on a single host family, a key to the species is also provided. A list of hosts citing correct names of host species has also been included. The corrections are based on the list published by Dr. M.B. Raizada in 1958.

For each species, "Beeli formula" as modified by Hansford (1961) is given after the name and citation. This is based on the following definition.

I. Main characters

(1) Spores:

2..... 3-septate

3..... 4-septate

(2) Perithecia:

1..... Without setae or appendages

2..... Bearing larviform appendages

3..... Bearing uncinate or coiled setae

4..... Bearing straight setae

(3) Mycelial setae:

0..... Absent

1..... Simple, entire, straight

2..... Simple, uncinate or coiled

3..... Dentate or shortly furcate

4..... Branched

(4) Capitate hyphopodia:

1..... Alternate

2..... Opposite

3..... Mixed opposite and alternate

II. Measurements

(1) Spore length (maximum observed):

1..... below 20 μ

2..... 21 - 30 μ

3..... 31 - 40 μ

4..... 41 - 50 μ

5..... 51 - 60 μ

6..... Over 60 μ

(2) Spore width (maximum observed):

1..... Upto 10 μ

2..... 11 - 20 μ

3..... 21 - 30 μ

4..... Over 30 μ

(3) Perithecia (maximum diameter):

1..... Upto 100 μ

2..... 101-200 μ

3..... 201-300 μ

4..... Over 300 μ

(4) Mycelial setae (maximum length):

1..... Upto 300 μ

2..... 300-500 μ

3..... 500-1000 μ

4..... Over 1000 μ

0..... Absent

This may be illustrated by Meliola geniculata, the very first species described in this work. This species has the Beeli Formula 3131:3221. Here the numbers on the left of colon mark indicate main characters whereas those on the right show the measurements. The first digit on the left viz. "3" pertains to the septation of ascospores and indicates that the spores are 4-septate. This is followed by digit "1" showing that the perithecia have no setae or appendages. The next digit "3" means that the mycelial setae are dentate at the tips. Similarly, the last digit on the left i.e. "1" shows that the capitate hyphopodia are arranged alternately on the cells of the hyphae. In the same way the digits on the right, can be interpreted. First digit i.e. "3" indicates that ascospores are upto 40 μ long. The second digit "2" would mean that spores are between 10-20 μ wide. The third digit i.e. "2" shows that the perithecia are upto 200 μ in diameter. The last digit "1" indicates the length of the mycelial setae, which in this case is upto 300 μ. In species where variable characters are met with, they are indicated in the formula by a fraction.

For example, species having both simple and dentate mycelial setae are shown as 1/3. Thus the main characters of a species can be seen at a glance by this formula.

II. REVIEW OF LITERATURE

The genus Meliola was established by Fries in 1825. Bornett in 1851 amended the description of this genus and gave the first general discussion. He published a comprehensive account of six species then known, with excellent illustrations. Gaillard's monograph "Le Genere Meliola" in 1892, recognised 111 species, with 30 names excluded or dubious and several others as synonyms. In 1897 McAlpine in Australia described the genus Asteridella, but classified it as belonging to Microthyriales, where it was compiled in Saccardo's Sylloge Fungorum; it was not until 1954 that the type was re-examined by Hansford, who found it to belong to Meliolinae. Sydow (1914) proposed the genus Meliolina for those species of the genus Meliola which had no characteristic hyphopodia. M. cladotricha Lev. was designated as type.

The number of known species of this group increased rapidly during the period 1880-1917, and then Theissen and Sydow (1917) made the subdivision of the genus Meliola, by erection of the new genus Irene to accomodate those species having no mycelial or perithecial setae, the type being the South African species Irene inermis (K. & C.) Theiss. et. Syd.

The genus Amazonia was erected by Theissen in 1913. This comprised a few species with typically Meliola like mycelium and spores but with perithecia which are dimidiate at maturity. On account of the form of perithecia, this

genus was placed in the family Microthyriaceae but von Hoehnel (1918) has shown that under the brown shield like cover a completely closed,thin walled perithecium, exists. This can therefore, be properly regarded as a transition genus between Meliola and the Microthyriaceae.

Certain species included by Theissen and Sydow in the genus Irene, have peculiar larviform appendages on the perithecia. This was regarded by Hoehnel (1919) as a distinction of generic importance and he established for them the genus Appendiculella with A. calostroma (Desm.) Hoehn. as type species.

In 1920, Beeli gave a synopsis of 459 species including a new genus Meliclinopsis and introduced an extremely useful system of group numbers.

Dr. F.L. Stevens during the year 1927-28, published a very valuable monograph of Meliolinae based on a personal revision of almost the total number of species described till then. These species, he classified under seven genera. In addition to Amazonia, Meliola, Meliolina and Irene, he included Actinodothis Syd. with dimidiate perithecia and no free mycelium and proposed two new genera Irenopsis and Irenina. Irenopsis accomodated those species of Irene, which bore true perithecial appendages, whereas the forms that have no perithecial setae or no mycelial setae, and no larviform appendages, were assigned to the genus Irenina. Stevens considered Appendiculella Hoehn. as a synonym of Irene Theiss. & Syd., because he believed that the type species

of Irene i.e. I. inermis possessed larviform appendages.

Doidge and Sydow (1928) and Hansford (1961) re-examined several collection of Irene inermis and concluded that the so called larviform appendages were in fact merely the conoid projections of the surface cells. Doidge and Sydow (1928) however, preferred to reunite Appendiculella with Irene. Irenopsis was considered synonymous with Meliola. So, Doidge and Sydow retained only the genera Amazonia, Meliolina, Irene and Meliola.

Ciferri (1938, 1951 and 1954) in a series of papers dealing with his collections in San Domingo has accepted the Steven's genera, but gave them the inferior rank of sub-genera. These subgenera are (1) Eumeliola Cif. (2) Chaetomeliola Cif. (3) Irene (Theiss. and Syd. emend Stev.) Cif. (4) Irenopsis (Stev.) Cif. and (5) Irenina (Stev.) Cif. For differentiating the above subgenera he considered the presence of setae in mycelium as of prime importance. Presence of appendages on perithecia was considered secondary character. These subgenera were further subdivided into sections on the basis of arrangement of capitate hyphopodia, on the mycelium viz. opposita, Alternata and Composita. Ciferri (1954) also gave a long list of new combinations for species recently described under the new subgenera discussed above. Hansford (1961) has opposed this view and regarded these new combinations of Ciferri as entirely unnecessary. Hansford (1961) has brought out an uptodate monograph of this group. He is of the opinion that Appendiculella Hoehn. is distinct from Irene Theiss. and Syd., and therefore, it should

be maintained as originally defined. He further regards that the genus Irenina Stev. falls into complete synonomy with Irene Theiss. and Syd. All the species classed by Stevens as belonging to Irene sensu Stevens, in reality belong to Appendiculella Hoehn., while those of Irenina Stev. are true species of Irene Theiss. & Syd. Hansford also discovered that the genus Asteridella McAlpine is in fact a true Irene in the original sense of Theiss. and Sydow. As it was founded in 1897, it long antedates Irene. Hansford in his monograph has recognised 5 genera viz. Amazonia, Meliola, Irenopsis, Appendiculella and Asteridella and has included 1814 species so far known from the world. He arranged the species according to the families of the host plants on which they occur; these host families being arranged according to the Hutchinson's system of classification. Gordon and Shaw (1960) have recently described a new genus Diporotheca belonging to Meliolaceae, which apparently does not belong to the group Meliolinae as it has only bicelled spores.

Ryan (1926), while comparing the development of perithecia in Microthyriaceae with that of genus Meliola, observed that the perithecia in Meliola always arise from hyphopodia, whereas, in Microthyriaceae, they originate from a cell of the mycelium. The perithecia in Meliola are more or less round, never flattened. They never show the radiate character at maturity although a few species may do so when very young. In contrast to Microthyriaceae, the perithecia

in Meliola are never inverse, but always borne on the upper surface of the hyphopodium. Ragle (1930), in order to find whether the closely related genera of Meliolinae showed any constant differences in perithecial structure, studied the microtome sections of several species. His investigations revealed that in the genera Meliola, Irene, Irenina and Irenopsis, the outer tissue is one cell thick and consists of dark coloured, heavy walled cells. In Amazonia, these cells are arranged in 2 or 3 to many rows. He also observed that there was variation in the surface cells in the outer layer of the perithecial wall. Warty protuberances were present on surface structure in large majority of species in this group. These may be so prominent so as to become vermiform appendages, as found in Irene, or may become still longer, as the perithecial setae of Irenopsis. Perithecial setae were not found in Meliola and Irenina. Graff in 1932 has studied the development of perithecia in Meliola circinans Earle, as described earlier under Introduction.

The earliest Indian records of Meliolinae are by M.C. Cooke (1880, 1884) who recorded Meliola zigzag Berk. and Curt. and Meliola densa Corda. Sydow and Butler (1911) reported 3 new species viz. Meliola butleri, M. geniculata, M. indica and 11 new records from India. Sydow (1916, 1921) further reported the occurrence of Meliola opiliae Syd. and M. memecyli Syd. from India. Several specimens of sooty molds collected from India were sent by W. McRae, Imperial Mycologist to the Imperial Bureau of Mycology, London, for

the purpose of having them named. These were determined by F.L. Stevens and published in the Memoirs of the Dept. of Agric. India, 1928. This account included 2 new species viz., Meliola eugenicola and Meliola holigarnae, one new variety i.e. Meliola indica var. caryae and 5 new records. Stevens in 1933, added two more species viz., M. carissae Doidge and Irenopsis crotonis (Stev. & Tehon) Stev. to the list of Indian Meliolinae. S.N. Bal and Coworkers (1921-22) recorded Meliola cadigensis Yates, M. stenospora Winter and M. jasminicola P. Henn. from this country. Uppal, Patel and Kamat (1936) reported Meliola sacchari, M. citricola and M. psidii Fr. from Bombay. They also listed undetermined species of Meliola on Atalantia racemosa and Erythrina indica, but they did not provide any descriptions. Tunstall and Sarmah (1947) reported an undetermined Meliola sp. on tea. Hansford and Thirumalachar (1948) have described 19 new species, one new variety and 3 new records from this country. Hansford (1957) has further reported 2 more species viz., Meliola similima Ell. & Ev. var. major and M. nothopegiae Hansf. from India. Bagchee (1953) reported an undetermined species of Meliola on Shorea robusta. Agnihotrudu (1960) reported Meliola albizziae Hansf. & Deight. from Assam. Recently Mueller and Bose (1959, 1964) and Bose (1962) have described a new species viz. Irenopsis crataegi and 2 new records viz., Asteridella taxi (Sawada) Hansf. on Taxus baccata and Meliola melanochaeta Syd. on Quercus leucotrichophora.

III. THE GENERA OF MELIOLINAE

The Meliolinae are obligate parasites having dark superficial mycelium, which produces both capitate and mucronate hyphopodia (except in Meliolina). Perithecia arising as short lateral branches, then enlarging to become globose or flattened-globose. Asci several in a loose basal group, sessile or subsessile, 2-3 spored, evanascent at maturity. Ascospores dark brown, cylindric, ellipsoid or subfusoid, straight or bent, 3-4 septate, smooth.

Key to the Genera

Mycelium without hyphopodia.....Meliolina

Mycelium with hyphopodia.

Perithecia more or less flattened, covered by a radiate mycelial layer.....Amazonia

Perithecia globose, not radiate.

Mycelial setae present.....Meliola

Mycelial setae absent.

Perithecia with setae.....Irenopsis

Perithecia with larviform appendages.....Appendiculella

Perithecia with neither setae nor appendages.....Asteridella

Description of the Genera

(1) Meliolina (Lev.) Syd.

in Ann. Mycol. 12: 553, 1914.

Syn. Meliola Fries (proparte).

Mycelium superficial, brown, reticulate, without hyphopodia, but with setae. Perithecia arising from the mycelium, black, leathery or carbonaceous, without a true ostiole, with or without setae. Asci usually 2-3 spored, thick walled, ellipsoid. Ascospores brown, 3-4 septate.
Type species: M. cladotricha (Lev.) Syd.

(2) Amazonia Theiss.

in Ann. Myc. 11: 499, 1913.

Syn. Meliolaster Doidge

in Trans. Roy. Soc. South Africa, 8: 123, 1920 (non Meliolaster Hoehnel)

Actinodothis H. & P. Sydow

in Philipp. Jour. Sci. C. (Botany), 9: 174, 1914.

Mycelium superficial, with hyphopodia, Meliola like. Outer perithecial wall radial, shield like, hemispherical, inverse, inner wall pale, thin, completely closed. Asci 2-spored, clavate. Spores 4-septate.
Type species: A. psychotriae (P. Henn.) Theiss. founded on Meliola asternoides Wint. var. psychotriae. P. Henn.

(3) Appendiculella von Hoehnel.

in Sitzb. K. Akad. Wiss. Wien. Math. Naturw. Kl. 128: 556, 1919.

Syn. Irene Stev. in Ann. Mycol. 25: 420, 1927, non Theiss. & Syd., 1917.

Mycelium superficial, brown, reticulate with hyphopodia, but without setae. Perithecia arising from the mycelium, black, leathery or carbonaceous, verrucose with typical larviform appendages, without a true ostiole. Asci aparaphysate,

usually 2-3 spored, thick walled, ellipsoid. Spores brown, 3-4 septate.

Type species: A. calostroma (Desm.) Hoehn. based on Sphaeria calostroma Desm.

(4) Asteridella McAlpine

in Proc. Linn. Soc. New South Wales, 1897, p. 38.

Syn. Irene Theiss. & Syd., in Ann. Myco. 15: 194, 1917. non Stevens, 1927.

Irenina Stevens

in Ann. Mycol. 25: 411, 1927.

Mycelium superficial, brown, reticulate, with hyphopodia, but without setae. Perithecia arising from the mycelium, black, leathery or carbonaceous, surface cells protuberent, conoid, without setae or larviform appendages, without a true ostiole. Asci 2-3 spored, spores brown 3-4 septate.

Type species: A. solani McAlpine

(5) Irenopsis Stev.

in Ann. Mycol. 25: 411, 1927.

Mycelium superficial, brown, with hyphopodia, and without setae. Perithecia with setae but without larviform appendages, arising from the mycelium, black, leathery or carbonaceous without a true ostiole. Asci usually 2-3 spored, thick walled, ellipsoid, spores brown 3-4 septate.

Type species: I. tortuosa (Wint.) Stev. based on Meliola tortuosa Wint.

(6) Meliola Fr. emend. Bornett.

in Ann. Sci. Nat. Bot. Ser. III, 16: 267, 1851.

Syn. Meliola Fr., in Syst. Orb. Veg. 1825, 111.

Amphitrichum Nees ex Spreng., in Pl. Crypt. Trop, 1820, p. 46, proparte.

Sphaeria Fr. Syst. Mycol. 2: 513, 1823 proparte.

Myxothecium Kze. ex Fr. Syst. Mycol. 3: 232, 1829.

Asteridium Sacc. in Syll. Fung. 1: 49, 1882.

Mycelium superficial brown, reticulate with hyphopodia and with setae. Perithecia verrucose without setae or larviform appendages, black, leathery or carbonaceous, without a true ostiole. Asci 2-3 spored, thick walled, ellipsoid spores brown 3-4 septate.

Type species: For many years Meliola amphitricha Fr., 1828. based on Sphaeria amphitricha Fr. 1823, was regarded as the type species of Meliola. It is now impossible to assign a type specimen to this name, or an identified host plant. Gaillard (1892), Stevens (1927) and Hansford (1961) have therefore, recommended the complete rejection of this specific epithet. Toro (1952) has recommended M.trichostroma (Kze.) Toro as the lecto type.

IV. MATERIAL AND METHODS

This work deals with the Indian species belonging to genera Meliolina, Amazonia, Asteridella, Appendiculella, Irenopsis and Meliola, which constitute a homogenous group "Meliolinae" within the family Meliolaceae. Most of the Indian specimens were examined in the Herbarium Cryptogamae Indiae Orientalis, New Delhi, where types of majority of Indian species were also available. Fresh collections were mainly made from different places in Himalayas, particularly from Sikkim, during a mycological survey in May, 1962.

For the microscopic examination, Gaillard (1892) recommended the procedure as follows: a drop of celloidin solution is placed on the fungus, allowed to dry, then lifted off bearing the fungus with it. The celloidin solution consisted of celloidin dissolved in ether-alcohol, to which little amounts of castor oil and lactic acid were also added. The celloidin film is lifted to the slide with a forceps and is then dissolved in ether-alcohol. The fungus is then mounted in glycerine jelly. Stevens (1916) modified this method a little by omitting oil and acid. He lifted the colonies to the slides when the film was dry and dehydrated by flushing it with absolute alcohol and then with xylol, after which the mount was made permanent in Canada balsam.

In C.M.I., Necol or similar cellulose acetate preparation is used for mounting these fungi. The cellulose acetate is thinned down with acetone until it flows like glycerine. A small drop of this is placed on the fungus colony and

allowed to dry. A thin colourless film is formed with the fungus firmly embedded in it, and this when quite dry may be peeled off with the help of a scalpel and mounted in glycerine. Hansford (1961) prefers to use celloidin dissolved in acetone. Necol solution, according to him has no special advantage over celloidin-acetone solution.

I have found, superior quality nail polish without any bright pigment (sold in the market as natural colour), is equally good for this purpose. A drop of nail polish is placed upon the colony selected for examination; after it has completely dried, its removal from the leaf, usually brings the whole of surface mycelium intact within it. I have mounted the films of Meliolinae directly into Canada balsam. Although these show the dark hyphae full of air, but this has not found to be of serious disadvantage, as the septa usually show quite clearly in mycelium, hyphopodia and spores. Most of the air is removed by repeated heating and cooling, before it is finally hardened for preservation.

There is a distinct advantage of mounting the whole film as removed from the leaf, as the whole colony is kept in its original condition. By this method it becomes possible to retain the actual type colonies, from which the original description of the colony has been made. Such film preparations show almost all details required for the determination of a specimen.

V. DESCRIPTION OF SPECIES

A. Dicotyledons

1. Anacardiaceae

Key to species:

Mycelial setae dentate

Mycelial setae upto 280 µ long; capitate hyphopodia 12-16 µ long; ascospores 32-38 x 14-18 µ....*Meliola geniculata*

Mycelial setae upto 900 µ long; capitate hyphopodia 20-36 µ long; ascospores 50-58 x 20-24 µ....*Meliola mangiferae*

Mycelial setae simple

Mycelial setae upto 800 µ long; capitate hyphopodia upto 60 µ long; ascospores 60-70 x 24-30 µ....*Meliola holigarnae*

Mycelial setae upto 700 µ long; capitate hyphopodia 25-35 long; ascospores 40-44 x 20-22 µ.....*Meliola nothopegiae*

1. *Meliola geniculata* Syd. & Butl.

in Ann. Mycol. 9: 381, 1911.

3131:3221

Colonies epiphyllous, thin, upto 5 mm. in diameter. Hyphae almost straight to undulate, cells mostly 16-28 x 6-8 µ, branching opposite at wide angles, loosely reticulate. Capitate hyphopodia, alternate or about 1% opposite, spreading or slightly antrorse, straight or slightly bent, 12-16 µ long; stipe cell cylindric, 3-6 long; head cell subglobose to short

cylindric, entire, 8-14 x 6-8 μ. Mucronate hyphopodia interspersed with capitate hyphopodia, alternate or opposite, conoid to ampulliform, 14-18 x 6-8 μ. Mycelial setae thinly scattered and grouped around perithecia, straight, upto 280 μ x 6-8 μ, apex 2-4 cristate-dentate. Perithecia scattered, verrucose, upto 170 μ in diameter. Ascospores cylindric to slightly ellipsoid, obtuse, 4-septate, 32-38 x 14-18 μ.

Material examined: On Odina wodier Roxb., Pulliyanur, Kerala, 8.10.1907, Leg. E.J. Butler - Type, H.C.I.O. No. 1366.

Host range: Odina wodier Roxb., Lannea sp., Antrocaryon micraster Pierre and Spondias pinnata Kurz. (=S. mangifera Willd.)

Distribution: India, Ghana, Sierra Leone and Java.

2. Meliola holigarnae Stev.

in Mem. Dept. Agric. India, Botanical series 15: 108, 1928; Sydowia, Beihefte II: 468, 1961.

3111:6333.

Colonies hypophyllous, upto 5 cm. in diameter, delimited by major veins, dense, velvety, Hyphae crooked, cells mostly 30-40 x 6-8 μ, branching opposite or irregular, becoming densely reticulate interwoven, closely adpressed and strongly adherent but some hyphae over the cuticular projections of the host are non adherent. Capitate hyphopodia usually remain on the leaf when the hyphae are detached in the film preparations, they are alternate or unilateral,

irregularly spaced, upto 60 μ long; stipe cell sinuous, cylindric rarely once septate, 12-30 μ long; head cell ovate, clavate, or very irregularly lobate, 16-20 x 10-12 μ. Mucronate hyphopodia few, conoid to ampulliform, 24-32 x 8-10 μ. Mycelial setae numerous, scattered, simple subacute or obtuse, mostly widely arcuate, upto 800 x 9-12 μ. Perithecia scattered, verrucose upto 270 u in diameter. Ascospores ellipsoid-obtuse, 4-septate, constricted, 60-70 x 24-30 μ, the middle cell is usually the largest.

Material examined: On Holigarna grahamii Hook. f., Amond, N. Kanara, 25.12.1917, Leg. L.J. Sedgwick - Type, H.C.I.O. No. 1981; Ekambe, N. Kanara, Oct. 1919, Leg. L.J. Sedgwick. H.C.I.O. No. 1986 a.

Host range: Holigarna grahamii Hook. f. and H. arnotiianum Hook. f.

Distribution: India

Remarks: This species is remarkable in having very irregularly spaced capitate hyphopodia, which are irregular and hypha like in shape. The presence of non adhering mycelium and ascospores of big size, are also very characteristic of this species. All these characters indicate its affinities towards the genus Meliolina. It probably constitutes a very interesting transition form between the genera Meliola and Meliolina.

3. Meliola mangiferae Earle

in Bull. New York Bot. Gard., 3: 307, 1905;

Ann. Mycol. 9: 382, 1911.

3111:531/33

Colonies mostly epiphyllous, subdense, velvety upto 4 mm. in diameter, sometimes confluent. Hyphae substraight to sinuous, cells mostly 20-33 x 7-9 µ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or bent, 20-30 µ long; stipe cell cylindric to cuneate, 4-10 µ long; head cell cylindric to clavate, entire to slightly rounded angulose often bent, 12-24 x 8-12 µ. Mucronate hyphopodia interspersed with capitate hyphopodia, alternate or opposite, ampulliform, 18-24 x 6-8 µ. Mycelial setae, scattered, straight or slightly flexuos simple with attenuate to obtuse apex, or 2-3 dentate, upto 100 x 8-10 µ. Perithecia scattered, verrucose upto 230 µ in diameter. Ascospores ellipsoid obtuse, 4-septate, deeply constricted, 50-58 x 20-24 µ.

Type: On Mangifera indica Linn., Jamaica, Earle 272, in Royal Botanical Gardens - Kew.

Material examined: On Mangifera indica Linn., Pulliyanur, 8.10.1907, Leg. E.J. Butler, H.C.I.O.No. 1050; North Kanara, June 1913, Leg. G.S. Kulkarni. H.C.I.O. No. 3316.

Host range: Mangifera indica L. and M. rigida Blume.

Distribution: It occurs on cultivated mango in most parts of the world where this is grown, with the notable exceptions

of Africa and Australia.

4. Meliola nothopegiae Hansf.

in Sydowia 10: 89, 1957.

3111:4333.

Colonies amphigenous but mostly hypophyllous, upto 5 mm. in diameter, dense. Hyphae crooked to sinuous, cells mostly 20-30 x 8-10 µ, branching opposite or irregular at wide angles, densely interwoven - reticulate. Capitate hyphopodia alternate, usually bent, 25-35 µ long, spreading or subantrorse; stipe cell cylindric, 4-10 µ long, head cell usually irregularly crenulate to sublobate, rarely oblong and entire, versiform, often bent 18-26 x 10-14 µ. Mucronate hyphopodia interspersed with capitate hyphopodia, opposite or unilateral, conoid to ampulliform, 20-27 x 8-10 µ. Mycelial setae scattered, straight, simple, acute, upto 700 x 10-12 µ. Perithecia scattered, verrucose, upto 210 µ in diameter. Ascospores oblong obtuse, 4-septate, rather strongly constricted, 40-44 x 20-22 µ.

Material examined: On Nothopegia colebrookiana Bl., Telgupai, Mysore, 29.10.1911, Leg. G.S. Kulkarni, Type, H.C.I.O. No.19993.

Host range: Nothopegia colebrookiana Bl.

Distribution: India.

Remarks: The colonies of this fungus are found in association with Asterina nothopegiae Ryan on the type specimen.

2. Apocynaceae

Key to species:

Hyphopodia sub-lobate.....Meliola carissae

Hyphopodia entire

Mycelial setae obtuse.....Meliola similima var. major

Mycelial setae acute

Mycelial setae upto 1000 μ long.....Meliola ichnocarpicola

Mycelial setae upto 450 μ long.

On Tabernaemontana sp...Meliola tabernaemontanicola

On Holarrhena antidysentrica..Meliola holarrhenae

5. Meliola carissae Doidge

in Bothalia 1: 72, 1921; Indian J. agric. Sci. 8: 912, 1933; Sydowia 10: 67, 1957.

3111: 4223.

Colonies mostly epiphyllous, upto 2 mm. in diameter, sometimes confluent, subdense, velvety. Hyphae almost straight, cells mostly 20-28 x 6-8 μ., branching opposite and acute becoming reticulate. Capitate hyphopodia, alternate or unilateral, straight or bent, antrorse, 18-24 μ long; stipe cell cylindric to cuneate 2-8 μ long; head cell versiform, ovate or sublobate, straight or bent, 12-18 x 8-12 μ. Mucronate hypopodia interspersed with capitate hyphopodia, sparse, alternate, ampulliform, 18-20 x 4-6 μ. Mycelial setae

fairly numerous, scattered, straight simple, acute, upto 600 x 8-10 μ. Perithecia scattered, minutely verrucose, upto 180 μ diameter. Ascospores oblong to ellipsoid obtuse, 4-septate, constricted, 38-44 x 16-20 μ.

Type: On Carissa arduina Mill., South Africa, Dept. of Plant Pathology, Union Dept. of Agric., Pretoria No. 9129.

Material examined: On Carissa sp., Thirathahalli, Mysore, 4.4.1945, Leg. M.J. Thirumalachar. H.C.I.O. No. 1090.

Host range: Carissa spp.

Distribution: South Africa, Goldcoast, Uganda and India.

Remarks: Stevens and Pierce have recorded this fungus on Carissa carandus L. from Bombay, but this specimen was not available to me for study.

6. Meliola holarrhenae Hansf. and Thirum.
in Farlowia 3: 294, 1948.
3111: 3222.

Colonies amphigenous, mostly epiphyllous, confluent thin, velvety. Hyphae substraight to undulate, cells mostly 15-25 x 5-7 μ, branching opposite at wide angles, loosely to rather closely reticulate. Capitate hyphopodia alternate, antrorse or spreading, usually straight, 14-21 μ long, stipe cell cylindric to cuneate, 3-7 μ long; head cell ovate to oblong, rounded or slightly pointed at apex, entire, 11-16 x 8-10 μ. Mucronate hyphopodia mixed with capitate hyphopodia,

alternate or opposite, ampulliform to conoid, 15-25 x 5-7 μ. Mycelial setae scattered, fairly numerous, straight, simple, acute upto 450 μ x 8-9 μ. Perithecia verrucose, upto 190 μ diameter. Ascospores cylindric to sub-ellipsoid, obtuse, 4-septate, slightly constricted, 30-38 x 12-15 μ.

Type: On Hollarrhena antidysentrica Wall., Balehonnur, Mysore, 18.7.1944, Leg. M.J. Thirumalachar.

Material examined: No specimen was available for examination. The description has been reproduced from the original.

Host range: Holarrhena antidysentrica Wall.

Distribution: India.

7. Meliola ichnocarpicola Hansf.

in Sydowia, Beiheft. II, 559, 1961.

= Meliola ichnocarpi Hansf. & Thirum.
in Farlowia 3 : 245, 1948

3111: 4323

Colonies amphigenous, mostly epiphyllous, thin, upto 2 mm. diameter or confluent. Hyphae more or less undulate, cells mostly 20-40 x 5-7 μ, branching opposite at wide angles, loosely reticulate. Capitate hyphopodia alternate, more or less bent, spreading, 15-30 μ long; stipe cell cylindric to cuneate, 4-10 μ long; head cell ovate to clavate cylindric, entire often bent, 11-18 x 8-12 μ. Mucronate hyphopodia mixed with capitate hyphopodia, alternate or unilateral, less commonly opposite, ampulliform, 16-22 x 5-9 μ. Mycelial setae

few, thinly scattered, more or less straight, simple, acute, upto 1000 x 8-10 μ. Perithecia scattered, verruculose, upto 170 μ diameter. Ascospores oblong to subellipsoid, obtuse 4-septate, constricted, 40-48 x 20-22 μ.

Material examined: On Ichnocarpus frutescens Br., Thirathahalli, Mysore, 3.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10878.

Host range: Ichnocarpus frutescens Br.

Distribution: India.

Remarks: The colonies on the type specimen are very incospicuous. Mature spores of 2 distinct size ranges were observed. One measures 32 x 12 -14 μ, while the other measures 40 x 20 μ. The latter is more common. The description agrees fully with M. ichnocarpi Stev. & Rold. (Philipp. J. Sci. 56: 72, 1935) except spore size. The smaller spores observed on the type specimen are very close to M. ichnocarpi Stev. & Rold. It may be accounted for in 3 possible ways (1) Either it is a mixed infection of M. ichnocarpicola and M. ichnocarpi Stev. & Rold. (2) It may be variation within the species. (3) Or it may be a contaminant. Since the material is very scanty it is not possible to draw any conclusion.

8. Meliola similima Ell. & Ev. var. major Hansf. in Sydowia 10: 89, 1956.

3111:3222

Colonies amphigenous, moderately thin, velvety upto

5 mm. diameter, sometimes confluent. Hyphae sinuous, cells mostly 20-32 x 46 µ, branching opposite or irregular at wide angles, loosely reticulate. Capitate hyphopodia alternate, spreading or antrorse, 12-16 µ long; stipe cell cylindric, 2-6 µ long; head cell globose to ovate entire, 8-12 µ. Mucronate hyphopodia interspersed with capitate hyphopodia, opposite, ampulliform 16-20 x 6-10 µ. Mycelial setae thinly scattered, straight or flexuous, simple obtuse, upto 350 x 6-8 µ. Perithecia scattered, verrucose, upto 150 µ diameter, spores cylindric obtuse, 4-septate, slightly constricted, 32-36 x 12-14 µ.

Material examined: On Holarrhena antidysentrica Wall., Bengal, 12.3.1913, Leg. A.L. Som, Type, H.C.I.O. No. 1988.

Host range: Holarrhena antidysentrica Wall.

Distribution: India.

Remarks: It differs from Meliola holarrhenae in having obtuse setae, otherwise it is identical.

9. Meliola tabernaemontanicola Hansf. & Thirum.
in Farlowia 3: 298, 1948.
3111:3222.

Colonies epiphyllous, rarely also hypophyllous, thin to subdense, upto 4 mm. diameter, or confluent, velvety. Hyphae substraight to slightly undulate, cells mostly 20-25 x 6-7 µ, branching opposite at wide angles, loosely to closely reticulate. Capitate hyphopodia alternate or very rarely

opposite, more or less antrorse, usually almost straight, 15-24 μ long; stipe cell cylindric to cuneate, 3-9 μ long; head cell cylindric with rounded apex, 12-17 x 8-10 μ. Mucronate hyphopodia mixed with capitate hyphopodia, opposite or alternate, ampulliform, 13-19 x 6-8 μ. Mycelial setae numerous, scattered and grouped around perithecia, straight or slightly bent, simple, acute, upto 450 x 7-9 μ. Perithecia scattered, verrucose, upto 170 μ diameter. Ascospores cylindric to subellipsoid-obtuse, 4-septate, 30-36 x 13-15 μ.

Material examined: On Tabernaemontana sp. Balehonnur, Mysore, 28-8-1944, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10976.

Host range: Tabernaemontana sp.

Distribution: India.

Remarks: This appears to be morphologically similar to M. holarrhenae Hansf. and Thirum. There is a possibility that both are the same species.

3. Aquifoliaceae

10. Meliola khasiensis Hansf.
in Sydowia, Beiheft. II: 336, 1961.
= Meliola falcatiseta Speg. var. khasiensis
Hansf. in Sydowia 9: 16, 1955.

3123: 4222.

Colonies hypophyllous, dense and subcrustose, upto

2 mm. in diameter or confluent, velvety. Hyphae substraight to undulate, cells mostly 12-15 x 8-9 μ, branching opposite at wide angles, closely reticulate and solid in centre. Capitate hyphopodia opposite or about 10% alternate, antrorse or spreading, usually straight, 12-18 μ long; head cell globose to oblong, entire, 8-14 x 7-11 μ. Mucronate hyphopodia not seen. Mycelial setae numerous, closely scattered, simple obtuse to acute, arcuate, coiled or uncinate above, upto 500 x 10-12 μ. Perithecia crowded in centre, verrucose, upto 180 μ diameter. Ascospores oblong, obtuse, 4-septate, constricted, 42-49 x 17-19 μ.

Type: On Ilex sp. India, in Herb. Kew. (Collector unknown).

Material examined: Not available for study. Descriptions and illustrations have been taken from the original publication.

Distribution: India.

Remarks: Meliola densa Corda has been reported from India by Cooke (Some exotic Fungi. Grev., 12: 85) on Ilex sp., the identification of the host is doubtful. This record of Meliola densa is also doubtful as it occurs only on Myrtaceae. This specimen is not available in Herb. Crypt. Ind. Orient.

I have collected a specimen of Meliola sp. on Ilex sp. from Kumaon hills. Unfortunately this is heavily infested with Helminthosporium sp. and it is not possible to determine the fungus. The possibility is that it might be same as

M. khasiensis, but it needs confirmation.

4. Araliaceae

11. Meliola dichotoma B. & C. var. kusanoi Hansf. in Sydowia, Beiheft. II: 484, 1961.

= Meliola kusanoi P. Henn., in Englers. Bot. Jahrb. 28: 272, 1901.

311/43: 4231.

Colonies epiphyllous, rarely hypophyllous, velvety, upto 4 mm. in diameter. Hyphae substraight, cells mostly 12-16 x 8-10 µ, branching opposite at wide angles, reticulate. Capitate hyphopodia mostly opposite, 12-16 µ long, antrorse; stipe cell short, cuneate, 4-6 µ long, head cell ovate or cylindrical, entire 10-12 x 7-8 µ. Mucronate hyphopodia scanty, interspersed with capitate hyphopodia, ampulliform, 16-20 x 8-10 µ. Mycelial setae straight or slightly bent, simple, upto 400 x 8-10 µ, acute or subobtuse or 1-2 dichotomously branched, with primary branches upto 50 µ long and secondary upto 40 µ. Perithecia verrucose upto 100 µ diameter. Ascospores oblong and obtuse, 4-septate, 38-40 x 14-16 µ.

Type: On Hedera helix L., Japan. Kusano, 1897, in Naturhistorika, Riksmuseet, Stockholm.

Material examined: On Hedera helix auct. non Linn., Narkanda, Himachal Pradesh, 13.11.1959, Leg. M.M. Payak, H.C.I.O. No. 26879.

Host range: Hedera spp.

Distribution: India, Japan.

Remarks: This is being reported here for the first time from India.

5. Bignoniaceae

12. Meliola crescentiae Stev.
in Ann. Mycol. 26: 240, 1928; Mem. Dept. Agric. India, Bot. 15: 109, 1928.

3111:3221.

Colonies epiphyllous, dense, upto 4 mm. diameter, often confluent. Hyphae slightly undulate, cells mostly 20-28 x 5-7 μ, branching opposite, acute to rather wide, reticulate. Capitate hyphopodia, alternate, more or less antrorse, straight, 12-16 μ long; stipe cell cylindric to cuneate, 3-6 μ long; head cell subglobose to ovate, entire, Mucronate hyphopodia mixed with capitate hyphopodia, opposite or alternate, ampulliform, 10-16 x 6-8 μ. Mycelial setae sparse, mostly grouped around perithecia, straight or very slightly curved simple, obtuse, upto 200 x 6-8 μ. Perithecia scattered, slightly verrucose, upto 160 μ in diameter. Ascospores oblong, obtuse, 4-septate, slightly constricted, 32-36 x 12-14 μ.

Type: On Crescentia sp., Trinidad, Stevens 940, in Illinois University Herbarium.

Material examined: On Heterophragma roxburghii DC., Dharwar, Bombay, Dec. 1912, Leg. L.J. Sedgwick, H.C.I.C. No. 1993.

Host range: Crescentia spp., Heterophragma roxburghii DC., Tabebuia pentaphylla Hemsl.

Distribution: Trinidad, Venezuela, India, Malaya.

Remarks: The Indian specimen differs from the type in having slightly larger and thicker spores. Head cell is also slightly larger.

6. Convolvulaceae

13. Meliola clavulata Winter
in Hedwigia 25: 98, 1886; Ann. Mycol. 9: 380, 1911.
= M. pontualli Vital, in Bol. Agric., Pernambuco, 14: 337, 1947.
= M. densa Cooke var. convolvuli Beeli, in Bull. Jard. Bot. Bruxelles, 8: 2, 1923, pro parte.

3111: 3221.

Colonies epiphyllous, subdense, upto 3 mm. in diameter. Hyphae sinuous, yellow brown and transluscent, cells mostly 10-20 x 7-9 μ, branching alternate or irregular at acute angles, closely reticulate. Capitate hyphopodia alternate, usually antrorse, straight, 12-21 μ long; stipe cell cuneate to short cylindric, 4-9 μ long; head cell globose to wide ovate, entire 9-14 μ in diameter. Mucronate hyphopodia usually

separate, opposite or alternate, ampulliform, 14-21 x 7-9 μ. Mycelial setae few to numerous, straight, simple, obtuse to slightly clavulate at apex, upto 280 μ x 6-10 μ. Perithecia scattered, verrucose, upto 180 μ diameter. Ascospores oblong, obtuse, 4-septate, slightly constricted, 32-36 x 10-12 μ.

Type: On Ipomoea sp., San Thome, Moller - Type.

Material examined: On Ipomoea sp., Pullyanur, Kerala, 8.10.1907, Leg. E.J. Butler. H.C.I.O. No. 1040; on Argyria hirsuta Arn., Balehonnur, Mysore, 7.9.1903, Leg. E.J. Butler, H.C.I.O. No. 1041.

Host range: Ipomoea spp., Hewittia sublobata Kuntze (=Hewittia bicolor Wight and Arn.), Calonyction spp., Merremia spp., Quamoclit coccinea Moench, Rivea corymbosa Hallier, Argyreia spp.

Distribution: India, South East Asia, Farmosa, Africa, South America, West Indies.

Remarks: This species stands out from the rest in having yellow and transluscent mycelium. The tips of the mycelial setae are slightly clavulate, which give the species its name M. clavulata.

7. Dichapetalaceae (Chailletiaceae)

14. Meliola dichapetali Hansf. & Thirum.
in Farlowia 3: 292, 1948.

3132: 4221.

Colonies epiphyllous, dense, velvety, upto 3 mm. in diameter, crustose. Hyphae substraight, cells mostly 10-20 x 6-8 µ, branching opposite, densely reticulate and almost compact. Capitate hyphopodia opposite or alternate, more or less antrorse, crowded, 15-20 µ long; stipe cell cylindric to cuneate, 2-9 µ long; head cell ovate to pyriform, often slightly bent, entire, 10-14 x 9-13 µ. Mucronate hyphopodia mixed with capitate hyphopodia, opposite or alternate, conoid to ampulliform, 14-20 x 8-10 µ. Mycelial setae numerous, scattered, straight, upto 280 x 10-12 µ, apex 2-3 dentate. Perithecia loosely aggregated, in the centre of the colony, almost smooth, upto 180 µ diameter. Ascospores cylindric obtuse, 4-septate, slightly constricted, 40-44 x 14-16 µ.

Material examined: On Dichapetelum gelenioides Engl. Balehonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar - Type, H.C.I.O. No. 10858.

Host range: Dichapetelum gelenioides Engl.

Distribution: India.

Remarks: It differs from Meliola scott-ellioti Hansf. and Deighton, also recorded on the same host, in having dentate mycelial setae instead of obtuse ones. Mycelial setae are also longer in Meliola scott-ellioti.

8. Ebenaceae

15. Meliola diospyri Syd.

in Ann. Mycol. 9: 381, 1911.

3113: 4223.

Colonies amphigenous, dense, velvety upto 5 mm. diameter, often confluent. Hyphae substraight, branching opposite, acute, densely reticulate, cells mostly 20-30 x 6-8 µ. Capitate hyphopodia mostly opposite, a few alternate also, straight or bent, spreading or antrorse, upto 18 µ long; stipe cell cylindric or cuneate, 2-6 µ long; head cell globose to oblong, widely rounded at apex, 9-13 x 8-10 µ. Mucronate hyphopodia few, mixed with capitate hyphopodia, opposite or alternate, ampulliform, 17-22 x 7-9 µ. Mycelial setae scattered and grouped around perithecia, straight, simple, obtuse, upto 700 x 10-15 µ. Perithecia scattered, verrucose, upto 180 µ diameter. Ascospores oblong-obtuse, 4-septate, constricted, 36-42 x 12-16 µ.

Material examined: On Diospyros montana Roxb., Koppa, Mysore, 15.9.1903, Leg. E.J. Butler, Type. H.C.I.O. No. 1044.

Host range: Diospyros montana Roxb.

Distribution: India.

Remarks: It is very similar to Meliola diospyricola Hansf. (Proc. Linn. Soc. N.S.W. 78: 55, 1953) from which it differs mainly in having obtuse mycelial setae and slightly larger spores.

9. Elaegnaceae

16. Meliola elaeagni Hansf. & Thirum.

Farlowia 3: 292, 1948.

3111:3223.

Colonies amphigenous, upto 8 mm. diameter, or confluent, thin. Hyphae sinuous, cells mostly 20-25 x 6-8 µ, branching opposite or irregular at wide angles, loosely reticulate. Capitate hyphopodia, alternate, straight or bent, spreading or antrorse, 12-23 µ long, stipe cell cylindric to cuneate, 3-8 µ long; head cell subglobose, clavate, straight or bent, usually entire, or slightly angulose, 9-15 x 9-14 µ. Mucronate hyphopodia, alternate or opposite, ampulliform, 14-18 x 7-9 µ. Mycelial setae scattered, straight, simple acute, upto 600 x 7-9 µ. Perithecia scattered verrucose, upto 150 µ diameter. Ascospores oblong to ellipsoid, obtuse, 4-septate, constricted, 34-40 x 13-17 µ.

Material examined: On Elaeagnus latifolia Linn., Balehonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar - Type, H.C.I.O. No. 10856.

Host range: Elaeagnus latifolia Linn.

Distribution: India.

10. Euphorbiaceae

Key to species:

Mycelial setae absent..... Asteridella malloti

Mycelial setae present.

Mycelial setae branched.... M. himalayense

Mycelial setae, simple..... M. ostodis

17. Asteridella malloti (Hansf. & Thirum.) Hansf.
in Sydowia 10: 47, 1957.
= Irenina malloti Hansf. & Thirum.
in Farlowia 3: 289, 1948.

3101: 5330.

Colonies hypophyllous, hidden amongst the dense tomentum of the leaf, upto 4 mm. in diameter, thin, sometimes confluent. Hyphae crooked, cells mostly 20-35 x 6-7 µ, branching irregular, loosely interwoven, reticulate. Capitate hyphopodia alternate, spreading or antrorse, straight or bent, 14-29 µ long; stipe cell cylindric, 5-10 µ long; head cell clavate or irregularly rounded angulose, sometimes sublobate, 10-20 x 11-16 µ. Mucronate hyphopodia scattered, alternate or unilateral, conoid to ampulliform, 17-22 x 7-10 µ. Perithecia closely scattered, upto 230 µ in diameter, surface cells mammillate, or with bent conoid processes, upto 35 µ high. Ascospores sub-ellipsoid, obtuse, 4-septate, slightly constricted, 49-24 µ, the central cell often slightly the largest.

Material examined: On Mallotus alba Muell., Balehonnur, Mysore 28.9.1944 Leg. M.J. Thirumalachar, Type, H.C.I.C. No. 10860.

Host range: Mallotus spp., Baloghia lucida Endl.

Distribution: India, Java, New South Wales.

Remarks: I was unable to locate any colony of this fungus, on the portion of the type specimen that is available in our Herbarium. The drawings and description have been reproduced from the original.

18. Meliola ostodis sp. nov.

3112: 4232.

Colonies epiphyllous, circular, upto 3 mm. in diameter, dense. Hyphae substraight, cells 18-30 x 5-8 μ, branching opposite at acute angles, very closely reticulate. Capitate hyphopodia, opposite, straight or very slightly bent, antrorse, 12-16 μ long; stipe cell short, cuneate, 3-5 μ long; head cell ovate to subglobose, entire, 8-10 x 6-8 μ. Mucronate hyphopodia, few, interspersed with capitate hyphopodia, ampulliform, 14-16 x 4-6 μ. Mycelial setae upto 320 x 8-10 μ, straight to slightly curved, simple obtuse, scattered but more dense around perithecia. Perithecia aggregated in the centre of the colony, verrucose, upto 220 μ in diameter; asco-spores oblong-obtuse, 4-septate, 40-44 x 12-14 μ.

Material examined: On Ostodes paniculata Bl., Singhik, N. Sikkim 24.4.1962, Leg. J.N. Kapoor, Type, H.C.I.O. No. 28360.

Host range: Ostodes paniculata Bl.

Distribution: India.

Remarks: No Meliola sp. is known on this host. It is quite distinct from all the Meliola spp. recorded on this host family, and is therefore, being proposed as a new species.

19. Meliola himalayense sp. nov.

3141: 3212.

Colonies amphigenous, dense, crustose, mostly upto 3 mm. diameter or confluent. Hyphae undulate, closely appressed to host surface, cells mostly 16-28 x 6-8 μ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, spreading or subantrorse, straight or bent, 16-40 μ long; stipe cell cylindric, 8-12 μ long, head cell, ovate, or cylindric or broadly clavate, often bent, entire, 16-20 x 10-12 μ. Mycelial setae numerous, scattered uniformly over the colony, upto 400 x 8-10 μ, dichotomously branched primary branches upto 160 μ long, secondary branches upto 60 μ long. Perithecia verrucose, upto 100 μ in diameter. Ascospores 4-septate, oblong obtuse, 34-40 x 12-14 μ.

Material examined: On Bridelia montana Willd., Sribadam, W. Sikkim, 7.4.1962, Leg. J.N. Kapoor, Type, H.C.I.O. No. 28363.

Host range: Bridelia montana Willd.

Distribution: India.

Remarks: Meliola brideliae Stev. & Hold. and M. bridelicola are also recorded on this host genus, but the above species is quite distinct in having dichotomously branched mycelial setae.

11. Fagaceae

20. Meliola melanochaeta Syd.
in Ann. Mycol. 26: 93, 1928, Indian Phytopath. 17: 19-20, 1964.

311/31: 4222.

Colonies epiphyllous, upto 5 mm. in diameter. Hyphae substraight to sinuous, branching irregular reticulate, cells 30-40 x 7-10 µ. Capitate hyphopodia alternate, straight or slightly bent, antrorse or spreading, stipe cell cylindric to cuneate, 6-10 µ wide; head cell subglobose, entire, 10-16 µ in diameter. Mucronate hyphopodia ampulliform, opposite, 15-25 x 8-12 µ. Mycelial setae scattered and grouped around the perithecia, straight, 3 forked at the apex or bluntly pointed, upto 480 µ x 7-9 µ. Perithecia are scattered, globose, verrucose, upto 200 µ in diameter. Ascospores oblong, 4-septate,

constricted at the septa, 35-50 x 14-20 μ.

Type: On Quercus spicata Sm., British North Borneo, Elmer 21770, in Herbarium bogorienose, Bogor, Indonesia.

Host range: Quercus spp.

Distribution: Borneo, India.

Remarks: The Indian specimen was collected by S.K. Bose on Quercus leucotrichophora A. Camus, from Ranikhet, Kumaon and determined by Bose and Mueller (Ind. Phytopath., 1964). This specimen has not been available to me for study. The description given above is the one recorded by Bose and Mueller (op. cit.). Some differences from the original description are obvious. The colonies according to the original description, are hypophyllous and much larger, whereas in Indian specimens they are said to be epiphyllous. Mycelial setae which are of two types, i.e. simple and forked, are stated to be of same size in the Indian specimen, whereas the simple setae in the original description are upto 1800 μ i.e. 3 times the length of forked setae. Spores are also smaller in the Indian specimen. It would, therefore, be useful to compare the Indian specimen with the type specimen.

12. Hamamelidaceae

21. Meliola bucklandiae sp. nov.

31⅛1: 4221

Colonies hypophyllous, dense, crustose, upto 5 mm.

diameter, often confluent. Hyphae substraight to crooked, cells mostly 16-28 x 4-6 μ, branching opposite at wide angles, rarely unilateral also, very closely reticulate. Capitate hyphopodia alternate, straight or bent, 16-20 μ long; stipe cell cylindric to cuneate, 5-6 long; head cell ovate to cylindric, entire, 14-16 x 7-10 μ. Mucronate hyphopodia scanty, interspersed with capitate hyphopodia, conoid or ampulliform, 20-22 x 5-6 μ. Mycelial setae scattered but more dense around perithecia, straight, tortuous or uncinate, upto 35 x 8-10 μ, obtuse, often bifid. Perithecia, scattered, verrucose, upto 200 μ in diameter. Ascospores oblong-obtuse, 4-septate, slightly constricted, 40-46 x 18-120 μ.

Material examined: On Bucklandia populnea Br. Demthang, W. Sikkim, 5.4.1962, Leg. J.N. Kapoor, Type, H.C.I.O. No. 28361.

Host range: Bucklandia populnea Br.

Distribution: India.

Remarks: There is only one species i.e. Meliola torta Doidge recorded on this host family. The above species is quite distinct in all the major morphological characters and is, therefore, being described as new.

13. Hippocrateaceae

22. Meliola salaciae Hansf.
in Proc. Linn. Soc, London, 157: 182, 1946;
Sydowia, Beiheft II: 346, 1961.

31½3: 4222.

Colonies epiphyllous, rarely also hypophyllous thin to subdense, upto 3 mm. diameter. Hyphae straight to slightly undulate, cells 15-20 x 6-7 µ, branching opposite at wide angles, loosely reticulate. Capitate hyphopodia alternate or 20% opposite, usually antrorse, straight or slightly bent, 14-18 µ long; stipe cell cylindric to cuneate, 3-6 µ long; head cell clavate entire, 10-14 x 8-10 µ. Mucronate hyphopodia scattered, mixed with capitate hyphopodia, opposite or alternate, ampulliform 12-20 x 6-9 µ. Mycelial setae scattered, straight, simple, acute or obtuse or 2 dentate, upto 480 x 8-9 µ. Perithecia scattered, verrucose, upto 170 µ diameter. Ascospores oblong obtuse, 4-septate, constricted, 36-43 x 13-16 µ.

Type: On Salacia elegans Welw., Uganda, Hansford, 4462 in Royal Botanic Garden, Kew Surrey.

Host range: Salacia spp.

Distribution: India, Uganda, Sierra Leone.

Remarks: As Indian specimen of this fungus on Salacia sp., collected by M.J. Thirumalachar was not available for study, the drawings and descriptions have been reproduced from the published account.

14. Lecythidaceae

23. Meliola indica Syd. apud. Syd. and Butl. in Ann. Mycol. 9: 382, 1911.

= Meliola barringtoniae Yates,"
in Philipp. J. Sci. C. (Botany) 12: 363, 1917.

311½: 4232.

Colonies amphigenous, velvety, upto 6 mm. in diameter, dense. Hyphae straight or slightly undulate, cells mostly 15-20 µ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia opposite or about 10% alternate, subantrorse, 10-15 µ long; stipe cell cylindric, 3-5 µ long; head cell globose, entire, 8-11 µ diameter. Mucronate hyphopodia few, interspersed with capitate hyphopodia, ampulliform, 20-25 x 8-10 µ. Mycelial setae numerous, straight, simple acute, upto 400 x 9-12 µ. Perithecia scattered verrucose, upto 240 µ diameter. Ascospores oblong, obtuse, 4-septate, constricted 40-48 x 14-18 µ.

Material examined: On Barringtonia acutangula Gaertn., Assam, 20.3.1910, Leg. A. Som, Type, H.C.I.O. No. 1036.

Distribution: India, Philippines and Java.

23a. Meliola indica Syd. var. careyae Stev.
in Ann. Mycol. 26: 223, 1928; Mem. Dept. Agric. India, Bot. Sr. 15: 107-111, 1928.

3113: 4223.

Colonies epiphyllous, dense, velvety, upto 4 mm. diameter or widely confluent, hyphae substraight to flexuous, cells mostly 25-30 x 6-8 µ, branching opposite at wide angles, densely interwoven, reticulate. Capitate hyphopodia alternate

or opposite, spreading to subantrorse, usually straight, 15-20 µ long; stipe cell cylindric, 3-6 µ long, head cell subglobose to broadly clavate, entire, 10-14 x 8-12 µ. Mucronate hyphopodia, separate or mixed with capitate hyphopodia, ampulliform, 16-20 x 7-9 µ. Mycelial setae numerous, scattered, straight, simple, acute, upto 700 x 9-12 µ. Perithecia scattered, verrucose, upto 180 µ in diameter. Ascospores oblong, obtuse, 4-septate, constricted, 38-50 x 14-18 µ.

Material examined: On Careya arborea Roxb., Gainsoppa Falls, N. Kanara, Bombay, October, 1919, Leg. L.J. Sedgwick, Type, H.C.I.O. No. 1985.

Host range: Careya arborea Roxb.

Distribution: India.

Remarks: It differs from M. indica Syd., recorded on the same host family, mainly in having longer capitate hyphopodia and mycelial setae.

15. Leguminosae

Key to species:

Mycelial setae acute, torulose at apex, upto 450 u long, ascospores 39-48 µ long..... Meliola tamarindii

Mycelial setae obtuse, entire at apex, upto 350 µ long, ascospores 36-40 µ long..... Meliola albizziae var. odoratissimae

24. Meliola albizzae Hansf. & Deighton var. odoratissimae var. nov.

(~~Meliola albizzae Hansf. & Deighton in Mycol. paper, I.M.I., 23: 1948~~; Curr. Sci. 29(4): 149, 1960.)

3111: 3222.

Colonies amphigenous, thin, confluent, often covering the entire surface of the leaflets. Hyphae undulate, branching opposite at wide angles, cells mostly 12-25 x 6-8 µ, loosely reticulate. Capitate hyphopodia alternate, spreading or slightly antrorse, straight or sometimes bent, 12-20 µ long; stipe cell cylindric to cuneate, 3-6 µ long; head cell globose to ovate, entire, 10-12 µ in diameter. Mucronate hyphopodia mixed with capitate hyphopodia, 12-15 x 6-8 µ, alternate or opposite, ampulliform to conoid. Mycelial setae thinly scattered, but rather dense in the centre of the colony upto 350 x 6-8 µ, apex acute, slightly torulose. Perithecia scattered, verrucose, upto 160 µ in diameter, spores oblong, obtuse, 4-septate, 36-40 x 12-14 µ, slightly constricted.

Material examined: On Albizzia odoratissima Benth., Cherideopurhat Tea Estate, Assam, 15.12.1959, Leg. J.L. Lampitt, Type, H.C.I.O. No. 27275.

Host range: Albizzia odoratissima Benth.

Distribution: India.

Remarks: This differs from the parent species M. albizziae Hansf. and Deight., in having simple mycelial setae and alternate capitate hyphopodia. Mycelial setae in M. albizziae are regularly 2-3 dentate and about 40% of capitate hyphopodia are opposite. Mycelial setae are also longer in this new variety. In this specimen, the mycelium is regularly undulate as against, straight to slightly undulate, in M. albizziae.

25. Meliola tamarindii Syd.

in Ann. Mycol. 10: 79, 1912; The Fungi of India p.29, I.C.A.R. Sci. Monograph No. 1, p. 29, 1931.

3111:4232.

Colonies mostly epiphyllous, subdense, velvety upto 2 mm. diameter. Hyphae substraight to undulate, cells mostly 20-30 x 6-8 µ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, a few opposite also, antrorse or spreading, straight or bent, 15-25 µ long; stipe cell cylindric, 4-9 µ long, head cell ovate, oblong, cylindric on irregularly rounded angulose, more or less bent 11-18 x 10-15 µ. Mucronate hyphopodia sparse, interspersed with capitate hyphopodia, opposite or alternate, ampulliform, 16-23 x 7-9 µ. Mycelial setae numerous, closely scattered and grouped around perithecia, simple obtuse or subacute, upto 450 x 8-10 µ. Perithecia closely scattered, verrucose, upto 250 µ diameter. Ascospores cylindric to subellipsoid, obtuse, 4-septate, constricted, 39-48 x 14-18 µ.

Type: On Tamarindus indicus, Philippines, Philippine Bureau of Science No. 7416.

Material examined: On Tamarindus indica L., Mysore, Malabar, 16.4.1913, Leg. L.S. Subramaniam., H.C.I.C. No. 3363.

Host range: Tamarindus indica L.

Distribution: India, Sierra Leone, Philippines, Gold Coast.

16. Loganiaceae

Key to species:

Mycelial setae upto 400 μ long,
Ascospores 36-42 x 17-20 μ.....Meliola gardneriae

Mycelial setae upto 280 μ long,
Ascospores 32-38 x 12-15 u.....Meliola petchi.

26. Meliola gardneriae Hansf. and Thirum.

in Farlowia 3: 293, 1948.

3111:4222.

Colonies epiphyllous, upto 2 mm. diameter, closely scattered, dense, subvelvety. Hyphae substraight to slightly undulate, cells mostly 10-25 x 7-9 μ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, straight or bent, entire, somewhat antrorse, 16-28 μ long; stipe cell cylindric upto 4-8 μ long; head cell cylindric, rounded at apex, entire or rarely subangulose, 12-18 x 6-9 μ. Mucronate hyphopodia interspersed with capitate hyphopodia, few, alternate, conoid to ampulliform,

18-24 x 6-8 μ. Mycelial setae thinly scattered, substraight, simple, acute, to 400 x 8-10 μ. Perithecia loosely scattered, verrucose, upto 160 μ diameter. Ascospores oblong, obtuse, 4-septate constricted, 36-42 x 17-20 μ.

Material examined: On Gardneria sp., Balehonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar - Type, H.C.I.O.No.10877.

Host range: Gardneria sp.

Distribution: India.

27. Meliola petchii Hansf.

in Proc. Linn. Soc. London 157: 182, 1946.

3111: 3221.

Colonies amphigenous, upto 5 mm. diameter, thinly velvety, often numerous and confluent. Hyphae substraight, cells mostly 20-30 x 6-8 μ, branching opposite at acute angles, closely reticulate. Capitate hyphopodia alternate, antrorse, straight or bent, 18-25 μ long; stipe cell cylindric to cuneate, 4-9 μ long; head cell cylindric to clavate, entire, 12-17 x 7-10 μ. Mucronate hyphopodia few, mixed with capitate hyphopodia, opposite or alternate, conoid to ampulliform, 15-22 x 7-8 μ. Mucelial setae fairly numerous, scattered, straight, simple, acute, upto 280 x 6-8 μ. Perithecia scattered, verrucose, upto 140 μ diameter. Ascospores oblong, 4-septate, constricted, 32-38 x 12.15 μ.

Type: On Strychnos nuxvomica L., Herb. Peradeniya, No. 6518.

Material examined: On Strychnos nux-vomica L., Malabar, 17.11.1912, Leg. T.R. Najanathan, H.C.I.C. No. 10488; Taliparamba (Malabar), 27.5.1952, Leg. N.V. Sundaram, H.C.I.C. No. 20422 (as Meliola stenospora Winter).

Host range: Strychnos nux-vomica L.

Distributions: India , Ceylon.

Remarks: Four species of Meliola are recorded on this host species viz. Meliola strychnicola Gaill., M. strychni-multiflorae Hansf., M. warneckei Hansf. and M. petchii Hansf. All these are morphologically more or less similar. Meliola petchi can be distinguished by its acute setae, non-clavate head cell and spore size.

Meliola stenospora Winter recorded on this host from India is apparently a misdetermination (Fig. 27). This specimen was examined and found identical with M. petchii Hansf. M. petchii is a new record for India.

17. Malvaceae

Key to species:

Mycelial setae absent, colonies thin, perithecial setae present.....Irenopsis molleriana

Mycelial setae present, colonies dense, perithecial setae absent.....Meliola kydiae calycinae

28. Irenopsis molleriana (Wint.) Stev.

in Ann. Mycol. 25: 437, 1927.

= Meliola molleriana Wint., Hedwigia 25: 98, 1886.

= Meliola (Irenina) procera Ciferri, Ann. Mycol. 36: 219, 1938.

3401: 3220.

Colonies mostly epiphyllous, thin to subdense, upto 2 mm. diameter, often confluent. Hyphae undulate, cells mostly 16-36 x 6-8 µ, branching mostly opposite at acute angles, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or slightly bent, 16-24 µ long; stipe cell short cylindric to cuneate, 4-8 µ long; head cell subglobose to pyriform, rounded angulose, often bent, 10-12 x 10-11 µ in diameter. Mucronate hyphopodia interspersed with capitate hyphopodia, ampulliform to conoid. Perithecia verrucose, upto 200 µ in diameter, provided with 0-7 perithecial setae which are substraight and bent at one or two places near the apex, thick walled, upto 100 µ long, septate, simple. Ascospores oblong to subellipsoid, 4-septate, constricted, 34-48 x 12-16 µ.

Type: On an undetermined Malvaceae, San Thome, Moller, 1885 in Royal Botanic Gardens.

Material examined: On Triumfetta bartramia Linn., Sribadam (W. Sikkim), 7.4.1962, Leg. J.N. Kapoor, H.C.I.O. No. 2836.

Host range: Hibiscus spp.; Abutilon spp.; Malache spp., Sida spp., Urena lobata Linn.; Triumfetta spp.

Distribution: Africa, South America, West Indies, Java, India.

Remarks: This is being reported for the first time from India.

29. Meliola kydiae-calycinae Hansf. & Thirum. in Farlowia 3: 296, 1948.

3111:3222.

Colonies mostly epiphyllous upto 4 mm. in diameter dense, velvety, often numerous and confluent. Hyphae crooked - undulate, cells 20-30 x 7-9 µ, branching opposite or irregular at wide angles, densely reticulate. Capitate hyphopodia alternate, spreading, 15-24 µ long, straight or bent, stipe cell 4-10 µ long; head cell irregularly angulose to shallowly lobate, straight or bent, 10-15 x 12-19 µ. Mucronate hyphopodia, separate, opposite or alternate, conoid to ampulliform, 16-23 x 6-8 µ. Mycelial setae numerous, closely scattered and grouped around perithecia, straight or irregularly bent, not hamate or uncinate, opaque, simple, rarely obtuse, usually acute, or apiculate acute, upto 340 x 11-14 µ. Perithecia glabrous, verrucose, scattered, upto 180 µ in diameter, surface cells conoid, spores narrowly ellipsoid to cylindric, obtuse, 4-septate, 33-39 x 10-12 µ, slightly constricted.

Type: On Kydia calycina Roxb., Mysore, India, Thirumalachar, No. 852.

Material examined: Not available for study.

Host range: ~~Heynia trijuga~~ Kydia calycina Roxb.

Distribution: India.

Remarks: Description and illustrations have been taken from the original.

18. Meliaceae

30. Meliola heyniae Hansf. & Thirum.
in Farlowia 3: 294, 1948.

3111: 4222.

Colonies epiphyllous, thin, upto 3 mm. in diameter or confluent, velvety. Hyphae substraight, cells mostly 15-20 x 6-7 µ, branching opposite at wide angles, loosely reticulate. Capitate hyphopodia alternate, slightly antrorse, usually straight, 17-21 µ long; stipe cell cylindric to cuneate 4-7 µ long; head cell ovate to cylindric or clavate, entire, 12-16 x 8-10 µ. Mucronate hyphopodia fairly numerous, opposite or alternate, conoid to ampulliform, 15-20 x 6-8 µ. Mycelial setae mostly grouped around perithecia, straight, simple, acute upto 300 x 7-8 µ. Perithecia scattered upto 180 µ diameter, spores ellipsoid, obtuse, 4-septate, constricted 36-42 x 16-19 µ.

Material examined: On Heynia trijuga Roxb., Thirathhalli, Mysore. 4.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.C. No. 10863.

Host range: Heynia trijuga Roxb.

Distribution: India.

19. Malastomataceae

31. Meliola heudoltii Gaill.

in Le Genere Meliola, p. 49, 1892; J. Dept. Sci. Univ. Calcutta, 4: 1-7, 1922.

= Meliola memecyli Syd.

in Ann. Mycol. 12: 198, 1914; Farlowia 3: 297, 1948; The Fungi of India, I.C.A.R. Monograph No. 1, p. 20, 1931.

3111: 5334.

Colonies amphigenous, upto 4 mm. in diameter or confluent, subvelvety, dense. Hyphae substraight cells mostly 20-30 x 8-10 µ, branching opposite at wide angles, reticulate. Capitate hyphopodia alternate, spreading or antrorse, straight or slightly bent, 20-28 µ long; stipe cell cylindric to cuneate, 4-8 µ long; head cell ovate to cylindric, entire or slightly rounded angulose, 14-20 x 10-14 µ. Mucronate hyphopodia few, opposite or alternate, interspersed with capitate hyphopodia, conoid to ampulliform, 16-24 x 8-10 µ. Mycelial setae numerous, scattered and grouped around perithecia, straight or curved, simple subobtuse, over 100 x 8-12 µ. Perithecia scattered, verrucose, upto 250 µ in diameter. Ascospores oblong to sub-ellipsoid, obtuse, 4-septate, 40-54 x 18-24 µ.

Type: On Memecylon edule Roxb. India. Sydow, Fungi Exotici exs., 251.

Material examined: On Memecylon edule Roxb., Bhubaneshwar, Orissa, Oct. 1920, Leg. S.N. Bal, H.C.I.C. No. 3321 (as Meliola heudolti Gaill.); Memecylon talbotianum Brandis, Angumbe, Mysore, Leg. M.J. Thirumalachar No. 870 (was not available for study).

Host range: Memecylon spp.

Distribution: India, Java, Philippines.

Remarks: Five species of Meliola are recorded on this host genus. These are Meliola disciseta Roger (3131:4223), M. memecyli Syd. (31½3: 5334), M. affinis Syd. (31½3: 5233) M. heudoltii Gaill. (31½3:4223) and M. memecylicola Hansf. (3111:4221). It is clear from the above that the first four species are morphologically more or less similar and it is very difficult to determine a specimen belonging to these species. It would be worthwhile to consolidate these 4 into a single species. In that case Meliola heudoltii Gaill. takes the priority since it antedates all the rest. Meliola memecylicola Hansf. is however, quite distinct.

The Orissa specimen in Herb. Crypt. Ind. Orient. was identified as M. heudoltii by S.N. Bal (Journ. Dept. Sci. Univ. Calcutta, 4: 1-7, 1922), and is maintained as such. This specimen has only simple setae and no dentate setae could be observed.

20. Menispermaceae

32. Meliola cissampelicola Hansf. & Thirum.
in Farlowia 3: 291, 1948.
3111: 3222.

Colonies mostly epiphyllous, upto 1 mm. in diameter or widely confluent, thin. Hyphae slightly undulate, branching opposite or irregular at wide angles, loosely reticulate, cells mostly 20-35 x 6-8 µ. Capitate hyphopodia alternate, subantrorse, straight, or bent, 20-30 µ long; stipe cell cylindric to cuneate, 4-11 µ long; head cell ovate to clavate, entire 13-20 x 9-12 µ. Mucronate hyphopodia separate, opposite or alternate or unilateral, ampulliform, 14-22 x 6-8 µ. Mycelial setae thinly scattered, somewhat bent, simple, obtuse, upto 340 x 8-10 µ. Perithecia in loose central group, verrucose, upto 160 µ diameter. Ascospores oblong to subellipsoid obtuse, 4-septate, constricted, 34-40 x 12-16 µ.

Material examined: On Cissampelos convolvulacea Willd. Agumbe, Mysore, 4.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10875.

Host range: Cissampelos convolvulacea.

Distribution: India.

Remarks: Meliola cissampeli Hansf. and Stev., also recorded on this host genus, differs in having dentate setae.

21. Moraceae

Key to species:

Ascospores 34-40 x 14-16 μ, colonies dense, velvety, mycelial setae upto 260 μ long..... Meliola bangalorensis

Ascospores 37-45 x 16-18 μ, colonies subdense, mycelial setae upto 240 μ long..... Meliola ficicola

Ascospores 29-37 x 13-16 μ, colonies thin, mycelial setae upto 200 μ long..... Meliola ovatipoda

33. Meliola bangalorensis Hansf. & Thirum. in Farlowia 3: 290, 1948.

3111: 3221.

Colonies amphigenous, subdense, velvety, upto 5 mm. in diameter, or on upper surface numerous and widely confluent. Hyphae substraight to crooked, cells mostly 15-30 x 6-8 μ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate or very rarely opposite, straight or bent, spreading or antrorse, 16-22 μ long; stipe cell cylindric to cuneate, 4-8 μ long; head cell sub-globose to clavate, entire, 10-16 x 10-14 μ. Mucronate hyphopodia fairly numerous ampulliform, 15-20 x 6-8 μ. Mycelial setae numerous grouped around perithecia or scattered, straight, simple, acute, upto 260 x 8-10 μ. Perithecia verrucose, upto 160 μ in diameter; Ascospores oblong, obtuse, 4-septate,

constricted,34-40 x 14-16 u.

Material examined: On Ficus sp., Bangalore, Mysore, 14.8.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10867.

Host range: Ficus spp.

Distribution: India.

34. Meliola ovatipoda Hansf. & Thirum.
in Farlowia 3: 297, 1948.

3111:4221.

Colonies epiphyllous, thin, upto 3 mm. in diameter or confluent. Hyphae substraight to undulate, cells mostly 15-20 x 6-8 μ, branching opposite at wide angles, loosely reticulate. Capitate hyphopodia alternate, antrorse, usually straight, 16-28 μ long; stipe cell cylindric to cuneate, 4-15 u long; head cell ovate, entire, 10-16 x 9-12 μ. Mucronate hyphopodia separate, opposite or alternate, ampulliform, 15-22 x 6-8 μ. Mycelial setae grouped around perithecia, few, substraight or irregularly bent, simple, acute, upto 200 x 8-10 μ. Perithecia scattered, verrucose, upto 160 u in diameter. Ascospores oblong, 4-septate, constricted 29-37 x 13-16 μ.

Material examined: On Ficus sp. , Balenhonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10868.

Host range: Ficus sp.

Distribution: India.

Remarks: See comments under Meliola ficicola.

35. Meliola ficicola Hansf. and Thirum.
in Farlowia 3: 293, 1948.

3111: 4221.

Colonies epiphyllous, subdense, upto 3 mm. in diameter or confluent. Hyphae straight, cells mostly 15-25 x 7-9 μ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, spreading or antrorse, straight, 16-22 μ long; stipe cell cylindric, 3-6 μ long; head cell cylindric to clavate, entire, 12-16 x 8-10 μ. Mucronate hyphopodia alternate, ampulliform, 16-22 x 6-10 μ. Mycelial setae, thinly scattered and grouped around perithecia, straight, simple, acute, upto 240 x 7-9 μ. Perithecia loosely scattered, verrucose, upto 160 μ in diameter. Ascospores oblong to ellipsoid, obtuse, 4-septate, constricted, 37-45 x 16-18 μ.

Material examined: On Ficus sp., Balehonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No.10868.

Host range: Ficus sp.

Distribution: India.

Remarks: The types of Meliola ficicola and M. ovatipoda occur on the same leaf. The type specimen was examined but it showed only one type of colony, which varied from thin to subdense. Even with the microscopic examination it was

not possible to separate out the two. According to authors, M. ovatipoda is distinguished from M. ficicola by thinner colonies, with rather more flexuous mycelium, narrower hyphae with different hyphopodia. These differences are however, not clear cut and could be due to the variation within the species. Both straight and bent mycelial setae were observed in the same colony. Hyphopodia also varied in shape, i.e. ovate, cylindric or clavate. It, therefore, appears, that the two species are the same. Meliola bangalorensis described on the same host genus by Thirumalachar and Hansford is also not much different from the M. ficicola, M. ovatipoda complex. It would, therefore, be desirable to merge the three names into one.

22. Myrsinaceae

36. Meliola transvaalensis Doidge
in Bothalia 2: 238, 1928.
311½: 5223.

Colonies mostly epiphyllous, dense, velvety upto 5 mm. in diameter, sometimes confluent. Hyphae substraight, cells mostly 12-20 x 8-10 µ, branching opposite at acute angles, very closely reticulate, almost compact. Capitate hyphopodia opposite or alternate, antrorse, straight or slightly bent, 16-20 µ long; stipe cell short cylindric, 6-8 x 4.6 µ; head cell ovate or cylindric, entire, 12-16 x 9-12 µ. Mucronate hyphopodia few, interspersed with capitate hyphopodia,

ampulliform, 22-24 x 8-10 μ. Mycelial setae straight or curved, acute or subacute, upto 560 μ x 9-12 μ. Perithecia verrucose, upto 200 μ in diameter. Ascospores 4 septate, oblong obtuse, constricted, 48-52 x 16-20 μ.

Type: On Myrsine africana L., South Africa, Department of Plant Pathology, Union Dept. Agric. Pretoria, No.17746.

Material examined: On Myrsine africana L., Chaubattia, 15.10.1959, Leg. J.N. Kapoor.

Host range: Myrsine africana L.

Distribution: South Africa and India.

Remarks: Meliola armata Speg., (Bot. Acad. Nac. Cienc. Cordoba, 11:381, 1889) and Meliola delicatula Speg. (Anal. Soc. Cienc. Argentina, 26: 63, 1888) are also recorded on this host genus from Brazil and Paraguay respectively. The former differs from the above specimen mainly in having only alternate hyphopodia and much shorter mycelial setae. M. delicatula is distinct in having larger colonies, alternate capitate hyphopodia, shorter mycelial setae and spores.

This is being recorded here for the first time from India.

23. Myrtaceae

Key to species:

Hyphae devoid of hyphopodia..... Meliolina arborescens

Hyphae with hyphopodia.

Ascospores fusoid..... Meliola trichostroma

Ascospores obtuse-ellipsoid.

Mycelial setae upto 1100 µ long; Cap. hyphopodia opposite..... Meliola eugenicola

Mycelial setae upto 340 µ long; Cap. hyphopodia alternate..... Meliola ranganathii

37. Meliolina arborescens (Sydow, H. & P.) Sydow, H.&P. in Ann. Mycol. 12: 553, 1914.

= Meliola arborescens Sydow, H. & P. in Ann. Mycol. 11: 256, 1913.

2140: 5343.

Colonies hypophyllous, very dense, velvety to arachnoid, upto 10 mm. in diameter, frequently confluent. Hyphae irregularly branched, cells 20-40 x 6-8 µ in wide, with remote articulations and devoid of hyphopodia. Mycelial setae numerous, scattered, forked, each division giving rise to two or rarely 3 branches with acute apices, which give them the dendroid appearance. They are upto 500 µ long. Perithecia scattered, black, globose, verrucose, upto 400 µ in diameter. Ascospores 3-septate, slightly constricted,

ellipsoid, obtuse, 52-58 x 18-21 μ.

Type: On Eugenia globosa Elmer, Mt. Apo, Mindano, Philippines, Elmer 11328, in Philippine Bureau of Science.

Material examined: On Eugenia jambolana Lamk, Cottamunda, Wynaad, 22.11.1909, Leg. W. McRae, H.C.I.O. No. 1034, as Meliola cladotricha Lév.

Host range: Syzygium (= Eugenia) spp.

Distribution: Philippines, India.

Remarks: Meliolina pulcherrima (Syd. H. & P.), Syd. H. & P., M. radians (Syd. H. & P.), Syd. H. & P., M. cladotricha (Lev.) Sydow, H. & P. and M. arborescens (Syd. H. & P.) Syd. H. & P. are recorded on Eugenia spp. All these are morphologically more or less similar and it is often difficult to identify a specimen of these with certainity. The spores in the specimen studied are of the same size as those of M. arborescens and are somewhat smaller than those of M. cladotricha. This specimen was earlier determined and recorded as M. cladotricha. Stevens in his monograph, has recorded it as Meliolina mollis (Berk. & Br.) Hoehnel, but this does not appear to be correct as the perithecia are not setoge in the Indian specimens. Meliolina mollis is reported to have setoge perithecia.

38. Meliola eugenicola Stev.
in Mem. Dept. of Agriculture, India, Bot. Ser. 15: 107, 1922.

3112: 4324.

Colonies amphigenous thin, upto 5 mm. in diameter. Hyphae straight, cells mostly 20-25 x 6-8, branching opposite at wide angles, loosely reticulate. Capitate hyphopodia opposite, spreading, or subantrorse, straight or slightly bent, 14-18 µ long; stipe cell cylindric, 3-5 µ long; head cell cylindric or reflexed entire, 11-14 x 6-8 µ. Mucronate hyphopodia interspersed with capitate hyphopodia, alternate or opposite, ampulliform 13-18 x 6-8 µ. Mycelial setae few, scattered, straight, simple, acute, upto 1100 x 8-10 µ. Perithecia scattered, verrucose, upto 140 µ in diameter. Ascospores ellipsoid, obtuse, 4-septate, rather deeply constricted, 42-44 x 22-22 µ.

Material examined: On Eugenia eucalyptoides, Pachandi, Manglore, 14.4.1913, Leg. L.S. Subramaniam, Type, H.C.I.O. No. 1989.

Host range: Eugenia eucalyptoides, F. Muell.

Distribution: India.

Remarks: There are several species recorded on this host genus or family, but this is quite distinct from all in having straight hyphae and opposite hyphopodia.

39. Meliola ranganathii Hansf.

Proc. Linn. Soc. London, 151: 185, 1946.

3111:3221.

Colonies amphigenous, upto 3 mm. in diameter, sometimes

confluent. Hyphae undulate, cells mostly 10-15 x 6-8 μ, branching close, opposite at wide angles, densely reticulate. Capitate hyphopodia alternate, spreading, straight or bent, 13-22 μ long, stipe cell cylindric, 4-8 μ long; head cell oblong, rounded at apex, straight or bent, 10-16 x 7-10 μ. Mucronate hyphopodia few, mixed with capitate hyphopodia, opposite or alternate, conoid, 14-18 x 6-9 μ. Mycelial setae, few, scattered, simple, acute, straight, upto 34 x 6-8 μ. Perithecia scattered, verrucose, upto 170 μ diameter. Ascospores cylindric, obtuse, 4-septate, constricted, 35-39 x 16-19 μ.

Material examined: On Eugenia sp., S. Kanara, 27.3.1913, Leg. T.R. Ranganath, Type, H.C.I.O. No. 10399.

Host range: Eugenia sp.

Distribution: India.

Remarks: This specimen is severely parasitized by Pleurophragmium capense Thuem. It differs from Meliola eugenicola Stev. also recorded on this host genus, in having alternate capitate hyphopodia and much shorter mycelial setae.

40. Meliola trichostroma (Kze.) Toro
in J. Dept. Agr. Univ. Porto Rico 36: 62, 1952.
= Meliola psidii Fr., in Linnea 5: 549, 1830; The Fungi of Bombay 8: 6, 1935.

3111: 4222.

Colonies hypophyllous, subdense, 2-5 mm. in diameter, velvety, often confluent. Hyphae crooked, branching opposite or irregular at wide angles, loosely interwoven, reticulate, cells mostly 20-30 x 5-7 μ. Capitate hyphopodia alternate, often formed considerably behind the distal septum of the parent cell, straight or irregularly bent cell, straight or irregularly bent, spreading, 15-30 μ long; stipe cell cylindric, 3-16 μ long; head cell straight oblong or subglobose to irregularly bent and rounded angulose to sublobate, apex often truncate, versiform, 10-18 x 6-14 μ. Mucronate hyphopodia mixed with capitate hyphopodia, alternate, ampulliform, 18-30 x 6-9 μ, neck often elongate, sometimes tortuous. Mycelial setae numerous, scattered, upto 400 x 6-9 μ, gradually attenuate to acute apex, straight or slightly bent, simple. Perithecia, closely scattered, slightly verrucose, upto 180 μ in diameter, spores sub-ellipsoid with ends from obtuse conoid to fusoid rounded, straight or slightly bent, simple, 4-septate, constricted 35-44 x 13-17 μ.

Type: On Psidium pomiferum Linn. (= P. guajava Linn.), Brazil, Weigelt, Naturhistoriska Riksmuseet, Stockholm.

Material examined: Not available for study.

Host range: Psidium sp.

Distribution: South American region, West Indies and India.

Remarks: This species is remarkable in having fusoid ascospores, which makes it quite distinct from all other Meliolinae. No Indian specimen of this species was available for study. This is recorded in Fungi of Bombay 8: 6, 1935 on fruits of Guava (Psidium guagava L.) as Meliola psidii which Toro, l.c., considers to be the synonym of M. trichostroma. The description and illustration have been reproduced from Hansford's monograph.

24. Oleaceae

Key to species:

Capitate hyphopodia opposite.....Meliola gemellipoda

Capitate hyphopodia alternate.

Colonies dense.....Meliola jasminicola var. indica

Colonies thin to subdense

Colonies thin, mycelial cell 20-40 x 6-8 μ, ascospores 34-40 x 14-16 μ.....Meliola daviesii.

Colonies thin to subdense,

mycelial cell 16-20 x 6-4 μ,

ascospores 28-36 x 12-15 μ.....Meliola malabarensis

41. Meliola daviesii Hansf.

in Proc. Linn. Soc. London, 157: 176, 1946.

3111: 3222.

Colonies epiphyllous, thin, upto 3 mm. in diameter. Hyphae straight to slightly tortuous, cell, mostly 20-40 x

6-8 μ, branching opposite at wide angles, loosely reticulate. Capitate hyphopodia alternate, antrorse, straight or slightly bent, 20-30 μ long; stipe cell cuneate or cylindric 6-12 μ long; head cell clavate cylindric, entire, apex rounded 12-16 x 8-10 μ. Mucronate hyphopodia few, interspersed with capitate hyphopodia, opposite or alternate, ampulliform or conoid, 12-20 x 6-8 μ. Mycelial setae mostly around the perithecia, straight, simple, acute, upto 400 x 6-8 μ. Perithecia scattered, verrucose, upto 150 μ diameter. Ascospores oblong, obtuse, 4-septate, 34-40 x 14-16 μ.

Type: On Jasminum sp. Uganda, Hansford, 2814, Royal Botanic Garden, Kew, Surrey.

Material examined: On Jasminum sp., Palampur (Punjab), 16.5.1963, Leg. V.S. Sharma, H.C.I.O. No. 27855.

Host range: Jasminum spp.

Distribution: India, Burma and Uganda.

Remarks: This is being recorded for the first time from India.

42. Meliola gemellipoda Doidge.
in Bothalia 1: 80, 1920.
= Meliola busogensis Hansf.
in Jour. Linn. Soc. Lond. 51: 538, 1938.
3112: 5233.

Colonies epiphyllous, less commonly amphigenous, dense,

velvety, upto 4 mm. in diameter. Hyphae straight, branching opposite, acute or wide, densely reticulate, cells mostly 16-28 x 6-9 μ. Capitate hyphopodia antrorse, opposite, straight or slightly bent, 14-20 μ long; stipe cell cylindric to cuneate, 4-6 μ long; head cell ovate to subglobose, entire or rounded angulose, 10-12 x 7-10 μ. Mucronate hyphopodia few, interspersed with capitate hyphopodia, ampulliform, 20-30 x 10 μ, opposite or alternate. Mycelial setae scattered, straight, simple acute, upto 700 x 9-12 μ. Perithecia scattered or in loose central group, verrucose, upto 210 μ in diameter. Ascospores oblong to subellipsoid, obtuse, 4-septate 44-52 x 16.20 μ.

Type: On Jasminium angulare, Vahl., South Africa, Dept. of Plant Pathology, Union Dept. of Agriculture, Pretoria, South Africa No. 12352.

Material examined: On Jasminum malabaricum Wight, Sirsi, Bombay, 10.9.1912, Leg. G.S. Kulkarni, H.C.I.O. No. 3298 (In association with Meliola daviesii Hansf.).

Host range: Jasminum spp.

Distribution: South Africa, Gold Coast, Sierra Leone, Tanganyika, Uganda, Belgian Congo, Malaya and India.

Remarks: The Indian specimen referred to above, was recorded as Meliola jasminicola P. Henn., which is obviously a mis-determination. In this specimen there is a mixture of 2 species. Meliola gemellipoda is quite distinct in having

opposite hyphopodia and dense colonies whereas the other has much thinner colonies and alternate hyphopodia. The latter probably belongs to Meliola daviesii. It could not be determined with certainity as no spores or mycelial setae could be seen on the specimen.

43. Meliola jasminicola P; Henn. var. indica var. nov.

3111:3222.

Colonies epiphyllous, dense, velvety, upto 2 mm. in diameter or sometimes confluent. Hyphae substraight or slightly undulate, branching opposite, acute, very densely reticulate, cells mostly 20-30 x 6-8 µ. Capitate hyphopodia alternate, spreading or slightly antrorse, straight or bent, 20-30 µ long; stipe cell cylindric 4-8 µ long; head cell ovate to oblong, entire, 12-16 x 8-12 µ. Mucronate hyphopodia interspersed with capitate hyphopodia, opposite or alternate, ampulliform, 20-30 x 6-8 µ. Mycelial setae mostly around perithecia straight or curved, attenuate acute, simple upto 300 x 8-10 µ. Perithecia scattered or grouped in the centre, verrucose, upto 160 u in diameter. Ascospores oblong to subellipsoid obtuse, 4-septate, 36-40 x 14-16 µ.

Material examined: On Jasminum auriculatum Vahl., Calcutta 6.6.1919, Leg. S.N. Bal., Type, H.C.I.O. No. 3295 (as Meliola jasminicola P. Henn.).

Host range: Jasminum sp.

Distribution: Uganda, Ghana, Ceylon, Philippine and India.

Remarks: The Indian specimen referred to above, was published as Meliola jasminicola P. Henn. in Journal of Science Dept., University of Calcutia 4: 3, 1922. This specimen differs from Meliola jasminicola P. Henn. in having only alternate hyphopodia, much shorter mycelial setae and smaller spores. It differs from M. jasminicola var. africana Hansf. also recorded on the same host genus mainly, in having substraight hyphae, clavate to cylindric head cell and much shorter mycelial setae. Hyphae in M. jasminicola var. africana are undulate, head cell is subglobose and mycelial setae are considerably longer. It is therefore, being proposed as a new variety of M. jasminicola P. Henn.

Two specimens of a Meliola spp. collected by S.L. Ajrekar from Northern Bombay (H.C.I.O. Nos. 3296, 3297), recorded under the name Meliola jasminicola P. Henn. were also examined but could not be identified, as the specimens were too brittle for film preparation, as also they were badly infected with Asterina sp. The specimen of M. jasminicola on Jasminum sambac Ait. reported by Bal l.c. from Bengal was not available for study.

44. Meliola malabarensis Hansf.
in Proceedings Linn. Soc. London, 157: 182, 1946.

3111: 3222.

Colonies amphigenous, thin to subdense upto 5 mm. in diameter, or confluent. Hyphae substraight, branching opposite at wide angles, closely reticulate, cells mostly 16-20 x 4-6 µ. Capitate hyphopodia alternate, slightly antrorse, straight or slightly bent, 16-24µlong; stipe cell cylindric, 4-8 µ long; head cell ovate to cylindric, entire, 8-12 x 6-8 µ. Mucronate hyphopodia, opposite or alternate conoid to ampulliform, 14-20 x 4-6 µ. Mycelial setae scattered, flexuous, simple, acute upto 400 x 6-8 µ. Perithecia scattered, verrucose, upto 140 µ in diameter. Ascospores subellipsoid, obtuse, 4-septate, constricted, 28-36 x 12-15 µ.

Material examined: On Olea sp., Tellichery, Malabar, 26.9.1904, Leg. E.J. Butler., Type, H.C.I.O. No. 3187.

Host range: Olea sp.

Distribution: India.

Remarks: Butler determined this specimen as M. amphitricha Fr. This epithet has been discarded by Hansford (Sydowia, Behefte II p. 765, 1961) because no type specimen or type host can be assigned to M. amphitricha.

25. Opiliaceae

Key to species:

Capitate hyphopodia alternate but almost 15% opposite. Mycelial setae furcate, branches upto 30 μ long.....Meliola cansjerae

Capitate hyphopodia opposite. Mycelial setae dentate or simple.....Meliola opiliae

45. Meliola cansjerae Hansf. & Thirum. in Farlowia 3: 290, 1948.

31½3: 4221.

Colonies amphigenous, dense, velvety, subcrustose, upto 3 mm. diameter or confluent. Hyphae substraight, cells mostly 15-30 x 6-8 μ, branching opposite, acute, densely reticulate and nearly solid in the centre. Capitate hyphopodia alternate or about 15% opposite, spreading or antrorse, bent, 13-20 μ long, stipe cell cylindric, 3-8 μ long, head cell ovate, clavate or cylindric, entire straight or bent, 10-17 x 8-11 μ. Mucronate hyphopodia few, interspersed with capitate hyphopodia, opposite or alternate, ampulliform, 20-25 x 7-9 μ. Mycelial setae numerous scattered, straight upto 280 x 8-10 μ, apex 2-3 dentate, or furcate, branches upto 30 μ long or rarely simple. Perithecia in

central group, verrucose, upto 195 μ diameter. Ascospores oblong, obtuse, 4-septate, 39-47 x 15-18 μ.

Material examined: On Cansjera rheedii Gmel., Nandi Hills, Mysore, 23.3.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10871.

Host range: Cansjera rheedii Gmel.

Distribution: India.

Remarks: Meliola opiliae var. singhalensis is also recorded on this host from Ceylon which differs from Meliola cansjerae in opposite arrangement of capitate hyphopodia and in having simple setae.

46. Meliola opiliae Syd.

in Ann. Mycol. 11: 327, 1913.

31½2: 4231.

Colonies amphigenous, dense, velvety, 2-3 mm. diameter or confluent. Hyphae straight, cells mostly 15-20 x 7-9 μ branching opposite, acute, densely reticulate and nearly compact in the centre. Capitate hyphopodia opposite, antrorse, straight or slightly bent, 13-18 μ long; stipe cell cylindric, 2-6 μ long, head cell subglobose to clavate, entire, 10-14 x 9-11 μ. Mucronate hyphopodia few, ampulliform, 17-20 x 6-8 μ. Mycelial setae numerous, rigid, straight, simple and obtuse or 2-3 dentate, upto 280 x 9-10 μ. Perithecia crowded, verrucose, upto 210 μ in diameter. Ascospores oblong-obtuse, 4-septate, 38-47 x 14-17 μ.

Material examined: On Opilia amentacea Roxb., Coimbatore, 12.12.1909, Leg. E.L. Fisher, Type, H.C.I.C. No. 10400 (in association with Asterina crebra Syd.).

Host range: Opilia amentacea Roxb. and Lepionurus oblongifolius Mast.

Distribution: India.

Remarks: Hansford (Sydowia Beih. II: 1961) has recorded it on Lepionurus oblongifolius Mast. from India. This specimen is available in Herbarium, Commonwealth Mycological Institute, Kew, Surrey, England.

26. Pittosporaceae

47. Meliola polytricha Kalchbr. & Cooke
in Grevillea 8: 72, 1979.

3111: 5222.

Colonies amphigenous, mostly epiphyllous, upto 4 mm. diameter, dense, velvety. Hyphae substraight, branching opposite, acute, closely reticulate, cells mostly 16-24 x 8-10 µ. Capitate hyphopodia, alternate, antrorse, 18-24 µ long; stipe cell cylindric to cuneate, 4-8 µ long; head cell slightly angulose, subglobose to broadly ovate, 12-16 µ in diameter. Mucronate hyphopodia separate, opposite or alternate, ampulliform, 10-16 x 6-8 µ. Mycelial setae numerous, scattered, straight, upto 350 x 8-10 µ, simple, acute. Perithecia

scattered, verrucose, upto 200 u diameter. Ascospores oblong obtuse, 4-septate, 52-56 x 18-20 µ, constricted.

Type: On Pittosporum viridiflorum Sims, Wood 222, Dept. of Plant Pathology, Union Dept. of Agriculture, Pretoria, South Africa.

Material examined: On Pittosporum dasycaulon Miq., N. Kanara, Oct. 1919, Coll. L.J. Sedgwick., H.C.I.O. No. 1983 (as Meliola elemeri Sydow).

Host range: Pittosporum spp.

Distribution: South Africa, Uganda, New South Wales, India.

Remarks: Stevens (Mem. Dept. of Agric. India Bot. Ser. 15: 109, 1928) identified this specimen as Meliola elmeri Sydow, from which it is distinct in having much bigger ascospores. This specimen has rather irregular head cell instead of subglobose to broadly ovate, entire as in the type of M. polytricha. Meliola polytricha Kalchb. and Cooke is being reported here for the first time from India.

27. Rhamnaceae

48. Meliola zizyphi Hansf. & Thirum.

in Farlowia 3: 299, 1948.

3111:3222.

Colonies epiphyllous, thin, upto 3 mm. in diameter or confluent. Hyphae substraight, cells mostly 20-30 x 4-6 µ,

branching opposite, loosely reticulate. Capitate hyphopodia mostly alternate, a few opposite also, spreading, often reflexed, bent, 10-17 μ long; stipe cell cylindric, 2-6 μ long; head cell cylindric clavate, often bent, entire, 8-12 x 7-9 μ. Mucronate hyphopodia mixed with capitate hyphopodia, alternate or solitary, ampulliform, 14-29 x 6-8 μ. Mycelial setae thinly, scattered, simple, acute, straight or slightly flexuous, upto 400 x 6-8 μ. Perithecia oblong to subellipsoid, obtuse, 4-septate, 30-36 x 12-14 μ.

Material examined: On Zizyphus rugosa Lamk., Balehonnur, Mysore, 28.4.1945, Leg. M.J. Thirumalachar, Type H.C.I.O. No. 10879.

Host range: Zizyphus rugosa Lamu.

Distribution: India.

28. Rosaceae

Key to species:

Perithecia with larviform appendages ascospores 3-septate, head cell lobate.....Appendiculella calostroma

Perithecia devoid of larviform appendages, ascospores 4-septate, head cell entire.....Meliola rubiella.

49. Appendiculella calostroma (Desm.) Hoehn.
in Sitzb. K. Akad. Wissen. Wien, Math. Naturn. Kl. 138: 556, 1919.

= Meliola calostroma (Desm.) Hoehn.
in Ann. Mycol. 15: 363, 1917.

= Irene calostroma (Desm.) Hoehn.
in Ann. Mycol. 16: 213, 1918.

= Meliola rubicola P. Henn.
in Hedwigia 43: 140, 1904.

= Irenina rubi Stev. & Rold. var. angulosa Stev. and Rold. in Philipp. J. Science 56: 52, 1935.

= Irenopsis crataegi Bose, Indian Phytopath 15: 144, 1962.

2201: 4230.

Colonies mostly epiphyllous, thin to subdense, upto 4 mm. in diameter. Hyphae straight to undulate, cells mostly 20-30 x 6-8 µ, branching opposite, sometimes alternate also, loosely to rather closely reticulate. Capitate hyphopodia alternate, or unilateral, more or less antrorse, straight or bent, 24-36 µ long; stipe cell cuneate to cylindric, 10-14 µ long; head cell angulose to lobate, 18-20 µ, in diameter. Mucronate hyphopodia few, interspersed with capitate hyphopodia, ampulliform, 18-24 x 6-8 µ. Perithecia scattered, upto 225 µ in diameter, surface cells conoid to mamillate, with some produced into larviform appendages, approximately 4-6 appendages, more or less curved or subattenuate above to obtuse apex, transversely striate, upto

60 x 20-24 μ at the base. Ascospores bent, cylindric, obtuse, 3-septate, 40-46 x 12-14 μ, slightly constricted.

Type: On Rubus trivialis Michx., U.S.A., Langlois 74, type of Meliola sanguinae, in Royal Botanic Gardens, Kew.

Material examined: On Rubus ellipticus Sm., Kalimpong, 19.3.1957, Leg. J.N. Kapoor, H.C.I.O. No. 26605; Crataegus crenulata Roxb., Chaubattia, 15.10.1959, Leg. J.N. Kapoor, H.C.I.O. No. 28331.

Host range: Rubus spp.; Crataegus crenulata Roxb.; Geum spp.; Cliffortia spp.; Leucosidea sericea Eckl. & Zeyh.

Distribution: India, New South Wales, Philippines, South Africa, South America, Formosa, Uganda.

Remarks: The Indian specimens are typical A. calostroma. Bose (Indian Phytopath. 15: 144, 1962) has described Irenopsis crataegi on a collection made from Chaubattia. The type collection of I. crataegi was not available for study but a collection made by the author in 1959 from the same place was examined and was found to be true A. calostroma. The description given by Bose agrees fully with the description of A. calostroma except the appendages which are of different type. Until, Bose's material is examined, it seems proper to put the same under A. calostroma. On the Rubus specimen, colonies of A. calostroma occur mixed with Meliola rubiella, which can easly be distinguished, in having

substraight mycelium entire head cells of hyphopodia and 4-celled ascospores. This is a new record from India.

50. Meliola rubiella Hansf.

in Sydowia Beih. 12: 115, 1957.

3111: 3222.

Colonies mostly epiphyllous, thin, upto 3 mm. in diameter. Hyphae substraight to undulate, cells mostly 20-28 x 4-6 µ, branching opposite at wide angles, very loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, 12-16 µ long, slightly bent; stipe cell slightly cuneate to almost cylindric 4-5 µ long; head cell ovate to sub-globose, mostly entire, rarely slightly angulate, 12-14 x 10-12 µ. Mucronate hyphopodia interspersed with capitate hyphopodia, opposite or alternate, ampulliform. Mycelial setae only around perithecia, straight or rarely bent, upto 350 x 8-10 µ simple, sub-acute to obtuse. Perithecia verrucose, upto 200 µ in diameter. Ascospores oblong-obtuse, 4-septate, constricted, 32-36 x 10-12 µ.

Type: On Rubus moluccans Linn., Philippines, Stevens 1461, in F.L. Stevens Herbarium, University of Illinois.

Material examined: On Rubus sp., Singhik (N. Sikkim), 14.4.1962, Leg. J.N. Kapoor, H.C.I.O. No. 28361; on Rubus ellipticus Sm., Kalimpong, 19.3.1951, Leg. J.N. Kapoor, H.C.I.O. No. 26605.

Host range: Rubus spp.

Distribution: India and Philipoines.

Remarks: The colonies in the two specimens are found mixed with those of Appendiculella calostroma. These can easily be made out, because of characteristic hyphopodia, which are globose and entire in contrast to the head cells of A. calostroma which are lobate, as also presence of mycelial setae and 4-septate ascospores. This is the first record from India.

29. Rubiaceae

Key to species:

Capitate hyphopodia very long, upto 60 μ long; stipe cell 1-3 celled hypha like.....Meliola plectroniae

Capitate hyphopodia only upto 32 μ long, stipe cell cylindric to cuneate.

Mycelial setae acute, head cell angulose.....Meliola canthii

Mycelial setae subacute, head cell entire.....Meliola weberae

51. Meliola canthii Hansford

in Proc. Linn. Soc. London 157: 22, 1945.

3111: 42x2.

Colonies amphigenous, mostly epiphyllous, dense,

velvety, upto 3 mm. in diameter. Hyphae substraight cells mostly 20-30 x 7-9 μ, branching opposite, alternate or irregular at acute angles, densely interwoven reticulate and radiating. Capitate hyphopodia alternate, bent or straight, more or less antrorse, 24-32 μ long; stipe cell cylindric to cuneate, 8-12 μ long; head cell cylindric-clavate, slightly angulose, 16-20 x 14-18 μ. Mucronate hyphopodia few, mixed with capitate hyphopodia, ampulliform. Mycelial setae straight, simple, acute, upto 400 x 10-12 μ. Perithecia not seen. Ascospores oblong, obtuse, 4-septate, slightly constricted, 42-46 x 14-16 μ.

Type: On Canthum vulgare, Uganda, Hansford 1912, in Royal Botanic Garden, Kew, England.

Material examined: On Plectronia parviflora Bedd. (= Canthium parviflorum Lam.), Bhubaneshwar, Oct., 1920, Leg. S.N. Bal, H.C.I.C. No. 3195 (As Meliola asternoides var. major Gaill.); Canthium rheedii DC., South Kanara, 27.3.1913, Leg. T.R. Ranganath, H.C.I.C. No. 10397.

Host range: Canthium spp.

Distribution: Indian, Uganda.

Remarks: The Bhubaneshwar specimen was recorded by S.N. Bal as Meliola asternoides Winter var. major Gaill. (J. Dept. Sci., Calcutta University, 4: 4, 1922). This is very similar to M. canthii Hansf. and has been identified as such. The other

material from South Kanara is severely parasitized and I was unable to see any spores or setae, but the mycelial characters indicate that it also probably belongs to this species. Meliola canthii is being reported here for the first time from India.

52. Meliola weberae sp. nov.

3111: 4223.

Colonies mostly hypophyllous, upto 3 mm. in diameter, dense, velvety. Hyphae undulate, branching mostly opposite at acute angles, cells mostly 20-27 x 6-8 µ. Capitate hyphopodia alternate, antrorse, straight or bent, 20-28 µ long; stipe cell cylindric 8-14µlong; head cell ovate to cylindric, entire or sometimes slightly angulose 14-20 x 10-14 µ. Mucronate hyphopodia on separate hyphae, conoid to ampulliform, 16-20 x 6-8 µ. Mycelial setae mostly around perithecia, straight or slightly bent, subacute, simple upto 800 x 6-8 µ. Perithecia verrucose, upto 120 µ in diameter. Ascospores 4-septate, oblong, obtuse, 40-48 x 18-20 µ.

Material examined: On Webera corymbosa Willd., Bilikere, Mysore, 19.9.1903, Leg. E.J. Butler, Type, H.C.I.O. No. 1035.

Host range: Confined to Webera corymbosa Willd.

Distribution: India.

Remarks: The specimen was labelled as Meliola asternoides Wint. var. major Gaill. This is obviously a misdetermination.

No other Meliola sp. is recorded on this genus and moreover it is quite distinct from other species recorded on this host family i.e. Rubiaceae, therefore, it is proposed as a new species.

53. Meliola plectroneae Hansf.

in Sydowia 9: 72, 1955.

3111:4223.

Colonies hypophyllous, thin, more or less velvety, upto 5 mm. diameter. Hyphae flexuous, cells mostly 25-40 x 6-8 µ, branching opposite or irregular at varying angles, loosely interwoven reticulate. Capitate hyphopodia alternate, crooked, 25-70 µ long; stipe cell cylindric, irregularly bent and often 1-3 septate, 48-60 µ long, head cell versiform, often uncinate, ovate and subentire to variously angled or sublobate 13-29 x 9-18 µ. Mucronate hyphopodia not seen. Mycelial setae scattered, straight, simple, acute, upto 550 x 8-10 µ. Perithecia scattered, verrucose, upto 180 µ in diameter. Ascospores oblong-obtuse, 4-septate, constricted, 40-44 x 14-16 µ.

Material examined: On Plectronia umbellata Benth. & Hook., Matheran, Bombay, 16.10.1911. Leg. S.L. Ajrekar, Type, H.C.I.O. No. 3196.

Host range: Plectronia umbellata

Distribution: India.

Remarks: This species is very characteristic in having hypha like capitate hyphopodia which are upto 60 u long and the stalk cell is 1-3 septate.

30. Rutaceae

Key to species:

Mycelial setae dentate or branched

Mycelial setae dichotomous.....Meliola tenella

Mycelial setae 2-4 dentate.

Capitate hyphopodia both alternate and opposite.....Meliola glycosmidis

Capitate hyphopodia only alternate.

Perithecia upto 220 μ in diameter.....Meliola butleri

Perithecia upto 170 μ in diameter.....Meliola citricola

Mycelial setae simple.

Mycelial setae, obtuse, hamate...Meliola zanthoxyli

Mycelial setae, acute, straight.

Mycelial setae upto 700 μ long, capitate hyphopodia only alternate.....Meliola teckliae var. toddalia-asiaticae

Mycelial setae upto 280 μ long, capitate hyphopodia both alternate or opposite.....Meliola toddalicola var. indica.

54. Meliola butleri Sydow.
in Ann. Mycol. 9: 379, 1911.
= Amazonia butleri Stev.
in Ann. Mycol. 25: 415, 1927.

31⅓1: 1233.

Colonies amphigenous, mostly epiphyllous upto 4 mm. in diameter, subcrustose, dense. Hyphae straight to undulate, cells mostly 12-24 x 6-8 µ, branching opposite or irregular, at wide angles closely reticulate. Capitate hyphopodia alternate or to some extent opposite, antrorse, bent, 16-24 µ long; stipe cell cylindric to cumeate 4-6 µ long; head cell ovate, clavate or cylindric, often bent, entire, 12-16 x 8-10 µ. Mucronate hyphopodia interspersed with capitate hyphopodia, opposite or alternate and ampulliform, 16-20 x 6-8 µ. Mycelial setae scattered, straight, acute or 2-4 dentate, 650 x 8-10 µ. Perithecia closely scattered, verrucose, upto 220 µ in diameter, originating from a radiate disc. Ascospores oblong to subellipsoid, obtuse, 4-septate, constricted, 32-44 x 14-18 µ.

Material examined: On Citrus medica Linn. var. acida, Bengal India, 15.8.1906, Leg. R. Sen, Type, H.C.I.O. No. 1042.

Host range: Citrus spp.

Distribution: India, Burma, Formosa, Philippines.

55. Meliola citricola Syd.

in Ann. Mycol. 15: 183, 1917; The Fungi of Bombay 8: 6, 1935.

31½3: 4223.

Colonies amphigenous, upto 5 mm. diameter, dense, sometimes subvelvety. Hyphae substraight to undulate, crooked on lower surface, cells mostly 15-20 x 6-8 µ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, or to about 15% opposite, spreading, straight, or bent, 15-22 µ long; stipe cell cylindric, 3-6 µ long; head cell cylindric, straight or bent, 10-16 x 7-11 µ. Mucronate hyphopodia mixed with capitate hyphopodia, opposite or alternate, ampulliform, 17-22 x 6-8 µ. Mycelial setae fairly numerous, scattered, straight, simple or obtuse or variously dentate, upto 700 x 8-11 µ. Perithecia scattered, verrucose, upto 170 µ diameter. Ascospores cylindric to ellipsoid, obtuse, 4-septate, constricted 33-42 x 14-18 µ.

Material examined: On Citrus spp., Luzon, Philippines, in Oct. 1915, Leg. M. Ramos, Phillipines Bureau of Sciences 23747, Type.

Host range: Citrus spp.

Distribution: South East, Asia, India, Ceylon.

Remarks: It is reported on Citrus limonis Wall. from Poona. The type specimen was compared to the type of M. butleri Syd. and was found to be identical. It would be proper to merge

the two under M. butleri Syd., which has the priority having been described earlier. Since no Indian specimen was available for study the description and drawings have been based on the Philippine type material.

56. Meliola glycosmidis sp. nov.

31⅓3: 4233.

Colonies epiphyllous, separate, upto 4 mm. in diameter, subdense, velvety. Hyphae almost straight to slightly undulate; cells mostly 16-24 x 6-8 μ, branching opposite at acute angles, closely reticulate. Capitate hyphopodia opposite or alternate, straight or bent, 12-24 μ long; stipe cell cylindric to cuneate, 3-5 μ long; head cell ovate or cylindric clavate, entire 12-20 x 8-10 μ. Mycelial setae abundant, aggregated around the perithecia, straight or bent, acute or 2-4 dentate, upto 800 x 8-12 μ. Perithecia scattered, verrucose, upto 250 μ in diameter. Ascospores oblong 4-septate, slightly constricted, obtuse, 36-42 x 10-16 μ.

Material examined: On Glycosmis pentaphylla Correa, Calcutta, 9.8.1919, Leg. S.N. Bal, Type, H.C.I.O. No. 3215.

Host range: Glycosmis pentaphylla.

Distribution: India.

Remarks: This specimen was lying in the Herbarium under the

name Meliola cadigensis Yates. It was compared with the type of M. cadigensis Yates and was found to be different, notably in colony characters and in having dentate setae. This is, therefore, being considered as a new species.

57. Meliola teckliae Hansf. var. toddaliae-asiaticae Hansf. in Proc. Linn. Soc. London, 153: 11, 1941.

3111: 4233.

Colonies epiphyllous, subdense, velvety, upto 3 mm. in diameter. Hyphae substraight, cells mostly 20-30 x 7-9 µ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, or in some colonies rarely opposite, 15-22 µ long, spreading, usually straight, stipe cell cylindric, 4-8 µ long; head cell cylindric to slightly clavate, entire, 10-18 x 8-12 µ. Mucronate hyphopodia, mixed with capitate hyphopodia, opposite or alternate, conoid to ampulliform, 15-22 x 7-10 µ. Mycelial setae numerous scattered, simple, acute, upto 700 x 9-12 µ. Perithecia scattered, verrucose, upto 220 µ in diameter. Ascospores oblong to subellipsoid, obtuse, 4-septate, constricted, 40-47 x 16-20 µ.

Type: On Toddalia asiatica Lam., Uganda, Hansford, 2408, in Royal Botanic Garden, Kew, Surrey, England.

Material examined: On Toddalia asiatica Lam. var. floribunda (= T. aculeata Pers.), Balehonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar.

Host range: Toddalia spp.

Distribution: India and Uganda.

58. Meliola tenella Pat.

in Rev. Mycol. 10: 140, 1888; Sydowia 5: 124, 1951.

3141: 4221.

Colonies amphigenous, thin to subdense, velvety, upto 5 mm in diameter or confluent. Hyphae substraight to undulate, cells mostly, 17-30 x 7-10 µ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, straight or slightly bent-spreading or subantrorse 20-25 µ long; stipe cell cylindric, 6-10 µ long; head cell cylindric to clavate, usually bent, entire 12-20 x 8-11 µ. Mucronate hyphopodia few, mixed with capitate hyphopodia, opposite or alternate, ampulliform. Mycelial setae scattered, straight 2-3 dichotomous at apex, branches widely divergent, reflexed, upto 240 x 9-12 µ. Perithecia scattered, verrucose, upto 180 µ in diameter. Ascospores oblong to subellipsoid obtuse, 4-septate, constricted 48-54 x 16-20 µ.

Type: On Murraya sp., Tonkin, Bon. 775 in Farlow Herbarium, University of Harvard.

Material examined: On Murraya exotica Linn. , Nandi Hills, Mysore, 12.2.1944., Leg. M.J. Thirumalachar, H.C.I.O. No. 10393.

Host range: Murraya spp.

Distribution: India, Java, Tonkin.

Remarks: The Indian specimen is very much distorted due to several hyper-parasites. Still, a few setae and spores as also hyphae, that could be seen, point to its being M. tenella Pat.

59. Meliola toddaliicola Hansf. var. indica Hansf. and Thirum.
in Farlowia 3: 299, 1948.

3113: 4221.

Colonies epiphyllous, dense, upto 3 mm. in diameter. Hyphae substraight, cells mostly 15-20 x 6-7 μ branching opposite, closely reticulate. Capitate hyphopodia opposite or to 30% alternate, spreading or antrorse, usually straight, 13-20 μ long; stipe cell cylindric to cuneate 3-5 μ long; head cell wide ovate; entire 10-15 x 8-10 μ. Mucronate hyphopodia mixed with capitate hyphopodia, opposite or alternate, ampulliform, 12-20 x 6-8 μ. Mycelial setae mostly grouped around perithecia, straight simple, acute, upto 280 x 7-8 μ. Perithecia scattered, verrucose, upto 150 μ in diameter. Ascospores oblong, obtuse, 4-septate, slightly constricted, 38-44 x 15-17 μ.

Material examined: On Toddalia asiatica Lam. var. floribunda (= T. aculeata Pers.), Balehonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.C. No. 10865.

Distribution: India.

Host range: Toddalia asiatica var. floribunda.

Remarks: On the type specimen of this fungus, the colonies of M. teckliae var. toddaliae-asiaticae are also reported to occur. In M. teckliae var. toddaliae-asiaticae the capitate hyphopodia are only alternate, mycelial setae are upto 700 μ long and ascospores are 40-47 x 16-20 μ, whereas in Meliola toddalicola var. indica, about 30% capitate hyphopodia are opposite, mycelial setae are upto 280 μ long and ascospores are 39-44 x 15-17. It is very difficult to distinguish the colonies of the two fungi. I was unable to locate any colony of M. toddalicola var. indica on portion of Type material that is deposited in Herbarium Cryptogamae Indiae Orientalis. The drawing and description have been taken from the original.

60. Meliola zanthoxyli Hansford

in Proc. Linn. Society, Lond. 158: 37, 1946.

3121: 4332.

Colonies epiphyllous, dense, velvety, upto 3 mm. in diameter. Hyphae substraight to undulate, cells mostly 12-18 x 8-10 μ, branching opposite at wide angles, densely, reticulate. Capitate hyphopodia, alternate, antrorse, straight, 20-28 μ long; stipe cell cylindric to cuneate, 8-12μlong; head cell irregularly lobed 12-12μ x 14-22 μ. Mucronate hyphopodia mixed with capitate hyphopodia, usually alternate, ampulliform, 12-20 x 8-10 μ. Mycelial setae scattered, simple, obtuse, widely hamate, upto 375 x 8-12 μ. Perithecia scattered, verrucose, upto 250 μ in diameter. Ascospores

oblong to ellipsoid, obtuse 4-septate, slightly constricted, 52-58 x 20-24 μ.

Type: On Zanthoxylum tetrasperum Wight and Arn., Ceylon in Herb. Peradeniya No. 5597.

Material examined: On Zanthoxylum ovalifolium Wight., Talguppa, Mysore, 29.10.1911, Leg. G.S. Kulkarni, H.C.I.O. No. 3189.

Host range: Zanthoxylum spp.

Distribution: Ceylon, India.

Remarks: This specimen was lying in the Herbarium under the name Meliola amphitricha Fr. This name has now been discarded as no type specimen or type host can be assigned to this species.

31. Santalaceae

61. Meliola osyridicola Hansf.
in Proc. Linn. Soc. Lond. 157: 184, 1946.

3111: 5231.

Colonies amphigenous, dense, subcrustose, upto 1 mm. in diameter. Hyphae substraight, cells mostly 14-18 x 6-10 μ, branching opposite, acute to wide, very densely interwoven reticulate and radiating, forming almost a solid plate. Capitate hyphopodia alternate, antrorse, 18-30 μ long, straight or bent; stipe cell cylindric to cuneate, 6-12 μ long;

head cell ovate to clavate, entire, broadly rounded at apex, 12-16 x 10-12 μ. Mucronate hyphopodia few, mixed with capitate hyphopodia, opposite or alternate, ampulliform. Mycelial setae closely scattered and grouped around perithecia obtuse to subacute, simple, straight upto 240 x 8-10 μ. Perithecia grouped in the centre of the colony verrucose, upto 230 μ in diameter. Ascospores oblong to subellipsoid obtuse, 4-septate, constricted 44-52 x 16-20 μ, the middle cell often slightly the largest.

Material examined: On Osyris arborea Wall., Ootacammund, 14.3.1939, Leg. C.S. Krishnaswamy, Type, H.C.I.C. No. 10402.

Host range: Osyris arborea Wall.

Distribution: India.

Remarks: There are no essential differences from M. osyridis Doidge (Bothalia 2: 462, 1928). The mycelium is rather compact in the case of M. osyridicola. It would be useful to examine the type of M. osyridis Doidge. The Type of M. osyridicola is badly infested with Pleurophragmium capense and that might explain the minor differences in colony and mycelial characters.

32. Thymelaceae

62. Irenopsis mysorensis Hansf. & Thirum.
in Farlowia 3: 287, 1948.

3401: 4230.

Colonies mostly epiphyllous, dense, numerous upto 2 mm. in diameter. Hyphae substraight to undulate, branching opposite at wide angles, closely reticulate, cells mostly 20-24 x 6-8 μ. Capitate hyphopodia alternate, usually straight, 15-22 μ long; stipe cell cylindric to cuneate 4-8 μ long; head cell globose to wide clavate, entire to slightly angulose, 10-15 x 10-14 μ. Mucronate hyphopodia few, interspersed with capitate hyphopodia, opposite or alternate, conoid to ampulliform, 14-20 x 6-8 μ. Perithecia grouped in the centre of the colony, upto 200 μ in diameter, surface cells conoid. Perithecial setae 0-5, erect, spreading, simple, obtuse, irregularly flexuous, upto 60 x 6-7 μ. Ascospores oblong sub-ellipsoid, obtuse, 4-septate, constricted, 38-44 x 14-18 μ.

Material examined: On Lasiosiphon eriocephalus Decne., Thirathhalti, Mysore, 4.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10855.

Host range: Lasiosiphon eriocephalus Decne.

Distribution: India.

Remarks: I was unable to see the perithecial setae on the Type specimen. These have been drawn from the original.

33. Verbenaceae

Key to species:

Hyphae substraight to slightly undulate, ascospores 30-34 µ long..... Meliola clerodendricola

Hyphae undulate to sinuous, ascospores 32-44 µ long.....Meliola callicarpicola

63. Meliola callicarpicola Yamam.
in Trans. Nat. Hist. Soc. Formosa 31: 226, 1941.
Sydowia Beih. II: 691, 1961.

3111: 4222.

Colonies mostly epiphyllous, thin, upto 3 mm. in diameter, often confluent, thin, hyphae undulate to sinuous, cells 20-30 x 5-6 µ, branching opposite or irregular, loosely reticulate, radiate. Capitate hyphopodia alternate, more or less antrorse, straight or slightly bent, 16-20 µ long; stipe cell cylindric to cuneate, 4-6 µ long; head cell subglobose to ovate, entire, 10-12 x 8-10 µ. Mucronate hyphopodia few, mixed with capitate hyphopodia, opposite or alternate, ampulliform, 18-22 x 6-8 µ. Mycelial setae slightly bent, simple, obtuse, tortuous below the apex, upto 450 x 8-10 µ. Perithecia loosely grouped in centre of the colony, verrucose, upto 150 µ in diameter. Ascospores oblong, obtuse, 4-septate, constricted 32-44 x 10-14 µ.
Type: On Callicarpa formosana Rolfe, Formosa, Yamamoto.
Material examined: On Clerodendron infortunatum auct., Bengal 7.12.1911, Leg. E.J. Butler, H.C.I.O. No. 3246; (as Meliola

clerodendricola); Balehonnur, Mysore, 29.4.1945, Leg., M.J. Thirumalachar, H.C.I.C. No. 10898 (as Meliola rizalensis).

Host range: Callicarpa formosana Rolfe, and Clerodendron infortunatum Gaertn.

Distribution: Formosa and India.

Remarks: This was originally identified by Butler as M. clerodendricola P. Henn. Thirumalachar collected the same fungus from Mysore and identified it as M. rizalensis. Hansford (Sydowia Beih. II: 1961) examined the types of M. rizalensis and M. sakawensis and concluded that this fungus was different, and very close to M. callicarpicola Yamamoto.

64. Meliola clerodendricola P. Henn.
in Hedwigia 37: 288, 1895.
= Meliola sakawensis P. Henn.
in Hedwigia 43: 141, 1904.

3111: 3221.

Colonies amphigenous but chiefly epiphyllous, upto 4 mm. in diameter, often confluent, velvety, subdense. Hyphae substraight to slightly undulate; cells 20-32 x 6-7 µ, branching opposite at acute angles, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or slightly bent, 14-18 µ long; stipe cell cylindric to cuneate, 3-6 µ long; head cell subglobose to globose, entire, 8-12 µ in diameter. Mucronate hyphopodia interspersed with

capitate hyphopodia, opposite or alternate, ampulliform, 14-18 x 6-8 μ. Mycelial setae substraight, thinly scattered, simple, obtuse, upto 250 x 6-8 μ. Perithecia scattered, verrucose, 120 u in diameter. Ascospores oblong, obtuse, 4-septate, 32-34 x 12-14 μ.

Type: On Clerodendron sp., Tropical Africa, Schweinfurth 2753, in Naturlistoriska Riksmurseet, Stockholm.

Material examined: On Vitex leucoxylon Linn., North Kanara, October, 1919, Leg. L.J. Sedgwick, H.C.I.C. No. 1984.

Host range: On Clerodendron spp. and Vitex leucoxylon Linn.

Distribution: Uganda, Ghana, Belgian Congo, Sierra Leone, San Domingo, Penang, Philippines, Tonkin, Japan, Cameroons, India.

Remarks: This species has a wide spread distribution but so far it has been reported to occur only on species of Clerodendron. The Meliola on Vitex leucoxylon is identical with Meliola clerodendricola and has therefore, been determined as such. Meliola cookeana Speg. that is reported on this host is distinct in possessing sinuous to crooked mycelium. This is the first record of this species on this host. This species has not been reported from India before.

34. Vitaceae

Key to species:

Perithecia flattened, covered with a radiate mycelial layer, colonies subcrustose and compact..... Amazonia leeae

Perithecia globose, colonies subvelvety, mycelium loosely reticulate.. Meliola bakeri

65. Amazonia leeae Hansf. & Thirum.
in Farlowia 3: 287, 1948.

3101: 4320.

Colonies mostly epiphyllous, dense, subcrustose, upto 1 mm. in diameter. Hyphae undulate, cells mostly 10-15 x 6-8 μ, branching alternate, or unilateral, radiating reticulate and almost solid. Capitate hyphopodia, alternate, antrorse, straight, 12-16 μ long, stipe cell cylindric to cuneate, 3-5 μ long; head cell subglobose entire, 10-12 μ diameter. Mucronate hyphopodia, not seen. Mycelial setae absent. Perithecia flattened globose beneath a radiate mycelial covering, upto 260 μ in diameter and about 100 μ high in the centre. Ascospores ellipsoid, obtuse, 4-septate, constricted, 40-44 x 14-20 μ.

Material examined: On Leea macrophylla Roxb., Balehonnur, Mysore, 29.4.1945, Leg. M.J. Thirumalachar, Type, H.C.I.O. No. 10870.

Host range: Leea macrophylla Roxb.

Distribution: India.

66. Meliola bakeri Sydow
in Ann. Mycol. Berlin 14: 335, 1916; Farlowia 3: 289, 1948.

3111: 4222.

Colonies mostly epiphyllous, upto 4 mm. in diameter or confluent, dense, velvety. Hyphae undulate, cells mostly 20-28 x 6-8 µ, branching opposite at subacute to wide angles, very closely reticulate. Capitate hyphopodia alternate, 16-20 µ long antrorse, stipe cell cylindric, 4-8 µ long, head cell ovate or short cylindric, 14-16 x 10-14 µ, straight or bent, entire or angulate. Mucronate hyphopodia few, interspersed with capitate hyphopodia or on separate hyphae, opposite or ampulliform, 16-18 x 6-8 µ. Mycelial setae numerous, scattered, straight simple acute upto 350 x 6-8 µ. Perithecia scattered, verrucose, upto 150 µ in diameter. Ascospores 4-septate, oblong, obtuse, 36-42 x 12-14 µ.

Type: On Tetrastigma sp., Philippines, Baker, 3987, in Philippine Bureau of Science.

Material examined: On Leea sp., Mysore, 28.4.1945, Leg., M.J. Thirumalachar, H.C.I.O. No. 10899.

Host range: Tetrastigma sp.; Leea spp.

Distribution: Malaya, Philippines, India and Uganda.

Remarks: The Indian specimen varies from the Type, in having more frequent alternate capitate hyphopodia, and head cell being rounded angulose.

B. Monocotyledons

35. Araceae

67. Asteridella pothodis (Hansf. & Thirum.) Hansf. in Sydowia 10: 49, 1957.

= Irena pothodis Hansf. & Thirum., Farlowia 3: 288, 1948.

3101: 4220.

Colonies mostly epiphyllous, upto 2 mm. in diameter, smooth subdense. Hyphae substraight to crooked, cells mostly 25-30 x 8-9 μ, branching opposite, wide, closely reticulate. Capitate hyphopodia, more or less antrorse, straight or bent, 15-25 μ long; stipe cell cylindric to cuneate, 4-10 μ long; head cell globose, ovate or clavate, rarely rounded angulose, straight or bent, 10-14 x 10-13 μ. Mucronate hyphopodia interspersed with capitate hyphopodia, opposite or alternate, ampulliform, 13-29 x 8-10 μ. Perithecia upto 190 μ diameter, surface cells conoid scarcely projecting. Ascospores cylindric to sub-ellipsoid, obtuse, 4-septate, constricted, 38-46 x 15-18 μ.

Material examined: On Pothos scandens Linn., Thirathalli, Mysore, 4.4.1945, M.J. Thirumalachar, Type, H.C.I.O.No. 10862.

Host range: Pothos scandens Linn.

Distribution: India.

Remarks: I was unable to locate any colony of the fungus on the type specimen. The description and illustration have been drawn from the published account.

36. Gramineae

Key to species:

Head cell distinctly lobate.

Mycelial setae 2-4 chotomous.....Meliola phyllostachydis

Mycelial setae bifurcate.....Meliola cymbopogonis

Head cell entire or rounded angulose

Mycelial setae dichotomous.....Meliola arundinis

Mycelial setae furcate to dentate.....Meliola sacchari

68. Meliola arundinis Pat.

in Jour. de Bot., p. 348, 1897; Mem. Dept. Agric. India, Bot. Series, 15: 109, 1928.

= Meliola dolabrata Syd.

in Englers Bot. Jahrb. 56: 431, 1921.

3141: 5231.

Colonies amphigenous, upto 4 mm. in diameter, very dense, velvety, easily peel off, subcrustose. Hyphae follow the parallel venation of the leaf, substraight or flexuous, cells mostly 20-28 x 7-9 μ, branching alternate or irregular

acute, very closely reticulate. Capitate hyphopodia alternate, spreading or antrorse, straight or bent, 20-28 μ long; stipe cell cylindric to cuneate, 6-12 μ long; head cell ovate to subglobose, or slightly irregular to rounded, and entire or slightly irregular to rounded angulose, rarely sublobate, 12-16 μ in diameter. Mucronate hyphopodia rather rare, ampulliform. Mycelial setae numerous, straight, upto 200 x 12-14 μ, dichotomously branched at apex with spreading branches. Primary upto 20 μ long, secondary upto 30 μ long, acute. Perithecia sub-aggregate, verrucose, upto 220 μ in diameter. Ascospores oblong to subellipsoid, obtuse, 4-septate, constricted, 44-52 x 14-16 μ.

Type: On Arundo donax Linn. Tonkin, Bon 5086, in Stevens Herbarium, University of Illinois.

Material examined: On Phragmitis karka Trin. ex Steud., Sibsagar, Assam, 19.4.1958, Leg. S. Chowdhuri, H.C.I.O. No. 26091.

Host range: Arundo donax Linn., Phragmites spp., Saccharum spp.

Distribution: India, Formosa, Uganda, Australia, Philippines.

69. Meliola cymbopogonis sp. nov.

3141: 4221.

Colonies epiphyllous, subdense, velvety, upto 3 mm. in diameter. Hyphae substraight to slightly tortuous, cells

mostly 16-20 x 7-9 μ, branching opposite or irregular, acute or at wide angles, reticulate. Capitate hyphopodia alternate, straight or bent, antrorse, 20-28 μ long; stipe cell cylindric to cuneate, 8-12 μ long; head cell versiform or irregularly globose, sublobate, often bent, 12-14 x 10-14 μ. Mucronate hyphopodia, opposite or alternate, ampulliform, 14-20 x 8-12 μ. Mycelial setae sparse, scattered, straight, upto 200 x 12-14 μ, apex mostly bifix, occasionally only subacute. Perithecia scattered, verrucose, upto 125 μ in diameter. Ascospores oblong to subellipsoid, obtuse, 4-septate, constricted, 40-48 x 12-16 μ.

Material examined: On Cymbopogon nardus (Linn.) Rendle, Aude Tode, Wynaad (Malabar), 13.11.1909, Leg. W. McRae, Type, H.C.I.O. No. 28213.

Distribution: India.

Remarks: This specimen was discovered while examining a herbarium specimen of Puccinia nakanishiki. It does not agree with any of the known species of Meliola recorded on gramineae. It, however, comes close to M. tenuis Berk. & Curt. on Arundinaria sp. and M. setariae Hansf. and Deight. on Setaria spp. It differs from both in shape and size of mycelial setae and ascospores.

70. Meliola phyllostachydis Yamamoto
in Trans. Nat. Hist. Soc. Formosa 31: 26, 1941.
= Meliola bambusicola Hansf. in Proc. Linn. Soc. London, 158: 31, 1946.

3141: 5332.

Colonies epiphyllous, sometimes hypophyllous also, dense, velvety, upto 12 mm. in diameter, easily peel off. Hyphae straight, undulate or sinuous, cells mostly 15-30 μ long, branching alternate or irregular, acute, densely reticulate. Capitate hyphopodia straight or bent, alternate, 20-35 μ long, antrorse; stipe cell cylindric to cuneate, 5-15 μ long; head cell irregular, versiform, 3-5 lobate, 14-26 x 10-22 μ. Muconate hyphopodia separate, sparse, alternate or opposite, ampulliform, 14-20 x 8-10 μ. Mycelial setae numerous, upto 340 x 8-12 μ, 2-4 dichotomous, branches widely divergent, primary upto 80 μ, secondary upto 50 μ, teritiary upto 20 μ, acute. Perithecia subaggregate, verrucose, upto 240 μ diameter. Ascospores oblong to subellipsoid, obtuse, 4-septate, constricted, 48-60 x 18-21 μ.

Material examined: On Bambusa sp., Ooty, Madras, 23.2.1939 Leg. P.G. Samayajulu, H.C.I.O. No. 10404, Type of Meliola bambusicola Hansf.

Type: On Pseudosasa usawai (Hayata) Makino and Nemoto, Formosa, Yamamoto, in National Fungus Collections, U.S. Department of Agriculture, Beltsville, U.S.A.

Host range: Bambusa sp., Pseudosasa usawai, Phyllostachys makinoi Hayata, and P. edulis A. & C. (= Bambusa edulis Carr.).

Distribution: Formosa, Japan, India.

Remarks: Hansford (Proc. Linn. Soc. London 158: 31, 1946)

erected a new species i.e. Meliola bambusicola of which the above specimen is the type. As this species is identical with the earlier known species M. phyllostachydis, the name M. bambusicola Hansf. may be rejected.

71. Meliola sacchari Syd.

in Ann. Mycol. 12: 548, 1914; The Fungi of Bombay, 8: 6, 1935.

3141: 4223.

Colonies mostly epiphyllous, upto 3 mm. in diameter, often confluent, dense, subvelvety. Hyphae substraight with transverse branches, sinous to crooked, cells mostly 15-30 x 8-10 µ, branching opposite at wide angles, closely reticulate. Capitate hyphopodia alternate, straight or bent, antrorse, 20-32 µ long; stipe cell, cylindric to cuneate 5-12 µ long; head cell subglobose, entire or angulose 13-15 µ in diameter. Mucronate hyphopodia mostly opposite, ampulliform, 17-20 x 7-9 µ. Mycelial setae scattered, mostly around perithecia erect, upto 530 x 9-11 µ, apex, 2-5-dentate and upto 20 µ, Perithecia scattered verrucose, to 200 µ diameter. Ascospores cylindric to subellipsoid, obtuse, 4-septate, constricted, 40-48 x 14-18 µ.

Type: On Saccharum spontaneum, Leg. K.C. McCroeger, Philippine Bureau of Science No. 20051.

Material examined: Not available.

Host range: Saccharum spontaneum and Saccharum officinarum.

Distribution: Philippine, India.

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in Hedw. 26: 31, 1887; Ann. Mycol. 9: 382, 1911. J. Dept. Sci. Univ. Calcutta, 5(4): 2.

3131: 5333.

Colonies amphigenous, mostly epiphyllous, velvety dense, upto 7 mm. in diameter. Hyphae straight to undulate, cells mostly acute, becoming closely reticulate. Capitate hyphopodia alternate, subantrorse, sometimes bent, 20-28 μ long; stipe cell cylindric to cuneate, 10-14 μ long; head cell, subglobose, ovate, angulose to sublobate, 14-18 x 12-16 μ. Mucronate hyphopodia mixed with capitate hyphopodia, sparse, ampulliform, 18-24 x 6-10 μ. Mycelial setae numerous, straight, upto 10 x 8-10 μ, apex 1-2 dentate. Perithecia subaggregate, verrucose, upto 220 μ diameter. Ascospores subellipsoid, obtuse, 4-septate, slightly constricted, 50-56 x 18-22 μ.

Type: On Phoenix reclinata Jacq., South Africa, in Dept. of Plant Pathology, Union Department of Agriculture, Pretoria, South Africa.

Material examined: On Phoenix sp., Mudigere, Mysore, 7.9.1903, Leg. E.J. Butler, H.C.I.O. No. 1045; P. sylvestris Roxb., Burdwan, Bengal, 12.7.1907, Leg. Bhattacharya, H.C.I.O. No. 1047; Hansure, Mysore, 20.9.1903, Leg. E.J. Butler, H.C.I.O. No. 1048; P. sylvestris, Godavari, Jan. 1908, Leg. S. Sundararaman, H.C.I.O. No. 10491; on Phoenix sylvestris, Jorhat, Assam, 19.5.1943, Leg. S. Chowdhuri, H.C.I.O. No. 10147; P. sylvestris, Harali, Mysore, 18.2.1944, Leg. M.J. Thirumalachar.

Host range: Phoenix spp.

Distribution: South Africa, India, Uganda.

Remarks: Hansford (Sydowia, 10: 81, 1957) separated the species of Meliola on Phoenix spp. from M. palmicola Wint. which is known on a large number of palm genera, and gave it a varietal rank. This variety differs from M. palmicola, slightly in shape and length of capitate hyphopodia, but this appears to be hardly justified.

C. Gymnosperms

38. Taxaceae

73. Asteridella taxi (Sawada) Hansford
in Sydowia 10: 50, 1957; Indian Phytopath. 12: 13, 1959.
= Irenina taxi Sawada
in Report Forest Exp. Sta. Tokyo, 46: 37, 1950.

2101: 5220.

Colonies chiefly hypophyllous, elongated, upto 3 mm. long and 1.5 mm. wide. Hyphae 5-6 μ wide sinuous to undulate, loosely reticulate. Capitate hyphopodia alternate, 10-13 μ long spreading; stipe cell cylindric to cuneate, small; head cell globose, 8-10 μ in diameter, entire. Mucronate hyphopodia not seen. Mycelial setae absent. Perithecia conspicuously verrucose, upto 170 μ in diameter. Ascospores subellipsoid to oblong-obtuse, 3-septate, end cells smallest, constricted at septa, often bent, 41-51 x 15-18 μ.

Type: On Taxus cuspidata Sieb. and Zucc., Japan, Sawada.

Material examined: Not available.

Host range: Taxus cuspidata Sieb. and Zucc. and T. baccata Linn.

Distribution: Japan, India.

Remarks: The Indian specimen was collected on Taxus baccata Linn. sub sp. walichianii (Zucc.) Pilg, from Wan Valley, Garhwal in Himalayas by Messers E. Mueller and S.K. Bose and deposited in E.T.H. Herbarium, Institute of Special Botany, Zurich, Switzerland. Dr. Bose informed me that the material is too scanty and might not be available to me for study. The description and drawings have been taken from the published account.

VI. HYPERPARASITES

1. Arthrobotryum melanoplaca Berk. & Curt.
Cuban Fungi, No. G. 24 in J. Linn. Soc. London, 10: 360, 1869; Sydowia 5: 125, 1951. (Plate XXXV, Fig. I).

Mycelium composed of pale olive hyphae, 2-4 μ wide, septate, reticulate, closely investing the hyphae of host; Synnemata scattered, erect, dark, upto 800 μ high, 24-50 μ in diameter, slightly swollen at the base, and the stalk hyphae divergent above to form a clavate head. Conidiophores represented by merely the slightly swollen ends of the stalk hyphae, straight, olive brown, septate, 4-6 μ wide, often on the outer surface with numerous warts or incrustations, forming conidia singly at the ends. Conidia borne acrogenously, single, elongate, obclavate, straight or slightly bent, somewhat truncate at the base, the apex attenuate into a paler beak, 32-40 x 6-10 μ in size.

Material examined: On Meliola zanthoxyli Hansf. on Zanthoxylum ovalifolium, Mysore, 29.10.1911, Leg. G.S. Kulkarni, H.C.I.O. No. 3189.

Thirumalachar and Lacy recorded this fungus on colonies of Meliola salaciae from Balehonur, Mysore, but this was not available to me for study.

2. Callariopsis gelatinosa (Ell. & Mart.) Syd.
in Ann. Mycol. 15: 254, 1917, Sydowia 5: 129, 1951.

= Mollinia gelatinosa Ell. and Mart., in Amer. Nat. 1783, 1883.

= Orbilia gelatinosa Sacc. in Syll. Fung. 8: 624,

= Coryne gelatinosa Rehm in Ann. Mycol. 5: 518, 1907.

= Calloria meliolicola P. Henn. In Engl. bot. Jabrh. 25: 509, 1898.

= Coryne meliolicola v. Hoehn. in Fragmente Z. Mycol. No. 247, 1909.

Ascomata smooth, gelatinous, dirty white to pink, 260-800 μ broad and 200 μ thick, convex, slightly imarginate, Asci ob-ovate, 35-40 x 15-20 μ. Ascospores bi-triseriate fusoid, subhyaline, 12-16 x 3-3.5 μ, 3-septate; paraphyses curved, apices capitulate.

Material examined: On Meliola tenella Pat. on Murraya exotica, Nandi Hills, Mysore, Leg. M.J. Thirumalachar, H.C.I.O. No. 10393.

Remarks: Although the dirty white gelatinous crusts were seen on the specimen, I could find no apothecia. Description has been taken from the published account.

3. Dimerium piceum (Berk. & Curt.) Theiss.
in Ann. Mycol. 10: 5, 1912; Sydowia 5: 124, 1951.

Mycelium of subhyaline to pale olivaceious, hyphae, 2-3.5 μ wide, more or less tightly enclosing those of the host cells and ramifying between them. Perithecia superficial, globose to conoid, upto 150 μ in diameter, dark olive to

subopaque, glabrous, smooth; wall of one layer of polygonal parenchyma. Asci usually aparaphysate, cylindric oblong, subsessile, 30-50 x 8-12 μ, 8 spored; spores 1-2 seriate, oblong ellipsoid, 1-septate, slightly constricted subhyaline at first, becoming brown, 10-15 x 3-5 μ, smooth, the upper cell very slightly shorter and slightly wider than the lower.

Material examined: On colonies of Meliola tenella Pat., Nandi Hills, Mysore, 12.12.1949, Leg. M.J. Thirumalachar, H.C.I.O. No. 10393.

Remarks: I have examined the above specimen but was unable to locate any fructifications of the fungus. The description has been taken from the published account.

4. Eriomycopsis meliolae Hansf. in Bothalia 4: 468, 1942; Sydowia 5: 124, 1951. (Plate XXXVI, Fig. V).

Colonies white, subglobose to effuse. Mycelium of loose branched hyphae which are 4-6 μ in diameter. Conidiophores fasciculate, erect, hyaline, straight or substraight, simple, septate, upto 400 μ in length and 6-10 μ wide, apex geniculate, nodulose. Conidia acrogenous, single, hyaline-fusoid, slightly curved 2-4 septate, slightly constricted at the septa, base conoid truncate, apex attenuated, 60-85 x 12-15 μ.

Material examined: On Meliola tenella on Murraya exotica, Nandi Hills, Mysore, Leg. M.J. Thirumalachar, H.C.I.O. No. 10393.

5. Eriomycopsis bosquiae Hansf.

in Bothalia 4: 466, 1942; Sydowia 5: 124, 1951.

Colonies yellowish; Mycelium composed of yellow to yellow brown hyphae, septate, branched, 4 μ in diameter. Conidiophores fasciculate, erect, simple or irregularly branched, pale below and hyaline above, upto 140 μ long, 4 μ wide; sterigmata nil. Conidia terminal single, first obovate later obclavate, apex attenuate, hamate, hyaline to slightly pale, 3-septate, upto 45 μ long and 5-7 μ wide, base attenuate truncate.

On Meliola memecyli Syd. (= M. heudoltii Gaill.), on Memecylon edule, Bannerghatta, Mysore.

This specimen was not available.

6. Isaria meliolae Hansf.

in Proc, Linn. Soc. Lond. 155: 63, 1943, Sydowia 5: 125, 1951.

Mycelium consists of fine pale olive hyphae, 2-3 μ wide, septate, forming a very close net work over and between those of the host, and giving grey appearance to the colonies. Coremia scattered, erect, white, simple, 600-900 μ high and 50-75 μ wide in the stalk portion, each with a clavate conidial head occupying the upper third of its length; head upto 200 μ long and 100-150 μ in diameter. Phialids simple, arising laterally and terminal on the hyphae of the head, 12-20 μ long, 3-4 μ wide at the base, ampulliform. Conidia in short

chains of 2-3, single, long elliptic to fusiform, hyaline, smooth and thin walled, 5-8 x 1.5 - 2 μ.

On colonies of Meliola cansjerae Hansf. and Thirum., Nandi Hills, Mysore.

Remarks: Thirumalachar and Lacy recorded this fungus from India, on the specimen of Meliola cansjerae Hansf. on Cansjera rheedii. Although this specimen was examined, but I was not able to locate this fungus. The description has been taken from the published account.

7. Pleurophragmium dorycarpum (Mont.) Hughes in Canad. J. Botany 36: 797, 1958. (Plate XXXV, Fig. II).
= Helminthosporium dorycarpum Mont. in Hist. Phys., Pol. et Nat. Cuba, p. 302, 1838-42.

The mycelium is subhyaline to pale brown, branched, septate, 2-3 μ wide. The conidiophores are scattered or very crowded, seldom in tufts; they are simple more or less cylindrical, straight or flexuous, pale brown, septate, upto 500 μ long x 4-6μ broad, towards the apex, they bear scattered or crowded conidial scars, slightly swollen and geniculate. The conidia arise singly and successively as blown out ends of successively produced growing points of conidiophores. They are pale brown to brown, usually 3-septate, occasionally upto 5-septate, not constricted at the septa, thin walled, vary in shape, mostly fusoid or narrowly obclavate, truncate at the base and with the terminal cell attenuated towards the rounded apex, they measure 20-28 x 5-7 μ.

Material examined: On Meliola tenella on Murraya exotica, Nandi Hills, Mysore, Leg. M.J. Thirumalachar, H.C.I.O. No. 10393.

Remarks: This hyperparasite is found growing on the colonies of various meliolinae, on a wide range of hosts. This is one of the common hyperparasites of the tropical world.

8. Pleurophragmium capense (Thuem)Hughes
in Canad. J. Botany 36: 796, 1958. (Plate XXXVI, Fig.IV)
= Helminthosporium capense Thuem., in Flora 59:570,1876.
= Helminthosporium melioloides Sacc.
in Atti. Acad. Sci. Ven.-Trent.istr., 3: 89, 1917.

The mycelium is composed of subhyaline to pale brown, septate hyphae, 2-4 μ wide. The conidiophores are erect, straight, in tufts; they are 200-300 μ long, septate, brown to dark brown, 5-8 μ wide, and more or less cylindrical but somewhat irregular in outline at the apex due to the presence of scattered conidial scars. The conidia arise as blown out ends and at maturity they are upto 7-septate but mostly 4-5 septate, more or less obclavate, truncate at the base, attenuated towards the rounded apex, straight or slightly bent, smooth, brown, upto 70 μ long x 8-12 μ wide, with a thin outer pellicle enclosing a much thicker inner wall.

Material examined: On Meliola ranganathii Hansf. on Eugenia sp., S. Kanara, 27.3.1913, Leg. T.R. Ranganath, H.C.I.O. No. 10399; M. mangiferae Earle, Pulliyanur (Kerala), 8.10.1907, Leg. E.J. Butler, H.C.I.O. No. 1050 .

9. Trichothyrium asterophorum (Berk. & Br.) Hoehn.
in S.B. Akad. Wiss. Wien, 113: 1482, 1909 (Plate XXXV, Fig. II).

= Spegazzinia meliolae Zimm.
in Zbl. Bakt., Abt. 2, 8: 221, 1902; Sydowia 5: 125, 1951.

= Isthmospora spinosa Stev.
in Bot. Gaz. 65: 244, 1918.

The mycelium consists of pale to olivaceous hyphae, closely investing those of the host, septate, smooth-walled, branched, 2-4 μ. The conidia which are also called isthmospores are formed in large masses, scattered all over the host colony, rather powdery, black, formed singly on short, erect branches of the mycelium, or at times sessile on the hyphae.

The isthmospores are rounded-oblong in surface view and measure 15-21 μ long and 12-17 μ wide. Each consists of four, large, black, thick walled cells arranged cruciately in a horizontal plate, each cell 7-9 μ in diameter; the two pairs of cells being separated by a vertical plate of 6 small cells, subhyaline and smooth, each above 4 μ in diameter. The four dark cells are conspicuously echinulate.

Material examined: On Meliola sp. on Holarrhena antidysentrica, Bengal, 12.3.1913, Leg. A.L. Som, H.C.I.O. No. 12956, Ascigerous stage not seen.

Remarks: This fungus is a common hyperparasite of the Meliolinae in the tropical countries. Hughes (Mycol. papers, C.M.I. No. 50, p. 77, 1953) has discussed this species

and its synonyms in details. In India, this fungus was recorded as Spegazzinia meliolae Zimm. This specimen was examined and found identical with the conidial stage of Trichothyrium asterophorum (Berk. & Br.) Hoehn. The ascigerous stage was not seen in the Indian specimen.

VII. DISCUSSION

In the preceding pages, an account of 74 species and varieties belonging to group Meliolinae is presented. This includes one species each of genera Appendiculella, Amazonia, Meliolina, two of genus Irenopsis and three of genus Asteridella. The remaining sixty-six species and varieties belong to the genus Meliola. This is the total meliolinae so far known from India. As a result of this study, 6 new species and two new varieties have been proposed. Six new records for India based on fresh collections were also established. Re-examination of the Herbarium specimens resulted in the revision of earlier determinations and as a result, 8 previously recorded species were excluded from the Indian list. In the latest edition of "Fungi of India" by Butler and Bisby, revised by R.S. Vasudeva which included reports upto 1952, fifty-five members of this group are listed as compared to 74 reported in the present work. This increase is mainly due to the present studies. The number of Meliolinae known in India is only a fraction of total meliolinae numbering over 1800 known from the world, being only about 4 per cent. This is surprising for the fact that several regions in India are climatically ideal to support the growth of various members of this group. In connection with the present work, only Sikkim in the eastern Himalayas was surveyed and this alone has contributed a large number of new records for our country. This indicates that if the

systematic surveys of other warm and humid regions like, Assam in North; Malabar, Nilgiris and Ghats, etc. in South, are undertaken it is very likely to swell up the list of Indian Meliolinae considerably.

The delimitation of species in this group is primarily based on host character as in other obligate parasites like Uredinales and Erysiphales, etc. It is generally believed that morphologically similar species but found to parasitize different host plants are distinct species. Each species or variety belonging to this group is limited to a comparatively narrow range of host plants. It is rarely seen, that a single species extends over more than a single family of phanerogamic hosts. Species described by earlier workers on widely separated host plants, therefore, necessitated re-examination of their specimens, and this has almost invariably led to separation of forms they had declared to belong to same species. Meliola amphitricha has been reported from India on widely separated hosts such as genera Zanthoxylum (Rutaceae) and Olea sp. (Oleaceae) but a re-examination of these specimens indicated that the former belonged to Meliola zanthoxyli and the other, to the Meliola malabarensis. The delimitation of species on morphological characters is practiced only upto host species level or less commonly upto genus level. It has been experienced during this work that in many cases species occurring on same host genus or host species are separated on trifling grounds and it becomes extremely difficult and uncertain to identify such a species.

For example, Meliola butleri and M. citricola, recorded on Citrus spp. are similar except for occurrence of both simple and dentate mycelial setae in the latter and only dentate setae in the former. Similarly it is very difficult to distinguish between Meliola ficicola and M. ovatipoda. Both these species occur on the same specimen belonging to Ficus sp. There are several similar other examples. It would, therefore, appear that the delimitation of species in this group, occurring on same host plant, is very arbitrary and largely based on the opinion of the individual taxonomist who is working on it. In such cases, it would seem more appropriate, if the infraspecific ranks, such as subspecies or varieties are used to accomodate forms having small morphological differences. There is also great scope for consolidating various species. In view of the very large number of species in this group, the chances of identifying a specimen, from an unidentified host, are very remote. It is, therefore, essential to know, at least the family of the host of each specimen, before any attempt can be made at accurate determination of these fungi. The position with the Meliolinae is now similar to that of the rusts, in which no one now would consider describing a new species on an 'unknown' host.

In this group, the value to be attached to various characters for taxonomic purposes, is problematic. The ascospores are remarkably uniform in a given species or even in groups of species. Thus in many families, are groups of closely related species differing in minor characters yet

agreeing in spore characters. Spore septation is absolutely constant. Spores, other than 3 or 4 septate have not been encountered. By far, the great majority have their spores 4-septate, whereas 3-septate spores were found only in Appendiculella calostroma (Desm) v. Hoehn. and Asteridella taxi (Sawada) Hansford. Ascospores, throughout this group, have obtuse ends, the only deviation from this occurs in Meliola trichostroma (= M. psidii) where the spores have conoid ends. The colour of mycelium is of some significance. It is always dark coloured except in Meliola clavulata, where it is yellow and transluscent. The size of the mycelial cell is quite constant for a given species but differs in different species. The mycelium also shows distinctive character in its branching and growth habit, i.e. straight, undulate or sinuous. The influence of the variation of the host leaf on the habit of the mycelium, is very clearly seen in the host family gramineae, where mycelial strands that run longitudnally with the veins are quite straight, whereas transverse mycelium is crooked.

Colony habit is also an important character, as it is quite constant for a species or a group of species. The colonies may be either epiphyllous, or hypophyllous or amphigenous; thin or dense; velvety or crustose, separate or confluent. The characters of capitate hyphopodia have been found to be extremely useful in delimitation of species. These are usually bicelled, but in Meliola plectroniae, the stipe cell has been observed to have more than one septum.

The arrangement of capitate hyphopodia on the mycelium is quite significant. Hyphopodia may be only alternate or opposite, or both in varying proportions. The outline of the head cell, may be entire, angulose or lobate. Their size is also constant for a given species.

Mucronate hyphopodia have been found to be remarkably uniform throughout this group. They are of little taxonomic value. The mycelial setae which occur only in genera Meliola and Meliolina both as to their character, length and branching serve an extremely useful character in the taxonomy of this group.

Genus Meliolina Syd. is quite distinct from other genera of this group, in having mycelium devoid of hyphopodia. In Meliola holigarni and Meliola plectroniae, the capitate hyphopodia are hypha like and appear to be the branches of the hyphae. This character is very suggestive of the close affinity between the genera Meliola and Meliolina. These species probably contribute a very interesting transition forms between the two genera.

In all the genera of Meliolinae, the perithecia are globose, except in genus Amazonia. In this genus, the true perithecia are hidden beneath a closely radiate plate of the mycelial hyphae, which usually extend beyond the sides of the perithecium and ultimately diverge to form ordinary hyphae with hyphopodia. The true perithecia are flattened-globose. Though superficially the perithecial structure of Amazonia approaches that of Microthyriales,

internally there is little similarity and its affinities are entirely with Meliolinae.

In the genus Appendiculella, a few surface cells of the perithecia are elongated to form the characteristic larvi-form appendages. These appendages are lighter in colour and are transversely striate. This genus is represented in India by a solitary species, A. calostroma (Désm.) Hoehn. In the Indian specimen of this species, the larviform appendages are sparse and rather inconspicuous and are, therefore, very likely to be missed by a casual worker, who may take it to be an Asteridella, which differs from Appendiculella, only in the absence of larvi-form appendages.

Genus Irenopsis is very distinct and is easily recognizable by the presence of Erysiphe like appendages on the perithecia. In India, only two species belonging to this genus viz. Irenopsis molleriana and I. mysorensis, have been encountered so far. Irenopsis crataegi reported by Bose from Kumaon, appears to be doubtful. The specimen collected from the same locality by the present author and determined as Appendiculella calostroma is identical with the Bose's fungus except for the appendages on the perithecia. Type specimen of I. crataegi was not available to me for comparison, but the figure given in the original publication indicates that the hyphae of the subicle on which the perithecia are seated, have been mistaken for the Erysiphe-like perithecial appendages. The scant larviform appendages on the perithecia were probably over-looked.

The Beeli formula which was used by earlier workers to group the morphological similar species, has been found to be of limited use now. There is no longer, the tendency to delimit the species on morphological characters alone and therefore, Beeli Formula has limited application in grouping species occurring on the same host family. Some drawbacks in the Beeli formula have been noticed during the present study. Two specimens belonging to the same species may fall into different groups even because of trifling variation. Even the same specimen is likely to be placed in different groups by two persons, because of difference in measurements due to personal error. It is not unusual to find a species under different group numbers in different publications. Another drawback that is very striking is that the group number for the width of spore has a very wide range. A great majority of species fall under group No. 2, which has a range from 11-20 μ. Only a few species are in group No. 3 (range 21-30), whereas there is none under "1" (range upto 11 μ). It would be more appropriate if this range of width is reduced from 10 μ to 5 μ.

Out of the six new species proposed in this work, the specimens of three viz. Meliola ostodis, Meliola bucklandiae and Meliola himalayense, were collected from various places in Sikkim, during a mycological survey of that area. Meliola bucklandiae was found only at one place called Demthang at 7000 ft. altitude in Western Sikkim. Meliola ostodis and M. himalayense were common throughout

the state, wherever these hosts were found. Re-examination of old herbarium specimens resulted in 3 more new species. Meliola cymbopogonis sp. nov. was found in an old Herbarium specimen of Puccinia nakanishikei. Meliola weberae sp. nov. is based on an earlier Indian collection, which was mis-determined as Meliola asternoides Wint. var. major Gaill. Meliola glycosmidis sp. nov. has been proposed as a result of redetermination of a specimen, which was wrongly reported to belong to Meliola cadigensis Yates. Although the specimens of the above 3 new species are very old, but they are in excellent condition of preservation and are easily identifiable.

Many of the new records of Meliolinae from India, are based on fresh collection made from various Himalayan regions. The specimen of Meliola dichotoma var. kushoi on Hedera helix was collected at 9000 ft. altitude, in Narkanda in Himachal Pradesh. This is remarkable, as this place is too cool and dry for Meliolinae to occur. Meliola transvaalensis on Myrsine africana was collected from similarly cool but more humid locality near Ranikhet in Kumaon hills. Meliola daviesii is fairly common at the low altitudes in the Himalayan range. Meliola rubiella and Appendiculella calostroma usually occur in association with each other on Rubus spp. They are restricted in distribution, being found only at altitudes ranging from 5000 to 6500 ft. in Sikkim and adjoining hills.

Among the excluded species from this work, are 5 doubtful records viz. Meliola amphitricha, Meliola camelliae,

Meliola densa, Meliola zigzag and Irenopsis crotonis.

Hansford (1961) rejected the name Meliola amphitricha Fr. because it was now impossible to assign a type specimen to this name. Therefore, specimens recorded as belonging to M. amphitricha were redetermined. The specimen on Zanthoxylum ovalifolium was found to belong to M. zanthoxyli Hansf., while that on Olea sp. has been found to belong to Meliola malabarensis Hansf. It was not found possible to identify the specimen on Terminalia catappa since this host was wrongly identified. Meliola camelliae has to be excluded from the list of Indian Meliolinae as its specimen has been found to belong to Capnodium sp., Meliola densa was recorded from India by Cooke in 1884 on Ilex sp.; but he was doubtful about the correct identify of the host. The specimen, on which this record is based, is not traceable. Meliola densa occurs only on some myrtaceous hosts, therefore, its record on Ilex sp. which belongs to family Aquifoliaceae must remain doubtful. The record of Meliola zigzag is based on a collection on Cinnamomum sp. from Wajhain, Assam. This specimen was examined and found to be immature and unidentifiable. M. zigzag is not recorded on any member of Lauraceae, therefore, its record from India remains doubtful. Irenopsis crotonis on Pavetta sp. appeared in the list of Fungi of Bombay compiled by Uppal et al. in 1935. This specimen is not traceable. Its occurrence on Pavetta sp. which belongs to host family Rubiaceae makes this record doubtful since it is known to occur only on quite unrelated host family, i.e. Euphorbiaceae.

A large number of Indian Collections have been found to be hyperparasitized. Nine species of fungi belonging to Hyphomycetes and Ascomycetes have so far been recorded to occur on the colonies of various Meliolinae. Among the Hyphophycetes, Pleurophragmium capense and P. dorycarpum have been very frequently encountered. These fungi are more commonly known as Helminthosporium capense and H. dorycarpum in literature. Arthrobotryum melanoplaca. Eriomycopsis meliolae and Trichothyrium asterophorum (Berk. & Br.) V. Hoehn. are also fairly common. Isaria meliolae and Eriomycopsis meliolae is rather rare. Among Ascomycetes, Dimerium piceum and Callariopsis gelatinosa are recorded. I was unable to locate the fructifications of these fungi on the specimen. The material of these is rather scanty and therefore, further efforts to locate these fungi were not made for the fear of exhausting them from the specimen.

In some cases, the infestation by hyperparasites was so severe, that the original colony was entirely consumed, leaving a few bits of hyphae with hyphopodia, to give the indication of the presence of a meliolinae. In such cases it was not at all possible, even to attempt any determination, and these therefore, were rejected. In some cases, conidiophores of hyperparasites resembled setae of Meliola and extreme caution had to be exercised, while describing the setae. The colony size was also found to be much altered due to the association of hyperparasite and in such cases only the uninfested colonies were described.

VIII. SUMMARY

1. Standardized descriptions and camera lucida drawings of 74 species and varieties, belonging to Meliolinae, so far, known from India have been given. Each description is preceded by Beeli formula, which has been explained under "Introduction".

2. The Meliolinae comprise the phaeophragmous genera of Meliolaceae and are popularly called sooty moulds or Black Mildews. All the six genera of this group viz. Meliolina, Amazonia, Asteridella, Appendiculella, Irenopsis and Meliola, are represented in India.

3. Only one species of each of the genera Meliolina, Appendiculella and Amazonia have been found to occur in India. These are Meliolina arborescens (Sydow H. & P.) Sydow H. & P.; Appendiculella calostroma (Desm.) Heehn. and Amazonia leeae Hansf. & Thirum.

The two species of Irenopsis recorded from India are I. molleriana (Wint.) Stev. and I. mysorensis Hansf. & Thirum. Genus Asteridella is represented in India by A. malloti (Hansf. & Thirum.) Hansf., A. pothodis (Hansf. & Thirum.) Hansf. and A. taxi (Sawada) Hansf. The remaining 66 species and varieties belong to the genus Meliola.

4. Six new species viz. Meliola ostodis on Ostodes paniculata Bl., M. himalayense on Bridelia montana Willd.,

M. glycosmidis on Glycosmis pentaphylla Correa, M.bucklandiae on Bucklandia populnea Br.,M. weberae on Webera corymbosa Willd. and M. cymbopogonis on Cymbopogon nardus (L.) Rendle. Two new varieties namely Meliola albizziae Hansf. & Deight. var. odoratissimae on Albizzia odoratissima Benth., and M. jasminicola P. Henn. var. indica on Jasminum sp. have also been proposed.

5. Six new records from India based on fresh collections were established. These are Appendiculella calostroma (Desm.) Hoehn. on Rubus ellipticus Sm. and Crataegus crenulata Roxb., Meliola dichotoma B. & C. var. kusanoi Hansf. on Hedera helix auct., M. transvaalensis Doidge on Myrsine africana L., M. daviesii Hansf. on Jasminum sp., M. rubiella Hansf. on Rubus sp., and Irenopsis molleriana (Wint.) Stev. on Triumfetta bertramia L.

6. As a result of this study, 20 earlier recorded specific names from India have been excluded from the Indian list. Several earlier determinations were found to be incorrect and consequently they were redetermined.

7. A large number of Indian collections were found to be hyperparasitized. Nine species of fungi belonging to Hyphomycetes and Ascomycetes have so far been recorded to occur on the colonies of Meliolinae, in India.

IX. LIST OF EXCLUDED SPECIES

1. Irenopsis crataegi Bose = Appendiculella calostroma (Desm.) Hoehn.

2. Irenopsis crotonis (Stev. & Tehon) Stev. - This is a doubtful record.

3. Meliolina mollis (Berk. & Br.) Hoehnel. This specimen has been redetermined as Meliolina arborescens (Sydow. H.& P.) Sydow H. & P.

4. Meliola albizziae Hansf. & Deight.- This specimen has been redetermined as Meliola albizziae var. odoratissimae var. nov.

5. Melila amphitricha Fr. - No type specimen or type host can be assigned to this species, and hence the epithet is discarded.

6. Meliola asternoides Wint. var.major Hansf. - This specimen has been redetermined as Meliola weberae sp. nov.

7. Meliola bambusicola Hansf. = Meliola phyllostachydis Yamam.

8. Meliola cadigemsis Yates - This specimen has been redetermined as Meliola glycosmidis sp. nov.

9. Meliola camelliae (Catt.) Sacc. - This belongs to Capnodiaceae.

10. Meliola cladotricha Lev. - This specimen has been redetermined as Meliolina arborescens (Sydow H.&P.) Sydow H. & P.

11. Meliola densa Corda - This is a doubtful record.

12. Meliola elemeri Syd. - This specimen has been redetermined as Meliola pohytricha Kalchbr. & Cooke.

13. Meliola jasminicola P.Henn. - This specimen has been redetermined as Meliola jasminicola P.Henn. var. indica var. nov.

14. Meliola memecyli Syd. - This specimen has been redetermined as Meliola heudoltii Gaill.

15. Meliola palmicola Wint.- This specimen has been redetermined as Meliola palmicola var. africana Hansf.

16. Meliola psidii Kze. = Meliola trichostroma (Kze.) Toro

17. Meliola rizalensis Hansf.- This specimen has been redetermined as Meliola callicarpicola Yamam.

18. Meliola sakawensis P. Henn. - This specimen has been redetermined as Meliola clerodendricola P. Henn.

19. Meliola stenospora Winter - This specimen has been redetermined as Meliola petchii Hansf.

20. Meliola zigzag Berk. & Curt. - This is a doubtful record.

X. HOST INDEX

Numbers following the host names refer to serial numbers of the species of Meliolinae as given in the text. Latest accepted host names are given within the brackets wherever necessary.

Eugenia eucalyptoides F. Muell. (= Syzygium eucalyptoides F. Muell) - Myrtaceae. 38.

Eugenia jambolana Lamk. (= Syzygium cumini (L.) Skeels) - Myrtaceae. 37.

Eugenia sp. (= Syzygium sp.) - Myrtaceae. 40.

Ficus spp. - Moraceae. 33, 34, 35.

Gardneria sp. - Loganiaceae. 26.

Glycosmis pentaphylla Correa. - Rutaceae. 56.

Hedera helix auct. non Linn. (= Hedera nepalensis K. Koch) - Araliaceae. 11.

Heterophragma roxburghii A.DC.. (= Heterophragma quadriculare (Roxb.) K. Schum. - Bignoniaceae. 12.

Heynia trijuga Roxb. - Meliaceae. 30.

Holarrhena antidysentrica Wall. - Apocynaceae. 6, 8.

Holigarna arnottianum Hook. f. = Anacardiaceae. 2.

Holigarna grahmii Hook. f. - Anacardiaceae. 2.

Ichnocarpus frutescens R. Br. - Apocynaceae. 7.

Ilex sp. - Aquifoliaceae - 10.

Ipomoea sp. - Convolvulaceae. 13.

Jasminum auriculatum Vahl. - Oleaceae. 43.

Jasminum malabaricum Wight. - Oleaceae. 42.

Jasminum sambac Ait. - Oleaceae. 43.

Jasminum sp. - Oleaceae. 41.

Kydia calycina Roxb. - Malvaceae. 29.

Lasiosiphon ericocephalus Dene. - Thymelaceae. 62.

Leea macrophylla Roxb. - Vitaceae. 65, 66.

Lepionurus oblongifolius Mast. - Opiliaceae. 46.

Mallotus alba Muell. - Euphorbiaceae. 17.

Mangifera indica Linn. - Anacardiaceae. 3.

Memecylon edulis Roxb. - Melastomataceae. 31.

Murraya exotica Linn. (= Murraya paniculata (L.) Jack. - Rutaceae. 58.

Myrsine africana Linn. - Myrsinaceae. 36.

Nothopegia colebrookiana Bl. - Anacardiaceae. 4.

Odina wodier Roxb. - Anacardiaceae. 1.

Olea sp. - Oleaceae. 44.

Opilia amentacea Roxb. - Opiliaceae. 46.

Ostodes paniculata Blume - Euphorbiaceae. 18.

Osyris arborea Wall. ex A.DC. (=Osyris wightiana Wall. ex. Wight.) - Santalaceae. 61.

Phoenix sylvestris Roxb. - Palmae. 72.

Phragmitis karka Trin. ex.Steud. (+ Phragmitis communis Trin.) - Gramineae. 68.

Pittosporum dasycaulon Miq. - Pittosporaceae. 47.

Plectronia umbellatum Benth. and Hook. - Rubiaceae. 53.

Plectronia parviflora Bedd. (= Canthium parviflorum Lam.) - Rubiaceae. 51.

Pothos scandens. Linn. - Araceae. 67.

Psidium guajava Linn. - Myrtaceae. 40.

Quercus leucotrichophora A. camus - Fagaceae. 20.

Rubus ellipticus Sm. - Rosaceae. 49.

Rubus sp. - Rosaceae. 49, 50.

Saccharum officinarum L. - Gramineae. 71.

Salacia sp. - Hippocrateaceae. 22.

Strychnos nux-vomica Linn. - Logamiaceae. 27.

Tabernaemontana sp. (= Tabernaemontana coronaria Willd.) - Apocynaceae. 9.

Tamarindus indica Linn. - Leguminosae. 25.

Taxus baccata Linn Sub. sp. Wallichiani (Zucc.) Pilg. - Taxaceae. 73.

Toddalia asiatica (L.) Lamk var. floribunda Gamb. (=Toddalia aculeata Pers.) - Rutaceae. 57, 59.

Triumfetta bartramia Linn. - Malvaceae. 28.

Vitex leucoxylon. Linn. - Verbinaceae. 64.

Webera corymbosa Willd. - Rubiaceae. 52.

Xanthoxylum ovalifolium Wt. (= Fagara ovalifolia (Wt.) Engler) - Rutaceae. 60.

Zizyphus rugosa Lam. - Rhamnaceae. 48.

XI. LIST OF SPECIES

The species are listed under respective host-families. The host-families are alphabetically arranged under their respective classes viz. Dicotyledons, Monocotyledons and Gymnosperms. The serial numbers of the host-families and species of Meliolinae correspond to those in the text.

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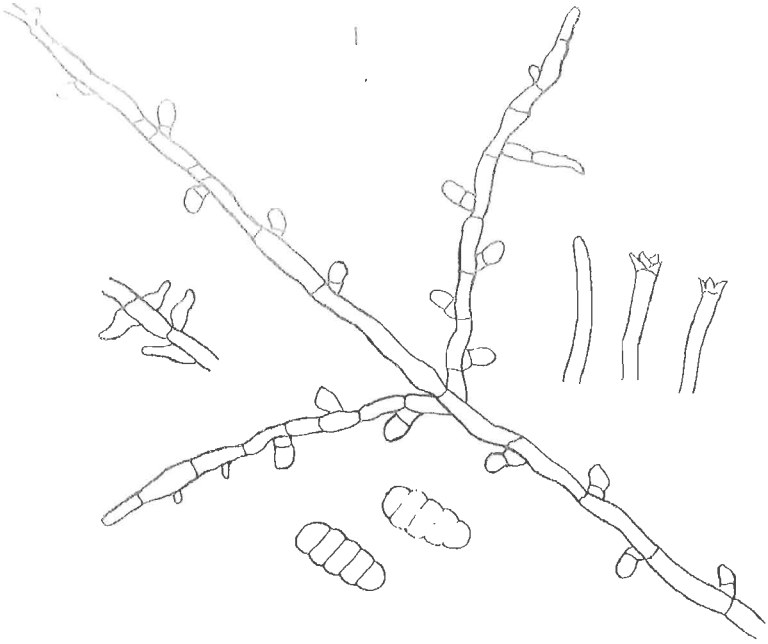
1



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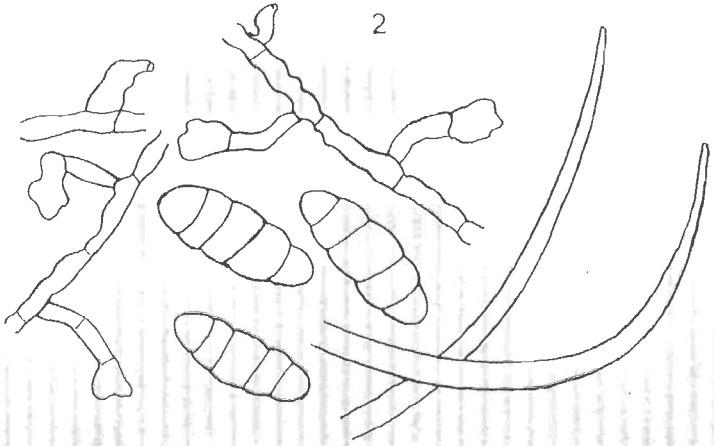

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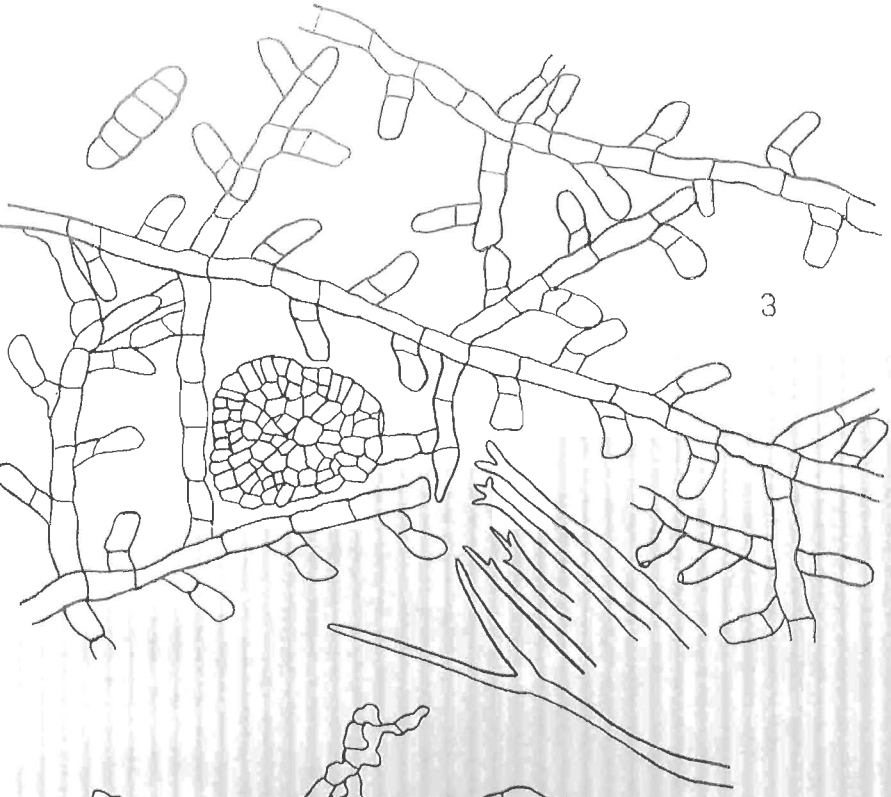

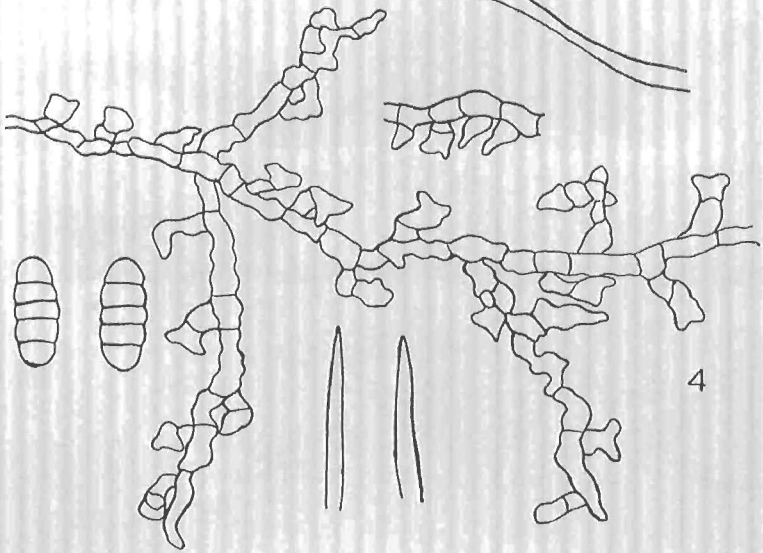

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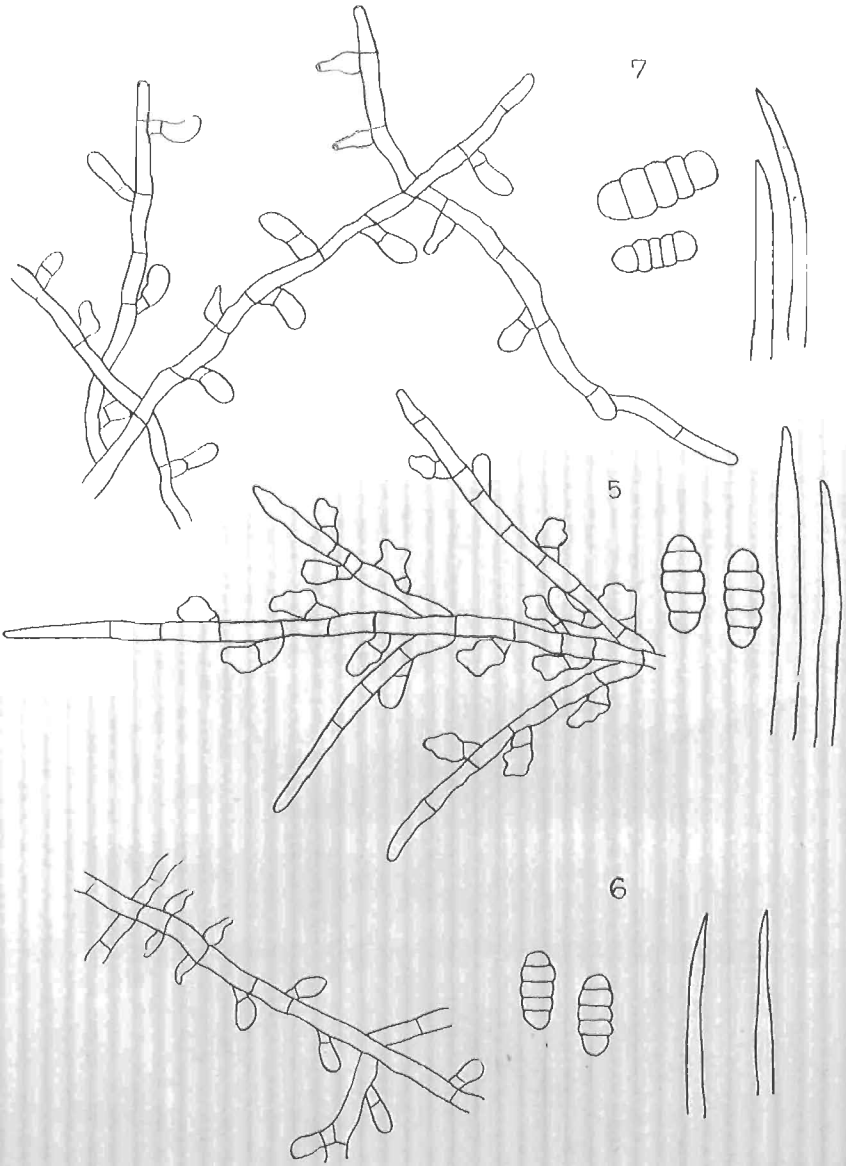

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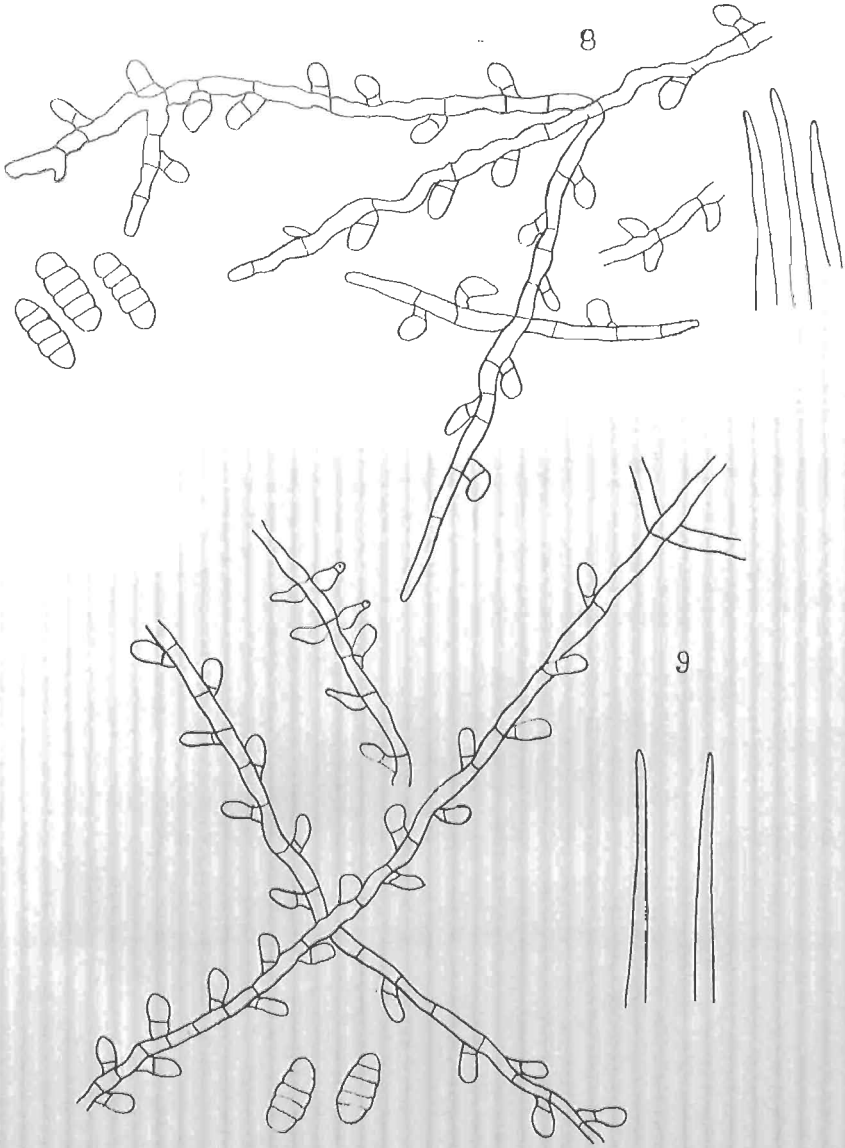

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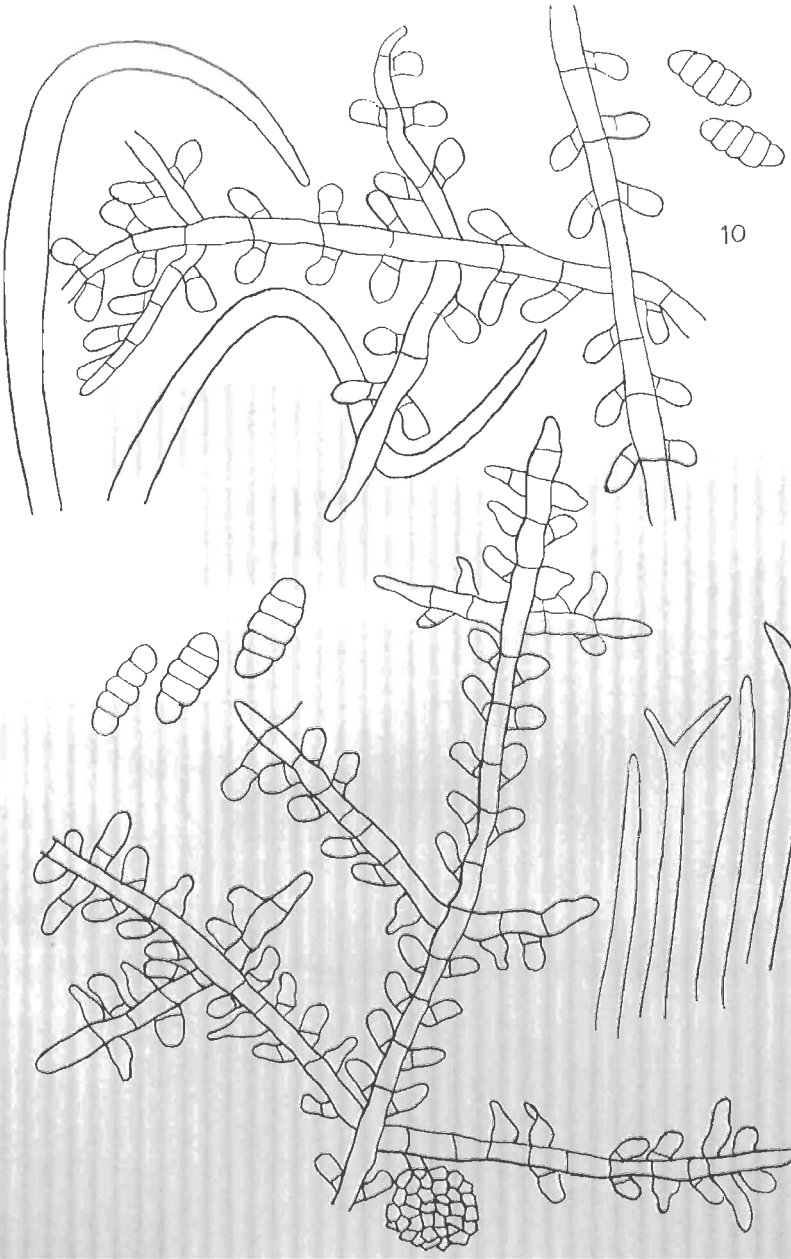

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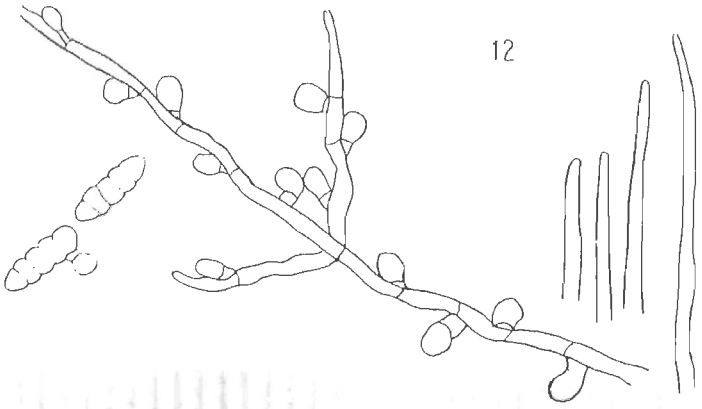
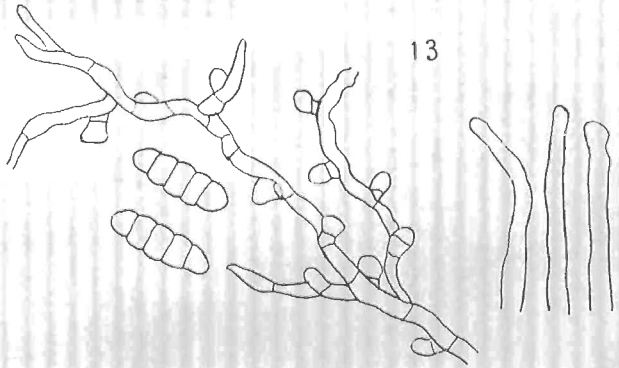




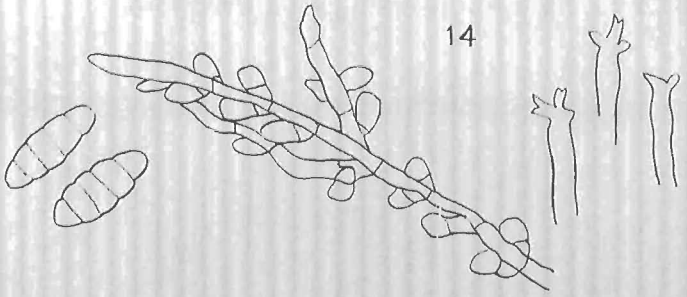
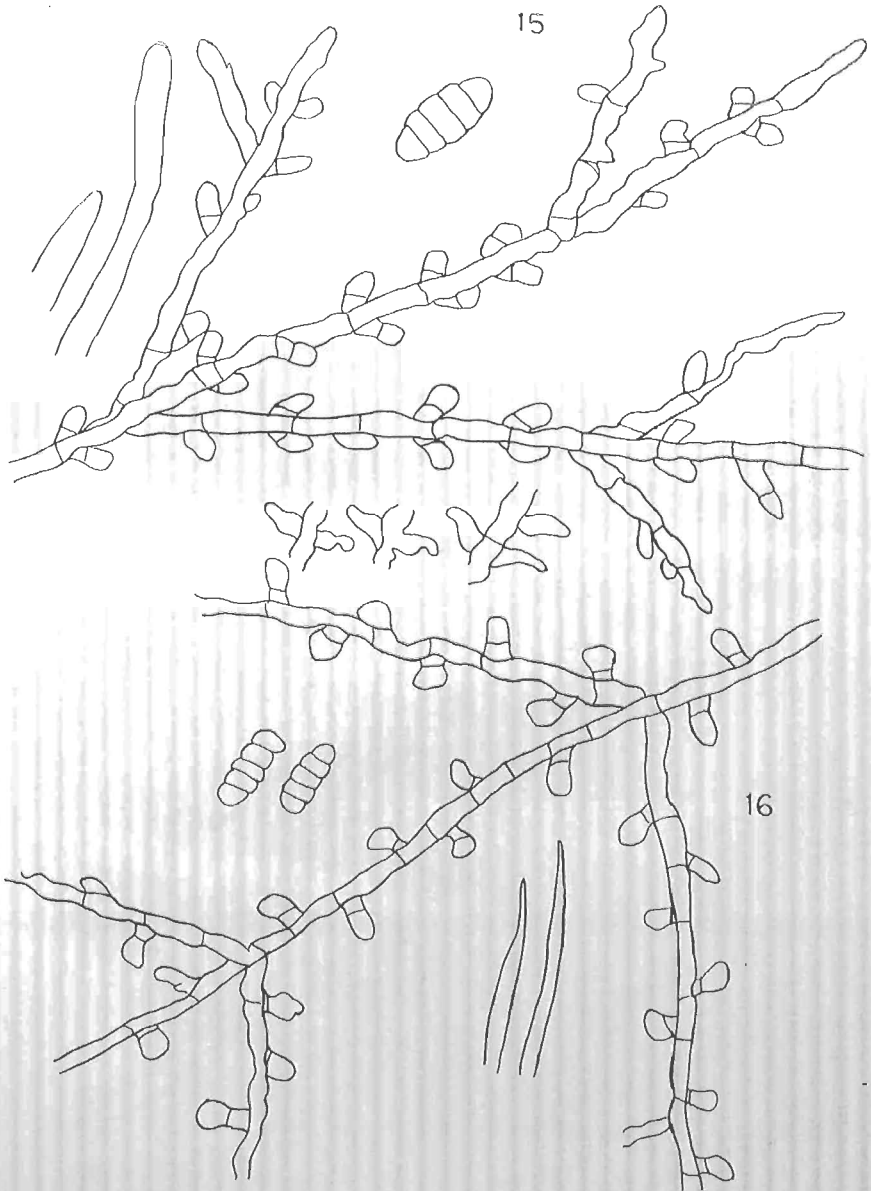


Plate . VII



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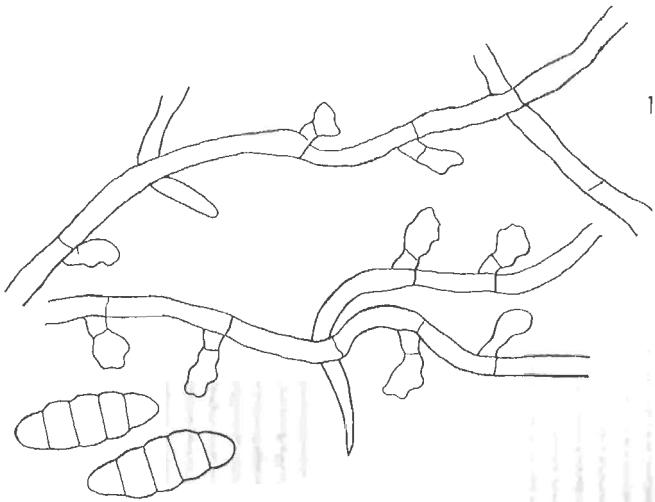

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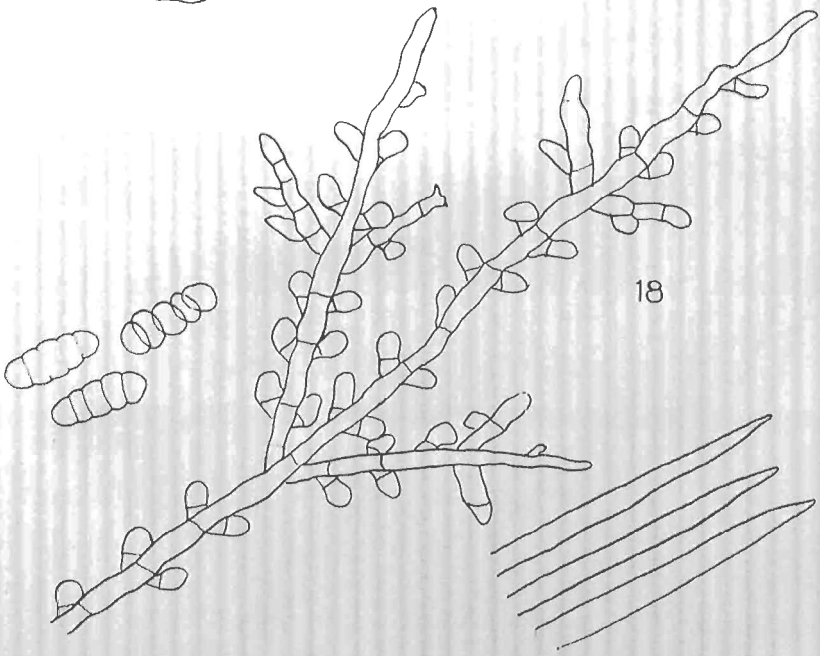

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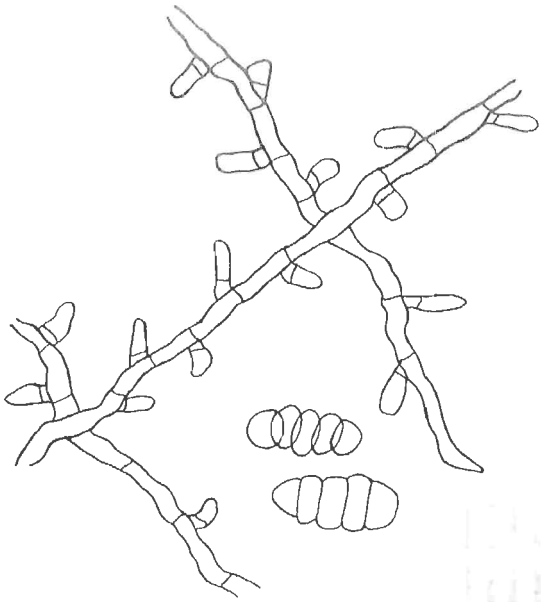
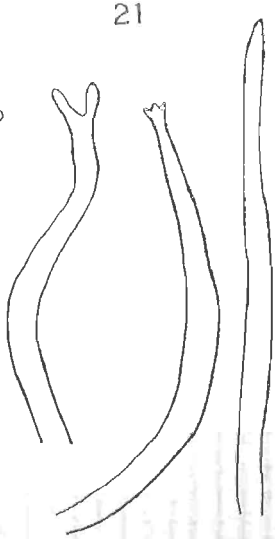
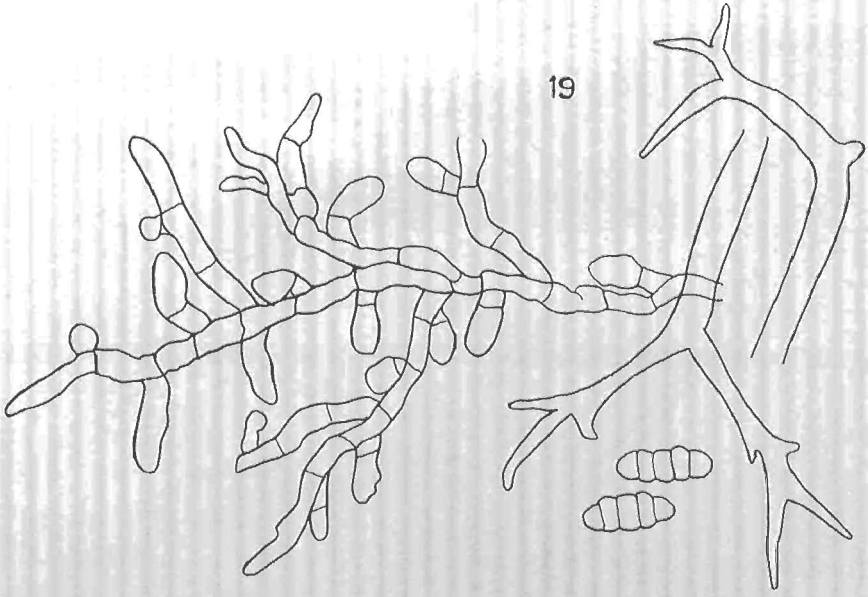
Plate. IX







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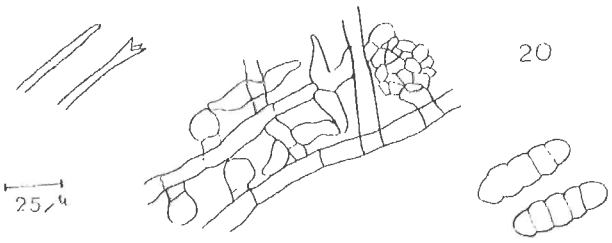

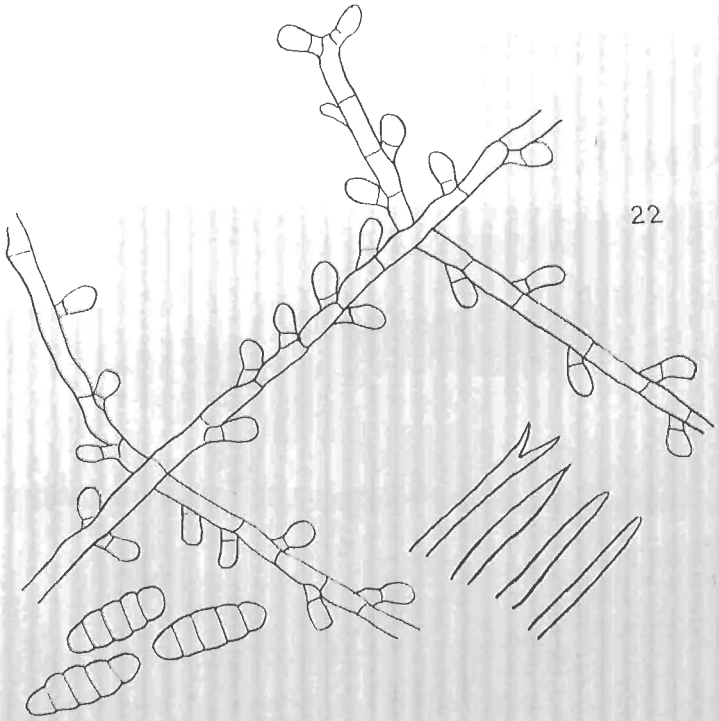

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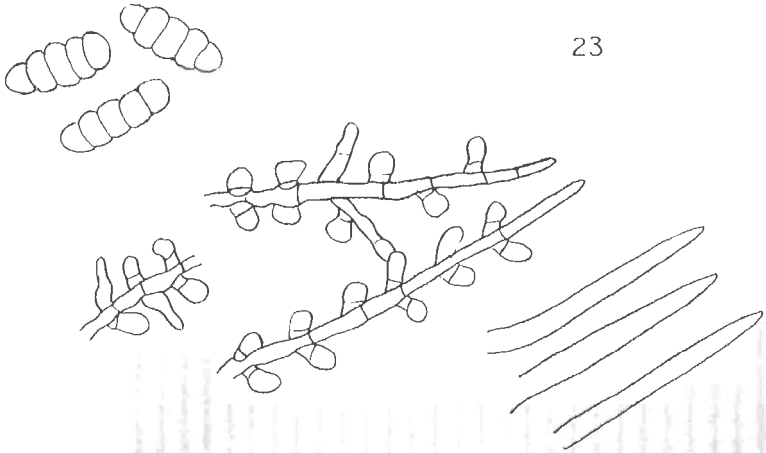

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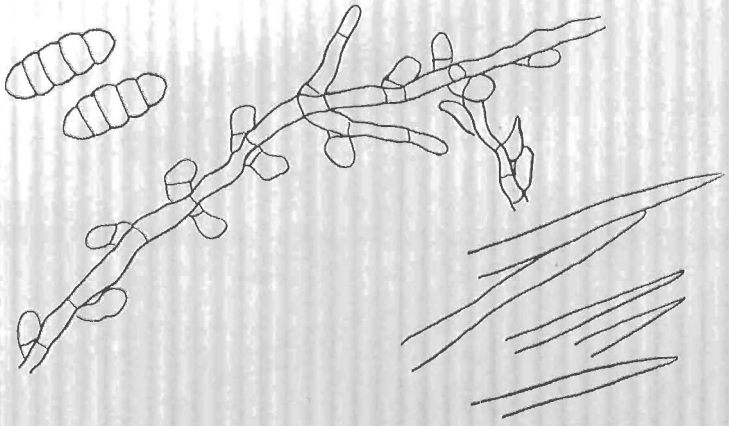

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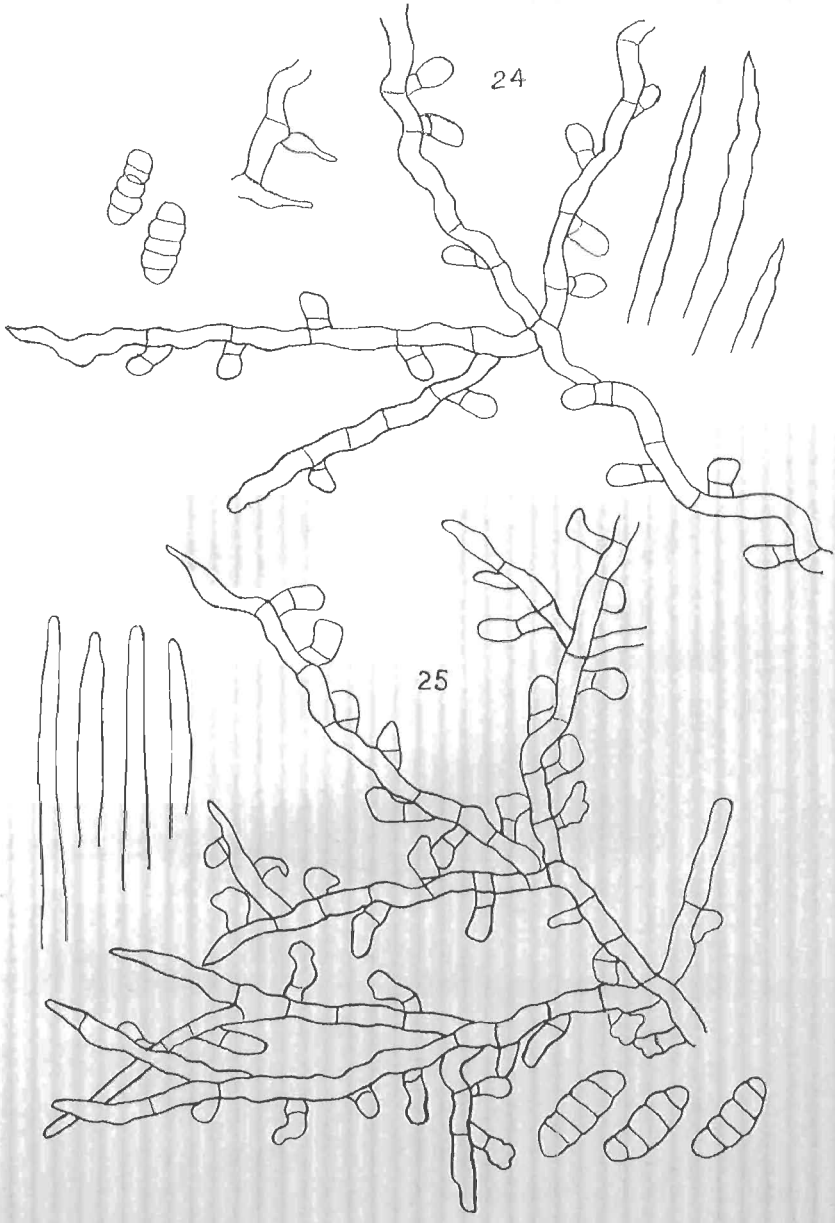
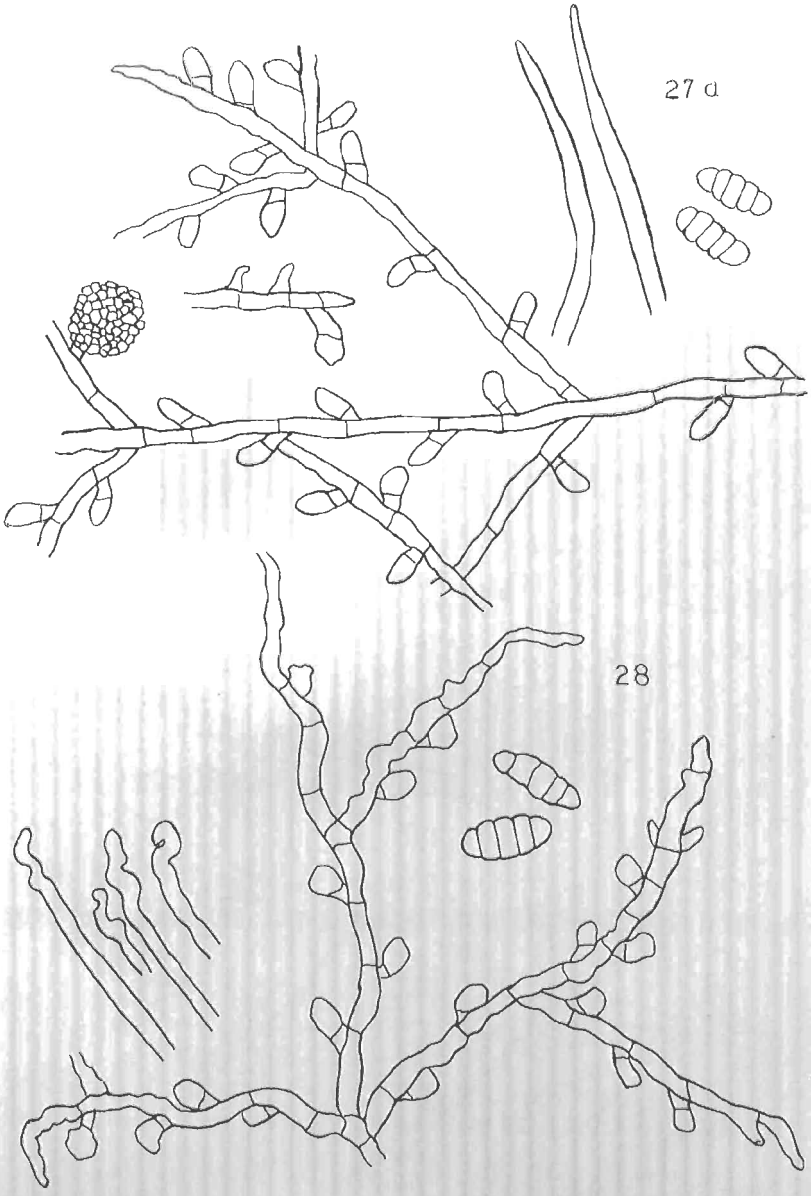


Plate. XIII

Plate. XIV



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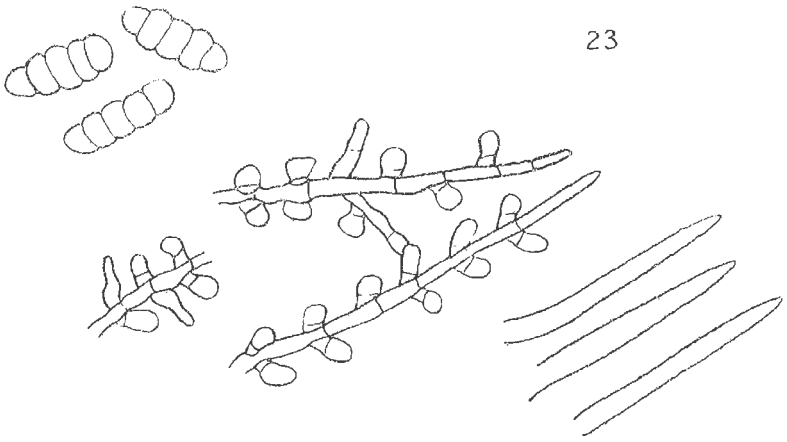

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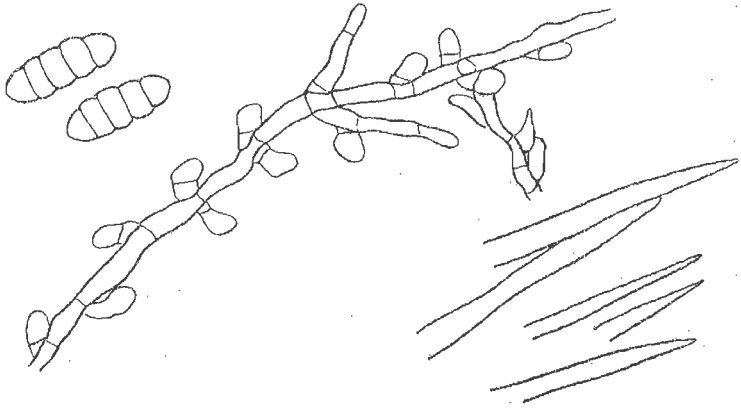

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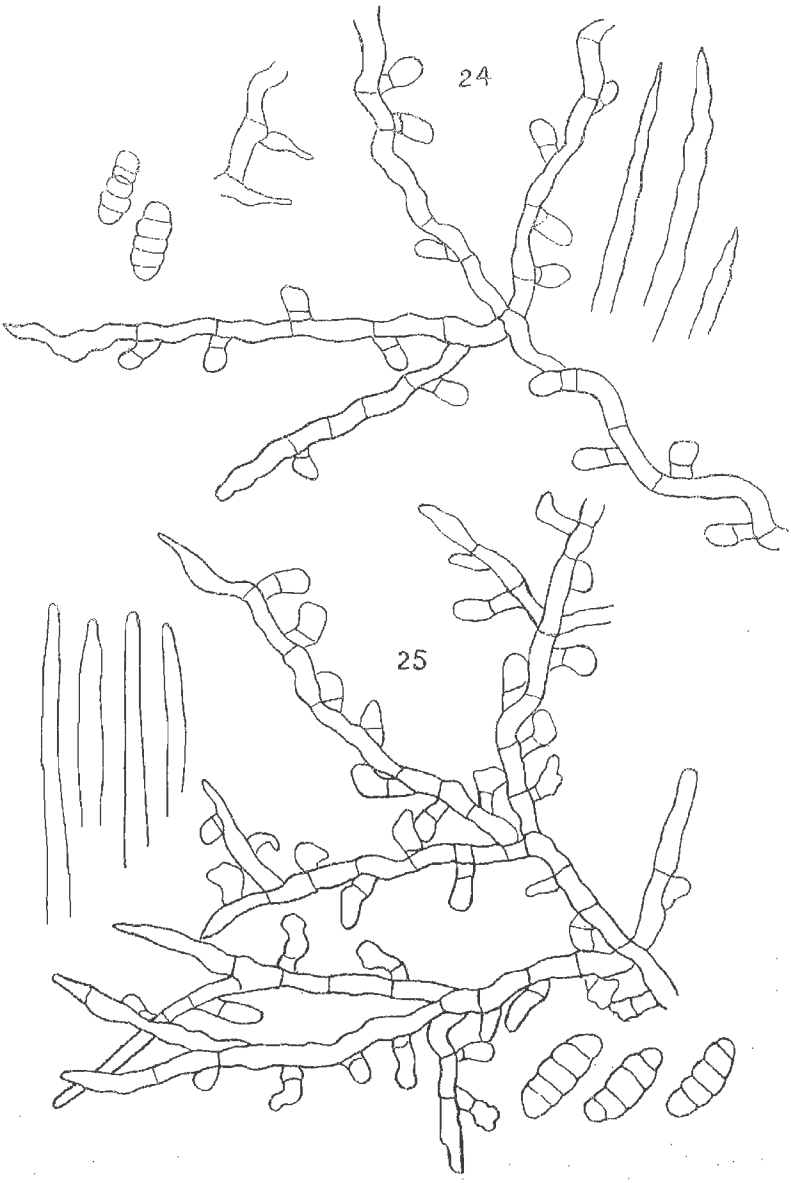

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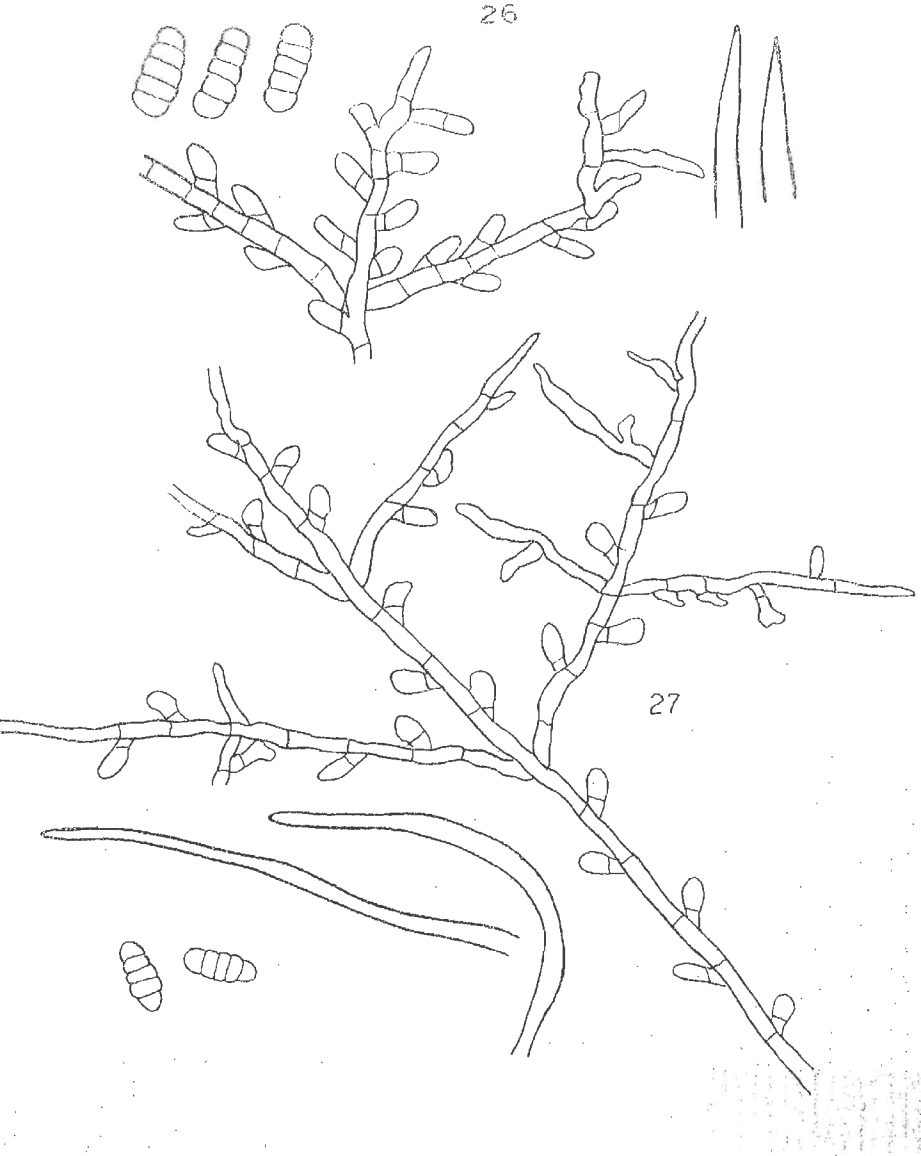

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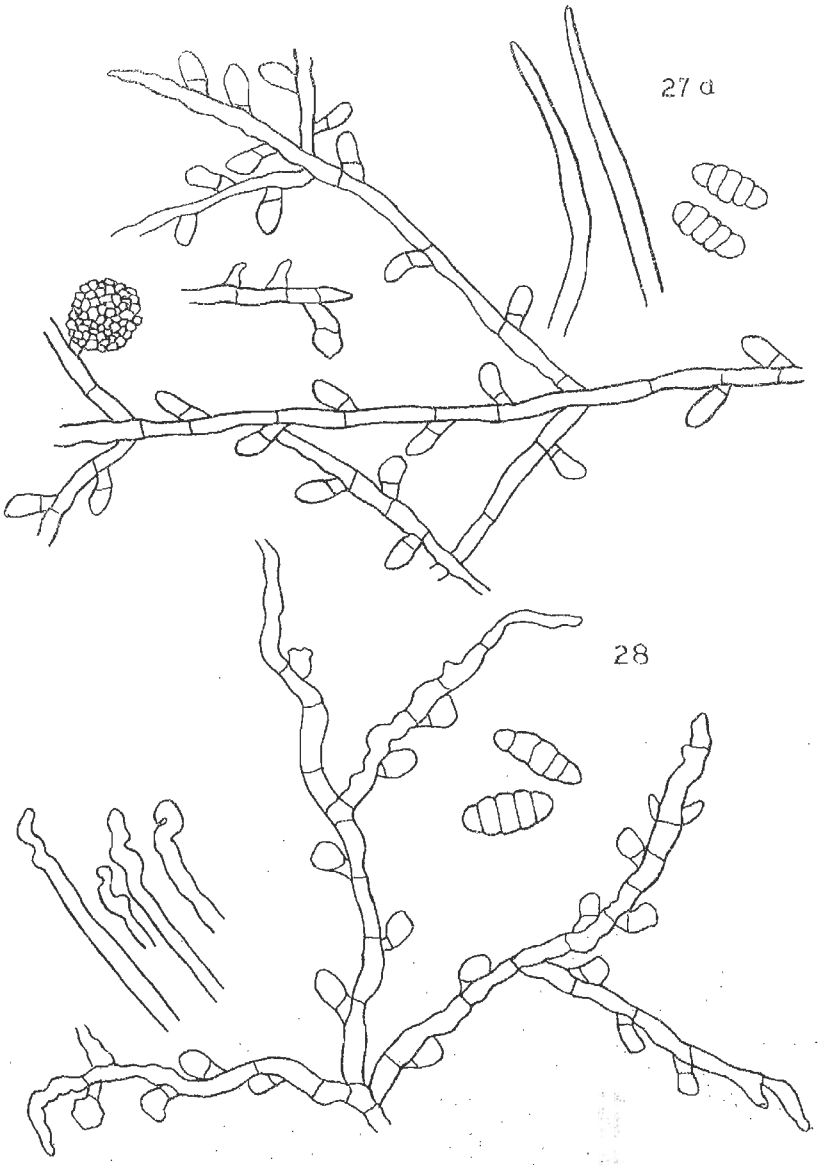

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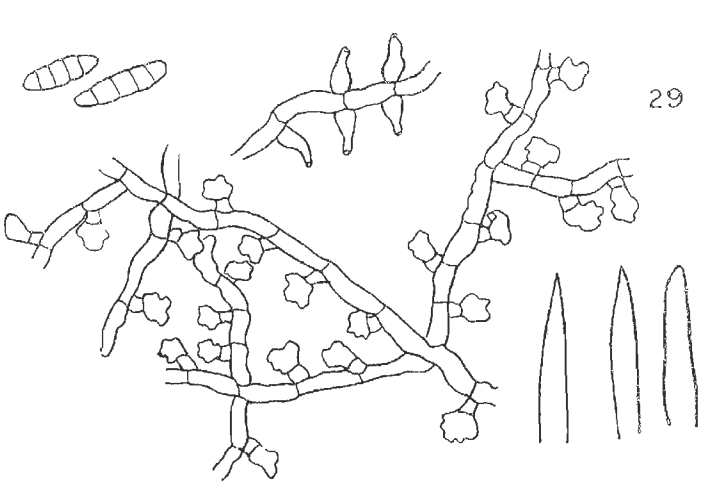

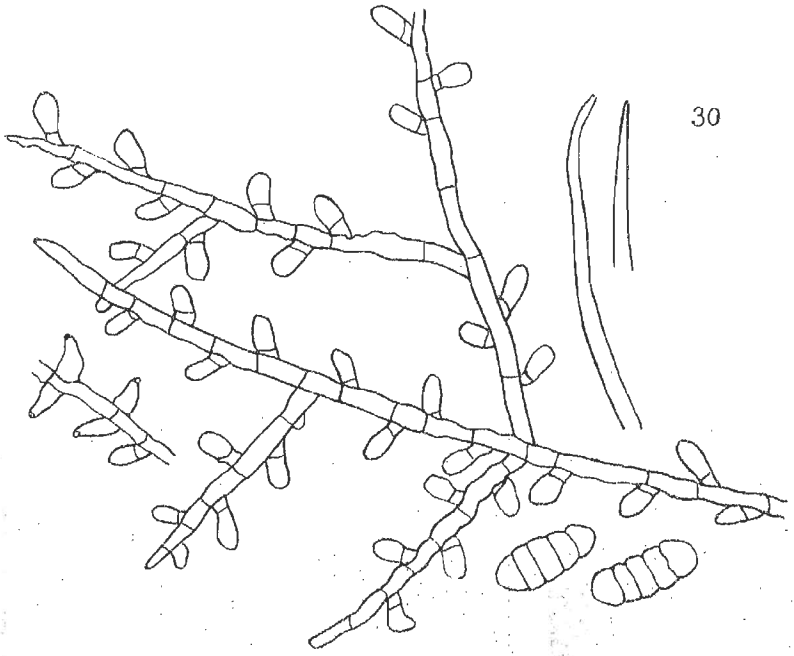

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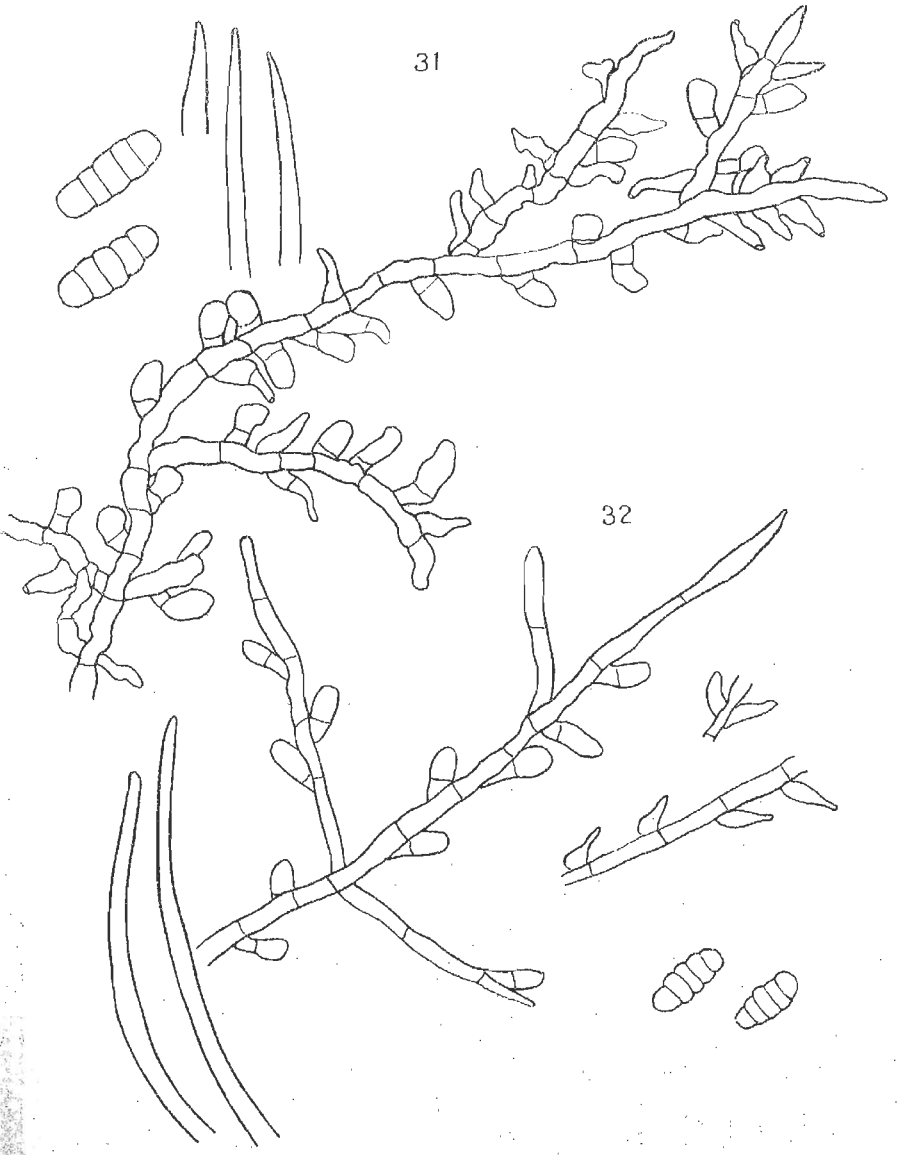

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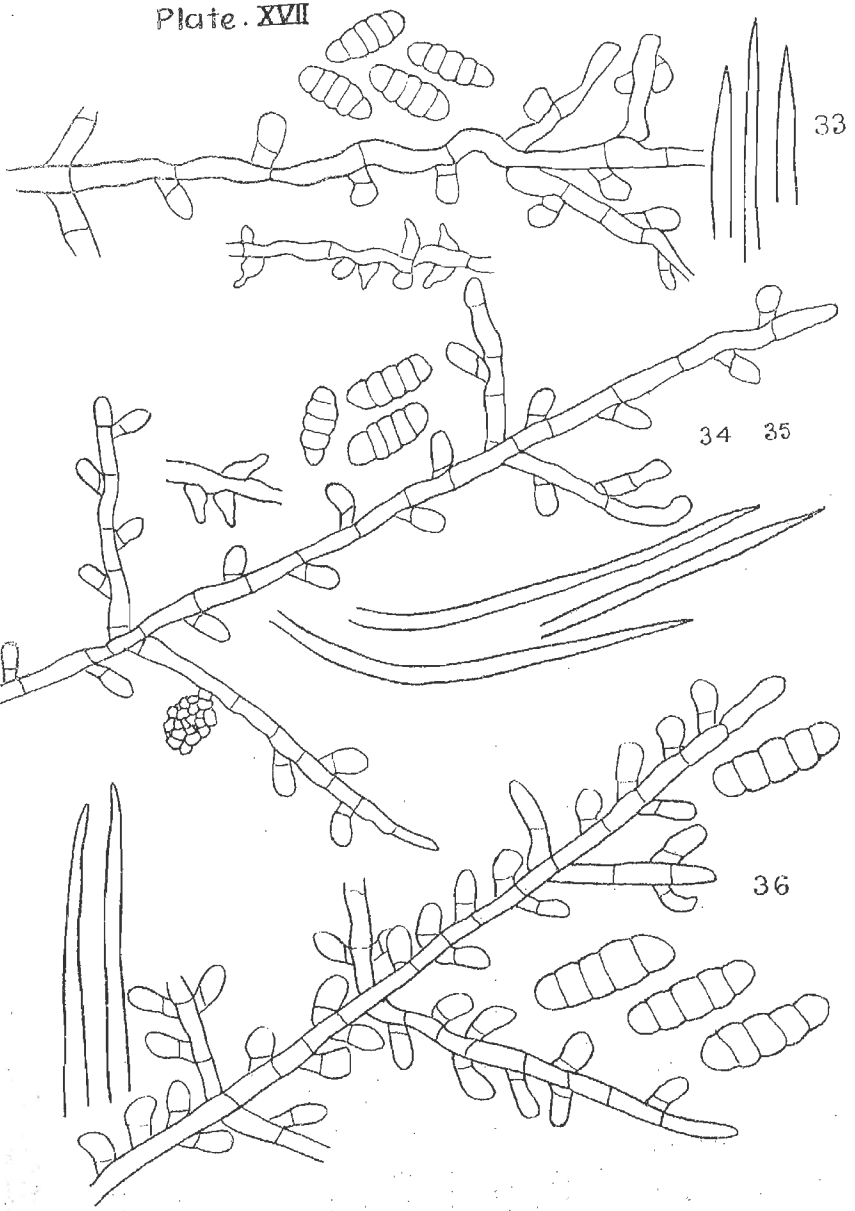

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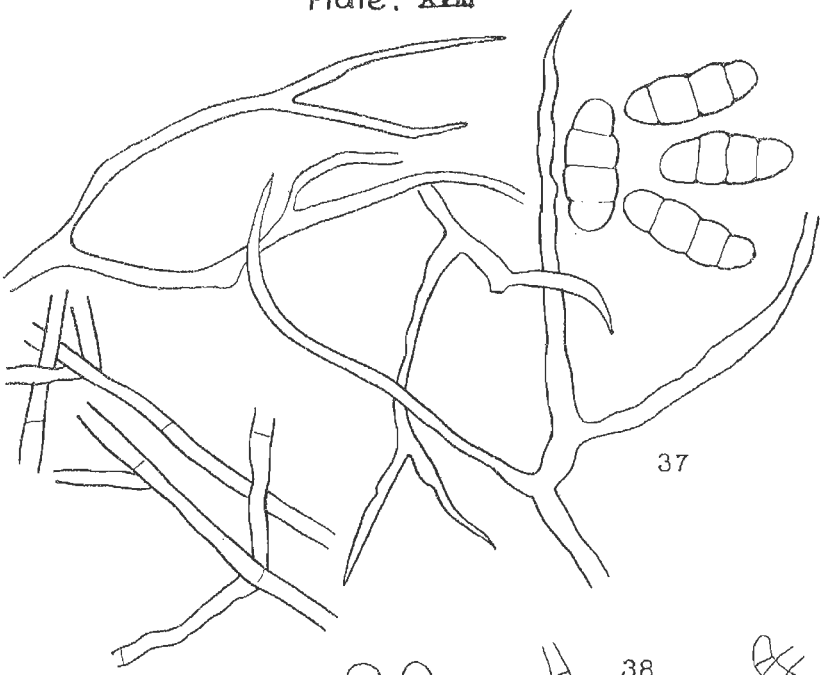

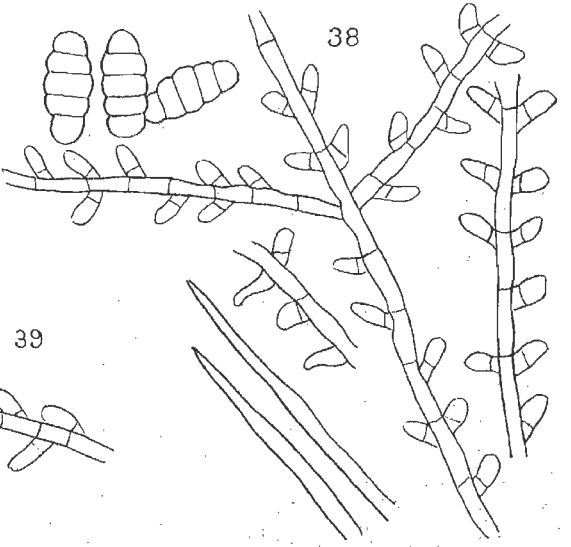

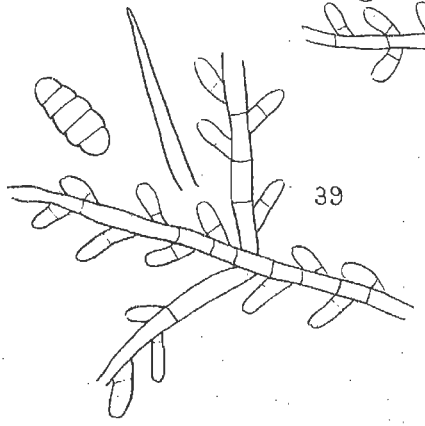

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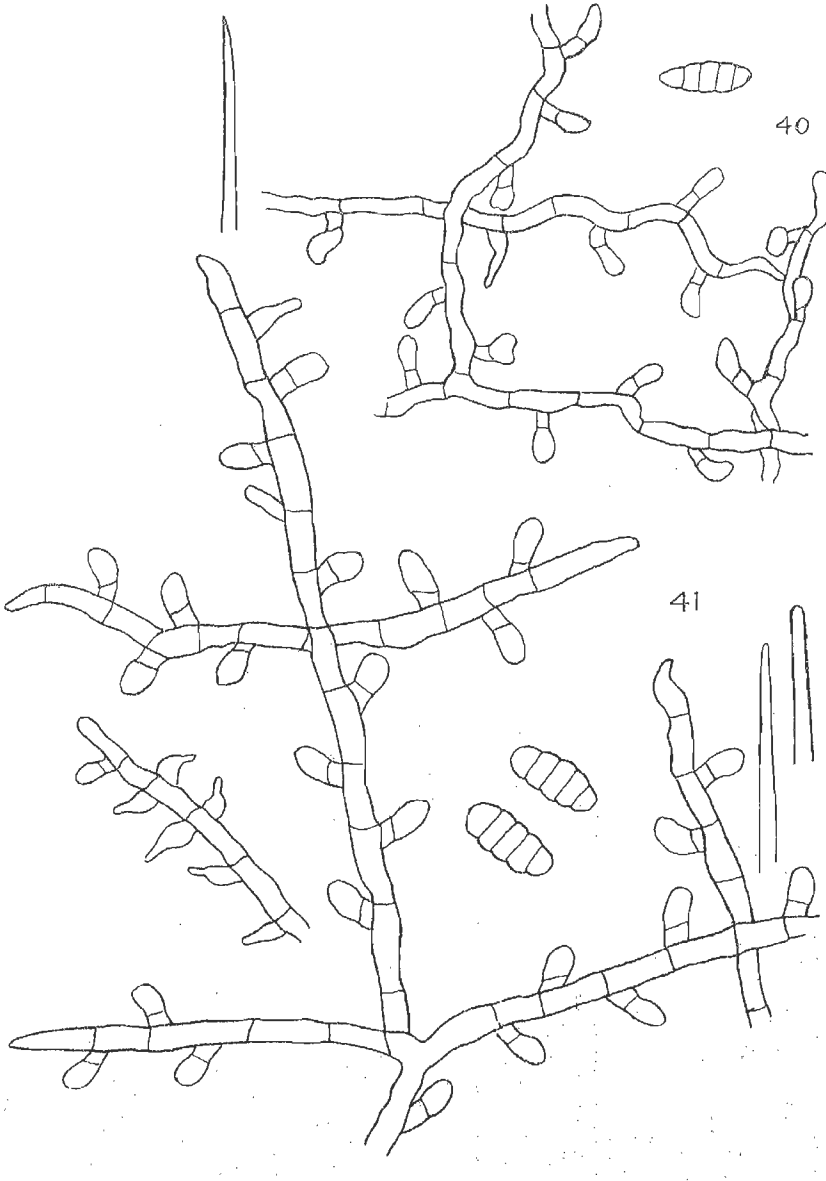

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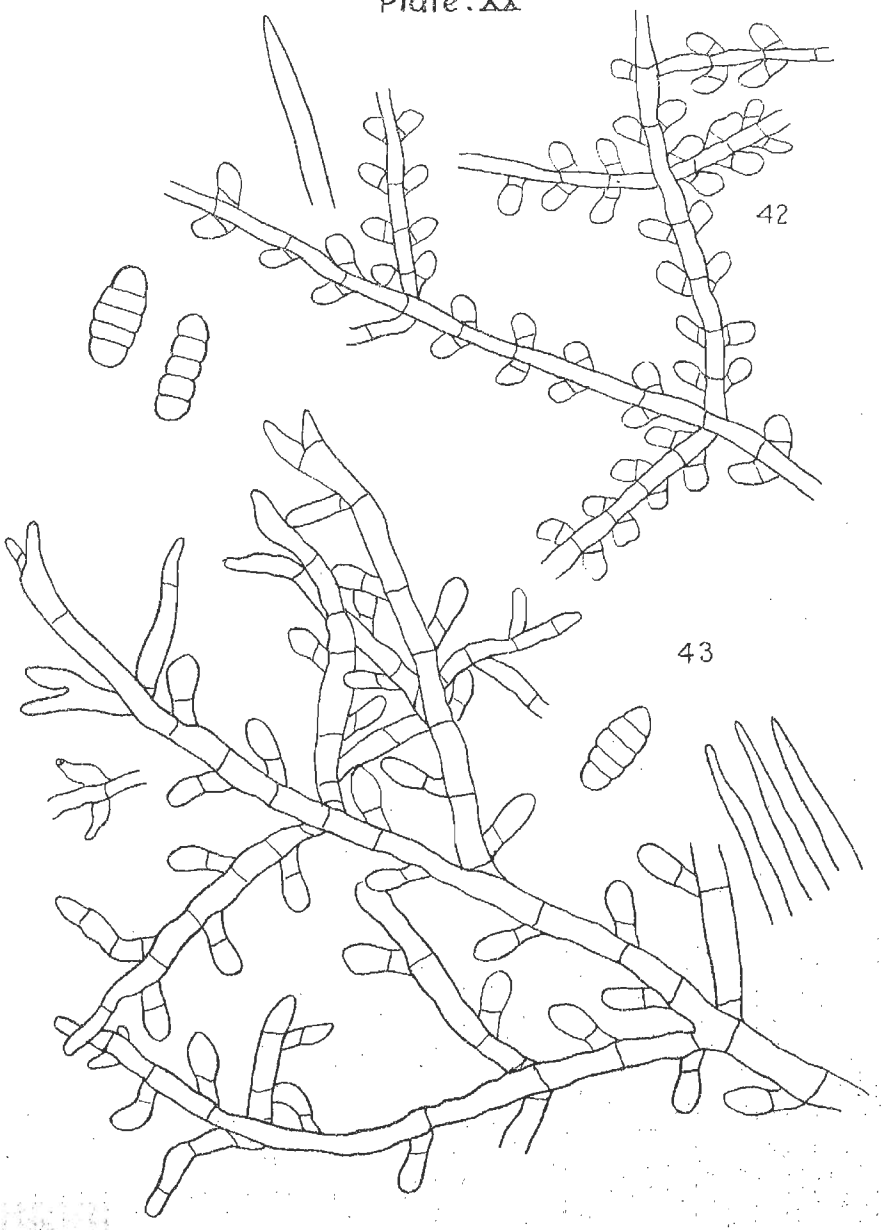

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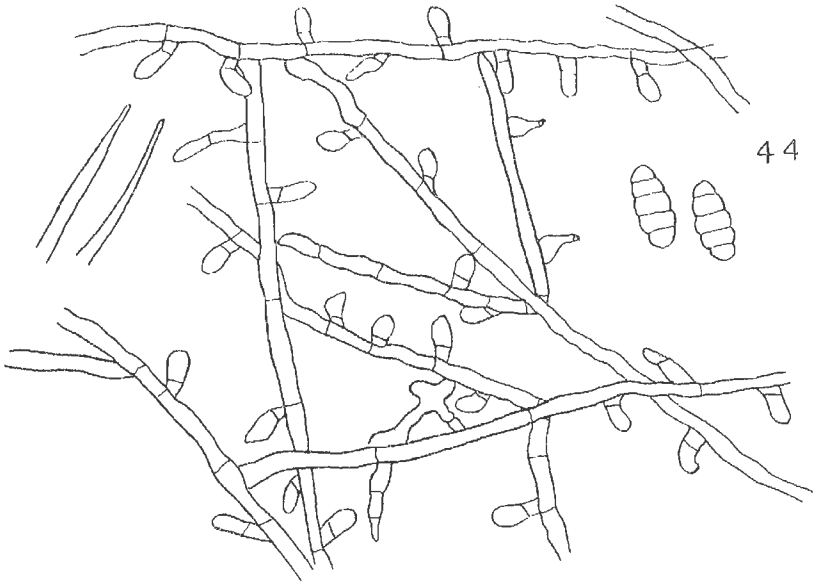

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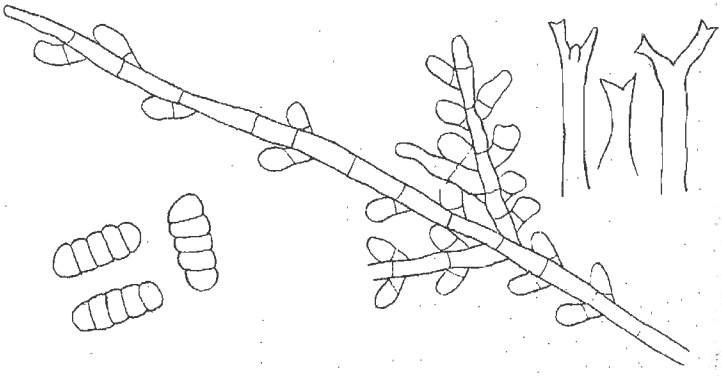

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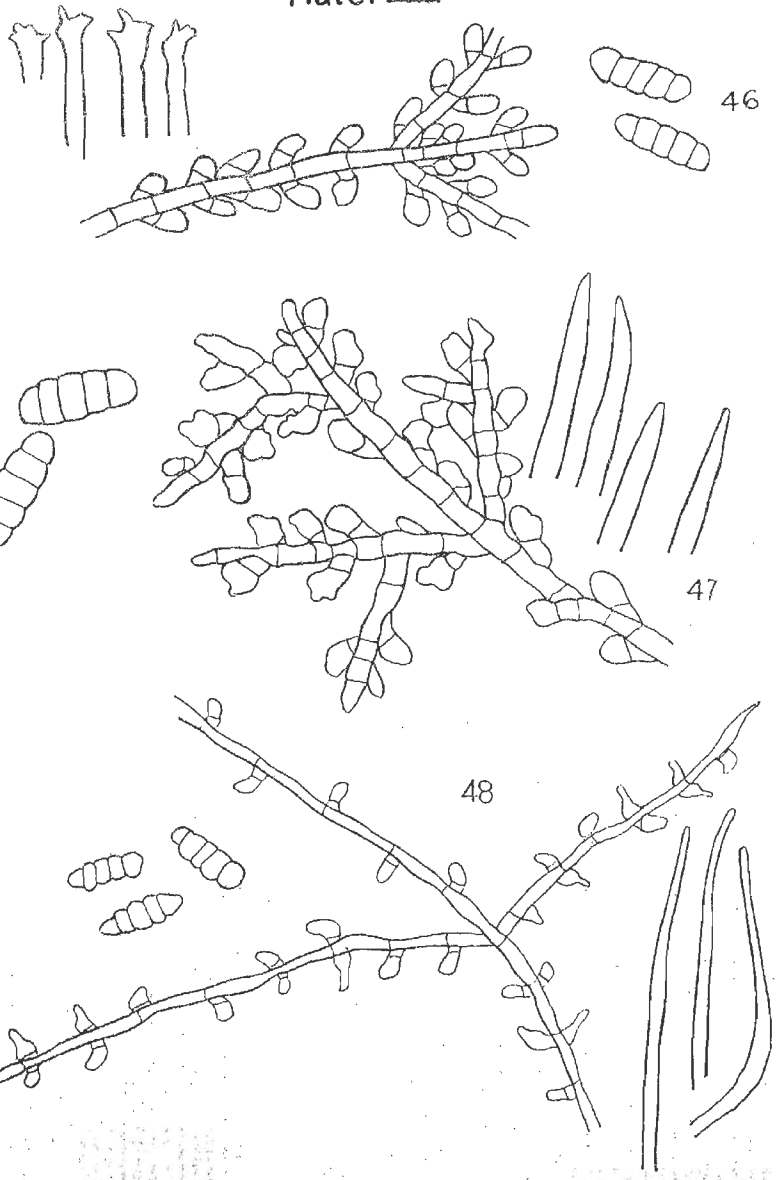

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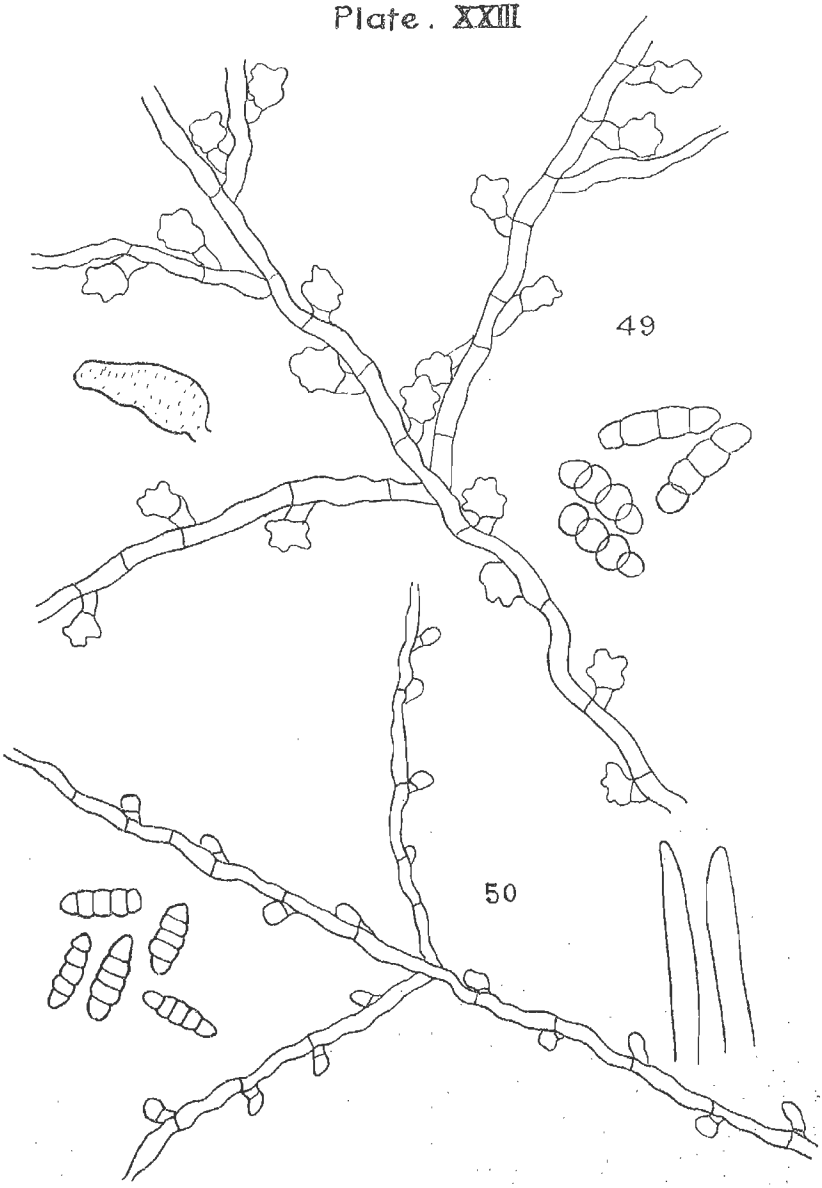

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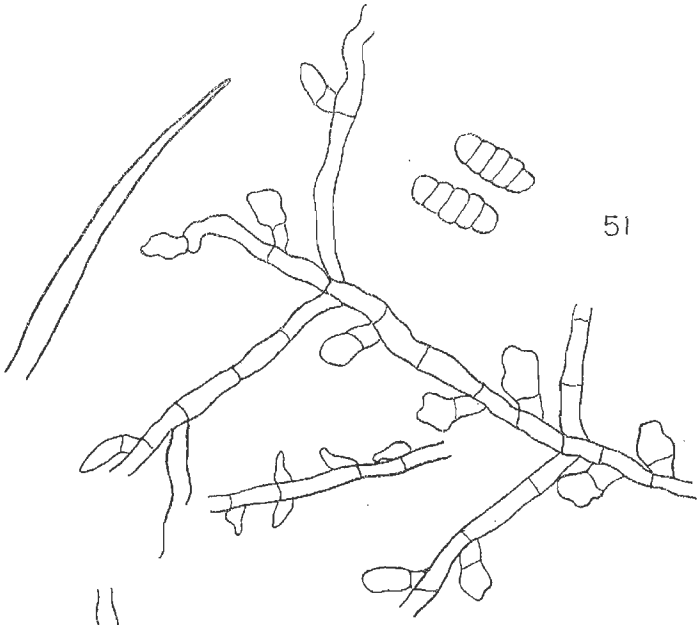

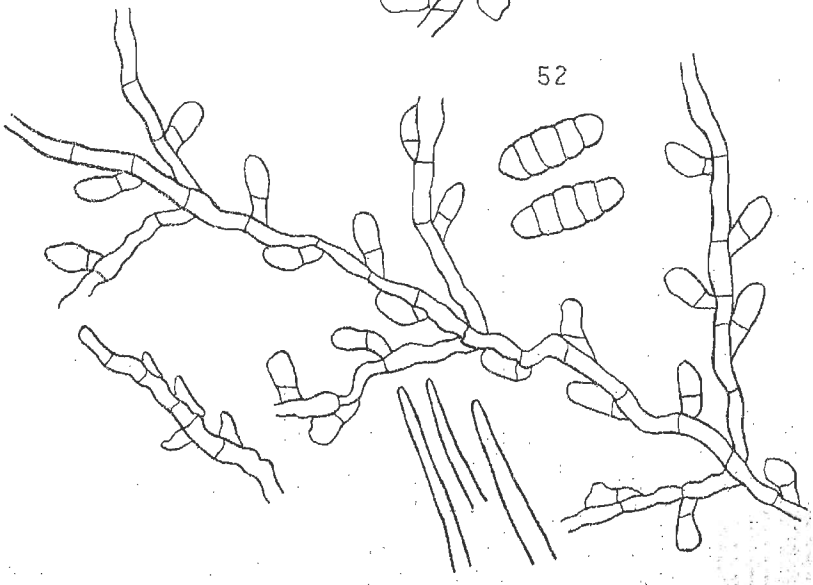

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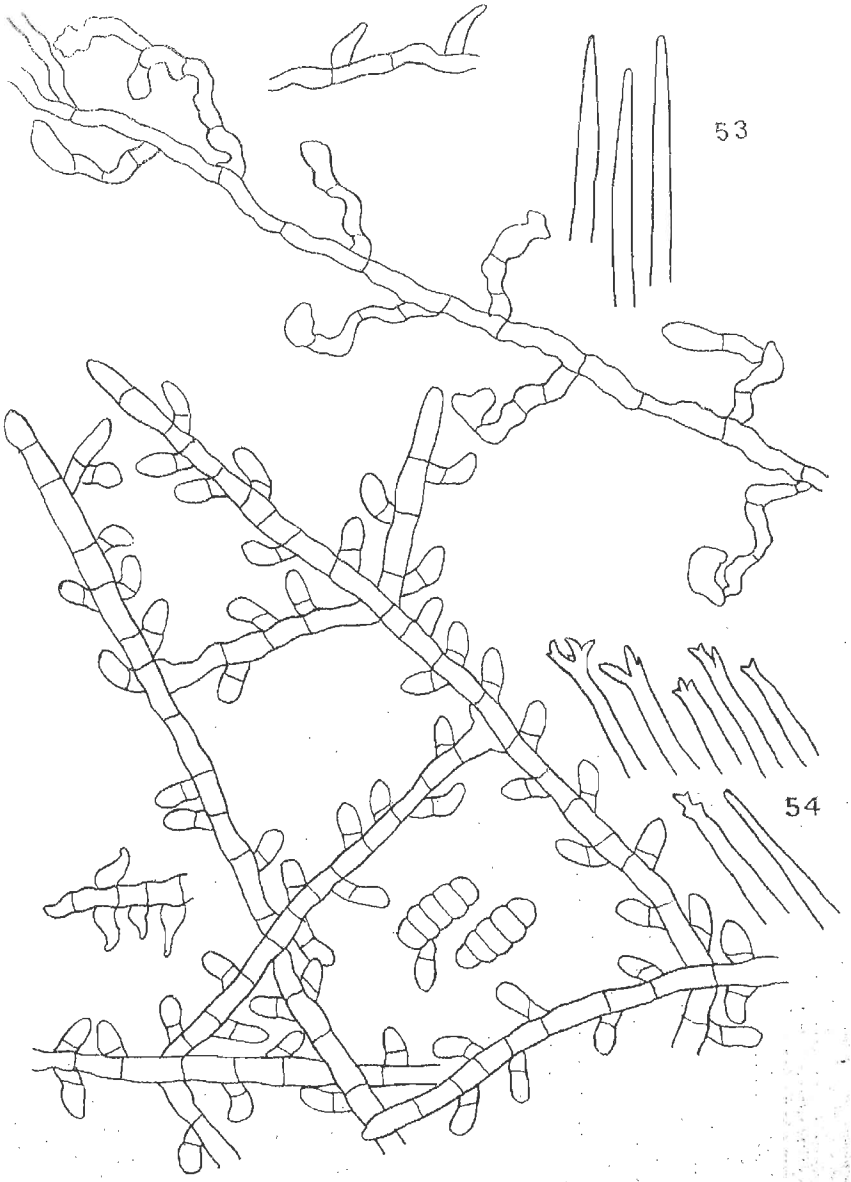

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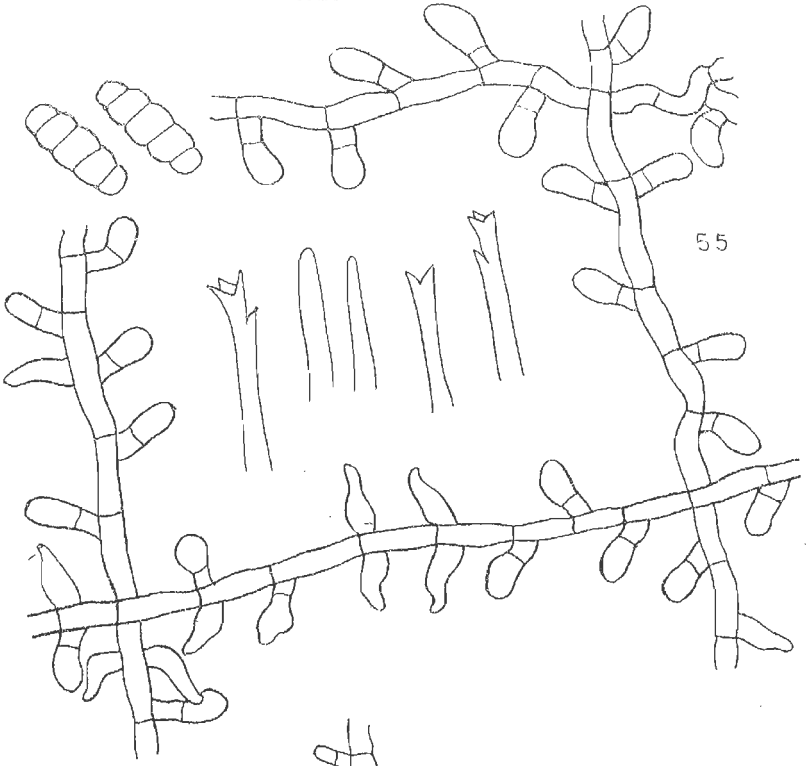

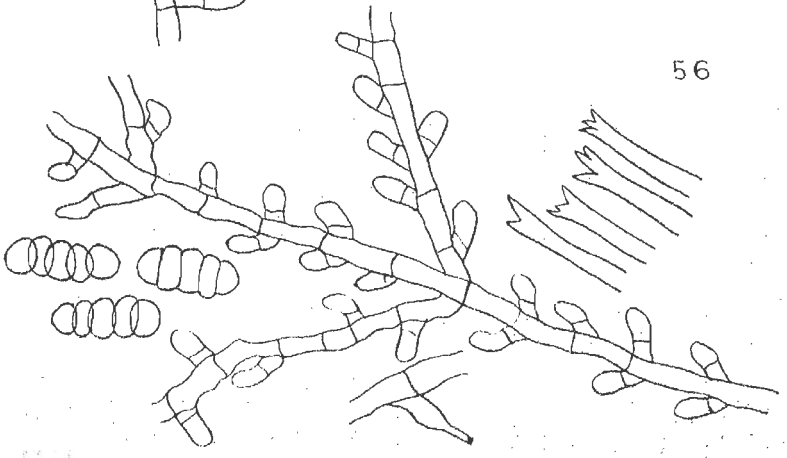

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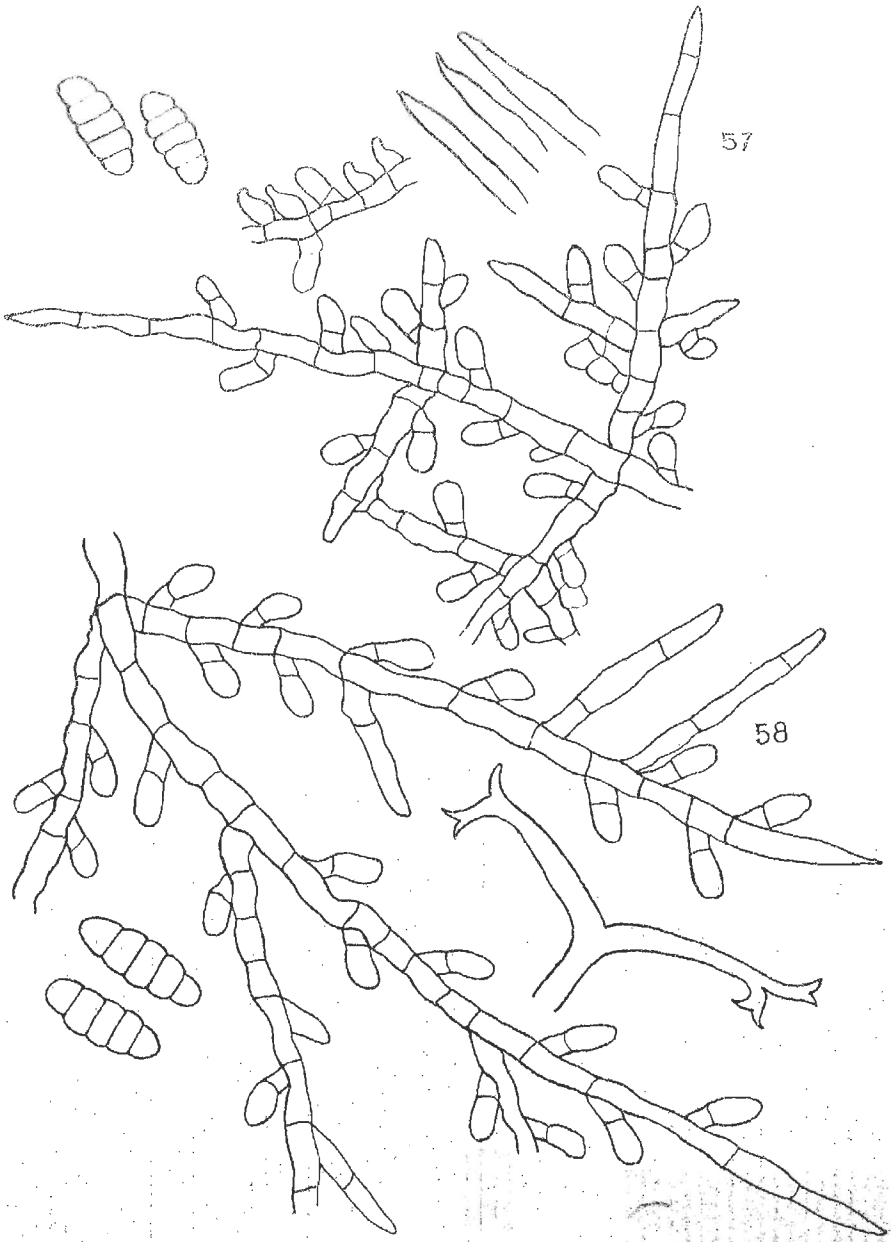

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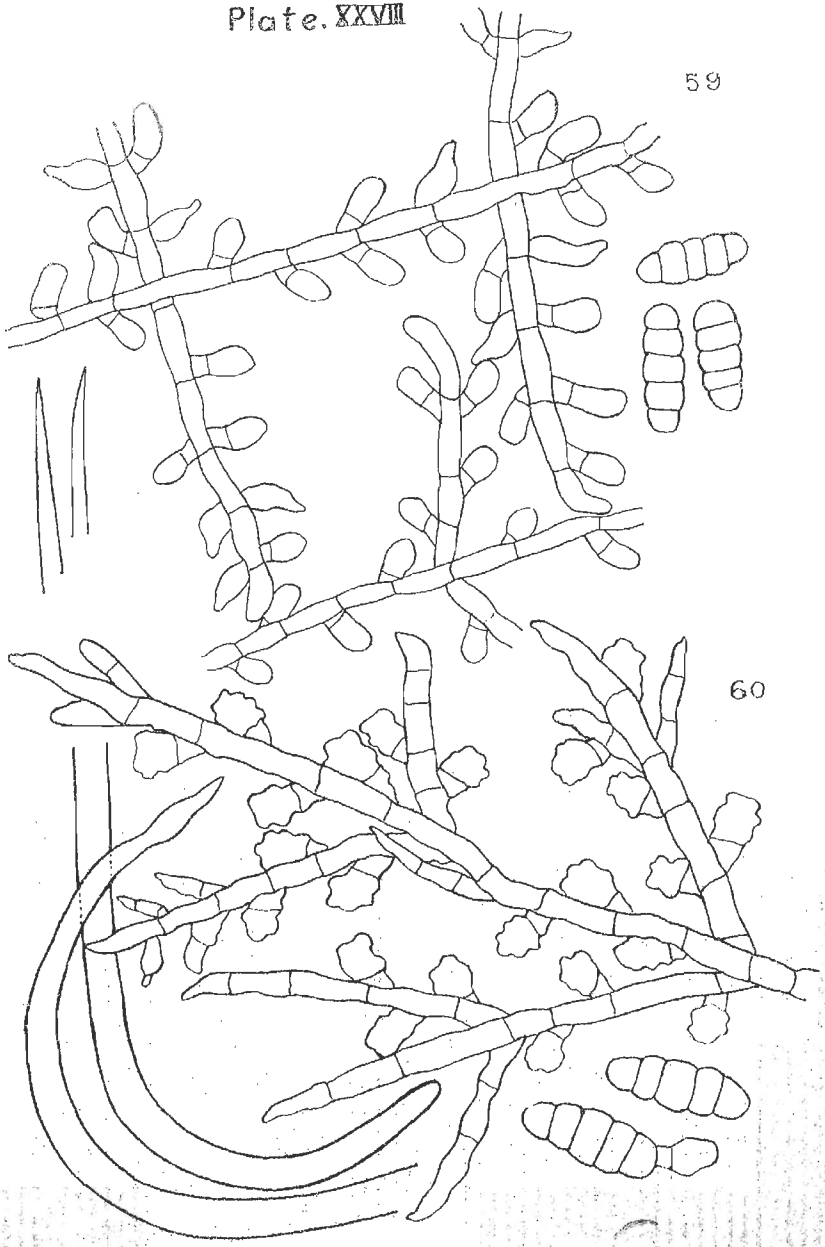

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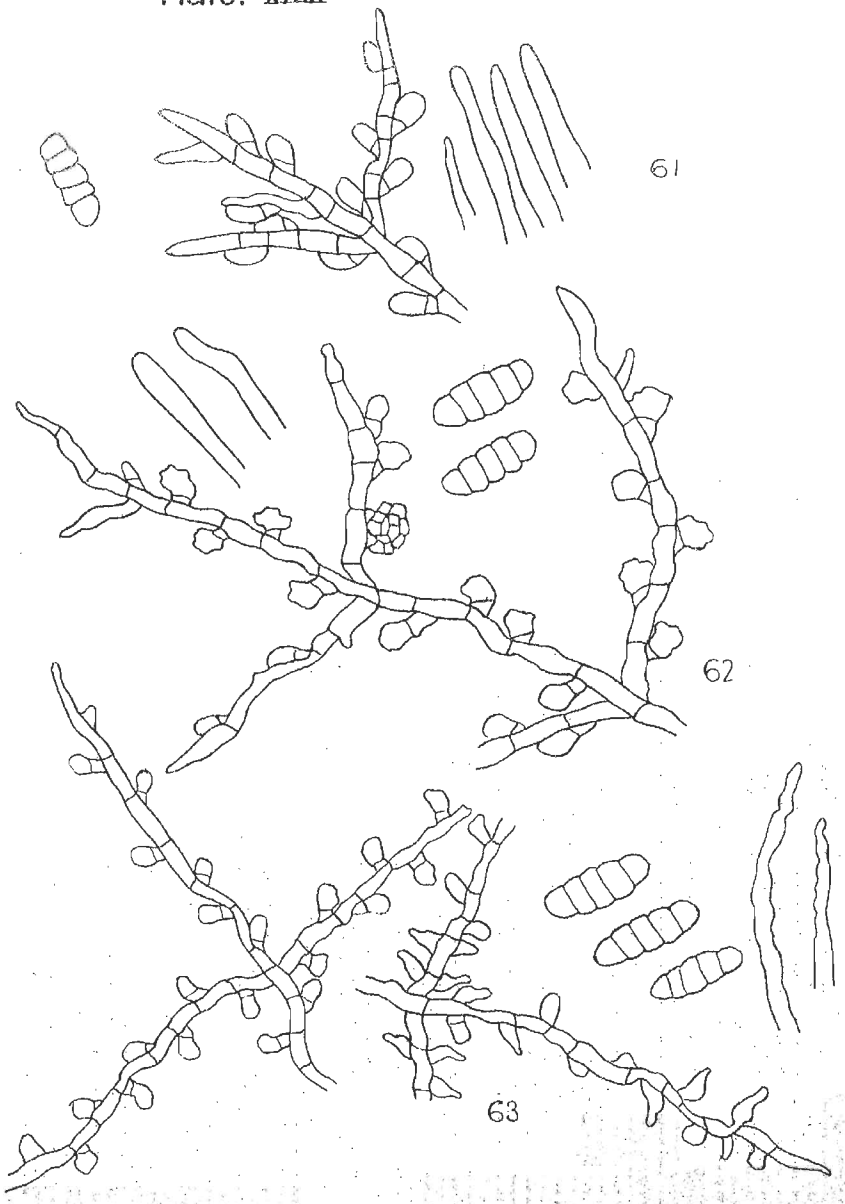

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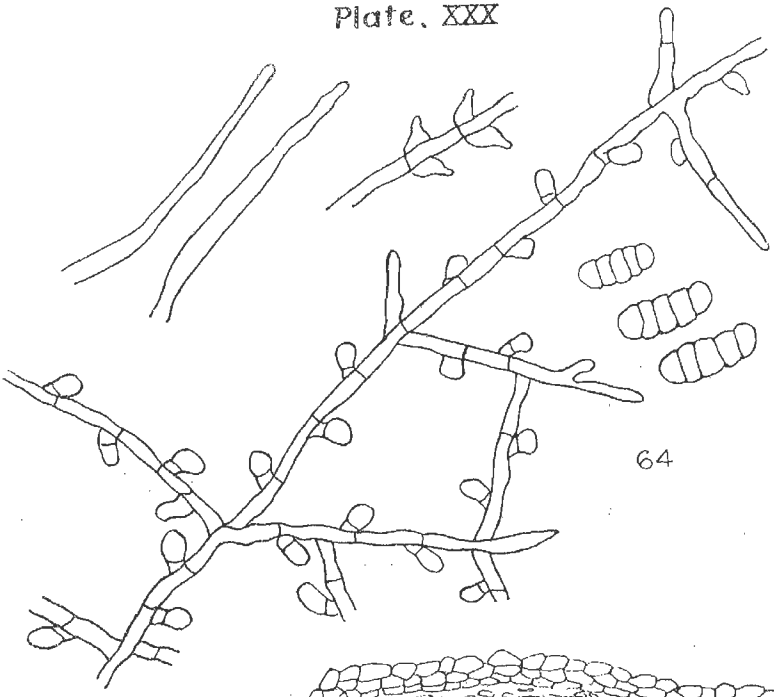

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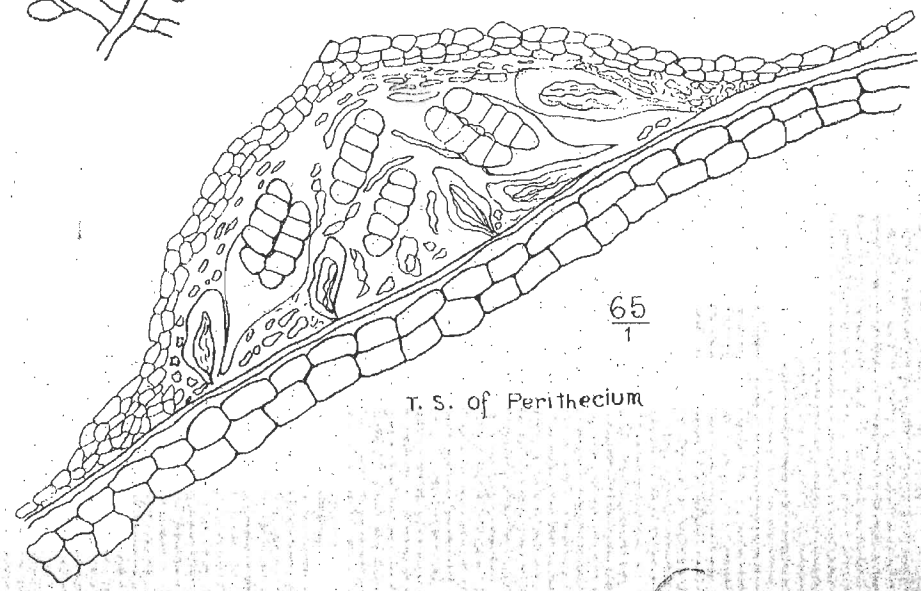

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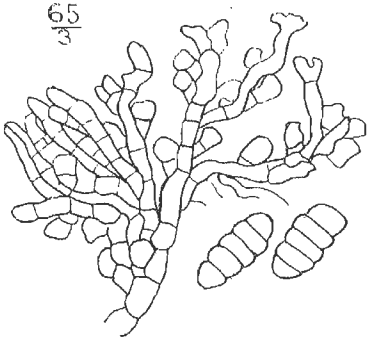
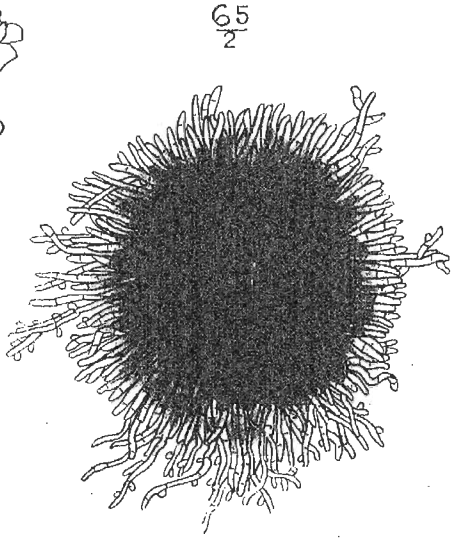
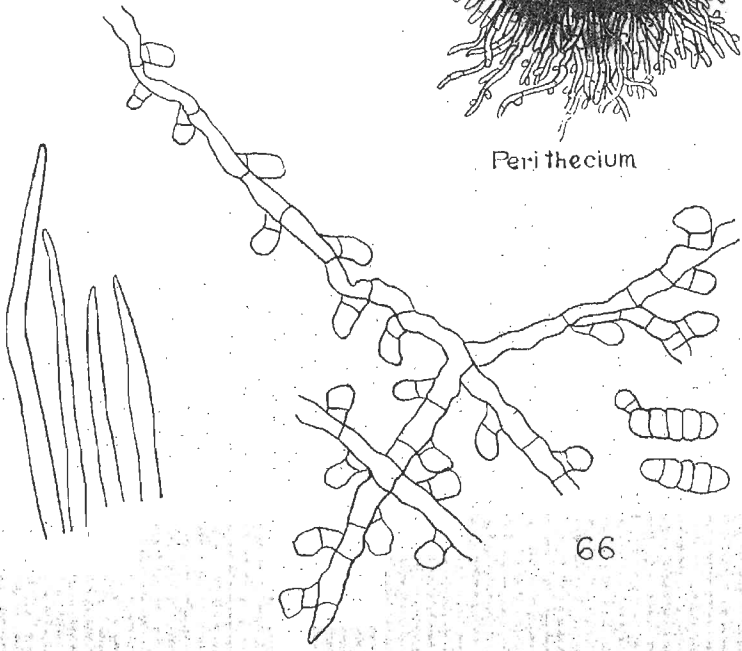
Plate. XXXI







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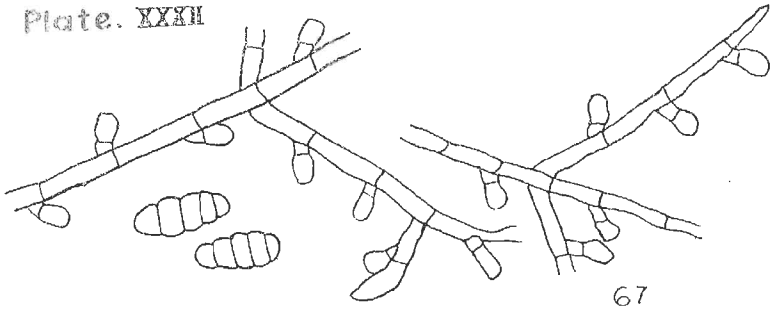

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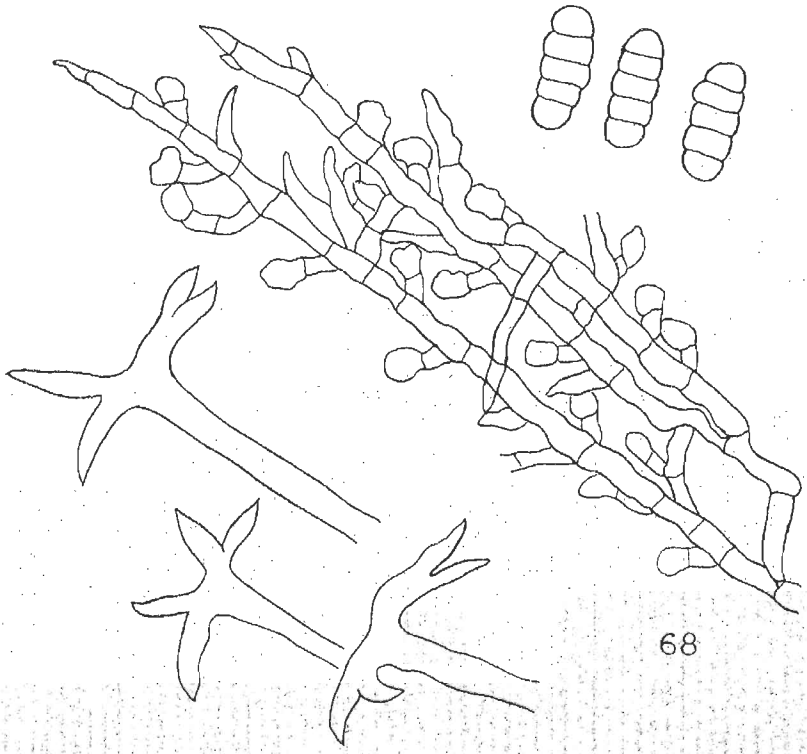

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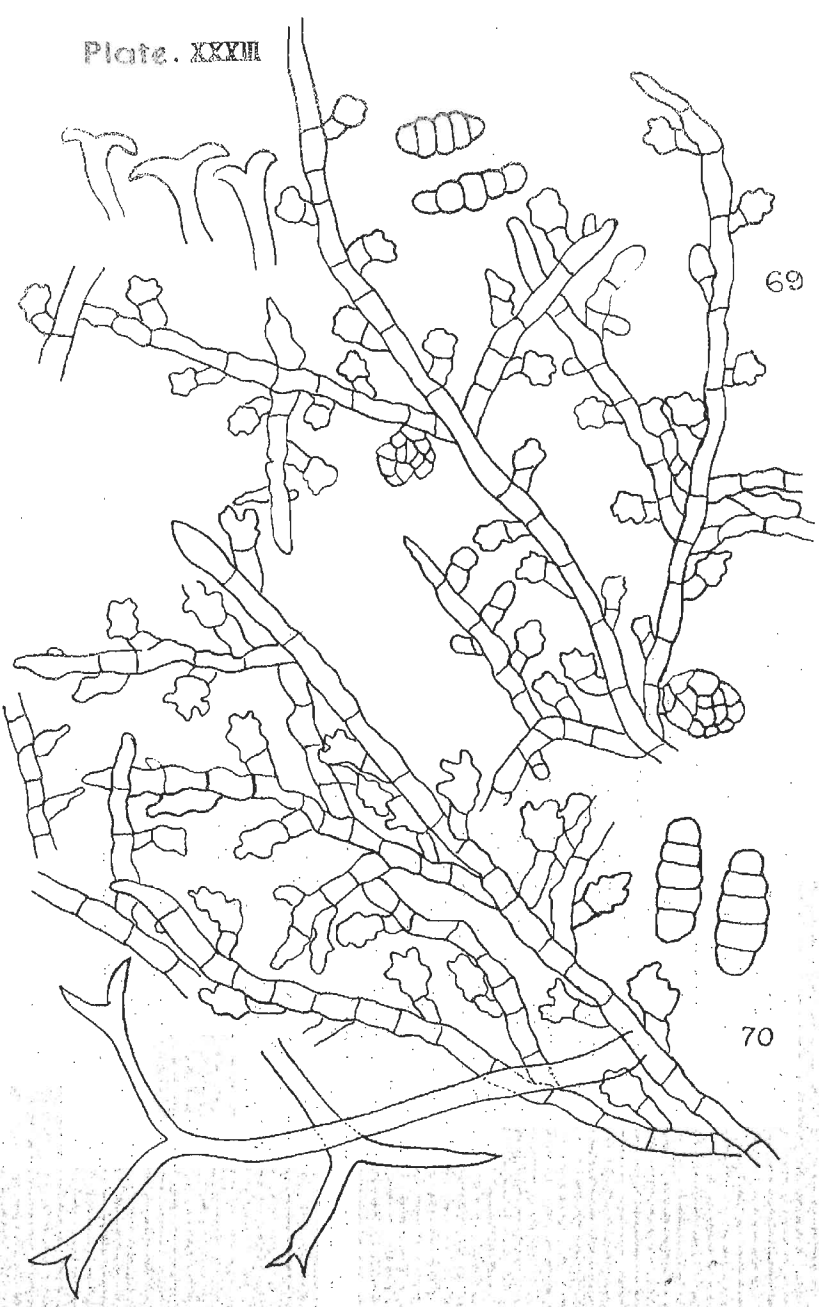
Plate. XXVIII



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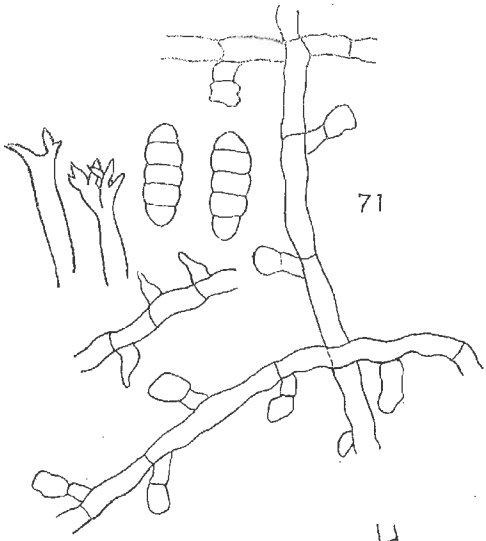

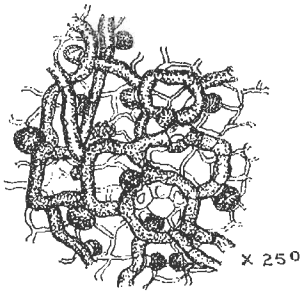

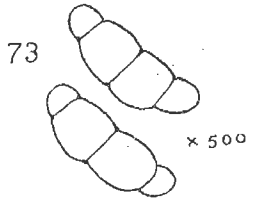

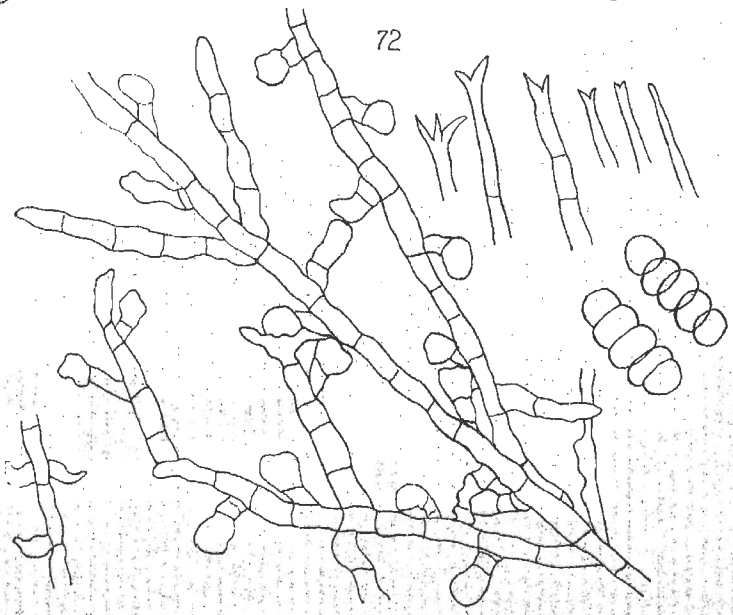

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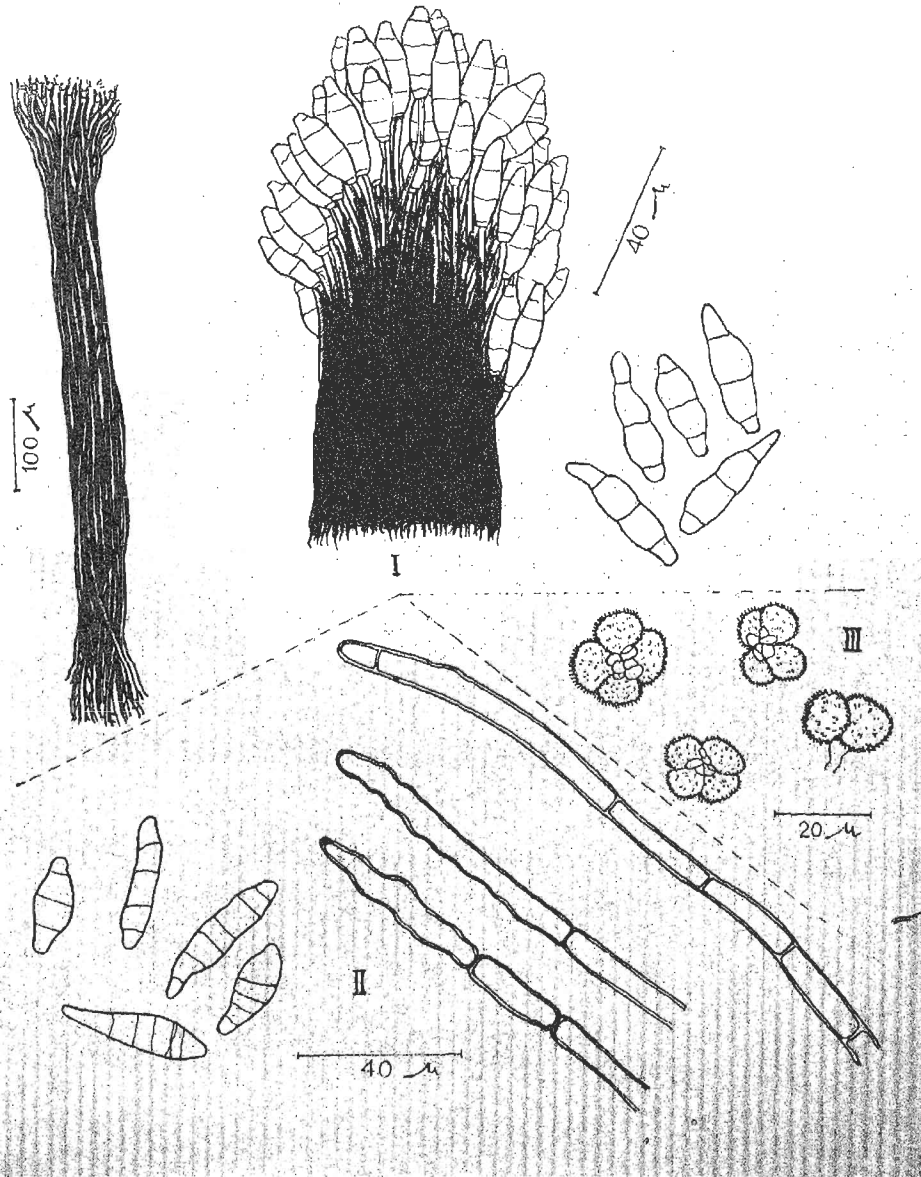

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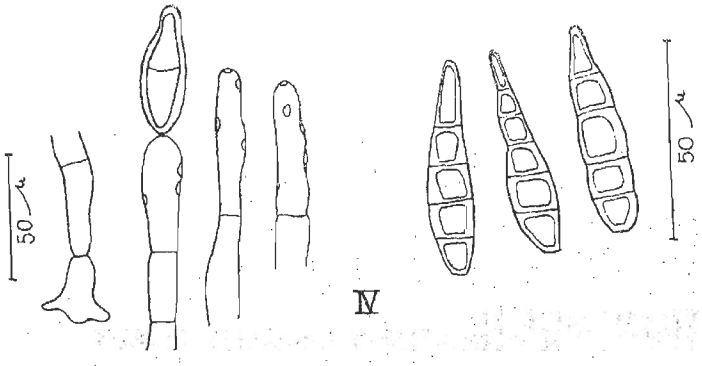

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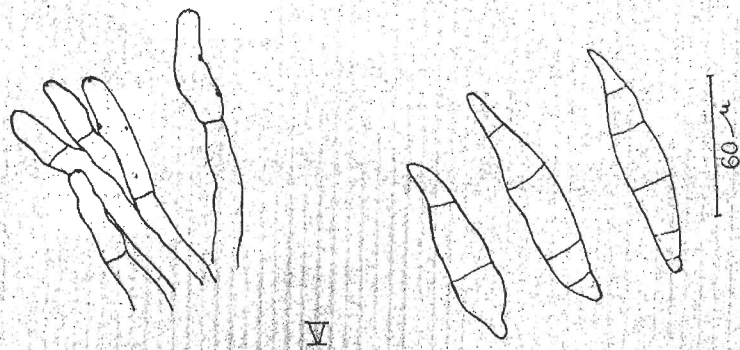

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