Chapter - III

Taxonomical studies in Meliolaceae.

I) INTRODUCTION

Taxonomy is the fundamental aspect of all branches of Biology (Ainsworth and Sussman, 1966) that are epitomised by sound "natural" classification. Such classifications are dependent on the nature of organisms to be classified and on detailed knowledge of their morphology, life histories and ecology. Classifications, therefore, evolve towards greater stability and become informative as the knowledge of particular groups of organisms increases.

According to Vasudeo (1962) taxonomy of fungi is comparatively speaking a neglected subject as only those branches of mycology which are of applied nature or concern economic problem directly receive the general support and early recognition. The subject of taxonomy is considered by many workers as only of academic importance and, therefore, attracts only those few workers who are fascinated by diverse and beautiful morphological and ecological features of these organisms.

Since the time fungi were shown to possess important metabolic activities in the production of antibiotics and various other industrial products, their role on the economic life of the society has been recognized. Because of this important aspect now-a-days the fungi are receiving much attention, but one has to recognise the fact that without

the fundamental advances in the basic knowledge one cannot go very far with the applied aspects. For the proper understanding of the different functions of various members of this group the taxonomical study is always essential.

In continuation of the studies of Indian Meliolaceae (Thite and Kulkarni, 1973, 1975, 1976, 1981 and Thite and Patil, 1978) the author has collected number of sooty mould fungi from Western Ghats near Kolhapur. From these collections four fungi are identified as species of Meliola on comparative studies of morphological characters and host specification. Out of these two are found to be new to science and remaining two are being reported for the first time from India. The specimens have been deposited in the Herbarium Cryptogamic Indiae Orientalies, New Delhi with herbarium numbers HCIO-33670 to 33673. The account of which is represented in this chapter.

II) HISTORICAL REVIEW

The sooty mould fungi which are growing on the leaves and young parts of the plant are generally ectophytic and least injurious to the hosts, but some times cause epidemic diseases of the plants and animals. Langeron (1929) has reported Asterina parasitic on human body causing Piedra disease in the countries like Paraguay, Brazil and Columbia.

Subba Rao (1938, 1939) described Asterina camellae causing great epidemic on Tea plants in India. Similar type of epidemic was reported by Ocfemia (1939) on Sugarcane in Philippines due to Meliola saccharii. Yamammoto (1940) has studied the large number of Meliola species growing on ornamental plants, mangroves and other economically important plants from Formosa. The plants like Sandlewood are also affected by Sooty moulds like Meliola congesta (Thirumalachar, 1946) in India. Similarly sometimes, large number of economically important plants like Tea (Tunstall and Sarmah, 1947; Vital, 1947); Citrus (Chaudhary, 1955; Janini, 1923); Sal (Bagchee, 1953); Papaya (Acuna, 1946) are also damaged by sooty moulds. These sooty moulds can also create great disturbance in the breeding experiments.

Apart from growing and causing great damage to these economically important plants large number of them cause more or less injuries to the wild plants throughout the world. This can be very clearly seen from the reports of Janini (1923) from Spain; Molisch (1925), Yamammoto (1940) from Japan; Arnaud (1925, 1931, 1936) from France; Langeron (1929) from Brazil; Boedijn (1931), Stevens and Roldon (1935); Ocfemia (1939), Sydow and Petrak (1931) from Philippines; Fraser (1933, 1934, 1935) from New South Wales; Sydow (1939) from Germany; Ciferri (1930, 1933, 1938, 1954) from Domingo;

Fisher (1940,1950) from Australia; Yamammoto (1940-a, 1940-b, 1941-a, 1941-b) from Formosa; Hansford (1937, 1938, 1941, 1944, 1945, 1946-a, 1946-b, 1954, 1957, 1961) from Uganda and West Africa; Acuna (1946), Lin (1947) from China; Stevens (1926, 1927, 1946) from Port-Rico; Lentz (1948) from Alabama; Vital and Batista (1947) and Batista (1951) from Brazil; Toro (1927, 1934, 1952) from Tropical America; Dennis (1954, 1968) and Dennis and Wakefield (1946) from England and Indonesia; Hughes (1952, 1953) from Gold Cast; Stevens (1927, 1928), Sydow (1921) from New Zealand.

From studies of Butler and Bisby (1932); Mundkar (1938); Mundkur and Ahmad (1946); Ramkrishanan and Sunderan (1953); Vasudeo (1962); Prasad (1967); Tilak and Rao (1968); Thind and Batra (1957); Kar and Maity (1970, 1971, 1972); Thite and Kulkarni (1973, 1975, 1976, 1978) and many others it is evident that Indian flora is also rich in these fungi growing luxuriently along with the members of other groups. The infections are normally limited to lamina of the leaves of the host, but sometimes extend to the young twigs and petioles. Occasionally they occur on older twigs and branches but very rarely on the fruits. The general appearance on the leaves is in the form of scattered, more or less circular black patches, thin to very dense and sometimes densely velvety with setae. Epiphyllous colonies can easily

be detached but those on the lower surface are often much more strongly adherent. Each black patch normally represents a single colony. Many species have their colonies widely confluent over the surface of leaf. Inspite of such luxurient growth of sooty moulds Hansford (1961) in his monograph on Meliolaceae has stated that "few or no records have been yet made from India, Malaya, China, Japan etc. and here is such a vast region that must be with very large number of species still awaiting discoveries". Thus the study of sooty moulds from India is rather important. Few collections have been made in scattered regions by Hansford and Thirumalachar (1948); Stevens (1927, 1928-a, 1928-b); Ryan (1928); Uppal et al., (1949); Kapoor (1947); Kamat et al., (1971); Tilak and Rao (1968); Thite and Kulkarni (1973, 1975, 1976); Thite and Patil (1982); Kar and Maity (1970, 1971, 1972) and many others. Most of the interior areas are still remaining almost untouched. In this connection Bisby (1953) has said that Indian fungi are vast and confusing assemblage and they are a challange to any army of students. With these considerations an attempt is being made to bring in to light some of the sooty moulds from the forests of Southern Maharashtra.

III) MATERIALS AND METHODS

The collections of specimens of sooty mould fungi

and their preservation are relatively simple processes as compared with those of some other groups of fungi. As they usually occur on the surface of leaves they can be dried by the usual pressing method which is used for phanerogamic specimens and then placed in the herberium packets. If usual herberium methods are used to protect these fungal specimens from insects and other moulds, they also remain in good condition for long time. In taxonomical studies accurate determination of the host plant is always needed.

For routine examination of material whole mounts, as well as free hand sections were prepared. While making whole mounts solution of collodion in acetone was used because the resulting film preparation is much tougher and some what thicker and so much less liable for damage or distortion in peeling it from the leaf surface and mounting.

During this process a drop of collodion solution is placed on the fungus colony selected for examination. It slowly dries and forms a thin film over it. With the help of the needle and forceps the entire colony is removed intact from the leaf surface and mounted in lactophenol. After removing the air bubbles by repeated heating and cooling process it was then covered with cover slip and then sealed with double layer of nail polish.

IV) TAXONOMICAL CRITERIA

The group "sooty moulds" presents a number of characters which have been or might be of use in the separation of genera and species, but still it is a matter of personal opinion as to which are the most important (Hansford, 1961). In the present investigations this group has been studied with the help of the following morphological criteria:-

1) Spore characters,
2) Hyphal characters,
3) Types of hyphopodia,
4) Mycelial setae,
5) Colony characters,
6) Perithecial characters,
7) Host family.

(1) Spore characters :

Shape, size, number of septa, nature of spore wall, dimensions of the ascospores etc. have been given importance in this study. Ascospore may be curved or clavate or sometimes with constricted appearance. The number of septa may vary from three to four. The spore wall may be smooth, or warty or sometimes with Cilium like out-growths.

(2) Hyphal character :

The length and diameter of the cells of the haphae may not be uniform in different species. The branching may be alternate, opposite or mixed, the angle of branching is often characteristic of certain species or group as the distance between successive branches may lead to the difference in the density of colony.

(3) Types of Hyphopodia :

The hyphopodia are of two types, the capitate and the mucronate. These two types may be alternate or opposite or mixed and sometimes variously lobed.

a) Capitate hyphopodia :

The capitate hyphopodia are extremely important in distinguishing the species and varieties. Some species have either straight or bent hyphopodia which may be of appressed or reflexed types. The length of capitate hyphopodia often serves to separate the varieties within the species. The hyphopodia on lower surface of the leaf are often irregular in outline than those on the upper surface.

b) Mucronate hyphopodia :

In general these are remarkable for their uniformity through out the whole group. In shape they may vary from conoid to ampulliform (bottle shaped).

(4) Mycelial setae :

The presence of setae on mycelium is considered as the important feature of this group, as it is very useful to distinguish the different genera. The mycelial setae may be simple or characteristically dented at the apex or branched in various manner. The apices may vary from obtuse to acute. In length the setae may show considerable variation in the same species collected from different localities. There may be great variation in the length of the setae in epiphyllous and hypophyllous colonies of the same species.

(5) Colony characters :

The occurance of the colonies on the lamina of the leaves of the host are of much importance in distinguishing the epiphyllous, hypophyllous and amphiphyllous forms. In some forms they may be on petioles or on stems and may be single or confluent. Some species have always very dense, sharply delimited colonies while others have thin, loose colonies tending to spread over the leaf. Size of the colony is often specific for the varietal character.

(6) Perithecial characters :

In many species the perithecia are irregularly and widely scattered over the colony but in others they may be

aggregated into more or less close groups, while in few forms there are usually minute colonies each with a single central perithecium. In the genus Meliola the true perithecia are hidden beneath the close, peltate ascostroma. Perithecia in the genus Asterina are of inverted type hanging below the hyphae i.e. borne on the lower surface of the mycelium and characterised by the formation of asterinoid fructifications known as "thyriothecia". These fructifications may or may not bear appendages or setae.

(7) Host family :

According to Hansford (1961) in view of the large number of species of Meliolaceae now known, it is essential to know at least the family of the host of each species. It is impossible to key out the species and varieties in any manner capable of rapid and accurate usage. Therefore, it is better to arrange the species and varieties according to host families and under each host family to provide key to the species of the particular genus growing on it.

It follows from these remarks that it is improper to describe a new species of this group in the absence of an accurate determination of the host plant or at least its family. In the absence of such host determination it will be virtually impossible to recognize new species. According to Ciferri (1954) it is evident that the Meliola is

apparently highly specialised fungi and so, the systematic position of the host plants as related to the description of the species must be considered, but within the limits of the host families only, this limitation being artificial and provisional.

V) MELIOLACEAE :

The family Meliolaceae is classified under the series Pyrenomycetes by various workers like Gillard (1892); Ward (1883); Bessey (1968); Booth (1966) and under the series Plectomycetes by Dennis (1968). This family comprises the genera like Meliola, Appendiculella, Amazonia and Asteridiella. The type genus Meliola was established by Fries (1825). A comprehensive discussion of this genus with its known six species was made by Bornet (1883). Gillard (1892) in his book "Le genera Meliola" has recognized one hundred and eleven species with nearly thirty new names and several other synonyms. Beeli (1920) has listed four hundred and thirty specific names and introduced exceedingly helpful scheme of group names. Hansford (1961) who studied the Meliolaceae for a period of about forty years and published a monograph on the same comprising nearly one thousand species of Meliola. In the past, a large number of species of Meliola has been described, occuring on unknown hosts. Hansford (1961) was able to provide determination of some species of

these unknown host with the help of taxonomists at Royal Botanic Garden, Kew. Inspite of this, still, remains a residue of species, so far unmatched with more recent collections, which are still retained as occuring on unidentified hosts in various parts of the world.

According to Yarwood (1973) the Perisporiaceae is synonymous with the Meliolaceae and classified under order Erysiphales synonymous with the Perisporiales. The taxonomy of Perisporiaceae is more confusing and unstable because, of the eighteen genera of Hansford (1946), only two are among the nine genera of Doidge (1917). The number of reported genera range upto at least 45 (Ainsworth, 1963) and 16 (Yarwood, 1973). The different genera included in this family are separated as follows.

Key to the genera of Perisporiaceae :

Ascospores two celled. ..

Mycelial setae present.

Perithecia parenchymatous, apically dehiscent .. Balladyna.

Perithecia mucose-difluent, with meridian hyphae .. Linotexis.

Mycelial setae absent.

Perithecia not mucose-difluent.

Perithecia thick walled,
on radiate mycelial disc. .. Armatella.
Perithecia thin walled,
with larviform setae. .. Wageria.
Perithecia glabrous or
with normal setae. .. Balladynastrum.
Perithecia with hypostroma
in stromata .. Stomatogene
Perithecia mucose-difluent
Perithecia with meridian
hyphae .. Parenglerula.
Perithecia without
meridian hyphae.
Perithecia sessile
Perithecia setose .. Xenostigme.
Perithecia glabrous .. Dialacenium
Perithecia stipitate .. Thrauste

Ascospores more than two celled.
Perithecia applanate
Free mycelium absent .. Actinodothis
Free mycelium present .. Amazonia
Perithecia globose
Mycelial setae present .. Meliola
Mycelial setae absent
Perithecia with setae .. Irenopsis.

Perithecia with larviform appendages	..	Appendiculella
Perithecia with neither Setae nor appendages	..	Asteridella

According to Hansford (1961) species of Perisopriaceae number is about 1840. About 1814 of these are in the Meliolineae and most of these are in the genus Meliola. Perisporiaceae occur in warm, humid forested tropical areas but may occur in areas with wet seasons alternating with long droughts. They usually are found only on adult leaves. According to Muller and Von Arx (1973) Meliolaceae is classified under order Meliolales. Most members of the Meliolaceae have been recorded only from warmer geographical areas, where they are common on tropical trees and shrubs. They often are characterised as "black mildews" and each species shows a narrow specialization with respect to a particular host species or genus. Unfortunately, they have not, as yet, been isolated in pure culture. The species of the genera Meliola, Asteridiella, Irenopsis, Appendicullella and Amazonia were monographed by Hansford (1961, 1965). More than 1800 species are described, distinguished essentially by their host range and by morphological characteristics. The different genera included in this family are separated as follows :

Key to the genera of Meliolaceae :

Ascospores 1 or 2 celled at germination, narrowing near the middle. .. Armatella

Ascospores with 2 to 5 septa.

Ascospores 3-celled with the central cell enlarged, ascomata ostiolate. .. Diporotheca

Ascospores mostly composed of 4-5 equal cells.

Ascomata flattened, radiate .. Amazonia.

Ascomata sphaerical or rarely So, not radiate

Mycelial setae present .. Meliola

Ascomata glabrous.

Mycelial setae absent .. Asteridiella

Ascomata setose or possessing appendages.

Ascomata with setae .. Irenopsis

Ascomata with larviform appendages. .. Appendiculella.

These members are widely distributed especially in wormer regions of the world, but are extended outwards from these in to Southern Parts of U.S.A., South Africa,

Central Europe, Japan and Tasmania. Few records have been made from New Zealand but none from Atlantic islands of St. Helena. Apart from these regions, this group is also represented from more isolated parts of the warm regions of the world. A large number of species have been listed from tropical America mainly by Stevens (1927, 1928); Ciferri (1954); and Sydow (1927, 1930, 1938). Similarly from South America the contributors like Spegazzini (1880, 1883, 1925) laid the foundation of the study of fungus flora, but still, there is a vast region awaiting discovery of large number of species. From south Africa the important contributors like Doidge (1917, 1920-a, 1920-b, 1921) have listed some members of this group, but it is probable, that many others still remain undiscovered. On the other hand, regions like tropical Africa, Sierra Leone, Gold cast and Uganda etc. are still to be explored in connection with these members. Few or no records have yet been made from the islands of Indian ocean. The most systematically explored part of Asia are Phillippine islands and Java while few records have been made from India, Malaya, China and Japan. At present the areas like Burma, Indo-China, Yannan represent a very large geographical gap in our knowledge of this group of fungi. Australia, Northen Queens land, New Guinea and the whole pacific Islands remain practically untcuched, while

there are few records from Tahiti, New Caledonia and Samoa, mostly from the last century.

As a general rule the members of this group parasitize only the indigenous plants of any particular region although in some instance they may be found on introduced or on cultivated plants closely allied to their native host (Ciferri, 1954).

As the climate in India is favourable for the growth of the members of Meliolaceae, there are large number of species parasitizing the plants of a number of families, but comparatively few species have been described so far. From India, 85 species of this group have been described and most of them are described from Mysore and Maharashtra State (Hansford and Thirumalachar, 1948). From Maharashtra State about 45 species of this genus have been reported (Thite and Kulkarni, 1973, 1975, 1976 and Thite and Patil, 1982).

VI) MELIOLA :

The type genus Meliola was established by Fries (1825) and was amended by Bornet (1883). Toro (1952) discussed the problem of the type species of the genus Meliola and Hansford (1961) agreed with his conclusions that lectotype should be Meliola trichostronea (Kze.), because for many years Meliola amphitrica (Fries, 1825) was regarded as the type species.

Previously Meliola was the only genus recognised in the family Meliolaceae. In 1897 McAlpine classified the genus Asteridiella under Microthyriales, but Ciferri (1954) re-examined the specimen and found it to belong to Meliolaceae. Fortunately the confusion with the use of the genus Irene in two different sense of Theissen and Sydow (1917, 1918) and Stevens (1927, 1928) has been obviated by a discovery that the genus Asteridiella is infact the true Irene. Ciferri (1954) did not recognise the genera Actinodothis (H. and P.Sydow) and Amazonia (Theiss) as their relationship with Meliola is doubtful and as both the genera are unclearly differentiated. He also did not recognise the genus Meliolina (H. and P.Sydow).

The first attempt to split the old Fries's genus Meliola has been ma-de by Von Hohnel (1941) establishing the new genus Appendiculella - characterised by the possession of vermiform appendages on the perithecium, but without setae. Similarly the genus Irene has been treated synonymous with Appendiculella by Stevens (1927, 1928). He also established the genus Irenopsis which is characterised by the presence of perithecial setae but the absence of mycelial ones and Irenina completely devoid of setae. Von Arx and Katumoto (1958-b, 1962) established new genus Armatella which is characterised by ascospores 1 or 2 celled at germination, narrowing near the middle.

Gordon and Shaw (1964) established the new genus Diporotheca which is characterised by 3-celled ascospores with the central cell enlarged and ostiolate ascomata.

The genus Meliola fries amended by Stevens is characterised by mycelial setae. This treatment of Stevens (1927, 1928) has been generally followed by many others but Ciferri (1954) proposed the recognition of the old incontestable unity of the Fries's genus Meliola considering all derived genera as sub-genera. Hansford (1961) has opposed this view and regarded these "new combinations" of Ciferri (1954) as entirely unnecessary and superflous "name making", except for the few species, in which Ciferri proposed on entirely new specific epithet. These new combinations have been omitted by Hansford (1961) in his monograph, "The Meliolanae" and has accepted only the genera Amazonia, Meliola, Irenopsis, Appendiculella and Asteridiella. According to Muller and Von Arx (1973) family Meliolaceae includes the genera Arnatella, Diporotheca, Amazonia, Meliola, Asteridiella, Irenopsis and Appendiculella. During the course of their studies the author have collected few species of Meliola from Western Ghats near Kolhapur. After critical study of present literature some of them are found to be new to Science and some are found to be new records for the country. Accordingly Meliola piperae, Thite and Patil (1983) and M. ochrocarpi, Thite and Patil (1983) are the new species.

While M.asclepiadacearum Hansf. and M.similinae Hansf. are new records to India. These four species can be separated as follows :

VII) KEY TO THE SPECIES OF MELIOLA UNDER STUDY :

A) Hypophyllous -
Hyphopodia Capitale rarely mucronate.
Ascospores wormiform, oblong
140-155 x 35-75 μ ..... M.piperae

AA) Amphiphyllous -
Hyphopodia of both the types.

B) Ascospores more than 40 μ
in length i.e. 40-45 x 14-15 μ.
Perithecia - 120 - 180 μ in diam. ... M.ochrocarpi

BB) Ascospores less than 40 μ in length.

C) Perithecia - less than
100 μ in diam.
Ascospores 35 - 40 μ in length .... M.asclepiadacearum

CC) Perithecia 180 - 200 μ in diam.
Ascospores 30-35 x μ in length .... M.similinae.

a) Species new to Science :

1) Meliola piperae : Sp. nov.

A critical study of literature shows that the members of the family Piperaceae are sparsely affected by species of Meliola. Only thirteen species of Meliola are recorded on the members of the family Piperaceae from other parts of the world, but from India there is not a single record. In 1980 the authors have collected a species of Meliola on the leaves of Piper nigrum L. (Black Piper - Piperaceae) a valuable plant used as a medicine and in spices. After comparison with known species (Table-I) it was found to be new and collected on hetherto unreported host.

The present fungus differs from rest of the species in mycelial cells which are longer i.e. 30-40 μ in length, capitate hyphopodia, rare or absence of mucronate hyphopodia and size of the ascospores.

Meliola Piperae - Thite sp. nov. Fig.1

Colonies are hypophyllous upto 8 mm in diameter, thin, confluent. Hyphae flexuous substrait; branching alternate or opposite, densely reticulate; cells mostly 30-40 x 6-8.5 μ; Capitate hyphopodia are alternate, ellipsoid straight to curved 10-13.5 μ wide. Stalk cells rectangular cylindrical 6.5 to 9 μ long; head cells globose to round 8-12 μ in diam.

Comparison between the species of Meliola growing on the members of the family Piperaceae.

la es	Host Plant	Colony	Hyphae	Capitate hyphopodia	Mucronate hyphopodia	Setae	Perithecia	Ascospores
la aridiana gensis	Piper samanense	Amphipyllous-dense velvety 3 mm in diam.	Substraight flexuous, opposite reticulate cells 10-15 x 6-8 μ	Mostly alternate rarely opp.antrose, 13-18 μ. ste. 3-6 μ. hc. ovate piriform 10-13 x 8-10 μ	Numerous ampulliform 14-20 x 7-10 μ Fem.Irregular ampulliform. 14-19 x 6-9 μ.	Straight, with apical 2 dentate 400 x 9-10 μ.	Scattered verrucose, 150 μ diam.	Ellipsoidoblong obtuse 4 septate constricted 35-45 x 17-18 μ.
la ardiana	Piper aduncum.	Epiphyllous densely velvety 2 mm diam.	Undulate crooked opposite closely reticulate cells 10-18 x 7-10 μ.	Antrose, alternate, 14-20 μ ste. 3-7 μ hc. subglobose, puriform 11-14 x 8-13 μ.	Fem.Irregular ampulliform 14-19 x 6-9 μ.	Elongate branched at apex, Coustrict. 220 x 8-10 μ.	Separate 170 μ diam.	Ellipsoid - 4-Sept. constricted 34-40 x 14-16 μ.
la rta.	Piper hispidus	Amphiphyllous thin 6 mm in diam.	Substrate opposite acute angle loosely interwoven cells 17-30 x 6-7 μ.	Alternate spreading or antrose, curved 17-29 m. Ste. 5-9 μ hc. ovate to ellipsoid 13-19 x 7-10 μ.	Mixed-opposite Ampulliform 15-22 x 6-8 μ.	Scattered straight below curved at above toothed 220 x 8-10 μ.	Scattered verrucose 170 μ.	Narrow ellipsoid 4 - Septate 34-37 x 11-12 μ.
.a .s	Piper aduncum	Caulicolous dense, velvety 5-10 mm. diam.	Substraight opposite, closely reticulate to solid cells 12-25 x 6-7 μ.	Alternate, to 50% opposite bent. 11-14-long ste. 3-5 μ hc. globose 770 x 6-9 μ.	Absent	Apically dichotomous, 200 x 6-8 μ.	Scattered setose 150 μ	Oblong ellipsoid 4 - septate. 29-35 x 10-12 μ.
.a hea	Piper tungummua	Epiphyllous minute dense 1-2 mm in diam.	Straight Undulate wide angle forming soilmass cells 10-15 x 7-9 μ.	Irregular and rose 12-16 μ. Ste. cuneate - 2-5 μ hc. subglobose 8-12 x 7-11 μ.	Mixed-irregular ampulliform 13-18 x 8-9 μ.	Fairly numerous straight acute 300 x 9-10 μ.	Scattered verrucose 180 μ diam.	Oblong-obtuse 4 Septate - constricted 36-40 x 15-16 μ.

ola les	Host Plant	Colony	Hyphae	Capitate hyphopodia	Mucronate hyphopodia	Satae	Perithecia	Ascospores
la spora major	Piper philippe-nsis.	Ephiphyllous subdense velv. 3 mm in diam.	Undulate, wide angled cells 20-25 x 8-10 μ.	Mostly alternate antrose 17-23 μ long Ste.cuneate 3-9 μ hc. lobed 12-20 x 11-15 μ.	Irregular Ampulliformum 17-20 x 7-9 μ.	Simple, straight 1000 x 10-12 μ.	Centrally grouped, 170 μ in diam.	Elliptical 4 septate, constricted 37-43 x 13-15 μ.
a es	Piper blattaram.	Ampiphyllous 10 mm. in diam.	Substraight undulate acutre branching cells 25-35 x 6-7 μ.	Alternate, Antrose 16-22 μ Ste. 4-7 μ hc. globose, angular 11-17 x 10-13 μ.	Opposite or alternate 13-17 x 7-9 μ.	Simple obtuse 700 x 7-10 μ.	Verrucose 170 μ in diam.	Oblong abtuse, 4 septate constricted 35-43 x 14-15 μ.
a sp.	Piper nigrum.	Hyphophyllous confluent 8 mm in diam.	Flexuous, substraight irregular branching cells 30-40 x 6.5-8.5 μ.	Alternate, ellip-soid, 16.5-20 x 10-13 μ Stec. 6.5-10 μ hc. 8-11 x 9-12 μ.	Very rare.	Numerous 245-270 x 10-13.5 μ.	Verrucose globose 180-200μ.	Oblong worm like 4 Septate 150-155 x 35-75 μ.

Mucronate hyphopodia are very rare. Mycelial setae are numerous, elongate, sometime bent, grouped around perithecia and 245- x 10-13.5 μ .. Perithecia are verrucose, globose 180 - 200 μ in diam. Ascospores are oblong to elliptical four septate and 120-155 x 35-75 μ.

On the leaves of Piper nigrum at Amboli (Dist.Ratnagiri) Dr. A.N. Thite material No. H.C.I.O. 33672.

Latin Diagnosis :

Coloniae hypophyllae, confluentes, 8 mm. diam. Hyphae subrectae, cellulae Plerumgue, 30-40 x 6-8.5 μ ramificatione opposita velalternata, hyphopodia capitatae alterna, ellipticae, rectae integra, expansa, 10-13.5 μ diam. cellulae stipitis cylindricae 6.5 - 10 μ cellulae capitatis rotuudae, globosae, integrae 8-11 x 9-12 μ. Setal myceliales dispositai cirea perithecia simplicea, acutae 265 x 10-13.5 μ. Peritheai dispersa globosis, verrnculosa 180-200 μ diamitro. Ascosporae oblongae quadri septatae 120-155 x 30-75 μ.

In follis Piper nigrum ex. Amboli (Dist.Ratnagiri, India) Lectus A.N. Thite HCIO No.33672.

2) Meliola ochrocarpi : Thite Sp. nov.

In October 1980 the authors have collected the leaves of Ochrocarpus longifolius Bth. & H.K. f. covered with black

diffused mass at Amboli, Dist. Ratnagiri (Maharashtra). After detailed study it was found to be a species of Meliola. Hansford (1961) described only four species of Meliola growing on different hosts belonging to the family Guttiferae. The comparative study of this new collection with the known species (Table No.2) shows that the present fungus is collected for the first time on hetherto unreported host.

The fungus differs from all other known species by mucronate hyphopodia which are comparatively smaller, and perithecia both being smaller than those of other species.

Meliola ochrocarpi Thite sp. nov. Fig.2.

The infection generally is in the form diffused mass on both the surfaces of the leaves. Sometimes distinct thin colonies of 11 mm in diam. are seen. Hyphae are substraight to undulate, loosely interwoven, branching alternate with acute angles. Mycelial cell are mostly 20-32 x 4-8 μ. Hyphopodia of both the types are present capitate hyphopodia are alternate straight totally 20-35 x 8-12 μ. Stalk cells are cylindrical 4-6 μ long, head cells are oblong abovate 9-20 x 4-6 μ and mixed with capitate hyphopodia alternate or separate and opposite. Mycelial setae are few, scattered around perithecia, straight, simple, pointed towards the apex 600-650 x 8-12 μ. Perithecia are small verrucose, globose

Table No. 2

Comparison between species of Meliola found on the members of the family Guttiferae.

Meliola species	Host plant	Colony	Hyphae	Mucronate hyphopodia	Capitate hyphopodia	Satae	Perithecia	Ascospores
Meliola garciniae	Garcinia mangostans	Epiphyllous thin 4 mm in diam.	Straight, opposite wide angle cells 20-35 x 8-9 μ.	Alternate ampulliform 22-28 x 8-10 μ.	Spreading, straight stc. 5-8 μ hc. ovate 8-12 μ.	Numerous, straight obtuse 750-850 x 9-11 μ.	Scattered 240 μ diam.	Oblong, elliptical 4 septate, constricted at septa Middle cell larger 40-50 x 15-20 μ.
Meliola mammeae	Mammea americana	Amphiphyllous, dense, velvety, 10 mm in diam.	Straight, opposite wide angle, cells 25-30 x 8-10 μ.	Irregular, with elongated neck 20-25 x 8-10 μ.	Spreading, subantrose stc. cuneate 8 μ hc. ovate, 15-20 x 10-13 μ.	Numerous straight, obtuse 1200 x 8-11 μ.	Globose scattered 230 μ in diam.	Oblong obtuse, constricted in septate 45-53 x 17-20 μ.
Meliola clusiae	Clusia minor	Hypophyllous dense 5 μ in diam.	Substraight, opposite wide angle close reticulate cells 20-30 x 8 μ.	Irregular ampulliform 20-27 x 8-10 μ.	Straight or curved total 20-25 μ Ste. 5-10 μ hc. angular 13-19 x 10-15 μ.	Grouped around perithecia simple 800 x 8-10 μ.	Globose 250 μ in diam.	Elliptical 4 septate, deep constricted 54-62 x 16-20 μ.
Meliola mammeicola	Mammea Africana	Epiphyllous dense velvety 8 mm in diam.	Straight, undulate opposite acutae angle densely reticulate.	Few mixed ampulliform neck long 20-28 μ.	Alternate 19-24 μ stc. 4-5 μ hc. ovate, cylin.	Straight, simple 900 x 10-11 μ	Circular 170 μ in diam.	Cylindrical 4 septate

about 120-180 μ in diameter with the stroma composed of smaller thick walled cells. Ascospores are few elliptical, oblong, obtuse, four septate 40-45 x 10-15 μ with rounded end cells.

On the leaves of Ochrocarpus longifolius (Guttiferae) at Amboli Oct. 1980 leg. A.N. Thite material No.HCIO 33671.

Latin Diagnosis :

Meliola ochrocarpi - Thite sp. nov.

Infectio amphiphyllae tenues, 11 mm. in diamitro. Hyphae sub-reetae, undulatae, acutae, cellulae plerumque 20-32 x 6-8 μ. Hyphopodias capitata, laterua, rectae, opposita, expansa 20-35 x 8-15 μ. Cellulae stipitis cylindrical 4-6 μ. Cellulae capitis oblongae, vel ovotae, intergrae 9-12 x 10-15 μ. Hyphopodis mucronata mixta capitatis hyphopodiis, alternata vel opposita. 8-10 x 4-5 μ Setae myceliales dispositae circa perithecia, Simplices, obtusal, 600-650 x 8-12 μ. Perithecia dispersa, globosa, verruculosa 120-180 μ. in diamitro. Ascosporae oblongae vel obtusae 4 - septatae; 40-45 x 12-16 μ.

In follis Ochrocarpus longifolius ex Amboli, (Dist. Ratnagiri) Leg. A.N. Thite.

b) New Records to India :

3) Meliola asclepiadacearum :

The authors have also collected a species of Meliola on the leaves of Asclepias sp. at Radhanagari (Dist. Kolhapur). Hansford (1961) has described Meliola asclepiadacearum growing on the leaves of Asclepias sp. from Brazil and on Cunauchum abysinicum Var. tomentosum from Uganda. The comparative study revealed that the present collection is similar to Meliola asclepiadacearum in all morphological characters.

The present fungus differs from other members of Meliola parasitizing plants from the family Asclepidaceae by broader colonies, longer capitate hyphopodia and the size of the fruictifications.

Meliola asclepiadacearum Hansf. Fig.4.

Colonies amphiphyllous circular, thin and upto 8 mm. in diam. Hyphae substraight, loosely interwoven, reticulate with opposite branching. Mycelial cells mostly 15-35 x 6-8 μ. Capitate hyphopodia are alternate, or opposite globose 10-25 μ long; Stalk cells cylindrical 4-12 μ long, head cells ovate, entire 10-15 μ wide. Mucronate hyphopodia mixed with capitate hyphopodia and they are opposite, 15-25 x 5-10 μ. Mycelial setae, numerous, scattered around perithecia, simple

elongate, 100-250 x 6-8 μ Perithecia scattered, verrucose and 80-100 μ in diam. Ascospores oblong to obtuse, four septate, 35-40 x 10-12 μ.

Collected on the living leaves of Asclepias sp. at Radhanagari (Kolhapur) No.1980 by A.N.Thite, HCIO No.33670.

4) Meliola simillinae Hansf. Fig.3.

Meliola simillinae was first reported by Hansford (1961) on Hemidesmus indicus from Ceylon. In 1980 the authors have collected the same from Panhala (Kolhapur).

Colonies are amphiphyllous, dense, upto 6-8 mm. in diam. Hyphae substraight, flexuous, mycelial cells mostly 20-35 x 5-8 μ with wide angle branching, capitate hyphopodia, with perispore, spreading straight or curved 13-25 x 12-16 μ. Stalk cells cylindrical, entire, 11-13 x 8-12 μ. Mucronate hyphopodia mixed with capitate hyphopodia, alternate, obtuse, 16-20 x 6-10 μ. Mycelial setae grouped around perithecia, straight 100-325 x 4-12 μ. Perithecia scattered, verrucose, globose 180-200 μ in diam. Ascospores oblong, four septate, dark brown, 30-35 x 10-12 μ.

Perasitizing the living leaves of Hemidesmus indicus Br. (Asclepidaceae) at Panhala (Kolhapur) October 1980. Leg. A.N. Thite, HCIC No.33673.

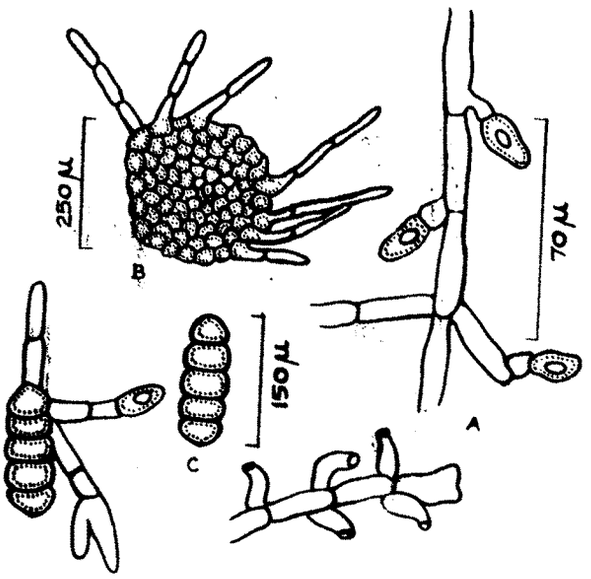

Fig.1

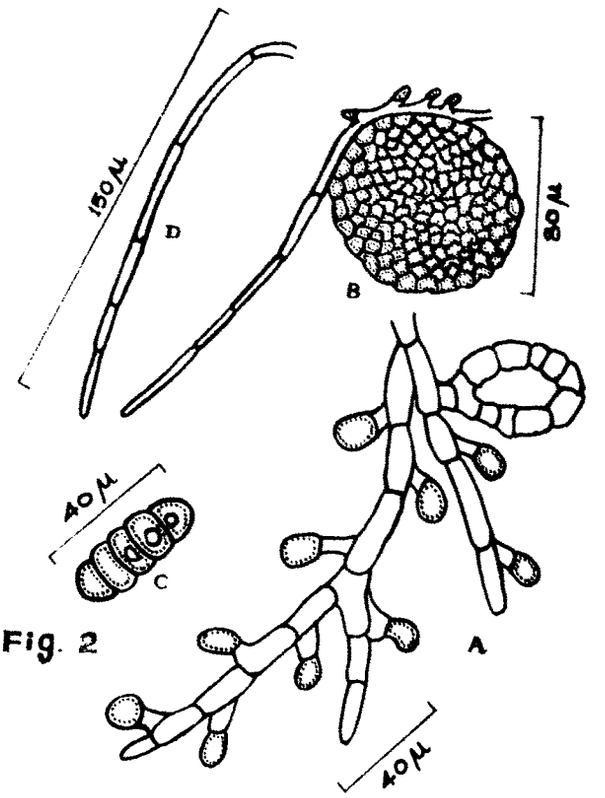

Fig. 2

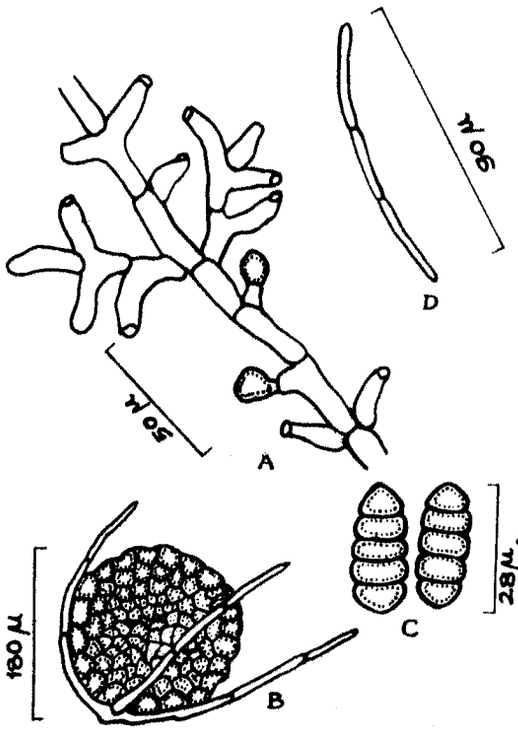

Fig. 3

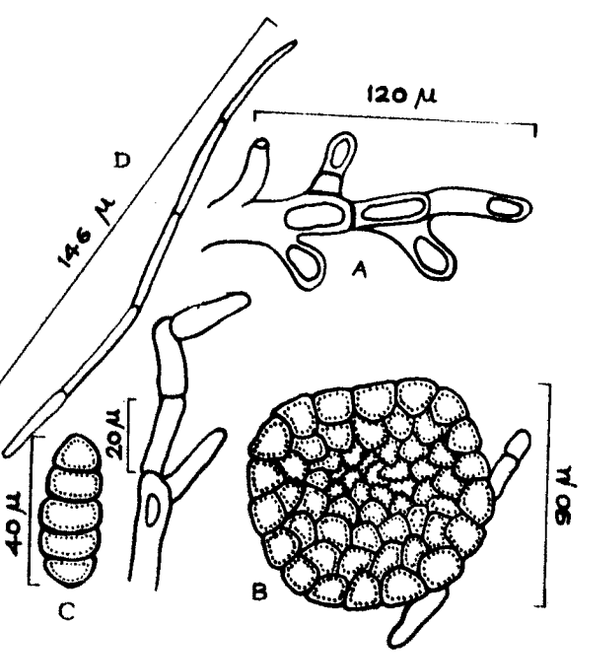

Fig. 4