PART I - GENERAL

CHAPTER I - GENERAL INTRODUCTION

CHAPTER II - MATERIALS AND METHODS

General Introduction

Maharashtra state is one of the unique state in India with a coastal area on the western side. It forms the part of South Western zone of the country and occupies an area of 306345 sq.kilometers.

The state is divided into three regions viz.:

1) Western Maharashtra
2) Marathwada and
3) Vidarbha

Western Maharashtra stretches North-South parallel to the western coast,forming a strip of 100-250 miles east-west and 400 miles north-south. It is further divided into three parts viz.coastal Konkan,Ghats and Desh. Because of the western ghats or Sahyadri ranges which forms the backbone of this region. It forms the main water shade. Western ghats divide the Western Maharashtra into two parts. A narrow coastal strip 30-40 miles broad forming Konkan, enfringed by Arabian sea on the west. The Desh or Deccan plateau is its second half on the east.

Geography,climate, vegetation etc. of the state have been described in detail by Arunachalam (1967) and Deshpande (1971). The present study is confined to South-Western part of Maharashtra. The area under study includes Pune,Satara,Sangli, Kolhapur and Ratnagiri districts. Among these five districts Kolhapur district is extremely southward of the Maharashtra and situated between 15^0 and 17^0 N latitude and 73^0 and 74^0longitude. The total area of the district is 8257 square kilometers.

Topography and soil :

The deccan trap influnces the land scape over a major portion of the area. The rocks of Dharwar and lower Kaladgi series introduce a change in the topography in the southern extremities. It is the part of the Deccan table land with an average hight of 500 m, above sea-level. Height varies from 600 m to 1000 meter. Sahyadri scrap forms the most prominent features along its Western boundary. West portion of the plateau is marked by several hill ranges which emerged from the main range and develop an eastward or north-eastward with ridges and valleys. The ranges have a typical "Lava" topography consisting of flat tops and several terraces or steps. The soil varies from tract to tract due to these topographical features. A variety of soils from rich to poor thin "Murmad" is met with.

The soils are mainly derived from the trap,except in the forest covered mountainous area in west where they are of "lateritic" origin. The laterite covers the trap rock therefore, the western portion of hilltops and ridges are covered by lateritic soils, while in the valleys the soils are of mixed character varying in colour from brownish to reddish. In the eastern portion, due to its undulating nature deeper soils are formed in the low lying parts, while the ridges are covered by shallow soils, more or less partially eroded.

Physiographically the area can be devided into following three broad zones :-

1) The Western part :

It receives heavy rainfall and forms the Konkan area averaging about 113 cm. The area is mountainous and is covered with lateritic soil. The pH varies from 4.5 to 6.5. The soils of the hilltops are red to brownish-red, mostly eroded and shallow with good drainage and are with low percentage of phosphrous, nitrogen and lime but soils of hilltops and ridge under forests are fertile and rich in humus. However, the soils in the vallies are better in Nitrogen and organic matter but are very poor in phosphrous and potash with good moisture retentive ability.

2) The central part :

It receives moderate rainfall and the soils are brownish, well drained and only of neutral reaction, the pH varying from 6.5 to 7.5. They are rich and fertile with excellent granular structure and well supplied with Calcium, fairly rich in Phosphrous and Potash but are poor in nitrogen.

3) The Eastern part :

It receives precarious rainfall and is covered with medium black,well drained soil of varrying depth with their pH varying from 7.5 to 8.5. Lime nodules occur in plenty. They are quite fertile and fairly rich in Phosphrous and Potash but

are poor in nitrogen. The whole area is drained by various rivers from north to south.

Rainfall : Mid-June to mid-September is the major period of the rainfall. The South-West monsoon brings almost entire rainfall which is as high as 6350mm at Gaganbawada near Sahyadri in the west and minimum about 480 mm at far east of the area. The isotopes (Line of equal rainfall) practically run from north to south. The monsoon months, June to September account for 90% to 95% of the annual rainfall in the extreme west. July is the wet month and getting about 40% of the annual rainfall.

Temprature : High tempretures are recorded on the Desh side during summer months of April and May. The highest record being 109°-119° F. Konkan has much less temprature. It goes down as low as 58°F during the month of December and January.

Relative humidity : The mean relative humidity of the region is nearly 57%. The relative humidity is maximum in July and August, minimum is about 20%.

In the following table the temperature and relative humidity is given during the four seasons of the year.

Months	Seasons	Mean max. temp.	Mean min. temp.	Relative humidity.
May	Summer	37.22°c	21.11°c	20-30 %
July	Monsoon	25.55°c	22.2° c	90-100 %
November	Autumn	26.6° c	12.2° c	60-80 %
January	Winter	21.66°c	16.1° c	20-40 %

Wind : The prevailing wind direction is from Western side during March to May though in the afternoon easterally winds occur on 50% of the days. The nights are generally cool due to influence of the sea breezes. Hot winds are common in April and May. In the month of October winds are mainly from north-east to east. Dry wind blast during November to February.

Climate and Climatic seasons : The climate of the area is temperate especially adjoining the ghats. The year may be divided into three climatic periods as follows-

i) A hot weather period from March to May.

ii) A rainy weather period from June to October and,

iii) Cold weather period from November to February.

The types of vegetation in South Western part of the Maharashtra State are as follows :

i) Tropical deciduous type;

ii) Dry deciduous type;

iii) Thorn and scrub type.

1) Tropical deciduous Forest :

This type of vegetation occurs in Western hilly tracts at an altitude of about 650 meter. The rainfall is fairly high. It mainly consists of deciduous species, except in Bhudargad and Amboli where the vegetation is mainly composed of evergreen species.

2) Dry deciduous type :

This type of vegetation occurs in the middle portion. The annual rainfall is moderate,higher than the Eastern but lower than the Western region.

3) Thorn and scrub type :

This type of vegetation occurs in the gently undulating eastern region. The rainfall in this area is scanty. The main thorn scrub species represented in the area are Canthium dicoccum (Caertn.) Merr Flacourtia indica (Burn.f.) Merr.Zizyphus sp. and Acacia pennata Wild,etc.

Thus the south western part of the Maharashtra state provides good opportunity for the growth of many fungi through out the year. It is found that fungi are also abundant in this region (Kamat et al 1977). It seems that the localities like Amba,Amboli,Gaganbawada,Panhala,Radhanagari,Mahabaleshwar, Matheran,Khandala and others in Maharashtra are chief reservoirs of fungi.

Classification of Hyphomycetes.

The classification of the Fungi-Imperfecti and keys to their identification are based principally on the system presented by Saccardo (1886) in his sylloge fungorum or later modificatins of this system by Lindau (1900), Saccardo (1906) and others.

In the current interpretation of this system (Ainsworth, 1963.), the fungi-Imperfecti are divided into four orders according to the type of fruictification produced. If the conidia and conidiophores are produced within a pycnidium then they are included in the sphaeropsidades and if on an acervulus then in the melanconiales. Those forms in which the conidiophores are neither in a pycnidium nor on an acervulus are classified in the monilia es (= mucedineaae of Saccardo) or if no spore from is produced, them in the mycelia sterilia. Saccardo equated his mucedineae with the Hyphomycetes, other authors (Ainsworth, 1963) regard the Hyphomycetes as including both moniliaes and Mycelia sterilia.

Saccardo divided the Hyphomycetes into four families viz. Mucedinaceae (= Moniliaceae), Dematiaceae, Tuberculariaceae and Stilbaceae (= Stilbellaceae.). In the Tuberculariaceae, the conidiophores are generally short and borne in more or less tightly packed, parallel series arising from a cushion-shaped, stromatic mass referred to as a sporodochium. In the stilbaceae, the conidiophores are generally long and more or less fused along

their length to form erect fructifications referred to as synnemata. In the moniliaceae and Dematiaceae the conidiophores are solitary, sometimes in groups or fascicoes, but are never in synnematal or sporodochial arrangements. The Moniliaceae, characterized by hyaline or lightly pigmented conidia and conidiophores and in the dematiaceae the conidia or conidiophores are more or less darkly pigmented.

The various families were divided further by Saccardo into sections based primarly on conidium morphology, with emphasis on the shape and septation of spores as follows : Amerosporae: Conidia nonseptate; Didymosporae: Conidia one septate; Dictyosporae: Conidia longitudinally and transverssely septate; scoleco sporae: Conidia filiform; staurosporae :Conidia stellate, radiate or trifurcate and Helicosporae : Conidia convolutely spiral.

Saccardo (1906) modified the section names with hyalo or phaeo prefixes depending on whether the conidia were hyaline or pigmented e.g.Hyalophragmae and phaeophragmae.

Over the years, there has been increasing dissatisfaction with the classification of Saccardo, particularly as it applied to Hyphomycetes. There have been many critics, notably Vuillemin (1910,1911) and Mason (1933,1937) in the earlier literature and Hughes (1953), Goos (1956),Tubaki (1958,1963), Subramanian (1962) and Luttrell (1963,1964) in their recent literature:

Criteria used for classification :

Great stress is placed in the Saccardo's system on the pigmentation of conidia and conidiophores. Degree of pigmentation is the basis of classsification. Moniliaceae and Dematiaceae are based on pigmentation with the continuing discoveries of new species of Hyphomycetes there is an increasing number of instances in which we find a group of species which are in all respects congeneric, except that some are hyaline and others strongly strong pigmented. If the species group is large,we usually find all gradation from hyaline to darkly pigmented within the complex.

As pointed by Hughes (1953), Goos (1956) and others, most workers on Hyphomycetes are loosing confidence in the major divisions based on pigmentation of the conidia and conidiophores. Hughes also cautious us, however with regard to colour,it is worth while remembering that large number of Hyphomycetes name, brightly coloured fruictifications and mycelium, characters which we have learned to associate with the Hypocreaes and some Basidiomycetes.

With further knowledge of the perfect states of Hyphomycetes, color may prove to be a useful character.

Septation of Spores :

Considerable stress is placed in the Saccardo's system on spore septation. As was pointed out by Hughes, the abscence

of septation of variation in septation has been given too much emphasis. However, septation is variable in some species. The conidia are mostly continuous, with occasional septaye spores. In other species spores may be mostly two-celled with occasional nonseptate spores. Between these two extremes all intermediate conditions may occur. Moreover septation is strongly influenced by age and substrate.

Sporodochium and Acervulus :

The presence of sporodochium in the family Tuvercula-riaceae of Hyphomycetes (Ainsworth, 1963) defines a sporodochium as a mass of conidiophores tightly placed together on a stroma or mass of hyphae. The presence of an acervulus is regarded as the key diagnostic feature of the melanconiales. Acervulus is defined in the dictionary of Ainoworth and Bisby as an erumpent cushion-like mass of hyphae having conidiophores and conidia and sometimes setae.

Unfortunately many fungi which produce acervuli on their natural substrate do not do so in culture.

Wet spores and dry spores :

Mason (1937) emphasized the distinction between dry and slimy spores and introduced the concept of the biological spore type. This approach was accepted by Wakefield and Bisby (1941), when they listed the British Hyphomycetes under

xerosporoe (dryspores) and Gliosporae (Slimy Spores). The use of this biological spore type, as a major criterion for separation of the Hyphomycetes into two major groups has not been generally accepted because it is too difficult to apply.

Classification of Hughes :

In an outstanding contribution to the mycological litrature, Hughes (1953) presented an experimental classification of the Hyphomycetes based on the different types of conidium development. The mononematous, synnematous or Tuberculariaceous nature of the conidiophores, the form of the mature conidia. Their dematiaceous or mucedinaceous nature, their septation and the presence or abscence of slime around them were treated as subsidiary characters.

Hughes divided the Hyphomycetes into eight sections and two subsections as follows. :

Section I A

Mycelium generally narrow, conidia usually developing in acropetal succession as blown ends at the apex of simple or branched conidiophores. The basal conidia of chains aggregated around the apical region of conidiophore. Hughes referred to the conidia in this section as 'blastospores' (arising as globular buds or blown out ends) with their development in acropetal chains inferred in this term,, Section I A is

considered later under the Blastosporae.

Section I B :

Mycelium generally wide, conidia developing in acropetal succession as blown out ends on simple or branched conidiophores sometimes the lateral branches are modified entirely into a number of conidia or into solitary conidia, are borne on conspicuous denticles.

Hughes referred these spores as 'Solitary blastospores' where they are in clusters, he referred to them as 'botryose' solitary blastospores.

Section II :

Conidia arising as blown out ends of the apex of simple or branched conidiophores and the ends of successively produced new growing points.

Section III :

Conidia usually thick walled, arising solitary as blown out ends of the apex of simple or branched conidiophores, a plurality of conidia may be produced.

Hughes referred to the conidia here as "Chlamydospores" which are usually produced at the apex of a hypha. He pointed out that they were usually solitary, large, thick-walled and dark-colored but might be small, hyaline and not particularly thick-walled when conidia are terminal, annellations may be produced on the conidiophore and successive conidia may remain loosely attached in chains.

Section IV :

Conidia (phialospores) developing in rapidly maturing basipetal series from the apex of a conidiophore (phialide) which may or may not posses an evident collarette.

Hughes referred to thé conidia here as " phialospores". The term" polyphialide" was introduced by Hughes to include phialides which produced a series of open ends from each of which a basipetal succession of phialospores is produced.

Section V :

Conidia developing in gradually maturing basipetal series and originating by the meristematic growth of the apical region of the conidiophore in such a way that the chain of conidia merges imperceptibly with the conidiophore that gives rise to the chain.

Hughes referred to the conidia here as " meristem arthrospores" and they occur in true chains. Their basipetal development due to the meristematic growth of the conidiophore seemed to him to necesitate a special term for them, although they be related to arthrospores.

Section VI :

Conidia usually thick-walled, developing from pores on conidiophores of determinate or indeterminate conidiphores of determinate indeterminate length. They are solitary or in

whorls and may occur in acropetal chains. The conidiophore may proliferate through the terminal pore to produce a further terminal conidium or the conidiophore may develop a succession of terminal conidia or successive poliferations developing just below the previous conidium.

Hughes referred these conidia as " porospores".

Section VII :

Conidia developing by the basipetal fragmentation conidiophores of determinate length which donot posses a meristematic zone.

He referred to the conidia as " arthrospores" and these may be slimy or dry.

Section VIII :

Conidia borne singly at apex, or singly at the apex and laterally, often in regular whorls on conidiophores showing basal elongation. Conidia often with a longitudianal slit in the wall. The conidia here are dry and produced as blown out ends and are borne either singly at the apex or lateral, generally in basipetal whorls. Hughes considered the basal elongation of the conidiophores which may be called basauxic conidiophores. The conidia are dry.

The classification of Hughes was accepted and extended by Tubaki(1958), who added a ninth section to include Trichothecium

and divided sections III,IV,VII into subsections. Later Tubaki (1963) presented a more generalised scheme in which he divided Hyphomycetes into six major groups named after type of spore produced as follows :

Blastosporae : Hyphomycetes producing blastospores.
Type genus : Cladosporium Link
Radulasporae : Hyphomycetes producing radulaspores.
Type genus : Beauveria Vuillemin,
Aleuriosporae: Hyphomycetes producing aleuriospores.
Type genus : Scopulariopsis Bainier,
Phialosporae : Hyphomycetes producing phialospores.
Type genus : Catenularia Grove,
Porosporae : Hyphomycetes producing porospores.
Type genus : Helminthasporium Link,
Arthrosporae : Hyphomycetes producing arthrospores.
Type genus : Geotrichum Link,

Tubaki classified 130 selected genera of Hyphomycetes with his revised system. He omitted well known genera because of unceratainities regarding their conidial structures. Naming the sections on spore type has obvious advantages over the numerical system adopted by Hughes and Tubaki in their experimental classifications.

The genus Papularia (= Arthroinium.) is considered by Hughes in section VII. Tubaki placed this genus in his series

Radulasporae. The relationship between Tubuki's revised Classification and that of Hughes is indicated in table 1.

An alturanative system of classification of the Hyphomycetes who, which merits attention was given by Subramanian (1962), who recognized six morphological types of spores and, based on these, he divided the group into six families as follows.

Torulaceae : Hyphomycetes producing blastospores.

Type genus : Torula pers ex.Fries

Bactridiaceae : Hyphomycetes producing gangliospores.

Type genus : Bactridium Kunze ex. Fries

Tuberculariaceae : Hyphomycetes producing porospores.

Type genus : Helminthosporium Link ex.Fries,

Geotrichaceae : Hyphomycetes producing arthrospores.

Type genus : Geotrichum Link ex. Saccardo

Coniosporiaceae : Hyphomycetes producing meristem arthrospores.

Type genus : Coniosporium Link ex.Fries,

Subramanian recognized a seventh spora type " the spiculospore" to include the spore produced at the tip on a pointed structure, as in Hirsutella or Akanthomyces. He suggested that the further work was necessary before this spore type category could be accepted for any formal taxonomic grouping.

Subramanian also considered an eighth spore type " the chlamydospore", but regarded this as having no taxonomic determination of genera. He introduced the term " gangliospore" to

replace the much abused 'Aleuriospore! The gangliospore is not precisely equivalant to the aleurisporae as used by Tubaki, as it does not include conidia produced on annellophores, which Subramanian considered under 'blastospores' in his family Torulaceae (section VIII).

Within each of the spore types recognized by Subramanian, on the basis of initiation and development he noted several well defined differences as follows.

1) Production of single solitary spore, terminating the growth of the conidiophore.

2) Production of successive solitary spores by

a) Meristematic activity of a sporogenous cells.

b) Proliferation of the conidiophore through the Scar of a fallen spore.

c) Sympodial growth of the conidiophore and the formation of spores repeatedly from new growing point.

3) Production of successive spores in chains by

a) acropetal budding

b) Meristematic activity if the conidiophore tip or sporogenous cell such as a phialide (basipetal chains)

c) 'Sympodial growth' of the conidiophore and formation of spores repeatedly from new growing points,basipetal chains different in ontogony from those of 3b.

On the basis of these secondary criteria, subramanian divided the Hyphomycetes into 24 sections dispersed among his six families. Thirteen of these sections were in the Torulaceae, four in the Bactridiaceae, two in the Tuberculariaceae, two in the Helminthosporiace. Two in Geotrichaceae and one in the Coniosporiaceae. It is unfortunate that Subramanian selected Tourla as the type genus for those forms producing blastospores. Hughes included Torula in his section VI(= porosporae). The genus is sometime anomalous. Each spore is produced through a minute pore in the darkened terminal cell of a hypha or previously formed conidium.

Barron prefers to place the genus Torula in porosporae. Although the cells are produced in acropetal succession blastogenously, the entire spore originates through a pore. Subramanians Torulaceae includes sections I A, IB, II, III (in part) and VIII of Hughes. The relationships of Subramanian's classification and that of Tubaki and Hughes is given in Table I.

Barron recognized ten sections in all excluding mycelia sterilia. The classification is essentially that of Hughes.

ECONOMIC IMPORTANCE OF HYPHOMYCETES

Hyphomycetes are widely distributed and have the ability to increase their tribe by a prolific reproductive capacity which is one of their striking geatures. Their contribution to decomposition process in nature and recycling of nutrient is also obvious. Their involvement in agriculture,forestry and medicine as causal agents of serious diseases of plants,animals and man is wellknown. Their use in many fermentation processes is so important that without them there would be no such fermentation industries. Many new and interesting organic compounds are derived from these moulds which are therefore much sought after by organic chemists. They are having a remarkable ability to produce a variety of enzymes and of metabolites such as antibiotics, and from their tremendous ability for biochemical syntheses and conversions such as of the steroids which are of great importance in medicine.

In fact,study of hyphomycetes gains a special relevance for these reasons.

A group with 7500 species in about little over 900 genera. Their wide distribution and common occurence on all kinds of substrates in all kinds of habitats.

Relationship to perfect states.

The fungi imperfecti as a group was established as a temporary measure to accomodate fungi without a sexual stage, and reproducing entirely asexually. The very large number of hyphomycetes belong to this temporary group. There has been a general belief that most hyphomycetes would eventually be connected with their perfect states which may belong largely to the Ascomycetes or the Basidiomycetes on the one hand and their conidial states to the other.

Tubaki has provided a stimulating discussion of the problem of relationship of hyphomycetes to ascomycetes and basidiomycetes. He classified the form genera into nine sections (mostly after Hughes, 1953) and their perfect states, where known, were disposed in orders or families of the Ascomycetes or basidiomycetes. The majority of the perfect states known belong to the ascomycetes and for their arrangement perfect states are known for many form genera which produce phialospores. Majority of these perfect states belong to Hypocreales. Those which produce blastospores also show perfect states in some cases.

In the nature when the imperfect form is growing may or may not produce its perfect state. If imperfect form growing or associated along with ascomycetous or basidiomycetous fungi,

may be suspected for its perfect state only because of its association on a common substratum, but it is not definite to suggest its perfect state relationship to either of the group of the organisms. The relationship, imperfect to perfect; can be confirmed by the pure culture studies or by monospore cultures. There are large number of the imperfect fungi, which are known to produce perfect states belonging to different classes of Ascomycetes, at the same time a single imperfect state may produce more than two perfect states, or vice versa, therefore, it is the imperfect state which is dominant in nature for propagation by conidia rather than by its perfect state spores, or in the course of evolution formation of perfect states may be eliminated or a substratum upon which imperfect state may produce but does not support the growth for perfect state formation.

No doubt the perfect or imperfect state formation is a genetically fixed mechanism and therefore, the genes responsible to form either perfect or imperfect states, depending upon the number of identical and external mechanism (Environmental, Nutritional etc.).

In the present investigation some imperfect forms were observed associated with their perfect states. For example

Xenosporium, Helicoma with Acanthostigmella and Tubeufia on their common substratum. Subramaniam C.V. and Von Arx related many imperfect states by their cultural studies to the perfect states.

History of Mycology:

History of Mycology in Maharashtra dates back to 1853, when Dymock reported Agarisus Ostreatus from this part of country (Mahabale and Patil 1959) Later many workers like Theissen and Blatter described number of fungi occuring in this area. The original work started by European workers was welltaken over by Indian workers like Kirtikar,Ajrekar (1931), Patel (1949), Kulkarni,Kamat et al.(1949),. Many of these workers being pathologist took keen interest in fungal pathogens. The first list of fungi of Maharashtra (Bombay)State was published by Uppal,Patel and Kamat (1935) and was supplemented by Patel, Kamat and Bhide (1949). The latest list of fungi of Maharashtra has been published by Kamat,Patwardhan, Rao and Sathe (1971), in which 1281 fungi have been listed excluding the Myxomycetes. This supplement has been revised by Desai and Patwardhan (1974). Eastablishment of Poona Agriculture college in 1907, University of Poona in 1948 with late Prof. Mandkur, and eminent mycologist of the country as the first Professor of Botany,Development of Hindustan Antibiotics at Pimpri near Poona,with Dr. Thirumalachar, a reputed mycologist as in charge of research section, establishment of Maharashtra Association for cultivation of sciences by late Prof Agharkar at Poona, became the prime centres of mycological studies in the state. New universities like Marathwada and Shivaji as well as Mahatma Phule Krishi Vidyapeeth at Rahuri where in active work in Mycology has been centred.

The work in mycology in the state is progressive due to keen and deep interest of the investigators such as Thirumalachar, Kamat,Kulkarni,Chiddarwar,Tilak,Patwardhan,Sathe, Rao, Pande, Ananthnarayan, Sheshadri, Srinivasan, Tendulkar, Anhosur, Kalani, Muthappa, Ponnappa, Thite, Chavan, Jagatap etc. These workers and many others have reported largenumber of fungi from the different parts pf the state,other workers who diversed their studies to the specific groups of the fungi,viz. Mehta (1966), Mujumdar (1968), Deoray (1975) have studied mostly the soil fungi of the Western Maharashtra. Tilak and Rao (1966,1968) concentrated their study on the lighicolous Ascomycetes mostly from Marathwada region, Bhagwat (1968) studied cellulolytic fungi and Kelkar (1975) studied Coprophilous fungi. Thite and Kulkarni (1972,1974) mostly studied the sooty molds and Patil et al studied the leaf-litter and other forms of fungi.

Extensive work has been done on taxonomy of fungi yet there is ample scope for the work on taxonomy of fungi. This feeling was well justified during the repeated mycological collection.

Present work is concerned with the systematic investigations of the Hyphomycetous fungi occuring in Western Maharashtra. Most of the Hyphomycetous fungi collected are saprophytic though a few parasitic fungi have been collected. Saprophytic fungi grow on variety of substrates most of them are

terrestrial and lignicolous.

All this climatic variability and the vegetation that is supported by the hills and the plateaus have served a good ground for the establishment of a variety of fungal forms. Various fungi belonging to hyphomycetes were collected during frequent visits to areas from Mahabaleshwar, Amboli, Ambaghat, Lonavala, Radhanagari, Panhala and other localities.

CHPATER-II

MATERIALS AND METHODS

All the specimens on which this thesis is based were collected at various localities mentioned in the text, paying frequent visits to different places. Most of them were found on dead, fallen decomposing leaves and wood in the litter of forests and also in the neighbourhood of the cultivated areas having trees and shrubs. These fungi grow on any plant material and show very little preference for particular substratum.

Generally they were collected in paper bags and brought to the Laboratory for further studies. They were found very often on torn, broken off pieces of leaves. The identification of their host substrata had to be made by studying the size, shape and venation of leaf and then collecting similar entire fallen leaves in the vicinity. Both the host and the fungus were examined together and their identification conformed. The hosts were identified tentatively so far as was possible on the spot and noted on the envelope containing the fungus.

In most cases one or two twigs with living leaves, flowers and fruits were also collected when available and put in the envelope for tallying them with herbarium specimens to confirm the identity of the host. The latest nomenclature of host substrate has been adopted as far as author is aware.

The slides were stained with cotton blue and mounted in lactophenol. The hard materials were treated with KOH for softening.

The slides were made semi-permanent by sealing them with wax.

All the drawings have been drawn with the help of prism type 'Erma' camera lucida. Using 10 X, 45 X, objectives and 5 X, 10 X, 15 X eye piece choice of objective and eye piece was according to the size of the fungal structure. Measurements were made by Ernst Leitz Wetzlar occular and 10 X, 45 X, objectives.

Microphotographs of the slides were taken by using olympus pm-6 unit of microphotography by 10 X, and 40 X objectives and 5X, 10 X and 15 X eye pieces; selection of objective and eye piece was dependent upon the size of the fungal structure. All the specimens studied in this work deposited under the code humber WIF.

All the specimens and preparations are deposited in the Mycological Herbarium, Dept. of Botany, Shivaji University, Kolhapur.