

MYCOFLORISTICS OF SOME FOREST LOCALITIES IN KHAMMAM DISTRICT, ANDHRA PRADESH, INDIA

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ABSTRACT

The forests of Bhadrachalam, Kothagudem and Paloncha of Khammam District in Andhra Pradesh, India were surveyed during 2007-2010 for micro- and macro-fungi colonizing litter, fruit, bark, humid soils, wood, dung and water, which revealed 131 species associated with diversified substrates of which 96 were micro-fungi and 35 being macro-fungi. Thirty four fungi were cultured, while the remaining could not be cultured. Sixty five species were found colonizing litter, whereas the rest were associated with other habitats of Bhadrachalam forest. Anamorphic fungi dominated the mycofloristics followed by Basidiomycotina. Mastigomycotina, Zygomycotina and Ascomycotina members.

Keywords: Anamorphs, Diversity, Forest, Fungi, Litter

INTRODUCTION

Fungi are important and integral part of an ecosystem, abundantly colonizing various habitats, viz., litter, soil, seed, etc. (Kirk & al., 2008) out of about 97,861 species of fungi recognised in the world, 29,000 species occur in India (Manoharachary & al., 2005). The beauty and endless variety of fungi never cease to enchant biologists all over the globe. India has always been a strong centre and a cradle for fungi. The fungi reported from India are indexed in volumes entitled Fungi of India (Bilgrami & al., 1979, 1981, 1991; Butler & Bisby, 1960; Jamaluddin & al., 2004; Sarbhoy & al., 1986, 1996; Tilak & Rao, 1968). Recent available literature on biodiversity and taxonomy of fungi indicates the wealth of fungal diversity (Prasher & al., 2008; Pratibha & Bhat 2008; Arun & Manimohan, 2009; Bhat, 2010; Sanjeev & Sharma, 2008; Kshirsagar & al., 2009; Kumar & al., 2010; Mani & Kumaresan, 2009; Manoharachary & Kunwar, 2010a,b,c; Pandey & Roy, 2008; Pandey & al., 2009; Singh & al., 2009; Shrivastava & al., 2009; Sureshkumar & al., 2009; Swapna & al., 2011; Bhosle & al., 2010; Kaviyaran & al., 2009; Sharma & al., 2010; Tiwari & al., 2010; Patil & al., 2011).

Contributions on diversified groups of fungi colonizing various substrates from Andhra Pradesh include that of Nagamani & al., (2006) on Soil Fungi; Rao (1988) and Gopal (1990) on Basidiomycetous fungi; and on aquatic fungi by Rao (1980) and Galaiah (1985). Significant and extensive work is available on Hyphomycetous fungi from Andhra Pradesh (Rao & al., 1982; Manoharachary and Ramarao, 1971, 1972, 1973; Manoharachary & al., 1971; Reddy & al., 1999; Rao and de Hoog 1986; Gopal & al., 1991; Manoharachary and Gopal, 1991; Rao & al., 2004, 2005, Sureshkumar & al., 2006, 2009 and Nagaraju & al., 2009, 2011a,b).

In spite of all such surveys conducted from time to time, there is a huge hidden wealth of fungi available in various Forests of Andhra Pradesh. Further, the mycofloristics of Bhadrachalam, Kothagudem and Paloncha of Khammam District have not yet been fully worked out.

MATERIALS AND METHODS

Study Area

Khammam district in Andhra Pradesh is located between 16°45' and 18°35' North latitudes and 79°47' and 80°47' East latitudes. The district is bounded by Chhattisgarh state to the north, Odisha state to the northeast, East and West Godavari districts to the east, Krishna District to the south, Nalgonda District to the southwest, and Warangal District to the west. It has an area of 16,029 sq. km out of which an area of 7489.82 sq. km (approximate 48%, as against 23.41% for Andhra Pradesh, and 22.80% for India) is under forest cover. The Godhavari River

passes through the eastern part of the district and harbors the richest biodiversity in the state. Other tributaries of Godavari like Taliperu, Kinnerasani and Sabari also help in bringing prosperity to the area. The district has a total population of 25, 78,927. The present investigation is confined to the forests of Bhadrachalam, Kothagudem and Paloncha of Khammam District (Fig.1).

Khammam district is endowed with rich mineral resources. Among the various minerals found here, the most important ones are Coal, Lime stones, Dolomite, Garnet, Corundum, Barites, Copper, Chromites, Haline, Graphite, Mica and Iron ore. Khammam district is appropriately known as “Nature's gift as a geological museum to Andhra Pradesh”. Khammam district has mainly three types of soils, namely sandy soils, black soils and brown soils. Maximum collections were made in black and brown soils which are richer than the sandy soils.

The district receives 1096 mm rainfall annually and is relatively less drought prone. It also has two extreme temperatures in the state, as it touches 10°C during winter and 50°C during summer.

Vegetation

The Forest areas covered in the present study in Khammam district were of natural and mixed teak forests of good quality, but slowly the percentage came down due to various reasons. The standing forest consists of primarily angiospermic plant species (Figs. 2, 3).

Collection

Specimens were collected from different localities of Khammam district for a period of 3 years (August 2007 - July 2010). Collections were made throughout the year, with an interval of 15 days. The collection included dead twigs, bark, stems, decaying wood, pods, fruits, dead leaves, decaying leaf litter and fresh water foam etc. Field data containing place of collection, date and other relevant information was immediately recorded and maintained. If possible, the name of the host or substrate on which fungal material was present was also noted in the field notes. The materials were then carried to laboratory by placing them carefully in fresh polythene bags, for systematic observation and study of fungi.

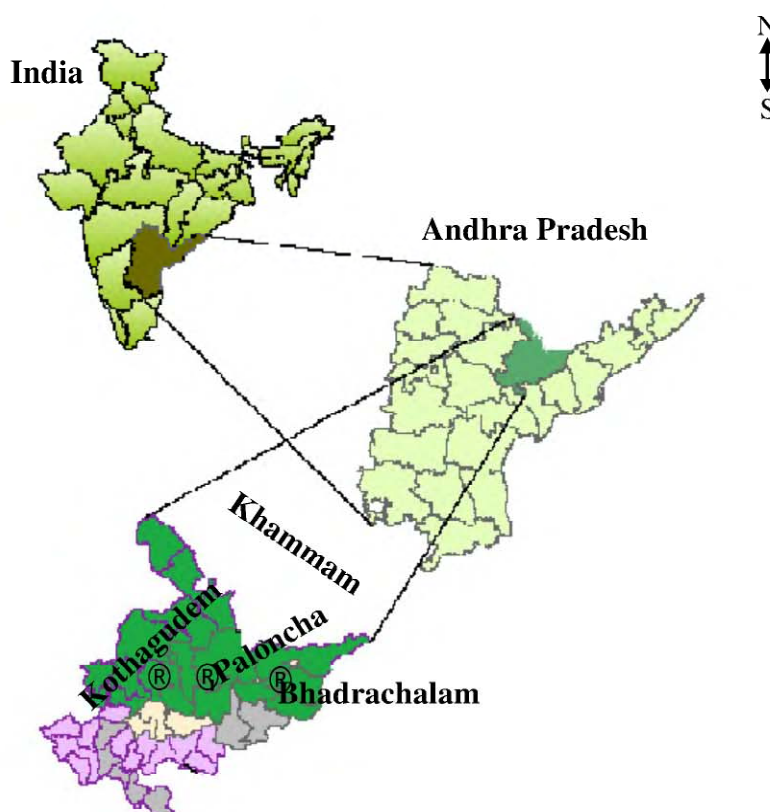


Fig. 1. Area Map of Fungal Samples Collection in Khammam District. A.P. , India.



Figs. 2. 3. Forests in Khammam district

Isolation of Micro-fungi

Micro-fungi colonizing litter, bark, twigs, senescent plant parts, water etc. were isolated by the following methods:

1. Direct observation from plant litter/ other substrates
2. Moist chamber incubation method
3. Isolation by particle plating method
4. Foam plating method

1. Direct observation from plant litter/ other substrates

The sample, say a decaying leaf, litter, nut or bark, was scanned under a stereo-microscope to locate a fungal colony. A small portion of the fungal material was picked by a fine-tipped needle and placed in distilled water or lactophenol mountant and examined under microscope. The detailed study of morpho-taxonomic characteristics of the fungus was done using a light transmitted microscope.

2. Moist chamber incubation

A thin layer of absorbent cotton superimposed by a circular piece of blotting paper was placed in a Petri dish (20 cm diam) and drenched with distilled water. Two slides were placed criss-crossing on the filter paper. The plates were sterilized at 121°C and 15lbs/cm³ pressure in an autoclave for 20 min. The sample was thoroughly washed in sterile distilled water, placed in the sterile moist plates and incubated at room temperature. Beginning on the 3rd day, the incubated samples were scanned daily under a stereomicroscope for growth of the fungi. The fungal colony was picked up and mounted on a slide containing a drop of distilled water or lactophenol for microscopic examination.

3. Isolation by particle-plating

Decaying leaves, twigs or bark was cut into small pieces and ground to fine particles in an electric blender. The particles were filtered through three super imposed metal sieves with mesh size of 1000 µm, 250 µm and 100 µm. Fine particles of size between 100 and 250 µm trapped in the lower sieve were repeatedly washed in sterile distilled water, diluted to suitable concentration and plated on malt extract agar (MEA) medium incorporated with a mixture of antibiotics (Bacitracin 0.02 g, Neomycin 0.02 g, Penicillin G 0.02g, Polymixin 0.02g, Streptomycin 0.02g and Tetramycin 0.04g dissolved in 10 ml of distilled water and added to 1 L of MEA medium). The fungal hyphae arising from the particles were aseptically and individually transferred into fresh MEA slants (Bills & Polishook, 1994). Some fungi sporulated in culture after several days/weeks of incubation. These were examined under the microscope and identified.

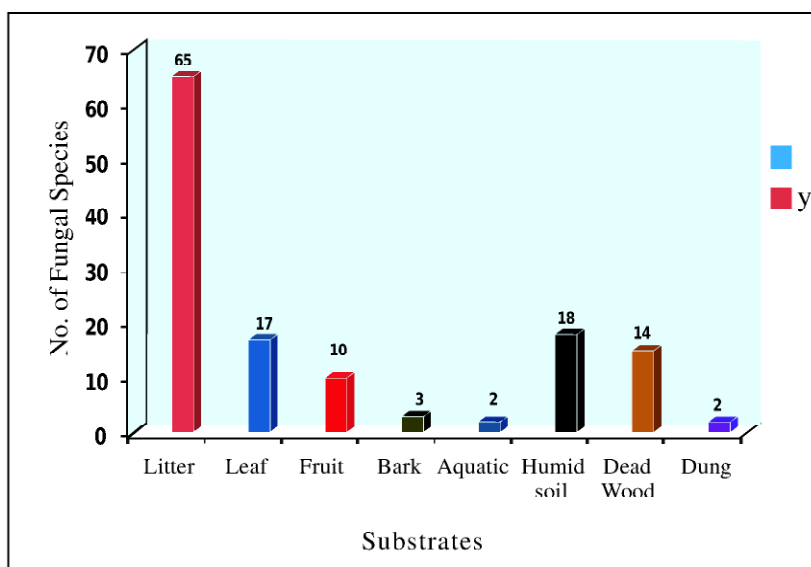


Fig. 4. Number of fungi recorded from various substrates in the Khammam District

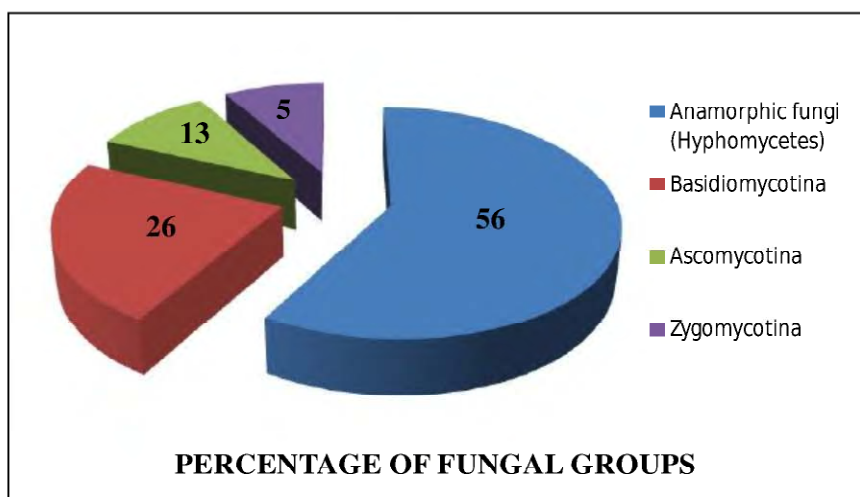


Fig. 5. Fungal groups (%) recorded from the forests of Khammam District

4. Isolation of aquatic fungi by foam plating technique

Naturally occurring surface foam, presumably laden with a heavy load of aquatic fungal spores, from clean running fresh water stream was scooped out into a glass jar and thinly spread over antibiotic-incorporated malt extract agar (MEA) plates. After a few hours of incubation spores germinate. The germinating spores/conidia were singularly and aseptically picked up and transferred in to fresh MEA slants.

When natural foam was not available, a few decaying leaves were gathered from the stream-bed and placed in glass jars, containing 1 leaf each in 500 ml distilled water. A constant flow of air was introduced into the jar using a fish-aerator. The agitation of water column induced fungal sporulation. Foam bubbles accumulated on the surface containing conidia and these were scooped and used for single-spore isolation (Ingold, 1975). A sizeable collection of microfungi were brought in to pure culture using this technique.

Drying and Preservation

The materials brought to the laboratory were taken out of the package and necessary drying was done. The materials were then fumigated with the help of 01% Mercuric chloride, 1% silver nitrate or 4% Formalin vapour (Domsch & al., 1980) to prevent contamination by other microorganisms. The materials were trimmed properly

to have only the parts where suspected colonies of fungi could be found and then colonies were marked with indelible ink after having observed under low power of a binocular dissection microscope.

Stiff and quality paper folders of standard size (15×10.5cm) were used for the preservation of the trimmed material. Before preservation each material was wrapped in clean and soft tissue paper. Labels of CABI standard size (12.6×7.69cm) with relevant details such as name of the collector, date of collection, and accession number etc. were prepared before affixing them to the folder accession number given in abbreviation being OUFH/DNR/No. OUFH, standing for Osmania University Fungal Herbarium and DNR for collector's name in abbreviation. Each of the paper packets or folder was placed in polythene cover to prevent desiccation and a piece of naphthalene ball was placed inside polythene cover to prevent mites/insects etc. All these folders were arranged alphabetically, taxa-wise in suitable containers.

Mountant and Stains

Aman's Lactophanol (Dade and Gunnel 1969) (Phenol crystals - 20g, Lactic acid - 20g, Glycerol - 40g, Water - 20g) was prepared for microscopic study. For the observation of hyaline fungal material 0.05g of cotton blue was added to the preparation. To observe dematiaceous nature of the material mounts were also prepared in distilled water.

Identification and Deposition of Fungal Herbaria

Identification of fungi was done with the help of available manuals such as Ainsworth (1973), Barron (1968), Barnett & Hunter (1972), Carmichael & al. (1980), Domsch & al. (1980); Ellis (1971, 1976), Ellis & Ellis (1998), Nagamani & al. (2006), Matsushima (1975), Reynolds (1981), Subramanian (1971), von Arx (1980) etc. besides taking help from relevant mycological papers from CABI, UK and other taxonomic literature published in different national and international journals. Some novel and interesting taxa which needed deposition, were sent to HCIO, IARI, New Delhi for deposition and received the accession numbers.

Culturing of some Fungi

Some fungi were cultured and maintained on potato sucrose agar medium.

Study of Macro-fungi

The methods followed by Kaviyarasan & al. (2009) have been used in the present study. Fresh materials were collected in polythene bags and were subjected for further study on the day of collection. Field data viz., shape, size, colour and texture were recorded besides taking field photograph.

Observations included morphology and thin sections of gill tissue, vegetative mycelia, pileus, annulus, sporeprint, basidiospores etc. The collected material was dried, packed, descriptions and identifications were made as per procedures of Kaviyarasan & al. (2009). Photographs of macrofungi were taken and photomicrographs were taken with the help of Leica microscope with attached camera for all the taxa proposed as new and for most of the taxa described,

RESULTS AND DISCUSSION

Mycofloristic survey undertaken revealed the association of 131 fungal species of which 96 were micro-fungi and 35 being macro-fungi (Table 1). Amongst various substrate or habitats surveyed (Fig. 4), litter was colonized by 65 fungal species belonging to Anamorphic group (Hyphomycetes). It was followed by humid soil and fallen leaves which were colonized by 18 and 17 fungal species, respectively. Humid soils supported mainly higher fungi while fallen leaves were colonized by Anamorphic fungi. Dead and dried wood and fruits were colonized by 14 and 10 fungal species, respectively. Dead wood supported only macro-fungi while fallen fruits were colonized with micro-fungi. Bark (3), water (2) and Dung (2) were colonized by least number of fungal species. The reason for heavy colonization of litter by fungi may be due to the presence of high amount of cellulose. Earlier workers like Hughes (1953), Subramanian (1971), Ellis (1971, 1976), Bhat and Kendrick (1993), Kirk & al. (2008), Manoharachary & al. (2009), and Kaviyarasan & al. (2009), have also reported similar observations.

Table 1. Micro- and Macro-fungi collected from Kothagudem, Bhadrachalam and Paloncha Forest localities from various substrates/ hosts along with locations and collection numbers.

Micro-Fungi				
S. No.	Fungi	Substrate/Host	Place	Herbarium No.
1	<i>*Absidia fusca</i> Linnem.	Litter	Kothagudem	OUFH No 701
2	<i>*Absidia spinosa</i> Lendn.	Litter	Kothagudem	OUFH No 702
3	<i>Achaetomium globosum</i> J.N. Rai & J.P. Tewari	Litter	Bhadrachalam	OUFH No 703
4	<i>Acremonium apii</i> (M.A. Sm. & Ramsey) W. Gams	Litter	Kothagudem	OUFH No 704
5	<i>Acremonium inflatum</i> (C.H. Dickinson) W. Gams	Litter	Bhadrachalam	OUFH No 705
6	<i>Acremoniula sarcinellae</i> (Pat. & Har.) G. Arnaud ex Deighton	<i>Citrus vulgaris</i> leaf	Yellandu	OUFH No 706
7	<i>Alternaria longipes</i> (Ellis & Everh.) E.W. Mason	Litter	Yellandu	OUFH No 707
8	<i>Alternaria porri</i> (Ellis) Cif.	Litter	Yellandu	OUFH No 708
9	<i>*Alternaria ricini</i> (Yoshii) Hansf.	Litter	Yellandu	OUFH No 709
10.	<i>Anguillospora crassa</i> Ingold	Submerged leaves	Bayyaram	OUFH No 710
11.	<i>Arthrotrichum conoidis</i> Drechsler	Litter	Bhadrachalam	OUFH No 711
12.	<i>Arthrotrichum oligospora</i> Fresen.	<i>Bauhinia</i> fallen leaves	Bhadrachalam	OUFH No 712
13.	<i>*Arthrotrichum superba</i> Corda	<i>Sterculia</i> sp. fallen fruits, Litter	Bhadrachalam	OUFH No 713
14	<i>*Arthrinxium phaeospermum</i> (Corda)	Bamboo reeds & M.B. Ellis	Bhadrachalam	OUFH No 714
15.	<i>Beltraniella odinae</i> Subram.	Litter	Bayaram	OUFH No 715
16.	<i>Beltraniella</i> sp.	<i>Eucalyptus</i> leaf	Bhadrachalam	OUFH No 716
17.	<i>Beltrania rhombica</i> Penz.	Litter	Kothagudem	OUFH No 717
18.	<i>Beltraniopsis esenbeckiae</i> Bat. & J.L. Bezerra	Litter	Yellandu	OUFH No 718
19.	<i>Bhadradriella hyalina</i> Nagaraju, Kunwar, Sureshk. & Manohar.	<i>Roystonea regia</i> pod	Bhadrachalam	HCIO No.50143
20.	<i>Cephalophora irregularis</i> Thaxter	Litter	Kunavaram	OUFH No 738
21	<i>Clonostachys candelabrum</i> (Bonord.) Schroers	<i>Samanea saman</i> fruit	Bhadrachalam	OUFH No 719
22.	<i>Chaetomella raphigera</i> Swift	Leaf	Kothagudem	OUFH No 720
23.	<i>Chaetomium atrobrunneum</i> Udagava & Takada	Litter	Bhadrachalam	OUFH No 721
24	<i>Chaetomium bostrychodes</i> Zopf	Litter	Bhadrachalam	OUFH No 722
25.	<i>*Chaetomium globosum</i> Kunze	Litter	Bayyaram	OUFH No 723
26.	<i>Chaetomium mollicellum</i> L.M. Ames	Litter	Bhadrachalam	OUFH No 724
27.	<i>Chaetomium reflexum</i> Skolko & J.W. Groves	Litter	Dummugudem	OUFH No 725
28.	<i>*Chaetomium spirale</i> Zopf	Litter	Bhadrachalam	OUFH No 726

S. No.	Fungi	Substrate/Host	Place	Herbarium No.
29.	<i>Chaetomium trilaterale</i> Chivers	Litter	Yellandu	OUFH No 727
30.	<i>Chaetopsina indica</i> Nagaraju, Kunwar, Sureshk. & Manohar.	<i>Albizia lebbek</i> fallen fruit	Bhadrachalam	HCIO. No. 50145
31.	* <i>Cladosporium cladosporioides</i> (Fresen.) G. A. de Vries	<i>Peltophorum</i> sp. fruit	Yellandu	OUFH No 728
32.	* <i>Chlamydomyces palmarum</i> (Cooke) E.W. Mason	Leaf	Kothagudem	OUFH No 729
33.	<i>Cochliobolus australiensis</i> (Tsuda & Ueyama) Alcorn	Litter	Bhadrachalam	OUFH No 730
34.	* <i>Colletotrichum graminicola</i> (Ces.) G.W. Wilson	<i>Ficus</i> sp. leaf	Bhadrachalam	OUFH No 731
35.	<i>Cunninghamella blakesleeana</i> Lendner	Litter	Kothagudem	OUFH No 732
36.	* <i>Cunninghamella echinulata</i> (Thaxt.) Thaxt. ex Blakeslee	Litter	Kothagudem	OUFH No 733
37.	* <i>Curvularia lunata</i> var. <i>aeria</i> (Bat. J. A. Lima & C. T. Vascon.) M. B. Ellis	<i>Bauhinia</i> sp. leaf	Bhadrachalam	OUFH No 734
38.	* <i>Curvularia pallescens</i> Boedijn	Litter	Bhadrachalam	OUFH No 735
39.	<i>Custingophora lignicola</i> Nagaraju, Kunwar, Sureshk. & Manohar.	<i>Acacia auriculiformis</i> leaf	Bhadrachalam	HCIO. No 50146
40.	<i>Cylindrocladium braziliense</i> (Bat. & Cif.) Peeraly	<i>Eucalyptus</i> leaf	Bhadrachalam	OUFH No 736
41.	* <i>Epicoccum purpurascens</i> Ehrenb.	Litter	Paloncha	OUFH No 737
42.	* <i>Geotrichum candidum</i> Link	Litter	Kothagudem	OUFH No 739
43.	<i>Gloeocercospora sorghi</i> D. C. Bain & Edgerton ex Deighton.	Litter	Bhadrachalam	OUFH No 740
44.	# <i>Glomerularia corni</i> D. H. Hend.	Litter	Bhadrachalam	OUFH No 741
45.	<i>Gonytrichum macrocladum</i> (Sacc.) S. Hughes	Decaying wood	Bhadrachalam	OUFH No 742
46.	<i>Graphium calicioides</i> (Fr.) Cooke & Masee	<i>Terminalia tomentosa</i> bark	Bhadrachalam	OUFH No 743
47.	* <i>Graphium putredinis</i> (Corda) S. Hughes	Litter	Bhadrachalam	OUFH No 744
48.	# <i>Gyrophthrix hughesii</i> Pirozynski	<i>Eucalyptus</i> sp. leaf	Bhadrachalam	OUFH No 745
49.	<i>Gyrophthrix podosperma</i> (Corda) Rabenh.	Litter	Yellandu	OUFH No 746
50.	<i>Helicomycetes hyderabadensis</i> P. Rag Rao & D. Rao	<i>Samania</i> sp. fruit	Dummugudem	OUFH No 747
51.	<i>Hyalopezalotrichum indica</i> Nagaraju, Kunwar, Sureshk. & Manohar.	Fruit	Paloncha	HCIO. No 50144
52.	<i>Idriella angustispora</i> Morgam-Jones	Litter	Kothagudem	OUFH No 748
53.	* <i>Khuskia oryzae</i> H.J. Huds.	<i>Sorghum</i> sp. Litter	Yellandu	OUFH No 750
54.	<i>Lasiodiplodia theobromae</i> (Pat.) Griffiths & Maubl.	<i>Cocoa</i> sp. fruit	Bhadrachalam	OUFH No 751
55.	# <i>Libertella betulina</i> Desm.	<i>Sesbania</i> sp. fruit	Bhadrachalam	OUFH No 752
56.	<i>Macrophomina phaseolina</i> (Tassi) Goid.	Litter	Kothagudem	OUFH No. 753

S. No.	Fungi	Substrate/Host	Place	Herbarium No.
57.	<i>Megalodocheium elaeidis</i> (Beeli) Deighton	Litter	Kothagudem	OUFH No 754
58.	* <i>Memnoniella echinata</i> (Rivolta) Galloway	Litter	Paloncha	OUFH No 755
59.	<i>Melanospora damnosa</i> (Sacc.) Lindau	Litter	Bhadrachalam	OUFH No. 756
60.	* <i>Monodictys levis</i> (Wiltshire) Hughes	Litter	Paloncha	OUFH No 757
61.	<i>Myrothecium gramineum</i> Lib.	Litter	Bhadrachalam	OUFH No 758
62.	<i>Myrothecium roridium</i> Tode	Litter	Bhadrachalam	OUFH No. 759
63.	<i>Nodulisporium gregarium</i> (Berk. & M.A. Curtis) J.A. Mey.	<i>Elangium</i> sp. leaf litter	Bhadrachalam	OUFH. No 760
64.	<i>Oidium curtisii</i> Berk. & Linder	<i>Vernonia</i> sp. Living leaves	Bhadrachalam	OUFH No 761
65.	<i>Olpitrichum</i> sp.	<i>Cicer aeritinum</i> leaf	Bhadrachalam	OUFH No 762
66.	* <i>Paezilomyces variotii</i> Bainier	Litter	Bhadrachalam	OUFH No 763
67.	<i>Periconia byssoides</i> Pers. ex Merat.	Bamboo leaf	Bhadrachalam	OUFH No 764
68.	* <i>Periconia cookei</i> E.W. Mason & M.B. Ellis	<i>Albizia lebbeck</i> fruit	Bhadrachalam	OUFH No 765
69.	<i>Pestalotiopsis glandicola</i> (Castagne) Steyaert	Litter	Yellandu	OUFH No 766
70.	<i>Phaeoisariopsis griseola</i> (Sacc.) Ferraris	Litter	Kunavaram	OUFH No 749
71.	* <i>Phoma glomerata</i> (Corda) Wollenw. & Hochapfel	Litter	Bhadrachalam	OUFH No 767
72.	* <i>Pithomyces terricola</i> (Manohar. & Ramarao) P.M. Kirk	Litter	Bhadrachalam	OUFH No 768
73.	<i>Pithomyces</i> sp.	<i>Tectona grandis</i> pod litter	Bhadrachalam	OUFH No 769
74.	<i>Pythium afertile</i> Kanouse & T. Humphrey	Litter	Kothagudem	OUFH No 770
75.	* <i>Spegazzinia intermedia</i> M.B. Ellis	Bark	Bhadrachalam	OUFH No 771
76.	* <i>Spegazzinia lobulata</i> Thrower	Fruit	Bhadrachalam	OUFH No 772
77.	* <i>Stachybotrys atra</i> Corda	Leaf	Bhadrachalam	OUFH No 773
78.	* <i>Strachybotrys kampalensis</i> Hansf.	Litter	Yellandu	OUFH No 774
79.	<i>Stachylidium bicolor</i> Link ex S.F. Gray	Dead stems, twigs	Bhadrachalam	OUFH No 775
80.	* <i>Thamnostylum piriforme</i> (Bainier) Arx & H.P. Upadhyay	Litter	Yellandu	OUFH No 776
81.	<i>Tharoopama trina</i> Subram.	Litter	Kothagudem	OUFH No 777
82.	<i>Tetraploa aristata</i> Berk. & Broome	Stream (aquatic)	Yellandu	OUFH No 778
83.	* <i>Torula herbarum</i> (Pers.) Link. ex S. F. Gray	Litter	Bhadrachalam	OUFH No 779
84.	* <i>Trichoderma viride</i> Pers. ex Fr.	Litter	Bhadrachalam	OUFH No 780
85.	* <i>Trichothecium roseum</i> (Pers.) Link ex S. F. Gray	<i>Sterculia foetida</i> fruit	Paloncha	OUFH No 781
86.	* <i>Trichurus spiralis</i> Hasselbr.	Litter	Bhadrachalam	OUFH No 782
87.	<i>Tripaspermum myrti</i> (Lind) S. Hughes	Eucalyptus leaf	Bhadrachalam	OUFH No 783
88.	<i>Tritirachium dependens</i> Limber	Litter	Bhadrachalam	OUFH No 784

S. No.	Fungi	Substrate/Host	Place	Herbarium No.
89.	<i>*Ulocladium gpagarwalii</i> Nagaraju, Kunwar, Manohar. & Agarwal	Litter	Yellandu	HCIO No 49187
90.	<i>*Ulocladium lignicola</i> Nagaraju, Kunwar, Manohar. & Agarwal	Bark	Yellandu	HCIO No 49188
91.	<i>Verticillium lecanii</i> (Zimm.) Viégas	Litter	Bhadrachalam	OUFH No 785
92.	<i>Verticillium theobromae</i> (Durc.) E.W. Mason & S. Hughes	Litter	Yellandu	OUFH No 786
93.	<i>Virgaria nigra</i> (Link) Nees & S. F. Gray	Litter	Yellandu	OUFH No 787
94.	<i>Volutella ciliata</i> (Alb. & Schwein.) Fr.	Litter	Bhadrachalam	OUFH No 788
95.	<i>Wiesneriomyces javanicus</i> Koorders	Litter	Bhadrachalam	OUFH No 789
96.	<i>Zygosporium oscheoides</i> Mont.	<i>Ficus</i> sp. leaf	Kothagudem	OUFH No 790
97.	<i>Agaricus campestris</i> sensu Cooke	Humid soil	Bhadrachalam	OUMF No.301
98.	<i>Agaricus heterocystis</i> Heinem. & Gooss	Humid soil	Bhadrachalam	OUMF No.302
99.	<i># Amanita fulva</i> Secretan	Humid	Bhadrachalam	OUMF No.303
100.	<i>Cantharellus aurantiacus</i> (von Wulfen) Fr.	Wood	Yellandu	OUMF No. 304
101.	<i>Clavaria cristata</i> (Holmsk.) Pers.	Dead wood twig	Yellandu	OUMF No.305
102.	<i>Clavaria fumosa</i> Pers.	Humid Soil	Bhadrachalam	OUMF No.306
103.	<i># Clavulinopsis dichotoma</i> (Godey) Corner	Humid Soil	Bhadrachalam	OUMF No.307
104.	<i># Coprinus cinereus</i> (Schasff) S.F. Gray	Dung	Bayyaram	OUMF No.308
105.	<i>Coprinus micaceus</i> (Bull. ex Fr.) Fr.	Dung	Bhadrachalam	OUMF No. 309
106.	<i>Coriolus versicolor</i> (L.) Quél.	Dead Wood	Kothagudem	OUMF No 310
107.	<i>Crepidotus eucalypticola</i> Singer	Dead wood twig	Bhadrachalam	OUMF No 311
108.	<i>Daldinia concentrica</i> (Bolten) Ces & De Not.	Dead wood log	Bhadrachalam	OUMF No.312
109.	<i>Fomes fomentarius</i> (L.) Kickx.	Dead wood	Yellandu	OUMF No.313
110.	<i>Ganoderma lucidum</i> (Curtis) P. Karst.	Dead wood	Bhadrachalam	OUMF No.314
111.	<i>Geastrum triplex</i> Jungh.	Humid soil	Bhadrachalam	OUMF No.315
112.	<i>Hygrocybe conica</i> (Schaeff.) P. Kumm.	Humid soil	Bhadrachalam	OUMF No.316
113.	<i>Hygrocybe miniata</i> (Fr.) P. Kumm.	Humid soil	Bhadrachalam	OUMF No.317
114.	<i>Inocybe friesii</i> R. Heim	Soil	Yellandu	OUMF No.318
115.	<i># Lentinus cladopus</i> Lév.	Soil	Kothagudem	OUMF No.319
116.	<i>Lentinus squarrosulus</i> Mont.	Dead Wood	Bhadrachalam	OUMF No.320
117.	<i>Lepiota ceramogenes</i> (Berk. & Broome) Sacc.	Dead wood	Bayyaram	OUMF No.321
118.	<i>Lepiota vascularis</i> Pegler	Dead Wood	Bhadrachalam	OUMF No.322
119.	<i>Lycoperdon depressum</i> W. G. Smith	Soil	Bhadrachalam	OUMF No.323
120.	<i># Marasmius silvicola</i> Singer & Digilio	Soil	Bhadrachalam	OUMF No.324
121.	<i>Mycena kauffmanii</i> A.L. Sm.	Soil	Paloncha	OUMF No.325
122.	<i># Mycena leptcephala</i> (Pers.) Gillet.	Soil	Yellandu	OUMF No.326
123.	<i>Phallus impudicus</i> L. ex Webster	Humid Soil	Bhadrachalam	OUMF No.327
124.	<i>Pleurotus ostreatus</i> (Jacq.) P. Kumm.	Dead wood	Bhadrachalam	OUMF No.328

S. No.	Fungi	Substrate/Host	Place	Herbarium No.
125.	<i>Podaxis carcinomalis</i> (L.F.) Fr.	Humid Soil	Bayyaram	OUMF No.329
126.	# <i>Polyporus grammacephalus</i> Berk.	Wood	Bhadrachalam	OUMF No.330
127.	<i>Schizophyllum commune</i> Fr.	Wood	Kothagudem	OUMF No.331
128.	# <i>Scleroderma citrinum</i> Persoon ex Shoothill and Fairhurst	Humid Soil	Bhadrachalam	OUMF No.332
129.	<i>Tremella frondosa</i> Fr.	Wood	Bhadrachalam	OUMF No.333
130.	<i>Volvariella volvacea</i> (Bull.) Singer	Humid Soil	Bhadrachalam	OUMF No.334
131.	<i>Xylaria hypoxylon</i> (L.) Grev.	Wood	Bhadrachalam	OUMF No.335

New to Andhra Pradesh; *Fungi cultured

A significant variation in occurrence of fungi was also recorded. It is evident from Fig. 5 that 5% fungal population belonged to Zygomycotina, 13% to Ascomycotina, 26% to Basidiomycotina and 56% of fungi belonged to anamorphic fungi.

The variations among the fungal species associated with different forest localities and richness of fungi of Bhadrachalam forest which has supported 74 species have been due to the type of litter that has been added in the form of diversified angiospermic vegetation, nutrition richness status, effect of temperature and relative humidity and also rainfall. Macro- fungi were limited to 35 because of their fruit body production, and their perennating structure are controlled by the edaphic factors, meteorological factors, survival of the inoculum and the type of the host. Similar observations were made by Manoharachary & al., (2006, a, b, c, d; 2007, a, b, 2009), Kaviyarasan & al., (2009), Kumar & Kaviyarasan (2011); Sharma & al., (2010) and Patil & al., (2011).

Out of 96 micro-fungi, 34 fungi were cultured and remaining fungi could not be cultured. *Glomerularia corni*, *Gyrophthrix hughesii*, *Libertella betulina*, *Amanita fulva*, *Clavulinopsis dichotoma*, *Coprinus cinerius*, *Lentinus cladopus*, *Marasmius silvicola*, *Mycena leptoccephala*, *Polyporus grammacephalus* and *Scleroderma citrinum* form new additions to the fungi of Andhra Pradesh, India.

The above data clearly indicates that there is a vast potential of unexplored tropical fungi in India. Many of the habitats and substrates in the tropical climate are now realized to be rich source and natural repositories of useful fungal genomes and their biotechnological utility.

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