



A Survey of Mushroom Diversity, Identification, And Preservation in Five Different Districts of South Gujarat

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Abstract

Mushroom is a macrofungus that is large enough to be seen without the use of magnification, has a distinct fruiting body that can be either epigeous or hypogeous and can be harvested. Macrofungi are found in almost every ecosystems and their types differ accordingly. There are ten main categories into which macrofungi are divided namely Ascomycetes, Basidiomycetes, Zygomycetes, Lichens, Slime Moulds, Rusts, Smuts, Chytrids, and Myxomycetes. Studies on the taxonomy and diversity of macrofungal species are becoming more and more crucial since many macrofungal species are becoming extinct or are in danger of falling extinct due to habitat loss.

Using the opportunistic sampling technique, a survey was carried out between July 2018 and December 2021 in various places (forests, secondary forests, agricultural fields, bush fallows, and farmers' pathways) in five districts of south Gujarat. The fungi were gathered, documented, and preserved. With the aid of the existing literature, they were further recognized morphologically and taxonomically abbreviated. In this article, the documentation of fungus in the south Gujarat area is discussed.

Keywords: Diversity; Morphology; Isolation; Preservation

Introduction

In the forest ecosystem, fungi, one of the significant groups of saprophytes, recycle carbon which has been stored into complex organic matter [1-3]. With high protein, vitamin, mineral, fiber, trace elements content, minimal to no calories, and cholesterol, mushrooms have a rich nutritional value [4]. Mushrooms have the ability to grow on a range of substrates, including lignin-rich plant debris, cellulose, hemicellulose, humus soil, and even hairs [5]. Also, they are important biotechnological tools for the synthesis of several enzymes and secondary metabolites [6]. Studies on mushrooms, particularly those concentrating on their use, therapeutic benefits, and edibility, along with earlier research on larger fungi, may be beneficial for humans [7]. The most common kind of mushroom has a pileus and stipe in the shape of an umbrella, although some species also include a volva, annulus, or both. In addition, some mushrooms have a cup-like shape, while others are spherical like golf balls. Some are in the shape of small clubs, some

coral; others are yellow or orange jelly like globs and some even much resemble the human ear; Infect, there are countless varieties of mushrooms [8].

Gujarat is endowed with a great diversity of natural ecosystems ranging from moist deciduous forests to pure desert conditions [9]. Though the climatic conditions are favorable and unique for the luxurious growth of fungal flora; there are only a few sporadic reports on fungal diversity for the state of Gujarat [10-17]. Dang district is one of the richest floristic areas located in between 20.39 ° to 21.05 ° North latitude and 73.29 ° to 73.51 ° East longitude with a wide range of ecosystem and species diversity [15].

The fungus survey helps us understand the number of species of fungi and fungus-like organisms that are present as well as their distribution across a variety of habitats, landscapes, and different regions [4]. The present study involves the examination and docu-

menting of fungal diversification from different districts of Dang, Navsari, Tapi, Valsad and Surat.

Materials and Methods

Material collection site

Fruiting bodies were collected from Dang, Navsari, Tapi, Valsad and Surat District of the Gujarat state. Survey was carried out during the period of rain, during July 2018 to December 2021. Collected samples were packed in sterile polyethylene bags for further study. Collection sites included undisturbed forests, secondary forests, crop fields, bush fallows, and farmers' trails. The morphological characteristic of macro-fungi and their fruiting bodies were recorded and photographed in their natural habitat with a digital camera [15].

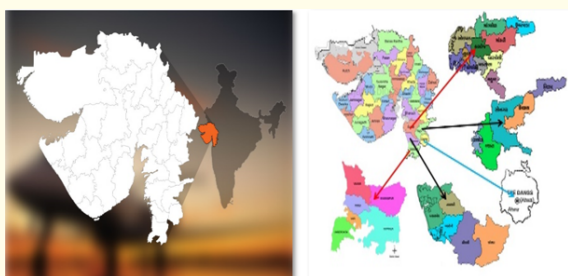


Figure 1: Five different Collection sites for mushroom diversity in South Gujarat.

Sample collection and preliminary identification

The macrofungal samples were excised with a surgical blade or chisel and hammer, immediately packed in sterile polyethylene bags and brought to the laboratory for further analysis. During the field survey, the microfungi were spotted and photographed in their natural habitat. The GPS coordinates were also recorded. After suitable trimming, they were surface sterilized by 0.1% HgCl₂ for 40-45 seconds, washed thoroughly with distilled water followed by 70% ethanol for a few seconds. All specimens were examined on the basis of their morphological characteristics and identified with the help of available literature [4,18,-24].

Mushroom preservation techniques

Different species needed compatible and distinctive alternative techniques for their active, pure and viable morphology in terms of color, texture, and taste. Preservation protocols were applied to store cultures in viable and stable form for long periods without losing genotypic, phenotypic and physiological traits [10].

Preservation in formalin (40 %) solution

The microfungal samples were brought to the laboratory. After suitable trimming samples were surface sterilized by 0.1% HgCl₂ for 40-45 seconds, washed thoroughly with distilled water followed by 70 % ethanol for a few seconds. Following samples were stored in culture tubes/Phyta-jar contained 40 % formalin solution at room temperature (28- 35°C) [25].

Cryopreservation (freezing at -20°C and storage in liquid nitrogen [-196°C])

The macrofungal samples were excised with a surgical blade. After suitable trimming and sterilization they were stored by using cryopreservation (Liquid Nitrogen -196°C) and low temperature storage (+4°C and 20°C) [10,26].

Drying techniques

The macrofungal samples were excised with a surgical blade or chisel and hammer. After suitable trimming samples were sent to sun drying (SD) and gas laboratory oven (LO) drying, solar dryer and hot air oven [27,28].

Results and Discussion

Extensive field work carried out in the Dang, Navsari, Tapi, Valsad, and Surat districts (Table 1) of the Gujarat state resulted in the collection of 57 species. Table 2 indicates the distribution area of different fungi collected and categorized according to their taxonomic remarking. From total of 57 collected species (Figures 2-6) of mushrooms, 53 species belonged to phylum Basidiomycota (Class: Agaricomycetes) and 04 species belonged to phylum Ascomycota (class: Sordariomycetes). The present checklist of macrofungal species belonged to 23 families in twelve Orders Agaricales, Boletales, Cantharellales, Phallales, Gloeophyllales, Auriculariales, Geastrales, Polyporales, Russulales, Darymycetales, Hymenochaetales and Xylariales. With respect to distribution over all five districts, the three family *Lyophyllaceae*, *Polyporaceae*, and *Agaricaceae* possessed wide distributions all over south Gujarat.

In the above mentioned list about 10 species (*Agaricus bisporus*, *Pleurotus ostreatus*, *Termitomyces eurhizus*, *Termitomyces microcarpus*, *Termitomyces clypeatus*, *Termitomyces heimii*, *Termitomyces medius*, *Dictophora indusiata*, *Dictophora multicolor*, *Ganoderma applanatum*) of macrofungi were found to be utilized by locals for edible purpose, while 2 species (*Dictophora indusiata* and *Ganoder-*

Table 1: Study area where field visits were made and the GPS Coordinates.

District	Location sites	GPS coordinates
Dang	Waghai, Mahal, Ambapada, Ahva, Girafall, Bhenskatari, Koshmal, Pimpari, Chichinagavtha, Bhujad, Shamgahan, Rambhas, Chinchali, Bhisya, Kasbabari,	20°45'23.2"N 73°30'09.3"E 20°47'20.6"N 73°30'51.3"E 20°55'30.6"N 73°40'05.1"E 20°56'06.1"N 73°30'28.0"E 20°42'41.9"N 73°31'16.2"E 20°48'04.9"N 73°32'29.5"E 20°56'25.5"N 73°34'18.6"E 20°47'59.5"N 73°36'38.3"E 20°55'16.6"N 73°34'13.4"E 20°37'25.9"N 73°43'09.9"E 20°46'18.1"N 73°40'14.8"E 20°46'09.3"N 73°44'32.6"E
Navsari	Vansda, Hanumanbari, Khergam, Sadakpur, Agasi, Godthal, Ghodmal, Bhinar	20°47'38.2"N 73°20'47.2"E 20°45'46.5"N 73°21'08.1"E 20°38'41.3"N 73°08'23.3"E 20°44'10.1"N 73°07'07.7"E 20°41'03.9"N 73°11'48.1"E 20°41'50.9"N 73°12'56.8"E 20°49'08.8"N 73°19'57.8"E
Surat	Bardoli, Mahuva, Anaval	21°06'43.7"N 73°07'28.1"E 21°03'57.0"N 73°08'10.7"E 20°53'15.0"N 73°13'03.0"E
Tapi	Padamdungari, Dolvan, Bhuhari, Valod, Kelkui, Amonia, Bedchit, Umarvavnajik, Kalamkui, Jamaliya, Bardipada, Chunavadi, Chimer	20°48'57.1"N 73°25'48.8"E 21°01'09.0"N 73°43'01.6"E 20°53'44.1"N 73°20'46.7"E 20°57'28.6"N 73°20'33.4"E 20°58'02.3"N 73°19'33.9"E 21°03'21.5"N 73°14'04.1"E 21°01'21.8"N 73°17'14.9"E 20°57'13.0"N 73°29'20.3"E 20°50'32.2"N 73°22'13.7"E 20°56'22.7"N 73°26'54.6"E 20°54'25.0"N 73°27'23.6"E 20°54'16.8"N 73°27'44.9"E
Valsad	Dharampur, Willson Hill, Kaparada, Barumal	20°31'40.0"N 73°14'02.9"E 20°31'04.9"N 73°10'56.7"E 20°30'47.3"N 73°16'36.9"E 20°21'17.2"N 73°13'11.5"E

Table 2: List of fungal species collected and their taxonomic ranking

Phylum	Class	Order	Family	Name of the species	Distribution	References
Basidiomycota	Agaricomycetes	Agaricales	Schizophyllaceae	<i>Schizophyllum commune</i>	Anaval Mahuva	GSBTM 2013 Rajput KS., <i>et al.</i> 2015 Ravat and John. 2016
			Agaricaceae	<i>Agaricus bisporus</i> (J.E. Lange) Imbach	Waghai Girafalls	GSBTM 2013 Korat., <i>et al.</i> 2013
				<i>Cystolepiota oregonensis</i> (H.V. Sm.) Vellinga	Chimer	Korat., <i>et al.</i> 2013
				<i>Leucocoprinus brebissonii</i>	Pimpari	Ravat and John, 2016
				<i>Leucocoprinus cepestipes</i>	Buhari	Ravat and John, 2016
				<i>Lepiota ignivolvata</i>	Bheskatari	Ravat and John, 2016
				<i>Macrolepiota procera</i>	Chimer	Ravat and John, 2016
				<i>Parasola auricoma</i>	Chimer	Ravat and John, 2016 Parihar S., <i>et al.</i> , 2015
			Pleurotaceae	<i>Pleurotus ostreatus</i>	Ahwa Padamdugari Godthal Anaval	Rajput KS., <i>et al.</i> 2015
				<i>Pleurotus pulmonarius</i>	Padamdugari Godthal Anaval	Rajput KS., <i>et al.</i> 2015
			Lyophyllaceae	<i>Hohenbuehelia Calocybe indica</i> purkayastha and A. Chandra	Mandavi Bheskatri Bhujad Bhinar	Senthilarasu GSBTM 2013
				<i>Termitomyces eurhizus</i> (Berk.) R.Heim	Bardoli Godthal	GSBTM 2013
				<i>Termitomyces microcarpus</i> (Berk. and Broome) R.Heim	Mahal	GSBTM 2013
				<i>Termitomyces clypeatus</i> R. Heim	Dolvan Amonia mandavi	Pradhan and Prakash.2014
				<i>Termitomyces heimii</i> Natarajan	Godthal Vasda	Pradhan and Prakash.2014
				<i>Termitomyces medius</i> (Mont.) J. L. Mata	Anaval	Pradhan and Prakash.2014
			Physalacriaceae	<i>Oudemansiella redicata</i>	Buhari	GSBTM 2013
				<i>Crepidotus variabilis</i>	Valod	Ravat and John, 2016

			<u>Mycenaceae</u>	<u>Mycena</u> sp.	<u>Padam dungari</u>	GSBTM 2013
			<u>Marasmiaceae</u>	<u>Marasmius siccus</u>	<u>Padam dungari</u>	Ravat and John, 2016 Parihar S., <i>et al.</i> 2015
				<u>Mycena subcaerulea</u>	<u>Bardipada</u>	Senthilarasu G., 2014
				<u>Mycena galericulata</u> (Scop.) Gray	<u>Padam dungari</u>	Ravat and John, 2016
				<u>Lactocollybia epia</u>	<u>Rambhas</u>	Senthilarasu G., 2014
			<u>Tricholomataceae</u>	<u>Collybia confluence</u>	<u>Bardipada</u>	Ravat and John, 2016 Senthilarasu G., 2014
		<u>Cantharellales</u>	<u>Pluteaceae</u>	<u>Pluteus cervinus</u>		Senthilarasu G., 2014
			<u>Clavulinaceae</u>	<u>Clavulina cristata</u>	<u>Anaval</u>	Ravat and John, 2016
				<u>Cantharellus subalbidus</u>	<u>Anaval</u>	Ravat and John, 2016
		<u>Phallales</u>	<u>Phallaceae</u>	<u>Dictophora indusiate</u> (Vent.) Desv	<u>Rambhas</u>	GSBTM 2013
				<u>Dictophora multicolor</u> Berk. and Broom	<u>Dharampur</u>	GSBTM 2013
				<u>Clathrus Delicatus</u> Berk. and Broome (Phallaceae)	<u>Waghai</u>	Patel RS., <i>et al.</i> 2018
		<u>Gloeophyllales</u>	<u>Gloeophyllaceae</u>	<u>Gloeophyllum sepiarium</u> (Wulfen) P. Karst.	<u>Mahal Valod Willsion hill</u>	Parihar, S., <i>et al.</i> 2015
		<u>Boletales</u>	<u>Boletaceae</u> <u>Sclerodermstscese</u>	<u>Boletus edulis</u> bull	<u>Waghai</u>	GSBTM 2013
				<u>Pisolithus albus</u> (cook and massee) Priest	<u>Padam dungari Kalamkui</u>	GSBTM 2013
				<u>Scleroderma citrinum</u> Pers.	<u>Ambapada Bheskatari Pimpari</u>	Korat., <i>et al.</i> 2013
		<u>Auriculariales</u>	<u>Auriculariaceae</u>	<u>Auricularia auricula-Judae</u> (Bull.) J.Schrot	<u>Bedchit Bardipada Waghai</u>	GSBTM 2013
		<u>Gaestrales</u>	<u>Gestraceas</u>	<u>Gastrum Saccatum</u> Fr.	<u>Bheskatari</u>	GSBTM 2013
		<u>Polyporales</u>	<u>Polyporaceae</u>	<u>Microporus xanthopus</u>	<u>Anaval</u>	GSBTM 2013
				<u>Microporus vernicipes</u> (Berk.) Kuntze	<u>Anaval</u>	GSBTM 2013
				<u>Microporus ochrotinctus</u> (Berk. and M.A. Curtis) Kuntze	<u>Chimer</u>	GSBTM 2013 Rajput KS., <i>et al.</i> 2015
				<u>Polyporus arcularius</u> (Batsch) Fr.	<u>Chimer</u>	GSBTM 2013

				<i>Podoscypha petalodes</i>	Chimer Anaval	GSBTM 2013
				<i>Lenzites betulina</i>	Mahuva Waghai	Rajput KS., et al. 2015
				<i>Trametes versicolor</i> (L.) Lloyd	Mahuva Waghai Anaval Agasi	Korat., et al. 2013
			Ganodermataceae	<i>Ganoderma applanatum</i>	Buhari	Rajput KS., et al. 2015
				<i>Ganoderma lucidum</i>	Anaval	GSBTM 2013
				<i>Ganoderma multipileum</i>	Padam dungari Waghai	GSBTM 2013 Rajput KS., et al. 2015
			Coriolaceae	<i>Deadaleopsis Flavida</i> (lev.)	Mahal	GSBTM 2013
				<i>Lenzites elegans</i>	Chimer vyara	GSBTM 2013
				<i>Laetiporus sulphureus</i>	Vasda	GSBTM 2013
		Russulales	Auriscalpiaceae	<i>Lentinellus cochleatus</i>	Chunavada Rambhas	Rajput KS., et al. 2015
		Dacrymycetales	Dacrymycetaceae	<i>Dacryopinax spathularia</i>	Anaval Chimer	Rajput KS., et al. 2015 GSBTM 2013
		Hymenochaetales	Hymenochaetaceae	<i>Phellinus badius</i> (Cooke) G. Cunn.	Mahal Anaval Buhari Bhinar Kaparada	GSBTM 2013 Rajput KS., et al. 2015 Parihar, S., et al. 2015
Ascomycota	Sordariomycetes	Xylariales	Xylariaceae	<i>Xylaria polymorpha</i> (Pers.) Grev.	Anaval Ambapada Hanumanbari	GSBTM 2013
				<i>Xylaria ferjeensis</i> (Berk.) Fr.	Anaval Mahal Waghai Valod Mandavi	GSBTM 2013
				<i>Xylaria regalis</i> Cooke	Anaval Ahwa Barumal Kelkui kaprada Mandavi	Rajput KS., et al. 2015 Parihar, S., et al 2015
				<i>Daldinia concentrica</i>	Mahuva Buhari Chinchali Sadakpor	Korat., et al. 2013



Figure 2: A-H. Fungal fruiting bodies A. *Hohenbuehelia petaloides* B. *Termitomyces microcarpus* C. *Termitomyces clypeatus* D. *Oudemansiella redicata* E. *Termitomyces heimii* F. *Termitomyces medius* G. *Termitomyces eurhizus* H. *Oudemansiella redicata* gill view.

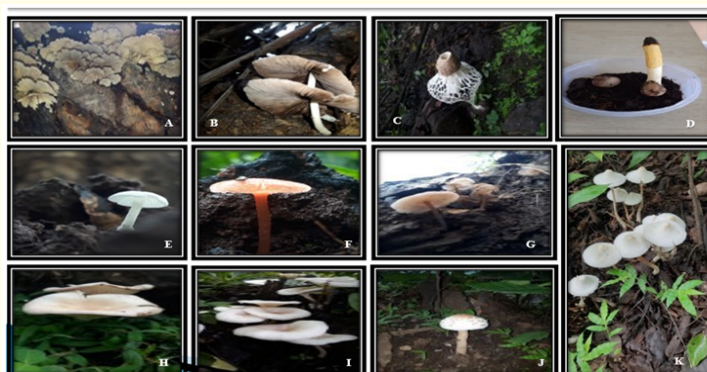


Figure 3: A-K. Fungal fruiting bodies A. *Schizophyllum commune* gill view B. *Parasola auricoma* C. *Dictophora indusiate* (Vent.) Desv D. *Dictophora multicolor* Berk. and Broom E. *Lactocollybia epia* F. *Mycena subcaerulea* G. *Mycena* sp. H. *Pleurotus pulmonarius* I. *Pleurotus ostreatus* J. *Agaricus hondensis* K. *Leucocoprinus cepetipes*.

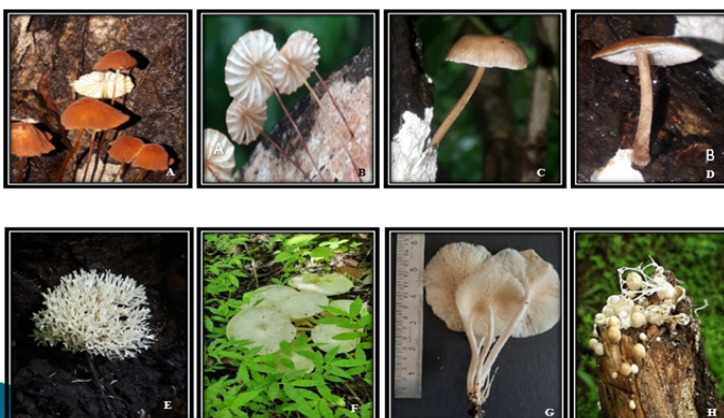


Figure 4: A-H. Fungal fruiting bodies A. *Marasmius siccus* B. *Marasmius siccus* Gill view C. *Collybia confluence* D. *Collybia confluence* gill view E. *Clavulina cristata* F. *Cantharellus subalbidus* G. *Cantharellus subalbidus* gill view H. *Clathrus Delicatus*.



Figure 5: A-G. Fungal fruiting bodies A. *Boletus edulis* bull B. *Pisolithus albus* C. *Scleroderma citrinum* Pers. D. *Auricularia auricula-Judae* E. *Geastrum Saccatum* Fr. F. *Microporus ochrotinctus* G. *Microporus ochrotinctus* gill view.



Figure 6: A-F: Fungal fruiting bodies A. *Ganoderma multipileum* B. *Ganoderma Lucidum* C. *Ganoderma applanatum* D. *Dacryopinax spathularia* E. *Xylaria polymorpha* F. *Xylaria regalis* G. *Daldinia concentrica*.

ma applanatum) were found to have medicinal use. It was found that the mentioned macrofungal species made a substantial contribution to nutrition and household economy. Both men and women used to gather wild edible fungi, even children between 8-16 years of age knew as many fungi as adults. The quantity of wild edible macrofungi in optimal weather weighed up to 1-1.5 kg per collector but the potential quantity that is collected depends on the

species, size and frequency of the fruit bodies. An interesting fact was that most of the mushroom collectors never harvested more than the amount required for subsistence consumption and they left some part of the sporocarps at the collection site because they believed that the residual part left by them would help the macrofungi to grow in the subsequent favorable conditions.

Name of the species	Preservation by Drying	Preservation in 40% formalin solution	Cryopreservation (-196° C)	Low-temperature storage (+4°C and 20°C
<i>Schizophyllum commune</i>	+	+	+	+
<i>Agaricus bisporus</i> (J.E. Lange) Imbach	+	+	+	+
<i>Cystolepiota oregonensis</i> (H.V. Sm.) Vellinga	-	-	-	+
<i>Leucocoprinus brebissonii</i>	+	+	+	+
<i>Leucocoprinus cepestipes</i>	+	+	-	-
<i>Lepiota ignivolvata</i>	+	+	-	-
<i>Macrolepiota procera</i>	+	+	-	-
<i>Parasola auricoma</i>	+	+	+	+
<i>Pleurotus ostreatus</i>	+	+	+	+
<i>Pleurotus pulmonarius</i>	+	+	+	+
<i>Hohenbuehelia petaloides</i>	+	+	+	+
<i>Calocybe indica</i> purkayastha and A. Chandra	+	+	+	+
<i>Termitomyces eurhizus</i> (Berk.) R.Heim	+	+	+	+
<i>Termitomyces microcarpus</i> (Berk. and Broome) R.Heim	+	+	+	+
<i>Termitomyces clypeatus</i> R. Heim	+	+	+	+
<i>Termitomyces heimii</i> Natarajan	+	+	+	+
<i>Termitomyces medius</i> (Mont.) J. L. Mata	+	+	+	+
<i>Oudemansiella redicata</i>	+	+	-	-
<i>Crepidotus variabilis</i>	-	-	+	+
<i>Mycena</i> sp.	+	+	+	+
<i>Marasmius siccus</i>	+	+	+	+
<i>Mycena subcaerulea</i>	+	+	+	+
<i>Mycena galericulata</i> (Scop.) Gray	+	+	+	+
<i>Lactocollybia epia</i>	-	+	+	+
<i>Collybia confluence</i>	+	+	+	+
<i>Pluteus cervinus</i>	+	-	+	+
<i>Clavulina cristata</i>	+	+	+	+
<i>Cantharellus subalbidus</i>	+	+	+	+
<i>Dictophora indusiate</i> (Vent.) Desv	+	+	+	+
<i>Dictophora multicolor</i> Berk. and Broom	+	+	+	+
<i>Clathrus Delicatus</i> Berk. and Broome (Phallaceae)	-	-	+	+
<i>Gloeophyllum sepiarium</i> (Wulfen) P. Karst.	+	-	-	-
<i>Boletus edulis</i> bull	+	-	+	+
<i>Pisolithus albus</i> (cook and massee) Priest	+	-	+	+
<i>Scleroderma citrinum</i> Pers.	+	-	+	+
<i>Auricularia auricula-Judae</i> (Bull.) J.Schrot	-	+	+	+
<i>Geastrum Saccatum</i> Fr.	+	+	+	+

<i>Microporus xanthopus</i>	+	+	-	-
<i>Microporus vernicipes</i> (Berk.) Kuntze	+	+	-	-
<i>Microporus ochrotinctus</i> (Berk. and M.A. Curtis) Kuntze	+	+	-	-
<i>Polyporus arcularius</i> (Batsch) Fr.	-	+	+	+
<i>Podoscypha petalodes</i>	+	+	-	+
<i>Lenzites betulina</i>	+	+	-	-
<i>Trametes versicolor</i> (L.) Lloyd	+	+	-	-
<i>Ganoderma applanatum</i>	+	+	-	-
<i>Ganoderma lucidum</i>	+	+	-	-
<i>Ganoderma multipileum</i>	+	+	-	-
<i>Deadaleopsis Flavida</i> (lev.)	+	+	-	-
<i>Lenzites elegans</i>	+	+	-	-
<i>Laetiporus sulphureus</i>	+	-	-	-
<i>Lentinellus cochleatus</i>	+	+	+	+
<i>Dacryopinax spathularia</i>	-	-	+	+
<i>Phellinus badius</i> (Cooke) G. Cunn.	+	-	-	+
<i>Xylaria polymorpha</i> (Pers.) Grev.	-	-	+	+
<i>Xylaria ferjeensis</i> (Berk.) Fr.	-	-	+	+
<i>Xylaria regalis</i> Cooke	-	-	+	+
<i>Daldinia concentrica</i>	-	-	+	+

Table 3: List of fungal species collected and preservation methods.
Key: + = method used for preservation, - = method does not apply.

Table 3 indicates the different preservation methods applied to all collected samples. Samples were collected in multiple numbers for different studies and preservation methods.

The earlier two major studies (18,19) dealing with diversity and distribution of Macrofungi have reported the presence of *Pleurotus ostreatus*, *Agaricus hondensis*, *Termitomyces microcarpus*, *Termitomyces clypeatus*, *Termitomyces heimii*, *Termitomyces medius*, *Termitomyces eurhizus*, *Schizophyllum commune*, *Pleurotus pulmonarius*, *Marasmius siccus*, *Scleroderma citrinum* Pers, *Collybia confluence*, *Microporus ochrotinctus*, *microporus xanthopus*, *Xylaria polymorpha* species. However, it cannot be taken into account that the remaining species are geographically restricted. Significant mycological explorations and the need for more long-term fungal studies in the South Gujarat region is still necessary.

Conclusion

Guajarat state blessed with varied physical feature and harbor a great diversity of plants with luxuriant vegetation, serious atten-

tion was paid to explore plant wealth of this district which resulted in publication of flora of the district. It has been found that several fleshy fungi are present in this region belonging to Ascomycota and Basidiomycota which shows biodiversity in fleshy fungi. for a detailed pharmacological evaluation such an analysis, will be useful in identifying few potent species from a big database.

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