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First Aeromycological Profile of the Mandangad tahsil, Maharashtra, India

V. D. Chavan
Loknete Gopinathji Munde Arts, Commerece and Science College Mandangad, District Ratnagiri, Maharashtra, India
Corresponding author Email: vinod80kumar@gmail.com
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ABSTRACT

Aim of this survey is to present the first aeromycological report of Mandangad tahsil, Ratnagiri, Maharashtra, India. In all 22 species of 16 genera from the 14 different localities of Mandangad tahsil were isolated successfully. From amongst the isolated fungi the species of *Aspergillus, Rhizopus* and *Mucor* were found to be the most dominating microbial components of the aeromycoflora whereas *Alternaria solani, Emmonsia pasteuriana, Curvularia lunata, Candida albicans, Humicola grisea, Penicillium* spp., *Rhizoctonia solani* and *Satchybotrys chartarum* were least abundant in comparison. Some of these including *Sclerotium rolfsii, Fusarium oxysporum, Fusarium solani, Fusarium dimerum, Cladosporium cladosporioides, Cladosporium herbarum* and *Cladosporium chartarum* showed general abundance. Hence first aeromycological profile of Mandangad tahsil apprise us about the fungal aeromycoflora affecting local medicinal and timber plants, human population, fruits, food products, clothes, furniture, leather products and dairy products, etc.

Keywords: Fungal diversity, airborne, *Aspergillus, Alternaria, Mucor* spp., aeromycology

INTRODUCTION

Mandangad tahsil is a hilly coastal biodiversity rich and socio-economically backward zone of Ratnagiri district of Maharashtra state, India. Symptoms of fungal infections are easily noticeable on plant parts as well as among the human population of this region. In Mandangad heavy rainfall during monsoon season and nearby Arabian Sea favours high relative humidity which plays a pivotal role in fungal infestations of the plants and plant products including human and animal population in the nearby surroundings in Mandangad. Hence, the study on fungal pathogens and looking for a solution to tackle the menace is of great importance and a sort of challenge before the mycologists and plant pathologists.

Therefore, in view of the public interest involved the main aim of this study was to construct the first aeromycological profile by analyzing the diversity and frequency of the fungal pathogens in the air of Mandangad tahsil.

MATERIALS AND METHODS

Air sampling and fungal culture: Fungal samples from the 14 different localities of Mandangad tahsil were collected during June 2017 to February 2018. For this purpose settle plate method containing potato dextrose agar medium was used. The media containing plates were exposed to air for 1hr. No sampling was undertaken during summer season because of less occurrence of fungal infestation due to the prevalence of drier climate. Four Plates per locality were used for sampling which were subsequently incubated at 20-28°C for 2-3 weeks and examined on daily basis for visible fungal growth. Purified fungal colonies were subcultured and subsequently identified to the generic level based on morphological features by consulting standard literature.

Identification of Plant fungal pathogens: Slides were prepared by using lacto phenol + cotton blue as a mounting medium and observed under the microscope (675X magnification). Fungi were identified using the available literature (Raper and Thom, 1984; Raper and Fennell, 1965; Ellis, 1971; Subramanian, 1960; Booth, 1977; Carmichael *et. al*., 1980; Waheganokar, 1984; Barnett and Hunter, 1998; Gilman, 1957; Nagmani *et. al*., 2006; Mukadum *et. al*., 2006; Salunkhe and Wahegaonkar, 2016).

Statistical Analysis for species diversity: The diversity of fungal species was studied in terms of species richness and relative abundance of the species.

i) Species richness (S): (Harrison *et. al*, .2004).

It represents the total number of different species in a particular area.

ii) Relative Dominance

It was measured by calculating the Berger-Parker dominance index.

$d = n/N$

Where, n = number of individuals in a species

N = S = Total number of individuals

RESULTS

In all 42 samples of fungi (3 samples from each site) were collected from 14 different sites of Mandangad tahsil. After seven days of incubation each fungal colony was examined under the microscope at higher magnification. Examination of the fungal cultures resulted in the documentation of sixteen fungal genera with 22 species. Diversity of fungi in the Mandangad tahsil was assessed by studying various factors like species richness, relative dominance and diversity of fungal species. It is normally assumed that more the number of species present in a locality 'richer' is the locality. Highest numbers of isolates (15 Genera out of 16) were recorded from the Palavni site. Kuduk and Adkhal site was quite poor in this regard. From Kuduk six taxa, namely *Aspergillus niger, Mucor, Rhizopus* spp., *Aspergillus flavus, Papulospora irregulans, Rhizoctonia solani* and from Adkhal only five taxa, namely *Aspergillus niger, Mucor, Rhizopus* spp., *Penicillium* spp. and *Aspergillus flavus* were documented in comparison (**Fig. 1 & Table 1**).

The Berger-Parker index for relative dominance was calculated at the generic level (Berger and Parker,1970). The genera *Aspergillus, Rhizopus* and *Mucor* appeared as the most

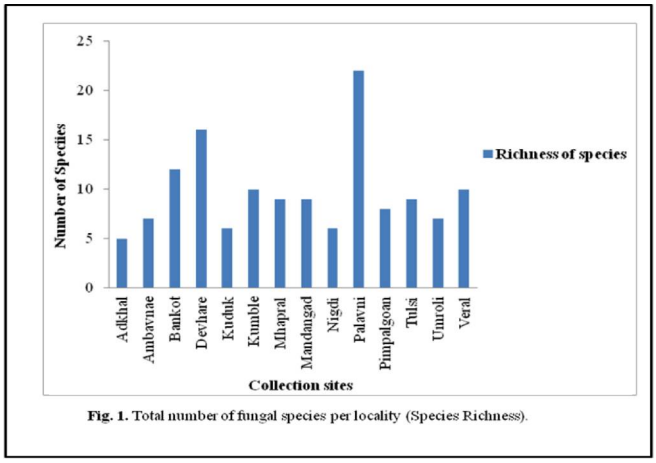

Fig. 1. Total number of fungal species per locality (Species Richness).

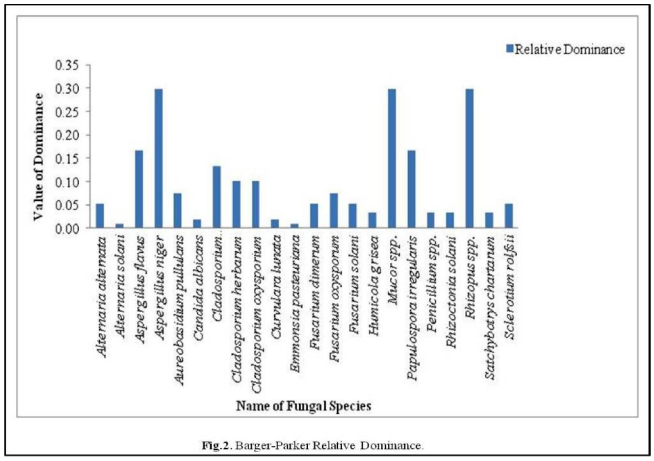

Fig.2. Barger-Parker Relative Dominance.

Table 1. Number of Fungal Species per Locality

Sr. No.	Collection Site	Name of the Fungal species
1	Adkhal	*Aspergillus niger, Mucor* spp., *Rhizopus* spp., *Aspergillus flavus, Penicillium*
2	Ambavnae	*Aspergillus niger, Cladosporium cladiosporioides, Candida albicans, Mucor* spp., *Rhizopus* spp., *Cladosporium oxysporum, Papulospora irregulans,*
3	Bankot	*Aspergillus niger, Aureobasidium pullulans, Cladosporium cladiosporioides, Mucor* spp., *Rhizopus* spp., *Stachybotrys chartarum, Cladosporium harbarum, Cladosporium oxysporum, Aspergillus flavus, Papulospora irregulans, Rhizoctonia solani, Sclerotium rolfsii,*
4	Devhare	*Alternaria alternata, Aspergillus niger, Aureobasidium pullulans, Cladosporium cladiosporioides, Fusarium oxysporum, Fusarium solani, Fusarium dimerum, Mucor* spp., *Rhizopus* spp., *Cladosporium harbarum, Cladosporium oxysporum, Humicola grisea, Aspergillus flavus, Papulospora irregulans, Rhizoctonia solani, Sclerotium rolfsii*
5	Kuduk	*Aspergillus niger, Mucor* spp., *Rhizopus* spp., *Aspergillus flavus, Papulospora irregulans, Rhizoctonia solani*
6	Kumble	*Aspergillus niger, Cladosporium cladiosporioides, Fusarium oxysporum, Mucor* spp., *Rhizopus* spp., *Penicillium* spp., *Stachybotrys chartarum, Humicola grisea, Aspergillus flavus, Papulospora irregulans*
7	Mhapral	*Alternaria alternata, Aspergillus niger, Emmonsia pasteuriana, Fusarium oxysporum, Fusarium solani, Fusarium dimerum, Mucor* spp., *Rhizopus* spp., *Aspergillus flavus*
8	Mandangad	*Aspergillus niger, Cladosporium cladiosporioides, Mucor* spp., *Rhizopus* spp., *Stachybotrys chartarum, Cladosporium harbarum, Cladosporium oxysporum, Aspergillus flavus, Sclerotium rolfsii*
9	Nigdi	*Aspergillus niger, Aureobasidium pullulans Fusarium oxysporum, Mucor* spp., *Rhizopus Sclerotium rolfsii*
10	Palavni	*Alternaria alternata, Aspergillus niger, Aureobasidium pullulans, Cladosporium cladiosporioides, Candida albicans, Emmonsia pasteuriana, Fusarium oxysporum, Fusarium solani, Fusarium dimerum, Mucor* spp., *Rhizopus* spp., *Penicillium* spp., *Stachybotrys chartarum, Cladosporium harbarum, Cladosporium oxysporum, Humicola grisea, Aspergillus flavus, Curvularia lunata, Papulospora irregulans, Rhizoctonia solani, Sclerotium rolfsii, Alternaria solani*
11	Pimpalgoan	*Alternaria alternata, Aspergillus niger, Cladosporium cladiosporioides, Candida albicans, Rhizopus* spp., *Cladosporium harbarum, Cladosporium oxysporum, Papulospora irregulans*
12	Tulsi	*Aspergillus niger, Fusarium oxysporum, Fusarium solani, Fusarium dimerum, Mucor* spp., *Rhizopus* spp., *Penicillium* spp., *Cladosporium harbarum, Humicola grisea*
13	Umroli	*Alternaria alternata, Aspergillus niger, Aureobasidium pullulans, Mucor* spp., *Rhizopus* spp., *Aspergillus flavus, Curvularia lunata, Papulospora irregulans*
14	Veral	*Aspergillus niger, Cladosporium cladiosporioides, Fusarium oxysporum, Fusarium solani, Fusarium dimerum, Mucor spp., Rhizopus* spp., *Cladosporium harbarum, Cladosporium oxysporum, Papulospora irregulans*

dominant genera in all localities whereas *Alternaria solani, Emmonsia pasteuriana, Curvularia lunata, Candida albicans, Humicola grisea, Penicillium* spp., *Rhizoctonia solani* and *Satchybotrys chartarum* were least abundant in comparison. Whereas *Sclerotium rolfsii, Fusarium oxysporum, Fusarium solani, Fusarium dimerum,*

Table 2. Frequency and Relative Dominance of Species.

Sr. No.	Name of the Species	% Frequency of per Species	Berger-Parker Dominance Index 'd'	Relative Dominance
1	*Alternaria alternata*	35.71	0.05	G
2	*Alternaria solani*	14.29	0.01	R
3	*Aspergillus flavus*	64.29	0.17	D
4	*Aspergillus niger*	**100.00**	0.30	D
5	*Aureobasidium pullulans*	42.86	0.07	G
6	*Candida albicans*	21.43	0.02	R
7	*Cladosporium cladosporioides*	57.14	0.13	D
8	*Cladosporium herbarum*	50.00	0.10	D
9	*Cladosporium oxysporium*	50.00	0.10	D
10	*Curvulara lunata*	21.43	0.02	R
11	*Emmonsia pasteuriana*	14.29	0.01	R
12	*Fusarium dimerum*	35.71	0.05	G
13	*Fusarium oxysporum*	42.86	0.07	G
14	*Fusarium solani*	35.71	0.05	G
15	*Humicola grisea*	28.57	0.03	R
16	*Mucor* spp.	**100.00**	0.30	D
17	*Papulospora irregularis*	64.29	0.17	D
18	*Penicillium* spp.	28.57	0.03	R
19	*Rhizoctonia solani*	28.57	0.03	R
20	*Rhizopus* spp.	**100.00**	0.30	D
21	*Satchybotrys chartarum*	28.57	0.03	R
22	*Sclerotium rolfsii*	35.71	0.05	G

Cladosporium cladosporioides, Cladosporium herbarum, Cladosporium chartarum showed general abundance in comparison (**Fig. 2 & Table 2**). Out of 16 fungal genera documented 12 were members of Phylum *Ascomycota*.

DISCUSSION

During the present survey a number of airborne fungal pathogens were recorded in the air of Mandangad tahsil. In all 22 species belonging to 16 genera were found to be from 14 different localities of Mandangad tahsil which were isolated successfully. Most of the documented fungal taxa were either plant pathogens or some of them were allergenic to human population (Thirumala and Nathu, 2013). This observation is in conformity with earlier such report by Pavan and Manjunath (2014) based upon their studies undertaken at Hesaraghatta village, Bangalore. As has been documented presently, the presence of *Aspergillus* in the air has been reported as the major risk factor for invasive aspergillosis by Campbell (1994). In another study, Dimitrov *et. al.* 1990 reported the presence of high concentration of potentially allergenic and toxigenic air mycoflora (*Alternaria, Aspergillus, Cladosporium, Fusarium* and *Penicillium*) in

and around cotton and soybean mills. Similar observation was made during the present survey. Throughout this survey the species of *Aspergillus, Mucor* and *Rhizopus* were quite common in all selected localities of Mandangad tahsil, indicating their dominance and ability to adapt easily to different environments and cause various types of allergic reactions in the dwelling population. In one of the recent study by Nielsen (2003) it was reported that *Aspergillus, Penicillium, Fusarium, Alternaria* and *Trichoderma* are the most frequently found fungal genera in the environment which are the main mycotoxin producers that can cause mycotoxicosis. It is a well known fact that mycotoxicosis is one of the major causes responsible for deterioration of liver and kidney functions if ingested by humans through infected food items (Marasas *et. al*., 2011). Genus *Cladosporium* documented during the present study is also reported to be the main component of airborne mycobiota in various regions of the world.

Extensive survey of plant pathogenic fungi in different forest ecosystems in the Western Ghats revealed the extensive occurrence of plant pathogenic fungi harboring the plants and causing different diseases of varying intensities (Mohanan, 2005). Fungal genera *Alternaria* and *Cladosporium* are reported to cause diseases of large variety of plants (Moss, 2008). Roy and Chourasia (1990) isolated *Aspergillus flavus*, *A. niger, A. ochraceus, Penicillium citrinum, Penicillium* spp., *Fusarium moniliforme, Fusarium* spp., from the roots of *Asparagus racemosus*. All such reports are indicative of the occurrence of such plant pathogenic and allergy causing fungi as has been observed in the air of Mandangad, which are responsible for various plants and human ailments in the region.

In one of the latest study, Udoh *et. al*. (2015) reported the role of *Mucor, Rhizopus, Candida albicans, Aspergillus, Penicillum* and *Fusarium* in the deterioration of the various fruits, vegetables and also in causing allergenic reactions in human population. In addition to their role in the deterioration of fruits and vegetables, fungi are also known to cause deterioration of milk, cheese, corn, peanuts, cotton, nuts, almonds and herbs, etc. (Mailafia *et. al*., 2017). During the present study also species of *Mucor , Rhizopus Aspergillus , Cladosporium, Penicillum, Fusarium* and *Candida albicans*, in Mandangad tahsil have also been documented to play a major role in the deterioration of various vegetables, fruits and dairy products at market places and at home.

CONCLUSION

It can be concluded that various plants as well as local population of Mandangad tahsil are under the cloud of various infectious fungi present in the surrounding environment. The current survey on the aeromycological profile of Mandangad tahsil is of utmost relevance to the foresters, nursery coordinators as well as local residents which helps to apprise them about the specific infective fungal pathogens in their immediate vicinity against which advance prophylactic measures can be initiated.

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